SOCIO-ECONOMIC IMPACT ASSESSMENT TOOLS FOR CLIMATE CHANGE WORKSHOP

24 – 25 November 2008
Klana Resort, Seremban
Negeri Sembilan

Organised by:
Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia (UKM)

Supported by:
Ministry of Natural Resources and Environment Malaysia
Second National Communications Project, United Nations Development Programme

Report

CONTENTS

INTRODUCTION

The workshop on Socio-Economic Impact Assessment Tools for Climate Change was held from 24 to 25 November 2008 by the Socio-Economic Impacts and Responses Support Group (SEI&R-SG) chaired by Institute for Environment and Development (LESTARI), UKM. The workshop was supported by Ministry of Natural Resources and Environment Malaysia and Second National Communications Project, United Nations Development Programme (UNDP).

The workshop was proposed and discussed by members during the fourth meeting of SEI&R-SG which was held on 10 October 2008 at LESTARI, UKM. Members agreed for a workshop to discuss specifically on the socio-economic impact assessment tools for climate change. The workshop also provided a platform for members to present the methodology application and challenges from different sectors. The workshop was attended by a total of 19 members.

WORKSHOP PROCEEDINGS

The workshop was chaired by Raja Datuk Zaharaton Raja Zainal Abidin. Prof. Dr. Joy Jacqueline Pereira, LESTARI, UKM presented an overview of the structure and functions of the support group in her capacity as Chair of the Socio-Economic Impacts and Responses Support Group (SEI&R-SG). Prof. Dr. Joy then raised the issues and challenges pertaining to vulnerability and adaptation which are the main focus of the support group. Issues had been identified to be resolved in future research. Among the issues were conceptual method for sectoral analysis, approach to cross-sectoral analysis and relevance of anticipated outputs to policy and decision-makers.

Different methodologies and case studies were presented by each sector. Energy sector had shared three methods for the economic impact analysis and national vulnerability and adaptation matrix of energy sector. Water sector presented the projected effects of climate change on water resources and suggestions for adaptation. It also shared case study on impacts in selected irrigation and domestic and industrial water users and analysis approach. Agricultural sector meanwhile specified types of crop chosen and data needed for the study. A framework for analysis was presented and three methodologies were identified for analysis. A more detailed research overview was presented from public health sector. The presentation outline the research objectives, research scope in accordance to WHO, research areas with their main economic activities, lists of data needed for different scopes of analysis, and methodologies and challenges. There were five study subjects identified for biodiversity sector. Therefore, presentation focused on the key variables, measurement and data collection for each study subject. An example regarding the impacts of climate change resulted the death of Rafflesia was presented. Meanwhile, forestry sector showcased the role and importance of forest and highlighted the impacts of climate change on forest. As for marine and coastal resources sector, the National Coastal Vulnerability Index Study was presented. An overview of the study was presented with focus on the socio-economic assessment.

WORKSHOP OUTCOMES

The outcomes of the workshop are listed below:

1. **Framework for the report**: Members of SEI&R-SG agreed with a reporting framework as shown in Table I. The reporting framework will record not only the analysis process but also the gaps and constraint and recommendations for further actions to be taken.

2. **Capacity needs and requirement**: Members raised few concerns for further attention and actions to facilitate the socio-economic assessment research in future. These included tools and software required for economic assessments in different sectors. Members are looking forward for future research collaboration and cooperation with relevant government agencies such as NAHRIM, Forestry Department, MARDI and national universities. In addition, the education, training and public awareness needs in future also rose by the members. Lastly, the financial sources and other assistances are concerns by members for them to undertaken the economic assessments research activities. All these issues are to be articulated in the report of the sub-group.

3. **Discussion on Input-Output Model**: Further discussion and relevant training on Input-Output Model will be undertaken in future. The SEI&R-SG Chair will convene a meeting to discuss this matter as soon as feasible.

4. **Finalisation of SEI&R-SG Report to NC2**: The reports to be submitted from each sector are currently compiled by SEI&R-SG Chair. A meeting will be arranged to meet and finalise the report with SEI&R-SG members. The economists for the sub-sectors are listed in Table II.

TABLE 1: REPORTING FRAMEWORK AND CONTENT

Font: Times New Roman size 12; single spacing; borders 2.5cm

1. Sectoral Analysis
   - o Scope of vulnerability assessment [All agencies] – ½ page
   - o Proposed conceptual approaches, methodology and tools [All agencies] – 2 pages
     - ▪ Procedures and arrangements to collect data [All agencies, if relevant]
   - o Expected/Key findings [All agencies] – ½ page
   - o Gaps and uncertainty analysis [All agencies] – ½ page
     - ▪ Limitations, challenges and issues
   - o Capacity requirements [All agencies] – ½ page
     - ▪ Facilities and other resources, software, infrastructure
   - o Research requirements [All agencies] – ½ page
   - o Education, training and public awareness [All agencies, if any] – ½ page
     - ▪ Human resources
   - o Information and networking [All agencies] – ½ page
     - ▪ Agencies/Stakeholders
   - o Sources of financial, technical and capacity building support for National Communication process [All agencies] – ½ page
     - ▪ Existing monetary and in-kind contribution
   - o Proposed future projects requiring financial and other assistance [All agencies] – ½ page
   - o Recommended good practice [All agencies] – ½ page
     - ▪ Coordination of physical and socio-economic aspects [Prof. Shahwahid]
     - ▪ Planning for integration [LESTARI]
     - ▪ Inter-agency collaboration [All agencies, if relevant]
   - o Action Plan [All agencies] – ½ page
     - ▪ Activity (Potential implementer, timeline [immediate: 2009-2010; medium: RMK10], budget)
     - ▪ Priority works for key sectors

2. Cross Sectoral and Integrated Analysis [LESTARI]

3. National Procedural Manual [LESTARI]
   - o Background
   - o Institutional arrangements

TABLE 2: ECONOMISTS FOR THE SUB-SECTORS

No.	Sector	Agency	Economist
1.	Water Resources	Pn. Hj. Zalilah Selamat, NAHRIM	Prof. Dr. Shahwahid Hj. Othman, UPM
2.	Agriculture	Dr. Mohad Zabawi Abdul Ghani, MARDI	Prof. Chamhuri Siwar, LESTARI, UKM
3.	Forestry	Tn. Hj. Yusoff Muda, JPSM	Pn. Tuan Marina bt. Tuan Ibrahim, JPSM
4.	Public Health	Dr. Lokman Hakim, IMR	Dr. Er. Ah Choy, FSSK, UKM
5.	Biodiversity	Dr. Saw Leng Guan, FRIM	Dr. Lim Hin Fui, FRIM
6.	Energy	En. Azman Zainal Abidin, PTM	Prof. Madya Dr. Abdul Hamid Jaafar, FEP, UKM
7.	Marine and Coastal Resources	Pn. Siti Aishah Hashim, JPS	Dr. Rawshan Ara Begum, LESTARI, UKM

APPENDIX II: PROGRAMME

SOCIO-ECONOMIC IMPACT ASSESSMENT TOOLS FOR CLIMATE CHANGE

Date: 24 – 25 November 2008
Venue: Klana Resort, Seremban, Negeri Sembilan

24 November 2008	
10.30 am	Registration of Participants
11.00 am	Welcoming Remarks
Chairperson: Raja Datuk Zaharaton Raja Zainal Abidin, Visiting Scholar LESTARI, UKM	
11.10 am –12.10 pm	An overview of the Socio-Economic Impacts and Responses Support Group – Prof. Dr. Joy Jacqueline Pereira, LESTARI, UKM
	Socio-Economic Impact Assessment: Methodology and Challenges for the Energy Sector by Assoc. Prof. Dr. Abdul Hamid Jaafar, Faculty of Economics and Business, UKM
	Q & A
12.30 pm	Lunch at Restaurant Selera CH
2.00 pm	Check-in
2.30 – 4.00 pm	Socio-Economic Impact Assessment: Methodology and Challenges for the Water Sector by Prof. Dr. Mohd. Shahwahid Hj. Othman, Graduate School of Management, UPM
	Socio-Economic Impact Assessment: Methodology and Challenges for the Agriculture Sector by Dr. Mohamad Zabawi Abdul Ghani, Malaysian Agricultural Research and Development Institute (MARDI)
	Q & A
4.00 – 4.30 pm	Coffee / Tea Break
4.30 – 6.00 pm	Socio-Economic Impact Assessment: Methodology and Challenges for the Marine and Coastal Resources Sector by Dr. Rawshan Ara Begum, LESTARI, UKM
	Socio-Economic Impact Assessment: Methodology and Challenges for the Public Health Sector by Dr. Er Ah Choy, Faculty of Social Sciences and Humanities, UKM
	Q & A
6.00 – 8.30 pm	Break and Dinner at Restaurant Selera CH
8.30 – 10.00 pm	Socio-Economic Impact Assessment: Methodology and Challenges for the Biodiversity Sector by Dr. Lim Hin Fui, Forest Research Institute Malaysia (FRIM)
	Socio-Economic Impact Assessment: Methodology and Challenges for the Forestry Sector by Forestry Department of Peninsular Malaysia (JPSM)
10.30 pm	Supper

25 November 2008	
9.30 - 10.00 am	Discussion 1: ▪ Consolidation of scope and tools for socio-economic impact assessment ▪ SEI&R-SG – NC2 Reporting Format
10.30 am	Coffee / Tea Break
10.45 am – 12.30 pm	Discussion 2: ▪ Recommendation for future research ▪ Expansion of research network
12.30 pm	Check-out and lunch

APPENDIX III: LIST OF SPEAKERS, TRAINER AND PARTICIPANTS

No.	Name	Organisation
		Chairperson
1.	Raja Datuk Zaharaton Raja Zainal Abidin	LESTARI, UKM
		Participants
1.	Prof. Dr. Joy Jacqueline Pereira	*Ketua Kumpulan Sokongan Impak Sosio-Ekonomi dan Tindakan, LESTARI*
3.	Dr. Mohamad Zabawi Abdul Ghani	*Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI)*
4.	Dr. Lim Hin Fui	*Institut Penyelidikan Perhutanan (FRIM)*
5.	Tuan Marina Bt. Tuan Ibrahim	*Jabatan Perhutanan Semenanjung Malaysia (JPSM)*
6.	Prof. Dr. Shahwahid Hj. Othman	Graduate School of Management, Universiti Putra Malaysia (UPM)
7.	Dr. Leela Anthony	*Institut Penyelidikan Perubatan (IMR)*
8.	Dr. Rawshan Ara Begum	*LESTARI, UKM*
9.	Dr. Er Ah Choy	*Fakulti Sains Sosial dan Kemanusiaan, UKM*
10.	Azman Zainal Abidin	*Pusat Tenaga Malaysia*
11.	Siti Indati	*Pusat Tenaga Malaysia*
12.	Radin Diana	*Pusat Tenaga Malaysia*
13.	Prof. Madya Dr. Abdul Hamid Jaafar	*Fakulti Ekonomi dan Perniagaan, UKM*
14.	Siti Khadijah Bt. Abd. Rasaid	*Jabatan Pengairan dan Saliran Malaysia (JPS)*
15.	Norzilla Mohammed	*United Nations Development Programme (UNDP)*
16.	Zawina Bt. Ahmad	*NRE/UNDP – NC2 Project Assistant Coordinator*
17.	Tan Ching Tiong	*LESTARI, UKM*
18.	Koh Fui Pin	*LESTARI, UKM*
19.	Mohd. Khairul Zain Ismail	*LESTARI, UKM*

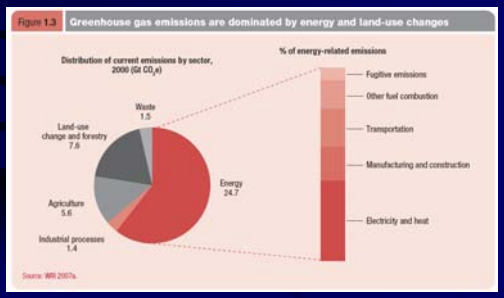
Socio-economic Impacts and Responses Support Group: An Overview

Joy Jacqueline Pereira
Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia

Climate Change – An Overview

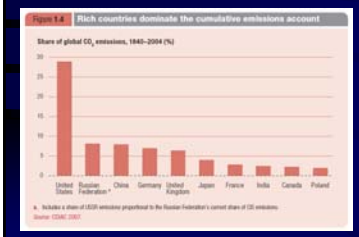
Global Emissions of Greenhouse Gases (1)

Contributing Sectors in 2000



Global Emissions of Greenhouse Gases (2)

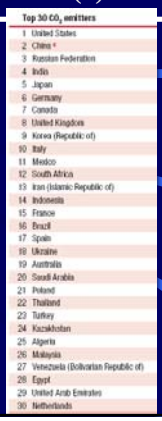
Contributing Countries (Cumulative, 1840-2004)



Global Emissions of Greenhouse Gases (3)

Snapshots of Top Emitters in 1990 & 2004

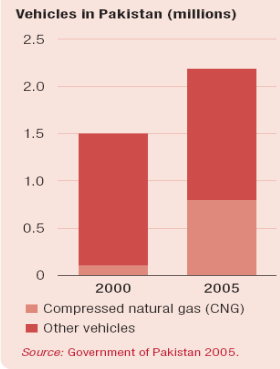
Top 30 CO_2 emitters	Share of World Total (%)		CO_2 emm. ($t CO_2$) per capita	
	1990	2004	1990	2004
1. US	21.2	20.9	19.3	20.6
2. China	10.6	17.3	2.1	3.8
8. UK	2.6	2.0	10.0	9.8
14. Indonesia	0.9	1.3	1.2	1.7
22. Thailand	0.4	0.9	1.7	4.2
26. Malaysia	0.2	0.6	3.0	7.5



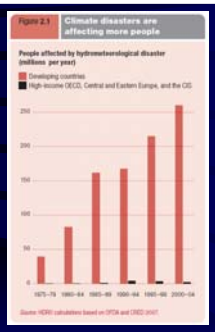
Strategies for Mitigation

Mitigation example from Pakistan

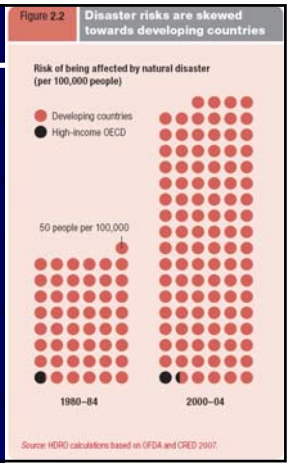
Figure 3.6 **Rapid transition of the car fleet is possible—Pakistan**



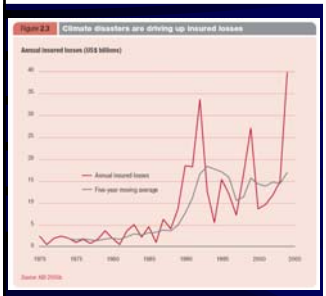
Risks & Vulnerability (1)



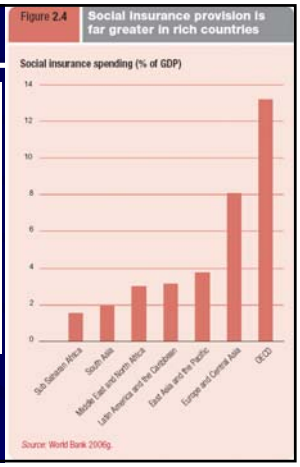
Unfortunately, the recipients are mainly from the developing world!



Risks & Vulnerability (2)

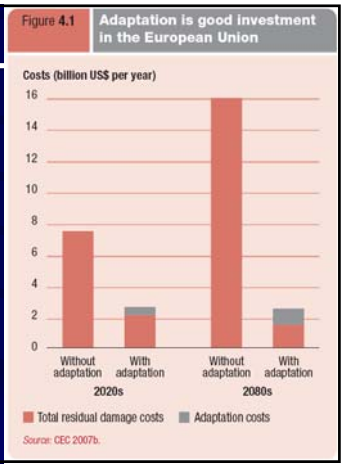


Economic losses are increasing world-wide but social insurance is greater in rich countries!



Adaptation

Adaptation equals to good investment!



NINTH MALAYSIA PLAN – MITIGATION PROGRAMME

- **Increase supply and utilisation of alternative fuel such as renewable energy (RE);**
- **By 2010 about 300 MW of RE is expected to be generated and connected to the TNB Grid in Peninsular Malaysia and 50 MW to SESB Grid in Sabah;**
- **RE projects utilising municipal waste will be promoted;**
- **The Clean Development Mechanism (CDM) under the Kyoto Protocol will be utilised to provide support for the implementation of Small Renewable Energy Programme (SREP);**
- **Supply to 55,000 unit of houses electricity generated from technologies such as hybrid solar system and micro-hidro;**
- **Encourage energy efficiency in industrial, building and transport sectors;**
- **Protect forest areas via sustainable forest management to ensure the forest areas are maintained as sink to greenhouse gas, i.e. Carbon dioxide.**

NINTH MALAYSIA PLAN – ADAPTATION PROGRAMME

- **Conduct Coastal Vulnerability Index (CVI) study;**
- **Implement coastline protection programme;**
- **Implement flood mitigation programme such as the Stormwater Management And Road Tunnel (SMART) Project;**
- **Undertake study to identify the relationship between the impacts of climate change and vector-borne diseases;**
- **Develop Integrated Coastal Zone Management.**

NATIONAL LEVEL (2nd National Communication)

GHG Inventory (FRIM)

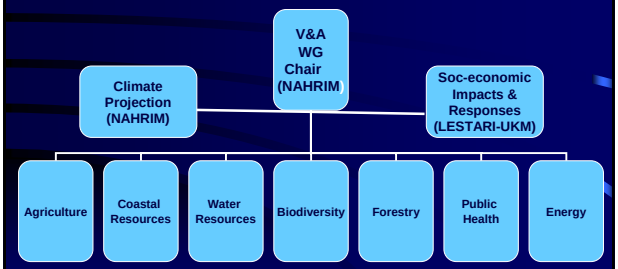
- Energy & Industrial Processes (PTM)
- Agriculture (MARDI)
- LULUCF (FRIM)
- Waste (DOE/KPKT)

Mitigation (PTM)

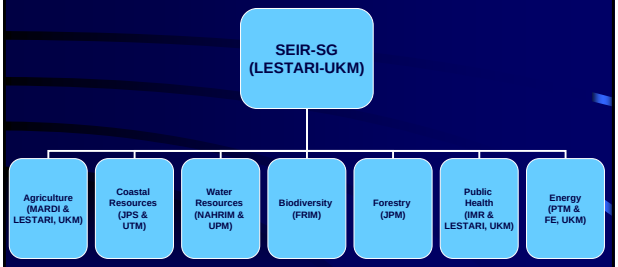
Vulnerability & Adaptation (NAHRIM)

- Agriculture (MARDI)
- Forestry (JPSM)
- Biodiversity (FRIM)
- Energy (PTM)
- Water Resources (NAHRIM)
- Coastal & Marine (DID)
- Public Health (IMR)
- Climate Projection (NAHRIM)
- Socio-economic Impacts & Responses (LESTARI)

Vulnerability & Adaptation Working Group



Socio-economic Impacts and Responses Sub-Group (SEIR-SG)



Issues and Challenges

Definitions

Vulnerability:-

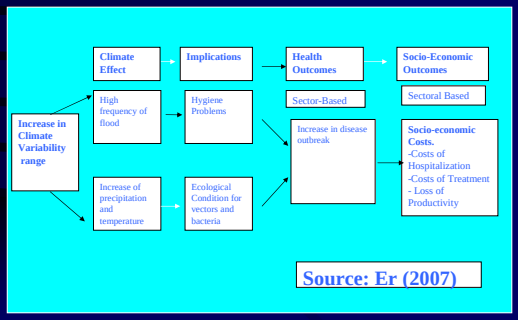
- Extent to which a natural or social system is susceptible to sustaining damage from climate change
- A function of the sensitivity of a system to changes in climate (the degree to which a system will respond to a given change in climate, including beneficial and harmful effects), adaptive capacity (the degree to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate), and the degree of exposure of the system to climatic hazards.

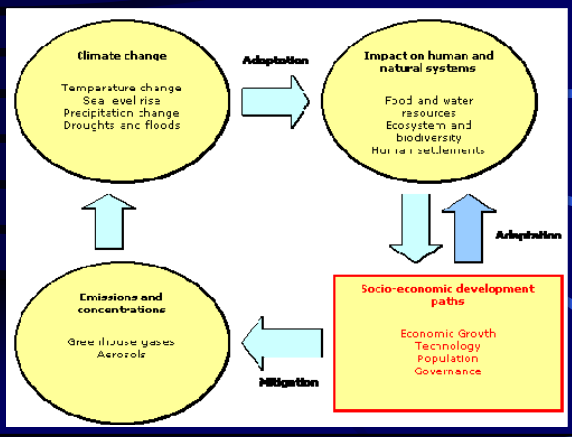
Adaptation:-

- Adjustments in practices, processes or structures to take account of changing climate conditions
- A crucial response because even if current agreements to limit emissions are implemented, they will not stabilize atmospheric concentrations of GHG emissions and climate

Source: The Third Assessment Report (TAR), UNFCC/IPCC)

Overarching Framework





Adaptive Capacity: Definition & Evolution of Understanding

- Adaptive capacity – ability of a system to:
  - Moderate the impacts
  - Take advantage of the opportunities
  - Cope with the consequences
- Evolution of understanding – links closely with vulnerability
  - End-point approach
  - Starting-point approach

Source: Tan et al. (2008)

Adaptive Capacity: End-Point Approach

- Design and implementation of adaptation:
  - Future climate change
  - Vulnerability in biophysical factors
- Uncertainties in the approach:
  - Climate scenarios
  - Climatic effects on sectors
  - Future socio-economic conditions
  - Unknown if adaptive capacity assets will be drawn in time of need
- Shortcomings:
  - Highly dependent on climate scenarios (CC may alter in a different way than expected) → adaptation measures may become inappropriate

Source: Tan et al. (2008)

Adaptive Capacity: Starting-Point Approach

- Adaptive capacity of the present's system:
  - Socio-economic factors + Biophysical factors
  - Enhancing the present's ability to respond to stressors and secure livelihood
- Pro:
  - Practical for coping with changes and uncertainties
  - Promote sustainable development
  - Facilitate cheaper adaptation strategies
  - Target the poor and vulnerable groups more effectively

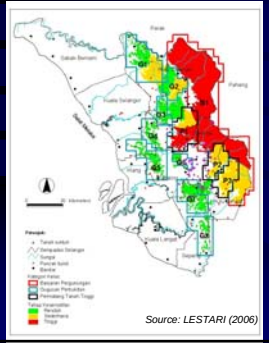
Source: Tan et al. (2008)

All flooded: An aerial view showing the level of flooding in Kota Tinggi town yesterday. - 15 January, 2007

Water, water everywhere: An aerial view of a housing estate in Kota Tinggi town at 9am yesterday. ? Courtesy of Ong Boon See - 14 January, 2007

Climate Change – Additional Stressors to Existing Sensitivity?

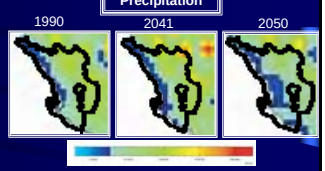
Environmentally Sensitive Areas in Highlands of Selangor



Source: LESTARI (2006)

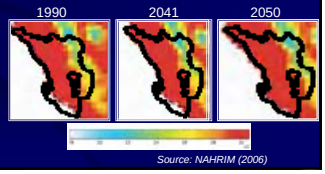
Precipitation

1990 2041 2050



Soil Surface Temperature

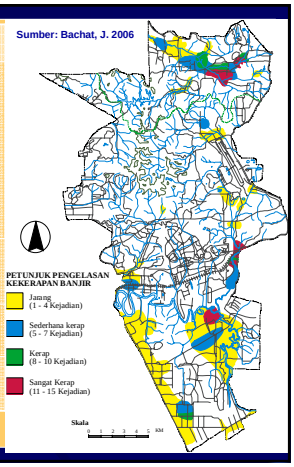
1990 2041 2050



Source: NAHRIM (2006)

Nama tempat	Bil. kejadian	Kekerapan (1990-98)
Lebuhraya Persekutuan (Sg. Rasau), Jln. Subang Airport, Kg. Subang, Kg. Lanchong Jaya, Kg. Melayu Kebun Bunga, Tmn. Sri Kilat, Tmn. Maznah, Kg. Bukit Naga, Tmn. Rashna, Kg. Lombong, Kg. Baru Hicom, Kg. Baru Subang, Jln. Glenmarie, NKVE (Plaza Tol Shah Alam), NKVE (Batu Tiga), Shah Alam, Ladang Elmina, Kg. Sg. Pelong & Kg. Baru Sg. Buloh	1 – 4	Jarang
Kg. Lembah Bina, Kg. Padang Jawa, Sg. Rasau, Kg. Melayu Subang, Bt. Kemuning, Kg. Jln. Kebun & Kg. Paya Jaras Dalam	5 – 7	Sederhana kerap
Kg. Merbau Sempak, Kg. Kubu Gajah, Kg. Paya Jaras Hilit & Kg. Paya Jaras Tengah	8 – 10	Kerap
Kg. Kebun Bunga, Batu Tiga, Tmn. Sri Muda, Kg. Paya Jaras Hulu & Bandar Baru Sg. Buloh	**11 – 15**	**Sangat kerap**

Sumber: Bachat, J. 2006



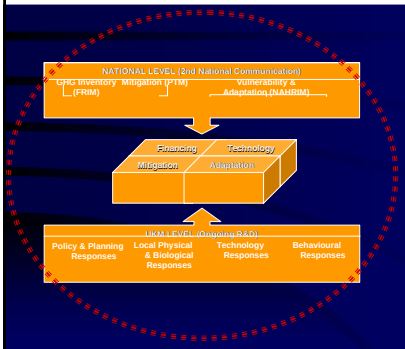
Challenges

- Methodology
- Information
- Balance between sector-based & macro-based approaches
- Physical science focused adaptation tools
- Process based adaptation
- Linking adaptation to growth agendas
- Challenges of adaptation governance over scales
- Balance between top-down and bottom-up approaches
- Pro-poor adaptation
- Transforming livelihoods and coping mechanisms
- Climate justice and rights

Issues to Resolve

1. Conceptual method for sectoral analysis
2. Approach to cross-sectoral analysis
3. Relevance of anticipated outputs to policy and decision-makers
4. Data availability and limitations
5. Scope of work for the future
6. Recommendations
7. Framework of NC2 Report

Malaysian Network for Research on Climate, Environment & Development (MyCLIMATE)



- **Consolidate R&D partnerships within UKM**
- **Strengthen linkages with government agencies, private sector, NGOs/CBOs and selected universities**
- **Complement national agencies and conduct R&D that is policy relevant**

THANK YOU

SOCIO-ECONOMIC IMPACT ASSESSMENT : METHODOLOGY AND CHALLENGES FOR THE FORESTRY SECTOR

BY

TUAN MARINA BT TUAN IBRAHIM
FORESTRY DEPARTMENT PENINSULAR MALAYSIA

OUTLINE

- ❖ FOREST – FAO DEFINITON
- ❖ FOREST TYPE
- ❖FUNCTION OF THE FOREST
- ❖FOREST AREA
- ❖THE ROLE OF FOREST
- ❖IMPACT OF ECONOMY FORESTRY

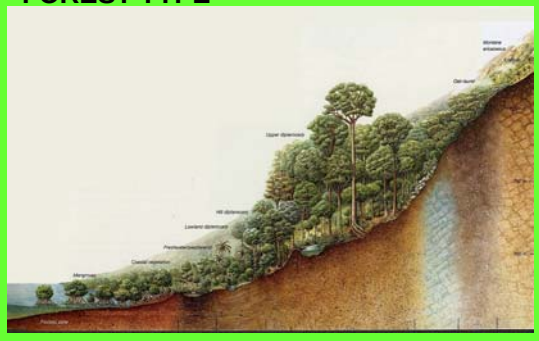
JABATAN PERHUTANAN SEMENANJUNG MALAYSIA
JALAN SULTAN SALAHUDDIN, 50660 KUALA LUMPUR
TEL :03 26164488 FAX:03 26925657

FOREST – FAO DEFINITION

Land with tree crown cover of more than 10 percent and area of more 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of ground; or open forest formation with a continuous vegetation cover in which tree crown exceeds 10 percent. Young natural sands and all plantations established for forestry purposes which have yet to reach a crown density of percent of tree height of 5m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of uman intervention or natural causes but which are expected to revent forest.

JABATAN PERHUTANAN SEMENANJUNG MALAYSIA
JALAN SULTAN SALAHUDDIN, 50660 KUALA LUMPUR
TEL :03 26164488 FAX:03 26925657

FOREST TYPE



JABATAN PERHUTANAN SEMENANJUNG MALAYSIA
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FOREST FUNCTION

PRODUCTIVE FOREST
- ➢Timber production forest

PROTECTIVE FOREST
- ➢Soil Protection Forest
- ➢Soil Reclamation Forest
- ➢Flood Control Forest
- ➢Water Catchments Forest

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AMENITY FOREST
- ➢Forest Sanctuary for Wildlife
- ➢Virgin Jungle Reserves
- ➢Amenity Forest
- ➢Education Forest
- ➢Research Forest
- ➢Forest for Federal Purposes

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FORESTED AREA, PENINSULAR MALAYSIA, 2007

Land Area	Hectare
Permanent Reserved Forest	469,630
Stateland	444,991
Wildlife Reserve	700,574
Total	5,841,195

THE ROLE OF FOREST IN REGLATING GAS EMISSIONS

The tropical forests, in particular, are very productive and rich in biomass, in which Mahli & Grace (2000) noted from computer models estimated that annual net carbon production is 18 Pg carbon even though forest biomass decreased 1.1 Gt of carbon annually due to deforestation and forest degradation (FAO 2005).

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Activities that lead the lack of forest covers at landscape level was partly cited along with the emissions from fossil-fuel combustion from developed countries as the greatest carbon contributor of green house gas. Above all, deforestation, in developing countries particularly, is singled out to be the culprints in the declining state of forest covers. Deforestation has produced more than 25% of carbon emissions from human activities in the last two decades (Sheeran 2006, Skutch et. Al. 2007)

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Estimated that about 465 million tons carbon were released every year between 1990 and 2000 in ASEAN countries due to overexploitation (Kim Phat et el. 2004)

Forest cover		Annual change rate		Annual carbon release (Tg* C)
1990	2000	X 1000 ha	%	
21,661.0	19,292.0	-236.9	-1.1	47.4

* Tg – 1.2^{10} kg carbon

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IMPACT OF CLIMATE CHANGE TO FOREST

DECREASE OF SPECIES HABITATS

Tree species distribution and abundance, in particular, are the manifestation of the physical environment. This is very crucial factor as it was noted by Whitmore (1984) that Peninsular Malaysia, seedling sensitivity to drought may be an important factor in distribution of *Shorea* spp.

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FOREST HEALTH AND PRODUCTIVITY

Climate change will also effect forest health and productivity that also able to trigger unprecedented numbers of disease outbreak in wildlife population in rainforest (Harvell et al. 2002)

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GROWTH AND YIELD

The alteration of physiological processes in trees and soil, influencing growth and yield forest over time. The relative loss of tree growth will be less if precipitation is reduced and increased of temperature (Andalo et. Al. 2005) On the other hand, Fearnside (2004) cited that night time temperatures are critical in La Selva Research Station in Costa Rica, whereby tree growth is less in hot years.

IMPACT OF THE ECONOMY FORESTRY

Economic analyses for several different climate scenarios indicate that forest productivity and yield are likely to have and impact. It also envisaged that changes in climate and consequent impact of forests are likely to change market incentives to harvest and plant trees.

IMPACT OF THE ECONOMY FORESTRY

DIRECT IMPACT	SHORT-TERM	LONG-TERM
Species habitat	X	
Health and Productivity	X	
Growth and Yield	X	
INDIRECT IMPACT		
Wildlife		X
Water and water catchment	X	X
Forest Recreation		X
Local community	X	
Forest Area		X

IMPACT OF THE ECONOMY FORESTRY

APPROACH VALUING

DIRECT IMPACT	Physical Impact Study	Monitoring Impact Study
Species habitat	Inventory	Stumpage Value
Health and Productivity	Productivity Survey	Change in Productivity Approach
Growth and Yield	Inventory	Stumpage Value
INDIRECT IMPACT		
Wildlife	Inventory	Market Based Approach
Water and water catchment	Productivity Survey	Residual Method
Forest Recreation		Travel cost Method
Local community		Market Based Approach
Forest Area	Inventory	Residual Value Technique

IO MULTIPLIER

- OUTPUT MULTIPLIER
- INCOME MULTIPLIER
- EMPLOYMENT MULTIPLIER

Table 1. List of Forest Resources by Major Categories

Forest Goods	Forest Services
Timber Rattan Bamboo Medicinal plants Fruits Nuts Vegetables Fibre/Thatch Ornamental Latex/Resin Dyes/Tannins Feed plants (fodder) Occult magic Fuelwood/poles Essential oils Vegetable oils Honey Climbers Water Wildlife Minerals Genetic resources Forest seedlings Seeds Palms	Microclimate regulation Carbon sequestration Recreation Soil protection Watershed protection Asthetic/amenity Wildlife habitat Human habitat Security Landscape Genetic conservation areas Land physical structure Pollination Nutrient cycling Air pollution control Noise pollution control Seed dispersal Shoreline stabilization Sediment retention Water transport Cultural heritage Natural museum Arboretum Games/hunting Research Education Training

Forest Goods and 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
Fruit Trees	Market-based	Residual Value Technique
Keruing Oil	Market-based	Residual Value Technique
Karas/Gaharu	Market-based	Residual Value Technique
Ornamental plants	Market-based/Stated Preference	Residual Value Technique/CVM
Water (as commodity)	Market-based/Stated Preference	Residual Value Technique/CVM
Recreation areas	Revealed Preference	Travel Cost Method
Wildlife	Market-based/Stated Preference	Residual Value Technique/CVM
Insect and Honey	Market-based/Stated Preference	Residual Value Technique/CVM
Local community dependence on forest (including orang asli)	Market-based	Residual Value Technique/ Ethnobotanical technique
Conservation value (option and existence)	Stated Preference	Contingent valuation method (CVM) and Choice Model (CM)

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Socio-Economic Impact Assessment: Methodology & Challenges for the Biodiversity Sector (Arising from Climate Change)

Lim Hin Fui & Mohd Parid Mamat
Environmental sociologist
Forest Research Institute Malaysia

24-25 November 2008
Bengkel Kumpulan Sokongan Impak Sosio-Ekonomi dan Tindakan (SEI&R-SG) – Socio-Economic Impact Assessment Tools for Climate Change,
Second National Communication (NC2)
Klana Hotel, Seremban, Negeri Sembilan

Outline of Presentation

- The Biodiversity Sector
- The Proposed Methodology
- Challenges

The Biodiversity Sector Change

- It means the change in the range of types and variability of animals, plants and microorganisms within the ecosystems
- This includes the biodiversity of trees, orchids, birds, fish, ferns, fungi, insects, etc.

The Proposed Methodology

Methodology here concerns finding out the socio-economic impacts when there is a significant change in biodiversity resources caused by climate change

Available Information

1. Land use change & its impacts on biodiversity
2. Socio-economic change & its impact on land use
3. Climate change leads to flood, drought, soil erosion & degradation →
4. affects agriculture sectors →socio-economic impacts
5. Socio-economic impacts related to change in water resources

=→Not much information on socio-economic impacts caused by change in biodiversity

Subjects for study

1. Local biodiversity dependent community
2. Local shop owners
3. Biodiversity resource traders
4. Biodiversity product value-added processing industries
5. Tourist operators

Initial Task

- Identifying the extent of the 5 target groups

1. local community,
2. local shop owners,
3. traders,
4. industries,
5. tourist operators

Rapid Rural Appraisal

A quick way of data collection to have a general overall views of:

1. The socio-economic conditions of a target group & its environment
2. The socio-impacts of change in biodiversity

Sampling

- Selecting the number to be study

  (a) Small number of subject – census

  (b) Big number of subject – sampling based on some knowledge of the characteristics of the population being sampled

Key Variables, Measurement

A. Local biodiversity dependent communities

1. Occupation (harvesters)
2. Employment status (employer, self-employed,
3. employee, unpaid family worker)
4. Use of biodiversity resources (subsistence, sale or both)
5. Yield of products (Quantity) & Price (RM/unit)
6. Income (cash & non-cash)
7. Rural-urban migration (number of out-migrants)
8. Remittance (RM)
9. Poverty (per capita income poverty line)
10. Loss of traditional knowledge (frequency use of medicine)

Methods of Data Collection

- Socio-economic survey or census
- Field observation on community as a whole & households

Key Variables, Measurement

B. Local shop owners

1. Employment of workers
2. Sales & profits
3. Income of workers
4. Poverty (per capita income poverty line)

Methods of Data Collection

1. Socio-economic survey or census
2. Field observation on community as a whole & households

Key Variables, Measurement & Data Collection

C. Biodiversity product traders

1. Yield of products (Quantity)
2. Price (RM/unit)
3. Gross income (RM)
4. Net profit (RM)

Method of data collection:

1. Socio-economic survey on traders

Key Variables, Measurement & Data Collection

D. Resource-dependent down-stream processing industries

1. Employment (number of workers employed)
2. Biodiversity materials supplied (quantity) & price (RM)
3. Annual sale (RM)
4. Net profit (RM)
5. Income per worker (RM)

Method of data collection: Socio-economic survey on

(a) biodiversity resource processing industries
(b) workers

E. Local tourist operators

1. Employment (Number of workers employed)
2. Visitors (Number of visitors)
3. Annual sale (RM)
4. Net profit of operators (RM)
5. Income tourism guides (RM)

Method of data collection: Socio-economic survey & field observation on

(a) tourist operators
(b) tourist guides

Data collection

Option 1:

If there is a base year data, use it to compare with the current research data, where appropriate.

Option 2:

If there is no relevant base year data, then gather time series data (actual or estimated) from the socio-economic survey

Option 3:

If time is not a constraint, make comparison between current year data with data to gather in the future, assuming that climate change is expected to continually affecting biodiversity change.

Primary Reference period

Last 12 months

Multiplier Effects

Change in BioD

↓

Reduced income of villagers

↓

Impacts on other sectors of economy

(retail trade, transportation, agriculture investment)

Example

How change in climate results in the death of Rafflesia spp in a particular forest reserve

1. Income to indigenous peoples harvesting Rafflesia for own use and for sale
2. Employment and income of indigenous peoples and tour operators running business by bringing tourists to the Raffesia site
3. Income and employment of factories processing Rafflesia
4. Income of local sundry shops
5. Multiplier effects on local agriculture investment

Challenges

- Difficulty in obtaining cooperation from traders and industries
- Measurement of multiplier effects
- Lack of secondary data

Thank You

MAY ALL OF US BE HAPPY & HEALTHY

Climate Change and Public Health: Impact and Intervention

Er Ah Choy
UKM
Socio-economic Impact Assessment Tools for Climate Change
Klana Resort, Seremban, Negeri Sembilan
24 November 2008

Team Members

- Dr. Er Ah Choy (Project Leader)
- Prof. Dr. Joy Jacqueline Pereira
- Dr. Mazrura Sahani
- Datin Paduka Dr. Halimaton Saadiah Hashim
- Dr. Hidayatulfathi Othman
- Dr. Mohd Talib bin Latif

Research Objectives

Three Main Research Objectives

- To determine the impact of climate change on human health
  - Analyses the types of diseases and health outcomes
  - Spatial distribution of diseases (for mapping purposes)

Research Objectives

- To study the responses from the perspectives of adaptive, co-beneficial and mitigative measures
- To develop a quantitative methodology to compute the socio-economic impact
  - Quantification of socio-economic costs
  - Utilization of statistical tools with special emphasis on time series for the purpose of forecasting

Climate Change Scope in Accordance to World Health Organisation Classification

- Air pollution
- Disasters: floods, strong winds (angin ribut) and droughts (if in existence)
- Vector-borne diseases
- Diarrhoeal disease in relation to water and food
- Depletion of stratospheric ozone
- Thermal environment on mortality and morbidity

Not inclusive of :

- *Food security*

Research Area: Langat River Basin

- Langat River Basin is chosen as the research area
- Langat River Basin is located at latitude 20^0 4'U to 3^0 20'U and longitude 101^0 10'E to 102^0 00'E
- Langat River Basin covers the Kuala Langat District and Sepang District of Selangor state and the Federal Territory (FT) of Putrajaya and Seremban District of the state of Negeri Sembilan

Research Area: Langat River Basin

Amongst the main economic activities:

- Agriculture
- Manufacturing
- Housing
- Commercial inclusive of wholesaling and retailing
- Aviation hub
- IT hub
- Higher education and training

Health-Related Socio-economic Costing as a Result of Air Pollution

Specific Environmental Data Required:

- Air Pollutant Index (API)

Diseases, patients, social & economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Health-Related Socio-economic Costing as a Result of Disasters: Floods and Droughts (if in existence)

Specific Environmental Data Required:

- Total rainfall per district/FT
- Affected Areas – for the purpose of mapping
  - Floods
  - Droughts
- Value of properties destroyed
- Value of furniture and fitting destroyed
- Emergency leave

Diseases, patients, social & economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Health Related Socio-economic Costing as a Result of Vector-Borne Diseases

Specific Environmental Data Required:

- Areas infected by dengue, malaria and chikungungya – for mapping purposes
- Temperature, humidity, rainfall and soil humidity (if in existence) per district/FT

Diseases, patients, social & economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Health-Related Socio-economic Costing as a Result of Water-Borne and Food-Borne Diseases

Specific Environmental Data Required:

- Temperature and rainfall per district/FT

Diseases, patients, social and economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Health-Related Socio-economic Costing as a Result of Depletion of Stratospheric Ozone

Specific Environmental Data Required:

- Ground-level ultra-violet radiation
  - If not in existence, a proxy needs to be developed
    - (e.g. temperature above a particular level/sunlight hours)

Diseases, patients, social & economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Health-Related Socio-economic Costing as a Result of Thermal Temperature On Mortality and Morbidity

Specific Environmental Data Required:

- Temperature per district /FT

Diseases, patients, social and economic costs' data required:

- Types of diseases for each district/FT
- Total number of patients per disease per district/FT
- Medical costs per disease per district/FT
- Medical leave granted per disease per district/FT
- Other economic costs that can be quantified per disease per district/FT
- Social costs that can be quantified per disease per district/FT

Statistical Methods and Quantification of Socio-economic Costs

- Time series data will be used for forecasting
- Costs of illness (COI) method employed for mortality and morbidity:
  - Direct expenses (hospital, doctors, medicines, etc.)
  - Opportunity costs (loss of earnings/productivity, etc.)
  - Disability-adjusted life years (DALYs)
    - if data is available for the whole Langat River Basin
- Preventative costs employed for adaptive measures (to be discussed later)
- If existing data is not available in Malaysia or accessible to the researcher, a proxy will be developed.

Definition of Adaptation

- Adaptation
  - Adjustment in natural or human system in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC, FAR 2007).
  - Actions taken to help communities and ecosystems cope with changing climate conditions (website UNFCCC Secretariat).

Mapping

- Utilization of GIS to map temporal and spatial distribution of diseases as a result of climate change.

Implementation Challenges

- Challenges of secondary data acquisition for diseases
  - Time-line data for the various diseases
    - Fairly complete for vector-borne diseases
    - For other diseases, collation of data requires a heavy input with possibility of missing data
    - Missing data requires specific statistical techniques
    - Developing appropriate proxies might entail a wide literature review of outside and within Malaysia.
      - The proxies developed will have to take into account peculiarities in Malaysia

Implementation Challenges

- Challenges of secondary data acquisition for environmental variables
  - Time-line data for the various environmental variables
  - Air Pollutant Indices data are complete and available
  - Other environmental variables may not be complete or as complete with heavy input required for data collation
  - Missing data requires specific statistical techniques

Implementation Challenges

- Challenges of secondary data acquisition for environmental variables (cont.)
  - Developing appropriate proxies might entail a wide literature review of outside and within Malaysia
    - The proxies developed will have to take into account the peculiarities in Malaysia

Workshop: Socio-economic Impact Assessment Tools for Climate Change *(24-25 November 2008)*

Socio-Economic Impact Assessment: Methodology and Challenges for the Marine and Coastal Resources Sector

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Universiti Kebangsaan Malaysia (UKM)
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Introduction

- National Coastal Vulnerability Index (NCVI) Study - initiated by the Dept. of Irrigation & Drainage, Ministry of Natural Resources and Environment (NRE) conducted by BUREAU FOR INNOVATION & CONSULTANCY UNIVERSITI TEKNOLOGI MALAYSIA
- Completed December, 2007

Objectives of the Study

To formulate a national Coastal Vulnerability Index (CVI) and to test/apply in two (2) pilot sites with widely varying characteristics, so that in the long term, the CVI will be applicable for the entire coastal zone of Malaysia

Preliminary Coastal Vulnerability Index Study (CVI) - two pilot sites in West Coast of Peninsular Malaysia which has been commissioned to identify the susceptibility of coastal areas to the impacts of sea level rise

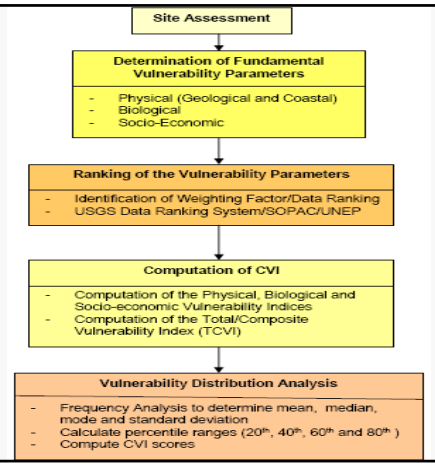
CVI Study has adopted:

1) USGS methodology to compute the CVI for the Physical Vulnerability Index
2) South Pacific Applied Geo-science Commission for the Biological/Environmental Vulnerability Index
3) UNEP Handbook Methodology for the Total of Composite Vulnerability Index which includes socio-economic variables

A Coastal Vulnerability Index (CVI) could be defined as a means to combine a number of separate variables to create a single indicator

A comprehensive development of the CVI carried out to consider the physical, biological, and socio-economic contribution to the vulnerability of the coastline to sea level rise

The total CVI is an average of the above variables with each variable being of equal weightage



Flowchart for the Development of CVI (Figure 4.1.1)

Two (2) pilot sites - with widely varying characteristics

Pilot Site 1 – coastal stretches from Tg Piai to Sg Pulai Estuary, Johor

Pilot Site 2 – western shorelines of Pulau Langkawi from Tg Belikit to Tg Malai, Langkawi

Sea Levels Rise Case Scenarios: Tg Piai, Johore

			Predicted Sea Levels		
Case No.	SLR Scenarios	Rate of SLR	Year 2000	Year 2050	Year 2100
1	Observed (local)	1.3 mm/yr	0.0 m	0.065 m	0.13 m
2	Global-Low	3.0 mm/yr	0.0 m	0.15 m	0.3 m
3	Global-Average	5.0 mm/yr	0.0 m	0.25 m	0.5 m
4	Gobal-High (Worst-case)	10.00 mm/yr	0.0 m	0.50 m	1.0 m

Socio-economic Assessment

In terms of ranking coastal vulnerability on socio-economic aspects, ranking can be defined in two categories:

1.Qualitative terms (e.g high, medium and low vulnerability)

2. Quantitative terms (e.g numerical value)

Socio-economic Assessment

The ranking of vulnerability on socio-economic features involved two steps:

Step 1: Identification and classification of coastal vulnerability in terms of social economic importance

Step 2: Ranking socio-economic features in terms of vulnerability to sea level rise

All socio-economic features have been reported in three categories such as characteristics, impact and vulnerability ranking

Data Collection

The following data for the socio-economic variables were collected:

- **Population and other demographic factors**
- **Cultural heritage**
- **Road, railways and other infrastructures present in the areas**
- **Land use and conservation status**
- **The existing and potential of sea-based socio-economic and tourism activities in the related areas**

Data Collection

Data collection process obtained the cooperation from the various agencies such as Johor and Kedah State Government, Langkawi Development Authority (LADA), Ministry of Tourism and Arts, Johor Port Authority, Jabatan Laut, Tourism Information Board and other related agencies.

Selected Parameters Used to Calculate the CVI (Table 4.1.1)

PHYSICAL		BIOLOGICAL	SOCIO-ECONOMIC
a) Geologic Variables	b) Coastal Process Variables	Variables	Variables
i) Geomorphology	i) Relative sea-level change	i) Wetland boundaries, vegetation type and cover	i) Population and demography
ii) Geologic materials	ii) Mean tidal range	ii) Marine habitats (seagrass, coral reefs, etc)	ii) Landuse
iii) Regional coastal slope	iii) Mean significant wave height		iii) Economic activities
	iv) Historical shoreline change rate		iv) Infrastructure
			v) Cultural heritage and conservation status

Data Ranking / Identification of Weighting

The main criteria in ranking coastal vulnerability will be as follows: (a) transparency; (b) easy to accept and explain to decision-maker, and (c) rankings will include human use features and preferably should be ranked separately.

Each parameter considered was classified, based on individually defined criteria

Vulnerability classification ranges from 1 (very low) to 5 (very high)

Economic activities – 5, Land use – 4, Population – 3, Heritage – 2, Infrastructure- 1

One weighting criteria was established and this criterion corresponds to a scaling of all parameter weights, from 1 to 5

Vulnerability Classification for Socio-economic Sector (Table 4.4.4.1)

Socio-economic features in the coastal area	Very Low 1	Low 2	Moderate 3	High 4	Very High 5
1. Tourism and recreational area	Coast with budget motel and backpacker at the water front	Coast with tourist motel and backpacker at the water front	1. Coast with tourist hotel at the water front with 1 and 2 star rating 2. Coast with recreation purpose	Coast with tourist hotel at the water front with 3 star rating	1. Coast with tourist hotel at the water front with 4 and 5 star rating 2. Coast with tourism attraction area/building
2. Landuse/ Economic Activity	Coast with idle land	Coast with agriculture land – low commodities – paddy/coconut and others	1. Coast with agriculture land – high commodities – rubber/ palm oil 2. Fishing for open sea/ related fishery industry	Coast with reserve land/mangroves	Coast with Industrial and commercial land
3. Population			Fishing villages (< 50 houses)	Fishing villages (> 50 houses)	
4. Infrastructure	Small access road to coastal area	Basic utilities – road, water, bridge, electricity	Housing area/village with out public infra	Housing area/village with basic infra – school, clinic, community hall, mosque	Major infra – airport/port/jetty
5. Heritage Site				Historical site without international recognition	Historical/gazetted site with international recognition

Socio-economic Vulnerability Ranking for Tg. Piai-Sg. Pulai [Table 4.4.4.2 (i)]

Sector No.	Location/Area	Population	Landuse	Economic Activities	Infrastructure	Heritage
1	Kg. Perpat Darat - Kg. Sg. Belukang	4 (high)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
2	Kg. Sg. Belukang - Tg. Piai National Park	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	5 (very high)
3	Tg. Piai National Park (southernmost tip)	3 (moderate)	4 (high)	5 (very high)	5 (very high)	5 (very high)
4	Tg. Piai National Park	3 (moderate)	4 (high)	5 (very high)	5 (very high)	5 (very high)
5	Tg. Piai National Park - estuary of Sg. Belukang	3 (moderate)	4 (high)	5 (very high)	5 (very high)	5 (very high)
6	Kg. Perpat Punggor	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
7	Kg. Perpat Pasir	4 (high)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
8	Area surrounding Sg. Chokoh Besar	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
9	Area between Kg. Sg. Chokoh Kecil and Kg. Chokoh Besar	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
10	Area between Kg. Sg. Sam and Kg. Chokoh Kecil	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
11	Area between Kg. Sg. Sam and Kg. Sg. Dinar	4 (high)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
12	Tg. Bin Power Station	3 (moderate)	5 (very high)	5 (very high)	5 (very high)	4 (high)
13	Tg. Bin Power Station	4 (high)	5 (very high)	5 (very high)	5 (very high)	4 (high)
14	Kg. Sg. Dinar - Kg. Sg. Chengkeh Besar	4 (high)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
15	Kg. Chengkeh Besar	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
16	Kg. Sg. Boh	3 (moderate)	4 (high)	3 (moderate)	3 (moderate)	4 (high)
17	Pelabuhan Tg. Pelepas	4 (high)	5 (very high)	5 (very high)	5 (very high)	4 (high)
18	Pelabuhan Tg. Pelepas	4 (high)	5 (very high)	5 (very high)	5 (very high)	4 (high)
19	Pelabuhan Tg. Pelepas reclamation area	3 (moderate)	5 (very high)	5 (very high)	5 (very high)	4 (high)
20	Pelabuhan Tg. Pelepas reclamation area	3 (moderate)	5 (very high)	5 (very high)	5 (very high)	4 (high)
21	Pelabuhan Tg. Pelepas reclamation area	3 (moderate)	5 (very high)	5 (very high)	5 (very high)	4 (high)
22	Kg. Pekejang and Kg. Tg. Adang	4 (high)	4 (high)	3 (moderate)	4 (high)	4 (high)
23	Kg. Tg. Adang and Pok Kecil Laut	4 (high)	4 (high)	3 (moderate)	4 (high)	4 (high)
24	Kg. Pok Kecil Laut	4 (high)	4 (high)	3 (moderate)	4 (high)	4 (high)

COMPUTATION OF CVI

$$CVI = \frac{\sqrt{(a*b*c*d*e*f)}}{N}$$

where a, b, c, d, e and f are the index parameters identified in each of the physical, biological and socio-economic variables;

N is the number of fundamental variables identified.

Summary of CVI Computational Methods used (Table 4.5.1)

Vulnerability Index	Method Adopted	Formula	Weighting Factor
1. Physical Vulnerability Index (PVI)	USGS Methodology (Hammar-Klose and Thieler, 1999)	PVI = $\frac{(a*b*c*d*e*f*g)}{7}$	All parameters of equal weightage: a = geomorphology b = geologic materials c = coastal slope d = sea level rise e = mean tidal range f = mean sig. wave ht. g = shoreline change rate
2. Biological or Environmental Vulnerability Index (EVI)	SOPAC (South Pacific Applied Geo-science Commission)	EVI = (EVI_1 + EVI_2) / 2	Both parameters of equal weightage; EVI_1 = % vegetation remaining EVI_2 = no. endangered species present
3. Socio-economic Vulnerability Index (SVI)	Coelho, et al (2006); Cutter (2002); and NOAA Coastal Service Center (1999)	SVI = $\{(E*w1) + (L \times w2) + (P \times w3) + (H \times w4) + (F \times w5)\} / 5$	Weighting scale in order of parameter importance: I = infrastructure, H = heritage, P = population, L = landuse and E = economic activities.
4. Total Composite Vulnerability Index (TCVI)	UNEP Handbook Methodology (Burton et al, 1998)	TCVI = $\frac{(PVI + EVI + SVI)}{3}$	All indices of equal weightage

Socio-economic Vulnerability Index (SVI) for Tg Piai –Sg. Pulai Estuary [Table 4.5.2 (c)]

Sector No.	Location/Area	Population	Landuse	Economic Activities	Infrastructure	Heritage	Relative SVI	SVI Score
1	Kg. Perpat Darat - Kg. Sg. Belukang	4	4	3	3	4	10.8	2
2	Kg. Sg. Belukang - Tg. Piai National Park	3	4	3	3	5	10.6	2
3	Tg. Piai National Park (southernmost tip)	3	4	5	5	5	13.0	4
4	Tg. Piai National Park	3	4	5	5	5	13.0	4
5	Tg. Piai National Park - estuary of Sg. Belukang	3	4	5	5	5	13.0	4
6	Kg. Perpat Punggor	3	4	3	3	4	10.2	1
7	Kg. Perpat Pasir	4	4	3	3	4	10.8	2
8	Area surrounding Sg. Chokoh Besar	3	4	3	3	4	10.2	1
9	Area between Kg. Sg. Chokoh Kecil and Kg. Chokoh Besar	3	4	3	3	4	10.2	1
10	Area between Kg. Sg. Sam and Kg. Chokoh Kecil	3	4	3	3	4	10.2	1
11	Area between Kg. Sg. Sam and Kg. Sg. Dinar	4	4	3	3	4	10.8	2
12	Tg. Bin Power Station	3	5	5	5	4	13.4	4
13	Tg. Bin Power Station	4	5	5	5	4	14.0	5
14	Kg. Sg. Dinar - Kg. Sg. Chengkeh Besar	4	4	3	3	4	10.8	2
15	Kg. Chengkeh Besar	3	4	3	3	4	10.2	1
16	Kg. Sg. Boh	3	4	3	3	4	10.2	1
17	Pelabuhan Tg. Pelepas	4	5	5	5	4	14.0	5
18	Pelabuhan Tg. Pelepas	4	5	5	5	4	14.0	5
19	Pelabuhan Tg. Pelepas reclamation area	3	5	5	5	4	13.4	4
20	Pelabuhan Tg. Pelepas reclamation area	3	5	5	5	4	13.4	4
21	Pelabuhan Tg. Pelepas reclamation area	3	5	5	5	4	13.4	4
22	Kg. Pekejang and Kg. Tg. Adang	4	4	3	4	4	11.0	3
23	Kg. Tg. Adang and Pok Kecil Laut	4	4	3	4	4	11.0	3
24	Kg. Pok Kecil Laut	4	4	3	4	4	11.0	3

SVI Value & SVI Score

Mean SVI	Mode SVI	Median SVI	Std. Deviation
11.78	10.20	11.00	1.50
20th percentile	40th percentile	60th percentile	80th percentile
10.20	10.80	12.60	13.40

Range of SVI Scores for Shoreline Categorisation at Tg. Piai

VERY LOW	≤ 10.2
LOW	$10.2 < x \leq 10.8$
MODERATE	$10.8 < x \leq 12.6$
HIGH	$12.6 < x \leq 13.4$
VERY HIGH	> 13.4

where x = Relative or calculated SVI obtained by using the weighting factor equation

VERY LOW	$\leq 20^{th}$ percentile
LOW	20^{th} percentile $\leq$ CVI $\leq 40^{th}$ percentile
MODERATE	40^{th} percentile $\leq$ CVI $\leq 60^{th}$ percentile
HIGH	60^{th} percentile $\leq$ CVI $\leq 80^{th}$ percentile
VERY HIGH	$\geq 80^{th}$ percentile

Total Composite Vulnerability Index (TCVI) for Tg Piai –Sg. Pulai Estuary [Table 4.5.2 (d)]

Sector No.	Location/Area	PVI Score	EVI Score	SVI Score	CVI Average	Total CVI Score
1	Kg. Perpat Darat - Kg. Sg. Belukang	3	1	2	2.00	1
2	Kg. Sg. Belukang - Tg. Piai National Park	3	1	2	2.00	1
3	Tg. Piai National Park (southernmost tip)	4	1	4	3.00	3
4	Tg. Piai National Park	5	1	4	3.33	4
5	Tg. Piai National Park - estuary of Sg. Belukang	5	2	4	3.67	5
6	Kg. Perpat Punggor	5	2	1	2.67	2
7	Kg. Perpat Pasir	4	1	2	2.33	1
8	Area surrounding Sg. Chokoh Besar	4	1	1	2.00	1
9	Area between Kg. Sg. Chokoh Kecil and Kg. Chokoh Besar	5	1	1	2.33	1
10	Area between Kg. Sg. Sam and Kg. Chokoh Kecil	5	1	1	2.33	1
11	Area between Kg. Sg. Sam and Kg. Sg. Dinar	4	1	2	2.33	1
12	Tg. Bin Power Station	1	3	4	2.67	2
13	Tg. Bin Power Station	1	3	5	3.00	3
14	Kg. Sg. Dinar - Kg. Sg. Chengkeh Besar	2	4	2	2.67	2
15	Kg. Chengkeh Besar	2	4	1	2.33	1
16	Kg. Sg. Boh	2	3	1	2.00	1
17	Pelabuhan Tg. Pelepas	1	4	5	3.33	4
18	Pelabuhan Tg. Pelepas	1	4	5	3.33	4
19	Pelabuhan Tg. Pelepas reclamation area	1	4	4	3.00	3
20	Pelabuhan Tg. Pelepas reclamation area	1	4	4	3.00	3
21	Pelabuhan Tg. Pelepas reclamation area	2	4	4	3.33	4
22	Kg. Pekejang and Kg. Tg. Adang	3	3	3	3.00	3
23	Kg. Tg. Adang and Pok Kecil Laut	4	3	3	3.33	4
24	Kg. Pok Kecil Laut	3	3	3	3.00	3

VULNERABILITY MAPS

For each pilot site, the following maps have been produced:

1) Physical Vulnerability Index (PVI) Map
2) Biological or Environmental Vulnerability Index (EVI) Map
3) Socio-economic Vulnerability Index (SVI) Map
4) Total Composite Vulnerability (TCVI) Map

ArcGIS/ArcView where a CVI map for each category

Appraisal of the Socio-economic Vulnerability Distribution

i) Due to the high economic activities, infrastructure, and landuse at Tg. Pelepas Port and Tg. Bin, the shoreline along these areas have been classified to be very highly and highly vulnerable to sea level rise.

ii) Areas along the southern tip of Tg. Piai National Park, due to the very high heritage values and ecotourism activities, have been categorized as highly vulnerable.

iii) Both highly and very highly vulnerable areas make up 41.7% of the total shoreline.

iv) The rest of the shoreline between Tg. Piai and Tg. Bin are under category 1 (very low) and 2 (low). These account for about 25.0% and 20.8% of the total shoreline respectively.

v) The less developed areas along the south and east of PTP are of moderate vulnerability to sea level rise.

Summary of Potential Impacts and Recommended Adaptive Measures for Tg. Piai – Sg. Pulai Estuary (Based on case 4: Global High / worst scenario (10.0mm/yr) [Table 6]

SECTOR	LOCATION	EXISTING PHYSICAL FEATURES	VULNERABILITY	POTENTIAL IMPACTS	RECOMMENDED ADAPTIVE MEASURES
1 - 2	North west of Tg. Piai	Tg. Piai National Park	Moderate	About 25% of mudflats and mangroves under threat of erosion and flooding.	A: allow mangroves to regenerate under natural processes P: Soft engineering shore protection structures with mangrove replanting programme
3	Tg. Piai (southernmost tip)	Tg. Piai National Park – Ramsar site	High	28.5% potential loss of the world heritage	P : Combination of hard and soft engineering shore protection structures
4 - 11	Between Tg. Piai and Tg. Bin	Tg. Piai National Park; Sg. Pulai Forest Reserve; Coastal villages and agricultural plots; Coastal road and bunds.	High – Very High	12 – 20% potential loss of coastal land. About 7 – 8km of coastal road and bund under threat of erosion and flooding	P: To install tidal gates at drainage/river outlets. Pumped drainage may be necessary
12 - 13	Tg. Bin and reclamation island	Power station and oil refinery industries	Very Low (assuming shore protection works installed)	About 55% of reclaimed island will be lost if no protection structure is installed	P: Shore protection structure around reclaimed island is mandatory
14 - 16	North of Tg. Bin and Sg. Pulai estuary	Sg. Pulai Forest Reserve	Low	10 – 15% potential loss of mudflats and mangroves.	A: Allow natural regeneration of mangroves on undeveloped land
17 - 21	Tg. Pelepas Port (PTP) and reclamation area	Port facilities	Low - Very Low	Removal of 19% – 24% of sedimentation at berthing areas and about 30% at Tk. Adang	A : Positive response to sedimentation problem at the Port's berthing facilities
22 - 24	South-east of PTP (Tg. Adang)	Sg. Pulai Forest Reserve; Agricultural plots and villages; Coastal bund and drainage.	Moderate - High	21 – 28% potential loss of coastal sediments; Overtopping of coastal bunds and drains.	P: To raise level of coastal bunds and to improve on drainage system.

A = Accommodate P = Protection R = Retreat

Challenges for the CVI Method

- **Major challenge in formulating the CVI is quantifying socio-economic variables that contribute to the response of the specific area to sea level rise**
- **CVI can be extended more areas to see vulnerable status**
- **Limited Socio-economic variables incorporated into this CVI**
- **Other important socio-economic variables could be included eg. household distribution (family headed, family size, ethnics…), income level, occupation, gender, demographic sub-groups (children, elderly people, indigenous….), economic development, quality & availability of public health care and so on**
- **VI method can also be applicable for other sectors - water, agriculture, health, ……**

Thank You

LESTARI

Methodology on Socio-Economics Impact Analysis of Climate Change on Agriculture

Crop involved

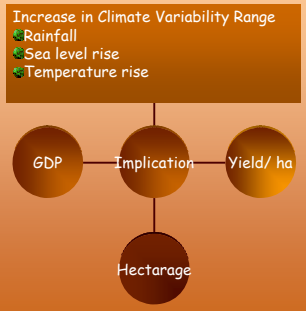
- Oil palm
- Rubber
- Cocoa
- Vegetables
- Floriculture
- Fruits
- Paddy

Data

- Agriculture GDP
- GDP overall
- Yield/ ha/crop
- Hectarage/ crop

- This work utilized secondary data, employed yearly data undertaken from 1990 - 2006

Framework



Methodology 1

- Regression Analysis

- Generalizing the two variable population regression function as below:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_I$$

- where Y is the dependent variable, X_2 and X_3 the explanatory variables, μ the stochastic disturbance term, and i the i^{th} observation in case the data are time series.
- This models are sets of equations that the structure of the economy and predict variables such as GDP, yield and hectarage.

- Risk
  1. Lack of time series data
  2. Statistical problem such as auto-correlation and multi-collinearity may influence the magnitude of coefficients

Methodology 2

- Mathematical programming

- This methods involves a technique whereby an objective function is maximized given certain restrictions. This method of which linear and quadratic programming are the best known can be used in impact analysis (Powell *et al*, 1985:6)
- Advantage:
  Can be construct without detail time series data
- Risk:
  The objective function which has to be maximized does however restrict its applicability in impact analyses

Methodology 3

- Time series econometrics
  - Forecasting the effects of the variables on the implications of the rainfall, sea level rise and rise in temperature to those variables:
    - GDP overall
    - GDP on agriculture
    - Yield/ ha/ crop
    - Hectarage/ crop

Expected Output of Socio-economics Impacts on Agriculture Sector

- Reduce the income of the agriculture household players
- Reduce the GDP
- Reduced the yield
- Increased expenditure on agriculture inputs
- Loss of income and productivity

NAHRIM

Socio-Economic Assessment of the Climate Change Vulnerability & Adaptation Responses for Water Resource Sector

Mohd Shahwahid Haji Othman

NAHRIM

Vulnerabilities

Projected effects on water resources are:

1. declines in low season river flows and lake levels and higher water temperatures with potentially implications for water supplies, water allocation, hydro-power production, waste assimilation and pollution concentrations, and for freshwater ecosystems,
2. ground water levels and quality are also likely to be under greater stress with levels declining in populated regions,
3. greater frequency of high intensity rainfalls that would increase soil erosion, flash floods and storm sewer overflow,
4. changing flow patterns have direct effects on wildlife distribution and survival, and in turn on subsistence communities

NAHRIM

Adaptation is a process to moderate, cope with and take advantage of the consequences of climate change.

NAHRIM

Adaptation Needs

1. water conservation measures by all users
2. greater emphasis on planning and preparedness for droughts and severe floods
3. expanded efforts at water quality protection from agricultural, industrial and human wastes
4. renewal of national (federal-state) monitoring efforts for water quantity, quality and climate, and
5. improved procedures for fair allocation of water within basins, districts, and between states, taking in-stream ecosystem needs into account.

NAHRIM

Adaptation Needs

Note:

- These adaptation measures would be required even without climate change
- With climate change, becomes more urgent & beneficial

Implications:

Economic analysis:

Total vs Incremental Cost

NAHRIM

Impact Valuation

- Efficiency and effectiveness of development investments are affected when water resources are threatening?
- Potentialities to reduce agricultural growth and human development.

Potential negative impacts include:

Direct impacts (e.g. damages from extreme weather and climatic events to infrastructure)

Indirect impacts (e.g. health impacts that reduce labour productivity in agriculture)

Underperformance (e.g. agricultural projects that fail when rainfall decreases)

'Mal-adaptation' (e.g. policies that inadvertently increase vulnerability, eg. those encouraging development in environmental sensitive areas: high slopes, water catchment).

NAHRIM

Objectives of Study

i. to identify the vulnerabilities occurring in the water resource sector and evaluate their economic costs;
ii. to identify and value the adaptation programs undertaken by water resource provider and users including potential changes in production and trade as a result of projected climate change.
iii. to assess the economy-wide impacts of changes in costs and benefits that are directly or indirectly incurred in (i) and (ii) and to assess their economic implications; and
iv. to recommend policy and adaptive economics measures on related sectors.

NAHRIM

Investigation on impacts in selected irrigation and domestic and industrial water users:

- MADA
- KADA
- Tanjung Karang irrigation scheme
- and
- Klang Valley water supplies and demand for residential and industry.

NAHRIM

- NAHRIM's study on "Preliminary Impact Assessment of Climate Change on Irrigation and Water Supply Scenario in Selected Areas in Peninsular Malaysia" will provide the basis for physical impacts on water resource availability and demand by the two sectors irrigation and water for residential and industrial use.

NAHRIM

Stakeholders to interview / survey:

i) farmers – paddy
ii) home owners
iii) several water dependent industrial sectorsiv) water-related recreationists
iv) water supply operators like LUAS
v) Irrigation authorities

NAHRIM

Among information seeked

- investment or raising of operational costs by irrigation authorities and domestic/industrial water supply operators either
  - to contain effects from potential droughts or
  - to manage effects from potential floods or excess water
- investment or raising of operational costs by domestic water users to maintain their standard of living despite.
  - potential droughts or
  - potential excess rain, or even floods
- investment or raising of operational costs by industrial water users to maintain their production level despite.
  - potential droughts or
  - potential excess rain, or even floods
- expenditures by farmers to maintain their production yields despite
  - potential droughts or
  - potential excess rain, or even floods
- expenditures on R&D and extension activities to generate resilient planting stocks and agronomic practices to combat water related climate change effects.
- expenditures by and benefits gain by recreationists to maintain their leisure utilities despite
  - potential droughts or
  - potential excess rain, or even floods

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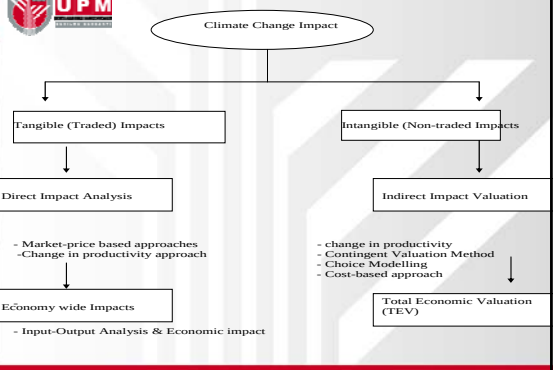
Economic Analysis on the Impacts of scenario changes to irrigation and water supply sectors in terms of:

a) Market transacted Impacts
- Direct impacts
- Indirect impacts
- Induced impacts

b) Non-market Impacts
- Economic values

NAHRIM

Economic Analytical Approach



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Output and Benefits

- Economic costs of vulnerability of water resources and water users to climate change
- Economic costs of adaptation activities by water resource suppliers and water users, to adjust to climate change
- Assessment of economic-wide impacts of the vulnerability and adaptation activities upon major economic sectors dependent on (using) water resources
- Recommendation of policy framework and further proposed R&D on a more detailed socio-economic assessment of the impact of climate change to water resources and users.

Quantifying the Economic Impact of Climate Change (energy)

ENERGY

Electricity WG	Oil & Gas WG	Transport WG
Tenaga Berhad Research Research (TNBR)	PETRONAS HSE Unit	Ministry of Transport
Ir Mohd Noh Ahmad	Dr. Foo Say Moo	Mr Leslie Leon

Pendahuluan

- It is important to distinguish between *economic and financial losses.*
- *Financial losses typically relate to the value of property damage of individual homes or businesses, without consideration of the impact of these losses on other agents in the economy.*
- *Financial losses from natural disasters are often equated to the value of insurance claims arising from that event, although they clearly ignore the value of non-insured losses.*
- Economic losses are much broader in scope.
- As well as accounting for the initial damage resulting from a hazard event, they also incorporate the flow-on effects of that damage on other sectors of the economy.
- A lifeline breakage is perhaps the most obvious example of how an impact in one sector – for instance, electricity transmission – can have potentially significant consequences for the remainder of the economy.

Pendahuluan

- Oleh kerana aktiviti sesuatu sektor ekonomi mempunyai kaitan dengan aktiviti dalam sektor ekonomi yang lain, maka sama juga, impak perubahan iklim dalam sesuatu sektor (contohnya pengangkutan) juga akan memberi kesan kepada sektor ekonomi yang lain.
- Atau dengan lain kata, ada kesan langsung dan ada kesan tidak langsung.

Bagaimana nak ukur kesan perubahan iklim

• Anggar output ekonomi jika kerosakan perubuhan iklim tidak wujud.	• Anggar output ekonomi kita dengan kerosakan/kekangan perubahan iklim
• RM700 billion	• RM650 billion

Kaedah anggaran impak ekonomi

- Computable General Equilibrium (CGE)
- Input-output model (IO model)
- Integrated Ekonometrik dan IO

Kajian lepas

- CGE
- prent link\Pages from IO UE highway scge.pdf
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- IO model
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- prent link\Pages from 04_DonaghyREIM.pdf

- Integrated Ekonometrik dan IO
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Modifying a One Region Leontief Input-Output Model to Show Sector Capacity Constraints

M. D. Petkovich and C. T. K. Ching

Model IO

- Model ini berasaskan jadual input-output yang diterbitkan oleh Jabatan Perangkaan Malaysia setiap beberapa tahun.
- Yang terkini ialah Jadual IO 2000, sebelum itu ialah Jadual IO 1991.
- Jadual I-O yang pertama Semenanjung Malaysia: 1960
- Kemudian: 1965 dan 1970, 1978, 1983, 1987

Jadual IO 2000

Navigation sector

Task 1:Sectoral assessments-4

Vulnerability Impacts	Estimated Cost of Impacts	Present measures/practices	Future actions	
			Adaptation Option 1	Adaptation Option 2
Rainfall, precipitation – flooding at surrounding area of the ports affecting the delivery of cargoes and congestion at port area. Also disruption of schedule activities	>50K (combined)	Design of port facilities. Flooding management plan.	Integrating port management with local planning, i.e. National Plan	

Navigation

Task 1:Sectoral assessments-1

Vulnerability Impacts	Estimated Cost of Impacts (per incidents)	Present measures/practices	Future actions	
			Adaptation Option 1	Adaptation Option 2
Riverflow – more dredging activities due to siltation and erosion to the river bank	< 10 M per year	Continuous dredging	Proper special planning mainly on local authority	
Temp rise- 1. engine performance of ships reduce, 2. high fuel consumption, 3. and efficiency of cooling reduce	< 10K (1) < 10K (2) < 10K (3)		Improvement on marine engines and cooling systems, and efficiency improvement	

VA matrix

- Our VA matrix

- Sekian
- Terima kasih

- Mohon pandangan tuan/puan