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Investing in healthy ecosystems makes sense

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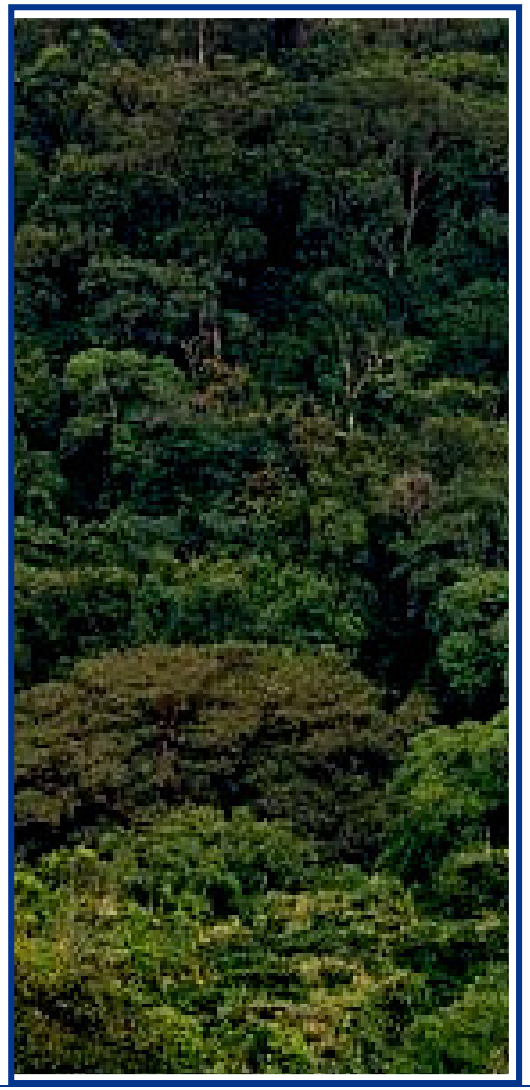
Investing in healthy ecosystems makes sense..

- Many studies indicating that people are willing to pay for ecosystem services and biodiversity protection
- Whether investments make sense depends on (opportunity) costs
- Benefit (and cost) estimates are context specific and when transferring values this needs to be accounted for
- Methodological innovations to pay attention to gap between WTP and WTA, differences between stated and actual WTP, framing, loss aversion etc.



The value of the world's ecosystem services and natural capital

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The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US$16–54 trillion ($10^{12}$) per year, with an average of US$33 trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US$18 trillion per year.

Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions. This neglect may ultimately compromise the sustainability of humans in the biosphere. The economies of the Earth would grind to a halt without the services of ecological life-support systems, so in one sense their total value to the economy is infinite. However, it can be instructive to estimate the 'incremental' or 'marginal' value of ecosystem services (the estimated rate of change of value compared with changes in ecosystem services from their current levels). There have been many studies in the past few decades aimed at estimating the value of a wide variety of ecosystem services. We have gathered together this large (but scattered) amount of information and present it here in a form useful for ecologists, economists, policy makers and the general public. From this synthesis, we have estimated values for ecosystem services per unit area by biome, and then multiplied by the total area of each biome and summed over all services and biomes.

Although we acknowledge that there are many conceptual and empirical problems inherent in producing such an estimate, we think this exercise is essential in order to: (1) make the range of potential values of the services of ecosystems more apparent; (2) establish at least a first approximation of the relative magnitude of global ecosystem services; (3) set up a framework for their further analysis; (4) point out those areas most in need of additional research; and (5) stimulate additional research and debate. Most of the problems and uncertainties we encountered indicate that our estimate represents a minimum value, which would probably increase: (1) with additional effort in studying and valuing a broader range of ecosystem services; (2) with the incorporation of more realistic representations of ecosystem dynamics and interdependence; and (3) as ecosystem services become more stressed and 'scarce' in the future.

Ecosystem functions and ecosystem services

Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions. For simplicity, we will refer to ecosystem goods and services together as ecosystem services. A large number of functions and services can be identified[1–4]. Reference 5 provides a recent, detailed compendium on describing, measuring and valuing ecosystem services. For the purposes of this analysis we grouped ecosystem services into 17 major categories. These groups are listed in Table 1. We included only renewable ecosystem services, excluding non-renewable fuels and minerals and the atmosphere. Note that ecosystem services and functions do not necessarily show a one-to-one correspondence. In some cases a single ecosystem service is the product of two or more ecosystem functions whereas in other cases a single ecosystem function contributes to two or more ecosystem services. It is also important to emphasize the interdependent nature of many ecosystem functions. For example, some of the net primary production in an ecosystem ends up as food, the consumption of which generates respiratory products necessary for primary production. Even though these functions and services are interdependent, in many cases they can be added because they represent 'joint products' of the ecosystem, which support human

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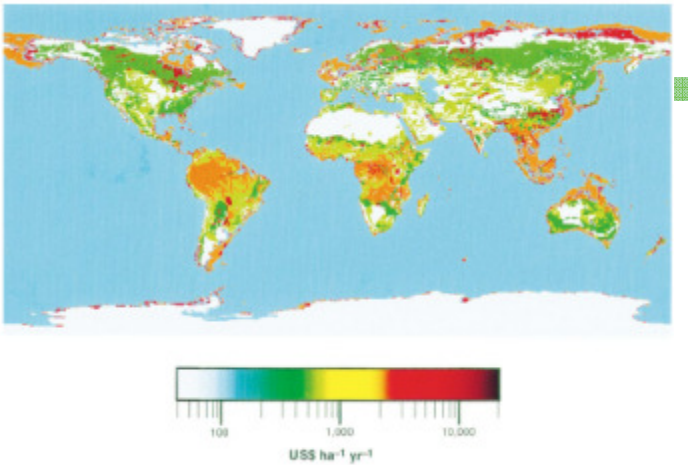
Figure 2 Global map of the value of ecosystem services. See Supplementary Information and Table 2 for details.



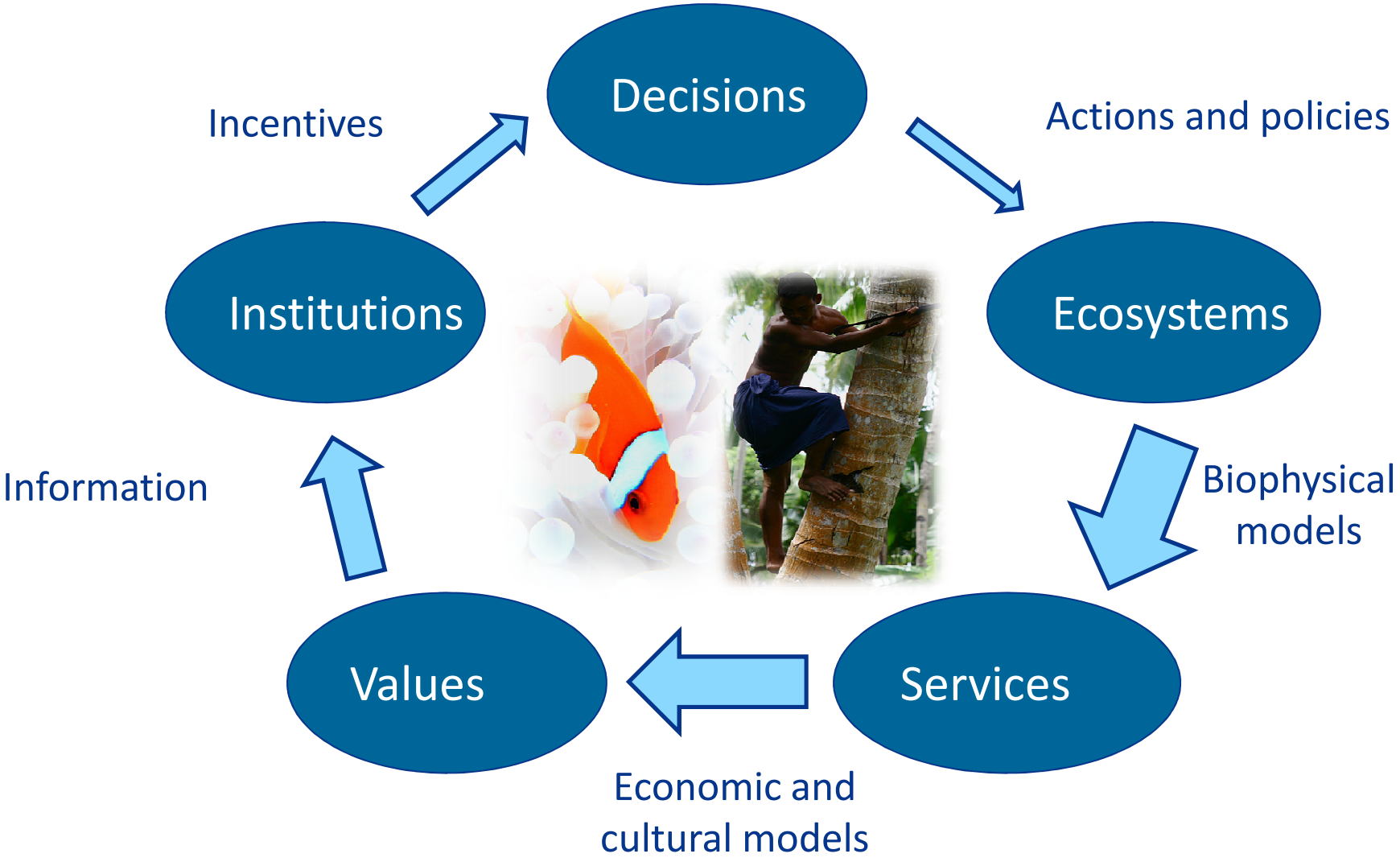
Wetlands	$14,785 $ha^{-1}yr^{-1}$
Lakes/rivers	$ 8,498
Tropical forests	$ 2,007
Coral reefs	$ 675
Open ocean	$ 252
Grasslands	$ 232

	Brouwer et al (1999)		Woodward & Wui (2001)		Brander et al (2006)	
	Variables	**Coefficient**	**Variables**	**Coefficient**	**Variables**	**Coefficient**
Dependent variable	Mean WTP (1990 SDRs)/hh/year		990 USD/acre/year		1995 USD/ha/year	
Constant	Intercept	3.356	Intercept	7.872**		
Socio-economic					GDP per capita (ln)	1.16*
					Population density	0.47***
Wetland type			Coastal	-0.117	Salt/brackish marsh	0.31
					Unvegetated sediment	0.22
					Mangrove	-0.56
					Freshwater marsh	-1.46**
					Freshwater wooded wetland	0.86**
Wetland function	Flood control	1.477****	Flood control	0.678	Flood and storm protection	0.14
	Water supply	0.691**	Water supply	0.737	Water supply	-0.95
	Water quality	0.545*	Water quality	-0.452	Water quality	0.63
			Recreational fishing	0.582	Recreational fishing	0.06
			Bird hunting	-1.055**	Recreational hunting	-1.10**
			Amenity	-4.303**	Amenity	0.06
			Habitat and nursery	0.427	Habitat and nursery	-0.03
			Storm protection	0.173	Materials	-0.83**
			Bird watching	1.804**	Fuelwood	-1.24***
			Commercial fishing	1.260	Biodiversity	0.26
Wetland size			Acres (ln)	-0.286**	Hectares (ln)	-0.11**
Continent	North America	1.361				
					South America	0.23
					Europe	0.84
					Asia	2.01
					Africa	3.51**
					Australasia	1.75*
Other geographic characteristics					Latitude (absolute value)	0.03
					Latitude squared	-0.00
					Urban	1.11**
Valuation method	CVM Open-ended	-0.411***			CVM	1.49**
			Hedonic pricing	5.043**	Hedonic pricing	-0.71
			Net factor income	0.273	Net factor income	0.19
			Replacement cost	2.232**	Replacement cost	0.63
			Travel cost	-0.341	Travel cost	0.01
					Production function	-1.00
					Opportunity cost	-0.03
					Gross revenues	-0.04
Payment vehicle	Income tax	1.880****				
Welfare measure			Producer surplus	-3.140**		
Study quality	Response rate (39-50%)	-2.253****	Published	-0.154		
	Response rate (>50%)	-1.904****	Data	0.000		
			Theory	-1.045		
			Econometrics	-3.186**		
Year of study			Year	0.016		
Other variables					Ramsar proportion	-1.32*
					Marginal value	0.95*
	Pseudo R2	0.365	R2	0.582	Adjusted R2	0.45
	n	92	n	65	n	202

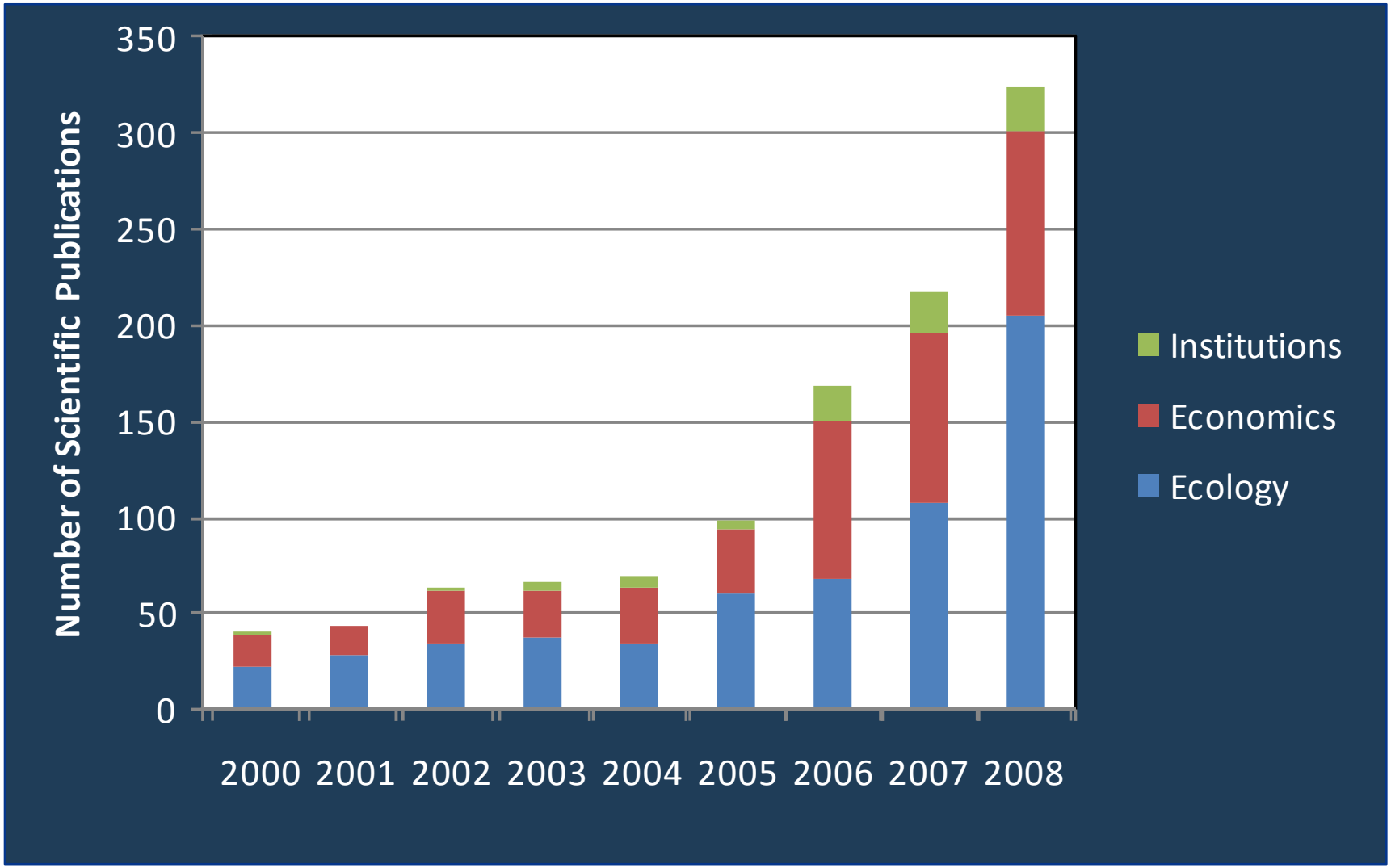
But..do we really invest in ecosystems?

- Pearce (2007) compared people's willingness-to-pay for biodiversity protection with actual expenditure and the expenditure required to protect biodiversity worldwide:
  - Global WTP for protected areas: **25-1400** USD/ha/yr
  - Costs of global biodiversity conservation: **7-93** USD/ha/yr
  - Actual global expenditure: **max.10 billion** USD/yr
  - Required global expenditure: **300 billion** USD/yr
  - Global subsidizing of economic activity: **1 trillion** USD/yr

Translating values to decisions



Academic literature



Translating values to decisions

- Rewarding benefits:
  PES, REDD, markets, etc.
- Some Issues:

  Voluntary mechanisms

  Allocation of property rights

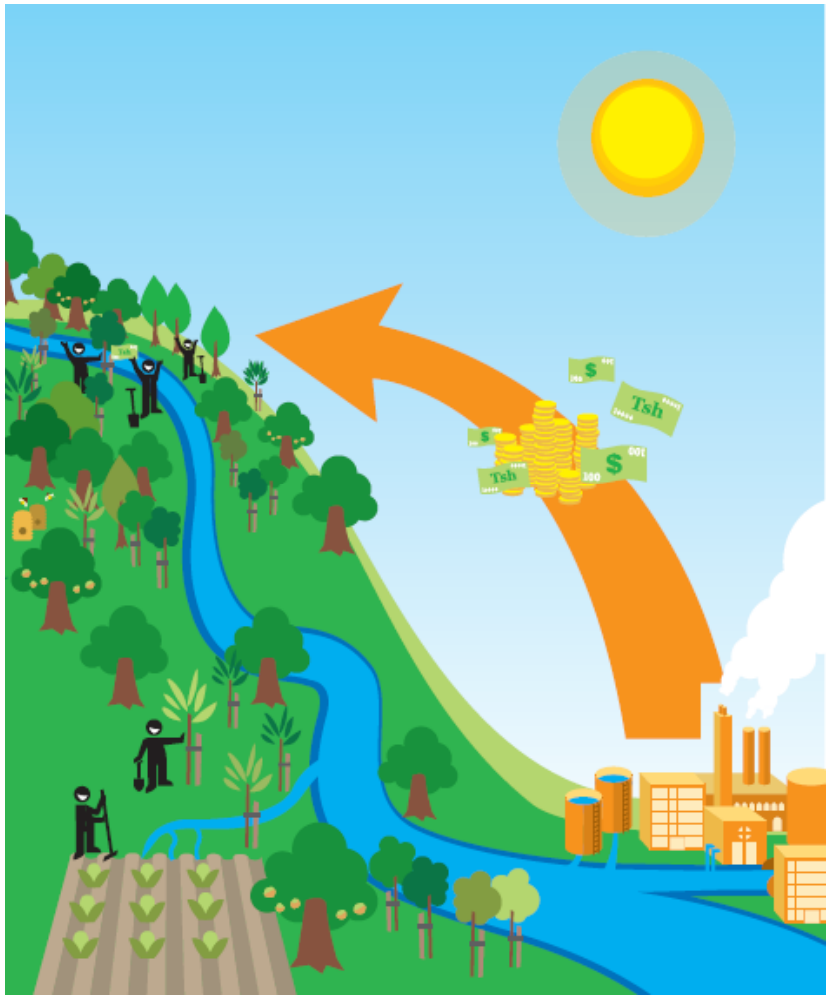
  Organization of demand/supply

  Asymmetric information

  Moral hazard

  Mechanism design

  Enforcement and control



Translating values to decisions

- Subsidy reform

  1 trillion USD/year spent on activities subsidizing economic activity

- Eco-labelling, sustainable production, chain management

  Certification

  Global demand/supply

  Trade barriers and transaction costs

  Important role for business

  Initiative Sustainable Trade

Translating values to decisions

- Addressing losses : Regulation legislation, liability, taxes & charges, offsets, banking
- Some issues:

  Deadweight losses

  Asymmetric information

  Mechanism Design

  Tradable permits

  Auctions

  Replacement costs

Translating values to decisions

- Protected areas
- Some issues:

  Sustainable financing

  Conservation-development trade-offs

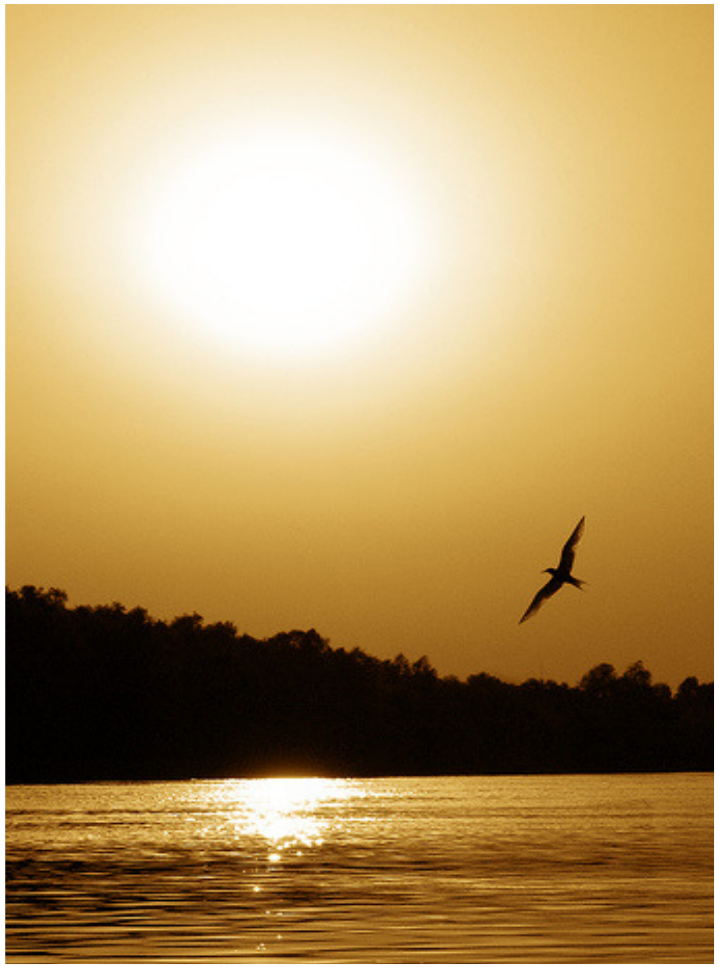
  Co-management arrangements

  Integrated conservation-development approaches

Development focus ← → Conservation focus				
Alternative livelihood mechanisms *(e.g. Micro-financing)*	Direct mechanisms *(e.g. PES)*	Indirect mechanisms *(e.g. certification)*	Tradable mechanisms *(e.g. REDD)*	Protected area financing mechanisms *(e.g. fees)*

Way forward

- Development and testing of effective instruments and investment tools
- Political commitment to translate values to decisions (and financial flows)
- Better understanding and awareness of the role of biodiversity in ecosystem service provision



Thank you !

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