

Current Environmental Concerns

Conserving Biodiversity Hotspots Running out of time

The nation state system of the world has inflicted on planet earth an incorrigible amount of damage to its bountiful biological resources. The science of economics has nurtured the idea of unlimited production while ignoring the fact that the earth has finite resources. Too often the environment and the natural world is a separate entity and seen solely as a source of income. What we do not know is that we are using precious capital, that is, the vast extent of different habitats and biodiversity and not making sufficient efforts to conserve them.

Understanding Biodiversity Hotspots

The groundbreaking theory of biodiversity hotspots proposed by Myers et al. (2000) had its beginnings in a journal paper by Myers (1988). Subsequently, working together with Conservation International (CI) and following more research, this theory was refined to its present framework in the year 2000. The biodiversity hotspots theory focuses on habitats around the planet that are rich in biodiversity and are facing grave threats to its existence. It identifies 25 hotspots around the globe that contain 44% of all vascular plant species, 35% of all vertebrate species that occupy 1.4% of earth's landmass (Myers et al., 2000). The focus here is on species, a visually recognisable form of biodiversity and to qualify as a hotspot, it must contain endemic plant species totaling to at least 0.5% or 1,500 of plant species worldwide. There are many endemic vertebrates in these hotspots, in total 27,298 species comprising 4,809 species of mammals, 9,881 species of birds, 7,828 species of reptiles and 4,708 species of amphibians. Fish is not included in this count as large scale data was lacking and poor. Most of the vertebrates in the hotspots have endemicity which range from 0.2 to 5.7% of world's total but they are not a criterion for the hotspots listing but serve as a backup to fortify the argument. Following this, the subsequent criterion for a hotspot is that it must have lost at least 70% or more of its primary vegetation. In total, the 25 hotspots have lost an average of 88% of their original land cover (Table 1).

By focusing conservation efforts on these hotspots, it is possible to gain the most positive outcome for the financial resources allocated. Much can be done to stem the tide as these areas stand to lose most of their primary vegetation in the near future as only 37.7% are in protected areas. Furthermore based on current rates of deforestation, hotspots in the Caribbean, Tropical Andes, Philippines, Mesoamerica, Sundaland, Indo-Burma, Madagascar and Choco-Darien-Western-Ecuador will face a mass extinction of species (Brooks et al., 2002). A primary reason these hotspots are experiencing heavy deforestation and accelerated species extinctions is borne by the fact that 19 of these hotspots are wholly in developing countries except for California Floristic Province, Mediterranean Basin (large proportion in Europe), Southwest Australia, New Zealand, Caribbean (a small portion in Florida) and New Caledonia (France). Hotspots in developing countries have a host of problems: the populations are increasing in tandem with smaller household sizes: there is a high demand for natural resources and there is lack of initiative in the conservation arena. Aggravating these problems are poor governance, corruption and mismanagement of finances.



The Impact of Demography

In 1995, it was estimated that more than 1.1 billion people live in the areas designated as biodiversity hotspots (Cincotta et al., 2000). The population growth from the years 1995 to 2000 in these hotspots is estimated at 1.8% / year. This figure is higher than the world average of 1.3% / year and the developed countries average of 1.6% / year. Furthermore in the same base year (1995), population density was 75 people / square kilometre in the hotspots. This is significantly higher (71%) than the world average of 42 people / square kilometre. In the same research conducted by Cincotta et al. (2000), population growth in the hotspots was found to be Continued on page 3

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From the desk of the Director General Current Environmental Concerns



Environmentally speaking, the Nation has all the necessary legislations in place. We are also articulate in international forums on environment and have ratified conventions and protocols within the time frame required. Each time a need arose for some aspect of the environment to be protected, we have risen to the occasion by passing the necessary laws. Yet we know that several environmental problems remain a challenge. Clearly I can only say that implementation has not been up to mark and that environmental citizenship on the part of the public needs to be stepped up to avoid more consequences. We also know that we are running out of time. Yes time! No one can say with certainty whether we have passed the "tipping point, put plainly, is when the environmental consequences of our actions or inactions are irreversible and permanent.

We are hence now pressed for time to avoid the 'tipping point' at all costs. Whatever further strategies we develop must be time-sensitive and time-effective. Therefore, we need to critically focus on issues that need our immediate action. In the articles presented in this issue, we have made an attempt to raise the profile of some of these issues : Conserving Biodiversity Hotspots; The Reformation of the Malaysian Water Industry; Public's Role in Solid Waste Management and Environmentally Sound Technologies together with feature articles on Mangroves and Earthquakes.

First on the biodiversity hotspots theory. The theory focuses on habitats around the Earth that are rich in biodiversity and which are facing grave threats to their existence. It identifies 25 hotspots, occupying 1.4% of the Earth's biomass, and containing 44% of all vascular plant species and 35% of all vertebrate species. To qualify as a hotspot it must contain endemic plant species totaling at least 0.5% of the 1,500 known plant species worldwide. In total, these 25 hotspots have already lost an average of 88% of their original land cover. By critically focusing on conservation efforts here, it is possible that dramatic and positive outcomes can be gained for each dollar of financial resources spent. Malaysia is part of one of these hotspots, called "Sundaland". Originally Sundaland's area of primary vegetation was reckoned at 1,600,000 square kilometres. It is now down to a paltry 125,000 square kilometres, of which 96,000 square kilometres is protected. How we sustain and manage these environmentally critical ecosystems surely indicates our will and resolve. The strategies adopted will also be useful in dealing with other problems besetting us that have severe environmental consequences such as demographics, household dynamics and resource consumption. And many of these hotspots are in poor or developing countries mired in economic stagnation, political instability, armed revolution and high population growth. All these indeed sound familiar - invoking our fears that unbalanced economic

development is at the root of environmental problems. Perhaps we should all move away from priority setting exercises, scientific studies and theoretical modeling and resort to robust direct action at least with regard to these 25 hotspots.

Water, a vital element in our lives and once thought to be ubiquitous, is going through a critical phase in our country with much public outcry against the managing of this resource. The legal framework of the water industry is now in place. In January 2005, constitutional amendments were made resulting in the transfer of matters related to water supply services from the State List to the Concurrent List. The Federal Government will now be in a better position to regulate the water services industry throughout Peninsular Malaysia. Together with the setting up of the National Water Services Commission and other related Acts, we should be better equipped to meet the challenges of using, resourcing, managing and conserving this most precious gift of nature. Afterall, in Malaysia, we recognise water as a human right.

As the nation moves into the next phase of industrial development, there is a definite move to identify cleaner technologies. As defined in Agenda 21 of UNCED 1992, environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of the wastes and products and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes. But we have to admit, we have a long way to go. Our recycling rate is a mere 5% as opposed to developed countries (e.g. Japan) which have rates as high as 30%. We as a nation, can do much better and much more than this.

And lastly as to solid waste management, the Ministry of Housing and Local Government estimates that Malaysians generate some 9.86 million tonnes of solid waste per annum. This is a gargantuan volume. If this is not managed in a safe environmental way, the consequences can be dire to us as social beings and to the environment as an ecosystem.

All these issues require sound strategies, political will, citizen participation and our ever urgent attention. Timely action and with more enforced implementation, surely we can avoid the environmental problems that we see before us!

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substantially higher than in the rest of the world and these growth rates are highest in the 19 hotspots located wholly in developing countries. However, what is ultimately and eventually clear is that continued population growth will encroach upon these biodiversity rich and threatened hotspots, thus greatly affecting its ecosystems and ecosystem services provided to humans. There will be a greater demand for resources and space, and unprotected areas in these hotspots will bear the brunt of this quest.

The second grave demographic problem facing hotspots in developing countries is the effect of household dynamics and resource consumption. Most developed countries have dealt with this problem by possessing greater science, creating high rise housing, preserving the remaining tracts of natural land and exploiting natural resources from developing countries. Developing countries on the contrary have a myriad of problems that require them to exploit and use these biodiversity rich sources. What chance do developing and undeveloped countries have when several among them face the daunting prospect of a crumbling economy, political instability, armed revolution and high population growth? The environment will be the first sector to suffer unless change or drastic action is implemented.

Finances and Governance

Since the theory was first proposed, there have been various non-governmental organisations (NGOs) investing in this theory, a total sum of USD400 million over the years 1989-1999 (Myers *et al.*, 2000). This amounts to USD40 million a year, a paltry sum compared to the global effort on conservation spent by countries around the world on ineffective conservation measures. A study of

Table 1: The 25 Hotspots. Source: Myers et al., 2000.

Hotspots Original extent Remaining Area protected Plant Endemic Vertebrata Endemic vertebrates of primary primary (km²) species plants species getation vegetation (% of hotspots) . (% of global (% of global (km²) (km²) plants vertebrates. 300,000) % of original 27,298) extent Tropical Andes 1.258.000 314,500(25.0) 79.687(25.3) 45.000 20.000(6.7%) 3.389 1,567(5,7%) Mesoamerica 1.155.000 231.000(20.0) 138,437(59,9) 24.000 5.000(1.7%) 2.859 1.159(4.2%) 263,500 29,840(100.0) 7,000(2.3%) Caribbean 29,840(11.3) 12,000 1,518 779(2.9%) 1,361 Brazil's Atlantic Forest 1,227,600 91 930(7 5) 33 084(35 9) 20.000 8 000(2 7%) 567(2.1%) Choc/Darien/Western Ecuador 63,000(24.2) 16,471(26.1) 2,250(0.8%) 260,600 1,625 418(1.5%) 9,000 Brazil's Cerado 1,783,200 356,630(20.0) 22,000(6.2) 10,000 4,400(1.5%) 1,268 117(0.4%) Central Chile 300 000 90,000(30,0) 9 167(10 2) 3 4 2 9 1 605(0 5%) 335 61(0.2%) California Floristic Province 324,000 80,000(24.7) 31,443(39.3) 4,426 2,125(0.7%) 584 71(0.3%) Madagasca 594,150 59.038(9.9) 11.548(19.6) 12.000 9.704(3.2%) 987 771(2.8%) Eastern Arc and Coastal 30.000 2.000(8.7) 2.000(100.0) 4.000 1.500(0.5%) 1.019 121(0.4%) Forests of Tanzania/Kenya 1,265,000 126,500(10.0) 20,324(16.1) 9.000 2,250(0.8%) 1.320 270(1.0%) Western African Forests 18,000(24.3) 14,060(78.1) 5,682(1.9%) **Cape Floristic Province** 74,000 8,200 562 53(0.2%) Succulent Karoo 112,000 30,000(26.8) 2,352(7.8) 1,940(0.6%) 472 45(0.2%) 4,849 Mediterranean Basin 2,362,000 110.000(4.7) 42.123(38.3) 25.000 13.000(4.3%) 770 235(0.9%) 500,000 632 50,000(10.0) 14,050(28.1) 6,300 1.600(0.5%) 59(0.2%) Caucasus Sundaland 1,600,000 125 000(7.8) 90.000(72.0) 25 000 15 000(5 0%) 1.800 701(2.6%) Wallacea 347,000 52,020(15.0) 20,415(39.2) 1,500(0.5%) 1,142 529(1.9%) 10,000 Phillipines 300,800 9,023(3.0) 3,910(43.3) 7,620 5,832(1.9%) 1,093 518(1.9%) Indo-Burma 2.060.000 100.000(4.9) 100.000(100.0) 13,500 7.000(2.3%) 2.185 529(1.9%) South Central China 800,000 64,000(8.0) 16,562(25.9) 3,500(1.2%) 178(0.7%) 12,000 1,141 182,500 Western Ghats/Sri Lanka 12,450(6.8) 12.450(100.0) 2,180(0.7%) 1,073 355(1.3%) 4,780 309,850 4,331(1.4%) SW Australia 33,336(10.8) 33,336(100.0) 5,469 456 100(0.4%) New Caledonia 18,600 5,200(28.0) 526.7(10.1) 3,332 2,551(0.9%) 190 84(0.3%) New Zealand 270 500 59 400(22 0) 52 068(87 7) 2 300 1 865(0 6%) 217 136(0.5%) 10,024(21.8) 4,913(49.0) 223(0.8%) Polynesia/Micronesia 46,000 3,334(1.1%) 6,557 342 , Totals 17,444,300 2,122,891(12.2) 800,767(37.7) 133,149(44%) 9,645(35%)

environment and biodiversity protection in developing countries. Since 1991, this fund implemented by United Nations (UN) Agencies (UN Environment Progamme, UN Development Program and World Bank), has raised USD14.5 billion and funded projects in 140 developing countries (www.gefweb.org).

While it is well and good that funding for conservation of biodiversity hotspots in developing countries is increasing, available and up and running, it is still simply not adequate for the task at hand. Aggravating the existing problems facing financing conservation in



Figure 1: The 25 Hotspots. The hotspot expanses comprise 3–30% of shaded areas. Source: Myers *et al.*, 2000.

Bearing in mind the immense costs needed to reinvigorate the conservation efforts on biodiversity hotspots CI has spearheaded the establishment of a USD75 million Critical Ecosystem Partnership Fund (Dalton, 2000a). This fund is expected to increase in amount as more organisations come forward to contribute. Subsequently there is also another independent funding organisation, The Global Environment Facility, that finances projects involving the

the Cape Floristic hotspot estimated that a one

time payoff of USD1 billion would be enough to

completely conserve this hotspot (Pimm et

al., 2001). In a separate study, a network of

connected reserves around the world covering

approximately 15% of each continent would cost

USD30 billion (James et al., 2000). Therefore it is

a safe assumption to conclude that preserving

the 25 biodiversity hotspots would cost between

USD10 to 30 billion. This figure though high is

inconsequential when compared to the annual

environmentally damaging subsidies provided by

governments worldwide which stand at USD1.5

biodiversity hotspots is poor governance. When researching the relationship between Governance Scores (lower score indicates higher instances of corruption) and countries in or outside biodiversity hotspots. Smith et al. (2003) made the observation that hotspot countries have lower governance scores compared to countries outside of the hotspots. In the same research, they found a direct link between negative population change (as numbers of a population declined, corruption increased) and corruption. Donor or funding agencies must demand transparency and accountability while encouraging reforms in order not to expedite corruption. This can easily be done by implementing and demanding proper feedback measures at every stage of a conservation project's implementation.

Critiques

Any scientific theory is bound to be criticised in the academic circles and the Biodiversity Hotspots theory is no exception. One of the main criticisms is that conservation priorities must take on a more comprehensive approach than mere species counts and should include local and regional guidelines when addressing the issues of culture and politics (Jepson & Canney, 2001). Others compare different classes of taxa and claim the designated hotspots are mismatched when it comes to capturing genetic diversity of relevant species (Jepson & Canney, 2001; Harcourt, 1999). From another viewpoint, *Continued on page 4*

An interesting example to illustrate the problems of population and household dynamics is the case of the Woolong Nature Reserve in the South Central China hotspot. This reserve was established in 1975 to preserve the Giant Panda, a species synonymous with the word conservation. Since the establishment of the reserve in 1975. the habitat for the Panda has become increasingly fragmented and the rates of habitat loss are similar or higher than rates of habitat loss outside the reserve (Liu et al., 2001). In 1975 there were 2,560 residents and 421 households in the reserve, this increased to 4,260 residents and 904 households in 1995. Along with the high increase in population and households, the labour force (people aged between 20 and 59 years) also increased to about 60% in 1995. Most of these labourers were farmers and their "economic activities in the reserve including agriculture, fuelwood collection, timber harvesting, road construction and maintenance, Chinese herbal medicine collection and tourism" (Liu et al., 2001) have caused this fragmentation. This situation underlines the issues concerning, population and household dynamics facing the hotspots in developing countries, because even in protected reserves, habitat loss is inevitable. Since population growth and decreasing household sizes is a natural progression and cannot be stopped, action must now be focused on minimising resource consumption and maximising efficiency.

Jepson (2001), citing a personal survey, made an observation that conserving habitat and species diversity are not a priority in Indonesia when compared to responsible land usage, sustainable development and renewable natural resources. He argues that this theory has still not convinced local policy makers.

While all these criticisms are valid, they fail to acknowledge that the single biggest threat to evolutionary mechanisms is the loss of biodiversity, more specifically the biodiversity rich and threatened habitats in the developing world. Subsequently these criticisms fail to understand that as this theory is global and geographically based, it should not be confused as an all out strategy for implementing conservation in the local areas. That should be the next step. This theory, as a stepping stone for a worldwide conservation agenda is a novel idea. Furthermore this theory sources data from over 100 scientists and it is the closest to a concurrence by global scientists regarding biodiversity rich and threatened areas in the world (Myers *et al.*, 2000; Hambler, 2004).

The Next Step

The first step will be for scientists to move away from "priority setting exercises, scientific studies, and theoretical modeling" (Whitten et al., 2001) and move towards a more hands-on approach that most non academic conservationists apply, simply because time is running out. The time for rhetorics and arguments must come to an end. Next, it is logical to stop duplicating conservation efforts as funds are limited. For example, the Worldwide Fund for Nature (WWF) promotes the Focal 25 areas, The Nature Conservancy promotes ecoregion based conservation, and WWF and International Union for the Conservation of Nature (IUCN) have centres of plant diversity (Mace et al., 2000). It will be time, resource and financially efficient if a single concerted effort is focused upon the Biodiversity Hotspots.

Planning and acquiring the financial resources for hotspots conservation are long overdue. Subsequently, the implementation of strict guidelines and necessary legislations at the local level for conservation, protection, management and finances of the 25 hotspots must follow. Priority must be given to developing countries and these measures must be local, unique, country specific and be integrated with socio-economic considerations. As stressed earlier, feedback measures must be present at every stage of implementation as corruption must be avoided at all cost. Finally the countries involved must be commited to abide by these guidelines. With its extremely professional workforce and vast expertise, there is only one world body capable of achieving a task of this undertaking, The United Nations. While this idea might seem far fetched, it is by all means not. The Montreal Protocol and Kvoto Protocol are evidence. All that is required is consensus among leading and eminent scientists in the world, and a resolution to be championed by leading world diplomats.

The need to conserve the fast declining biodiversity reserves of the world is an urgent imperative. They are most vulnerable in developing countries as exemplified by the issues discussed. Henceforth the Biodiversity Hotspots theory must be the blueprint to base all further initiatives. The science is sound, threat imminent and consequences profound. In retrospect, mankind's existence on earth must not be regarded as the most devastating period. Let there be no illusions, civilisation is now at the crossroads, what with conclusive evidence on global warming, natural disasters at unprecedented magnitudes, and mankind exceeding his ecological footprint. The decisions taken now will shape the course of the future for better or worse. Mankind must make the right decision.

References

- Brooks, T. M., Mittermeier, R.A, Mittermeier, C. G., da Fonseca, G. A. B., Rylands, A. B., Konstant, W. R., Flick, P., Pilgrim, J., Oldfield, S., Magin, G. & Taylor, C. H. 2002. Habitat loss and extinction in the hotspots of biodiversity. *Conservation Biology* **16**: 909-923.
- Cincotta, R. P., Wisnewski, J. & Engelman, R. 2000. Human population in the bio-diversity hotspots. *Nature* **404**: 990-992.
- Dalton, R.2000a. Ecologist back blueprint to save biodiversity hotspots. *Nature* **406**: 926.
- Harcourt, A. H.1999. Coincidence and mismatch of biodiversity hotspots: A global survey for the order, primates. Biological Conservation 93: 163-175.
- Hambler, C. 2004. *Conservation*. Cambridge: Cambridge University Press, Cambridge.
- James, A., Gaston, K. J. & Balmford, A.2000. Why private institutions alone will not do enough to protect biodiversity. *Nature* **404**:120.
- Jepson, P.2001. Global biodiversity plan needs to convince local policy-makers. *Nature* **409**: 12.
- Jepson, P. & Canney, S. 2001. Biodiversity hotspots: hot for what? *Global Ecology & Biography* **10**: 225-227.
- Liu, J., Linderman, M., Ouyang, Z., An, L., Yang, J. & Zhang, H. 2001. Ecological Degradation in Protected Areas: The Case of Woolong Nature Reserve for Giant Pandas. *Science* **292**: 98-101.
- Myers, N.1988. Threatened biotas: 'hotspots' in tropical forests. *Environmentalist* 8: 187-208.
- Myers, N.1999. Lifting the veil on perverse subsidies. *Nature* **392**: 327-328.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G.A.B., & Kent, J., 2000.Biodiversity hotspots for conservation priorities. *Nature* **403**: 853-858.
- Pimm, S. L, Ayres, M., Balmford, A., Branch, G., Brandon, K., Brooks, T., Bustamante, R., Costanza, R., Cowling, R., Curran, L. M., Dobson, A., Farber, S., da Fonseca, G. A. B., Gascon, C., Kitching, R., McNeely, J., Lovejoy, T., Mittermeier, R. A., Myers, N., Patz, J. A., Raffle, B., Rapport, D., Raven, P., Roberts, C., Rodríguez, J. P., Rylands, A. B., Tucker, C., Safina, C., Samper, C., Stiassny, M. L. J., Supriatna, J., Wall, D. H.& Wilcove, D.2001. Can we defy Nature's end? *Science* 293: 2207-2208.
- Smith, R. J., Muir, R. D. J., Walpole, M. J., Balmford, A. & Leader-Williams, N.2003. Governance and the loss of biodiversity. *Nature* **426**: 67-70.
- Whitten, T., Holmes, D. & MacKinnon, K.2001. Conservation biology: displacement behaviour for academia? *Conservation Biology* 15: 1-3.
- http://www.gefweb.org Accessed on 22nd March 2004.

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Public's Role in Solid Waste Management

What is Solid Waste?

Solid waste or commonly known as "rubbish" is defined generally as all residues in solid form that are produced from human and animal activities, which are discarded because they are deemed useless, unwanted and have no economic value.

In the recently formulated Solid Waste and Public Cleansing Management Act (2007), solid waste is legally defined as:

- (a) any scrap material or other unwanted surplus substance or rejected products arising from the application of any process;
- (b) any substance required to be disposed off as being broken, worn out, contaminated or otherwise spoiled; or
- (c) any other material that according to the Act or any other written law is required by the authority to be disposed off.

Table 1: Eight (8) categories of solid waste as definedas "Controlled Solid Waste" under the Act.

Figure 1: Solid waste is managed by a 6-step process

Solid waste disposed off at final disposal

facilities such as landfill or incinerator

Solid waste generation

Solid waste temporarily stored in waste bins at generation source

Solid waste collected by the collection

workers and transported by trucks

Household solid waste	Generated from a household, or any premises when occupied as a dwelling house, which includes garden waste.
Commercial solid waste	Generated from any commercial activity such as shop-lots, shopping malls etc.
Construction solid waste	Generated from any construction or demolition activity, including improvement, preparatory, repair or alteration work.
Institutional solid waste	Generated from institutional establishments, such as government office, hospital, clinic, school, university, college, mosque etc.
Industrial solid waste	Generated from any industrial activity (except Scheduled Wastes)- prescribed under Schedule 1 of the EQA.
Public solid waste	Generated from public places, which are under the supervision or control of any local authority, such as recreational park, bus station etc.
Imported solid waste	Generated in other countries and imported to Malaysia for further processing or disposal.
Special solid waste	Controlled solid waste as may be prescribed which is or may be dangerous to public health; or is difficult to treat, keep or dispose off, that special provisions are required to deal with it.

How is Solid Waste Being Managed?

In general, all solid waste generated from multiple sources as mentioned above is managed following a 6-step process as shown in Figure 1 and as a flow diagram in Figure 2. However, there are some exceptional cases where the solid waste generated does not fall into the 6step process. This is when the waste is either directly sold by the waste generator to recyclers or disposed off (illegally dumped, burnt, buried). Based on the projection of total solid waste generation and actual amount of solid waste recorded at the licensed disposal sites throughout Malaysia, it has been estimated that at least 20% of the total solid waste generated is not being delivered to these disposal sites; they are suspected of being recycled, reused, illegally dumped, burnt or buried.

Solid wastes that are

recyclable will be sent to

recycling industries for

recycling purpose

Why is Solid Waste Management Important?

The Ministry of Housing and Local Government reveals that each Malaysian is estimated to generate about 0.8 to 1.0 kilogram of solid waste every day. Based on a projected population of 27 million in year 2007, the total solid waste generation in Malaysia was estimated to be about 21,600 to 27,000 tonnes per day, which is equivalent to about 7.88 to 9.86 million tonnes a year.

Solid wastes are processed

in facilities approved by the

Government such as solid

waste transfer stations

This tremendous amount of waste generated in Malaysia needs to be managed effectively, in order to prevent adverse impacts not only on the environment, but also on the socio-economic and well-being of human health and the entire ecosystem as a whole, as shown in Table 2.

What is the Public's Role in Solid Waste Management?

It is a common perception that solid waste management is the responsibility of the Government. In their minds, this includes eradication of illegal dumps, providing waste collection services and providing facilities for proper waste treatment and disposal.

However, the Government will never be able to implement solid waste management effectively without the involvement and cooperation of the public. The public as consumers are one of the largest waste generators. Therefore, the public should also shoulder the responsibility and play an effective role in solid waste management

Table 2: Adverse impacts of poor waste management

Human Health	 Breeding ground for vectors that carry diseases such as rats, cockroaches, mosquitoes and flies. Possible diseases caused by the vectors include malaria, dengue and cholera. Solid waste also causes skin diseases; other health impacts are caused by toxic gases emitted from the degradation of wastes especially in the disposal sites. 	
Environment	 The degradation of solid waste produces a liquid that is known as "leachate". Leachate contains various kinds of pollutants and will pose serious pollution such as contamination of river water, soils and underground water. The degradation of solid waste also produces methane gas which is one of the greenhouse gases that causes depletion of the ozone layer of the earth. Methane gas is highly explosive and flammable. In case of a fire at the disposal sites, it is extremely difficult to put off the fire, therefore creating serious air pollution problem. Rivers polluted with solid waste will endanger marine resources such as fish and turtles, and subsequently destroy the ecosystem as a whole. 	
Socio-economy	 Solid waste management requires a tremendous amount of money every year for waste and litter collection, transportation and disposal costs, as well as the cleaning of solid waste in rivers, drainage and illegal dumps. Solid waste also brings social impacts such as the scavenging activities at the disposal sites, which is very harmful to human health and safety. 	
Disaster / Tragedy	Littering and illegal dumping of solid waste into the drainage system results in blockage of the waterways and poses a high risk of flooding.	



Littering of solid waste into the drains - blocking the waterway poses a high risk of flooding.

> "Reuse" – reuse the bottles to fill in other drinks; reuse old newspapers for wrapping; donate old books, magazines, furniture or clothes to other people who may reuse these items.

so as to reduce the burden of solid waste, management borne by the Government. Public's role in solid waste management is summarised as follows:

• Practising 3R

The public can put into practice the 3R principle of "reduce", "reuse" and "recycle" in their day-to-day living. A large quantity of the waste generated in our daily lives is recyclable. These are glass bottles, plastic containers, papers, metal cans, aluminium cans, as well as electronic and electrical wastes. In addition, organic food waste can also be turned into compost if they are treated in the right way.

Some examples on how to practise 3R are summarised here:

"Reduce" – reduce the usage of disposable materials; bring your own food container when buying food to reduce the use of polystyrene boxes; reduce the use of tissue papers by using handkerchief; reduce the use of plastic bags when shopping by bringing your own shopping bag.







Solid waste leachate that contains various types of pollutants needs to be treated properly.



Fire at a disposal site, can cause serious air pollution problems.

"Recycle" – deliver recyclable materials to recycling centres or sell the recyclable materials to the door-to-door collectors; do composting at home using food residues to produce fertilisers or soil conditioners.

• Give Priority to Cleanliness

The public must always maintain cleanliness not only of their own premises, but also public places that they are visiting. Waste should be placed in the waste bin and not littered on the road, into the drains or even rivers. In case of special bulky waste such as furniture which needs to be discarded, a waste contractor should be contacted to collect the waste instead of illegally dumping the waste. Solid waste generated should be handled in a proper manner to allow easier and efficient collection by the waste collection workers.

• Change Your Lifestyle

Human lifestyle has a direct relationship with the amount of solid waste generated because the habit of impulsive buying of goods that are beyond necessity tends to result in the generation of more solid waste. Therefore, the public should avoid

impulsive buying and should have a proper daily lifestyle plan to ensure minimum wastage.

• Be a Wise Consumer/Buyer

Be a wise consumer who always cares for the environment. The quality of products should be emphasised because low quality products tend to have a shorter lifespan, and will therefore become solid waste within a shorter period. In addition, the public should choose products that are environmental friendly or at the least with a logo that indicates that the product is recyclable.



Scavenging activities at a landfill site - the social impact.



Illegal dumping – a tremendous amount of money is spent on cleanup every year.

• Complying with the Laws

The public should at all times comply with any laws, regulations, or even guidelines, related to solid waste management. Illegal dumping, littering and open burning of solid waste should be avoided at all costs.

• Educating the Next Generation

The public should be aware of the importance of environmental education to the younger generation. Parents especially should set a good example to their children and educate them with sufficient knowledge on proper environmental management as well as their responsibility and role in overall solid waste management.

Conclusion

The increase in solid waste generation from year to year has caused the disposal sites in Malaysia to reach a critical stage, with many disposal sites almost reaching their maximum capacity to receive wastes. Consequently, it is extremely crucial for solid waste to be managed effectively so that adverse impacts caused by improper management of solid waste can be minimised. Solid waste management is no longer the responsibility of the Government per se: it is a shared responsibility of the Government and the public who constitute one of the largest waste generators.

If the public is able to play their role by practising 3R principles in their daily life, an efficient solid waste management system will be achieved while the lifespan of the disposal sites can be prolonged, and pollution to the environment

can be significantly reduced and the world's resources can be preserved as a whole.

Together We Can Make the Earth a Better Place to Live In.

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Reformation of the Malaysian Water Industry

Recently, the Malaysian water industry faced a major reformation and restructuring First. the Constitutional process. Amendments in January 2005 resulted in the transfer of matters related to water supply services from the State List to the Concurrent List. The objective of the amendment is to enable the involvement of the Federal Government in the water services sector to establish a regulated water services industry in Peninsular Malaysia. Following that, with the setting up of the National Water Services Commission and the enforcement of the National Water Services Commission Act and the Water Services Industry Act, major changes are expected in the water sector. Tradability of water rights and implementation of a water market are also issues widely discussed in recent years. However, in Malaysia water has been stipulated as a human right and therefore the challenge is to ensure that the new industry model will result in a more holistic approach in the management of water services.

Water is crucial and important to all livings and the importance of water cannot be stressed often enough. Yet, it is the single most abused and ill-treated resource the world over. It has been widely mismanaged, depleted, wasted, polluted and changed beyond what is clearly recognisable as water. Unlike in the not too distant past when water was plentiful and populations scarce, water is now becoming a scarce commodity in many parts of the world. During the last century, the population of the world has more than tripled, from 1.6 billion to over 6 billion, while water resources have remained constant.

In Malaysia, the National Water Resources Study (2000-2050) indicates a clear annual increase in the demand for water. It is also estimated that we will have to develop 62 water projects costing RM51.9 billion, construct 47 dams and undertake major water transfer projects between states. The cost of the planned projects is about RM77 billion.

The challenges facing water resources are daunting. Extreme importance has been placed upon the financial, institutional and legal measures in water management. Indeed without the appropriate legal framework, the ability of the state to regulate, control and allocate its water resources is hampered; its role in ensuring the efficient and proper use is hindered; and its right to protect those resources is challenged.



Water legislations usually specify principles and priorities that are expected to guide decisions concerning water. Such principles can include conservation and protection of the state's water resources, equitable division of the resources among all potential users, sustainable use of water resources, use of water to promote economic development and efficient management.

For the Malaysian water sector, many recent developments have taken place that will directly impact the water services agenda in the Ninth Malaysia Plan. When water was under the purview of the state government, water resource management, abstraction, treatment and distribution were under its care. Water treatment was privatised due to the lack of funds by the state governments to upgrade facilities. Following this move, many states faced major problems, especially distribution as there is a high level of Non Revenue Water, which is a common term used in the Asian Region for water lost during the distribution period due to old facilities, broken pipes, pilferage and other issues. So, the water department which has been assigned the task of distributing water faced major financial challenges as they had to buy the treated water from the private company but lost revenue on "lost" water. Slowly, the states began privatising water supply services to private companies and the privatisation process was mostly rushed into without a proper legal framework and regulations governing it. On the other hand, public outcry on water quality, regular disruptions in supply

and most importantly the tremendous increase in water tariff were compelling reasons for the government to take action on this issue.

The change in the legal framework, issues on governance as well as methods of managing water resources are being studied and looked into following the amendment of the Federal Constitution to transfer the jurisdiction of law from state purview to the Concurrent List. Following the Constitutional Amendments, Federal Government involvement in the state water supply services are in the areas of regulating the service providers and the provision of funds for the maintenance and expansion of water supply services. Two new water acts namely the National Water Services Commission Act and the Water Services Industry Act were gazetted and enforcement of the acts is expected to come into force by end of 2007.

The Water Services Industry Act seeks to provide and regulate water supply services and matters incidental thereto. The main objectives of the act are to establish a licensing and regulatory intervention to promote the national policy objectives for the water supply and sewerage services. The act which contains 13 parts, covers the following:

- Economic Regulations: Licensing and duties and obligation of licensee to provide water supply and sewerage services.
- Technical Regulations: Technical and scientific standards and specifications,

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permits and certification of contractors and plumbers.

- Social Regulations: Establishment of Water Industry Fund, Sewerage Capital Contribution Fund and Water Forum
- Consumer Protection: Includes quality of services, consumer complaints and tariff setting.

The National Water Services Commission (*Suruhanjaya Perkhidmatan Air Negara*, SPAN) will regulate all water service providers irrespective of government or private ownership, whilst the management of water resources will remain within the jurisdiction of the state governments.

Meanwhile, one of the major infrastructure developments in the water sector is the construction of the Pahang-Selangor Raw Water Transfer Project which is expected to commence in the Ninth Malaysia Plan and be completed in the Tenth Malaysia Plan. The project will transfer 2,260 million litres of water per day. Water will be captured by Kelau Dam in Pahang and released to the Semantan River via the Kelau River. The Semantan Intake and Pumping Station will transfer the water via dual pipelines to the tunnel inlet. The tunnel will then transfer the water across the Main Range to Langat 2 Water Treatment Plant in Selangor.

Challenges facing the Water Industry over the Next 5 Years.

The major challenge is to ensure that the industry model will result in sustainable water resources management in Malaysia. The following are some of the issues which will concern the general public in the next few years following reformation of the national water sector:

Migration of existing concessionaires to the new regulatory regime: The existing concession agreements (CA) are given options to continue with the agreement or to migrate to the new regime which is outlined in the license authorised by SPAN. The CAs are required to be registered under SPAN.

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Promote efficiency and facilitate competition: SPAN is expected to introduce and practise the concept of comparative competition and benchmarking. The comparing of performance of individual companies and setting of price limits with incentives for companies to increase efficiency will result in breaking up the existing setup of local monopolies due to the physical nature of network infrastructure, which does not enable competition to exist.

- Tariff Setting: The issue of water tariffs needs to be addressed with respect to social responsibility and cost recovery, together with the funds needed to improve and expand water services, conservation of freshwater supplies as well as reclamation of degraded water systems. The privatisation of water services should result in greater efficiencies in the sector and equitable distribution of water. The planning of water services should take into account future technological innovations and consumption patterns that may reduce the need for water supply infrastructure, and consequently result in lower capital expenditure.
- Incorporating water and sewerage services bills: Considering this merger from an environmental view point, this is a big step to be taken towards holistic water management services which is critical to save Malaysia's water resources. While 97% of our water supply is from rivers, the public is yet to understand the linkages between river pollution and water supply, evidenced by the increasing numbers of "dead" and polluted rivers.

If a proper scheme is enforced to ensure the poor and vulnerable are not deprived of their basic water and sanitation needs through this system, a single engineering and project management service in one region or state to upgrade and improve both water supply and sewerage facilities will be cost efficient and will eventually prevent increases in water tariff due to high treatment cost of polluted water.

Studies conducted by OFWAT (UK Water Commission, similar to SPAN) showed that water and sewerage companies performed better in operational efficiencies compared to water only companies in the UK. Paying for sewerage is an important message to be understood by the public because improper sewerage treatment poses health threats.

5 Establishment of a Water Forum: Encouraging greater participation among consumers in addressing various policy and regulatory issues through a Water Forum is an essential move. The main aim is to achieve greater efficiency, and to better handle consumer complaints.

Enhancement of policies to protect and sustainably utilise the natural water resources: Implementation of policies with regard to river rehabilitation, water conservation, utilisation of groundwater and water recycling are expected. SPAN is expected to confer with the Ministry of Housing and Local Government in reviewing the Uniform Building By-Law to incorporate amendments for the initiation of rain water harvesting (as promoted by the Prime Minister at the Third National Water Resources Council in March 2007), water efficient fittings and appliances as well as wastewater recycling. Tax incentives for the companies undertaking wastewater recycling are also expected to be promoted by SPAN.

Conclusion

The Federal Government is moving towards greater involvement in the management of water supply services and water resources, respectively in order to ensure efficient water supply services and sustainable water resources development.

However, we the public should play our role in managing our own water resources. Our lifestyle that is based on water-depleting consumerism is no longer sustainable. Water is everybody's responsibility and we are part of the solution. We no longer live in an era in which we could have indefinite expansion of water resources development. We have to re-look at on how we use water and play our roles from water capture to consumption, and to wastewater discharge. That is where new water will be 'found'.

In economic terms, the present scenario is that, instead of living on freshwater income, we are irreversibly diminishing freshwater capital. At some time in the near future, we will be freshwater bankrupt, unless we rethink water services and resources management.

References

- Issues of Water Law Reform, FAO Legislative Study (67).
- Malaysian Water Association. *Water Malaysia*, Issue No 12 (January 2006).
- National Water Resources Plan 2000-2050.
- Regulatory Framework for Water Resources Management, The World Bank.
- World Water Council Website : www.worldwater council.com

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Climate Change and Environmentally Sound Technologies

The alarming rise in temperatures around the world is bringing about significant negative impacts on the global environment, particularly in the climate system. Instrumental observations indicate that the global surface temperature rose by an average of about 0.74°C over the past hundred years between 1906 and 2005, with stronger warming in the more recent years. This global warming trend results in extreme changes in climatic patterns and a rise in sea levels, threatening the ecosystems and human health.

There has been ample scientific evidence to associate these changes with the exponential rise in the emissions of greenhouse gases (GHGs) from anthropogenic sources, notably carbon dioxide and methane, which contribute over 60% and 20% respectively of the enhanced greenhouse effect. The other major GHGs that include nitrous oxide and ozone together account for the remaining 20%.

Findings of a new study reported by a team of researchers from Australia, France, Germany, United Kingdom and United States indicate that CO_2 in the atmosphere is increasing even faster than expected, escalating from 280 ppm in the 1700s to 380 ppm in 2005, due essentially to the acceleration in global emissions, particularly in the early 2000s when the proportional growth rate in global emissions was 3.3% per year for 2000-2005, while the same growth rate was 1.0% per year through the 1990s. This escalation was attributed to increased industrial use of fossil fuels coupled with a decline in the ability of the oceans and land to absorb the gas, partly due to the rising temperature.

Impacts of Climate Change

The current trends of GHG emissions, if uncurbed, could result in enhanced global warming with the average global temperatures rising by 2-3°C in the next fifty years. This would bring about many severe impacts, particularly higher frequency of floods, droughts, storms and heat waves that affect human health and well-being and the environment on a global scale, threatening some basic elements of life such as access to food and water. Developing countries are especially vulnerable to climate change because of their geographic exposure, low incomes and greater reliance on climate sensitive sectors such as agriculture. Even developed countries are not spared as a higher occurrence of extreme weather events and natural disasters are being forecasted. In



A cogeneration system using carbon-neutral biomass fuel generates both process steam and electricity and contributes directly to quantifiable reduction of GHG emissions from conventional fossil fuel sources

Malaysia, the recent big flood that occurred at the end of 2006 and early 2007 in the southern region of the Peninsula, for example, served as a clear reflection of how extensive and far-reaching the damages and hardships that could be inflicted upon the general population by such an extreme meteorological event.

The Kyoto Protocol

Pooling international efforts in combating the aforesaid situation, the United Nations Framework Convention on Climate Change (UNFCCC), signed by 154 states in 1992 at Rio de Janeiro, came into force in 1994. It set off a string of negotiations, culminating in the adoption of the Kyoto Protocol at COP-3 on 11 December 1997 in Kyoto, Japan. The Protocol recognises that developed countries (Annex 1 Parties), with higher per capita emissions than those in most developing countries, would have greater capabilities to address the climate change problems, and have therefore a legally binding commitment to reduce their collective emissions of six specified GHGs by at least 5% compared to 1990 levels by the period 2008-2012.



Palm oil milling generates enormous quantities of effluent and waste biomass. In common practice, effluent is treated in open lagoon systems which emit greenhouse gases from anaerobic digestion in the form of biogas consisting of methane and carbon dioxide, while in many cases, empty fruit bunches are disposed off in fields for landfilling resulting in methane emission through anaerobic decay. These 'wastes' can be beneficially harnessed in co-composting systems under aerobic conditions to produce biofertilisers for on-site application in the plantations, thus bringing about a significant quantifiable GHG reduction through avoidance of methane emissions in the baseline scenario.

Besides carbon dioxide, methane and nitrous oxide, the other three target GHGs are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride. These GHGs have Global Warming Potential (GWP) of 1, 21, 310, 6500-9200, 140-11700 and 23900 respectively. With the Russian Federation's ratification, the Protocol entered into force on 16 February 2005. The Clean Development Mechanism (CDM) was introduced in Article 12 of the Kyoto Protocol, and is the only flexible mechanism that allows developing countries to participate in the Protocol through GHG reduction projects involving Annex 1 countries whereby part of the latter's reduction obligations could be achieved, while contributing to the former's sustainable development.

CDM is based entirely on private investments, the return on which is enhanced by trading in the derived GHG benefits quantified in standard units (tonnes of carbon dioxide equivalent), referred to as Certified Emission Reductions (CERs), generated in accordance with set procedures and modalities. Environmentally sound technologies should therefore be adopted in projects that are recognised to bring about a quantifiable reduction in GHG emissions under the CDM, particularly those in the industrial sector.

Environmentally Sound Technologies

As defined in Agenda 21 of the United Nations Conference on Environment and Development (UNCED 1992), environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of the wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes. In the context of climate change mitigation, these are process and product technologies that either generate low or no waste for pollution prevention, or are end-of-pipe technologies for sustainable pollution treatment, emphasising the conservation and efficient use of resources and utilities, in particular energy use, and minimisation, recovery or avoidance of GHGs. The industrial sector's contribution to global GHG emissions arises from two main sources: primary energy consumption accounting for 47% of global CO2 releases, and process-related emissions with varied reliability in their estimates. Technologies that could be adopted for reducing GHG emissions in the industrial sector are given in the ensuing paragraphs.

Energy Efficiency and Thermal Cascading

Optimised use and conservation of energy in all processes and operations, use of energy-efficient equipment and machinery, and sequential capture and reuse of lower temperature heat for appropriate applications. Table 1: Examples of Environmentally Sound Technologies and Their Climate and Other Environmental Benefits*

Technological Option	Selected Examples	Climate Benefits	Other Environmental Benefits
Energy efficiency and thermal cascading	ncy and ding ding ding ding ding ding ding di		Reduction in air pollution
Fuel switching	 To natural gas To biomass (especially for agro- industries) To renewables (e.g. solar drying) To electricity substitution when it reduces GHG emissions 	Savings of 20% CO ₂ /year by 2020 for industrial sector	Reduction in air pollution
Cogeneration	 Combined heat and power (new industrial facilities, retrofit old facilities) Gas turbines/combined cycle 	Savings of 20% CO ₂ /year by 2020 for industrial sector	Reduction in air pollution
Process improvements	 N₂O reduction for nylon production CF₄ reduction in aluminium production HCFC elimination 	Savings of 2-5% CO ₂ -eq/year by 2010	$N_2 O$ and HCFC reduction for protection of ozone layer
Material substitution • Replacing metals with plastics • Replacing concrete with wood or plastics • Lighter materials to lower transport-related CO ₂ • Using chemicals made from plant materials		Various undetermined benefits	Reduction in air pollution
Material recycling	 Design for dis-assembly Designing materials for reuse Material quality cascading 	Savings of 29 MtC/year by OECD countries for a 10% increase in recycling	Less solid waste and lower resource use

*Estimated reductions assume a 1990 industry manufacturing sector structure. Reductions by different technological options may not be additive.

Fuel switching. Efficient use of biomass in steam and gas turbine cogeneration systems as substitute for fossil fuels, or switching to less carbon-intensive industrial fuels in a cost-effective manner.

Cogeneration. New industrial facilities or retrofit from single cycle to combined cycle, and combined heat and power.

Process improvements. Replacement of industrial feedstocks, such as natural gas as the source of industrial hydrogen with biomass hydrogen or with water electrolysis using carbon-free energy sources, or cost-effective reduction or even elimination of all process-related GHGs such as PFCs and NO_x.

Material substitution. Total or partial substitution of materials with high GHG emissions in the product or even in the packaging with alternatives that perform the same function, particularly alternatives classified as wastes in other industrial processes.

Material recycling. Recycling of materials or products after use to restore original use, or cascading the materials by successively downgrading use into applications requiring lower quality or specification.

Table 1 lists the climate and environmental benefits of some examples of the aforesaid technologies.

The Way Forward

Findings of studies on climate change reported to date and the occurrence of extreme meteorological events with increasing frequency have proved beyond a shadow of doubt that the threat to the global environment by escalating GHG emissions due to anthropogenic activities is increasingly severe. Concerted efforts by the entire international community need to be intensified to combat this threat for the well-being of the present and future generations. Adoption of environmentally sound technologies by the industrial sector aimed at GHG emission reduction is one of the direct and effective measures towards this end. Hence, innovative programmes and mechanisms need to be designed and strengthened to entice the sector into institutionalising such practices in their core business operations. The progress achieved to date by the CDM lends support to this contention.

References

- IPCC. 2007. Fourth Assessment Report. Intergovernmental Panel on Climate Change, Geneva.
- Raupach, M.R., Marland, G., Ciais, P, Le Quere, C., Canadell, J.G., Klepper, G., and Field, C.B. 2007. Global and regional drivers of accelerating CO₂ emissions. *Proc. Nat. Ac. Sci.*, **104(24)**: 10288-10293.
- Stern, N. 2007. *The Economics of Climate Change*. The Stern Review. Cambridge: Cambridge University Press.
- Watson, R.T., Zinyowera, M.C., and Moss, R.H. (Eds.). 1996. Technologies, Policies and Measures for Mitigating Climate Change. Intergovernmental Panel on Climate Change, Geneva.

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A Voice for Mangroves

Mangrove forests are among the world's most productive, prominent and complex ecosystems. They are dominated by salt-tolerant trees and shrubs in which the rate of primary production of organic carbon is high. Mangroves are an important transition zone found in inter-tidal zones of tropical and subtropical regions. They play an important role in protecting banks and shores against the force of tide, removing pollutants, enhancing nutrient cycling as well as providing good habitats and feeding sites for aquatic organisms.

Sediment can be a good and sensitive indicator for both spatial and temporal trends in the marine environment. The presence of fluctuating water regimes create a dynamic interface between anaerobic and aerobic conditions that supports the microbially driven anerobic/ aerobic processes of methanogenesis and methanotrophy, denitrication and nitrification, and sulfate reduction and sulfide oxidation.



Map 1: Map of Penisular Malaysia showing the mangrove forests

Most mangrove forests in Malaysia are found along the coastline of Sabah (341,377 hectares) followed by those in Sarawak (172,792 hectares) and in Peninsular Malaysia (123,482 hectares) (Jakabson *et al.*, 2007). Over half the total mangrove forests are located in the East and South-east of Sabah. About 60% of the mangrove areas in Malaysia have been designated as forest reserves to be used for sustainable harvest of mangrove products. One of the best and oldest mangrove forest management systems was designed for the Matang Forest (Peninsular Malaysia). It is one of the most well managed mangrove areas in the world. Mangroves on the West Coast of Peninsular Malaysia are more widespread than the East Coast due to the different wave patterns of water bodies bordering these coasts. The Eastern side of Peninsular Malaysia is bordered by the South China Sea that has larger, energetic waves while the West Coast is bordered by the Straits of Malacca that has limited wind and is relatively calmer. The East Coast mangroves are found almost entirely inside the estuaries, while the West Coast mangroves are found fringing the coastline of the Straits of Malacca and also inside estuaries.

The mangrove forests of Malaysia have contributed considerably to the socio-economic development of the country, particularly coastal communities. Besides producing timber and fuel of economic value, the mangroves are rich in fishery resources and fishing activities are often centred in or around mangrove areas. In recent years, mangroves have been progressively clear-felled for conversion to other land uses (aquaculture, agricultural and industrial development). Malaysia has lost almost 30% of her mangroves and the rate is expected to continue at 1% a year. Relatively little is known of the effect of uncontrolled destruction of the mangroves and mangrove habitats continue to shrink around the world.

Despite the importance of mangroves, they are being destroyed at an alarming rate and it has become an urgent matter to understand trophic interactions and material flow within these ecosystems. Though mangrove ecosystems have been studied extensively, they remain poorly understood and the results of such studies are not encouraging; mangrove habitats continue to shrink around the world with continuing degradation and destruction. The full extent of the damage is not yet fully known, but technological advances (e.g. airborne multispectral sensors and satellite



imagery) are allowing researchers to map and monitor mangrove habitats. In recent years, there has been a great deal of controversy over the role of coastal aquaculture development in the destruction of mangroves. However, information on the causes of destruction is limited. As mentioned earlier, mangrove forests have immense importance for many organisms and humans. Increasing human population demands more land for housing and recreation. Habitat destruction through human activities has been the primary cause of mangrove depletion. Diversion of freshwater for irrigation and land reclamation have also destroyed extensive mangrove forests. In the past several decades, numerous tracts of mangrove have been converted for aquaculture, fundamentally altering the nature of the habitat. Measurements reveal alarming levels of mangrove destruction. Some estimates put global loss rates at one million hectares per year, with mangroves in some regions in danger of complete extinction.



Map 2: Distribution of mangrove forests in Sabah (left) and Sarawak (right)

Heavy historical exploitation of mangroves has left many remaining habitats severely damaged. Mangroves are the first to be cleared (because of their perceived uselessness), filled in, used for rubbish dumps or turned into housing estates or parks. This puts mangrove forests, like all tropical resources under severe pressure. Mangroves are important for many plant and animal species and their destruction means a dramatic loss to the commercial and recreational fishing industry and the erosion of shorelines, resulting in many species of plants and animals appearing on endangered or extinct lists. Aquaculture development has been a significant cause of mangrove destruction in Asian countries during the last 30-40 years.

The local villagers use mangroves as a major wood resource for house construction and as fuel. Minor uses of mangrove products include pharmaceutical and medicinal applications, tanning material, and furniture making.

It is suggested that future studies focus on biological, chemistry and ecological aspects and their links with mangrove forest management. Linking scientific research with management issues should enable effective and efficient management guidelines for mangrove forest (Jahara & Santha, 2003). These studies are also important in teaching the community the proper value of mangroves in terms of economic and biological aspects.



One of the most destructive uses of mangroves in Borneo was the Japanese-based mangrove wood chip industry. In Sabah, 40% of the mangroves (120.000 hectares) were allotted for woodchip export to Japan and there was a mean annual clear felling of 4,000 hectares. In Sarawak, 1,600 hectares were clear-cut annually. This wood chip industry in Malaysia was apparently halted in 1995. The industry continues to decimate the Kalimantan mangrove forests, but at an unknown rate (in 1990, licenses had been issued for 200,000 hectares). Most of the mangroves in Kalimantan have been lost. Smaller tracts of land have also been cleared to make room for new coastal settlements as part of Indonesia's transmigration programme. A survey done by Dahdouh-Guebas et al. (2000) around Mida Creek, Kenya, comprising mangrove forests and other marine resources, indicate the economic, ecological and the environmental importance of the mangroves to the local village communities.

In the context of mangrove management in Malaysia, the National Forestry Policy applies. The National Mangrove Management Plan in the National Forestry Policy of Malaysia has economic, social and environmental objectives to optimise returns while ensuring that damage or degradation of these resources is kept to a minimum and resource sustainability is achieved. There are three management alternatives for mangrove areas: preservation or closed exploitation, conservation and conversion. Preservation in its natural state will be applied in mangrove areas without causing any damage to the system. It will be done with great care because it can lead to irreversible economic or ecological results if pushed too far. Conversion meanwhile will alter the condition of the mangrove ecosystem such that all other potential uses are foreclosed. The inputs required are much higher than in preservation or conservation.



Conclusion

Wetlands International-Asia Pacific in 1996 recommended a smart partnership based on an integrated framework for action as an alternative to the National Mangrove Management Plan of Malaysia. An integrated framework for action implies the process of government and community uniting with the science and management plan of protection and development of coastal ecosystem and resources. A smart partnership involving good public-private partnership is an excellent way to conserve the mangroves.

References

- Dahdouh-Guebas, F., Mathenge, C., Kairo, J. G. & Koedam, N. 2000. Utilization of Mangrove Wood Products around Mida Creek (Kenya) Amongst Subsistence and Commercial Users. *Economic Botany* 54: 513–527.
- Jahara Yahya & Santha, C. R. 2003. Coastal Resource Development In Malaysia: Is There A Need For Sustainable Mangrove Forest Management? FEA Working Paper No. 2003-2. Department of Development Studies and Department of Applied Economics, Faculty of Economics & Administration University of Malaya 50603 Kuala Lumpur, Malaysia.
- Jakobson, F., Hartstein, Franchisse, J. & Golingi, T. 2007. Sabah Shoreline Management Plan (Borneo, Malaysia): *Ecosystems and Pollution. Ocean and Coastal Management* **50**: 84-102.
- Images are courtesy of http://assets.wwf.org.my/ downloads/protected_areas_jpg.pdf; http:// www.unon.org, http:// www.ianskipworth.com, http:// www.flickr.com & Environmental Indicator Report (Sabah), 2002.

Source Sarva Mangala Praveena, Miroslav Radojevic, Mohd Harun Abdullah & Ahmad Zaharin Aris Email: smpraveen@gmail.com

Earthquakes

Earthquakes can be considered as the most destructive natural disaster ever known to man. Many areas in the world are seismically active and subjected to earthquakes. Throughout the history of mankind, hundreds of earthquakes are known to have occurred resulting in colossal amounts of damage to properties and infrastructure as well as losses of lives.

Sources of Earthquakes

Most earthquakes are a result of the sudden massive shifting in bedrock due to forces within the earth. These are known as tectonic earthquakes and the movements occur along faults. This shifting generates shock (also known as seismic) waves that move outward from the fault. Sometimes only a short section of the faults move, and these movements are small, thus generating a mild earthquake. Other times, a much longer section of the fault moves, sometimes hundred of kilometres, and shifts, perhaps several metres, creating powerful and destructive earthquakes.

Earthquakes in volcanic regions are caused both by tectonic faults and by the movement of magma in volcances. Such earthquakes can serve as an early warning of volcanic eruptions.

Tectonic (Naturally Occurring) Earthquakes

The Earth's rocky body or lithosphere is a patchwork of plates in slow but constant motion caused by the release of heat from the Earth's mantle and core to space. The heat causes the plates to move slowly but surely. Plate boundaries lock as the plates move past each other, creating

Table 1: Description of selected major earthquakes (adapted from Kramer [1] and other sources [2,3,4])

Date	Location	Magnitude and Intensity	Deaths	Remarks	
1906	California	M = 8.3, XI	700	The great San Francisco Earthquake; first great earthquake to strike a densely populated area in the United States. Most damage was caused by subsequent fires.	
1908	Italy	M = 7.5	60,000	Messina Earthquake, Sicily, Italy.	
1920	China		200,000	Gansu Earthquake, China.	
1923	Japan	M = 8.4	140,000	Great Kanto Earthquake. It devastated Tokyo, the port city of Yokohama, surrounding prefectures of Chiba, Kanagawa and Shizuoka; also caused widespread damage throughout the Kant region.	
1935	Pakistan	M = 7.7	30,000-60,000	D Balochistan Earthquake, Quetta, Pakistan.	
1948	Central Asia	M = 7.9	>110,000	Ashgabat Earthquake in Turkmenistan.	
1960	Chile	M = 8.3, XI	2,230	One of the largest earthquakes ever recorded.	
1960	Morocco	M = 5.7	15,000	Agadir Earthquake, Morocco. Another 12,000 people were wounded, and at least 35,000 were left homeless.	
1964	Alaska	M = 9.2	131	Good Friday Earthquake: largest recorded in North America. Caused severe damage due to liquefaction and generated tsunamis throughout the Pacific ocean.	
1964	Japan	M = 7.5	26	Widespread liquefaction caused damage, especially in Niigata	
1970	Peru	M = 7.9	>40,000	Ancash Earthquake. It caused a landslide that buried the town of Yungay, Peru.	
1971	California	M = 6.2, X	65	Sylmar Earthquake. Produced liquefaction in an earth dam and many structural failures. Prompted rehabilitation of many dams and revisions in building codes.	
1972	Nicaragua		>10,000	Managua Earthquake, Nicaragua.	
1976	China	M = 8.2	>255,000	Tangshan Earthquake, China. One of the most destructive earthquake in modern times.	
1985	Mexico	M = 8.1, IX	9,500	Great Mexican Earthquake. The epicenter was off the Pacific Coast, but greatest damage was in Mexico City, 360 km (220 miles) away due to its poor soil conditions.	
1988	Armenia	M = 7.2	>25,000	Spitak (aka Leninakan) Earthquake.	
1990	Iran	M = 7.7	>35,000	Iran Earthquake in Gilan Province, southwest of Caspian Sea.	
1995	Japan	M = 6.8, X	>6,400	Great Hansin Earthquake. Caused extensive (USD100 million) damage in Kobe.	
1999	Turkey	M = 7.4	>17,000	Izmit Earthquake in northwestern Turkey, killing over 17,000 people and leaving approximately half a million people homeless.	
2003	Iran		>40,000	Bam earthquake. Over 40,000 people were reported dead.	
2004	Indian Ocean	M = 9.3	>285,000	Also known as the great Sumatra-Andaman Earthquake. The undersea earthquake occurred at 00:58:53 UTC (07:58:53 local time) December 26, 2004, with an epicenter off the west coast of Sumatra, Indonesia. The earthquake triggered a series of devastating tsunamis along the coasts of most landmasses bordering the Indian Ocean, killing large numbers of people and inundating coastal communities across South and Southeast Asia, including parts of Indonesia, Sri Lanka, India, and Thailand.	
2005	Pakistan	M = 7.6	>76,000	Kashmir (aka Great Pakistan) Earthguake.	



strike-slip faulting

strike





Global plate tectonic movement (Source:Nasa)



A village in Sumatra lies in ruins after the December 26, 2004, Indian Ocean earthquake that generated a tsunami that struck South and South-east Asia

frictional stress. The surface of the Earth consists of 14 major plates and 38 minor ones, totaling 52 plates. When the frictional stress exceeds a critical value, called local strength, a sudden failure occurs.

The boundary of tectonic plates along which failure occurs is called the fault plane. In geology, fault or fault line is a planar rock fracture. When the failure at the fault plane results in a violent displacement of the Earth's crust, energy is released as a combination of radiated elastic strain seismic waves, frictional heating of the fault surface, and cracking of the rock, thus causing an earthquake. The shearing action along a fault begins at a point called the focus or the hypocentre, and then spreads over a certain area of the fault. The focus is typically 5 to 50 kilometres (3-30 miles) below the ground surface, but may be as deep as 600 kilometres (400 miles). The epicentre is the point on the ground surface immediately above the focus. However, faults are rarely vertical, so the epicenter is generally offset from the fault trace.

Epicentre



Focus and epicentre

Most of the world's earthquakes (90%, and 81% of the largest) take place in the 40,000-kilometrelong, horseshoe-shaped zone called the circum-Pacific seismic belt, also known as the Pacific Ring of Fire, which for the most part bounds the Pacific Plate [5,6]. Massive earthquakes tend to occur along other plate boundaries, too, such as along the Himalayan Mountains.



The Pacific Ring of Fire

Intensity and Magnitude

The intensity of an earthquake is an assessment of its effect at a particular location. Large earthquakes have greater intensity than small ones, and observers near the epicentre experience greater intensity than those further away. Several intensity scales have been used, the most popular one is the Modified Mercalli Intensity Scale, where the assessment of the variable effects of an earthquake is ranked in Roman numerals from I (not felt) to XII (total damage).

The magnitude of an earthquake is a measure of the amount of energy released, that creates

seismic waves. Earthquakes are recorded with a seismometer, also known as a seismograph. The magnitude of an earthquake is conventionally reported, with magnitude 3 or lower earthquakes being mostly imperceptible and magnitude 7 causing serious damage over large areas. It is a logarithmic parameter with an increase of one on a magnitude scale representing a thirty-fold increase in energy. Thus a magnitude 7 earthquake is 900 times more powerful than a magnitude 5.

Size and Frequency of Occurrence

Small earthquakes occur nearly constantly around the world in places like California and Alaska in the U.S., as well as in Chile, Peru, Indonesia, Iran, the Azores in Portugal, New Zealand, Greece and Japan [7]. Large earthquakes occur less frequently, the relationship being exponential; for example, roughly ten times as many earthquakes larger than magnitude 4 occur in a particular time period than earthquakes larger than magnitude 5.

The number of seismic stations has increased from about 350 in 1931 to many thousands today. As a result, many more earthquakes are reported than in the past because of the vast improvement in instrumentation (not because the number of earthquakes has increased). The United States Geological Survey (USGS) estimates that since 1900, there have been an average of 18 major earthquakes (magnitude 7.0 - 7.9) and one great earthquake (magnitude 8.0 or greater) per year, and that this average has been relatively stable [8]. In fact, in recent years, the number of major earthquakes per year has actually decreased, although this is likely a statistical fluctuation [9].

Effects/Impacts of Earthquakes

There are many effects of earthquakes including:

- Shaking and ground rupture
- Landslides and avalanches
- Fires
- Soil liquefaction
- Tsunamis
- Human impacts

Shaking and ground rupture are the main effects created by earthquakes, principally resulting in more or less severe damage to buildings or other rigid structures. The severity of the local effects depends on the complex combination of the earthquake magnitude, the distance from epicentre, and the local geological and geomorphological conditions, which may amplify or reduce wave propagation. Ground rupture is visible breaking and displacement of the earth's surface along the trace of the fault, which may be of the order of few metres in the case of major earthquakes. Ground rupture is a major risk for large engineering structures such as dams, bridges and nuclear power stations. Earthquakes can cause landslides and avalanches, which may cause damage in hilly and mountainous areas. Following an earthquake, fires can be generated by break of the electrical power or gas lines. In the event of water mains rupturing and a loss of pressure, it may also become difficult to stop the spread of a fire once it has started.

Soil liquefaction occurs when, because of the shaking, water-saturated granular material temporarily loses its strength and transforms from a solid to a liquid. Soil liquefaction may cause rigid structures such as buildings or bridges to tilt or sink into the liquefied deposits.



After being generated by an undersea earthquake, a tsunami may propagate unnoticed over vast reaches of open ocean before cresting in shallow water and inundating coastlines

When a large earthquake epicentre is located offshore, the seabed sometimes suffers sufficient displacement to cause a tsunami, for example, the 2004 Indian Ocean earthquake. A tsunami is basically a submarine earthquake that dislocate, the oceanic crust, pushing water upwards. Earthquakes may result in disease, lack of basic necessities, loss of life, higher insurance premiums, general property damage or destabilisation of the base of buildings which may lead to collapse in future earthquakes.

References

- 1. Kramer, S.L. (1996). Geotechnical earthquake engineering. Prentice Hall, Upper Saddle River, NJ.
- 2. http://en.wikipedia.org/
- 3. http://www.news.navy.mil/
- 4. http://www.britannica.com/
- 5. Historic earthquakes and earthquake statistics: Where do earthquakes occur? USGS. (http://earthquake.usgs.gov).
- Visual glossary ring of fire. USGS. (http://earthquake.usgs.gov/).
- 7. Earthquake hazards program. USGS. (http://earthquake.usgs.gov/).
- Common myths about earthquakes. USGS. (http://earthquake.usgs.gov).
- 9. Earthquake facts and statistics: Are earthquakes increasing?. USGS. (http://earthquake.usgs.gov).

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Activity Highlights Department of Environment, Malaysia

September 2007

Third Meeting of the Conference of the Parties (COP3-Haze) to the ASEAN Agreement on Transboundary Haze Pollution



The Third Meeting of the Conference of the Parties (COP3-Haze) to the ASEAN Agreement on Transboundary Haze Pollution was held in Bangkok, Thailand in the traditional spirit of ASEAN cooperation and cordiality from 3 - 7 September 2007. Hosted by the Ministry of Natural Resources and Environment, Thailand, the Meeting was attended by delegates from Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam and The ASEAN Secretariat.

Among the issues presented and discussed were the review

of fire and haze occurrences and forecast of meteorological conditions by ASEAN Specialised Meteorological Centre (ASMC), ASEAN Transboundary Haze Pollution Control Fund and the status of ratification by Indonesia and Philippines. The Meeting also noted the outcome of the stocktaking and review of relevant regional activities that support the implementation of the Haze Agreement where the following five priority areas had been identified by the Committee:

- 1. Implementation of the ASEAN Peatland Management Strategy (APMS);
- 2. Implementation of activities to further promote zero burning and controlled burning practices;
- 3. Conduct of table-top and simulation exercises to enhance joint emergency response;
- 4. Capacity building for law enforcement, and investigation and prosecution; and
- 5. Regular forums/dialogues with the international donor community and other stakeholders to promote the implementation of the Haze Agreement.

October 2007

Workshop on Enhancement of **Environmental Education and Awareness Programme**

The Workshop on Enhancement of Environmental Education and Awareness Programme was organised by Department of Environment (DOE) on 25 October 2007 at Parameswara



Hall, MINES Beach Resort and Spa, MINES Resort City, Seri Kembangan, Selangor. The workshop was officiated by Dato' Hajah Rosnani binti Ibarahim, Director General of Environment. The participants were divided into 4 sectors, that is, Schools and Institutions of Higher Learning, Industrial, Media and NGOs. Each sector was led by a facilitator and a rapportuer. A total of 60 participants from various agencies and institutions with expertise in their respective areas participated in the workshop. This collaborative effort is anticipated to emerge as a strategic plan to guide DOE in implementing environmental awareness programmes and activities for the future.



November 2007 National Wira Alam Camp for Secondary Schools at Kuala Gula Chalet, Perak

The Department of Environment (DOE), in collaboration with Malaysian Nature Society (MNS) and Ministry of Education Malaysia, organised the National Wira Alam Camp for Secondary Schools at Kuala Gula Chalet, Perak from 2-4 November 2007.

About 130 secondary students who are also members of the School Nature Club (Kelab Pencinta Alam) and 30 teachers from throughout Malaysia participated in the Camp. During the 3-day informative, fun-packed Camp, students went on nature trails, observed fireflies, went bird watching and indulged in other hands-on activities.

Thank You

The year 2007 is over all too soon and we would like to thank all our article contributors. We hope to enjoy similar support in the following years.

As we move to the next year, perhaps it is timely to pause and ask: 'What have we done for the environment?' If the answer is 'not much' perhaps we can make a resolution to do more in the coming years.

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Views and opinions expressed by the contributors do not necessarily reflect the official stand of DOE.

