Global Research Trends in the Valuation and Accounting of Natural Capital and Ecosystem Services

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Outline

- Natural capital and ecosystem services
  - Stock and flow, green/ecological infrastructure
- Economic valuation
  - Methodology and total economic value
  - World and global estimates
- TEEB (The Economics of Ecosystems and Biodiversity)
  - Mainstreaming nature's value, and TEEB in business coalition
- Business accounting
  - Environmental Profit & Loss account (PUMA)
- National accounting
  - WAVES (World Bank)

Natural Capital and Ecosystem Services

- Natural capital
  - An economic metaphor for the limited stocks of physical and biological resources found on earth, cf. human capital, and financial capital
- Ecosystem services (ES)
  - flows of value to human societies as a result of the state and quantity of natural capital
    - The Millennium Ecosystem Assessment (MA) assessed the consequences of ecosystem change for human well-being. From 2001 to 2005, the MA involved the work of more than 1,360 experts worldwide
  - Provisioning services
    - Food, timber, fuelwood, raw materials, fresh water, medicinal resources
  - Regulating services
    - Local climate and air quality, carbon sequestration and storage, moderation of extreme weather events or natural hazards, waste-water treatment, erosion prevention and maintenance of soil fertility, pollination, biological control
  - Cultural services
    - Recreation and mental and physical health, tourism, aesthetic appreciation and inspiration for culture and art, spiritual experience and sense of place
  - Supporting Services
    - Nutrient cycling, formation of soil, primary production

Natural Capital and Man-made Assets

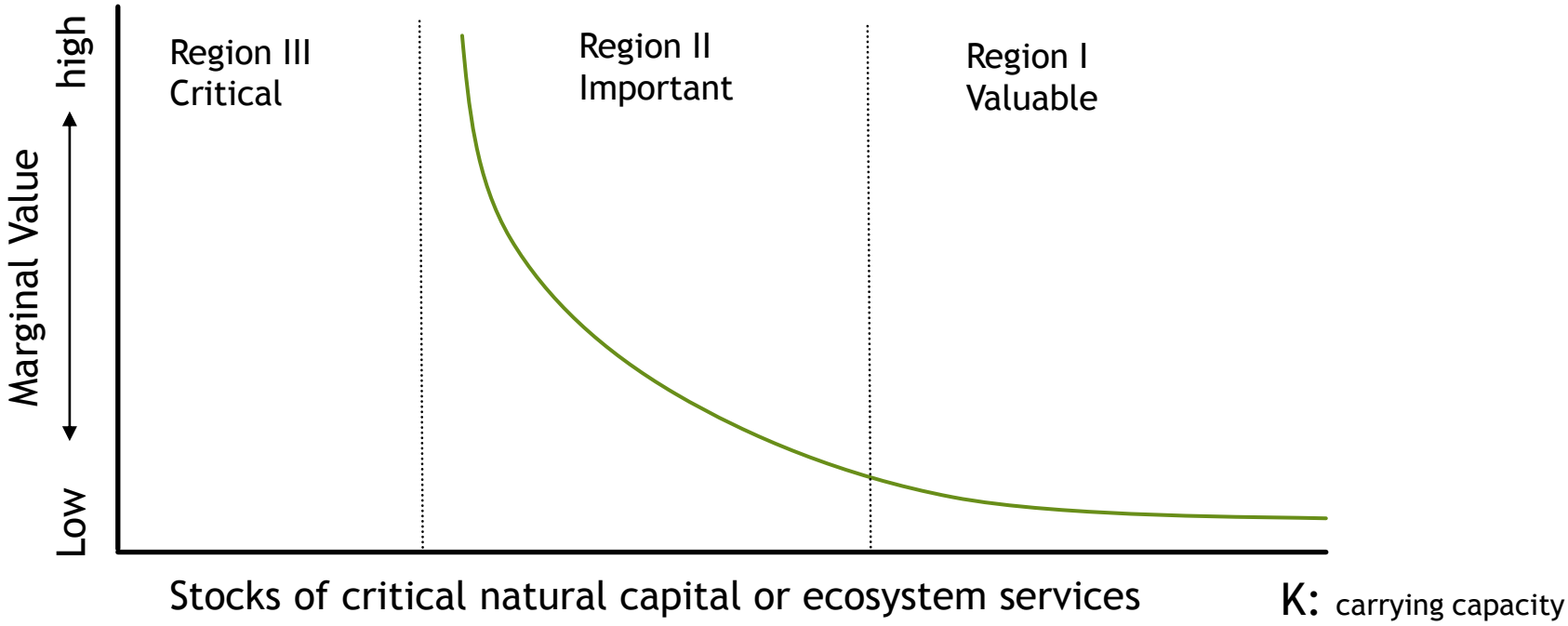
Green/ecological infrastructure
(Natural capital)

Man-made assets

Economic Valuation

- Monetary value ($, €, \) of natural capital and ES
- Demonstration and cost-benefit analysis in decision making
- Overview of methodologies used in assessing value
- Market analysis
  - Price-based, cost-based, production-based
  - Based on data associated with actual markets
- Revealed preference methods (RP)
  - Travel cost method, hedonic pricing, averting expenditure
  - Rely on the link between a market good and ES
- Stated preference methods (SP)
  - Contingent valuation method, choice modeling
  - Based on a hypothetical market simulated through the use of surveys, non-use value

A Conceptual Framework for the Valuation of NC and ES



- In region I, stocks are healthy and resilient, marginal uses are not essential, and demand is elastic, which means marginal values are insensitive to small changes in stocks. Monetary valuation may facilitate decisions on allocation between conservation and conversion
- In region II, capital stocks are less resilient and approaching a threshold beyond which they cannot spontaneously recover from further loss or degradation. Marginal uses are increasingly important, and values are increasingly sensitive to small changes in stocks (inelastic demand). Conservation needs should determine the supply of the stock available for conversion and hence the price
- In region III, capital stocks have passed critical ecological thresholds. Marginal values are essentially infinite, and restoration of natural capital stocks essential

Source: Farley (2008) The role of prices in conserving critical natural capital, *Conservation Biology*, 22(6), 1399-1408.

Total Economic Value (TEV)

- TEV provides a well-structured conceptual framework to consider all of the values of natural capital and ecosystem services
- Use value
  - Direct benefits from use of primary goods
  - Option for future use of goods and services
  - Indirect benefits from secondary goods and services
- Non-use value
  - Bequest value for future generations
  - Altruist value for others
  - Existence value without use/consumption of goods and services
- Market analysis and RP can assess only use value but SP can assess non-use value as well as use value
- NBSAP2012-2020 emphasized the integration of non-use value into policy and business decision making

The Value of the World's ES and Natural Capital

- Total value estimates
- Costanza et al. (1997) "The Value of the World's Ecosystem Services and Natural Capital." *Nature*, 387, 253-260.
  - The economic value of 17 ecosystem services for 16 biomes was estimated to be in the range of US$16–54 trillion per year, with an average of US$33 trillion per year. Global GNP was US$18 trillion per year.

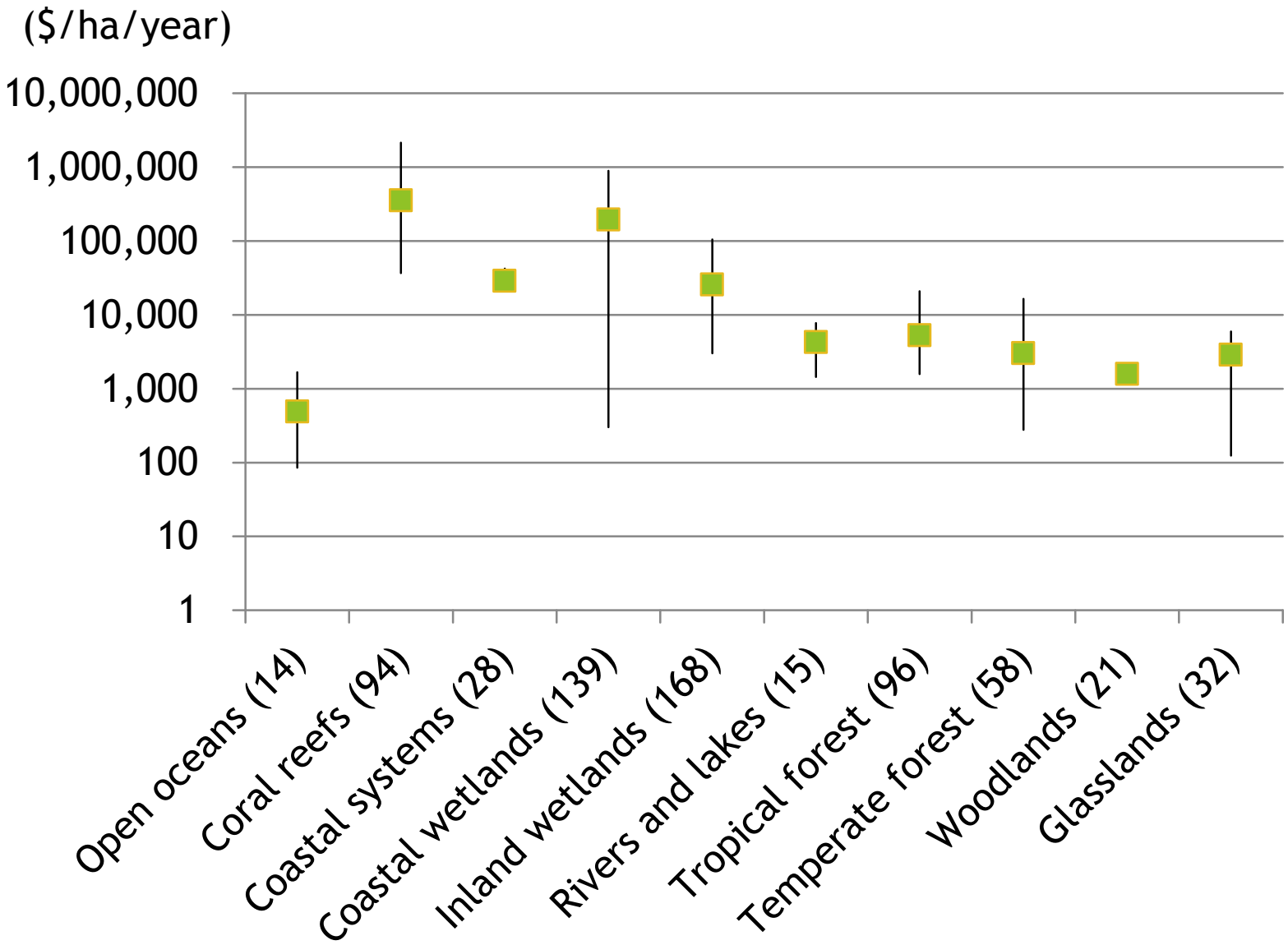
- Marginal value estimates
- de Groot et al. (2012) "Global Estimates of the Value of Ecosystems and their Services in Monetary Units." *Ecosystem Services*, 1, 50-61.
  - A selection of 665 value estimates was used for the analysis. The total value of ecosystem services of 10 main biomes is considerable and ranges between 490 int $/year for the total bundle of ecosystem services that can potentially be provided by an 'average' hectare of open oceans to almost 350,000 int $/year for the potential services of an 'average' hectare of coral reefs

Average Global Value of Annual Ecosystem Services

Biome	Area ($ha \times 10^6$)	Total global flow value ($\$ \times 10^9$/year)
Open ocean	33,200	8,381
Coastal	3,102	12,568
Forest	4,855	4,706
Grass/rangelands	3,898	906
Wetlands	330	4,879
Lakes/rivers	200	1,700
Desert	1,925	–
Tundra	743	–
Ice/rock	1,640	–
Cropland	1,400	128
Urban	332	–
Total	51,625	33,268

Source: Costanza et al. (1997)

Total Monetary Value of ES per Biome



Source: de Groot et al. (2012)

Mean WTP for Biodiversity and Habitat Services and Values

Type of good study	WTP/person/year (€, 2006)
Biodiversity preservation	28.7
Wildlife preservation	1.8
National parks and nature reserves	8.7
Wetlands	35.0
Watercourses	27.2
Landscape	57.5
Endangered species protection	120.9
Woodlands	18.8

Source: Nijkamp, Vindigni, and Nunes (2008) "Economic Valuation of Biodiversity: A Comparative Study." *Ecological Economics*, 67, pp.217-231

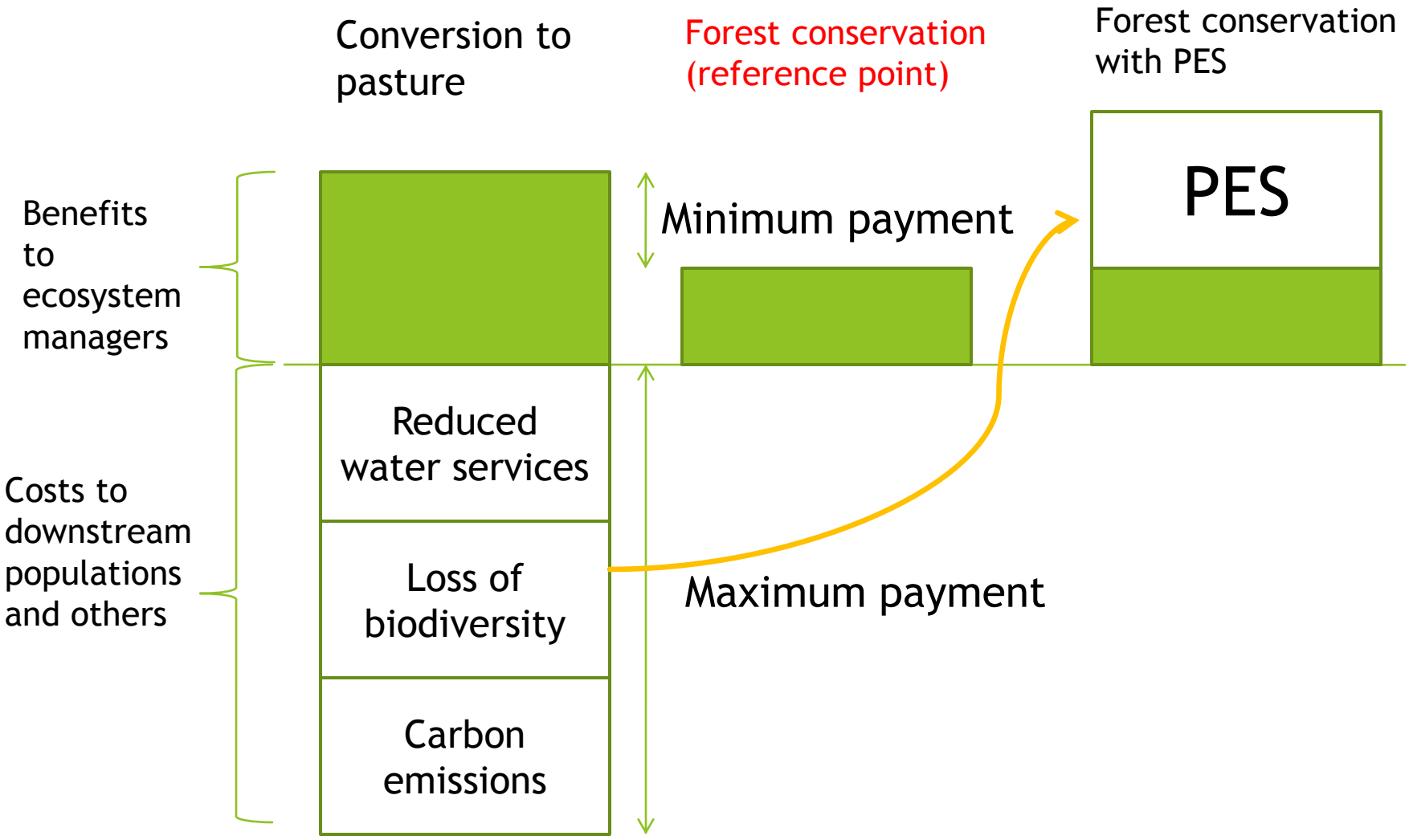
The Economics of Ecosystems and Biodiversity

- TEEB is a global initiative focused on drawing attention to the economic benefits of biodiversity. Its objective is to highlight the growing cost of biodiversity loss and ecosystem degradation
  - TEEB presents an approach that can help decision-makers recognize, demonstrate and capture the values of ecosystems & biodiversity
- In March 2007, environment ministers from the G8+5 countries meeting in Potsdam, agreed to initiate the process of analyzing the global economic benefit of biodiversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation
- The results were presented as *TEEB An Interim Report* at CBD COP9 in 2008
- TEEB produced four additional key reports, presented at the CBD COP10 in 2010
  - Ecological and economic foundations, national and international policy making, local and regional policy, business and enterprise, citizens
  - *Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB*
- TEEB implementation phase, additional studies and in-country studies

A Tiered Approach of TEEB

1. Recognizing value in ecosystems, landscapes, species and other aspects of biodiversity is a feature of all human societies and communities and is sometimes sufficient to ensure conservation and sustainable use
2. Demonstrating value in economic terms is often useful for policy makers and others such as business in reaching decisions that consider the full costs and benefits of an ecosystem rather than just those costs or values that enter the markets in the form of private goods
    - The costs and benefits of conserving ES provided by wetlands in controlling floods compared to building flood defenses. The demonstration of an economic value even though it does not result in specific measures is an important aid in achieving efficient use of natural resources
3. Capturing value involves the introduction of mechanisms that incorporate the values of ecosystems into decision-making through incentives and price signals. This can include payments for ecosystem services, reforming environmentally harmful subsidies for conservation

Payment for Ecosystem Services (Engel et al. 2008)



Conclusions and Recommendations of TEEB

- Make nature's values visible
- Pricing the priceless
- Accounting for risk and uncertainty
- Valuing the future
- Measuring better to manage better
- Natural capital and poverty production
- Beyond the bottom line – disclosure and compensation
- Changing the Incentives
- Protected areas offer value for money
- Ecological infrastructure and climate change
- Mainstreaming the economics of nature

National and Business Accounting of Natural Capital

- Business accounting
  - TEEB for Business Coalition, Trucost Plc
    - Natural Capital at Risk: The Top 100 Externalities of Business (2013)
  - PUMA Environmental Profit and Loss Account (E P&L)
    - Supply chain (2010)
    - Value chain (2012)
  - The Natural Capital Declaration
    - UNEP Finance Initiative
- National accounting
  - Green GDP (Nordhaus and Tobin (1972))
  - SEEA (System of Environmental and Economic Accounts)
  - Natural Capital Accounting
    - WAVES (Wealth Accounting and the Valuation of Ecosystem Services)

Business and Natural Capital

- Natural Capital at Risk: The Top 100 Externalities of Business (2013)
  - Trucost's analysis has estimated the unpriced natural capital costs at US$7.3 trillion relating to land use, water consumption, GHG emissions, air pollution, land and water pollution, and waste for over 1,000 global primary production (agriculture, forestry, fisheries, mining oil and gas exploration, utilities) and primary processing region-sectors (cement, steel, pulp and paper, petrochemicals)
- The global natural capital cost by the primary production and primary processing sectors
  - Land use: US$ 1.8 trillion
  - Water consumption: US$ 1.9 trillion
  - Greenhouse gases: US$ 2.7 trillion
  - Air pollution: US$ 0.5 trillion
  - Land and water pollution: US$0.3 trillion
  - Waste: US$ 50 billion

Natural Capital Declaration (NCD)

- A commitment from banks, investors and insurance firms to change their business models to reflect the materiality of natural capital for the financial sector
  - UNEP FI and the Global Canopy Programme, Steering Committee of signatories and supporters
- Phase I: The launch of the Natural Capital Declaration at Rio+20 in 2012
- Phase II: More than 40 CEOs of banks, investors and insurers worldwide have signed the Declaration
- Natural Capital Declaration
  - The roadmap to a green economy
  - The importance of natural capital
  - Leadership from the financial sector
  - Why Government Action is Essential Now
    - Because natural capital is a part of the 'global commons' and is treated largely as a free 'good', governments must act to create a framework regulating and incentivizing the private sector
    - We welcome the World Bank's Wealth Accounting and Valuation of Ecosystem Services (WAVES) initiative and encourage governments to participate
  - Our Commitment at the Rio+20 Earth Summit

PUMA Environmental Profit & Loss

- E P&L is a means of placing a monetary value on the environmental impacts along the entire supply chain of a given business
  - Profit: activities that benefit the environment
  - Loss: activities that adversely impact the environment
- E P&L cover all significant environmental impacts from the production of raw materials through to the point of sale
  - PUMA Operations; offices, warehouses, shops, etc.
  - Tier 1 (manufacturing); shoe, apparel and accessory manufacturing
  - Tier 2 (outsourcing); outsole, textile, insole production
  - Tier 3 (processing); leather tanning, cotton weaving, petroleum refining
  - Tier 4 (raw materials); Cattle, cotton farming, rubber plantations, petroleum
- Category of environmental impact
  - Water use
  - Greenhouse gas emissions
  - Land use conversion
  - Other air pollution
  - Waste

PUMA's 2010 E P&L Results

EUR million	Water use	GHGs	Land use	Other air pollution	Waste	TOTAL	(%)
TOTAL	47	47	37	11	3	145	(100%)
PUMA operations	<1	7	<1	1	<1	8	(6%)
Tier 1	1	9	<1	1	2	13	(9%)
Tier 2	4	7	<1	2	1	14	(9%)
Tier 3	17	7	<1	3	<1	27	(19%)
Tier 4	25	17	**37**	4	<1	83	(57%)

The PUMA Product E P&L Account (2012), (€)

Product (shoes)	GHGs	Water	Waste	Air Pollu-tion	Land use	Environ-mental costs	Retail price
Conventional suede	2.16	0.61	0.30	0.74	0.48	4.29	85
Biodegradable InCycle Basket	1.41	0.49	0.12	0.84	0.09	2.95	95
InCycle savings	-35%	-21%	-60%	+14%	-20%	-31%	+12%

Product (T-shirt)	GHGs	Water	Waste	Air Pollu-tion	Land use	Environ-mental costs	Retail price
Conventional T-shirt	1.79	0.33	0.10	1.00	0.20	3.42	20
Biodegradable InCycle Basket	1.20	0.34	0.06	0.70	0.06	2.36	20
InCycle savings	-33%	+2%	-36%	-30%	-70%	-31%	0%

Natural Capital Accounting

- Natural capital accounting can provide detailed statistics for better management of the economy beyond GDP
  - The concept of accounting for natural capital has been around for more than 30 years
  - A major step towards achieving this vision is the adoption by the UN Statistical Commission of the System for Environmental-Economic Accounts (SEEA)
    - SEEA provides an internationally agreed method to account for material natural resources like minerals, timber, and fisheries
- The Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a global partnership, which World Bank launched at CBD COP10 in 2010
  - The WAVES partnership include UNEP, UNDP and the UN Statistical Commission
  - Countries implementing programs; Botswana, Colombia, Costa Rica, Madagascar, and the Philippines
  - Financial support; Australia, Canada, France, Japan, Norway, UK and NGOs
- TEEB country study
  - After CBD COP10, countries have initiated TEEB studies to demonstrate the values and to encourage policy-making related to ES and biodiversity
    - Armenia, ASEAN, Belgium, Brazil, Czech Republic, Germany, India, Japan, etc.

Discussions and Conclusions

- Key studies, MA, TEEB, and WAVES, etc. have been drawing much attention to the value of natural capital and ecosystem services
  - In Japan, the value of ES from forests has been assessed since the 1970s
  - Recognizing, demonstrating and capturing achieved. Do we need more?
  - Mapping, weighting, concentrating, forecasting future demands, etc.
- Synergies and trade-offs between ecosystem services
  - Demonstration: the role of monetary valuation approaches
  - Forest ES: timber production vs. disaster prevention, carbon vs. biodiversity, natural forest vs. artificial forest
- Total or marginal value
  - Total value: demonstration for demonstration in order to draw attention
  - Marginal value: cost-benefit analysis, decision making
  - Marginal value (per hectare) is getting more practical and useful for demonstration and accounting
  - Marginal values change in accordance with the quantity and quality of natural capital and ecosystem services
- Mainstreaming the value of natural capital and ES