

THE IMPACT OF CLIMATE CHANGE AND THE NEED FOR OFFICIAL STATISTICS IN MALAYSIA

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Abstrak

Perubahan dalam keadaan iklim seperti kenaikan purata suhu dan peningkatan paras laut atau hujan lebat akan mengakibatkan perubahan iklim. Sektor yang paling terjejas adalah pertanian, perhutanan, sumber pantai dan marin, tenaga, sumber air dan kesihatan awam. Artikel ini menekankan peranan statistik rasmi dalam pengukuran impak perubahan iklim ke atas pengeluaran pertanian, jaminan makanan, hakisan pantai, tenaga, kekurangan air dan penyakit bawaan vector. Ia juga membincangkan peranan dan cabaran yang dihadapi oleh Jabatan dalam membangunkan pangkalan data alam sekitar.

Kata kunci: *Impak perubahan iklim, Statistik rasmi.*

Abstract

Changes in climatic conditions such as increase in average temperature and rise in sea level or heavy downfall of rain will lead to climate change. The most affected sectors are agriculture, forestry, coastal and marine resources, energy, water and public health. This article highlights the role of official statistics in the measurement of the impact of climate change on agriculture production, food security, shoreline erosions, energy, scarcity of water and vector borne diseases. It also discusses the role and challenges faced by the Department of Statistics Malaysia (DOSM) in developing a database on environment statistics.

Keywords: *Impact of climate change, Official statistics*

Introduction

Climate change is considered to be one of the major pressures faced by nature and humanity today. Changes in climatic conditions, for example, the increase in average temperature and rise in sea level or heavy downfall of rain will lead to climatic changes. The causes of climate change can be divided into two categories: natural causes (such as continental drifts, volcanic eruptions and the earth's tilt) and anthropogenic origin (man-made activities such as land clearing, industrial development and production of greenhouse gases). These man-made activities could be influenced by global, national and local factors. Open burning is one of the global factors that is trans-border in nature whilst industrialisation, clearing of land for agriculture and encroachment of fragile ecosystem are examples of national and localised factors (Baharuddin, M.K. 2007).

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United Nations Framework Convention on Climate Change

Malaysia signed the United Nations Framework Convention on Climate Change (UNFCCC) agreement on 9 June 1993 and ratified it on 17 July 1994 (Ministry of Science, Technology and the Environment (MOSTE), 2000). In response to the obligation to UNFCCC, a National Steering Committee on Climate Change (NSCCC) was formed in January 1995, chaired by MOSTE, now the Ministry of Natural Resources and Environment. Representatives from relevant government ministries and agencies are represented in this Committee as well as non-governmental organisations (NGOs). DOSM is one of the members of NSCCC in preparing the Initial National Communication (INC) Report. Through this Committee, Malaysia submitted her INC Report to the UNFCCC Secretariat in 2000 with the support from UNDP/Global Environment Facility (GEF) reporting the 1994 Greenhouse Gases (GHG).

The preparation of the Second National Communication (NC2) which began in October 2006 is a continual step towards further implementation of the UNFCCC at the national level, which aims to generate a comprehensive report on climate change related issues in Malaysia. The NC2 (2011) reports on the national GHG inventory of Malaysia for the year 2000 considering emissions and absorptions for the following sectors:

- a. energy and transportation: mainly emissions from fossil fuel consumption;
- b. industrial processes: emissions from mineral, chemical and metal production;
- c. Land Use, and Land Use Change and Forestry (LULUCF): emissions from forest conversion and some soil emissions and absorptions from forest management and conversion of abandoned land;
- d. agriculture: emissions from livestock management, rice cultivation, field burnings and fertilizer applications; and
- e. waste: emissions from solid waste, domestic & commercial waste water treatment and industrial waste water treatment.

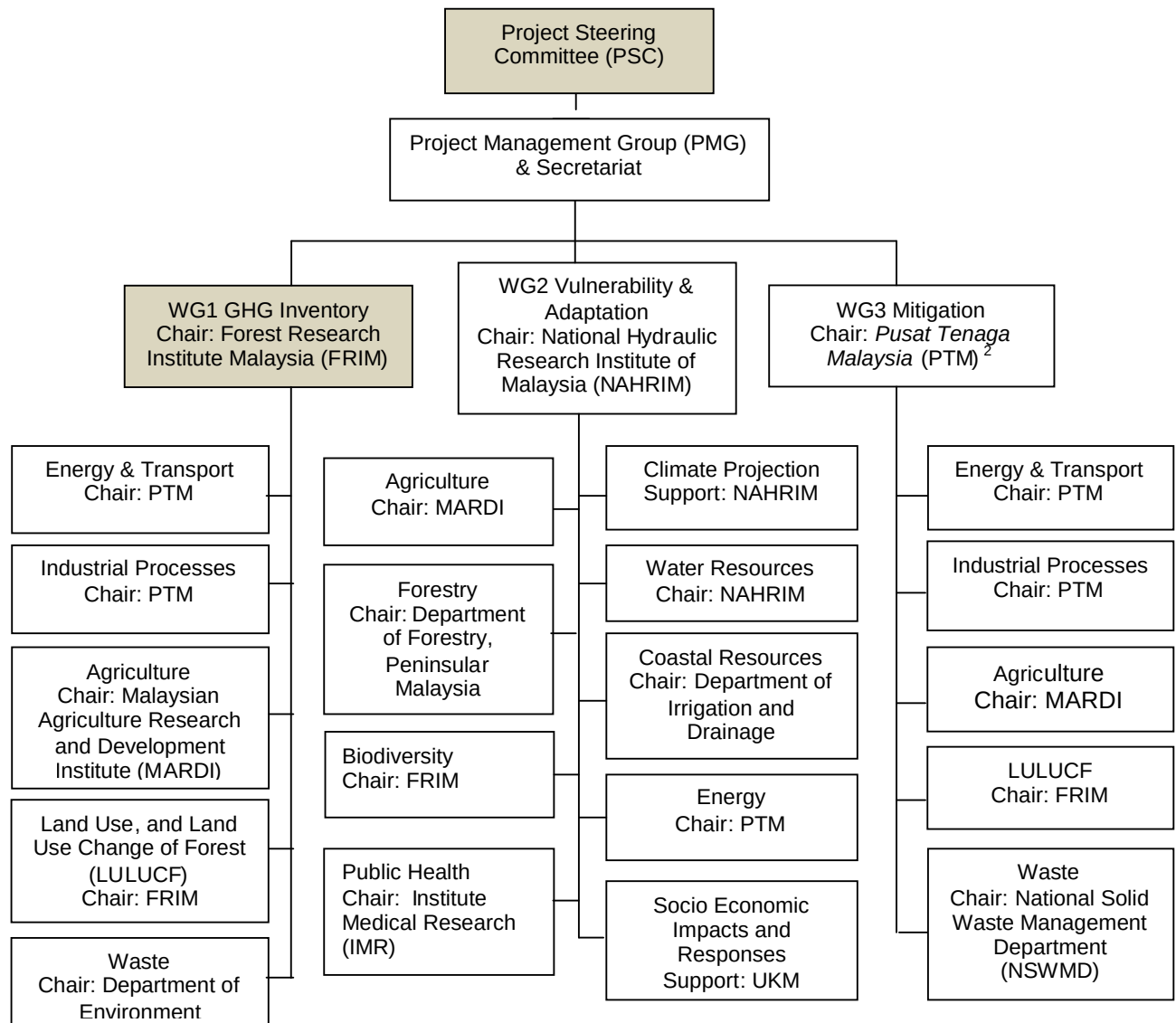
DOSM is also a member of the NC2 Project Steering Committee (PSC). The NC2 Operational Framework consists of 3 thematic working groups, namely:

- a. GHG Inventory Working Group;
- b. Vulnerability & Adaptation Working Group; and
- c. Mitigation Working Group.

DOSM is a member of the GHG Inventory Working Group. The role of DOSM is to furnish relevant data such as population and industries for the calculation of GHG emission.

The main GHG that were inventoried are carbon dioxide, methane and nitrous oxides. The NC2 project ended in July 2010 and the report was submitted to UNFCCC in January 2011.

Below is the NC2 organisational structure:



Source: *Malaysia Second National Communication [NC2] to the UNFCCC*, 2011

²PTM is currently known as Malaysia Green Technology Corporation

Current issues of climate/environment in Malaysia

Malaysia is facing a number of environmental issues/problems such as pollution from industrial activities and vehicular emissions, water pollution, global warming, land reclamation, deforestation and also waste disposal.

Air pollution from industrial and vehicular emissions is a major issue in the urban areas of Malaysia. Haze from open burning is a trans-border issue which is frequent during the hot and dry season between June and September. Locally, there would also be a rise in the incidence of open burning particularly land and forest clearings and peat soil fires.

Also, in several urban and industrial areas, organic pollution of water has resulted in environmental problems and adversely affected aquatic life. The main sources of organic water pollution are domestic and industrial sewage, effluent from palm oil mills, rubber factories and animal husbandry. Mining operations, housing development, road development, logging and clearing of forest are major causes of high concentration of suspended sediments in the rivers.

Landslide is also an environment issue. It is defined as a wide range of ground movement such as rock falls, deep failure of slopes and shallow debris flows (landslides forensic investigations). Landslides in Malaysia are largely triggered by heavy rain due to either a single heavy thunderstorm/rain or successive days of moderate rain especially during the rainy season (Low, K. C. 2006). Deforestation for the development of projects at highland or hilly terrain will also increase the risk of landslide occurrence.

Solid waste also contributes to environmental problems in Malaysia. It plays a significant role in the ability of nature to sustain life within its capacity. In 2007, daily waste generation produced each day in Malaysia is over 23,000 tonnes with estimated general waste composition made up of 45% food waste, 24% plastic, 7% paper, 6% aluminium, 3% glass and 15% others. Based on population growth projections for the period 2002 to 2020, waste generation is estimated to increase at an average of 3.6 per cent per annum. Therefore by 2020, it is estimated that daily solid waste generated in Peninsular Malaysia will be 31,500 tonnes. (Ministry of Natural Resources and Environment (NRE), 2011).

Improper solid waste management also contributes to climate change where decomposing waste produces methane and production of new products to meet demand emits greenhouse gases and utilises natural resources. In Malaysia, a new Solid Waste and Public Cleansing Management Act (2007) [Act 672] was gazetted in August 2007. This Act was enacted to allow a centralised and coordinated management of solid waste by the Federal Government of Malaysia with the exception of Sabah and Sarawak. (NRE, 2011).

Impact of climate change on selected sectors in Malaysia

Malaysia's annual mean surface temperature ranged from 26⁰C to 28⁰C. Based on 40 years of record (1969 to 2009), the rate of mean surface temperature increased from 0.6⁰C to 1.2⁰C, per 50 years. (NRE, 2011).

Currently in Peninsular Malaysia, a regional hydrologic-atmospheric model called the 'Regional Hydro-Climate Model' to generate climate and hydrological projections has been developed by the National Hydraulic Research Institute Malaysia (NAHRIM) (NRE, 2011). Another modeling tool used for climate projections is the 'Providing Regional Climates for Impact Studies' (PRECIS) by the Malaysian Meteorological Department. Based on these two models, surface temperature is projected to rise while rainfall and river flows are projected to experience greater fluctuation. The projections based on the medium range emission scenario indicate a 1.5⁰C to 2.0⁰C increase in surface air temperature by 2050. (NRE, 2011).

The impact of climate change affects several sectors in Malaysia mainly agriculture, forestry, coastal and marine resources, energy, water and public health. However, adaptation and mitigation measures play an important role in reducing these impacts.

a. Agriculture Industry and Food Supply

Agriculture is one of the sectors greatly affected by extreme climate change. The climate change is vital in determining crop performance and also one of the major potential threats to national food security and sustainable agriculture for a country. Physical damage, lost of crop harvest, drop in productivity are some examples of direct and indirect effect of the extreme climate change.

Malaysia's INC (2000) and NC2 (2011) reports highlight some of the impacts of climate change on agriculture sector in the following scenarios:

- i. plantations are close to the coast (low lying planted areas) that could be exposed to floods due to rise in sea level;
- ii. increase in rainfall could affect crops that do not need access water;
- iii. an increase in daily temperatures above 34⁰C will reduce rice yields, on the other hand, the occurrence of floods (15 per cent increase in seasonal rainfall) and through modeling simulations for the Muda Agriculture Development Authority (MADA) area showed that a temperature increases of 2⁰C above the threshold temperature will reduce rice yield by as much as 13 per cent;
- iv. prolong droughts affects the planting of rice crops; and droughts (15 per cent decrease in seasonal rainfall) early in the growing season could decrease yields by as much as 80 per cent; and
- v. security of food supply can be threatened.

According to official projections, increase in temperatures and changes in rainfall pattern could affect crop yields directly or spread of fungus thus affecting yield. The sustainability of food supply could also be affected by climate change. With increase in rainfall, crops could be exposed to diseases, thus affecting the yield. As climate is

continuously changing and affecting the agriculture in diversified ways, a good measurement of its impacts on sustainable agriculture and smooth adaptation are needed to ensure long run sustainability agriculture in Malaysia.

Some adaptations measures should be taken by:

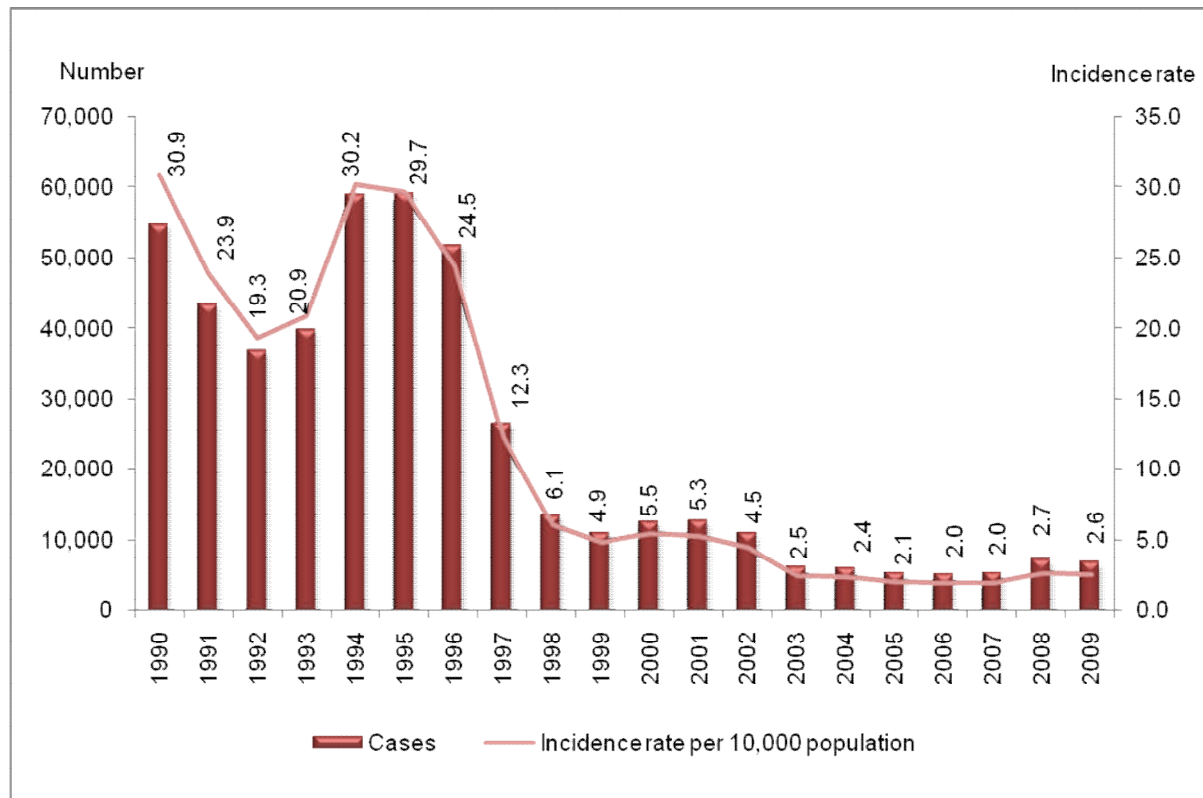
- i. developing plant varieties that are tolerant to floods, droughts and extreme temperatures should be continued;
- ii. preserve permanent forest reserve and water catchment's areas to ensure adequate water supply for agriculture; and
- iii. strengthen integrated pest management to deal with increase incidences of pests and diseases.

b. Health

Malaysia with its high temperature and heavy rainfall can expect significant impact on health. A high extreme or extreme temperature could lead to heat waves that might cause health stress, heat exhaustion and respiratory illness due to air pollution. There could also be an increase in vector borne diseases such as malaria and dengue fever as changes in temperature will increase the availability of suitable breeding habitats for the vectors.

Public health initiatives have been successful in significantly reducing the number of detected malaria cases. Statistics showed that the number of malaria cases dropped to 5,294 in 2006 compared with 54,831 cases in 1990, however in 2008 it increases to 7,390 cases and dropped again to 7,010 in 2009 (See Figure 1). However, this success is being threatened by changes in the climate that could reverse the downward trend in cases and pose dangers to communities living close to what could be new and more mosquito breeding grounds. The increase in temperature and rainfall will encourage malaria vectors to survive in areas immediately surrounding their current distribution limit. Deforestation without proper and sound land practice could open more breeding areas, thus leading to a higher incidence of malaria (*Climate Change in Malaysia* [CCM], 2005).

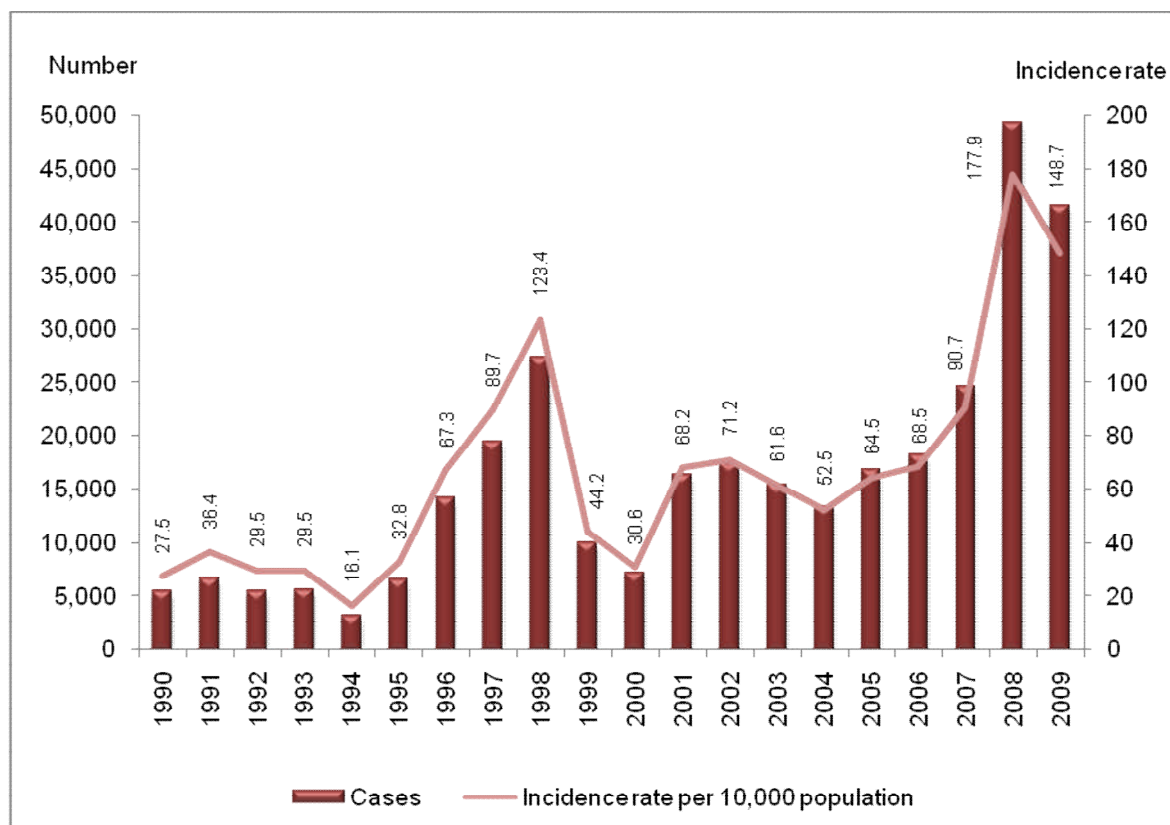
Figure 1: Number of reported cases and incidence rate of malaria, Malaysia, 1990–2009



Source: Compendium of Environment Statistics, DOSM 2010

Dengue fever is currently a highly endemic disease. In the case of dengue fever and dengue haemorrhagic fever, the number of reported cases and incidence rate fluctuated between 1990 and 2004 but started to increase thereafter. In 2008, there was a sharp increase to 49,335 cases compared with 24,634 cases in 2007, however it dropped to 41,486 cases in year 2009 (See Figure 2). Increased incidences of dengue and dengue haemorrhagic fever are observed especially in urban areas after heavy rainfall. Rainwater retention provides suitable breeding conditions for *Aedes* mosquitoes. Without appropriate mitigation measures and adaptability programs planned and implemented, we would expect higher incidence of mortality and morbidity. Warmer temperatures can also increase transmission potential by allowing the mosquito vector to survive and reach maturity much faster and shorten the virus incubation.

Figure 2: Number of reported cases and incidence rate of dengue fever and dengue haemorrhagic fever, Malaysia, 1990-2009



Source: Compendium of Environment Statistics, DOSM 2010

c. Coastal and marine resources

The coastal and marine sectors are vulnerable to the sea level rise due to climate change. Areas most prone to sea level rise are in the east coast of the Peninsular Malaysia, Sabah and Sarawak, where the effects may be felt by farmers with crops close to the sea or fishermen and communities who are dependent on the resources along the coast. According to CCM 2005 report, in a worst case scenario where sea levels are projected to rise 0.9cm/yr, for year 2100 the impacts could range from tidal inundation, shoreline erosion and increase wave action. It is estimated that at that level of rise, the fringing mangrove belt could deplete and the sandy shoreline could retreat at a rate of 30 per cent more to the existing shoreline erosion.

Rise in sea level would lead to socio-economic impacts like loss of agricultural production from eroded/inundated lands, displacements of flood victims with associated disruption of business/economic activities resulting from increased flooding, loss of fisheries production due to mangrove loss and interruption of port operation. Apart from socio-economic impacts, mangroves that are home to diverse flora and fauna are under threat of destruction, erosion of beaches, an increase of wave action and acidification of ocean. Increase in sea temperature (1%-3%) will result to more frequent coral bleaching (Shaaban, 2007).

The National Coastal Erosion Study 1986 had concluded that from the 4,809 km of the country's coastline, 29 per cent are facing erosion. Based on the rate and the

value of the economic activities threatened, these erosion sites have been classified into the following categories:-

Table 1: Total length of coastline facing erosion

Category	Category Definition	Number of Areas	Total Length of Coastline (Km)
1. Critical	Areas suffering from coastal erosion where shore-based facilities are in imminent danger of loss or damage;	74	232.7
2. Significant	Areas where shores-based facilities are expected to be endangered within 5 to 10 years if no remedial action is taken; and	64	221.1
3. Acceptable	Erosion areas that is generally undeveloped with consequent minor economic loss if erosion continues unabated.	77	946.5
Total Length of Coastline		215	1,400.3

Source: The National Coastal Erosion Study, 1986

d. Water Resources

Rapid urbanisation and industrialisation has led to higher demands for water resources from the industrial sector, agriculture (through irrigation) and for household and commercial use (CCM, 2005). With projected increase in temperature and changes in precipitation, Malaysia could experience lower rainfalls and will have an impact on water availability. This will reduce inflows to water storages such as dams and reservoirs, stream flows, water available for rain fed agriculture and recharge of groundwater.

Expected changes in water availability by year 2050 in the various sub-sectors and states of Peninsular Malaysia require a review of current water resources plans. In recent years, rainfall patterns are changing largely due to regional and global weather and climate shifts. For example, the El Nino of 1997/98 and La Nina of 1998/99 have affected the water resource situation in Malaysia.

Floods and droughts are significant natural disasters due to its topography and uneven rainfall distribution. Despite implementing structural flood and drought control measures, growth in population and land development activities have aggravated the incidence of floods and droughts particularly in the urban centers. With regards to floods, nine per cent of the land area in Malaysia is flood prone.

e. Energy Sector

The energy sector contributes significantly to emissions of GHG. Changes in rainfall, temperature and rise in sea level could affect the way electricity is produced and consumed. Industrial energy demand for cooling purposes could rise due to higher ambient temperatures.

Overall our energy consumption has increased over the years and GHG emissions also increased with industrial and transport sectors being the biggest emitters. The final energy demand was 22,164 ktoe in 1995 and had increased to 44,268 ktoe in 2007 (Table 2) (NRE, 2011).

Table 2: Final Energy Demand by Sectors (ktoe)

Sectors	1990	1995	2000	2005	2006	2007
Agriculture	Not available	446	104	101	258	281
Non-Energy	908	2,994	2,250	2,173	2,809	2,958
Residential and Commercial	1,646	2,837	3,868	5,134	5,430	6,196
Transport	5,387	7,827	12,071	15,384	14,825	15,717
Industrial	5,276	8,060	11,406	15,492	17,002	19,116
Total	13,217	22,164	29,699	38,284	40,324	44,268

Source: Ministry of Energy, Green Technology and Water (2007) - National Energy Balance, 2007

Role and importance of official statistics in the measurement of impact of climate change

In Malaysia, official statistics are published by DOSM and also by other agencies. DOSM currently produces a wide range of statistics, encompassing economic, social and environment. These statistics are collected through censuses and surveys such as population, services, manufacturing and agriculture as well as data compiled from secondary sources. For measuring the impact of climate change, official statistics are obtained from various Ministries/Agencies/Institutions.

The need to ensure a clean, safe and healthy environment is envisaged in the National Policy on the Environment. To measure the state of the environment, there is an urgent need for official statistics. Hence, DOSM is entrusted with the task of being the central depository for environment statistics as outlined in the Seventh Malaysia Plan (1996 – 2000). This resulted in the setting up of the Environment Statistics Division in DOSM tasked to compile environment statistics.

In line with its role as the central depository for Environment Statistics, DOSM published the first Compendium of Environmental Statistics (CES) in 1998. It focused on four main environmental media/issues namely air, water (inland and marine), land and human settlements. The development of the environment statistics was based on the Malaysian Framework for the Development of Environment Statistics (FDES) which in turn conforms to the United Nations Statistics Division (UNSD) FDES.

Importance and the usefulness of an environmental database

Environment statistics are still in the early stages of development in many countries and data are often sparse. One of the critical issues is institutional arrangement for collecting data, which requires comprehensive cooperation and collaboration among relevant government bodies. Currently in Malaysia, environment statistics including GHG inventories are compiled by various government agencies as follows:

	Ministries/agencies	Statistics
a.	Department of Environment	Environment statistics pertaining to: i. air quality; ii. river water quality; iii. scheduled waste management; iv. control of black smoke emission; v. oil spill incidents; vi. motor vehicles noise; and vii. environmental impact assessment.
b.	NAHRIM	Hydroclimate database which consists of modules: i. precipitation; ii. evapotranspiration; iii. soil water storage; iv. surface temperature; and v. stream flow.
c.	Malaysian Green Technology Corporation (MGTC)	Malaysia Energy Database and Information System pertaining to GHG inventory for energy sector and other energy related data.

Thus a central depository under the custodian of a lead agency is essential to integrate all official data and indicators especially for GHG inventories. The purpose of this one-stop centre is to provide easy and systematic access to available information.

Realising the need for time series data, DOSM has taken the initiative to develop an environmental information database in 2002. Initially, it was a stand-alone system based on the specifications from the Development of an Environmental Information Database for State of the Environment Reporting, United Nations. This database comprises 16 main topics which are Land, Water, Atmosphere & Climate, Biodiversity, Population, Education, Poverty, Health, Agriculture, Tourism,

Transportation, Energy, Industry, Economy & Employment, Natural Disasters and Policies & Institutions.

The main challenge faced in integrating the information is in standardising the different classifications, definitions, concepts and terms used by various agencies. This is one of the most important tools for ensuring consistency and continuity in the compilation of environment statistics. A typical example is the differences in the classification and definition of protected areas for forestry in Peninsular Malaysia, Sabah and Sarawak. In relation to this, the setting up of an Inter-agency Committee on Environment Statistics during the initial stage of developing the CES in 1997 was a good platform to address issues pertaining to the compilation of environment statistics.

Way forward

With the development of a PC-based environment database, DOSM is also focusing in developing an 'online system' database that can be accessed by relevant agencies. The database is useful for authorised users in order to integrate environmental information.

Currently the UNSD is in the midst of revising the FDES, a framework that will integrate environment statistics, indicators and accounts. Hence, DOSM is also looking into updating the Malaysian FDES as it serves as an important tool in environment statistics. Since the development of CES 1998 was also based on FDES, the current CES will be recompiled based on the newly revised FDES.

Conclusion

Climate change is an important global issue with social, economic and environmental impact. Malaysia has drawn and implemented policies and strategies on climate change to minimise its impact. Statistics are vital in measuring the impact of climate change. The development of a centralised and online database will immensely facilitate researchers and policy makers to assess environmental information.

References:

- Baharudin, M.K. (2007, September). *Climate Change – Its effects on the agricultural sector in Malaysia*. Department of Agriculture, Malaysia.
- Department of Statistics Malaysia. (1998, March). *Framework for the Development of Environment Statistics (FDES) in Malaysia*. Kuala Lumpur, DOSM.
- Department of Statistics Malaysia. (2010). *Compendium of Environment Statistics, Malaysia*. Putrajaya, DOSM.
- Iyer, L.R. (2008). Malaysia's Second National Communication to the UNFCCC (NC2) Project. *IMPAK*, issue 3/2008, 14-15.
- Low, K. C. (2006, October). *Capabilities on Hydrometeorological and Landslides Hazards*. Malaysian Meteorological Department.
- Malaysia, Initial National Communication. (2000). Ministry of Science, Technology and the Environment Malaysia.
- Malaysian Meteorological Department. Retrieved from <http://www.met.gov.my>
- Ministry of Housing and Local Government. (2005). *National Strategic Plan for Solid Waste Management*.
- Ministry of Natural Resources and Environment. (2005). *Climate Change in Malaysia*. Putrajaya.
- Ministry of Natural Resources and Environment Malaysia. (2011, January). *Malaysia Second National Communication to the UNFCCC*. Malaysia, ISBN 978-983-44294-9-2.
- Rapporteurs report on National Seminar on Socio-Economic Impacts of Extreme Weather and Climate Change*. (2007, June 21-22). Malaysian Meteorological Department.
- The National Coastal Erosion Study. (1986). Department of Irrigation and Drainage, Malaysia. Retrieved from web site: www.water.gov.my
- Overview of environmental issues and environmental conservations practices in Malaysia, Chapter 1. (n.d). Retrieved from web site www.env.go.jp/earth/coop/oemjc/ma
- Shaaban, Hj. A. J. (2007, September 11). *Water and coastal management in coping with climate change*. *National Hydraulic Research Institute of Malaysia*. Retrieved from web site: http://www.undp.org.my/uploads/f_Water_Coastal_Mgmt_NAHRIM.pdf