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**WORKSHOP ON  
CLIMATE CHANGE & BIODIVERSITY:  
MOBILIZING THE RESEARCH AGENDA**  
13-14 December 2010, Senate Room, UKM Bangi

**Socio-Economic Impacts of Climate Change on  
Biodiversity**  
by  
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*Faculty of Forestry, Universiti Putra Malaysia*





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**PRESENTATION OUTLINE**

- Introduction & problem
- Economic importance of biodiversity
- Impacts of climate change on biodiversity – socio-economic
- Current status
- The Way Forward
- Conclusion






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## General Background

- Debate on global climate change continues among scientific community, policy makers, decision makers, civil society organizations
- Global warming is real
- Human socio-economic activities is having a significant effect on the global climate change
- More programmes, activities, mitigations and adaptations
- Economic development has brought serious environmental problems
- Threatening human livelihoods; human survival on an environmental fragile is the most important issue
- Environmental problems has caused climatic instability and a rise in sea levels threatens global biodiversity (ecosystems, habitat, landscape, species, genetic)
- The threat: agriculture, food security, human health, water resources, forestry, biodiversity, wildlife
- Global warming – destabilize the world’s climate, and in turn affect ecosystems. Other effects include – heat-related deaths, vector borne diseases, etc






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## General Background

- Since 1980’s – evolved from one scientific inquiry → global concern (small island, fragile states)
- Acknowledge the reality of climate change and the long term and strategic challenges in socioeconomic development and biodiversity conservation
- What are the effects of climate change on biodiversity → these changes affect food security, public health
- What are the approaches for sustainable development?
- Historical background:
- 1960’s – concerns on adverse impacts of large scale development projects on the environment –unsustainable agricultural practices, pollution emissions, exploitation of natural resources → BCA, EIA, regulation, environmental monitoring → not effective
- What is more important → search for more causes of these environmental problems, then find the solution
- What is the socio-economic impacts of the changes?

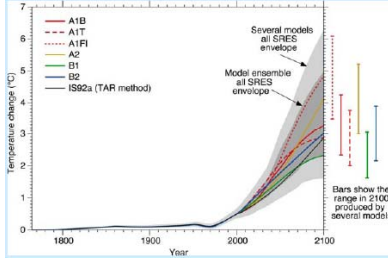


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## CLIMATE CHANGE – A GLOBAL PROBLEM: (Stern Report 2005)

“The economics of climate change is shaped by the science. ... Human-induced climate change is caused by the emissions of carbon dioxide and other greenhouse gases (GHGs) that have accumulated in the atmosphere mainly over the past 100 years.

The scientific evidence that climate change is a serious and urgent issue is now compelling. It warrants strong action to reduce greenhouse gas emissions around the world to reduce the risk of very damaging and potentially irreversible impacts on ecosystems, societies and economies. ... Delay makes the problem much more difficult and action to deal with it much more costly. ...”






  
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## CLIMATE CHANGE – A GLOBAL PROBLEM: (Stern Review 2005)

The report estimated that climate change would cost at least 5 percent of global GDP annually, now and forever. The worst case scenario would be 20 percent a year (\$7 trillion). The Stern Review was the first of many reports that tried to put climate change under an economic perspective. The UN Framework Convention for Climate Change suggests that climate change could cost between \$70 to \$100 billion by 2030, that's the cost of 3 Beijing Olympics.

Social cost, externalities, delay much more costly, requires deliberate, strong policy action...




  
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## CLIMATE CHANGE – A GLOBAL PROBLEM: (ADB 2009)

“Over the past 150 years, global average surface **temperature** has increased **0.76°C**, according to the Intergovernmental Panel on Climate Change (IPCC 2007). This global warming has caused greater **climatic volatility**, such as **changed precipitation patterns and increased frequency and intensity of extreme weather events including typhoons, heavy rainfall and flooding, and droughts; and has led to a rise in mean global sea levels**. It is widely believed that climate change is largely a result of anthropogenic greenhouse gas (GHG) emissions and, if no action is taken, likely to intensify.”







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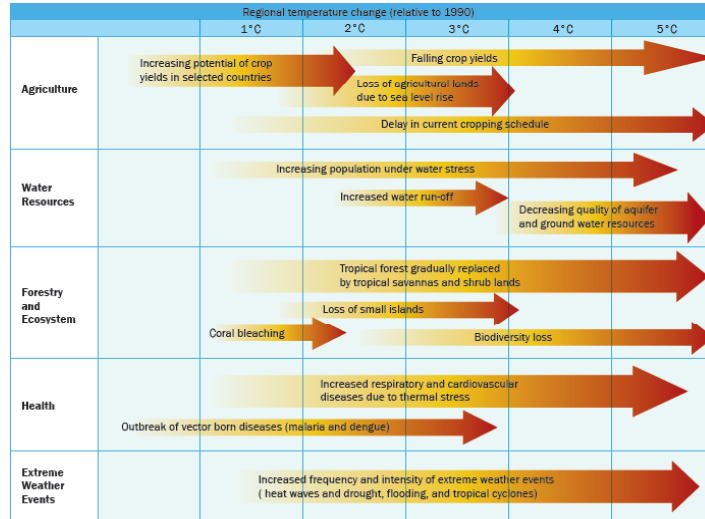
## Key results of ADB Study 2009 (Southeast Asia)

- Southeast Asia—highly vulnerable to climate change—is already suffering from its effects, and the worst is yet to come.
- If no action is taken, the four countries: Indonesia, Philippines, Thailand, and Vietnam - could suffer a loss equivalent to more than **6% of GDP annually by 2100**, more than double the global average loss.
- Malaysia?



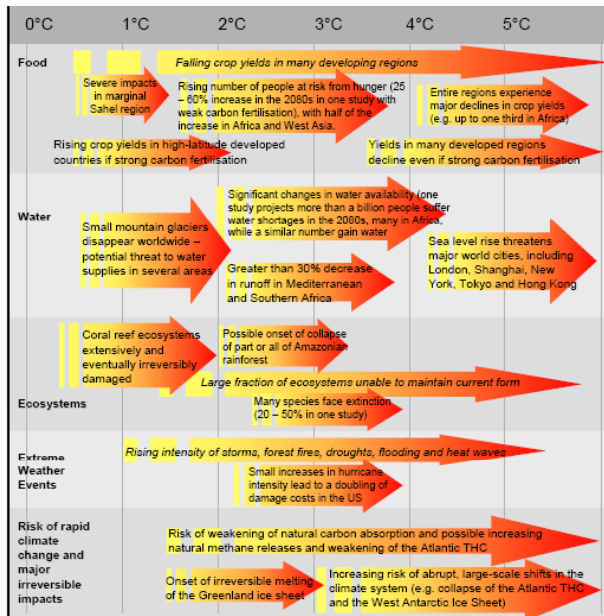
A significant proportion of the population has been affected by the outbreak of malaria and dengue. All these impacts are predicted to worsen due to increased warming, changes in precipitation patterns, and sea level rise, etc. Southeast Asia, as a tropical region, has endured climate extremes that include the monsoon, tropical cyclones, El Niño and La Niña events, extreme variability in rainfall, and very high temperatures (ADB, 2009)

Figure 3.12. Potential Impact of Climate Change on Key Sectors



Source: Adapted from Stern (2007).

Source: ADB (2009)



Stern Review (2005)



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## Importance of Biodiversity


- Maintenance of life-sustaining systems.
- Possibilities for future evolution of the biosphere.
- Ecological, genetic, social, economic, scientific, educational, cultural, recreational, and aesthetic services for human populations. These services range from harvesting of individual wildlife species, to production of clean water and air, to aesthetic wilderness values, to global biogeochemical cycling.
- Genetic resources of critical importance for meeting food, health and other needs of the world population.
- Biological resources that support traditional activities of many indigenous and local communities.



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## The potentials of biodiversity


- Malaysia has undergone tremendous socio-economic development under various RMK
- Even though the engines of growth have been transformed over the years, these economic sectors will remain very important
- For continued prosperity and sustained development to achieve vision 2020 as high income nation
- → potentials of biodiversity


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## The potentials of biodiversity

- Agriculture
- Forestry
- Fishery
- Biotechnology
- Biopharmaceuticals
- Ecotourism



- Plants
- Animals
- Microbes
- Aquatic organisms
- Other goods and ecosystem services e.g. enzymes, pesticides, protected areas,


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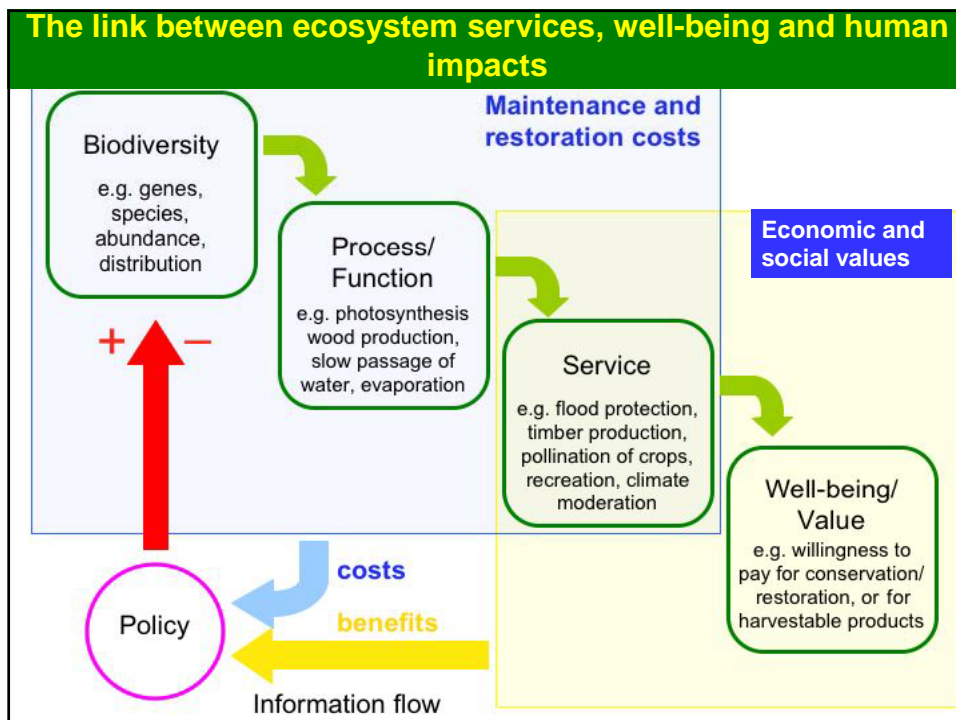
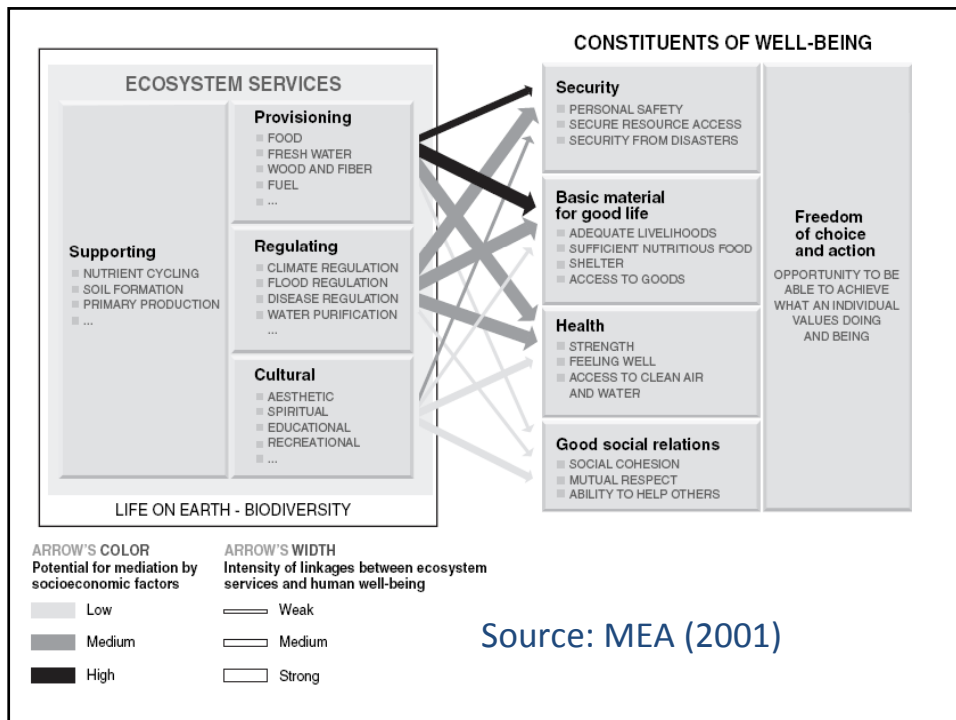
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### Forest resources provide important ecological, economic and social benefits

- Foreign exchange earnings (7% of GNP, RM22 billion, estimated RM53 bill in 2050)
- State revenue (RM2 billion)
- Employment (>300,000 persons)
- Regional development
- Recreation (> 125 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
- Other NTFPs
- Ecotourism
- Etc...







## COOL HIGHLAND RESORTS

- Genting Highlands
- Cameron Highlands
- Fraser's Hill
- Bukit Larut
- Penang Hill
- Bukit Tinggi
- Kinabalu Park



## IMPACTS ON ADVENTURE WITH NATURE





**SOCIO-ECONOMIC IMPACTS....  
ADVENTURE WITH NATURE**

- Jungle discoveries/nature trails
- Mountain climbing
- Rock climbing
- Cave exploration
- River cruising
- White water rafting
- Four wheel drive expeditions
- Mountain biking
- Bird watching
- Wreck driving
- Kelip-kelip watching
- Elephant conservation area
- Orang utan rehabilitation
- Turtle conservation



**BIRD WATCHING**





**Ecotourism -  
Enjoyment, Satisfaction, Benefits?**

**Willing to pay (WTP)- how much?**



**Species Biodiversity**



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## Importance climate change impact on biodiversity

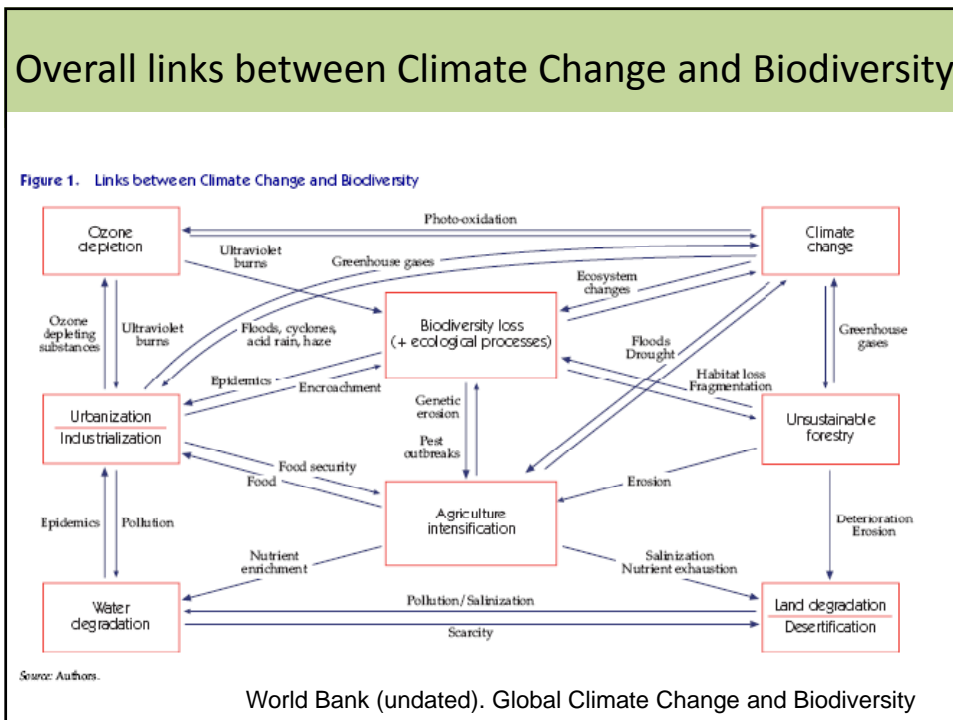
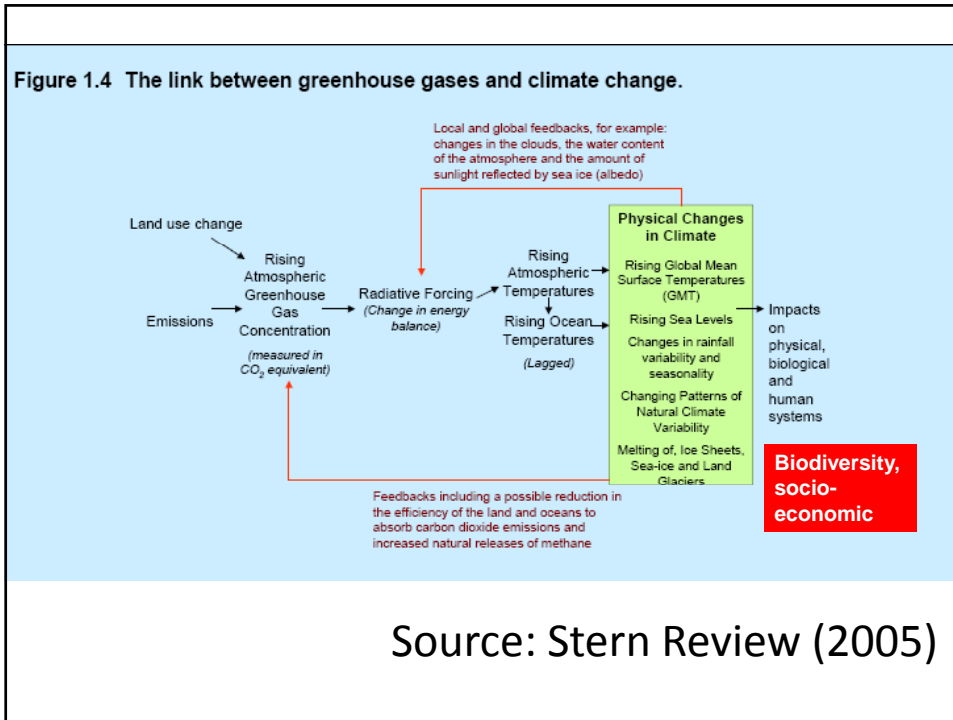
- Species will respond differently to climate change because of differences in competitive abilities, migration rates, and responses to disturbance, etc.
- New combinations of species will arise. This “reorganisation” in species composition has as yet unknown consequences for ecosystem functioning.
- Many species may be able to disperse fast enough to keep up with projected climate change provided they can disperse through continuous, relatively undisturbed, natural ecosystems.
- Other niche parameters may not change at same rate as climate, resulting in novel habitat combinations that species have not experienced before.



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## Importance climate change impact on biodiversity

- Changes in the seasonal events - may have strong negative impacts for many species, especially migratory ones.
- Invasion of alien species into natural ecosystems - caused by climate change → resulting in a generally “weedier”, structurally simpler biosphere compared to ecologically complex, old-growth state.
- Markedly different effects of climate change on species composition will occur within individual landscapes → because of local effects of soil, land use, and topographic variation.

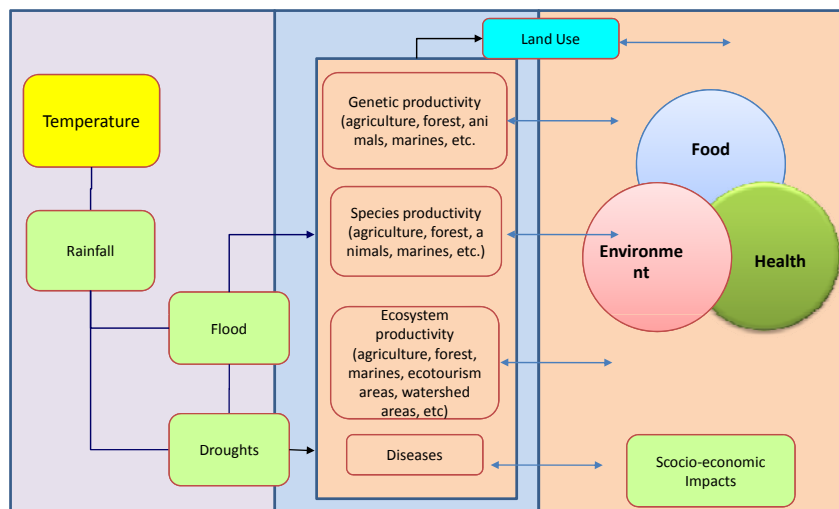


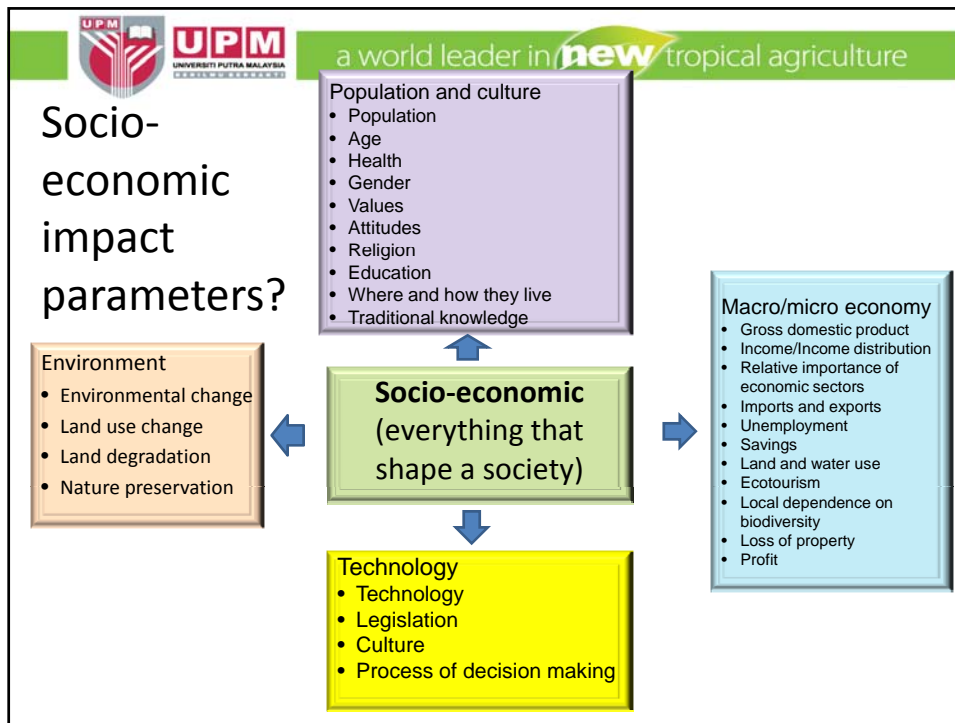
### Components of climate change and the nature of changes

Component	Nature of changes
Mean temperature	Rise in global mean temperature of 1°–3.5° Celsius by 2100
Mean sea level	Rise in global mean sea level of 50 centimeter (range 13–94 centimeter) by 2100
Very hot/cold days	Increase in number of very hot days; decrease in number of very cold days
Minimum temperatures	Disproportionate increase in minimum temperatures: <ul style="list-style-type: none"> <li>• Night-time temperatures rise faster than day-time temperatures</li> <li>• Winter mean temperatures rise faster than summer mean temperatures</li> </ul>
Hydrology	Intensification of global hydrological cycle: <ul style="list-style-type: none"> <li>• Altered pattern of floods and droughts</li> <li>• More droughts in drought-prone areas</li> </ul>
Hurricanes	Global changes in frequency and/or intensity of hurricanes (tropical cyclones) are unknown; regional changes in hurricanes likely
Warming	Warming likely to be greater on land than in the ocean
Uncertainty	Greatest uncertainty is due to future socioeconomic factors that affect fossil fuel consumption

World Bank (undated). Global Climate Change and Biodiversity

### The impact pathway of CC on Biodiversity






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## Current research

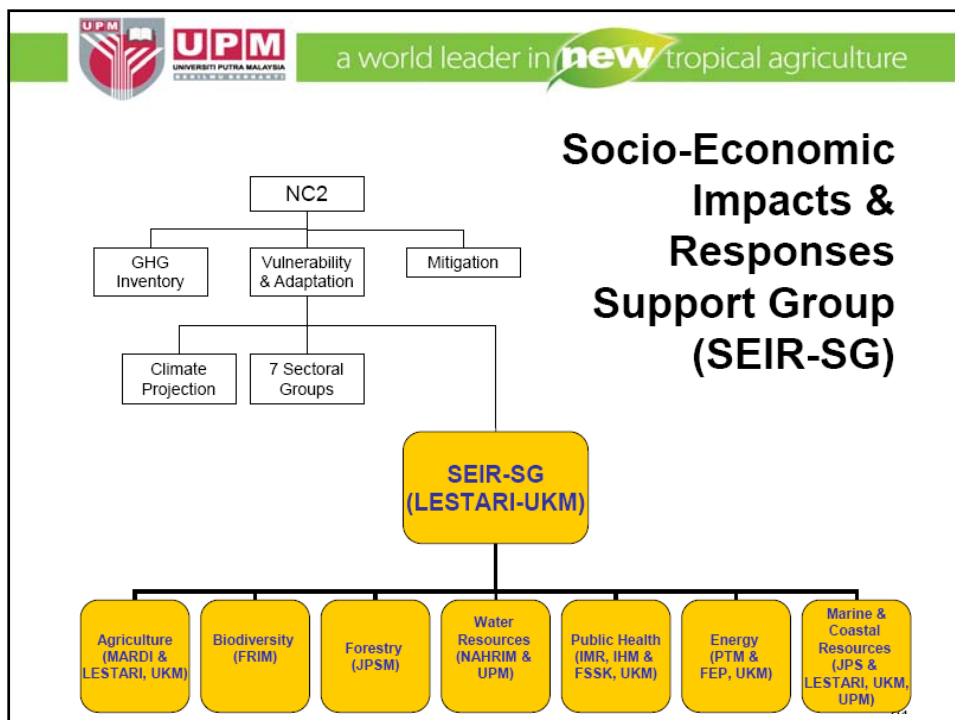
- Focuses mainly on the impacts of forestry harvesting activities on the socio-economic livelihood of local communities.
- Other studies focus on biodiversity of species and ecosystem, economic value of biodiversity, ethnobotany, local dependence of biodiversity, etc
- There is yet to be a study examining socioeconomic conditions caused by biodiversity resource change as a result of climate change.


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## Socio-economic impacts of climate change – NC2

- 2006 - Second National Communication (NC2)
- 3 main working groups: National Greenhouse Gas (GHG) Inventory, Vulnerability, and Adaptation and Mitigation.
- Two support groups are established under the Vulnerability and Adaptation - The Climate Projection, and Socio-Economic Impacts and Response (LESTARI, UKM)
- 7 seven sectors: agriculture, energy, water resources, biodiversity, coastal and marine resources, forestry and public health.







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## Socio-economic impacts of climate change – Biodiversity

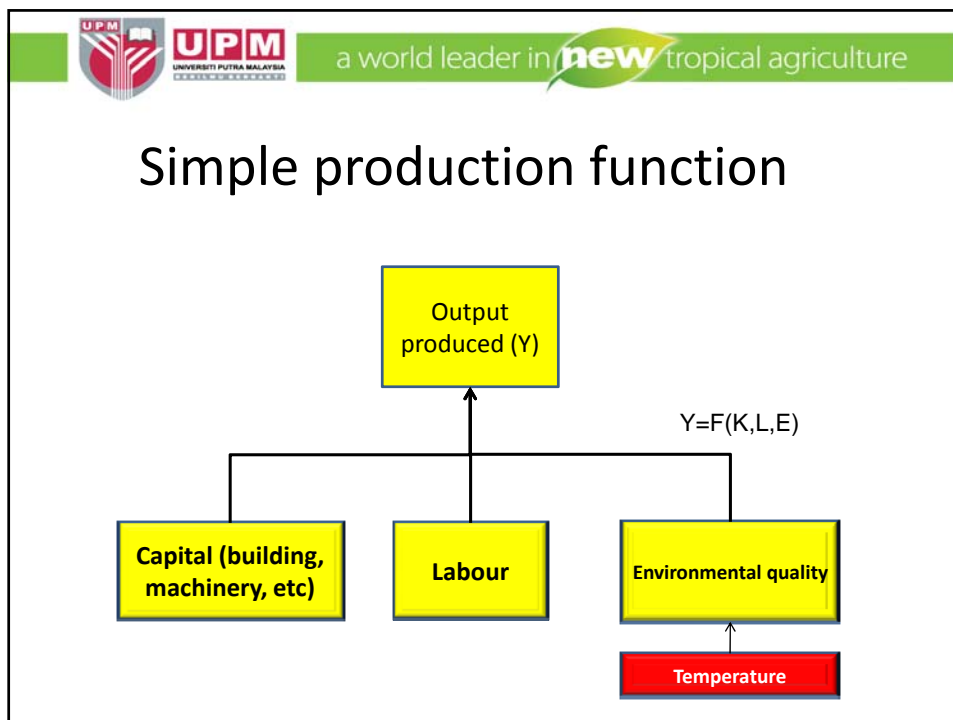
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- 7 seven sectors: agriculture, energy, water resources, biodiversity, coastal and marine resources, forestry and public health.
- Scientists and socio-economists/environmental economists



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## Challenges in socio-economic impact study?

- The appropriate framework and approach of the study
- Cross sectoral impacts of biodiversity in the context of sustainable development - economic stability, development with social equity and poverty eradication, and the continued functioning of eco-systems as life support systems
- Micro vs macro, sectoral vs ecosystem, rural or urban, i.e. the scale of analysis and selection of significant socio-economic parameters
- Time series data and projection of future impacts
- Changes of future technology , human behaviour and preferences, policy direction, and economic situation
- Suitable/appropriate model or technique to be used
- Cooperation from all sectors and stakeholders
- Treatment of externalities, uncertainties and risks
- Identification of target group who will be affected by the change



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## What considerations should be given in socio-economic impact study?

- Global trend in climate change or other parameters
- Long term trend of time horizons
- Risk and uncertainty at its core, and examine the possibility of major, non-marginal changes
- Interaction with other market failures and economic dynamics
- Use advance and significant technique of economic theories
- Focus on welfare, equity and justice, freedoms and rights and its impacts on consumption, health, education and the environment over time
- Intra- and inter-generational equity

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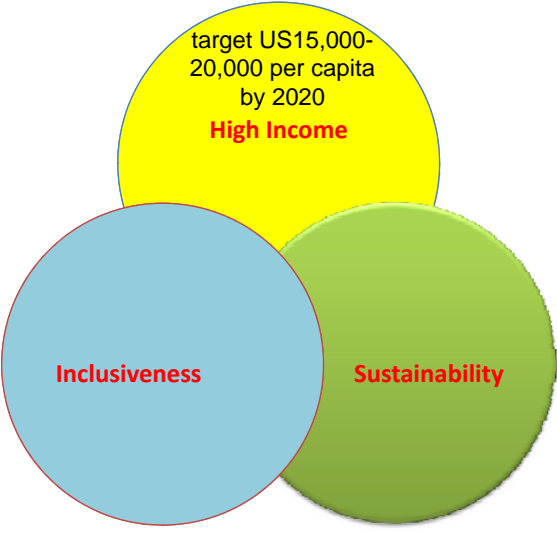
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## THE WAY FORWARD – R&D

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### Goals of New Economic model



- High Income**  
target US15,000-20,000 per capita by 2020
- Inclusiveness**  
enables all communities to fully benefit from the wealth of the country
- Sustainability**  
meets present needs without compromising future generations



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## 5 Thrusts in National Mission – RMK10

**THRUST 1: MOVING THE ECONOMY UP THE VALUE CHAIN**

**THRUST 2: TO RAISE THE CAPACITY FOR KNOWLEDGE AND INNOVATION AND NURTURE A “FIRST CLASS MENTALITY”**

**THRUST 3: ADDRESSING PERSISTENT SOCIO-ECONOMIC INEQUALITIES**

**THRUST 4: IMPROVING THE STANDARD AND SUSTAINABILITY OF QUALITY OF LIFE**

**THRUST 5: STRENGTHENING INSTITUTIONAL AND IMPLEMENTATION CAPACITY**




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## 5 Thrusts in National Mission – RMK10

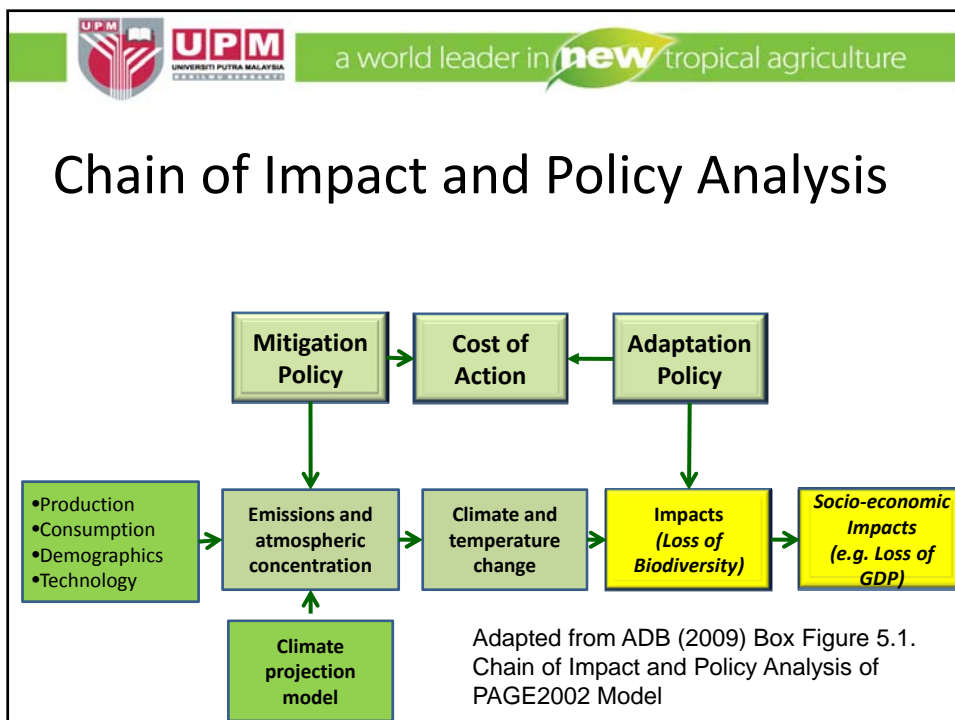
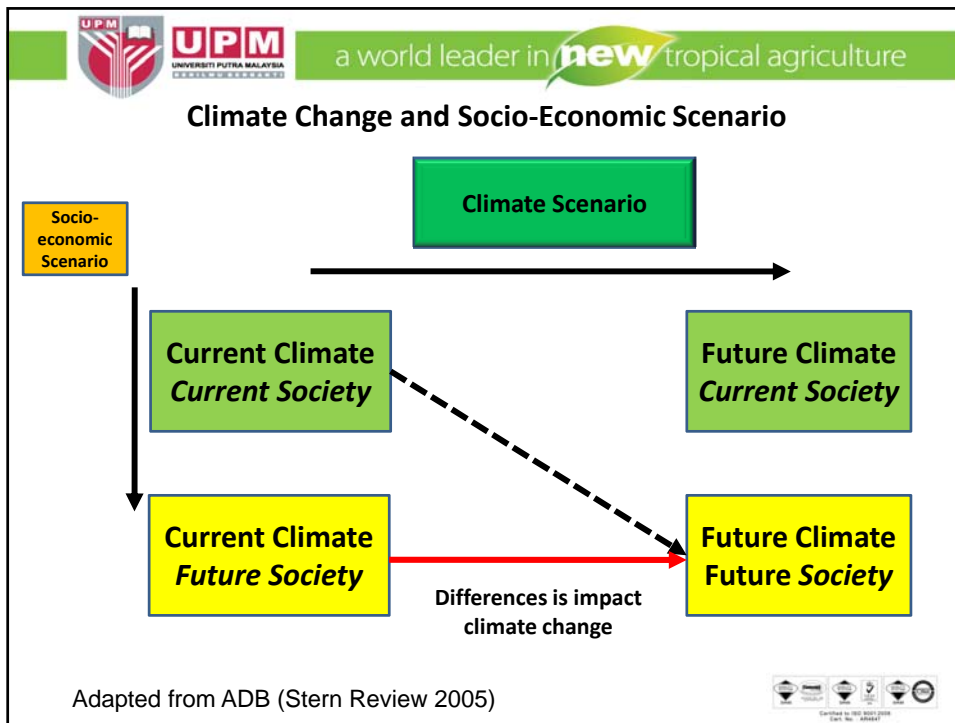
**THRUST 4: IMPROVING THE STANDARD AND SUSTAINABILITY OF QUALITY OF LIFE**

The Government has consistently stressed that national economic growth has to be accompanied by better quality of life for all Malaysians.

To achieves this, the Government will focus on six main strategies:

- First : Increasing health care services;
- Second : Meeting housing needs and improving urban services;
- Third : Building basic infrastructure;
- Fourth : Improving transportation facilities;
- Fifth : **Ensuring conservation of the environment and sustainable management of resources;** and
- Sixth : Generating positive community development.



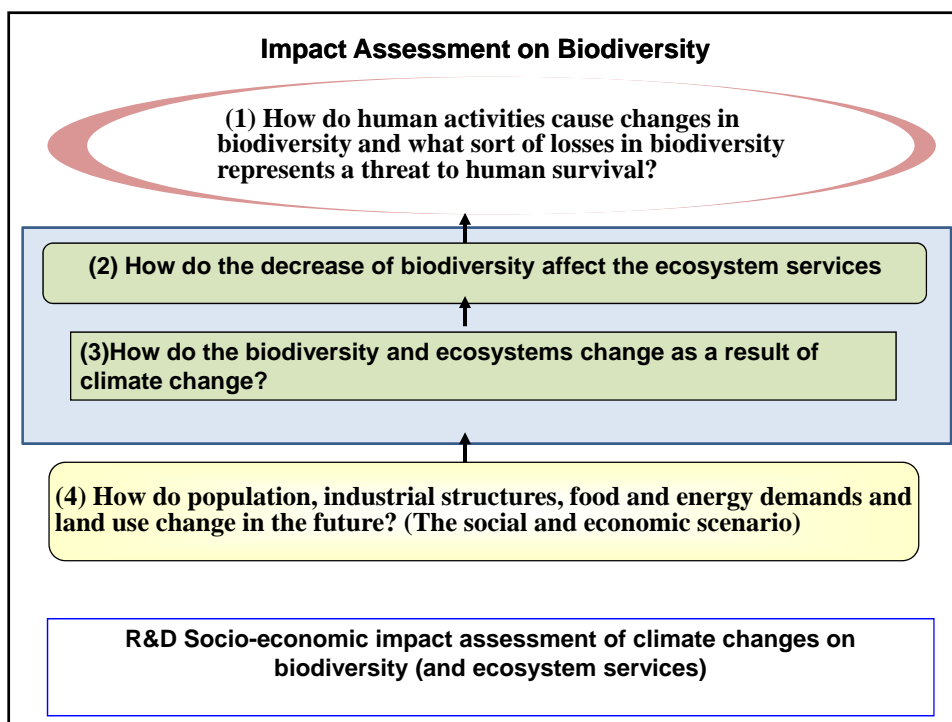




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## Analytical Tools

- Social Benefit Cost Analysis (SBCA)
- Total economic valuation framework (TEV)
- Social impact assessment (SIA)
- Risk analysis (RA)
- Cost effectiveness analysis (CE)
- Multicriteria analysis (MA)
- Social and economic environmental accounting (SEEA)
- Input-output model (I-O)
- General equilibrium model (GCE)
- Econometric modelling





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## Future actions

- Strengthen networking among agencies & researchers
- R&D with strategic focus area on socio-economic impacts of climate change on biodiversity
- Long term projection model taking into account socio-economic impacts of climate change on biodiversity
- Adaptation and mitigation measures should be part of the overall framework analysis on socio-economic impact



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**In summary, there is strong link between biodiversity and climate change and its impact on socio-economic. Appropriate framework for R&D is important to study socio-economic impacts.**

**Climate change**



**Biodiversity**



**Socio-economic  
Impacts**

