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Forests: Nature at Your Service

World Environment Day 2011
Forests: Nature at Your Service

Forests cover one-third of the earth's land mass, and play important functions to make the Earth a habitable area particularly in the battle against climate change, and in the storing of carbon dioxide. Sadly, deforestation and degradation are responsible for the loss of nearly 14.6 million hectares of natural forests each year with devastating consequences on the environment, wildlife and the communities that depend on forests for their survival.

Year 2011 has been declared by the United Nations as the International Year of Forests, and World Environment Day (WED) is commemorating this celebration by taking the theme, *Forests: Nature at Your Service*. This year's theme highlights the need for both conservation and sustainable consumption of forests to reap the benefits that forests provide to humankind. Besides, it aims to help raise awareness on the serious impacts of deforestation and forest degradation.

The International Year of Forests 2011 (Forests 2011) logo is designed to convey the theme of "Forests for People" celebrating the central role of people in the sustainable management, conservation and sustainable development of our world's forests. The iconographic elements in the design depict some of the multiple values of forests and the need for a 360-degree perspective: forests provide shelter to people and habitat to biodiversity; are a source of food, medicine and clean water; and play a vital role in maintaining a stable global climate and environment. All of these elements taken together reinforce the message that forests are vital to the survival and well being of people everywhere, all 7 billion of us!

India: The Global Host

India took the honour as the global host of the WED 2011 on 5th June 2011 to show its strong commitment to work with the global community for sustainable development. Being the 2nd most populous country and one of the fastest growing economies in Asia, India is facing serious environmental challenges from many aspects of life such as population increase, uncontrolled urbanisation, industrialisation and massive intensification of agriculture. These developments, while leading to growth in terms of the economy, have led to many problems that need immediate attention such as pollution, loss of water resources, deforestation, forest degradation and wildlife trade. It is important for India to inspire its 1.2 billion citizens and people around the world to be proactive in taking care of the environment.

The Minister for Environment and Forests, India, Mr Jairam Ramesh, noted during the release of a major report on the assessment of the impact of climate change last year that India is one of the most vulnerable countries in the world to climate change and this makes it important for them to have sound evidence-based assessments on the impact of climate change and continuously focus on rigorous climate change science.

The celebration in India kicked off on 2nd June and a whole week of colourful events were organised across the country, lead by Mr Jairam Ramesh and UN Under-Secretary General and UNEP Executive Director, Mr Achim Steiner. Mr Steiner proudly declared that India's cities and communities have been among the most active in terms of organising and participating in a myriad of events during the WED celebration every year. WED 2011 celebrations will serve as the inauguration of a series of events leading to the hosting of the 11th Conference of Parties to the Convention on Biological Diversity.

Continued on page 3

Contents

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From the desk of the Director General

Forests: Nature at Your Service

All over the globe, every year on 5th June, people actively mark World Environment Day (WED). This year, the official host country for this global event was India. This issue of IMPAK kicks off with news and views from the WED host country, the world's second most populous nation on earth. It is always heartening to hear of new environmental initiatives being launched in countries which are both populous and fast developing – China, India, Brazil and Indonesia. Such initiatives motivate all of us who have green hearts because it helps us to believe again that the numbers are with us!

The good news from WED in India is that both cities and communities, working with NGOs, have taken environmental issues to heart. There is no let up in conservation efforts. The government has included a Clean Energy Fund in the National Budget. There is much discussion in the private sector on how best to build a 'green' economy. Many green events are initiated by civil society. India will be home to one of the largest green energy projects in the world beginning 2012. It is slated to generate 20,000 MW of solar energy from a single site. But perhaps the most important lesson of all is that the government can and must assist in providing a viable framework for a green economy but ultimately it is the involvement of people from all walks of life that will save the day for the environment!

Closer home, this issue of IMPAK takes a good hard look at our forests. This is timely given that 2011 is the UN designated "Year of the Forest" with the theme - 'Forests: Nature At Your Service'. Indeed, forests have provided peerless service to mankind from time immemorial! But sadly we are not always willing to pay the fair price for this sterling service which is best paid for by simply leaving these forests to nature's care and untouched for future generations. Attention has also been drawn to mangrove forests. Mangrove forests, found only in inter-tidal zones, literally watch over the ebb and flow of life on Earth! They are an extraordinary gift of nature. Over millions of years, plant and animal life has adapted to this complex habitat where salinity changes by the hour. They are also nurseries for numerous fish species and other valuable marine life such as crustaceans. All told, it is estimated that there are 15.2 million hectares of mangroves in the world. They are also alternatively called coastal woodlands or tidal forests. Of this area, some one-third is in Asia. The Sunderbans in India/Bangladesh is the world's largest deltaic mangrove forest. Sadly only a small percentage of Malaysia's mangroves fall within the legally gazetted 'Totally Protected Areas'. Some 0.3% of mangroves in Peninsular Malaysia, 0.2% in Sarawak and 1.3% in Sabah fall within these totally protected areas. The UN recommendation is that at least 10% must be protected to ensure sustainable tropical biodiversity. Clearly, more needs to be done to ensure we do not lose this precious resource forever.

Moving inland and away from mangrove forests, the rain forests of the plains and uplands of Malaysia are also under severe stress. Every move we make to ensure our lives are easy and comfortable seems to be at the expense of the forests around us - from expanding agriculture to new homes and new townships. Malaysia has some of the best rules and regulations on forest management and conservation and it is beginning to show results. Very recently, Sabah was certified as having the biggest and best managed forests in the country. The Forest Stewardship Council certified the Ulu Segama-Malua Forest Reserves (241,098 hectares) and the Tangkulap-Pinangah Forest Reserves (50,070 hectares) as well managed forests under the Scientific Certification System (SCS).

Forest degradation and deforestation are highlighted in the REDD and REDD+ directives which are applicable to us following COP-16 at Cancun. It is essential to take note that both LULUCF and REDD programmes not only contain deforestation and degradation rules, but also strongly prohibit any attempts to convert current forests into other uses such as exotic plantations. This provision remains contentious among developing countries and reformulation is anticipated to allow, besides retention of existing forests, carbon credits to be given to pro-active logging regimes that emphasise *sustainable forest management*. However, the problem is: there is no real agreement on the definition of *sustainable forest management*.

Many of us may not be aware that every cup of water we drink is a gift of the forests around us. It is estimated that we receive 990 billion m^3 of rainfall. Of this huge volume, only some two-thirds become surface runoff water or ground water that feeds our rivers. The rest evaporates into thin air. And rivers are our primary source of raw water. The rate at which rainwater runs off the surface is largely a function of our forests. The forests are a natural sponge. Less sponge, less water storage and more water runs off. But we need water all year around! The catchment areas of all our rivers need to be closely guarded and monitored.

Lastly human beings have to remember that forests are also home to fauna and flora. Animals have also to survive and breed while the plant biodiversity resource needs to be protected in its natural habitat. Taken together, the message in these articles is clear: "We too should be at nature's service".

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From page 1

India's Initiatives

In commemoration of the World Environment Day, the Indian government has initiated several action plans towards environmental protection. One of its major projects is the launch of an afforestation programme under which any diversion of public forests for non-forestry purposes is compensated through afforestation in degraded or non-forested land. The funds received as compensation are used to improve forest management and protection of forests and of watershed areas. Moreover, a government authority has been created specifically to administer this programme. To complement this programme, a tree-planting system has been instituted to combat land-degradation and desertification, including windbreaks and shelter belts to protect agricultural land.

India's Ministry of Environment and Forests is supportive of this conservation and sustainable use of forests for the protection of the endangered species such as the Golden Langur monkey and Royal Bengal tiger, and to date has 39 protected areas for tigers and earmarked another 5 for the near future.

In conserving its critical ecosystem, India has successfully introduced projects that track the health of the nation's plants, animals, water and other natural resources, including the Sunderbans - the largest deltaic mangrove forest in the world, and home to one of India's tiger breeds.

A Clean Energy Fund has been provided for in the national budget. This Fund provides subsidies for green technology and has been the basis for a National Action Plan on Climate Change which sets specific targets on issues such as energy efficiency and sustaining the Himalayan eco-system. India will also be home to one of the largest green energy projects in the world that will generate 20,000 MW of solar energy and 3,000 MW from wind farms on 50,000 acres in Karnataka in southwest India. The first phase of the USD50 billion project will start in 2012.

Events to Mark World Environment Day 2011

Government Officiated Events

On 3rd June, Minister Jairam Ramesh and Achim Steiner opened a green bazaar of non-timber forest products at the famous Dilli Haat, a traditional crafts market in the heart of New Delhi. The Haat also hosted a Knowledge Park, where students and eco-clubs from across the country show-cased conservation projects and educational materials. The Haat also witnessed the launch of a dedicated World Environment Day song by a famous artist, Shubha Mudgal, titled *The Colour of Life*.

Earlier in the day, the Confederation of Indian Industries (CII) hosted a special session on *Building a Green Economy*. Speaking at the session, Minister Jairam Ramesh said, "We have a great responsibility towards our growing population, we need to add 8-10 million jobs every year and ensure that the jobs are green. We also have to ensure environmental conservation as livelihoods need to be preserved and enhanced." He defined the Green Economy as one that protects and enhances natural capital while meeting the economic imperatives of the country. Ramesh called upon industrialists to take up the leadership in India's transition towards a green economy.

Addressing business leaders, Achim Steiner, said that the Green Economy is not an alternative economy but is very much a thing of the present. While underlining the significance of the corporate sector in the green economy, he stated that industry is part of the solution as much of the problem and the power to shift from a conventional model to a green economy actually lies with the corporate sector.

In New Delhi, Minister Jairam Ramesh administered a pledge for "saving our environment" and waved a flag to start a Green Walkathon from India Gate, with about 1,000 participants from all walks of life. In the southern city of Bangalore, Steiner flagged off a 10 km green marathon with thousands of participants taking part.

Civil Society Green Events

Over 100 women leaders showed their support by organising a one-day conference in New Delhi on *Nature & Livelihoods: Women's Perspective*. Women from indigenous groups, civil society and the grass roots shared experiences and success stories. UNEP's Achim Steiner and UN Resident Co-ordinator for India praised the initiatives of women leaders and emphasised the crucial role they play in forest conservation.

On 2nd June, over 100 journalists, from Nepal, Bhutan, Bangladesh, Sri Lanka, the Maldives and India, participated in a day-long workshop on *Journalism & the Environment*. The workshop focused on the role of forests in combating climate change, conserving biodiversity and catalysing transformation to a green economy.

Green Strides of Businesses

The Times Group in association with Conmat and ONGC have organised *Plant-a-Thon* 2011 to celebrate the World Environment Day on 5th June. *Plant-a-Thon* is an annual green drive to spread eco-awareness and increase the green footprint in the city. ICICI, India's biggest private bank led a *Pledge for the Planet* campaign that saw 8,362 bank employees make simple yet impactful environmental commitments such as switching to low-energy bulbs and using the stairs at work. Meanwhile Infosys, India's second largest IT firm spearheaded two major activities for employees' children. The *Petit-Infoscions* took part in a Walkathon to bring attention to the conservation of the rapidly disappearing Bellandur Lake, before planting 20,000 native trees in Ramnagaram Forest in Bangalore. Coca-Cola India also announced the launch of *eKO cool solar* coolers designed to be climate friendly while generating more income for rural retailers, who have limited/ intermittent access to electricity.

Conclusion

Needless to say, WED celebrations were not limited to the host country. Thousands of individuals and organisations in several countries marked the day with just as much fervour and passion as their Indian counterparts All in all, WED will show how individual actions can have an exponential impact on our environment. The WED anticipated outcome: a cleaner, greener and brighter outlook for ourselves and future generations.

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The Diminishing Tropical Rain Forests: Causes, Symptoms and Remedial Action

Introduction

Forests are nature's versatile renewable resource providing simultaneously a wide range of economic, environmental, social and cultural benefits and services. The demand for its numerous products and functions is increasing but at the same time the areas under forests continue to decrease while its quality is deteriorating.

Tropical rain forests account for about 40% or 1.7 billion hectares of the earth's total forest of 4.1 billion hectares. The natural rain forests are among the richest ecosystems in the world in terms of biological diversity. Often, forests are termed the heart and lungs of the world. The rainforests of South-east Asia are believed to be the oldest and among the most biologically diversed in the world. Our forests are home to some 15,500 species of higher plants, 746 birds, 300 mammals, 379 reptiles, 198 amphibians, and 368 species of fish.

Tropical forests have been addressed as a priority item on numerous national and international agendas on environmental, political, policy, socio-economic and scientific issues, culminating at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992 with the adoption of the Statement on the Forest Principles which is the first global consensus on forest policy. Since the Earth Summit, there have been several initiatives worldwide on forests.

The Problem

The widespread concern about tropical forests always centres on two issues (i) deforestation and (ii) forests degradation. Both have potentially disastrous environmental, economic, social and cultural effects.

The causes of deforestation and forest degradation can be classified as natural or man-made. Natural causes, particularly climate, are beyond our control and cause relatively insignificant negative consequences as compared to man-made causes. The human factor has been recognised as the main catalyst of deforestation and forest degradation. Commercial agriculture and other non-forestry land use, mining, shifting cultivation and other forms of encroachment are mainly responsible for deforestation.

Extent of the Problem

Global Scenario

An average of 8.9 million hectares of forest disappeared every year from 1990 to 2000 (FAO, 2007). This represents 0.22% of the total forest per year. The loss was highest in Africa at 4.4 million hectares per year followed by Latin America and the Caribbean at 4.2 million hectares per year.

In addition to deforestation, harvesting has increased in all tropical regions. Primary forests are lost or modified at a rate of 6 million hectares per year. Reforestation has not kept pace with deforestation; just merely 31% has been replanted.

Forests in Malaysia

The total land area under natural forests in Malaysia is estimated at 20.1 million hectares with 5.8 million hectares in Peninsular Malaysia, 4.3 million hectares in Sabah and 10 million hectares in Sarawak. The natural forest resources of Peninsular Malaysia are classified into three main forest types, namely the Dry Inland Forest, Peat Swamp Forest and Mangrove Forests. Of this, a total of 15.5 million hectares have been gazetted as Permanent Forest Reserves (PFR); Peninsular Malaysia has 4.9 million hectares, Sabah 3.6 million hectares and Sarawak, 7 million hectares. These PFRs are managed under sustainable forest management principles for economic, social and environmental benefits (Table 1).

Deforestation

Taking the situation of Peninsular Malaysia, forests declined from 73% of land area in 1966 to 49% in 1981-82. Between 1990 and 2000, a total of 78,500 hectares of Malaysian forests gave way to development and logging (FAO, 2007).

Deforestation in Peninsular Malaysia is mainly due to expansion of commodity plantations (rubber and oil palm). In Sarawak, shifting cultivation has been blamed for much of deforestation. The forested area damaged by this practice increased from 2.3 million hectares in 1960 to 3.3 million hectares in 1985 (Dimin, 1988). The most recent case of deforestation is the Bakun hydroelectric project which involves the inundation of 69,640 hectares of forests for the reservoir.

Deforestation in Sabah has also been blamed on shifting cultivation which involved about 1.07 million hectares (Shim, 1993). Encroachment into the Permanent Forest Reserve (PFR) for agriculture and settlement is quite widespread throughout the country particularly in states with a high rate of poverty. In Kelantan, for example, about 48,000 hectares of forests under PFR have been encroached, constituting 5.4% of the state's total forested area (Kelantan State Forestry Department, 1993). Shifting cultivation by the natives is actually a minor problem. The main cause for deforestation is agricultural expansion and excessive forest harvesting.

Table 1: Permanent Forest Reserves area by forest types (Peninsular Malaysia-2009)

State	Inland Forest (a)	Peat Swamp Forest (b)	Mangrove Forest (c)	Forest Plantation (d)	Total Area (e)=(a+b+c+d)
Johor	357,396	5,429	30,244	43,859	436,928
Kedah	333,462	-	6,201	2,950	342,613
Kelantan	609,030	-	-	14,819	623,849
Melaka	4,953	-	92	35	5,080
Negeri Sembilan	154,739	-	-	2,319	157,058
Pahang	1,395,613	140,830	2,416	24,043	1,562,902
Perak	946,080	-	40,538	4,818	991,436
Perlis	10,150	-	-	658	10,808
Pulau Pinang	5,058	-	1,040	-	6,098
Selangor	130,640	81,458	18,089	11,381	241,568
Terengganu	525,206	13,757	1,295	3, 860	544,118
Wilayah Persekutuan	63	-	-	-	63
TOTAL	**4,472,390**	**241,474**	**99,915**	**108,742**	**4,922,521**

Forest Harvesting

The remaining forest resources in the country are under great pressure from commercial logging. Forest harvesting in the country takes place in the PFR which is managed under sustained yield principles and also from outside the PFR, the state land forests.

In Sabah, the total forest reserve and state land forest harvested to date are 1.79 million hectares and 888,600 hectares, respectively. The annual average rate between 1984 and 1987 has been given as 176,466 hectares. The total area under harvesting license in Sarawak as of 1986 is 6.5 million hectares.

For Peninsular Malaysia, a total of 25,522 hectares of PFRs that were managed based on sustainable forest management practices were harvested in 2009. This represents 69.1% of the total Annual Allowable Cut approved amounting to 36,940 hectares. In addition, an area of 27,760 hectares of Stateland Forest and 17,112 hectares of Alienated Land were also harvested.

For Peninsular Malaysia and Sabah alone, the total state land deforested during the same period would then be 1,287,030 hectares. Based on reports from the Forestry Department, the current data for licensed logging in Peninsular Malaysia indicates that merely 48% from the total of 86,883 hectares of forest harvested in 2009 was done sustainably in the Permanent Reserved Forests whereas the rest was harvested outside the PFR.

Impacts/Symptoms

The impacts of deforestation and forest harvesting/exploitation are similar but different in severity and magnitude. These shall be discussed under several headings.

Biodiversity

Since the tropical forests are home to more than two-thirds of world species, annual forest loss in the tropics may doom 13% of the world species to extinction by the year 2015, which would mean 8,000 to 28,000 species per year (Reid, 1992). Based on other estimates, the loss of biodiversity is estimated to be as many as 100 species daily.

Malaysia is the third country having the highest number of threatened (based on IUCN Red List) species in the world after Ecuador and The United States (FAO, 2005). Loss of biodiversity also means loss of potential economic sources and possible cures for various ailments. The U.S. National Cancer Institute has identified 3,000 plants that are active against cancer cells with 70% of these plants being found in the rainforests (Taylor, 2004).

According to the Department of Forestry of Peninsular Malaysia, in year 2000, revenue earned from medicinal herbal products in the local market was estimated around RM4.6 billion whereas revenue from timber products and other forest related products amounted to more than RM20 billion, contributing 5% to gross domestic product (GDP). Ecotourism also generates almost RM1 billion out of the RM24 billion annually from the tourism sector in Malaysia. In addition, biodiversity provides us a large gene pool to ensure our food security.

Climate Change Effects

According to a report, 18% of global warming is due to clearing of tropical rain forests (Sizer, 1994). Deforestation has also been blamed for 40% of carbon emission. The increase in carbon dioxide in the atmosphere may have serious consequences on global climate which in turn may affect tree growth and functions of the forests.

Climate change not only affects forest health but could also affect our livelihood. Forests are home to 300 million people around the world. More than 1.6 billion people depend, to a varying degree, on forests for their livelihoods, e.g. fuel, medicinal plants and foods. About 60 million indigenous people are almost wholly dependent on forests (World Bank, 2004). The world's population, both in the urban and rural areas, in the future will become more dependent on agriculture for food.

Source: Moving Ahead with REDD.

Land Degradation

Another negative impact of deforestation is degradation of soil. To describe the seriousness of this problem, we have to look into our future requirement for food. Six billion of the Earth's population relies on food grown on just 11% of the global land surface. By 2030, more than 8 billion people need to be fed and FAO estimates farmers will have to grow almost 30% more grain than they do now (Mann, 2008).

There is still some debate on what land degradation actually constitutes and its exact meaning is seldom defined. This is because of the complexity of the causes and the process of restoration. In general, land degradation can be defined as the loss of productive capacity of the land to sustain life. If we relate this to forest land, it can be further redefined to comprise two components, i.e. soil degradation, which is a reduction in soil fertility and loss or impoverishment of vegetative cover which includes all standing biomass.

Accordingly, any land in which biodiversity declines or biological productivity decreases can be considered to be degraded. How is land degradation related to deforestation and forest harvesting? The three issues are closely inter-related. First, forest degradation, a consequence of forest harvesting, is characterised by a gradual reduction of the biomass, productive capacity and biodiversity of the forests. Continued degradation will ultimately result in deforestation. Harvesting, for instance, may cause forest degradation, but not necessarily deforestation but both harvesting and deforestation will result in land degradation.

Extent of Degraded Land

Sanchez *et al.* (1994) state that as much as 250 million hectares or 40% of the 600 million hectares are degraded land worlwide. These figures do not take into account areas that are now under active logging. On the local scene, Ahmad Zainal(1992) reported a total of 4.6 million hectares of degraded secondary forests in mid-1980s. Assuming that a third of every hectare harvested would be degraded land (Kamaruzaman, 1992; Sanchez *et al.*, 1994), we would then have a total of 1.5 million hectares of degraded forest land, not including areas currently under active logging, ex-tin mining land and the shifting cultivation areas in Sarawak and Sabah.

Source: Moving Ahead with REDD.

Remedial Action

Forest land degradation is a symptom, not a cause. It is an indicator of problems rather than a problem in itself. If we wish to continue enjoying the economic, environmental, social and cultural benefits of the forests, we have to cure the symptom which in this context is land degradation.

Restoration and rehabilitation efforts include silvicultural treatments to simulate development of valuable timber producing capacity of forest land. For example, the Selective Management System (SMS) in pratice for the hill dipterocarp forest since 1978 in Peninsular Malaysia can be considered as a rehabilitative measure to reduce the problem of land degradation. The system advocates a choice between different management options, based on a pre-harvesting inventory of stocking levels to determine trunk diameter limits and species selection for harvesting.

In cases of severe degradation such as total loss of forest cover as a result of shifting cultivation, reclamation measures, for example, have been advocated. The establishment of forest plantations can be considered as a reclamation approach even though the main objective of establishing it is to meet the future demands of timber. As of December 1994, a total of 54,189 hectares had been planted with fast-growing timber species, mainly *Acacia mangium* (Forest Department Peninsular Malaysia, 1995).

Reclamation of degraded forest land in Sabah started in 1976 by the Sabah Forestry Development Authority (SAFODA). As of 1991, the agency had planted about 25,799 hectares and another 49,000 hectares were planted with trees by other forestry agencies (Udarbe, 1994). In 1997, the Deramakot Forest Reserve (55,139 hectares) and in 2007, the Sabah Softwoods Sdn Bhd forest plantation area (27,313 hectares) were certified as sustainably managed forests by the Forest Stewardship Council (FSC) under the Scientific Certification System (SCS).

Then in 2011, Sabah was certified as having the biggest and best managed forests in the country when the FSC certified the Ulu Segama-Malua Forest Reserves (241,098 hectares) and the Tangkulap-Pinangah Forest Reserves (50,070 hectares) as well managed forests under the SCS. The Sabah Forestry department is working towards getting SC certification for five other forest reserves over the next two years. In Sarawak, only 6,613 hectares out of 3.3 million hectares of degraded land have been rehabilitated between 1979 and 1991.

Challenges, Constraints and Recommendations

The main challenge in the context of land degradation is to intensify the present efforts of reforestation. We are still very far away from restoring all the degraded forest land in the country to productive forestry. More financial and manpower resources need to be injected into the rehabilitation and restoration programmes.

Issues related to policy should also be addressed. While the forest policy is clearly defined, its implementation faces several obstacles because of constitutional separation of functions between the Federal and State Governments. Another policy issue of significance is related to the award of timber concessions where a substantial number was found to have been awarded to people with no knowledge of sound forest management principles. As a result, there is no commitment to long-term investment and care for the environment.

Perhaps the concept of privatisation which has been proven highly successful in other sectors and has been addressed in a number of forestry meetings should be implemented. The financial and manpower constraints facing the Forestry Department and other related agencies could be relieved if some of the activities including forest rehabilitation are privatised.

Another major constraint as far as forest restoration is concerned is the dispersed location of scientific knowledge on the subject. There is sufficient technical knowledge within the country to provide the technical backing for successful rehabilitation but the expertise is dispersed in various research or academic institutions and seems to be uncoordinated. Research and coordination need to be intensified.

Foresters alone cannot be effective and forestry can no longer be treated in a strictly sectoral fashion, in isolation from the rest of natural resource development. We require innovation and leadership to address the problem facing our forests and to ensure that our forests will continue to yield benefits well into the future.

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Importance and Benefits of MANGROVE FORESTS

Introduction

Mangroves are referred to as *bakau* or *hutan paya laut* in Bahasa Malaysia. They have been variously described as 'coastal woodland', 'tidal forest', and 'mangrove forest'. The species which are known as mangroves are derived from a variety of plant families which vary in dependence upon littoral habitats. Where conditions are suitable, the mangroves may form very extensive and productive forests. Mangrove trees and shrubs are a common sight on mudflats and banks of tropical and subtropical coastlines in many parts of the world. They stand with their roots in saltwater. As such, they are a special form of vegetation existing at the boundary of two environments and receiving food from the land and the sea. A mangrove forest often possesses a strange and convoluted beauty and it flourishes in conditions of heat, salinity and oxygen-starved mud that would overwhelm other terrestrial plants. To cope with this hostile environment mangroves have undergone selective changes. With passing time, they have adapted and emerged as the most successful coloniser of tropical coastal wetlands.

The extent of mangrove vegetation depends on the morphology and exposure of the coastline. On exposed coasts, mangroves may be entirely absent or restricted to a few trees sheltered behind rocks, while on protected coasts with large intertidal mudflats, they may extend more than 25 km inland. About one-third of the world's mangroves are found in Asia (39%), followed by Africa (21%) and North and Central America (15%) (FAO, 2007). It is estimated that a total of 15.2 million hectares of mangroves exist worldwide and their main distribution is in the tropical areas.

In Asia and the Pacific alone, mangroves are estimated at 6-8 million hectares. Malaysia is one of top ten countries with the largest extent of mangroves in the world (FAO, 2007; Table 1).

Mangroves are found on all coasts of Malaysia, with the largest area (75%) on the coast of Sabah, concentrated particularly in the northeast. Sarawak also has considerable areas (26%), mostly concentrated in the deltas of the Sarawak, Rajang and Trusan-Lawas rivers. Despite having the longest coastline, Peninsular Malaysia has only 17% of the country's mangrove, most of which are concentrated on the more sheltered west coast. Large areas of mangroves are concentrated in the west coast of Peninsular Malaysia especially in Perak, Selangor, Johor and Kedah. (Figure 1)

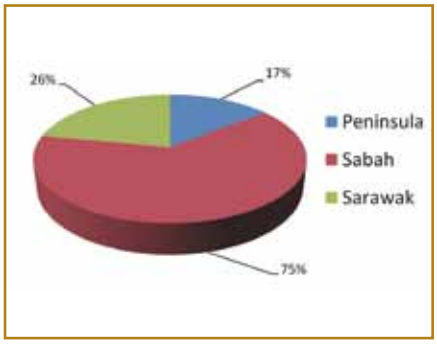

Figure 1: Extent of mangrove forests in Malaysia.

The Mangrove Ecosystem

The mangrove ecosystem plays an important role in fishery production, coastal stabilisation, and in the maintenance of critical habitats for many common, threatened and endangered species. The importance and benefits of mangrove forests will be discussed under several headings.

Ecological

Ecologically, mangroves have many direct and indirect roles in maintaining a high quality of life for man. Located in the inter-tidal areas, they are flushed daily by the flood and ebb tides. The flooding tides not only bring sediment but also flush out organic carbon, organic matters and nutrients to the near shore waters when ebbing. Exported by ebb tides, these organic matters and carbon become a source of food for the near shore fisheries, while the nutrients are utilised by plankton to increase the productivity of the near shore waters. This is a very complex ecosystem, a food chain relationship and an energy transfer process, which plays an important role in the ecological balance of nature (Box 1 (Next page); Figure 2). Many mangrove areas form parts of international flyways for migratory birds (Picture 1).

Picture 1: Mangrove forests play an important role as wildlife habitat.

Table 1: Countries with large areas of mangroves.

Country	Mangrove Area km²	As % of Total Land Area	As % of Total Forest Area 1995	Population Density/ km² 1995	GDP per capita USD 1995
Indonesia	42,500	2.23	3.88	109.1	1,003
Brazil	13,400	0.16	0.24	19.1	4,327
Australia	11,500	0.15	2.81	2.4	19,522
Nigeria	10,515	1.14	7.63	122.7	362
Cuba	7,848	7.07	42.60	100.5	id
India	6,700	0.20	1.03	314.7	349
Malaysia	6,424	1.95	4.15	61.3	4,236
Bangladesh	5,767	4.00	57.10	925.2	246
Papua New Guinea	5,399	1.17	1.46	9.5	1,139
Mexico	5,315	0.27	0.96	49.1	2,743

Note: The mangroves in these countries represent 64% of the world's mangroves *Source*: ISME, WRI

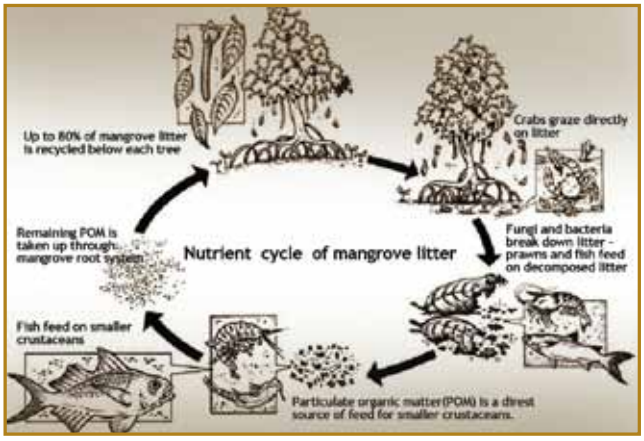

Figure 2: Nutrient cycle in the mangrove forests.

Box 1: Nutrient Cycling and Food Chain in the Mangrove Forest

The detached parts of the mangrove plants that fall on the floor are called 'litter-fall'. These include leaves, stems, roots, flowers and fruits. Microorganisms found in the soil decompose the fallen parts. During this process, nutrients are released which enrich the surrounding waters. The decomposed organic matter along with microbial biomass is known as detritus. It is rich in protein and serves as a nutritious food for a variety of organisms including fish that feed on detritus. Detritus-feeding fishes are preyed upon by larger carnivorous forms. The influx of nutrients generated by the mangroves supports other sensitive habitats like the coral reefs, seaweeds and seagrass beds. Detritus largely consists of both living and inert materials in suspension, which continuously settle to the bottom. Thus mangroves serve as a very important source for maintaining the carbon budget, sustaining the microbial food chain and recycling of nutrients in the estuarine complex (Wafar *et al.*, 1997).

Physical and Geomorphological

Mangroves also play important physical and geomorphological roles in that they act as a windbreaker that absorbs the full brunt of strong winds first, thus reducing the impact of occasional storms and monsoonal winds to the residential, agricultural and industrial areas of the surrounding areas. Besides, the roots and pneumatophores of the mangrove vegetation can also become wave breakers by absorbing and reducing the energy of waves generated by storms, boat wakes, and strong water currents of the monsoon, thus minimising erosion of coastal areas and riverbanks. Moreover, mangroves also help in the process of flow and velocity reduction causing the suspended sediments carried by the tidal waters to be deposited on the mangrove surface, thus causing mangroves to accrete sediment and grow both vertically and horizontally. This phenomenon is a safe and natural process of land reclamation and shoreline protection.

A study done on mangrove vegetation in Kemaman, Terengganu revealed that mangroves can accrete vertically at a rate 0.6 to 1.6 cm per year. It has been reported that some mangroves in the West Coast of Peninsular Malaysia can grow horizontally and reclaim land from the sea, up to a rate of 40 cm per year. The ability to trap sediments makes mangroves the most unique ecosystem that can naturally reclaim land from the sea. Lately, many studies and measures are being taken to counter and mitigate the impact of global sea level rise, reported to be in the region of 1 to 2 mm per year. Mangrove vegetation, it seems, is the only tropical coastal ecosystem that is able to counter and mitigate such a rise as it has the ability to trap sediments at a rate exceeding that of the sea level rise.

Mangroves are known to remove CO_2 from the atmosphere through photosynthesis. This perhaps reduces the problems that go with the greenhouse gases and global warming. They fix greater amounts of CO_2 per unit area, than what phytoplankton does in the tropical oceans (Kathiresan & Bingham, 2001). The mangroves are capable of accumulating and storing carbon in the soil in large quantities (Box 2).

Box 2: Mangrove Forests as Carbon Sink

The ability of a *Rhizophora* forest to divert carbon below ground is remarkably high. A 20-year old plantation of mangroves stores 11.6 kg/m^2 of carbon with a burial rate of 580 g/m^2/yr (Fujimoto, 2000) and hence, a plantation of mangroves provides great benefits to control global climate change by stabilising atmospheric carbon. Mangroves also respond well to high CO_2. For example, *Rhizophora mangle* under high CO_2 conditions, which was double than normal for one year, showed greater accumulation of biomass (Farnsworth *et al.*, 1996). Because the mangroves fix and store significant amounts of carbon, their loss may have an impact on the global carbon budget.

Picture 2: Charcoal production at Larut Matang mangrove forest.

Economic

Mangrove areas provide numerous products of commercial value and generate economic opportunities in many countries. Millions of people use products of mangroves and the mangrove environment for subsistence and survival. Economically, mangroves are important for prime feeding grounds, breeding zones, hatcheries and nurseries for many species of prawn, crab and fish demanded commercially. Indeed, mangroves are recognised as the second most productive ecosystem in the world and furthermore some studies have reported that 20% to 30% of the consumed seafood (of some prawns and fishes) is derived from mangroves.

Traditionally, mangroves have been harvested for fuel, charcoal, timber and poles (Picture 2). Secondary products include medicine, fruits, tannin and wood for household products. Nipah palms have provided a source of thatching and sugar and have led to a cottage industry of small items such as fishing rods and matting. Besides, mangrove areas are also rich in timber resources which can be sustainably felled. They also harbour a wide variety of plant and animal life, some of which are rare and unique, and capable of attracting visitors and tourists and generating an income base.

As in other countries, offshore fisheries are very important and have been closely linked to the mangroves for a number of fish and prawn species. Aquaculture practices include cockle culture, the widespread use of floating cages of fish, and the development of ponds, mostly for prawn culture (Box 3).

Box 3: Dependence of Fisheries Industry on Mangrove Forests

Mangrove forests serve as links between terrestrial and marine ecosystems. There is generally an import of inorganic nutrients from the land to the mangroves and an export of organic matter from the mangroves to the sea. The primary producers of the mangrove ecosystems are, of course, the trees. A study in Thailand roughly estimated that the primary production of the trees per unit area was about seven times that of the coastal phytoplankton. Only a minor part of this large primary production is consumed directly by the animals; however, the majority enters the marine food web as dead organic matter, detritus - either to be consumed within the mangrove or to be exported in a more or less degraded form.

Many species of commercially important marine organisms seem to depend on

mangroves for at least part of their life cycle and mangroves are also feeding grounds for coastal fish.

Mud crabs, *Scylla serrata*, are highly priced and form the basis of a valuable small-scale fishery throughout the Indo-Pacific region. Oysters are hacked loose from mangrove roots while blood clams, *Anadara*, and other cockles are extensively collected from mud-flats in front of mangrove areas. Snails, which are found everywhere, are collected and usually boiled before eating. Many species of penaeid shrimp spawn offshore but use mangroves as refuge and feeding grounds during the later stages. Observers found that in the Indian Ocean area, the *Penaeus indicus, P. merguiensis* and *P. monodon* shrimp depend on mangrove forests for shelter during their juvenile stages (MacNae, 1974). Mysids and smaller species such as *Acetes* are extensively caught in mangroves. They are sold fresh, dried or made into shrimp paste.

The Matang forest on the west coast of Peninsular Malaysia has been sustainably managed since the start of this century and is one of the very few examples of successful sustained management of a tropical forest ecosystem in the world. In addition to a timber industry employing some 2,400 people, with a revenue of USD6 million per year, there is an associated fishing industry in the area which employs about 10,000 people with annual revenue of USD12-30 million (Picture 3). On the other hand, the mangrove forests of Terengganu are not as extensive as those found in the West Coast of Peninsular Malaysia and hence are limited in resource yield, rendering them uneconomical for exploitation on a commercial scale. As such, the economic activities practised are often conducted on a part-time basis depending on seasons which include fishing activity and forestry.

Picture 3: Aquaculture activities at the Larut Matang mangrove forest.

Threats to Mangrove Forests Ecosystems

Throughout the world, firewood and domestic fuel are decreasing in supply, while at the same time the demand is rapidly rising. To offset the deficit, mangrove forests are used directly by local people for firewood such as in India and much of Africa or the wood turned into charcoal for domestic and small industrial use. In some cases, large scale exploitation has resulted in a complete loss of certain areas mainly due to unsuccessful natural regeneration and the great demand for conversion to other forms of land use. Over a long term, massive deforestation will result in a gradual decrease in area and decline in timber productivity. These changes will affect the mangrove's function as a breeding and feeding area for prawns, oysters, crabs, etc. The fishing carried out within forest areas may provide an even greater source of employment than the forestry operations, as has been shown in the case of the Matang mangroves in Malaysia.

Coastal swamp forests in saline, anaerobic environments have traditionally been considered to be marginal or totally unsuitable for agricultural or aquaculture production. However, with improvements in science and technology, the mangrove environment is being viewed as a major alternative for the global increase in agricultural production and aquaculture. In many areas around the world, for example, in Asia and Africa, the pressure on arable land has led to efforts to convert mangrove lands into agricultural land. This usually involves the digging of a narrow canal and piling up the diggings to form bunds on one or both banks of the canal. The bunds prevent seawater intrusion and gates in the bunds allow excess water to be drained at low tides. Such reclamation can lead to extensive loss of mangrove areas and their high productivity and to adverse effects on the fisheries of surrounding coastal areas. In addition, the canals also cause a change in the freshwater regimes of the unclaimed seaward mangroves and can have deleterious effects on the system.

The destruction of the mangrove forest and the conversion of mangrove lands to domestic and industrial development is a major problem in high-income countries and are beginning to become a problem of consequences in developing countries. The most common forms of conversion are to housing and residential development, coastal tourist facilities and industry, including small port development.

Mangrove Forest Conservation in Malaysia

In Malaysia, most of the mangrove forests are designated as Permanent Forest Reserves (PFR), and as such come under the management of the respective State Forest Departments. Mangrove forests outside of the PFRs are considered as Stateland Forests and can be converted for development purposes. Mangrove losses have been considerable in many parts of Malaysia, e.g. the mangrove forest reserves decreased by 12% between 1980 and 1990, mostly through loss of mangrove forest to agriculture, urban development, shrimp ponds and deforestation. We need to protect the mangrove forests from unsustainable practices of forest exploitation, aquaculture and agriculture activities and indiscriminate coastal development, which can lead to ecosystem disruption and economic loss. In order to overcome the issues, raised awareness and sustainable development of the mangrove forests and its rehabilitation are vital to ensure that the future of our mangrove ecosystem is protected.

Up to now, only a very small percentage of Malaysian mangroves fall within legally gazetted Totally Protected Areas: 0.3% in Peninsular Malaysia, 0.2% in Sarawak, and 1.3% in Sabah. The figure is still far below the 10% recommended in the United Nations List of National Parks and Protected Areas for protection of tropical biodiversity.

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The REDD Directives and LULUCF: Implementation Challenges

Introduction

It is accepted that the objectives of Cancun Agreement (covered in Issue 1 of IMPAK, 2011) cannot be achieved unless key milestones are implemented for the year 2011 by participating countries to the COP-16 Conference. With that in view, four key milestone decisions were charted at COP-16 for national implementation.

The key milestones are guided by several crucial documents:

1. Developed Country Emission Reduction Targets
2. Further Specific Decisions under the Kyoto Protocol
3. Decisions Addressing Developing Country Mitigation Plans
4. **Reduction of Emissions Through Stronger Actions on Forests**
5. Cost-Effective Means to Achieve Mitigation Goals
6. Addressing Economic and Social Consequences of Response Measures

Reduction of Emissions Through Stronger Actions on Forests

Of these, the document *Reduction of Emissions Through* ***Stronger Actions on Forests*** is of particular importance to the theme of this issue of IMPAK and will be discussed in detail. The document is also particularly crucial for developing countries and the ASEAN bloc (Indonesia, the Philippines, Brunei, Thailand, Vietnam, Cambodia etc) in several aspects. This is because this document demands extensive national actions with special reference to the Reducing Emissions from Deforestation and Forest Degradation (REDD) Directive. This would explain the reservations expressed by Malaysia as a member of the ASEAN bloc. This sentiment is also prevalent among participating forest-rich countries who will encounter considerable implementation challenges as well such as the Latin American countries of (Brazil, Argentina, Bolivia, Mexico, etc).

The REDD Directive

REDD Directive Basics

Reducing Emissions from Deforestation and Forest Degradation (REDD) Directive, for all practical purposes, is a participative programme that seeks to ensure reduction of greenhouse gas emissions closely associated with **forest** activity which include *avoided deforestation* activity.

The general understanding is that forest-rich countries which have taken concrete steps to reduce emissions primarily from **deforestation** activities must be compensated in financial terms for taking such measures. This is the basic understanding of the REDD initiative at COP-16 in Cancun, Mexico.

REDD+ Basics

On the other hand, REDD+ initiative is an additional consideration taken for reducing greenhouse emissions beyond the **normal** 'deforestation and forest degradation' (REDD) requirement.[1] This **additional consideration** is given especially to sustainable forest management and the afforestation/reforestation factor.

Both the REDD and REDD+ initiatives apply to forest-rich developing countries only. In other words, ASEAN (including Malaysia) for that matter may either opt for participation in the REDD or REDD+ initiatives for domestic implementation.

The original REDD directive text is not without controversy among the forest-rich countries who have forwarded their intention for renewed discussion and negotiation.

Land Use, Land Use Change and Forestry (LULUCF) Initiative

Land use, land use change and forestry (LULUCF) initiative refers to the programme known as *Reforestation & Afforestation, Land Clearing and Agriculture*[2] negotiated in COP-16 under the emission sector of the Kyoto Protocol encompassing *cropland and grazing land management, land clearing and forest management* terms of reference.

In comparison with the REDD programme, there is no real distinction except for the practical fact that LULUCF programme applies to **developed countries** whereas **developing countries** such as the ASEAN region observe the REDD (and if possible, the REDD+ initiative).

For the year 2011, developing countries are obliged to implement the four key milestones with special emphasis on forests[3] by adopting measures which will help reduce emission from deforestation and degradation activities. The main challenges lie not in the REDD programme but in the implementation stages.

In other words, the REDD Directive is still pretty *raw*. How do ASEAN countries implement the REDD programme when each member country has unique forestry interests in terms of economic priorities, international trade imperatives and domestic demands?

The REDD Challenge

Critical Analysis of Policy Imperatives

The Cancun Agreements require developing countries i.e. ASEAN countries and Malaysia to formulate policies and take proactive initiatives[4] to reduce emissions from *deforestation and forest degradation* activities. In addition to that obligation, steps must be taken to conserve and carry out sustainable *forest management*[5] and enhance *forest carbon stocks*.[6] This is easier said than done. Malaysia, Thailand and Indonesia do not share the same implementation methodologies with regard to the REDD programme.

Critical Analysis of Implementation Imperatives

There is currently no accurate and consistent accounting rules for REDD players and developers.[7] This is an administrative barrier to the achievement of the REDD programme.[8]

As part of the on-going REDD accounting discussion, there is great concern that once a REDD credit is created for a specific sector of a designated forest, the government must ensure that this protected sector is permanently shielded from any form of forest encroachment and the consequential tree-felling activism. This is aggravated by the phenomenon of carbon 'leakage'. Again, this is extremely difficult to ascertain and quantify due to a lack of reliable technical surveillance technology and manpower in forest-rich ASEAN countries such as Indonesia, Thailand, Malaysia etc. despite strict enforcement.

Carbon Offset Option

Countries can bypass LULUCF requirements by utilising the REDD option. Industrial emissions can be offset by the purchase of certified REDD credits from developing countries. This option has been perceived, by many critics, to be detrimental as it could, in the long term period, cause distortion in the carbon emission reduction equation under the LULUCF programme and consequentially make a mockery of both LULUCF and REDD initiatives.

Natives' Rights and Indigenous Communities

Another crucial aspect not fully addressed within LULUCF and REDD parameters are the rights of the natives/aborigines[9] living in the forest/jungle boundaries. There is a real risk that REDD carbon credits associated with forests/jungles are sold

without knowledge and consent of indigenous communities living in the REDD targeted forests/jungles. The role of the natives in REDD credits and carbon trading schemes within the REDD programme remains mystifying to the natives who do not appear to have any representative voice in COP-16 and events prior to COP-16.

Natives do not have any participatory role in the REDD programme and this unfortunate trend is set to change as natives around the globe unite to form an alliance for a fair and transparent implementation of the REDD programme.

Preservation of Natural Biodiversity

The protection of natural biodiversity in forest/jungles is – apart from the fact that it is a global responsibility – critical in order to prevent emissions brought about by deforestation and forest degradation activities which could threaten global biodiversity.

It is therefore essential to take note that both the LULUCF and REDD programmes not only contain deforestation and degradation rules, they strongly prohibit any attempt to convert current forests into other uses such as exotic plantations. The conversion provision remains contentious among developing countries and hence requires reformulation so as to allow, besides retention of existing forests, carbon credits to be given to pro-active logging regimes that emphasise *sustainable forest management*. There is also no real agreement on the definition of *sustainable forest management*.

Regulatory Issue and Governance

There is no single body authorised to supervise and perform regulatory compliance with the REDD programme. This means that REDD certified by a developing country may face complications in obtaining the relevant financial credits and compensation from the proposed REDD Fund. The voluntary nature of data and compliance submission does not imbue confidence and certainty from a financial accounting analysis.

Accounting Rules

The understanding behind the REDD programme is the pledge by developed countries[10] i.e. OECD to channel relevant funding[11] to developing countries i.e. ASEAN for the purposes of effecting REDD. This fund will be used to manage and control the primary drivers of deforestation. It will be used to pay or – compensate forest owners/stakeholders for taking various administrative measures to protect the forest which is viewed as a *social, environmental, and financial asset*. This is of course the understanding on paper but in reality, it is extremely difficult to see how it could work due to different implementation strategies and economic practices between developed countries – as the provider of funds – and developing countries as recipients of such funds.

ASEAN-EU Participation

One way to resolve the perceived stalemate in the REDD programme is to set out clear working guidelines and a collaboration framework between the provider and the receiver of such funds. The collaborative framework must not be limited to the stakeholders of the forests *per se* but there is a need to incorporate a more comprehensive cross-sector or cross-industrial drivers between owners of forests within the *supply-and-demand* matrix unique to the ASEAN region.

Malaysia's Position

Malaysia is committed to the Post-Cancun national implementation 2011 notwithstanding the fact that as a developing country, Malaysia has *no quantitative commitments* under the Kyoto Protocol. However, the specific issue concerning *Reduction of Emissions Through Stronger Actions on Forests* document requires further clarification before effective measures could be mapped out. The REDD implementation details particularly with reference to the methodologies, technical accounting compliance etc. pose serious challenges because there is currently no consensus among forest-rich developing countries on numerous outstanding REDD issues highlighted in the foregoing critical analysis.

Recommendations

Malaysia must take steps to undertake re-negotiation of the REDD and REDD+ terms and compliance rules under the REDD mechanism. The same applies to developed countries under the LULUCF programme.

REDD+ remains as controversial as REDD itself. Crucial components such as forest conservation, sustainable forest management, and enhancement of forest carbon stocks under REDD+ rules must be re-negotiated to balance the rights and interests of forest-rich developing countries including the ASEAN bloc. Malaysia must maintain initiative momentum to promote continual capacity-building under the Kyoto Protocol environment and the guiding Cancun Agreements for ASEAN and developing countries as a whole.

Conclusion

Both the REDD and LULUCF initiatives under the Convention and hammered out at COP-16 must be given an opportunity to develop a true working framework that can be deployed effectively in developing the region.

At this initial framework stages, both REDD and LULUCF lack clarity. But this cannot be translated into actions to boycott pro-active attempts by the global community to achieve climate change objectives as framed by the landmark Kyoto Protocol. Discussions are in progress to define them, and if need be, redefine the ramifications and scope of REDD and LULUCF implementation. Hence, there is a clear need to work together to make it a participative success for the global community.

It is hoped that another form of positive consensus can be reached at the upcoming *17th United Nations Framework Convention on Climate Change* in the sunny city of Durban, South Africa (28 Nov 2011 to 9 Dec 2011) and the finer implementation framework to the REDD Directive could be equitably formulated on a holistic scale between developing countries and the developed bloc. If it was hot for the participants at COP-16 last year in Cancun, Mexico, the upcoming COP-17 in Durban will be equally '*REDD*' hot at 20-27 °C.

Notes

1 See discussion concerning REDD+ at COP-15 in Copenhagen.

2 For details, see Decision 2/CMP.6 *The Cancun Agreements: Land use, land-use change and forestry* (FCCC/KP/CMP/2010/12/Add.1

3 Global forest cover is 3952 million ha in 2005 which is about 30% of the world's land mass area. Forests are considered to be a crucial component of the world's carbon stock.

4 For a discussion relating to the assessment of true costs of REDD+ action for forests restoration and protection, etc see *World Bank REDD+ costs manual*, at *http://wbi.worldbank.org/wbi/Data/wbi/wbicms/files/drupal-acquia/wbi/OppCostsREDD+manual.pdf*

5 For Guidelines for the submission and review of information on forest management reference levels/baselines, see Appendix II, FCCC/KP/CMP/2010/12/Add.1

6 For a discussion on this aspect, see *USAID Forest carbon calculator*, at *http://winrock.stage.datarg.net/gcc/login.aspx*

7 For a brief guidance concerning feasibility tolls for REDD developers, see *Feasibility tool for REDD developers-PDD Costs, a template that may help to estimate the costs of developing a Project Design Document*, at *http://www.carbonpositive.net/viewarticle.aspx?articleID=44#PDD*

8 Under LULUCF, activities which require compulsory accounting are afforestation, reforestation and deforestation. Apart from these three activities, there are many other activities which are not accounted for. For instance, activities such as cropland management, grazing land management and forest management.

9 The United Nations Declaration on the Rights of Indigenous Peoples, at *http://www.un.org/apps/news/story.asp?NewsID=23794&Cr=indigenous&Cr1=*

10 Annex II countries are signatory nations to the UNFCCC which are also members of the OECD - the most industrialised economies. They have extra obligations to help developing nations combat climate change via technology transfer and financial help.

11 See Green Climate Fund.

**The above professional analysis is the writer's personal view and in no way represents the view/position of the research institutes/thinktanks/organisations to which he is currently attached to.*

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FORESTS: Our Life Support System

The United Nations General Assembly (UNGA) proclaimed the 2005 to 2015 period as the International Decade for Action with the theme 'Water for Life'. Goal 7 of the Millennium Development Goal (MDG is to 'Ensure Environmental Sustainability'. Target 10 of this goal is 'to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.'

Earth has approximately 97% of its water in the form of sea water with the remaining 3% constituting fresh water. Of this 3% fresh water, 68.7% is contained in frozen ice caps and glaciers, 30.1% is ground water, 0.9% is in other origins (clouds) and 0.3% is surface water (rivers, lakes and springs). About 87% of the surface water comes from lakes, 11% from fresh water swamps, and only 2% is drawn from rivers. In Malaysia, we rely totally on the supply of river water for processing into drinking water. With such small amounts of fresh water available, how are we going to safeguard it?

Forests and Raw Water Supply

It is estimated that the annual rainfall in Malaysia is about 990 billion m^3 by taking into consideration the surface area of 330,000 km^2 and the average annual rainfall of about 3,000 mm. About 566 billion m^3 of the annual rainfall becomes surface runoff (water that flows on the surface of earth), 630 billion m^3 evaporates and another 64 billion m^3 infiltrates into the ground to be groundwater.

Table 1: Raw water use (according to Malaysia Water Industry Guide 2009)

State	2008				2009			
	Direct from river	Storage dams	Ground water	Total	Direct from river	Storage dams	Ground water	Total
	Million Litre per Day (MLD)				Million Litre per Day (MLD)			
Johor	1,039	398	-	1,437	1,265	334	-	1,599
Kedah	1,226	17	-	1,243	1,246	16	-	1,262
Kelantan	207	-	135	342	200	-	148	348
Labuan	41	10	-	51	40	11	0.7	51
Melaka	342	145	-	487	289	216	-	506
N. Sembilan	703	368	-	1,071	509	420	-	929
Pulau Pinang	860	78	-	938	895	96	-	991
Pahang	971	-	6	977	1,090	-	4	1,094
Perak	1,134	127	-	1,261	1,021	319	-	1,340
Perlis	47	53	9	109	50	53	8	112
Sabah	596	241	45	882	599	243	45	887
Sarawak	858	100	-	958	892	100	-	993
Selangor	3,843	145	-	3,988	3,914	153	-	4,067
Terengganu	551	-	0.2	552	571	-	0.1	571
MALAYSIA	12,418	1,683	195	14,295	12,583	1,961	206	14,750

The rainfall is captured by our forests and supplied to us in the form of raw water via rivers and groundwater. The peat layer in the forest areas is a good 'sponge' that delays water flow during a heavy rainfall. Therefore, the forest plays an important role in ensuring continuous raw water availability for human living and nature.

As the population grows, so do our needs. This has put a huge stress on our forest cover as development has encroached into forested lands. While it poses immediate danger to wildlife, the long term impact is actually on our very survival. Water usage is basically divided into domestic, industrial and agricultural sectors which contribute 17%, 21% and 62% respectively. Our core issue is the security of raw water emanating from our forests. Table 1 shows that the total raw water use in 2009 was 14,750 MLD.

Protecting Water Catchment Areas

Water catchments that mainly consist of forests are now under threat. Thus, securing our forest is vital to ensuring a sufficient surface water supply which is our main source of drinking water.

Case Study 1: Bukit Larut – Cable Car Project

In 1910, 7,130 hectares of Bukit Larut (Maxwell Hill) was gazetted as forest reserve and half a century later in 1962, 2,747 hectares of the Bukit Larut Forest were gazetted as the Larut Hills Virgin Jungle reserve for water catchment, research and education.

The overall primary water catchments are about 21.53 square kilometre (km^2). The secondary and tertiary catchment areas have not been gazetted. There is no buffer zone in the Bukit Larut catchment to prevent untoward incidents. This catchment supplies water to 200,000 people, industries and the commercial sector.

Approval given by the state government for a cable car project in 1997 with the MoU being signed in 2010 is seen as the biggest threat to the catchment area. An increase in tourist flow from the current 200 per day to 1,000 per day to Bukit Larut will cause an immense increase in solid waste and sewerage waste. More of such waste will need to be transported out resulting in increased frequency of pick-up sewerage trucks travelling in and out of the catchment area for waste water discharge. Piping for the sewerage needs to be developed and leakages may have an immediate effect on the sensitive ecosystem. It is suggested that any project in a sensitive ecosystem be subjected to Environment Impact Assessment.

Case Study 2: Ulu Muda Forest Reserve – Logging

The Ulu Muda forest covers an area of 162,931 hectares located within the districts of Baling, Padang Terap and Sik of Kedah. There are three large man-made lakes within the Ulu Muda area, namely Muda, Ahning and Pedu which supply water for domestic use and irrigation for most of Kedah, Penang and Perlis.

Logging in this reserve will seriously jeopardise water needs for all three states. The Penang and Perlis state governments do not pay any fees to protect these water catchment areas. Therefore, the Kedah state government must be allowed to preserve the forest without losing projected income from logging and this can be done by imposing a raw water tariff based on water quality to prevent logging. This will be a win-win situation to all parties.

Case Study 3: Pahang-Selangor Raw Water Transfer Project

The Ministry of Energy, Green Technology and Water (KeTTHA) is undertaking a massive raw water transfer project which will see raw water being drained from a number of rivers. The principal rivers are the Sg. Bentong, Sg. Telemong and Sg. Kelau. The raw water from the connecting basin will be transferred through the tunnel by gravity flow to an outlet connecting basin. The collected water will be further distributed to receiving basins of a planned treatment plant through pipelines via gravity flow.

The implementation of the dam will produce a total reliable yield of 2,259 MLD of raw water to water stressed areas in the Klang Valley. In return, there will be a raw water charge to ensure the Pahang state government preserves the water catchment areas.

Conclusion of Case Studies

There should be a raw water tariff mechanism which provides state governments with an economic lifeline to protect water catchment areas. This tariff must also cover raw water quality which is a key element in ensuring low water treatment cost. Trans-boundary issues must also be addressed in developing the tariff mechanism.

Preventing Pollution of Raw Water

Issues of quality, transparency, effectiveness and consumer services are surfacing in the Malaysian water service industry. These changes and adaptations are for the betterment of the Malaysian public and Integrated Water Resource Management. The sewerage industry which is part of the reform, plays an important role too.

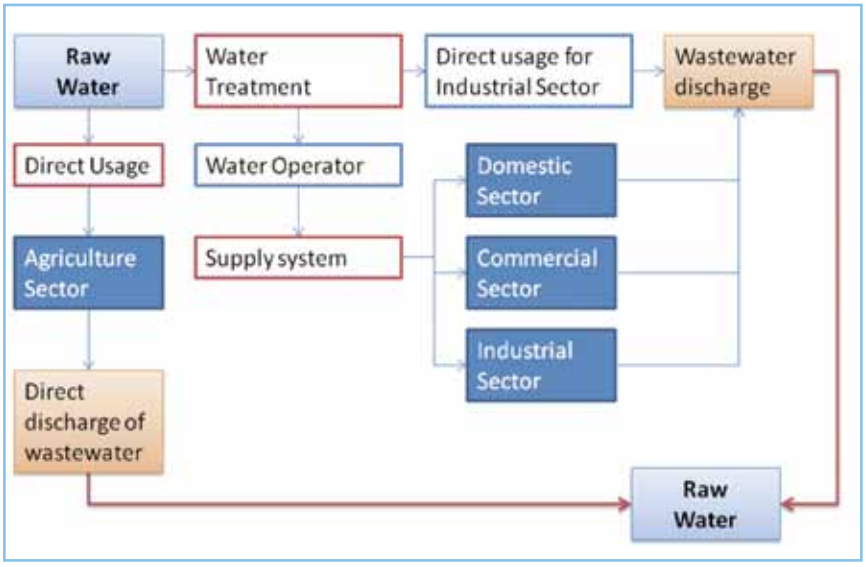

Figure 1: Water usage Closed Loop System

Figure 1 shows the closed loop system of water usage. The raw water we consume is from the environment. We consume directly or treat and supply it to all levels of users and finally produce wastewater. This wastewater needs to be treated before being discharged into the environment again. For this model to function, the environment must be able to sustain our polluting (discharge) and demand parameters.

Closed loop systems are beneficial to policy makers and consumers as we will not be detached from it. However, our failure to be efficient will cause major crises such as water shortage, high capital expenditure, operational expenditure and high water tariff.

The Environment Quality Act 1974 (EQA) is the first Act for preventing pollution to water resources as well as water pollution in general. Section 47 of the EQA clearly specifies that the Department of Environment (DOE) is entitled to recovery of costs and expenses. Subsection (3) of the same section also allows DOE to charge the amount onto properties or interests held by the wrong doer. EQA also allows DOE to force a clean up or carry out a cleaning exercise and claim expenses. EQA does not cover other losses incurred which are outside its jurisdiction of work.

The second act, Water Services Industry Act 2006 (WSIA) empowers Suruhanjaya Perkhidmatan Air Negara (SPAN) to take action for offences related to contamination according to Section 121, subsection (1)(b) and (1)(c) of WSIA. WSIA also penalises the wrong doer, upon conviction with sentences such as jail terms as well as a fine ranging from RM100,000 – RM500,000 depending on the seriousness of the conviction.

The Water Catchment Forest Rules 2009 which were approved on 24 November 2009 contain four parts: (i) interpretation, (ii) classification of procedures, (iii) establishment of the Committee on the Development and Management of Water Catchment Forest, and (iv) restrictions in the water catchment forest.

The adoption of the Water Catchment Forest Rules will enhance the effectiveness of forest management in Peninsular Malaysia in line with the practice of sustainable forest management specifically in ensuring the continuous production of clean water for domestic, agriculture, irrigation and industrial use. These new regulations should also contribute towards environmental stability.

Conclusion

Depending on our forests for our raw water supply is unavoidable. While we have identified the main raw water security problems, we have been very slow in following up with remedial actions. Three major actions must be taken immediately if we are to avoid a water crisis:

1 The Water Catchment Forest Rules must be enforced stringently to ensure future water needs.
2 We must manage pollution to water sources efficiently
3 We must innovate alternate sources of water as part of Demand Side Management

The water security of our nation lies squarely in our ability to cater to our water needs. Let us work as a cohesive group in securing water security in Malaysia.

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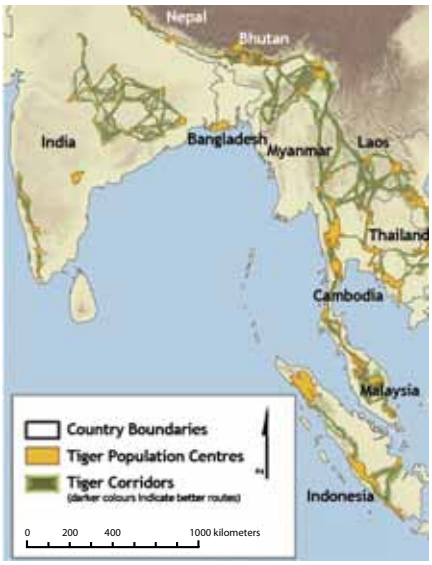
Animal Corridors in Forests: An Important Wildlife Landscape

A forest corridor refers to a linear forest area which forms or is a part of a larger complex forest network. It functions as a corridor for wildlife to move from one forest complex to another without encroaching on human habitats. Wildlife corridors play crucial roles in maintaining connections between animal and plant populations that would otherwise be isolated and at greater risk of extinction.

The corridor provides for sustainability of wildlife populations within the habitat blocks as it allows for mating and breeding between populations. This, of course, helps prevent the negative effects of inbreeding and reduced genetic diversity that often occur within isolated populations. Corridors may also help facilitate the re-establishment of populations that have been reduced or eliminated due to fires or disease or habitat fragmentation. The latter occurs as a result of development that may break up wildlife habitat into smaller fragments. Fragmentation is a leading threat to the survival of many terrestrial animals, and it tends to most affect species that roam far and wide for food and breeding purposes.

Here are some examples of animal corridors that function to link two larger forest areas or habitat to enable mobility of wildlife. The tiger corridor network in Asia was established to increase the tiger population in the natural habitat.



Much of the forest areas in Kinabatangan, Sabah have been developed into oil palm estates. The estate's owners were asked to establish forest corridors of 100 metre-wide along the Kinabatangan riverbank as an important step to safeguard the habitat of the *orang utan*. Efforts to establish such *orang utan* habitat or corridor network will support the overall endeavor of protecting the species especially in Sabah.

Tiger *(Pantera tigris)*

Pygmy elephant *(Elephas maximus borneensis)*

Sumatran Rhinoceros *(Dicerorhinus sumatrensis)*

Orang utan *(Pongo pygmaeus)*

Animal corridors in North America

Functions of a Corridor

- As a strategy to sustain part of the natural link which is crucial to wildlife.
- To rehabilitate and sustain the network among fragmented forests (which occur due to development, agriculture practices or the clearing of forest) through ecological linkages.
- Increase biological diversity of flora and fauna of the area involved.
- Ensure movement of wildlife from one habitat to another in order to breed.
- Ensure mobility of vegetation or wild plants through distribution by animals or other distribution agents such as wind for continuous succession.
- Minimise direct link with predator or human (reduce the possibility of conflict between human and wildlife).
- Serve as a buffer zone to allow for an increase in the population of flora and fauna species particularly those species that can rarely be found as it allows for an extension of usable habitat.

- Create pathways between forest segments which provide demographic advantages for population distribution of wildlife species.

Factors that Threaten Corridor Stability

First on the list is the competition for area utilisation needs of either retaining the corridor or other development purposes such as roads, industries, agriculture, housing etc. Competition can also occur through encroachment either through hunting or illegal logging. Next, we have the economic factors which include higher management costs. As an example, when uncertainty exists in the preservation of corridors, would it be better to retain the corridors to facilitate survivability of all identified species or would relocation of wildlife be a better option.

The stability of wildlife corridors near to human habitats can also be threatened by predation of domesticated animals on wildlife. Another threat is the spread of diseases or pests either from domesticated animals or plants which occur due to the availability of a access road to the corridor. Other threats to wildlife are forest fires occurring in fire-prone areas such the peat swamp forests and natural catastrophes such as flood and drought. Not all corridors are suitable for all animal or plant species. Such a situation may lead to the corridor being dominated by certain species, thus causing the depletion or extinction of other species.

Ensuring Corridor Sustainability

Systematic planning is necessary by identifying important locations for protection of wildlife through the establishment of a corridor. An effective wildlife corridor must be sustained at least 500m wide and kept as a forest reserve or protected area (buffer zone). The financial allocation necessary to create the corridor needs to be determined as larger corridors will incur more operational costs. Mapping of corridor(s) is therefore an effective management tool in ensuring corridor sustainability and biological sustainability within the corridor.

Monitoring of the corridor through reconnaissance or implementation of short-term or long-term studies is important for corridor sustainability. Studies could include species reconnaissance, animal population study, ecology, breeding and the observation of species using camera traps. The relevant needs of each selected species will have to be evaluated. Wildlife needs such as movement and dispersal patterns, nesting, rearing or germination sites, as well as dispersal or migratory patterns of the animals should be identified. A target species may need to be selected from all species present in the area.

Wildlife corridors are usually designed with an 'umbrella species' in mind. These are large animals with widespread popular appeal like tigers, elephants and orang utans that need a lot of land and tend to garner public support. Protecting their habitat, which is often large, can extend protection to smaller species that share the same space. In this way, an umbrella species shields many other species that fall under its habitat 'umbrella.'

Maintenance of data on wildlife and species in the corridor is extremely important. Information on wildlife needs to be updated for experts in the related field i.e. government, academia and non-governmental organisations (NGOs) for policy actions. This would include data within the corridor area on the status of wild flora or fauna under the categories of rare, endemic, threatened, protected, totally protected or endangered.

Lastly for greater involvement of the public in the corridors, there is a need to provide courses and talks to various communities to improve their knowledge and promote awareness of the importance of wildlife corridors.

Species Groups and Target Species

In developing wildlife corridors, species groups and targeted species need to be determined in areas that require the development of such corridors. When evaluating a corridor, it is important to determine which species the corridor will serve. Corridor use can be evaluated with respect to both broad species groups and specific target species. Six species categories include:

- Edge vs. interior species
- Exotic vs. native species
- Regionally abundant vs. regionally rare species
- Generalists vs. specialists
- Coarse-grain vs. fine-grain species

How can Development and Wildlife Conservation Co-exist?

Plantations

The development of plantation areas will normally cover areas of commercial crop plantations, infrastructure development, roads, firebreaks and include non-commercial areas or areas reserved for wildlife habitat or native vegetation. These non-developed areas are important for protecting water resources i.e. rivers or wetlands which are in the proximity of the plantation areas. Networks between the reserved habitat fragments can form wildlife corridors or serve as an important leeway in ensuring the survivability of wildlife species existing within the plantation environment. Care should be taken to ensure that development works be kept away from the banks of the canals in order to retain the width of the wildlife corridors.

Housing

Population increases will cause demand for housing to increase. Areas with steep hilly slopes which impede housing development are normally left as forested areas. Such fragmented forests in highlands become habitat remnants which are available for wildlife still occupying the area. An effort to develop wildlife corridors between the housing areas will provide larger habitat space for the survivability of the wildlife. The planning of sufficient space can help in the preservation and enhancement of wildlife links.

Recreation

A well-organised recreation area development will normally allow for the protection of forest fragments. These forest fragments can form wildlife corridors or serve as leeway allowing wildlife especially animals to move from the forest areas to the recreation areas. Such a situation can attract more tourists with the presence of free-range wildlife in the recreation area. Recreation areas can act as conduits for wildlife with the planting of trees and the creation of man-made ponds.

Bukit Melawati recreation area in Selangor, Malaysia is home to monkeys.

Conclusion

Man and wildlife co-exist in this planet and share the same space and environment. Maintaining a balance between the needs of human and wildlife is necessary for the benefit of our future generations.

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Event Highlights
Department of Environment, Malaysia

April 2011

Assessment on Effectiveness of Environmental Education and Awareness Programme Workshop Series 1/2011

Held from 26 to 28 April 2011 in Port Dickson, the above workshop was organised by the Department of Environment in collaboration with the Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia. A total of 32 participants, mainly from government agencies involved in promoting awareness and environmental education programmes, attended the workshop.

The 3-day workshop was essentially aimed at having a brainstorming session towards the establishment of an Environmental Commitment and Awareness Index. This new Index will be used to evaluate and determine environmental commitment and awareness of the people in the country.

The next workshop is tentatively scheduled for November 2011 with the target groups drawn from the government sector, private sector, NGOs and academicians.

May 2011

The 9th Meeting of the ASEAN Working Group on Environmentally Sustainable Cities (9th AWGESC)

The 9th Meeting of the ASEAN Working Group on Environmentally Sustainable Cities (9th AWGESC) was held in Yangon, Myanmar from 2-3 May 2011. It was hosted by the Yangon City Development Committee, Myanmar and chaired by Ms. Liana Bratasida, Special Assistant to the Minister on Environment Global Affairs and International Cooperation, Ministry of Environment, Indonesia.

A total of 35 delegates attended the Meeting. They were from Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Singapore, Thailand, Vietnam and the ASEAN Secretariat. The delegates also included representatives from the Insititute for Global Environmental Strategies (IGES), German International Cooperation (GIZ), ASEAN-US Technical Assistance and Training Facility (TATF), Hanns Siedel Foundation and Energy Research Development Centre of China.

Among the issues discussed at this Meeting were the development of Key Performance Indicators (KPIs) for Clean Air, Clean Water and Clean Land. The KPIs will be useful for the local governments to mitigate the impact of climate change, and to initiate mechanisms for the selection of the ASEAN Environmentally Sustainable Cities Award.

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