Economic Valuation of Forest Ecosystem Services in Malaysia

by

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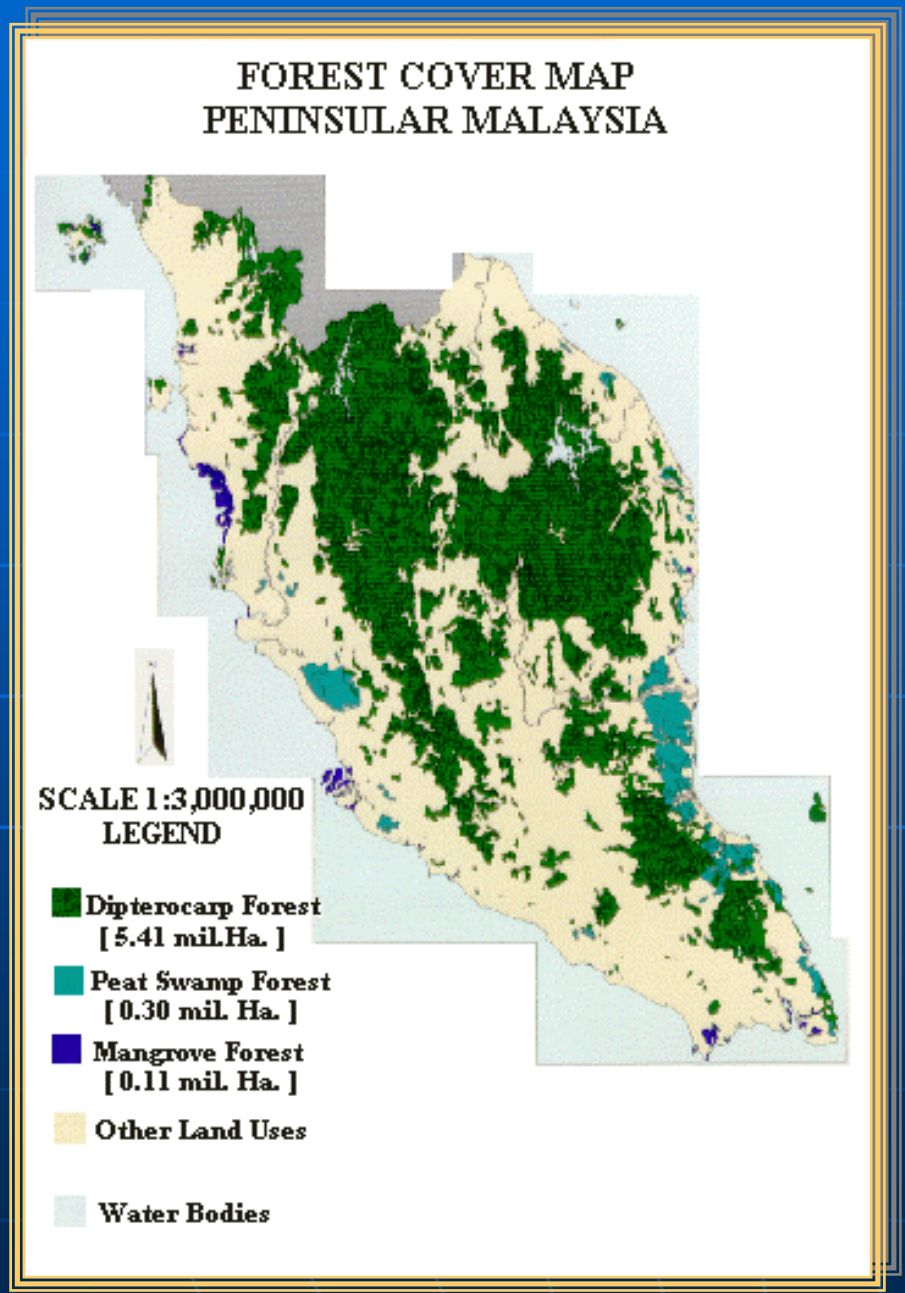
Outline of Presentation

- Importance of forest resources and ecosystems
- Issues related to forest resource depletion
- The need for forest ecosystem valuation
- Valuation studies in Malaysia
- Potential Applications
- Future Research
- Conclusions



Forestry sector in the national economic development

- Foreign exchange earnings *(7% of GNP, RM13 billion)*
- State revenue *(RM2 billion)*
- Employment *(250,000 persons)*
- Regional development
- Recreation *(> 116 recreation areas)*
- Environmental protection *(wildlife, biod, national parks)*
- Water supply *(agriculture, domestic, industry)*
- Medicinal plants *(Tongkat ali, Kacip fatimah, …)*
- Carbon sequestration
- Rattan and Bamboo
- Honey
- Resins
- NTFPs – 5% of state revenue

General Background

- In 1960's and 70's, large forest areas have been cleared for agriculture development *(Forested area has declined from 23.4 million ha in 1970 to 20 million ha in 2000)*
- Depletion of forest resources is a fundamental problem in the past and continue to challenge us today
- Increasing tropical deforestation has called attention to the sustainable forest management (SFM)
  (Area for timber harvesting had decreased 44% for the last 10 yrs)
- The focus has been shifted from timber production to environmental conservation and protection

General Background

- Presently, more emphasis on ecotourism and environmental benefits (water, soil protection, carbon sequestration, biodiversity conservation, wildlife conservation, etc)
- However, most of the benefits are not quantified in terms *economic value*
- These economic values are largely ignored in the decision making process and lead to serious environmental problems
- Reasons for forest resource depletion?

Reasons for Forest Resource Depletion

Policy and Market failures

Policy

- Policies on subsidies - encourage the development of agriculture activities
- Inefficient forest revenue system - concession areas are sold below the market price

Market

- Cost of externalities not included in forest resource pricing
- Property rights are not well defined
- Forest ecosystem services - public goods
- Unpriced forest ecosystems

Reasons for Forest Resource Depletion
Institutional and social failures

Institutional Failure

- No clear institutional arrangement - property rights structure or market-based instruments
- High transaction cost - legal dispute, policing and getting complete information (inventory, survey, damage assessment, lawyer fees, etc)

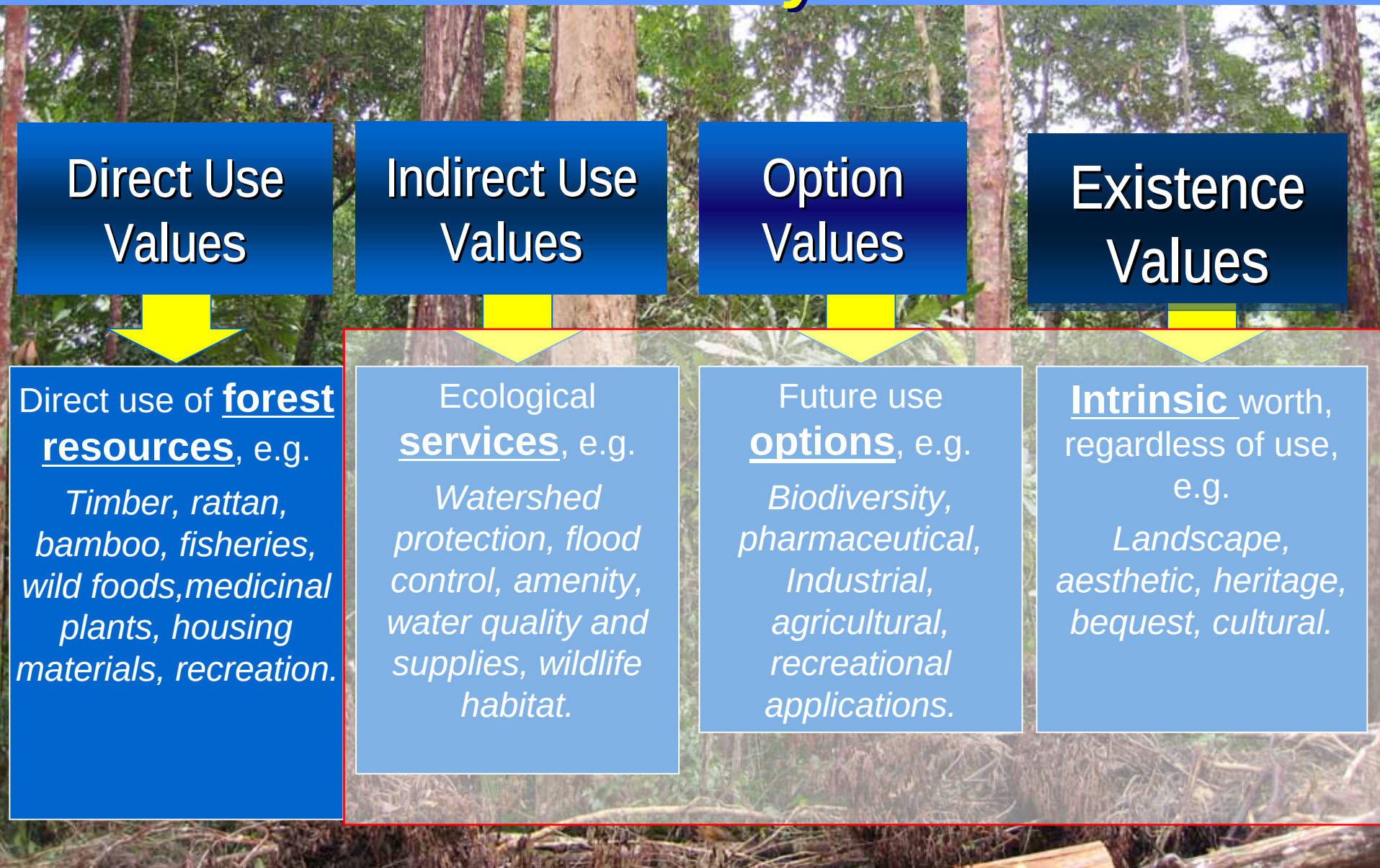
Social Failure

- Lack of conservation & protection efforts – ecosystem services are considered as "free gift"
- "Free riders" behaviour
- Lack of environmental education and awareness
- "Rent seeking" behaviour
- Disregard to the "law of god"

The Need for Forest Ecosystem Valuation

- Provide mechanism for policy instruments (market-based instruments)
- Allocation of public spending on forest and environmental conservation
- Incorporate public willingness to pay in forestry and environmental conservation project
- Evaluate competing forestry and environmental projects (BCA framework)
- Prioritise forestry and environmental development project
- Optimize forest investment
- Optimize forest goods and ecological service values of forest ecosystem
- Forest resource accounting – adjustment to national accounting

Total Economic Value of Forest Ecosystem Services



Direct Use Values

Direct use of **forest resources**, e.g.

Timber, rattan, bamboo, fisheries, wild foods,medicinal plants, housing materials, recreation.

Indirect Use Values

Ecological **services**, e.g.

Watershed protection, flood control, amenity, water quality and supplies, wildlife habitat.

Option Values

Future use **options**, e.g.

Biodiversity, pharmaceutical, Industrial, agricultural, recreational applications.

Existence Values

Intrinsic worth, regardless of use, e.g.

Landscape, aesthetic, heritage, bequest, cultural.

Past Studies on Forest Ecosystem Services and Valuation Methods

Forest Goods/Services	Approach	Technique
Timber	Market-based	Residual Value Technique
Rattan	Market-based	Residual Value Technique
Bamboo	Market-based	Residual Value Technique
Medicinal Plants	Market-based	Residual Value Technique
Recreation areas	Revealed Preference	Travel Cost Method
Wild Fruits	Market-based	Residual Value Technique
Protected areas	Stated Preference	Contingent valuation method (CVM) and Choice Model (CM)
Wildlife	Market-based/Stated Preference	Residual Value Technique/CVM
Carbon benefits	Market-based	Market price
Watershed protection	Market-based	Residual Value Technique/Production function
Local community	Market-based	Market price/ Ethnobotanical technique

Timber/Stumpage value

Dipterocarp forest
-RM4,200-RM42,000/ha

Mangrove forest
-RM187-RM9,086/ha

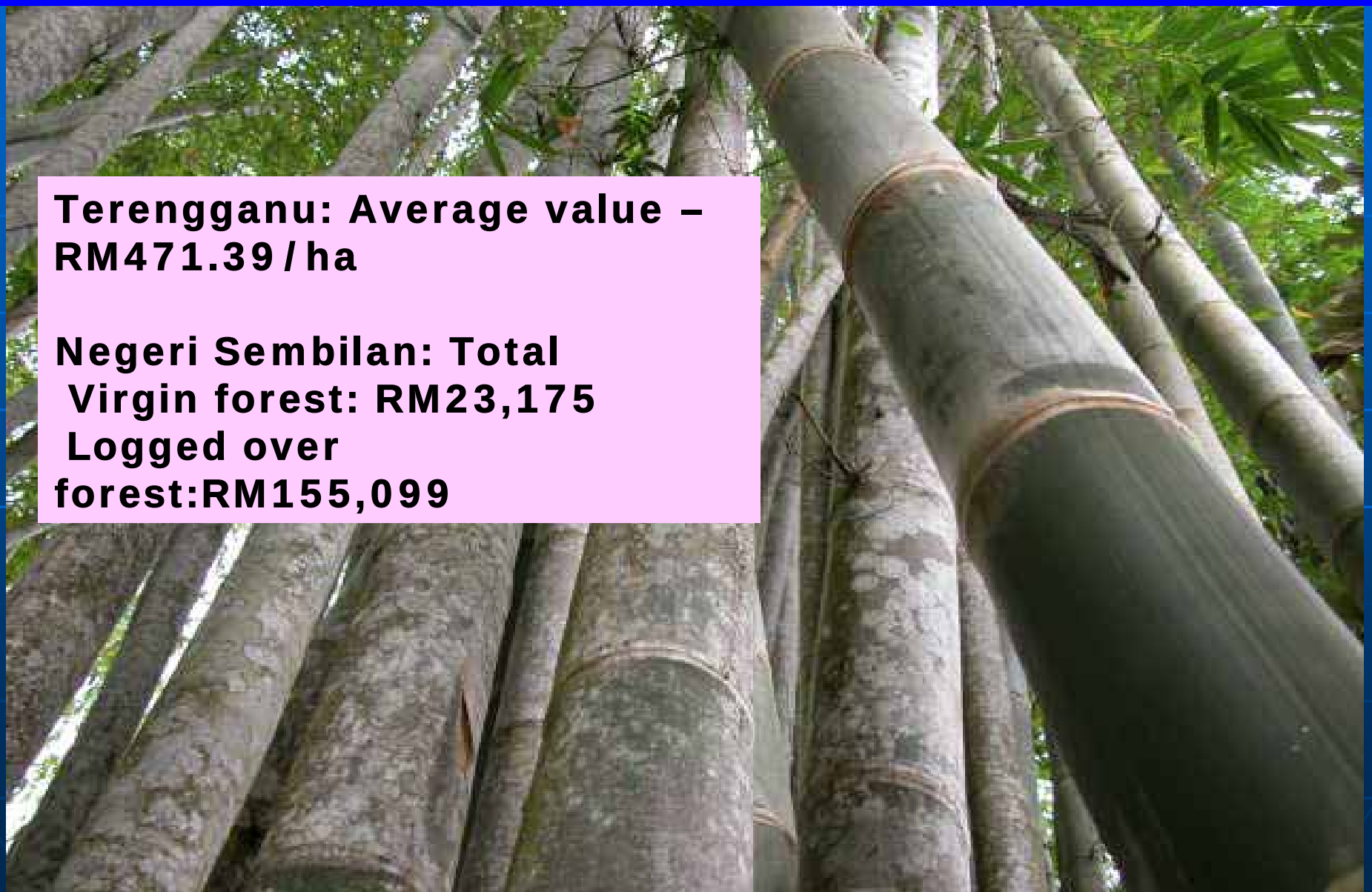
Plantation
-RM3,378/ha

Peat swamp forest
-RM1,722-RM15,765/ha

Rattan Value

- Economic value – depends on species and forest status
- Stock value of rattan range from RM0.94 – RM32.52/ha
- The total economic value per hectare – RM942.52/ha

Bamboo



Terengganu: Average value – RM471.39/ha

Negeri Sembilan: Total
Virgin forest: RM23,175
Logged over forest:RM155,099

Wild Fruits

- Petai (*Parkia speciosa*)
  - Pasoh Forest Reserve – RM22.04/ha
    (NPV: RM314,86/ha)
    (Woon and Poh, 1998)
  - Average Peninsular Malaysia – RM12.97/ha

- Other wild fruits
  - Pasoh Forest Reserve – RM892/ha

Economic Value of Fruit Trees in Pasoh FR (50 ha)

Project type/ issue of studies (object valued)	Scientific name	Value Total value (RM)
Fruits and nuts	*Artocarpus integer*	3,375
Fruits and nuts	*Baccaurea griffithi*	150
Fruits and nuts	*Baccaurea ramiflora*	167
Fruits and nuts	*Bouea oppositifolia*	3,533
Young Leaves	*Champeria manillana*	1,121
Roots	*Eurycoma longifolia*	4,475
Fruits	*Garcinia atroviridis*	240
Young Leaves	*Garcinia atroviridis*	72
Fruits and nuts	*Lansium domesticum*	24,505
Fruits and nuts	*Mangifera indica*	883
Fruits and nuts	*Parkia specioca*	6,450
Fruits and nuts	*Phyllantus emblica*	62

Source: Anon (1995)

REALIZED ECONOMIC VALUE OF NTFPS IN JENGAI FOREST RESERVE, TERENGGANU

(ITTO PROJECT)

Item	No. of Collectors	RM/year	RM/person/year
Gaharu	4	166,787	41,697
Rattan	5	6,717	1,343
Keranji	5	20,265	4,053
Petai	6	1,744	291
Medicinal Plants	5	14,916	2,983
Bamboo	5	288	58
Total		210,717	

Estimates of economic value of medicinal plant [value per hectare per year (US$)]

Scenario	Drug value		
	Low (US$390 million)	Medium (US$1000 million)	High (US$7,000 million)
100% appropriation rate:			
• protected area (711,472 ha)	38.73	99.30	695.11
• protected area+production forest (5.34 mill ha)	5.16	13.23	92.61
• effective protected area (2.1 mill ha)	13.12	33.64	235.50
50% appropriation rate:			
• protected area (711,472 ha)	19.36	49.65	347.55
• protected area+production forest (5.34 mill ha)	2.58	6.62	46.31
• effective protected area (2.1 mill ha)	6.58	16.82	117.75
10% appropriation rate:			
• protected area (711,472 ha)	3.87	9.93	69.51
• protected area+production forest (5.34 mill ha)	0.52	1.32	9.26
• effective protected area (2.1 mill ha)	1.31	3.36	23.55

Source: Kumari (1995)

Medicinal Plants

Forest Reserve	Location	Total Value of Medicinal Plants (RM/ha)	Total Value of Tongkat ali (RM/ha)	% of Tongkat ali to total values
Gunung Jerai				
Compartment 22	Lowland	1,984	517	26.1
Compartment 2	Top ridge	2,451	1,457	59.5
Gunung Raya				
Compartment 7	Lowland	3,279	195	5.9
Compartment 9	Top ridge	4,330	127	2.9
Bukit Perak				
Compartment 48	Lowland	6,921	49	0.7
Compartment 50	Top ridge	10,033	162	1.6
Average all compartments		4,832	418	8.6

Source: Mohd Azmi (2004)

Forest Recreation Areas (FRAs)

- WTP in 20 FRAs in P. Malaysia- RM1.46/visit, and the capitalized value at 5% discount rate is RM53.06 million (total FRAs in P. Malaysia in 2003 – 125)
- Other studies

State	Forest Reserve	Value
Selangor	Kanching FR	RM300, 000/year (consumer surplus)
	Semenyih Dam	RM0.50-2.50/visit
	Air Hitam FR	RM1.23 per visit
Negeri Sembilan	Ulu Bendul FR	RM61,005/year (consumer surplus)
	Ulu Bendul FR	RM0.58 to RM2.26 per visit

Protected Areas

- Economic varies by sites and types of protected areas
- Income to indigenous people range from US15 – 2714/household (Tasik Bera)
- WTP range from RM62 – 120/visitor per trip (KS Nature Park)
- Total Expenditure – RM6.5 million (National Parks)

Wildlife

- Economic values vary by species and sites
- Milky stork – RM246,000 per bird
- Spotted dove – RM10 per bird

Carbon benefits

- Carbon storage
  - RM500 million in 1989

Summary of Economic Value of Protected Areas in Malaysia

State	Protected Area	Value	Non-monetary indicator	Year of assessment	Source
Pahang	Tasik Bera	US$15-2714/ household Mean:US$84/household	-	1990	Anon (1995)
Selangor	Kuala Selangor Nature Park	WTP RM62-120 per visitor per trip (CVM)	-	1995	Jamal (1997) (1995)
	Kuala Selangor Nature Park	CS RM126 per visitor per visit (TCM) WTP RM15 per visitor (CVM)	-	2001	Rusmani (2001)
	Kuala Selangor Nature Park	US476,252 (1987-2000)	-	1995	Mohd. Shahwahid (1995)
Terengganu	Rantau Abang Turtle onservation Area	RM3.65 mill. (1984-95)	-	1995	Mohd. Shahwahid (1995)

Summary of Economic Value of Protected Areas in Malaysia

Pahang	National Parks	RM6,530,044 (Total visitor expenditure in the park, including transportation cost) RM120 – RM280 per visitor per year	No. of visitors 18,000/year 57,000 (1998)	1994 2000	Ahmad Shuib (1994) Norlida and Jamal (2000)
Johor	Mangrove Protection (Benut Mangrove Forest)	RM1/household per month or RM151,000 per year (12,650 households)		1999	Bann (1999)
Sarawak	Bako National Park	RM990,436/year (consumer surplus)	No. of visitors 32,880	1982	Chung (1982)
Sarawak	Niah National Park	RM851,761/year (consumer surplus)		1982	Chung (1982)
Sarawak	Lambir National Park	RM1,011,611/year (consumer surplus)		1982	Chung (1982)

Watershed Protection

Good/Service	Total protection	Conventional Logging	Reduced Impact Logging
• Timber	-	119,406,465	87,966,199
• Treated Water	128,841,265	121,354,969	125,876,881
• Total Net Benefits (PV at 10% discount rate)	128,841,265	249,761,434	213,843,080

The total catchment area is 118,600 ha, of which 98,539 ha are MUDA catchment area and 20,134 ha are Pedu catchment.

Source: Mohd. Rusli (2002)

Value of Net Benefits from Watershed Protection Under Different Forest Landuse Options in Hulu Langat Water Catchment Area, Selangor

Good/Service	Total protection	Reduced Impact Logging
Timber	-	16,692,434
Treated Water	7,694,319	7,694,319
Hydroelectric power	2,736,918	2,211,635
Total Net Benefits (PV at 10% discount rate)	10,431,237	26,598,388

- Source: Mohd Shahwahid et al. (1999)

Total Economic Valuation

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)

Total Economic Value (TEV) of some Forest Goods and Services in the North Selangor Peat Swamp Forest (Net Present Value at 8% discount rate) (FRIM/DANCED Study)

No.	Good/Service	NPV at 8% (RM million)	Note
1	Timber	321.21	26,649 ha are commercial forests
2	Hydrological	109.56	Irrigation water accounted for 99% of the total hydrological value
3	Carbon: Above ground Below Ground	 583.33 99.03	A value of RM14 per Ct was used
4	Ecotourism	1.78	WTP of RM1.42 per person used
5	Fish	2.08	Based on fishing in Sg, Tengi and main canal.
6	Asam kelubi	0.023	Based on socio-economic survey by Lim et al. (1998)
7	Total social values	113.437	Items 1+2+2+4+5+6
8	Total global values	682.36	Item 3
9	Total private values	321.21	Item 1
Grand Total		1,117.01	

Source: Anon (1998)

Total Economic Value (TEV) of some Forest Goods and Services in Matang Mangrove Forest, Perak (Figures in 1998)

No.	Good/Service	Economic value	Note
1	Timber	RM2,448/ha	Stumpage value based on charcoal production – allocated area
		RM2,535/ha	Stumpage value based on charcoal production – tendered area
		RM3,053/ha	Stumpage value based on charcoal production – excellent forest
		RM2,549/ha	Stumpage value based on charcoal production – good forest
		RM1,843/ha	Stumpage value based on charcoal production – poor forest
2	Ecotourism – bird watching	RM38-70 per trip	Consumer surplus using individual travel cost method (TCM) using semi-log regression model
3	Ecotourism – sport fishing	RM15.69 – 18.93 per trip	Consumer surplus using individual TCM using semi-log regression model
4	Conservation value (non-use value)	RM10-17 per household	Mean WTP using logit model from 571 respondents

Source: Jamal et. Al (1998)

….cont'd

5	Conservation value (non-use value)	RM8.84 per household	Mean WTP using choice model from 571 respondents This value is an equivalent surplus (ES) (WTP to avoid a degradation in resource use)
		RM18.28 per household	Compensating surplus (CS) (WTP to obtain an improvement in resource use)
6	Fish	RM452.60 per vessel/month	Resource rent for open sea fishing
		RM583.64 per vessel/month	Resource rent for river fishing
		RM8,621,138 per year	Total resource rent from fishing

Evaluation of Past Studies

- Quite extensive, but focus more on timber and market goods in a given forest ecosystem & compartment level
- Values at landscape, species and genetic levels are still lacking
- Various methods employed – market-based, revealed preference, and stated preference
- Economic value of NTFPs – focus on plant resources. Lack of economic values to indicate environmental resources and non-plant resources
- Application of valuation in BCA, NRA, resource pricing and economywide policies are still lacking
- No theoretical research conducted, focus on application of the valuation methods
- The information gathered from forest valuation studies are not spatially analysed using GIS/remote sensing technologies

Review of Past studies

Potential application of EV studies in Forestry Sector

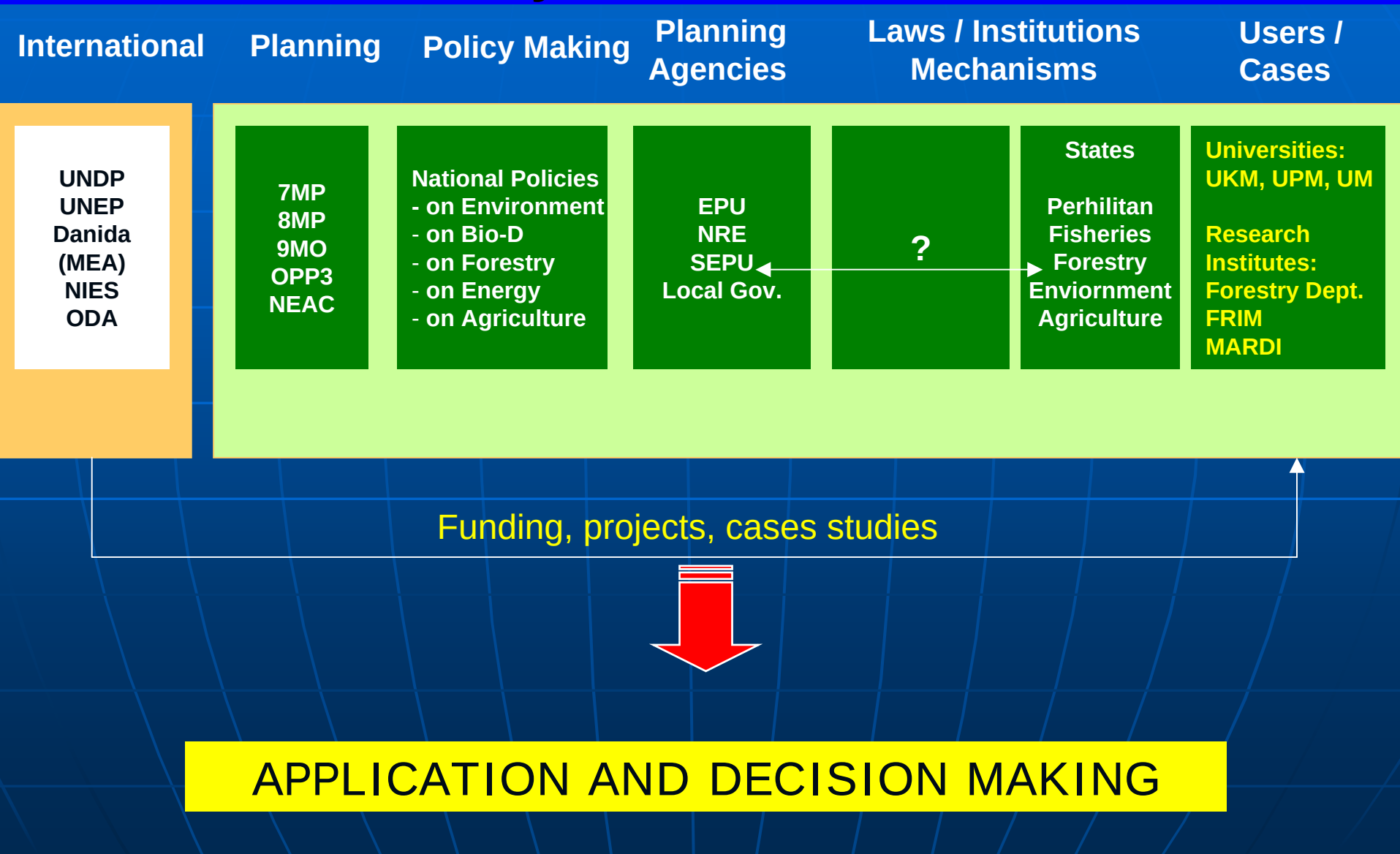
- Decision Making
  - Compare trade-off between several options, eg. logging, constructing dam, or water catchment
  - Justify conservation policies on economic basis
  - Timber Pricing - tendering
- Management and Conservation
  - Optimise the use of the conservation area (e.g. estimate non-use values, in forest resource mgmt)
  - Use of incremental cost framework in evaluating different logging technologies in a peat swamp forest
  - Develop proposal for wetlands or mangrove areas to be properly evaluated and full social cost pricing introduced
  - Recommend that a forest mgmt plan be prepared to ensure that the social and environmental benefits of wetlands are managed in a sustainable manner

Review of Past studies

Potential application of EV studies on tourism and recreation

- Optimal pricing of entrance fees to capture the value of tourism
  - Eg. source of revenue for the state, as well as to recover costs for park mgmt
- Encourage the potential role of economic analysis in protected area management, such as preparation for management plan of protected areas
- Determine the value of recreational benefits of a conservation area and eventually determine the potential economic viability of sustainable tourism as part of TEV for consideration to award protection status.

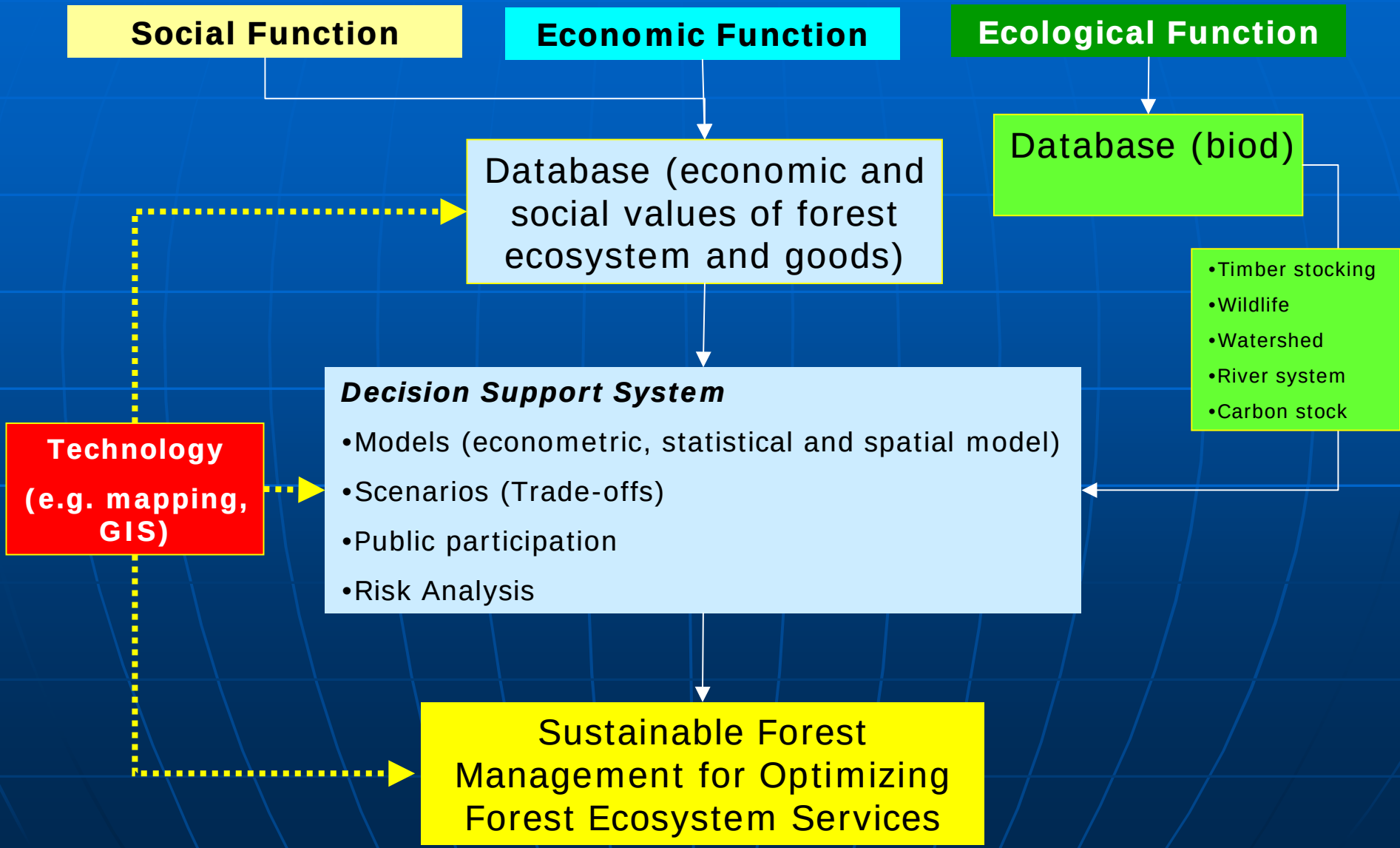
Framework for Environmental and Forest Ecosystem Valuation



Potential Research Priority Areas

- Estimating economic values of forest ecosystem services for local, national and global communities
- Establishment of database values for forest ecosystem services
- Scenario analysis of long term economic changes in values of forest ecosystem services and impacts of land use
- Risk assessment of forest development and linking with values of forest ecosystem services using GIS (*BCA, zoning, EIA, SIA, biodiversity, or comprehensive value of ecological services, spatial analysis*)
- Formulation of market-based instruments for long term forest development planning
- Legal implications of capturing the economic values of forest ecosystem services (*who pays, who gets benefits, whose preference count*)

Forest Ecosystem Services Valuation & Technology



Conclusions: Valuation of Forest Ecosystem Services

- The results show valuation can improve and influence decision-making in forest development and conservation
- There are an increasing number of examples of:
  - *Forest ecosystem values being integrated into environmental decisions*
  - *Forest ecosystem values being integrated into economic decisions*
- But this remains the exception rather than the rule
- Forest valuation can provide a powerful – and much needed – tool for influencing decision-making
- But both environmental and economic guidelines, requirements and best practices rarely emphasise forest ecosystem valuation
- Clear need for improved procedures, awareness and capacity to apply valuation to influence decisions in the real world