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From Data to Knowledge : The Journey

Statistics for Sustainable Social Environmental Development

Valuing Ecosystem Services as a Key Driver of Sustainable Development in Malaysia

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OUTLINE OF PRESENTATION

1. Introduction
2. Sustainable development
3. Ecosystem service (ES)
4. Valuation methods of ES
5. Valuation of ecosystem services in Malaysia
6. Challenges and actions needed
7. Conclusion

Introduction

- Ecosystems generate a wide range of goods and services important for human well-being → **ecosystem services**

- Progress has been made in understanding how ecosystems provide services and how service provision translates into **economic value**

- However, it is difficult to move from general findings about the benefits nature provides to people to credible, quantitative estimates of ecosystem service values

- Explicit values of ecosystem services across landscapes that might inform policy and decision makers are still lacking

Introduction

- Sustainable development goals (SDGs) recognize the interconnections between social and ecological systems.

- New interest in integrated social–ecological indicators

- SDGs → from sector specific goals towards more integrated social–ecological planning, tracking and reporting

- Integrated SDG will require tracking and monitoring nature's contribution to human wellbeing and impacts of human activity on nature

- Most common notion of nature-human interaction is through **ecosystem services**

    → the benefits people derive from their interaction with ecosystems

→ Need to value ecosystem services as a key enabler in achieving SDGs

Meaning of sustainable development

Brundtland Report (1987)

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Three elements: Ecological, Social, Economic

Sustainability is the foundation for today's leading global framework for international cooperation – the 2030 Agenda for Sustainable Development and its **Sustainable Development Goals** (SDGs).

17 SDGs have been formulated

The 17 United Nations Sustainable Development Goals (SDGs)

Sustainable Development Goal - Malaysia

Goal 15: Live on Land
Protect, restore and promote **sustainable use** of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
12 Targets 14 Indicators

| Target	Indicator
Target 15.9 By 2020, **integrate ecosystem and biodiversity values into national and local planning**, **development processes**, **poverty reduction strategies** and **accounts**	Indicator 15.9.1: Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020

National Biodiversity Action Plan 2016-2025

GOAL 2: WE HAVE SIGNIFICANTLY REDUCED THE DIRECT AND INDIRECT PRESSURES ON BIODIVERSITY

Target 3: By 2025, biodiversity conservation has been mainstreamed into national development planning and sectoral policies and plans.

Target 4: By 2025, our production forests, agriculture production and fisheries are managed and harvested sustainably.

Target 5: By 2025, tourism is sustainably managed and promotes biodiversity conservation.

NATIONAL POLICY
ON BIOLOGICAL DIVERSITY
2016 – 2025
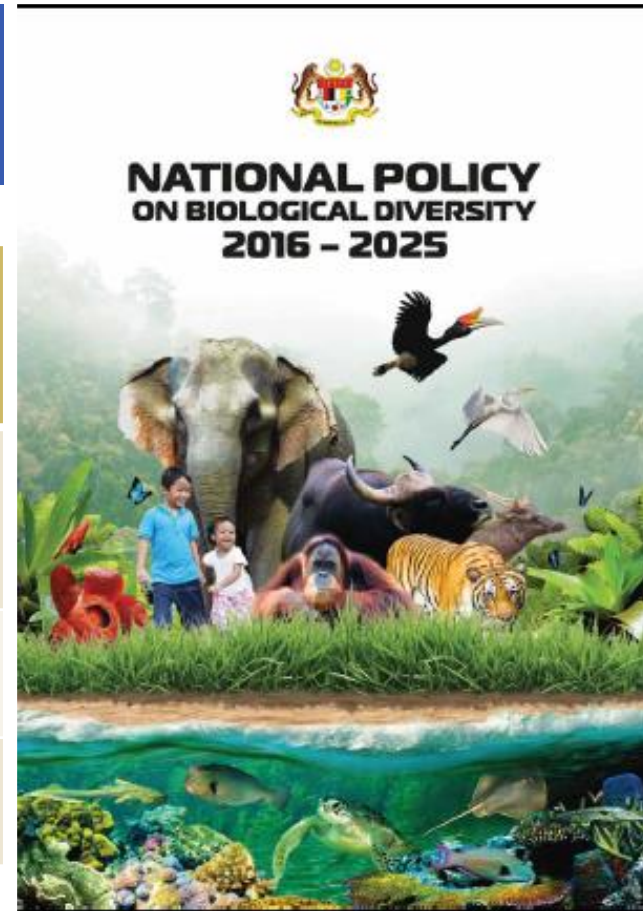
National Biodiversity Action Plan 2016-2025

Target 3: By 2025, biodiversity conservation has been mainstreamed into national development planning and sectoral policies and plans.

Action 3.1: Embed biodiversity conservation into national and state development planning and sectoral policies and plans

Action 3.2: Recognise the economic value of biodiversity and ecosystem services

Action 3.3: Protect environmentally sensitive areas in statutory land use plans

Action 3.4: Promote sustainable consumption and production

Action 3.2

- Establish a **Natural Resource Accounting** programme to monitor the values of natural resources, including biodiversity, to provide information that will permit the economic value of biodiversity to be taken properly into account in national planning.

- Undertake a **comprehensive valuation of biodiversity and ecosystem services including research on full-cost accounting** of perverse subsidies and the internalizing externalities

- Adopt appropriate mechanisms which may include **payment for ecosystem services** (PES) schemes such as public payment instruments, carbon trade and biodiversity offsets.

RMK11 (2016-2020)

Growth through sustainable use of natural resources

Focus Area A: Strengthening the enabling environment for green growth

Strategy 3: Establishing sustainable financing mechanism

- Expanding existing economic instruments → PES, PPP
- Funding green growth through economic instruments → green tax, carbon tax, green bond,

ELEVENTH
MALAYSIA
PLAN
2016-2020
ANCHORING GROWTH ON PEOPLE

The Economic System and The Environment

The Environment ← **has been largely ignored....**

Energy →

Air →

Energy →

Water →

Amenities →

Firms (Production)

Inputs — THE ECONOMY — Outputs

Households (Consumption)

↑ Raw material

Air pollution →

Solid waste →

Waste heat →

Water pollution →

(Source: Titernberg, 2010)
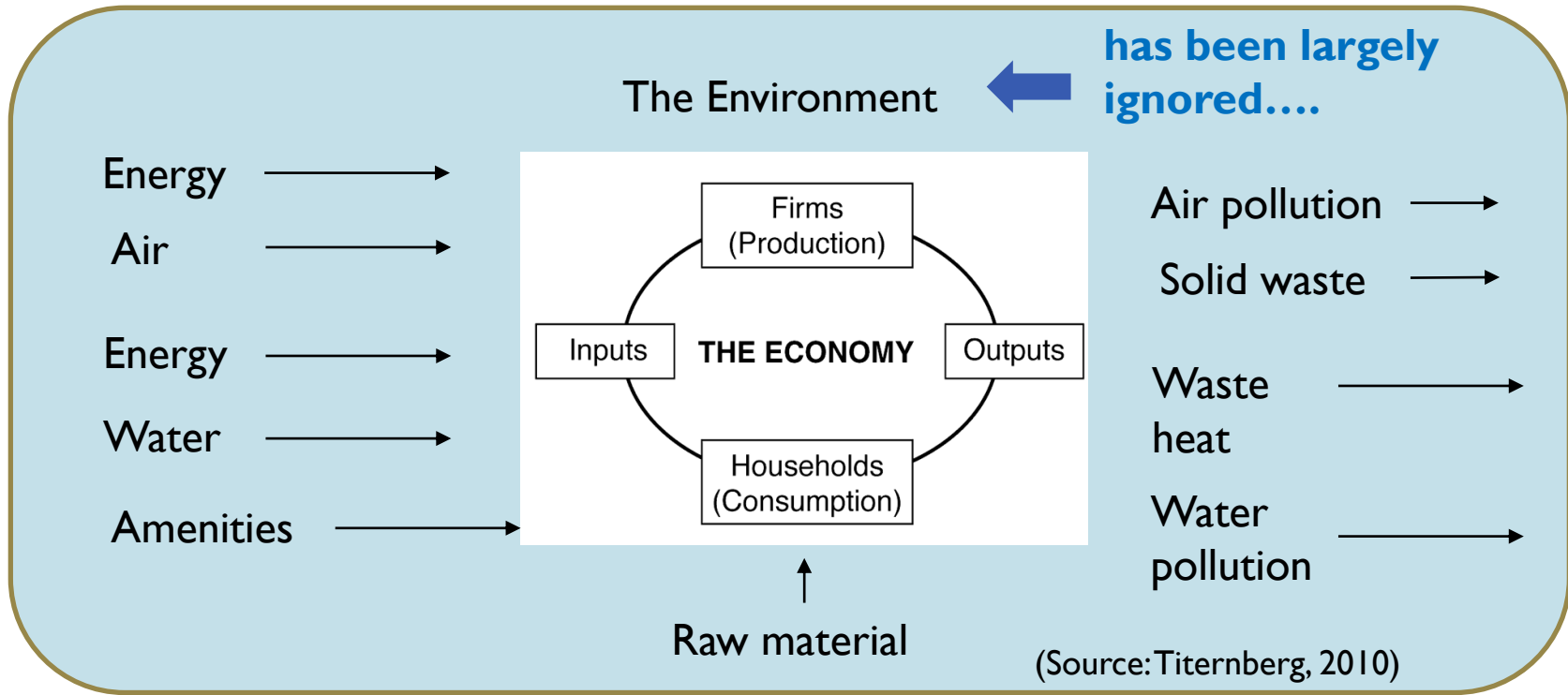
Loss of biod, reduced national income

Environmental degradation - deforestation, soil erosion, landslide, flood

Loss of productivity, loss of assets

Economic Invisibility of Nature
Case study: Shrimp farms in South Thailand

US$/ha in 1996

- $9,632 — private profits (Shrimp Farm)
- $584 — private profits (Mangroves)
- $1,220 — private profits less subsidies (Shrimp Farm)
- $584 — private profits (Mangroves)
- -$9,318 — Net of public costs of restoration after 5 yrs (Shrimp Farm)

After adding public benefits from mangroves

$12,392
- $10,821 Storm protection
- $987 Fisheries
- $584 Forest prods.

Legend:
- Shrimp Farm
- Mangroves
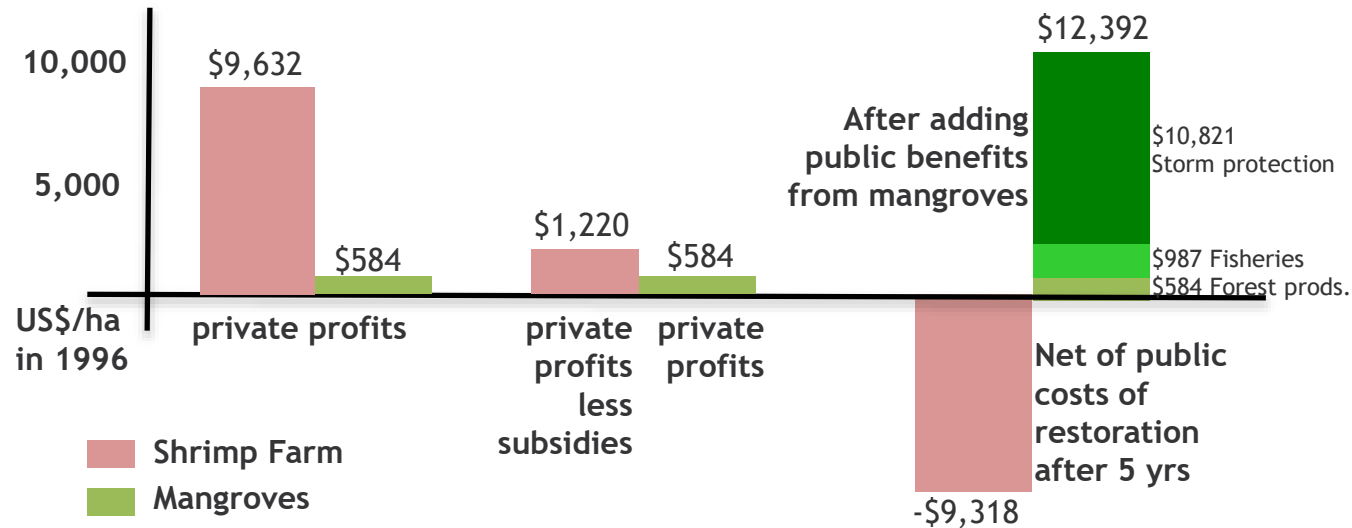
Data from Barbier (2007)

All values in NPV over 9 yrs (1996-2004) at 10% discount rate

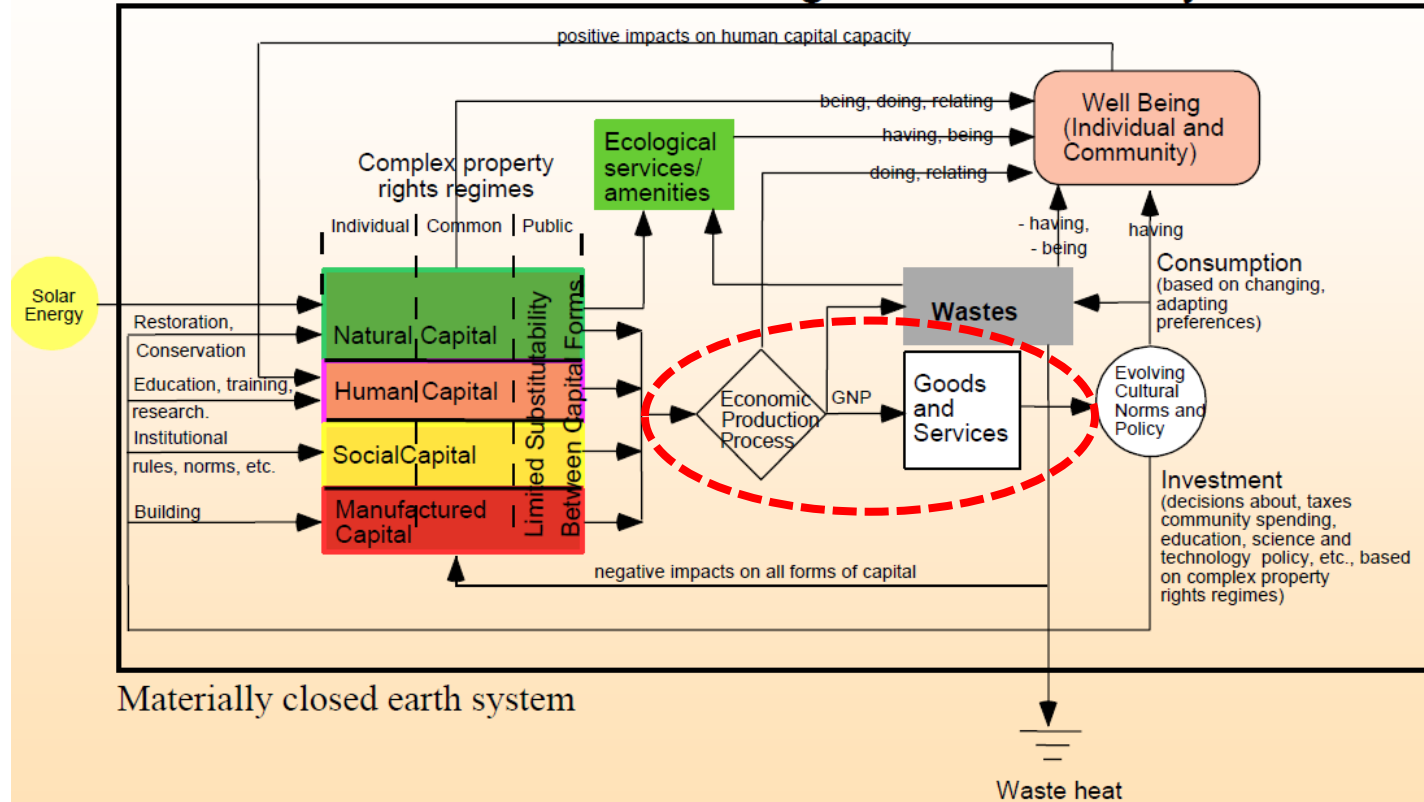# "Full World" Model of the Ecological Economic System

From: Costanza, R., J. C. Cumberland, H. E. Daly, R. Goodland, and R. Norgaard. 1997. An Introduction to Ecological Economics. St. Lucie Press, Boca Raton, 275 pp. Costanza (2008)

Ecosystem

A dynamic complex of plant, animal, and micro-organism communities and the non-living environment interacting as a functional unit.

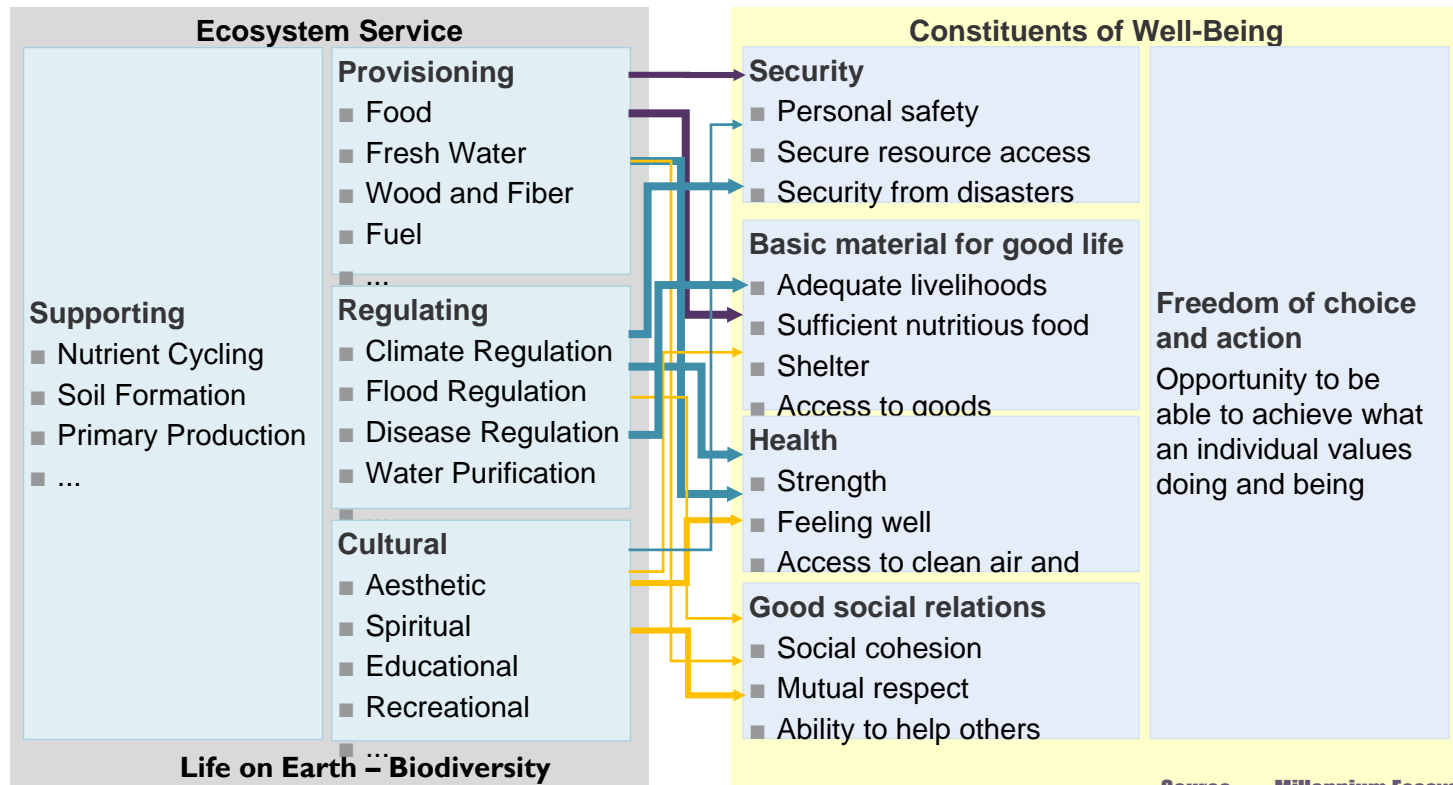**How ecosystems provide services?**

Ecosystem services (MEA 2003):

*The **benefits** that people obtain from **ecosystems** – the goods and services of nature.*

How service provision translates into economic value?

Link between ecosystem services and human well-being

Ecosystem Service

Provisioning
- Food
- Fresh Water
- Wood and Fiber
- Fuel
- ...

Supporting
- Nutrient Cycling
- Soil Formation
- Primary Production
- ...

Regulating
- Climate Regulation
- Flood Regulation
- Disease Regulation
- Water Purification

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

Life on Earth – Biodiversity

Constituents of Well-Being

Security
- Personal safety
- Secure resource access
- Security from disasters

Basic material for good life
- Adequate livelihoods
- Sufficient nutritious food
- Shelter
- Access to goods

Health
- Strength
- Feeling well
- Access to clean air and

Good social relations
- Social cohesion
- Mutual respect
- Ability to help others

Freedom of choice and action
Opportunity to be able to achieve what an individual values doing and being

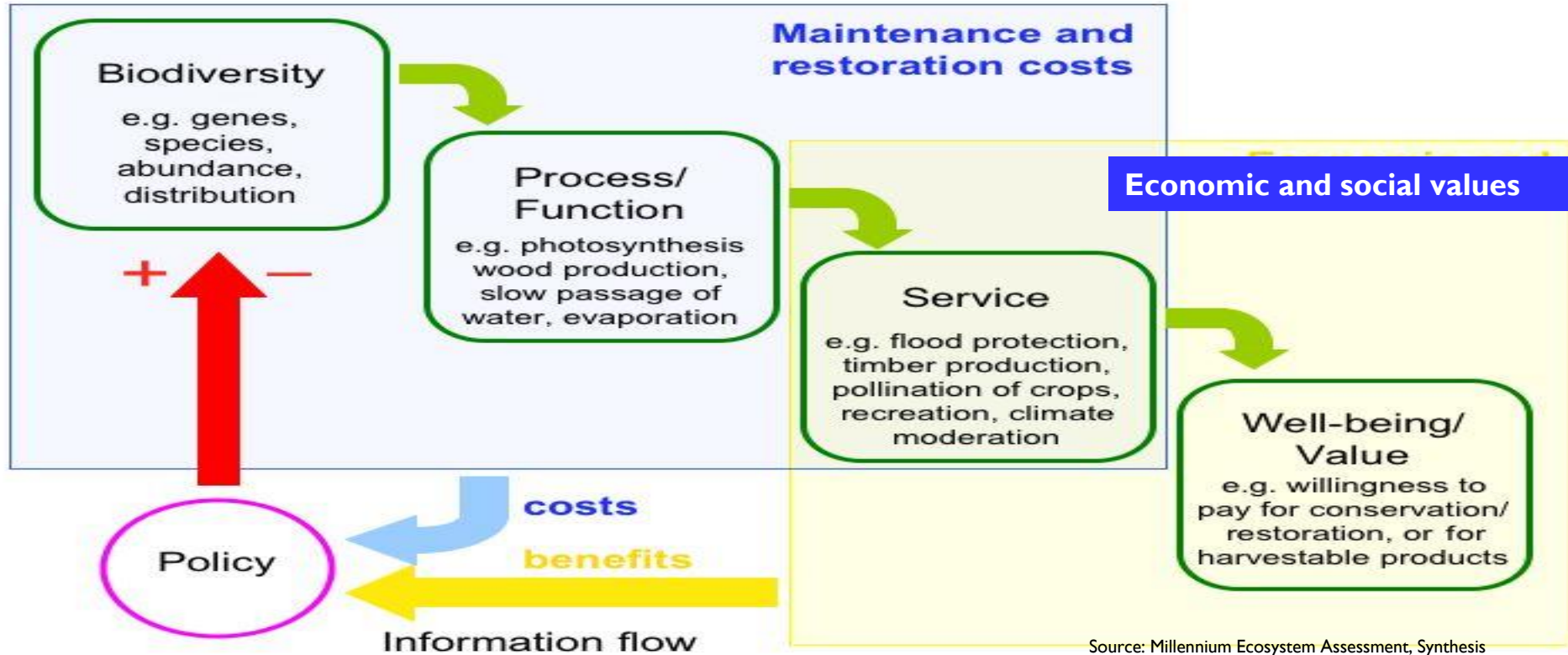Source: Millennium Ecosystem Assessment

Arrow's Color Potential for mediation by socioeconomic factors

Key: ■ Low   ■ Medium   ■ High

Arrow's Width Intensity of linkages between ecosystem services and human well-being

Key: □ Week   □ Medium   □ Strong

The link between ecosystem services, well-being and human impacts

Source: Millennium Ecosystem Assessment, Synthesis

Typology of Ecosystem Services in TEEB

Provisioning Services	Regulating services	Habitat Services	Cultural and amenity services
Food (*fish, game, fruit*)	Air quality regulation (*capturing fine dust*)	Maintenance of life cycles of migratory birds	Aesthetic information
Water (*drinking, irrigation*)	Climate regulation (*C-sequestration*)	Maintenance of genetic diversity (*gene pool protection*)	Opportunities for recreation and tourism
Raw materials (*timber, fodder, fertilizer*)	Moderation of extreme events (*storm protection*)		Inspiration for culture, art and design
Genetic resources (*crop improvement*)	Regulation of water flows (*natural drainage*)		Spiritual experience
Medicinal resources (*biochemical products*)	Waste treatment (*water purification*)		Information for Cognitive development
Ornamental resources (*ornamental trees*)	Erosion prevention		
	Maintenance of soil fertility (including soil formation) and nutrient cycling		
	Pollination		Source: Kumar (2010) (ed.)
	Biological control (*seed dispersal*)		Note: TEEB – The Economics of Ecosystems and Biodiversity

	Marine	Coral reefs	Coastal systems	Coastal wetlands[a]	Inland wetlands	Fresh water (rivers/lakes)	Tropical forest	Temperate forest	Woodlands	Grasslands
Provisioning services	102	55,724	2396	2998	1659	1914	1828	671	253	1305
1 Food	93	677	2384	1111	614	106	200	299	52	1192
2 Water				1217	408	1808	27	191		60
3 Raw materials	8	21,528	12	358	425		84	181	170	53
4 Genetic resources		33,048		10			13			
5 Medicinal resources				301	99		1504			1
6 Ornamental resources		472			114				32	
Regulating services	65	171,478	25,847	171,515	17,364	187	2529	491	51	159
7 Air quality regulation							12			
8 Climate regulation	65	1188	479	65	488		2044	152	7	40
9 Disturbance moderation		16,991		5351	2986		66			
10 Regulation of water flows					5606		342			
11 Waste treatment		85		162,125	3015	187	6	7		75
12 Erosion prevention		153,214	25,368	3929	2607		15	5	13	44
13 Nutrient cycling				45	1713		3	93		
14 Pollination							30		31	
15 Biological control					948		11	235		
Habitat services	5	16,210	375	17,138	2455	0	39	862	1277	1214
16 Nursery service		0	194	10,648	1287		16		1273	
17 Genetic diversity	5	16,210	180	6490	1168		23	862	3	1214
Cultural services	319	108,837	300	2193	4203	2166	867	990	7	193
18 Esthetic information		11,390			1292					167
19 Recreation	319	96,302	256	2193	2211	2166	867	989	7	26
20 Inspiration		0			700					
21 Spiritual experience			21							
22 Cognitive development		1145	22					1		
Total economic value	491	352,249	28,917	193,845	25,682	4267	5264	3013	1588	2,871

[a] Coastal systems include estuaries, continental shelf area and seagrass, but exclude wetlands like tidal marsh, mangroves and salt water wetlands.
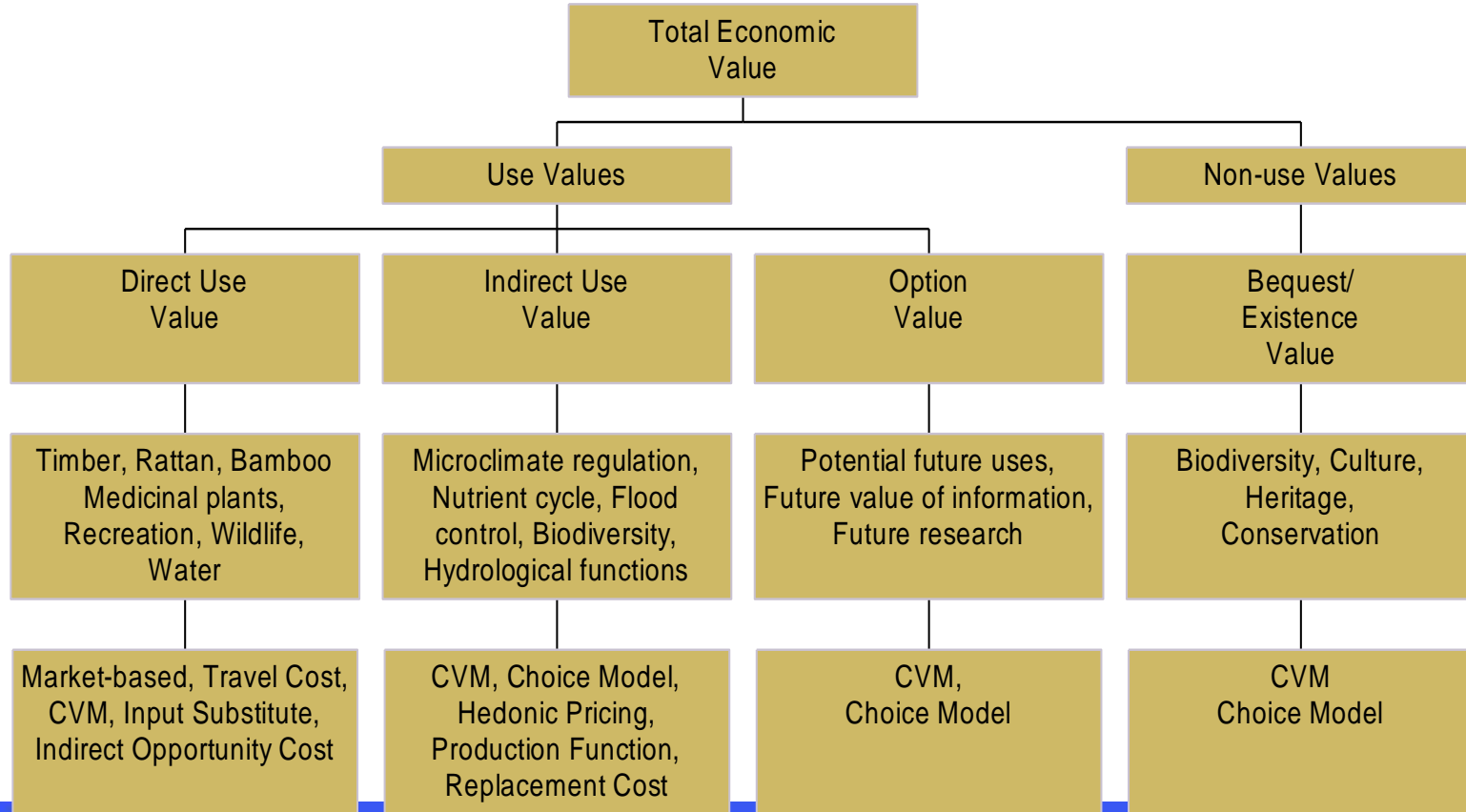
Source: de Groot et al. (2012)

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Why valuing of ecosystem services?

- **Resource accounting** – System of environmental and economic accounting (SEEA) – forestry, energy, water, fisheries, mineral, ecosystem

- **Shadow pricing** of ecosystem services - to be used in damage assessment, compensation, benefit cost analysis (BCA)

- **Project Appraisal and Planning** – benefit cost analysis (trade-off analysis, e.g. mangrove conservation vs. shrimp production) – EPU, SEPU, other agencies in project development new project, EPU (project appraisal guideline). Need to use extended social benefit cost analysis or BCA for environmental assets

- **Setting national and sectoral priorities** (prioritize the projects/programmes, e.g. budget allocation for mangrove forest planting, conservation of wildlife sanctuary, river of life project, flood mitigation projects – knowing the value of the asset will continue to support the project

Applications of Economic Valuation for Policy Analysis & Instrument

- **Damage assessment** (e.g. compensation for loss of income by fishermen due to oil spill)- DOF, DOF, DOA,

- **Payment for ecosystem services** (e.g. appropriate rate of payment for biodiversity, watershed, carbon, landscape beauty, bundled of services)

- **Environmental Impact Assessment** (EIA). Need to include in environmental benefits and cost in EIA (DOE). Guideline for environmental valuation

- **Accrual accounting** (intangible, tangible assets) – treasury, state governments

- Depends on the need and situation
  - Pollution and resource depletion assessment (traffic congestion cost, loss of life due to accident, coastal erosion)
  - PES, MBI, CFS, Carbon, Compensation or loss, environmental policy and law (eg US – CERLA 1980 – Comprehensive Environmental Response, Compensation & Liability Act (CERLA or Superfund) (1980)

Total Economic Value and Methods of Valuation

Total Economic Value

Use Values

Direct Use Value

Timber, Rattan, Bamboo
Medicinal plants,
Recreation, Wildlife,
Water

Market-based, Travel Cost,
CVM, Input Substitute,
Indirect Opportunity Cost

Indirect Use Value

Microclimate regulation,
Nutrient cycle, Flood
control, Biodiversity,
Hydrological functions

CVM, Choice Model,
Hedonic Pricing,
Production Function,
Replacement Cost

Option Value

Potential future uses,
Future value of information,
Future research

CVM,
Choice Model

Non-use Values

Bequest/ Existence Value

Biodiversity, Culture,
Heritage,
Conservation

CVM
Choice Model

Economic Valuation: Three Approaches

- **Market-based Approach -** using market actual market price to value ecotourism area
  - market price, change in productivity, damage cost avoided, benefit transfer approach
- **Revealed Preference Approach** (Surrogate Market) – estimate the cost of travel + time to a particular ecotourism site, i.e. people's behaviour towards ecotourism
  - Travel cost method, hedonic price method
- **Stated Preference Approach** - elicit willingness to pay (WTP) from visitors & non-visitors using questionnaire to conserve an ecotourism site
  - Contingent valuation method, choice model

Ecosystem Services Studies in Malaysia

- > 170 studies (133 forest ecosystem studies – 77%)

- 456 economic values, largely forest resources (66%), wetland resources (20%), coastal and marine resources (11%), urban parks and urban trees (3%) and agriculture or agroparks (1%).

- Capacities to conduct ecosystem service valuation from various institutions - universities, research institutions, and government agencies

Number of economic values estimated by types of ecosystems

Ecosystem	Number of economic values estimated	Percentage
Agri-ecosystem	3	0.7%
Coastal	11	2.4%
Forest	391	85.7%
Marine	37	8.1%
Urban	14	3.1%
Total	456	100%

Economic Value Putrajaya Lake and Wetlands

Ecosystem Services	Total economic value (RM) (Present value at 8% discount factor)
Provisioning	*32,252,555*
1 Food	1,339,644
2 Water	22,849,772
3 Raw materials	5,371,213
4 Genetic resources	Not estimated
5 Medicinal resources	1,251,177
6 Ornamental resources	1,440,749
Regulating	*183,695,487*
7 Air quality regulation	Not estimated
8 Climate regulation	6,167,416
9 Disturbance moderation	37,737,511
10 Regulation of water flows	70,849,460
11 Waste treatment	2,363,334
12 Erosion prevention	32,947,653
13 Nutrient cycling	21,649,148
14 Pollination	Not estimated
15 Biological control	11,980,965

Ecosystem Services	Total economic value (RM) (Present value at 8% discount factor)
Supporting/Habitat services	*31,026,654*
16 Nursery service	16,265,297
17 Genetic diversity	14,761,357
Cultural	*52,549,421*
18 Aesthetic information	16,328,488
19 Recreation	27,374,229
20 Inspiration	8,846,704
21 Spiritual experience	Not estimated
22 Cognitive development	Not estimated
Total	*299,524,117*

Conservation	RM1,027,356,375
Recreation	RM1,120,487,790
Aesthetic view	RM2,331,176,630
Total:	RM4,778,544,912

Total Economic Value (TEV) in the North Selangor Peat Swamp Forest
(Present value 1980 price, 8% discount rate)

Good/Service	Base Case	% of TEV	Change from Base Case Option to Sustainable Option		
			B1	B2	B3
	(RM/ha)		(RM/ha)		
Timber	2,149	21.3	-696	-399	-873
Agro-hydrological	319	3.1	0	411	680
Endangered species	454	4.4	35	20	44
Carbon stock	7,080	69.2	969	1,597	1,597
Rattan	22	0.2	88	172	192
Bamboo	98	1.0	0	-20	-20
Recreation	57	0.6	0	0	0
Domestic water	30	0.3	0	0	0
Fish	20	0.3	0	0	0
TEV	10,238	100.0	396	1,782	1,620

Source: Kumari (1995)

Economic values of mangroves along Peninsular Malaysia (GEF/UNDP/IMO, 1999) **RM5,407,927,661**

RM2,475,741,981	RM2,932,185,680

Direct Use Values	Indirect Use Values	Option Values	Existence Values
RM233,721,896	RM2,238,036,135	RM3,983,950	RM2,932,185,680
4%	96% (non-market)		
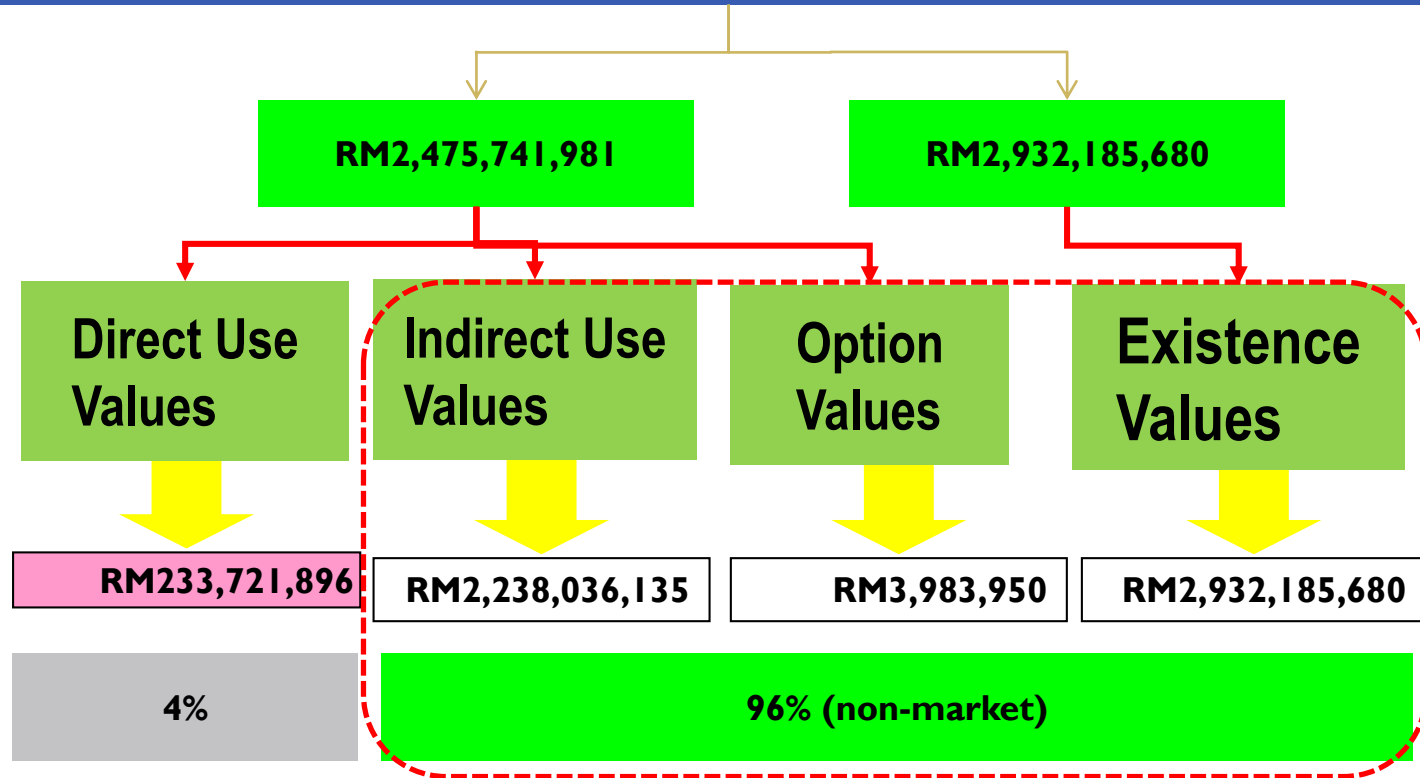
Challenges in ecosystem services valuation

- Public perception and awareness of ecosystem services
- Application and acceptance of ecosystem valuation in public project analysis (using benefit transfer approach?)
- Full cost pricing / internalizing the externalities
- Green accounting of GDP – (System of integrated Environmental and Economic Accounting – SEEA)
- Application of Standard Ecosystem Services Classification System – standard system used in SEEA of the UN
- Ecosystem valuation standard
- Transdisciplinary approach in deriving the ecosystem service values

Actions needed

- Build political will by publicizing the benefits of ecosystems and ES
- A multidisciplinary research framework to account for ecosystems and ES
- Develop human capacity to implement ES valuation
- Structure ecosystem services valuation to answer critical policy questions and trade-off analysis
- Mainstreaming ecosystem services valuation in national and sectoral economic planning
- Promote the development of available tools and methods to accurately quantify the value of ecosystems and ecosystem services, reflecting the current situation and a future scenario
- Application of ecosystem value indicators in decision making process

Conclusion

- Ecosystem should be treated as an important asset in an economy
- Ecosystem services should be valued in a similar manner as any other forms of wealth
- Need to understand the economics and ecology in assessing ecosystem services and their values and implications in a wealth accounting framework and to achieve sustainable development goals (SDGs)

Thank You

Questions?