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ASEAN Peatland Forests Project – Sustainable Management of Peatland Forests in Southeast Asia

Guidelines on Integrated Management Planning for Peatland Forests in Southeast Asia

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Guidelines on Integrated Management Planning for Peatland Forests in Southeast Asia

Under the Framework of the
ASEAN Peatland Forests Project (APFP)
and SEApeat Project

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with support from
Global Environment Centre (GEC) and
in consultation with the ASEAN Member States

Financial support provided by
Global Environment Facility (GEF) through its implementing agency the International Fund for Agricultural Development (IFAD)
and
European Union via Global Environment Centre

This document is aimed at the practitioner and the planner. It provides practical, relevant and user-friendly guidelines for the integrated management planning for peatland forests in Southeast Asia (SEA).

It focuses on the principles of integrated management planning for peatland forests and provides guidance on dealing with the key drivers of change that underpin peatland degradation and loss in Southeast Asia.

It provides general guidance on the planning, development and implementation of integrated plans for peatland forests – a process which would normally be driven by government planning and land management agencies. It does not provide detailed, step-by-step instructions on management planning for peatland forests.

It is intended primarily for use by local, regional and national planning authorities, and managers of peatland reserves and sites in the ASEAN Member States.

Other users include national level policy and decision-makers, agencies / companies involved in developing peatland forests for various uses, and international governmental and non-governmental organizations or aid agencies working to support and promote the sustainable management of the peatland forests in Southeast Asia.

These Guidelines are meant to support the implementation of the ASEAN Peatland Management Strategy 2006-2020, and to guide the development and/or implementation of National Action Plans for Peatlands in the ASEAN Member States.

These Guidelines were developed under the regional component of the *ASEAN Peatland Forests Project* and *Sustainable Management of Peatland Forests in Southeast Asia (SEApeat) Project*, coordinated by the Global Environment Centre.

Preface

Peatlands cover over 20 million hectares of land in Southeast Asia, comprising 60% of tropical peatlands.

In many ASEAN Member States, many communities live in these less than fertile areas due to a lack of arable land. It is a feasible option, as peatlands abound with various species of blackwater fish, wildlife, edible plants and those with commercial value. Being acidic in nature, agriculture on peatlands is challenging, but not impossible. However, poor management of peatlands create many unwanted complications, especially acid sulphate poisoning and peat wildfires which destroy crops and lead to transboundary haze.

Planting of suitable crops, intercropping and proper water management will go a long way to allow livelihood activities especially agriculture and fisheries without upsetting the ecological balance of peatlands. Zero burning and contained burning techniques will also help to protect peatlands and avoid wildfire outbreaks on peatlands. With intact peatlands, ecotourism can be another viable option for a livelihood source for those living on this ecosystem.

To ensure the ecological balance is protected, steps must be taken to maintain the hydrological balance; steps such as water management and a buffer zone around protected areas. This requires long term planning and enforcement. While best management practices on peatlands are important to peatland conservation; an integrated management plan is the key to enabling its success.

We thank those who shared their knowledge during the Integrated Management Planning Workshop held in Cherating Pahang, Malaysia in June 2012. We hope that this book will benefit those responsible for sustainable planning for peatland areas, or working with communities living on peatlands.

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Summary for Decision Makers

1. Southeast Asia (SE Asia) is home to the largest area of tropical peatland forests in the world. The total area of peatlands in SE Asia is estimated to be about 25 million hectares (ha), comprising 60% of the world's tropical peatlands and roughly 6% of the entire extent of the global peatland resource.

2. The majority of these peatland forests occur in Indonesia, which has approximately 83% of the total peatland area in the region. Other major peatland areas are found in Malaysia, Brunei Darussalam, Thailand, Viet Nam, and the Philippines.

3. Peatland forests are the main terrestrial wetland ecosystem type in SE Asia, and an important component of the world's wetland resources. The global significance of peatland forests has been acknowledged through resolutions and decisions adopted by Member Countries/Parties to the Ramsar Convention on Wetlands, the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change.

4. Peatland forests provide a variety of ecosystem services, both directly and indirectly, in the form of forestry and fisheries products, energy, flood mitigation, water supply and groundwater recharge. However the nature and value of these services, especially in the wider, basin context are not well understood.

5. The remaining area of peatland forests in SE Asia has been significantly reduced in the last 30 years, with an estimated 34% remaining in relatively intact condition in the western part of the region, 46% being in fragmented or degraded condition and 20% converted to plantations.

6. The direct drivers of change for this loss are agricultural development, land conversion, drainage, and overharvesting and overexploitation. The primary indirect driver of change is increasing economic pressure to develop peatland resources.

7. Countries in the SE Asian region have identified five common issues of concern relating to peatland forests in the region: (i) peatland fires and transboundary haze; (ii) carbon losses; (iii) degradation and loss of peatland forests and their services, including biodiversity; (iv) lack of knowledge and understanding regarding the peatland ecosystem; and most importantly, (v) the lack of an integrated approach to managing peatland forests.

8. These Guidelines are intended to assist the ASEAN Members States to develop and implement integrated responses to address the issues identified, and in doing so, to enable countries to better manage their peatland and peatland forest resources in a sustainable manner.

9. These Guidelines aim to achieve recognition of the importance of peatland forests to the maintenance of global biodiversity and the storage of the water and carbon that is vital to the world's climate system, and to promote their wise use, conservation and management for the benefit of people and ecosystems. This aim is consistent with that of the *Guidelines for Global Action on Peatlands* (GAPP), adopted by Ramsar member states at the 8th Conference of the Contracting Parties to the Ramsar Convention (COP8, Valencia, 2002).

10. These Guidelines are limited in scope to approaches, strategies and actions that speak directly to adopting an *integrated approach* to management planning for peatland forests,

and not the practical application of site-level management techniques for peatland conservation and wise use. In Part 5 of these Guidelines, the reader is directed to a bibliography of information sources pertinent to the management of peatland forests at the site level.

11. The approach to integrated management planning for peatland forests adopted by these Guidelines is founded on five basic principles:
    - Recognition of the critical function of tropical peatland forests in retaining and distributing water across the river basin landscape;
    - Recognition of the complex interaction of climate, hydrology, geology, ecology and time on the creation and evolution of peatland forests in the tropical region;
    - Recognition of the need for inter-disciplinary collaboration and coordination when working towards integrated management planning;
    - Recognition that good will, compromise and communication among stakeholders will be invaluable in the pursuit of a complex and dynamic result – healthy, functioning peatland forests that approximate natural systems as best as current knowledge and capabilities allow; and
    - Recognition that best practices will evolve with continued research, monitoring, and adaptive management.

12. These Guidelines recommend a series of priority approaches to address the issues of concern and to enhance the integrated management planning of peatland forests in SE Asia under seven themes:
    - ✓ Knowledge of peatland forest resources
    - ✓ Education and public awareness on the importance of peatland forests
    - ✓ Policy and legislative instruments that support the integrated management of peatland forests
    - ✓ Wise use of peatland forests
    - ✓ Research networks, regional centres of expertise, and institutional capacity
    - ✓ Regional and International cooperation
    - ✓ Implementation and support

13. The seven themes adopted for these Guidelines are consistent with that of the GAPP. In this way, it provides a framework for actions and outcomes at the site through to the national levels to respond to, and inform, priorities at the global level. Equally, it allows for future revisions/updates to the GAPP to be fed back into the integrated management planning processes at the national through to the site levels. Finally, for Ramsar Contracting Parties in the SE Asia region, it facilitates reporting on the implementation of the GAPP.

14. The strategies recommended under each of the seven themes are:
    - ✓ Knowledge of peatland forest resources
        - ✓ Inventory of the peatland forest resource
        - ✓ Detecting changes and trends in the quantity and quality of the peatland resource
    - ✓ Education and public awareness on the importance of peatland forests
        - ✓ Develop a National Peatland CEPA Action Plan
        - ✓ Communicate Effectively
        - ✓ Build Capacity in Peatland Management
        - ✓ Enhance the Participation of Stakeholders
    - ✓ Policy and legislative instruments that support the integrated management of peatland forests

        - ✓ National Wetland Policy
        - ✓ National Action Plan on Peatlands, including individual action plans for CEPA, and capacity development
    - ✓ Wise use of peatland forests
        - ✓ Restore peatlands
        - ✓ Regulate hydrology and water
        - ✓ Reduce human-induced greenhouse gas emissions from peatlands and protect their carbon stores
        - ✓ Promote best practices and the sharing of knowledge, technology and resources
        - ✓ Use a range of tools and approaches for the integrated management of peatland forests
    - ✓ Research networks, regional centres of expertise, and institutional capacity
        - ✓ Participate in Research Networks related to Peatlands
        - ✓ Establish Centres of Peatland Excellence at the National and Regional Level
        - ✓ Enhance Capacity of Institutions at the National and Local Levels
    - ✓ Regional and International cooperation
        - ✓ Enhancing Regional Cooperation
        - ✓ Enhancing International Cooperation
    - ✓ Implementation and support
        - ✓ Adopting Good Governance and Effective Law Enforcement
        - ✓ Adopting a Multi-stakeholder Approach to Peatland Policy Development and Management Planning
        - ✓ Financing an Integrated Approach to Peatland Management Planning

15. A total of 83 actions are identified in this document to deliver the seven strategies listed above, at the regional, national and sub-national levels. The anticipated outcomes of implementing these actions are:
    - Increased cooperation across departments, governments and other organizations to manage peatland forest ecosystems;
    - Better integrated responses to cross-cutting issues and unanticipated events related to peatland forest ecosystems;
    - Better and more timely collection of information on key risks and their relationship to existing programmes and initiatives, and to the provision of ecosystem services from peatland forests;
    - Ongoing measurement of the actual effects of policies, programmes and operations on peatland forest ecosystems;
    - Identification of areas of shared responsibility among key stakeholders; and
    - Greater accountability in the management of these shared responsibilities.

16. This document intended primarily for use by local, regional and national planning authorities, and managers of peatland reserves and sites in the ASEAN Member States. Other users include national level policy and decision-makers, government agencies and private companies involved in developing and managing peatland forests for various uses, and governmental and non-governmental organizations and aid agencies working to support and promote the sustainable management of the peatland forests in SE Asia.

17. These Guidelines respond broadly to the Goal and General Objectives of the ASEAN Peatland Management Strategy and specifically to the actions called for in Focus Area 8: Integrated Management of Peatlands.

18. These Guidelines were developed under the ASEAN Peatland Forests Project and SEApeat Project, coordinated by the Global Environment Centre, and financed by the Global Environment Facility (GEF) through its implementing agency the International Fund for Agricultural Development (IFAD), and the European Union, respectively.

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Part 1: Introduction

1.1 Defining Peatland Forests

Before embarking upon a discussion about the integrated management of tropical peatland forests, it is necessary to define the subject matter under discussion. To start, it should be recognized that the subject can be clearly subdivided into two: firstly the material itself, generally indicated as **peat**; and secondly its physiographic or geomorphological setting (the landscape units) which are given a wide variety of names such as **peatland**, **peatland forest**, **tropical peat swamp** and **tropical peat swamp forest**.

Each of these terms is defined as follows:-

Peat is sedentarily accumulated material consisting of at least 30% (dry mass) of dead organic material.

A **peatland** is an area with or without vegetation with a naturally accumulated peat layer at the surface.

A **peatland forest** is an area where natural or semi-natural forest types occur on peat deposits.

The term **tropical peat swamp** is defined as land containing peat in the tropical or subtropical zone (lying within latitudes 35° North and South). A **tropical peat swamp forest** is then defined as land qualifying as forest located on tropical peat swamp.

In Parts 1 and 2 of this document, the use of these terms follows that used in the source material.

For the purposes of the *Guidelines for Integrated Management Planning for Peatland Forests in Southeast Asia* presented in Part 3 of this document, the term **peat** is used to describe the material or substrate and **peatland** is used to describe the area while the term **peatland forest** is used to describe both tropical peat swamp forests (which occur largely in Indonesia and Malaysia), and subtropical swamp forest growing on peat (such as the *Melaleuca* swamp forests in Vietnam).

Defining peatlands: Any effort to promote and implement integrated management planning for peatland forests must be superseded by the development of a nationally-accepted definition for 'peatland forests'.

Wetlands International (2010) notes that previous studies of peatlands in Malaysia have used different or interchangeable definitions of 'peatland' or 'peat soil', rendering comparisons difficult; In some reports, it is unclear whether area estimates are for peat swamp forest, peatlands, or peat soils. This is compounded by the differences in classification systems between Peninsular Malaysia, Sabah and Sarawak. For Peninsular Malaysia, the DOA (2002) land use maps do not classify peat swamp forest according to canopy cover, but classify them as 'swamp' or 'forest'. Data for Sabah provided information on the extent and distribution of 'wetland soils', which led the report's authors to use the Klias soil association as a surrogate for peat soils. To determine the area of peat soils in Sarawak, the authors adopted the estimate from the Sarawak Agricultural Capability Maps produced in 1986 (Maas and Tie, 1986). Finally, 'Peat' and 'Peatlands' are defined in Malaysia's National Action Plan for Peatlands (2011) as: 'Peat has high organic matter content (more than 65%) in a soil layer at least 50cm deep. Areas where peat soil has naturally accumulated are called peatlands.'

Box 1 illustrates how Indonesia developed a nationally-accepted definition to map peatlands for the purpose of determining appropriate peatland management practices to reduce greenhouse gas emissions.

Box 1. Indonesia: Towards a nationally-accepted definition for peatland mapping and management

In Indonesia, there are two broad peatland definitions: Authoritative and Scientific. Government Ministries responsible for peatland management and utilization use their own authoritative designations of peatland: The Ministry of Environment of Indonesia defines 'peat' as a plant residue formed naturally through long-term decomposition processes, accumulating in swamp areas or static reservoirs. The Ministry of Agriculture defines 'peat' as soil formed as a result of organic matter accumulation with a naturally occurring composition of greater than 65% from the decaying vegetation growing on it, whose decomposition is slowed down by anaerobic and wet conditions. Meanwhile, the Ministry of Forestry defines 'peat' as organic matter residue accumulating over a long period of time.

Several scientific definitions have been introduced and acknowledged by the scientific community, based on field observations and analyses of peat soil properties. Key elements include physical peat properties, such as degree of decomposition (humification), bulk density, water content, porosity and others, and chemical properties, such as carbon content, ash content, pH, and C/N ratio.

In 2012, the Indonesia Climate Change Center produced the *Policy Memo - Peatland Definition, from Uncertainty to Certainty* which recognises that:

a) There are large discrepancies on peatland understanding, especially related to area and depth. These differences partly arise from different definitions of 'peat' both in theory and in practice;
b) A nationally accepted definition of 'peat' is necessary for Indonesia, so that the country can move forward to determine appropriate peatland management practices to support the reduction of greenhouse gas emissions; and
c) A clear and operable definition of 'peat' in Indonesia needs to be formulated in order to improve peat management across multiple ministries and agencies.

The Policy Memo recommends the following definition for 'peatland':

Peatland is an area with an accumulation of partly decomposed organic matter, with ash content equal to or less than 35%, peat depth equal to or deeper than 50 cm, and organic carbon content (by weight) of at least 12%.

Four categories for peatland delineation are recommended based on the following classification: 1) Peat depth, 2) Peat layer, 3) Hydrological area in peatland, and 4) Land-use in peatland. Other recommended variables to consider are peatland boundary and classification.

Source: *Policy Memo - Peatland Definition. From Uncertainty to Certainty*, Indonesia Climate Change Center (ICCC), 2012 (http://iccc-network.net/document/PM01_082012_EN.pdf)

1.2 The Importance of Peatlands and Peatland Forests in Southeast Asia

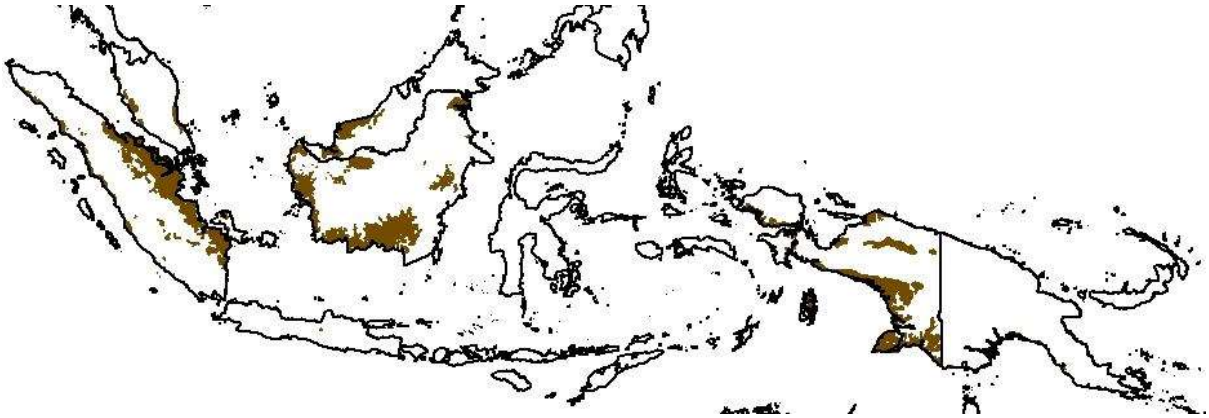
Peatland forests are waterlogged forests growing on varying depths of peat soils which, in the tropics comprise un-decomposed plant materials. They comprise an ancient and unique ecosystem characterized by waterlogging, with low nutrients and dissolved oxygen levels in acidic water regimes. Their continued survival depends on a naturally high water level that prevents the soil from drying out to expose combustible peat matter. This harsh waterlogged environment has led to the evolution of many species of flora uniquely adapted to these conditions.

Most modern lowland peat deposits in SE Asia began forming in the mid-Holocene (5,000 to 6,000 years ago), when sea level was at a maximum and vast areas of the coastal plain were flooded (Anderson & Muller, 1975; Neuzil, 1997; Hope *et al.*, 2005). These peatlands are usually found at low altitude, in sub-coastal areas extending inland for distances of up to 300 kilometres (km). The depth of peat varies from 0.5 metres (m) to more than 10m.

SE Asia is home to the largest area of peatlands in the world. The total area of peatlands in SE Asia is estimated to be about 25 million hectares (ha), comprising 60% of the world's tropical peatlands and roughly one-tenth of the entire extent of the global peatland resource. However, only 34% of this is estimated to remain in relatively intact albeit harvested form.

Peatlands occur in all 10 SE Asian countries with the majority (approximately 92%) occurring in Indonesia and Malaysia. The total area of peatlands in Indonesia is estimated at approximately 21 million ha, or 83% of the total peatland area in the region, while Malaysia has approximately 2.6 million ha, or 10% of the total peatland in the region. Figure 1 shows the peatland cover in Malaysia and Indonesia.

Figure 1: Peatland cover in Malaysia and Indonesia (source: Sarvision)



Other major peatland areas are found in Myanmar, Brunei Darussalam, the Philippines, Thailand, and Viet Nam. Table 1 provides a breakdown of the total area of peatlands by SE Asian country.

Table 1: Area of peatlands in SE Asia, by country

Country	Area (ha)	Source
Brunei	90,900	Page *et al.*, 2011
Cambodia	4,580	Quoi, L.P. 2012
Indonesia	20,695,000	Page *et al.*, 2011
Lao PDR	19,100	Page *et al.*, 2011
Malaysia	2,588,900	Page *et al.*, 2011
Myanmar	122,800	Joosten, 2009

Philippines	64,500	Page *et al.*, 2011
Singapore	50	NEA,2013
Thailand	63,800	Page *et al.*, 2011
Vietnam	53,300	Page *et al.*, 2011

The remaining area of peatland forests in Southeast Asia has been significantly reduced in the last 30 years with an estimated 34% remaining in relatively intact condition in the western part of the region; 46% being in fragmented or degraded situation, and 20% converted to plantations.

1.2.1 Peatland forest ecosystem services

Peatland forests are the main wetland ecosystem type in SE Asia, and an important component of the world's wetlands – the dynamic link between land and water, a transition zone where the flow of water, the cycling of nutrients and the energy of the sun combine to produce a unique ecosystem of hydrology, soils and vegetation.

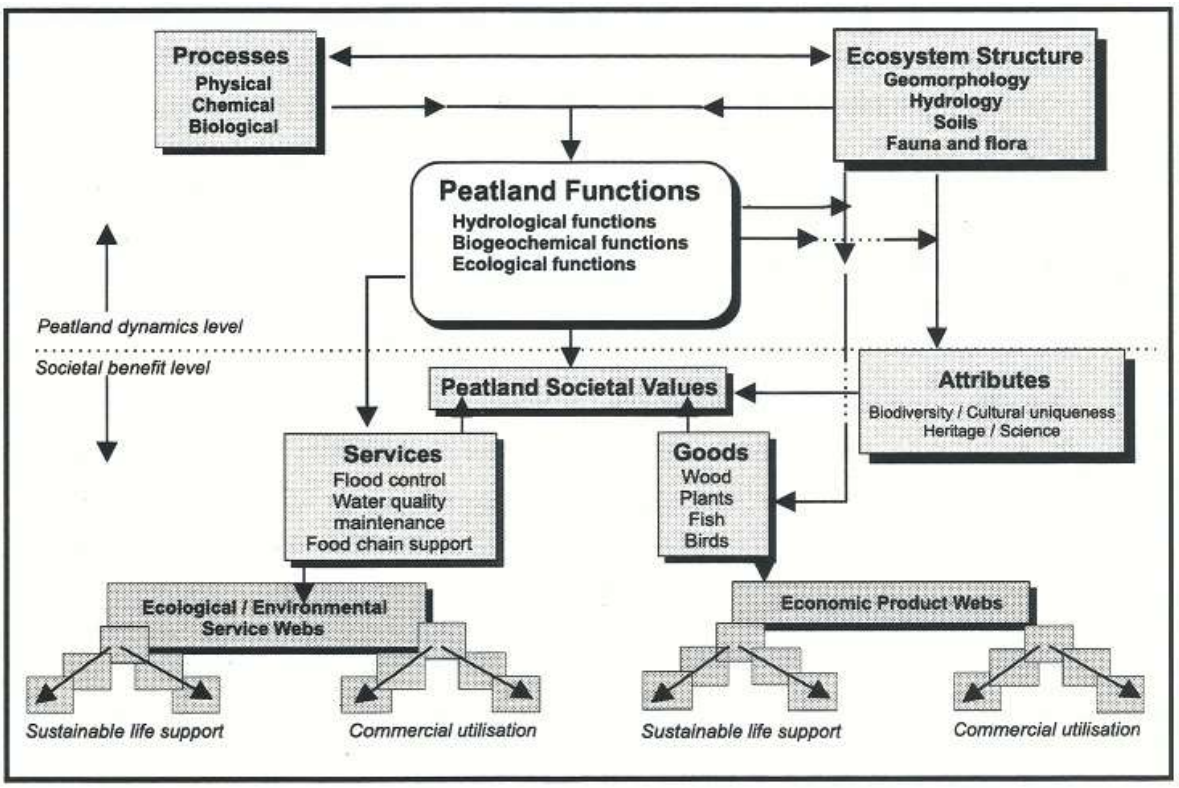
Peatland forests provide a variety of ecosystem services, both directly and indirectly, in the form of forestry and fisheries products, energy, flood mitigation, water supply and groundwater recharge. However the nature and value of these services, especially in the wider, basin context, is not well understood. Table 2 provides a summary of the main ecosystem services provided by functioning peatland forests.

Table 2: Potential Ecosystem Services Provided by Functioning Peatland Forests

Services	**Examples**
Provisioning Services	Timber and non-timber forest products Water supply Fish production
Regulating Services	Flood mitigation Prevention of saline water intrusion Maintenance of base flows in rivers Sediment removal Nutrient removal Toxicant removal Groundwater recharge & discharge Carbon sink
Supporting Services	Soil formation Nutrient cycling
Cultural Services	Cultural/spiritual value Recreational value Historic value Aesthetic value Educational value

Sources: compiled from MA (2005), UNDP Malaysia (2006)

Safford and Maltby (1998) presents the following conceptual diagram of the relationships between peatland functions, processes, structure, attributes, goods, services and values and the resultant economic, ecological and environmental webs that these functions support:



Note: Above the dashed line the ecosystem operates irrespective of society's perception of value. Below the dashed line society perceives that the peatland possesses a value, or produces goods and services that possess a value.

Source: *Safford, Lesley and Maltby, Edward (Eds). 1998. Guidelines for Integrated Planning and Management of Tropical Lowland Peatlands with special reference to Southeast Asia. IUCN, Gland, Switzerland and Cambridge, UK. xvi + 66pp* https://portals.iucn.org/library/efiles/documents/WTL-025.pdf

Of the ecosystem services listed in Table 2 above, the following have received the most amount of attention in recent years, largely due to increasing concerns about the adverse impacts arising from the loss of these services:

Role of peatlands in hydrology and water regulation

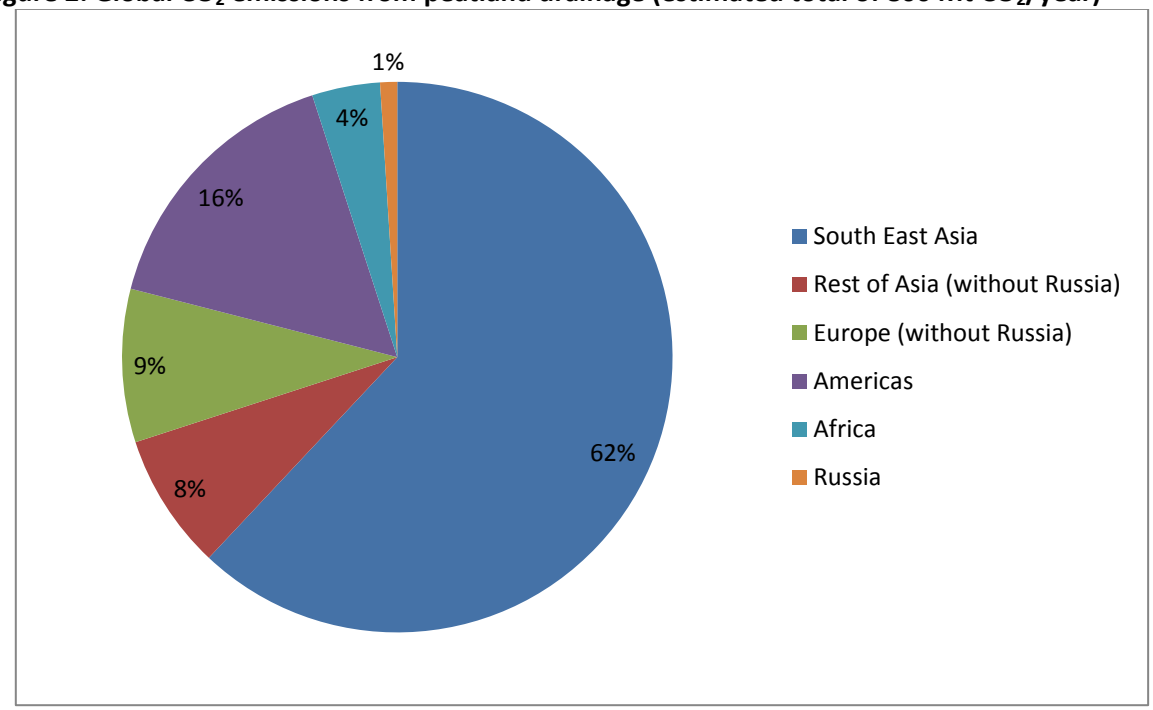
Peatlands modify water quality and quantity, act as sinks for some substances and producers of others, and influence the temporal pattern of water delivery to rivers and lakes. Thus, the extent and condition of peatland within a river basin influences the habitat conditions for aquatic biota and the ecological status of water bodies. Depending on their position within the hydrological and landscape system, many peatlands also provide 'unseen' water regulation functions with considerable direct value to human society. Peatlands in the upper catchment receive and store water from rainfall and release it gradually with beneficial effects on river flow downstream. Peatlands situated in the lower parts of river basins act as transition areas for water, providing temporary storage for both rainfall and runoff, smoothing flow regimes over time. Peatlands located on floodplains can attenuate flood peaks moving downriver thereby providing a degree of natural flood protection to downstream human settlements.

Role of peatlands in climate change

Peatlands are dependent on climate, especially rainfall and temperature, for their formation and maintenance. Greenhouse gas exchange between the atmosphere and peatlands exhibits much spatial and temporal variation related to differences in climate, hydrology and management.

Peatlands have been major global carbon stores for millennia. Peatlands also emit carbon dioxide (CO_2) and methane (CH_4), the amounts being influenced by temperature and water level, both of which are likely to be affected by removal of vegetation, drainage and future climate change. Agriculture on drained peatlands and peat extraction lead to substantial emissions of carbon dioxide and, in the case of the former, also nitrous oxide (N_2O). These emissions, on a unit area basis and for the same groundwater depth, are higher in the tropics than in temperate and boreal areas, because the rate of aerobic decomposition is strongly influenced by temperature (Hooijer *et al.*, 2010). Although the impacts of peatlands and their management on climate change and vice versa are not fully understood, it has recently become clear that the degradation of peatlands is contributing significantly to global greenhouse gas emissions.

Figure 2: Global CO_2 emissions from peatland drainage (estimated total of 800 Mt CO_2/year)



Source: A. Hooijer, S. Page, J. G. Canadell, M. Silvius, J. Kwadijk, H. Woosten, and J. Jauhiainen (2010). Biogeosciences, 7, 1505–1514, 2010. *CO_2 emissions from drained peat in Southeast Asia. Current and future CO_2 emissions from drained peatlands in Southeast Asia*. www.biogeosciences.net/7/1505/2010/

A peat carbon content of 50 kg C m^{-3} is considered to be representative for SE Asian peatlands in general and combining this value with peatland area and thickness, suggests that carbon storage in SE Asian peatlands is at least 58 Gt., equalling at least 212 Gt of potential CO_2 emissions (Strack, 2008).

Hooijer *et al.* (2010) reported that the estimated CO_2 emission from peat decomposition in drained peatlands in SE Asia in 2006 was 632 Mt y^{-1} (with a possible range of 355 Mt y^{-1} and 855 Mt y^{-1}). The report postulates that if current rates and practices of peatland development and degradation continue, CO_2 emission is expected to peak at 745 Mt y^{-1} in 2015, followed by a steady decline over subsequent decades as the remaining peat deposits become increasingly depleted. By 2030, emission is projected to decline to a likely value of 514 Mt y^{-1} if peatland drainage continues without mitigation, and decline further to 236 Mt y−1 by 2070. The report concludes that the total cumulative CO_2 emission, up to 2006 from all peatlands in Southeast Asia included in their analysis, was estimated at 9700 Mt (5300 Mt – 13700 Mt). Total cumulative emission by 2030 is projected to

be 25900 Mt (17200 Mt – 31000 Mt), and by 2070 it is projected to be 37300 Mt (28900 Mt – 39900 Mt).

Harris *et al.* (2013) simulated future scenarios of oil palm expansion until the year 2050 across Indonesia (Kalimantan, Sumatra and Papua), Malaysia (Sarawak and Sabah) and Papua New Guinea. They investigate the potential magnitude of net carbon emissions under three policy scenarios: (1) expansion of the industry to double production by the year 2050, which assumes that growth will follow practices defined as business as usual (BAU); (2) a moratorium on peat coupled with yield improvements of 0.7% annually, which reduces the demand for land and limits new oil palm expansion to low biomass landscapes on mineral soils (MRT); and (3) a moratorium on peat coupled with yield improvements – plus the gradual displacement of existing plantations on peat to low biomass areas on mineral soils, starting in 2020, with subsequent rewetting and restoration of retired plantations to natural peat forest (RET).

Their findings recorded net cumulative carbon emissions under BAU at an estimated 15.2 Pg CO_2 by 2050; approximately 77% of these emissions would originate from the continuous drainage of peat on existing and new plantations, which by 2050 would cover 15% of the total area of oil palm plantations estimated at 26 Mha. Halting expansion into peat areas and shifting it to lower biomass areas in the MRT scenario can potentially reduce total net cumulative emissions by more than 50%. Displacing existing plantations on peat to mineral soils, rewetting drained peat and restoring retired peat plantations to native forest vegetation in the RET scenario would eventually lead to annual emissions near zero for a mature stable oil palm sector covering approximately 21 Mha of plantations.

They conclude that oil palm expansion in Southeast Asia could proceed with a lower emissions profile. Policies that motivate producers to shift to low biomass landscapes on mineral soils and to end all development on peat are shown to be feasible options within the growth projections of the industry. Further reductions in the GHG footprint of the sector can be achieved by retiring existing plantations on peat forest at the end of their current 25-year planting cycle, which would transform the industry and reduce its impact on the atmosphere without sacrificing levels of production.

Role of peatlands in maintaining biodiversity

Tropical peatlands are amongst the most biologically-diverse ecosystems on the planet, and are extremely important for biodiversity maintenance at the genetic, species and habitat levels. They contain species that are found only or mainly in peatlands and are home to some of the rarest species of plants and animals many of which are highly adapted to the specific habitat conditions.

Table 3: Number of species recorded from peat swamp forests of Southeast Asia.

Total number of species	Plants	Mammals	Birds	Reptiles	Amphibians	Freshwater Fish
Recorded from Peat Swamp Forests (PSF)	1524	123	268	75	27	219
Restricted to PSF	172	0	0	0	0	80
Species strongly associated with PSF	-	6	5	1	3	0

Source: Posa, M.R.C. *et al.* (2011)

The peatland forests of SE Asia provide habitat for rare and endangered fauna, including the Bornean Orang Utan *Pongo pygmaeus*, Sumatran Orangutan *Pongo abelii*, Sumatran Tiger *Panthera tigris sumatranus* and Sumatran Rhinoceros *Dicerorhinus sumatrensis*, as well as the lesser-known bird species such as the White-winged Duck (*Cairina scutulata*) and Storm's Stork (*Ciconia stormi*). Peat swamp forests also harbour a number of species that are confined to this habitat, such as the endangered False Gharial *Tomistoma schlegelii* (Bezuijen *et al.* 2001).

Among the faunal groups, fish exhibit the highest endemicity to peat swamps (Table 3). Work in Peninsular Malaysia has shown that the blackwaters of peat swamps are not species poor or low in biomass, and up to 33% of the known freshwater fish species are associated with peat swamps (Ng *et al.* 1994, Kottelat *et al.* 2006, cited in Posa *et al.*, 2011). Peat swamps also harbour a number of miniature fishes, including *Paedocypris progenetica*, the smallest known vertebrate (Kottelat *et al.* 2006, cited in Posa *et al.* 2011). Many of these fishes were discovered only in the last 20 years and many more await formal description.

Peat swamp forests are a source of valuable timber species, chief amongst which is Ramin *Gonystylus bancanus*. Other important timber species are *Dactylocladus stenostachys*, *Dryobalanops rappa*, and the Meranti group, especially *Shorea platycarpa*, *S. albida* and *S. uliginosa* (Wetlands International, 2010).

Despite this, tropical peat swamp forests remain inadequately understood scientifically, which is alarming given the vast areas that have been lost or degraded. The paucity of information is in part the result of early views that peat swamp forests had low animal diversity and abundance. This, coupled with the extremely difficult logistics posed by swampy conditions, has until recently discouraged biologists from survey work (Posa et. al, 2011).

1.2.2 Tropical peatland forests as a priority ecosystem in the global and regional context

Global Level

Peatlands have a wide international significance and the need to manage and use them wisely is relevant to the implementation of the Ramsar Convention, the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and other international and regional instruments and agreements. The section below describes some of the significant decisions, resolutions, agreements and tools related to the conservation and management of peatlands that have been adopted at the global and regional level.

Peatlands and the Ramsar Convention
The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Within the wetland classification system used by the Convention, peatland forests are classified under 'Inland Wetlands: forested'.

Between 1996 and 2008, Ramsar Contracting Parties recognized the global significance of peatlands (forested and non-forested) through Resolutions and Recommendations adopted by Contracting Parties at several Conferences of the Contracting Parties (COPs). The most significant product of these is the *Guidelines for Global Action on Peatlands* (Resolution VIII.17, COP8, Valencia, 2002; www.ramsar.org). The overall aim of the guidelines and their implementation is to achieve recognition of the importance of peatlands to the maintenance of global biodiversity and the storage of the water and carbon that is vital to the world's climate system, and to promote their wise use, conservation and management for the benefit of people and the environment.

Peatlands and the Convention on Biological Diversity (CBD)
The 2007 Global Assessment of Peatlands, Biodiversity and Climate Change, produced as part of the UNEP/GEF Integrated Management of Peatlands for Biodiversity and Climate Change project, aims to provide a synthesis of knowledge on the important functions and roles of peatland ecosystems in

relation to biodiversity conservation, sustainable use and climate change mitigation and adaptation. It provides options for the sustainable management of peatlands, and builds a case for a cost effective contribution to averting further increases in carbon emissions worldwide, in developing as well as developed countries. The Assessment's findings were subsequently noted in the CBD COP 9 Decision IX/16 *Biodiversity and climate change* (2007) and Ramsar COP 10 Resolution X.24 *Climate Change and Wetlands* (2008).

More recently, CBD COP 11 (2011) Decision XI/19 *Biodiversity and climate change related issues: advice on the application of relevant safeguards for biodiversity with regard to policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries* (2011) '… encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances:

(a) Reducing emissions from deforestation;
(b) Reducing emissions from forest degradation;
(c) Conservation of forest carbon stocks;
(d) Sustainable management of forests;
(e) Enhancement of forest carbon stocks;

In the Annex to Decision XI/19 it notes that the following should be considered when addressing safeguards for and multiple benefits of these activities:

(b) Implement ecosystem management activities, including the protection of natural forests, natural grasslands and peatlands, and the sustainable management of forests, considering the use of native communities of forest species in reforestation activities;

(f) Where appropriate, promote biodiversity conservation, especially with regard to soil biodiversity, while conserving and restoring organic carbon in soil and biomass, including in peatlands and other wetlands, as well as in grasslands, savannahs and drylands;

The CBS's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) has adopted the following Recommendations related to peatlands:

SBSTTA 10 (Bangkok, 2005) Recommendation X/5: Indicators for assessing progress towards, and communicating, the 2010 target at the global level
Lists 'peatlands' as an indicator for the Global Biodiversity Outlook

SBSTTA 12 (Paris, 2007) Recommendation XII/5 XII/5: Proposals for the integration of climate-change activities within the programmes of work of the Convention, options for mutually supportive actions addressing climate change within the Rio conventions and a summary of the findings of the global Assessment on Peatlands, Biodiversity and Climate Change
Recognizes the importance of wetlands, and in particular peatlands in the global carbon cycle, and the potential of their conservation and sustainable use as a cost-effective tool to address climate change.

SBSTTA 13 (Rome, 2008) Recommendation XIII/2: Review of implementation of the programme of work on forest biodiversity
[Invites] [Urges] Parties, other Governments, and relevant international and other organizations to:

[(b) Address direct and indirect negative impacts that the production and consumption of biomass for energy might have on forest biodiversity, including on peatlands, and develop guidelines and standards, for the production of bioenergy, in particular biofuels, that consider such impacts;]

SBSTTA 14 (Nairobi, 2010)
Recommendation XIV/2*:* In-depth review of the programme of work on the biological diversity of inland water ecosystems
23. Notes that inland water ecosystems are significant stores of carbon and that peatlands and other wetlands have very high carbon stocks, particularly below ground, as recognized in decision IX/16 D, and as recognized by the report of the second Ad-Hoc Technical Working Group on biodiversity and climate change (UNEP/CBD/SBSTTA/14/INF/21) that peatlands and other wetlands store more carbon than the world's tropical forests;

Recommendation XIV/5*.* In-depth review of the work on biodiversity and climate change
(n)Implement ecosystem management activities, including the protection of natural forests, natural grasslands and peatlands, the sustainable management of forests, the use of native communities of forest species in reforestation activities, sustainable wetland management, restoration of degraded wetlands and natural grasslands, conservation of mangroves, salt marshes and seagrass beds, sustainable agricultural practices and soil management as a contribution towards achieving and consistent with, the objectives of the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification and the Convention on Biological Diversity;

(s)Adopt policies that integrate and promote biodiversity conservation, especially with regards to soil biodiversity, while conserving and restoring organic carbon in soil and biomass, including in peatlands and other wetlands as well as in grasslands, savannahs and drylands;

SBSTTA 17 (Montreal, 2013) adopted Recommendation XVII/1*:* Scientific and technical needs related to the implementation of the Strategic Plan for Biodiversity 2011-2020
Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Peatlands and the United Nations Framework Convention on Climate Change (UNFCCC)

The 37th Session of the Intergovernmental Panel On Climate Change (IPCC) in Batumi, Georgia (14-18 October 2013) adopted the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands - Methodological Guidance on Lands with Wet and Drained Soils, and Constructed Wetlands for Wastewater Treatment - (Wetlands Supplement). This document provides guidance an methodology to assess GHG emissions from peatlands including tropical peatlands. It also provides guidance on rewetting of peatlands and related emission factors. This document was specifically requested by the parties to the UNFCCC to assest them in undertaking action to reduce emissions from peatlands and guide rewetting and restoration of drained peatlands.

Since December 2011 (UNFCCC Durban) peatland rewetting has been included in the Kyoto Protocol. For the Second commitment period (2013-2017), countries may choose peatland rewetting to comply with Kyoto Protocol commitments. While this does not apply to countries in Se Asia the experience from this may provide input to the mechanisms in the new global agreement on limiting emissions currently under negotiation by UNFCCC and expected for implementation by 2020. In the meantime south east Asian countries can consider peatland rewetting and sustainable management

as Nationally Appropriate Mitigation Actions or NAMAs. If classified as NAMAs these measures may be eligible for funding under new mechanisms being established to fund NAMAs. Peatland management actions can also be considered as part of national climate change adaptation strategies as improved management of peatlands can reduce the risk of fire, flooding, water shortages etc as a result of changing climate patterns. Support can be requested from the least Developed Countries Fund and the Special Climate Change Fund (SCCF) as well as the Adaptation Fund and in the future potentially the Green Climate Fund. Bilateral funding mechanisms are also available to support emission reductions through enhanced peatland management.

With regard to potential financing under voluntary mechanisms - specific guidelines have been developed under the Verified Carbon Standard including:

· Global standard for Peatland Rewetting and Conservation (PRC) under Verified Carbon Standard. The Peatland Technical Working Group developed existing VCS requirements for peatland rewetting and conservation projects (PRC), released in 2011.

· Agriculture, Forestry and Other Land Use (AFOLU) Requirements (V.3.3, 3rd October 2012) provides the VCS Program requirements for the development of Agriculture, Forestry and Other Land Use (AFOLU) projects and methodologies. Eligible AFOLU project categories include Afforestation, Reforestation and Revegetation (ARR), Agricultural Land Management (ALM), Improved Forest Management (IFM), Reduced Emissions from Deforestation and Degradation (REDD), Avoided Conversion of Grasslands and Shrublands (ACoGS) and Wetlands Restoration and Conservation (WRC).

New VCS methodology for rewetting SE Asian peatlands

A new Verified Carbon Standard (VCS) methodology was adopted in 2014 that quantifies the emission reductions and removals achieved by rewetting drained peatlands. This methodology falls within the VCS category of Restoring Wetland Ecosystems, and is the first VCS methodology to address emission reductions and removals associated with rewetting peatlands.
The methodology applies to project activities in which drained tropical peatlands are rewetted through construction of permanent or temporary structures such as dams. These structures reverse the pattern of drainage and the damage caused by pre-existing drainage channels. Outputs from the Simulation of Groundwater (SIMGRO) model form the basis of the quantification of emission reductions. The model calculates water table depths on the basis of a range of input parameters such as terrain characteristics, peat thickness and climate variables.

The methodology is applicable to projects in the main tropical countries with peatland soils in Southeast Asia; specifically, Malaysia, Indonesia, Brunei and Papua New Guinea. Downloadable under: http://www.v-c-s.org/sites/v-c-s.org/files/Rewetting%20of%20drained%20tropical%20peatlands%2C%2026%20Aug%202014.pdf
Source: IMCG Bulletin August 2014

SE Asia Regional Level

ASEAN Regional Haze Action Plan (RHAP)
The Regional Haze Action Plan was endorsed by the ASEAN Environment Ministers in December 1997 during a period of intense fire and transboundary haze pollution. Under its overall framework, strategic measures and activities have been targeted to strengthen the region's capacity and capability to address transboundary haze pollution. The RHAP has three primary objectives, namely (i) to prevent land and forest fires through better management policies and enforcement; (ii) to establish operational mechanisms to monitor land and forest fires; and (iii) to strengthen regional land and forest fire-fighting capability with other mitigation measures.

The RHAP has three major components: prevention, mitigation and monitoring. Malaysia takes the lead in prevention, Indonesia in mitigation, and Singapore in monitoring of fires and haze. ASEAN Member States (AMSs) also undertake national-level actions that relate to the three RHAP components. Implementation of the RHAP at the sub-regional and regional level should complement measures taken at the national level.

ASEAN Agreement on Transboundary Haze Pollution
The Landmark ASEAN Agreement on Transboundary Haze Pollution was signed by the ten AMSs on 10 June 2002 in Kuala Lumpur, Malaysia and came into force on 25 November 2003. It contains provisions on monitoring, assessment and prevention, technical cooperation and scientific research, mechanisms for coordination, lines of communication, and simplified customs and immigration procedures for disaster relief. The Agreement also provides for the establishment of an ASEAN Coordinating Centre for Transboundary Haze Pollution Control. To date, Brunei Darussalam, Cambodia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam have ratified the Agreement and deposited their instrument of ratification with the ASEAN Secretariat. Indonesia is still in the process of ratification.

ASEAN Peatland Management Initiative (APMI)
The concept for this initiative was developed through discussion with a broad range of agencies in 1999-2001. Information on peatland fires and the need for cooperation was discussed at the 13th ASOEN-HTTF Meeting and the 7th ASEAN Ministerial Meeting on Haze (AMMH) in July 1999. The 19th ASOEN-HTTF Meeting and the 9th AMMH on 10-11 June 2002 discussed the issue of fire prevention and control in peatlands. The 9th AMMH also discussed the need for proper development and utilisation of peatlands in the region, and requested the HTTF and its working groups to explore development of this initiative. The APMI was discussed and developed further through consultations, questionnaires and regional meetings, and was adopted in February 2003 at the 20th ASOEN-HTTF Meeting in Manila, Philippines, together with a work plan for 2003-2005. The APMI was highlighted at the 10th AMMH in March 2003 in Siem Reap, Cambodia.

ASEAN Peatland Management Strategy (APMS)
As a main output of the APMI, this regional Strategy was developed to provide a common framework for peatland management in the region in the period 2006–2020. There are four main objectives to the proposed strategy, namely:

- To enhance understanding and build capacity on peatland management issues in the region.
- To reduce the incidence of peatland fires and associated haze.
- To support national and local level implementation activities on peatland management and fire prevention.
- To develop a regional strategy and cooperation mechanisms to promote sustainable peatland management.

This strategy includes 25 operational objectives in 13 focal areas namely inventory and assessment; research, awareness and capacity building information sharing, policy and legislation, fire prevention, control and monitoring, conservation of peatland biodiversity and integrated management of peatlands, promotion of demonstration sites for peat, restoration and rehabilitation, peatland and climate change, regional cooperation and financing of the implementation strategy. The strategy was endorsed by the HTTF in November 2005 and adopted by the ASEAN Ministerial Meeting on the Environment in November 2006 in Cebu, Philippines. National Action Plans (NAPs) on Peatlands are being prepared in AMS to provide the respective Member States with their national focus, and identify agencies involved, funds and requirements for implementing activities towards the sustainable management of peatlands. The status of development of NAPs is shown below:

Status of National Action Plans on Peatlands (NAP) in ASEAN Member States as at June 2014

Country	NAP status
Brunei	NAP finalised
Cambodia	Peatland assessment underway. NAP yet to be developed.
Indonesia	NAP completed in 2006 and revised in 2012. Key issues to be included in Government Regulation on Peatlands
Lao PDR	Peatland assessment underway**.** Consultation started in August 2012
Malaysia	Completed in 2010. Endorsed by Cabinet August 2010 and under implementation
Myanmar	Peatland assessment underway. NAP planned after assessment is complete
Philippines	Completed in 2009. Incorporated into National Wetland Strategy and Action Plan; and the Philippine Development Plan (2011-2016).
Singapore	Existing peatlands zoned within Natural Reserve. Focus on supporting issues at regional level. No NAP proposed to be developed.
Thailand	Draft NAP awaiting government approval
Vietnam	Final Draft completed. Awaiting government approval.

Regional Institutional Framework

The main regional institutional framework related to peatland management and degradation is described in the SSEAN peatland management strategy 2006-2020 which was revised in September 2013. The implementation mechanism for the strategy will build on the current arrangement under the APMI and AATHP. The main mechanism for the management will be through the ASEAN's mechanisms related to land and forest fire and transboundary haze pollution, notably the AATHP (see Figure 1a).

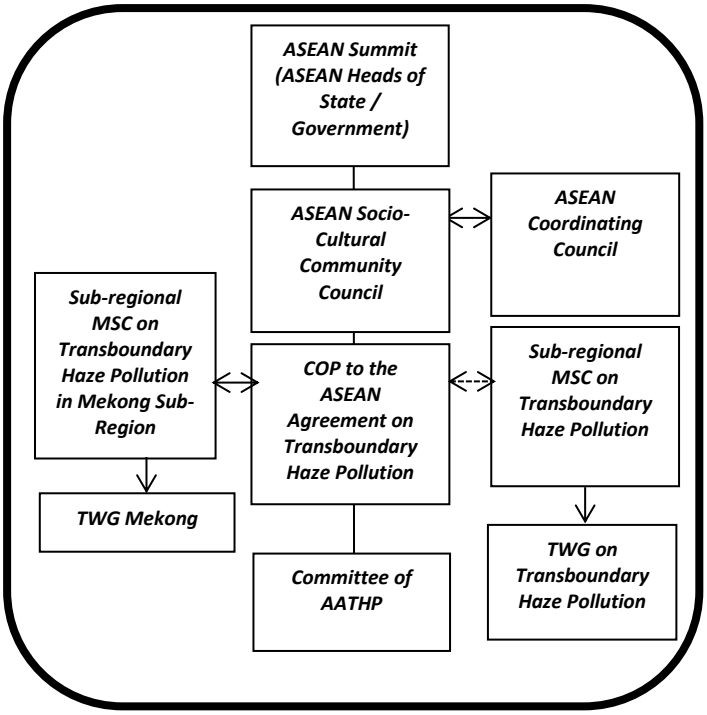


Figure 1a Diagram showing the ASEAN institutional framework on transboundary haze

The outline of the mechanism to oversee the APMS is shown in Figure 1b below:

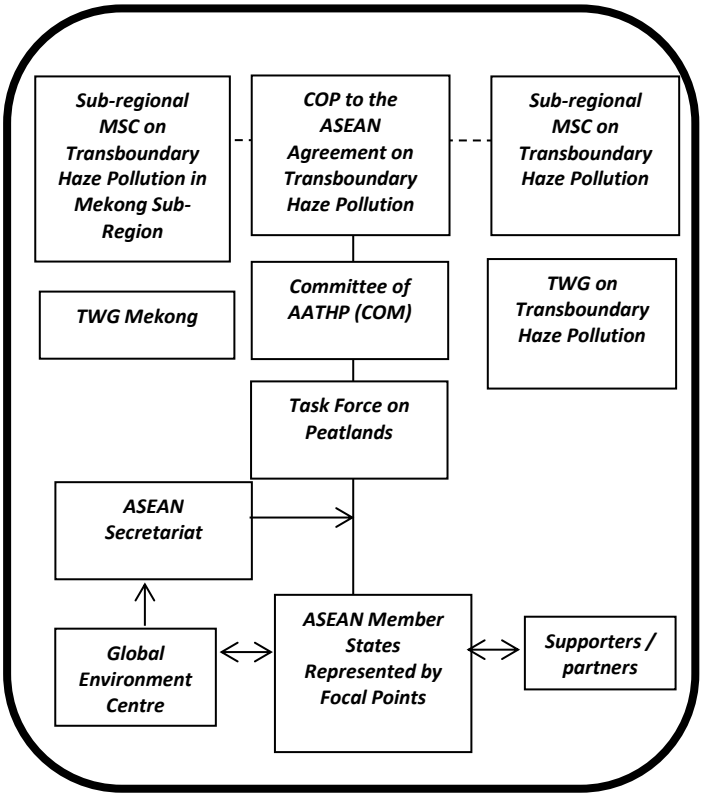


Figure 1b: Diagram showing the ASEAN institutional framework to oversee and guide the implementation of the ASEAN Peatland Management Strategy at the regional level

- ***COP: Conference of the Parties***
- ***TWG : Technical Working Group (southern region)***
- ***TWG Mekong: Technical Working Group in Mekong Sub-region***
- ***MSC: Ministerial Steering Committee (southern region)***
- ***MSC Mekong: MSC in Mekong Sub-region***
- ***ASEC: ASEAN Secretariat***
- ***GEC: Global Environment Centre***

The Conference of Parties (COP) on Transboundary Haze Pollution
The COP on Transboundary Haze Pollution will provide oversight and policy guidance for the implementation of the strategy as well as facilitating linkage to activities at the national level. Task Force on Peatlands will be established under the COM to specifically look into peatland issues and give input to the implementation of the strategy and undertake other technical tasks. Linkage should also be made to other appropriate ASEAN structures especially the ASEAN Working Group on Nature Conservation and Biodiversity.

ASEAN Secretariat
The ASEAN Secretariat will undertake the formal coordination amongst AMSs and facilitate the main regional activities and meetings as well as linkage with other activities coordinated through the ASEAN Secretariat.

Task Force on Peatlands
An ASEAN Task Force on Peatlands will be established as a subsidiary body under the COM of the ASEAN Agreement on Transboundary Haze Pollution (AATHP) to monitor and guide implementation of the APMS. Membership will include representatives from APMS focal points from ASEAN Member States and peatland experts.

Global Environment Centre (GEC)
The GEC is a well-established organisation based in the ASEAN region with special expertise on peatlands and the Coordinator of the SE Asian Peatland Network with over 400 members. It is a Founding Partner of the APMI and has provided technical and operational support to the APMI/APMS since its inception. GEC will continue to provide this technical and operation support for the implementation of the strategy as well as assist in generating resources to support its implementation.

ASEAN Member States (AMSs)
The AMSs will play a critical role in directly implementing the strategy within each country as well as contributing to regional activities. Implementation by the AMSs will be guided by their respective NAPs.

Partners
Partners of this initiative include those organisations or on-going projects which are undertaking activities related to sustainable management of peatlands in the region. They contribute by:
▪Assisting in the implementation of appropriate components of the strategy
▪ Exchanging experience and lessons learned from their activities
▪ Inviting participation of countries and institutions in the ASEAN region in their activities as appropriate
▪ Providing other contributions as necessary

Supporters

Supporters include donors, research or educational institutions, private sector and the media. They assist by:

- Providing funds or technical guidance
- Promoting the initiative and providing other support

Active participation of partners and supporters in the implementation of the strategy will be encouraged to draw from their wealth of expertise and experience and to promote a strong sense of commitment and ownership of projects and activities.

1.2.3 Common Issues and Concerns relating to Peatland Forests in SE Asia

The common issues and concerns described below are drawn from the presentations made at the *Workshop on the integrated Management Plans for Peatlands in Southeast Asia* held from 9-10 July 2012 in Cherating, Pahang, Malaysia.

1. Peatland fires and transboundary haze

The most important management issue of regional importance is the prevention of fires in modified peatlands. Peat fires in the SE Asia region almost always occur as a result of human intervention. Un-drained peat rarely burns – so peat fires, and the resulting transboundary haze pollution, have mainly been attributed to drainage of peatlands for agriculture, forestry and other purposes.

2. Carbon losses

The high levels of organic carbon in peatlands make them a significant carbon store. Peatlands in the ASEAN region are thought to store up to 5% of all carbon stored on the world's land surface. Burning of peat can lead to significant carbon emissions. Table 4 provides a summary of the total emissions from degrading peat in 1990 and 2008 for individual SE Asian countries (where available), Asia and at the global level. These estimates mainly relate to emissions from drainage and not fire. More recent estimates show emissions of up to 1.5 Billion tonnes of CO_2/annum.

Table 4: Total emissions from degrading peat in 1990 and 2008

Country/Region	1990 (in Mton CO_2/annum)	2008 (in Mton CO_2/annum)
Indonesia	200	500
Malaysia	14	48
Vietnam	5.3	5.2
Myanmar	4	4
Thailand	2.2	2.2
Brunei	0.4	0.6
Laos	0.4	0.4
Philippines	0.3	0.3
Singapore	0.07	0.07
Southeast Asia	345	722
Global (total)	1058	1298

Source: Extracted from Wetlands International (2010)

3. Degradation and loss of peatland forests and their services

Of primary concern in this regard is the resulting modification of water regimes loss of the hydrological regulation services provided by naturally-functioning peatland ecosystems. Water management is the critical issue for the management on peatlands: drainage of natural forest increases the rate of subsidence, and increases the risk of fires in the peatland and adjacent areas, particularly during the dry seasons. Commercial and illegal logging, and agriculture and plantation development are the other main drivers for peatland loss in SE Asia (Box 2).

Box 2. Main Drivers and Impacts of Peatland Degradation and Loss in SE Asia between 1980 and 2012

Agriculture and plantation development
Mega-rice project, Kalimantan: 1.5 million ha
Oil palm and Pulp and paper plantations: 3 million ha
Other agriculture, including smallholder activities: 2-3 million ha
Commercial and Illegal logging
Majority of PSF allocated for harvesting; relatively few implementing sustainable management plans
Widespread illegal logging
Fires
1 million ha East Kalimantan 1982/83 El Nino
3 million ha Sumatra, Kalimantan in 1997/98 El Nino
Significant additional areas burnt in 2002, 2006

Source: *Workshop on the integrated Management Plans for Peatlands in Southeast Asia* held from 9-10 July 2012 in Cherating, Pahang, Malaysia.

4. **Lack of knowledge and understanding regarding the peatland ecosystem**
   One significant constraint to peatland management is the lack of knowledge and understanding of the functions and complexity of the peatland ecosystem. This hinders efforts to identify the broad, cross-cutting measures needed to manage the peatland ecosystem at a scale that is appropriate to enable the system to continue to provide services.

5. **Lack of policy, legislative and planning frameworks to promote the integrated management of peatland forests**
   In all SE Asian countries, peatlands are governed by policies related to environmental management, forestry, water resources, fisheries, water regulation, forest and land fire control, water pollution, protected areas, and forest protection. Such policy frameworks often have gaps or create conflicts for peatland management. Given the largely sectoral approach to the development and implementation of these policies (and their resultant plans), the values of peatland ecosystem services have not been sufficiently captured and included. Some sectoral policies, such as those that deal with forestry and agricultural expansion contain provisions that encourage the clearing of peatlands. While these actions can have beneficial economic and social impacts, they could potentially lead to the loss of vital ecosystem services provided by the natural functioning peatland such as flood control resulting in increased flooding of the areas located downstream of the peatland.

   In some countries, drainage and agricultural production subsidies are often strong financial inducements to convert peatland forests to cultivated land. Without the inducement, economic factors would usually discourage conversion. Conversely, there are few incentives for landowners to maintain peatlands in a natural state.

Other concerns include, but are not limited to:

1. **Loss of biodiversity**
   Peatland forest biodiversity is lost through drainage and clearance, and as a result of fires. Over-harvesting of peatland species such as timber tree species and medicinal plants also leads to loss of biodiversity resources, many of which are unique to the peatland habitat. Additionally, altered or fragmented peatland ecosystems are more susceptible to invasion by non-native species of animals, and risk the introduction of new diseases by promoting the transmission and exchange of parasites between resident and non-native species.

2. **Impacts from community livelihood activities**
   Local community groups use peatland forests and its resources to earn a livelihood, e.g. collecting medicinal plants, harvesting non-hardwood products, and farming. These activities can cause small-scale and largely localised impacts on peatlands.

3. **Data uncertainties on the total area of peatlands at the regional and national levels**
   The total area of peatlands in SE Asia is *estimated* to be about 25 million hectares. As with other wetland types in SE Asia this figure is indicative only as it derives from a range of published values for the total tropical peatland resource, most of which are derived from pre-1990 sources. There has subsequently been considerable land development in most of the SE Asian countries where peatlands are found and, since deforestation and drainage can lead to rapid oxidative losses of organic material, there has likely been a reduction in the area of peatland which is not accounted for in current estimates. An additional problem is that natural peatland converted to another land use may then not be classified as a peatland but as agricultural land, although by definition, these are still peatlands. Box 3 illustrates the challenges arising from data uncertainties on the total area of peatlands in Indonesia.

Box 3. Data uncertainties on the status of peatlands in Indonesia

There is insufficient information on the status of peatlands in Indonesia. Brady and Kosasih (1991) and Brady *et. al.* (1995), recorded that peatlands with a peat depth of up to 17m could be found in Sumatra, Kalimantan and Irian Jaya (Papua). Most of the areas are covered with mixed forests, secondary forests of logged-over areas, shrubs and swampy grasslands. However, the absence of common definitions, measurement techniques and other peatland-related information (forest status or intensive converted peatlands) has seen substantial divergence on the same information. The recent data from Wetlands International (Wahyunto and Heryanto, 2005) revealed that peatland area in Indonesia is estimated to be 20.6million ha or about 11% of the land area of Indonesia. Of this, about 5.8million ha or 28% is said to be in Kalimantan, and about 7.2million ha or 35% in Sumatra.

The absence of a common understanding on definitions and techniques has also made monitoring and evaluation of peatlands very difficult. Indonesia does not have the actual rate of degradation of peatlands, but it is estimated that about 50% of peatland areas in Indonesia has been degraded. This approximately tallies up with 15% of the total deforestation rate in Indonesia.

Sources: www.aseanpeat.net

1.3 The need for an integrated approach to managing peatland forests

The integrated management of peatland forests is a key element in ASEAN Peatland Management Strategy. The primary ecological rationale for this is that each peatland is a discrete hydrological unit. Drainage of one portion leads to drainage and subsidence of other portions, while patchwork development will fragment the peatland. Actions such as these lead to the loss of vital ecosystem services provided by a naturally-functioning peatland unit.

From an economic perspective, there are three broad, interrelated economic reasons why peatland ecosystems continue to be lost. These are i) information failures, ii) market failures, and iii) exaggeration of the private benefits of habitat conversion.

For many peatland ecosystems there is a lack of awareness about of the connection between the services provided by the natural system and how this declines as the system is degraded as a consequence of human-induced impacts, such as drainage, clearing and burning, and infilling for agricultural development. Although this is an understandable reflection of substantial technical difficulties in undertaking some evaluations, future work needs to focus on comparing delivery of multiple services across a range of competing land uses if it is to better inform policy and planning decisions.

Second, market failures play a fundamental role in driving habitat loss. In most cases studied, the major benefits associated with retaining systems more or less intact are non-marketed externalities, accruing to society at local and global scales. Conversion of ecosystems generally makes narrow economic sense as external benefits or related external costs (as in the case of the damage caused by conversion of a peatland forest to agriculture) have very little impact on those standing to gain immediate private benefits from land-use change. Hence, conserving relatively intact peatland habitats will often require compensatory mechanisms to mitigate the impact of private, local benefits foregone, especially in developing countries. The development of market instruments that capture at a private level the social and global values of relatively undisturbed peatland ecosystems, for example through carbon or biodiversity credits or through premium pricing for sustainably harvested wild caught fish or timber, is a crucial step toward sustainability.

In order to effectively address these challenges, peatland planners and managers need to evaluate the significance of peatland ecosystem services at various scales, and within the appropriate national/subnational economic development scenarios, and policy and planning frameworks.

Management planning for peatland forests therefore has to involve multiple agencies, local communities and the private sector; it has to address a range of elements including, but not limited to, forest and water management, land use, fire prevention, community livelihood, and carbon and biodiversity conservation; it has to be based on a long term, in-depth understanding of the nature and functioning of the peatland unit; and its implementation needs to be supported by appropriate coordination and regulatory mechanisms.

1.4 Aim, Intent and Target Audience for these Guidelines

The overall aim of the guidelines and their implementation is to achieve recognition of the importance of peatland forests to the maintenance of global biodiversity and the storage of the water and carbon that is vital to the world's climate system, and to promote their wise use, conservation and management for the benefit of people and the environment.

These guidelines are intended to inform the planning, development and management of peatland forests in the ASEAN Member States, as called for in the ASEAN Peatland Management Strategy. These Guidelines can be applied at the site, local/provincial, basin or national levels, and to some extent at the regional and global levels.

These Guidelines provide:

a) a framework for site, local/provincial, basin and national policies, strategies and plans to promote the integrated management of peatland forests;
b) guidance on mechanisms to foster local, national, regional and international partnerships of government, the private sector, and non-government agencies to fund and implement actions in support of the integrated management of peatland forests; and
c) approaches to facilitate adoption and support for implementation of action on peatland forests through international and regional framework treaties and agreements such as the Ramsar Convention, the CBD, the UNFCCC, the ASEAN Agreement on Transboundary Haze Pollution and other appropriate instruments.

This document intended primarily for use by local, regional and national planning authorities, and managers of peatland reserves and sites in the ASEAN Member States.

Other users include national level policy and decision-makers, government agencies and private companies involved in developing and managing peatland forests for various uses, and governmental and non-governmental organizations and aid agencies working to support and promote the sustainable management of the peatland forests in SE Asia.

The anticipated outcomes of implementing these Guidelines are:

- Increased cooperation across departments, governments and other organizations to manage peatland forest ecosystems;
- Better integrated responses to cross-cutting issues and unanticipated events related to peatland forest ecosystems;
- Better and more timely collection of information on key risks and their relationship to existing programmes and initiatives, and to the provision of ecosystem services from peatland forests;
- Ongoing measurement of the actual effects of policies, programmes and operations on peatland forest ecosystems;
- Identification of areas of shared responsibility among key stakeholders; and
- Greater accountability in the management of these shared responsibilities.

1.5 Using these Guidelines

The *Guidelines on Integrated Management Planning for Peatland Forests in SE Asia* is designed to be used in tandem with broader policy-related documents (e.g. land-use, river basin, climate change, and poverty reduction), sectoral management planning documents (e.g. water, agriculture, forestry plans), and national action plans for peatlands, where they exist. The premise is that management planning for peatland forests requires an integrated approach from planning inception through to

implementation. An integrated approach requires the involvement of a multidisciplinary management team; peatland forests cannot be sustainably managed by any one discipline in isolation.

These Guidelines are limited in scope to approaches and activities that speak directly to the *integrated* management of peatland forests and not the practical application of management techniques for peatland conservation and wise use. It is a guideline and not a handbook, which means that it outlines a general approach rather than a precise recipe for integrated management planning. The body of the text contains guiding principles, and recommended approaches and activities, with a minimal level of background material. The reader is, therefore, directed to the bibliography of published literature for information pertinent to the management of peatland forests.

Part 2: Guiding Principles and Priority Approaches for Integrated Management Planning of Tropical Peatland Forests

Introduction

2.1 The Guiding Principles

The approach to integrated management planning for peatland forests adopted by these Guidelines is founded on five basic principles:

1. Recognition of the critical function of tropical peatland forests in retaining and distributing water across the river basin landscape;
2. Recognition of the complex interaction of climate, hydrology, geology, ecology and time on the creation and evolution of peatland forests in the tropical region;
3. Recognition of the need for inter-disciplinary collaboration and coordination when working towards integrated management planning;
4. Recognition that good will, compromise and communication among stakeholders will be invaluable in the pursuit of a complex and dynamic result – healthy, functioning peatland forests that approximate natural systems as best as current knowledge and capabilities allow;
5. Recognition that best practices will evolve with continued research, monitoring, and adaptive management.

The principles above are inherent in the Guidelines presented in Part 3, and consistent with the operational objectives defined for Focus Area 8: *Integrated Management of Peatlands* of the ASEAN Peatland Management Strategy.

As a matter of 'good practice', planners and managers need to build these cross-cutting principles into all components of their work, to ensure that the coordination and coherence required for effective results is actually achieved. In addition to these principles, there are 13 key elements that define a successful integrated management planning process for wetlands, including peatlands (Table 5).

Table 5. The key elements of a successful integrated management planning process for peatlands

Jurisdiction	Management authorities and jurisdiction of government departments and agencies are acknowledged and affirmed.
Recognition	Existing agreements and commitments are recognized.
Cross-sectoral cooperation in policy development and implementation	All of the public sector agencies with responsibilities for activities or policies that influence land, water and peatland forests should commit themselves to cooperative processes of consultation and joint setting of policy objectives, at national level as well as at river basin level.
Equity in participation and decision-making factors	There should be equity for different stakeholders in their participation in management decisions related to peatlands.
Consensus	Decisions and recommendations are made by consensus and the process includes mechanisms for dispute resolution.
Accountability for decisions	Decision-makers should be accountable. If agreed procedures are not followed or subjective decisions can be shown to be contrary to the spirit of the above principles, then decision-makers should provide a full explanation. Stakeholders should have recourse to an independent body

	if they feel that procedures have not been followed.
Transparency in implementation	Once plans, procedures and management decisions have been defined and agreed, it is important that they are seen to be implemented correctly.
Clarity of process	The process by which decisions are made should be clear to all stakeholders
Flexibility of management	It is essential that an adaptive management strategy be adopted, which requires plans that can be changed as new information or understanding comes to light.
Efficiency	The process respects and strengthens existing approaches, facilitates cooperation and collaboration and avoids overlap and duplication, with issues being addressed in a timely manner.
Credibility of science	Scientific methods used to support management decisions should be credible and supported by review from the scientific community.
Precautionary Principle	Decisions made are taken with due diligence to the risks identified.
Sustainability as a goal	Adequate protection from the impacts of land and water uses should be provided, respecting the natural dynamics of the ecosystem for the benefit of future generations.

2.2 Priority Approaches

Resolution VIII.17 Guidelines for Global Action on Peatlands (GAPP), adopted at the 8th Conference of the Contracting Parties to the Ramsar Convention (COP8, Valencia, 2002), forms the basis for the development of a global action plan for peatlands by Ramsar Contracting Parties, the Convention's bodies, and International Organization Partners and other organizations working to address peatland issues. Resolution VIII.17 "…. ENCOURAGES Contracting Parties, within their capacities, to implement these guidelines."

The overall aim of the GAPP and its implementation is to achieve recognition of the importance of peatlands to the maintenance of global biodiversity and the storage of the water and carbon that is vital to the world's climate system, and to promote their wise use, conservation and management for the benefit of people and the environment.

The GAPP recommends a series of priority approaches and activities for global action on the wise use and management of peatlands under seven themes:

A. Knowledge of global resources
B. Education and public awareness on peatlands
C. Policy and legislative instruments
D. Wise use of peatlands
E. Research networks, regional centres of expertise, and institutional capacity
F. International cooperation
G. Implementation and support

The *Guidelines on the Integrated Management of Peatland Forests in SE Asia* presented in Part 3 of this document adopts the same seven themes as that of the GAPP to provide a framework for actions and outcomes at the site through to the national levels to respond to, and inform, priorities at the global level. Equally, it allows for future revisions/updates to the GAPP to be fed back into the integrated management planning processes at the national through to the site levels. Finally, for Ramsar Contracting Parties in the SE Asian region, it facilitates reporting on the implementation of the GAPP.

Part 3: Guidelines for Integrated Management Planning for Peatland Forests in SE Asia

Theme 1: Knowledge of peatlands and their resources

1.1 Inventory of the peatland forest resource

Defining and classifying peatlands: Estimates of the extent of peatlands in SE Asian countries differ significantly among different studies and are highly dependent on the definition of peatlands used and on the methods for classifying and delineating peatlands. In some cases, this problem is compounded by outdated or incomplete data. When outdated or incomplete data from the site, local, provincial/state level is aggregated to the national level and subsequently to the regional level, the resultant figures have limited value as a basis for regional planning and management related to peatlands.

The ASEAN Peatland Management Strategy recognises that one of the problems in managing the region's peatland resources arises from the lack of common definition and classification of peatlands in the region which in turn leads to problems in clearly delineating the peatlands and developing common management guidelines.

Within each country, the lack of a nationally-accepted definition for peatlands (as illustrated in Box 1 in Part 1 of this document), and the lack of a nationally-accepted classification system for identifying and delineating peatland ecosystems is a serious stumbling block to efforts to integrate the management planning for peatland forests into broader policy and planning frameworks.

Finally, where data is available through scientific and research studies, it is often not readily accessible and not presented in a form that is digestible by non-technical resource managers, planners and decision-makers.

Peatland character: Tropical peatland forests are highly diverse and differ significantly in character throughout its distribution in SE Asia. Variances in location, climate, hydrology, and peat-deposition age and depth all influence the character of a peatland ecosystem. While much of the SE Asian peatlands are forested, the difference in their character is not often recognised and therefore not factored into planning and decision-making related to their use.

Ecosystem services: Comprehensive information about the full suite of ecosystem services provided by peatlands is lacking. Decisions about peatland development tend to be dominated by a single sector approach which focuses entirely on the provisioning services, such as the extraction of timber products, water supply, or for the harvesting of fibre, fuel or food. Often, regulating services such as flood mitigation, maintenance of base flows in rivers, and groundwater recharge and discharge, are not accounted for in the land-use planning process. This is largely due to two factors: a) the lack of knowledge, information and data about the importance and value of these 'unseen' services; and b) where the knowledge, information and data exists, it is not communicated to decision-makers and land-use planners in a timely manner or not presented in a form that can be used to advise planning processes.

According to Page et al 2011, peatlands in SE Asia store at least 68,500 Megatonnes (Mt) of soil carbon. This carbon is increasingly released to the atmosphere due to drainage and fires associated with plantation development and logging. At the same time, there are some newly-emerging possibilities for conserving peatlands, particularly for their carbon storage function, through *Reduced*

Emissions from Deforestation and Degradation (REDD) and REDD+, and Carbon financing mechanisms under Article 3.4 of the Kyoto Protocol, which allows for activities that enhance carbon sequestration in agricultural soils to be counted towards emission reduction targets, and be traded on the international carbon market via the Protocol's "flexibility mechanisms".

Voluntary emission reductions are reductions that are not mandated by any law or regulation, but originate from an organisation's desire to take active part in climate change mitigation efforts. This may enable the organisation to be recognised as a proactive advocate for new technologies and approaches in this area. The voluntary carbon market is now growing because companies, government bodies, non-governmental organisations, and others that are often not subject to binding greenhouse gas regulations wish to:

- Make a quantifiable contribution to reduce emissions
- Increase response options and flexibility of carbon management
- Enhance public relations
- Generate goodwill by entering the carbon market
- Cement strategic interest in specific offset projects
- Manage corporate social responsibility commitments
- Become carbon neutral and/or sell carbon neutral products and services

Voluntary carbon units are providing companies and institutions with a solution to accelerate the shift towards a low carbon economy. This is done by channelling funds through voluntary offset programs to low carbon technologies that directly reduce greenhouse gas emissions from the production and consumption of energy and from industrial processes.

Status and Condition of the peatland ecosystem: Information on the current status of peatlands in each SE Asian country is lacking particularly with regards changes in land-use, and the resultant impact on the condition of the ecosystem. Condition is a subset of status; it focuses on the hydrological condition of the peatland ecosystem including, but not limited to, the effects of draw-down of water tables (permanent or seasonal), the status of the biodiversity within the ecosystem, and the presence of barriers to the functioning of the system, e.g. trunk roads, canals, etc.

Inventories of wetlands (including peatlands) have been conducted at the Asia regional level and at the national level in some SE Asian countries. However, these only captured discrete peatland sites that, at the time, fulfilled the *Ramsar Criteria for Wetlands of International Importance*, and then, only for the peatland sites for which information was available at the time.

Additionally, such inventories have been conducted from a conservation viewpoint, focusing largely on biodiversity values. Peatland inventory data available through national soil surveys in relation to agricultural development, and national classifications of forest types were often not captured in these inventories. Finally, the regional and national inventories undertaken thus far were one-off exercises and none have been updated since, so they have limited value in terms of being able to inform integrated management planning for peatlands and peatland forests today.

A national inventory of peatland resources is an essential first step in any integrated management planning process.

The inventory should give priority attention to the following:

Action 1.1.1: Develop a nationally-accepted definition for peat, peatland and peatland forest.

Action 1.1.2: Develop a nationally-accepted classification system for peatland forests.

Action 1.1.3: Compile up-to-date information on where peat soils are present in the country. This should be mapped out accurately at the river basin level.

Action 1.1.4: Undertake comprehensive assessment of the full character of each peatland hydrological unit within the river basin.

Action 1.1.5: Undertake an assessment of the ecosystem services provided by each peatland hydrological unit within the river basin (including services that have been degraded or lost), and the current condition of each peatland unit, e.g. land use (e.g. secondary forest, logging concessions, oil palm plantations, tree plantations, perennial cropping, etc.), biodiversity status, and hydrological condition.

1.2 Detecting changes and trends in the quantity and quality of the peatland resource

Box 4. Working definitions for wetland inventory, assessment and monitoring:

Wetland Inventory: the collection and/or collation of core information for wetland management, including the provision of an information-base for specific assessment and monitoring activities.

Wetland Assessment: the identification of the status of, and threats to, wetlands as a basis for the collection of more specific information through monitoring activities.

Wetland Monitoring: the collection of specific information for management purposes in response to hypotheses derived from assessment activities, and the use of these monitoring results for implementing management. The collection of time-series information that is not hypothesis-driven from wetland assessment is here termed surveillance rather than monitoring.

Source: *Resolution IX.1, Annex E: An Integrated Framework for wetland inventory, assessment and monitoring*, Ramsar COP 9, 2005, www.ramsar.org

In most SE Asian countries, there remains a need for a comprehensive assessment and monitoring system to provide the basis for the decisions and plans related to peatland forest management, and to track trends in the status of the peatland resource.

Peatland forest assessments, as with inventory and monitoring, can be undertaken at discrete spatial scales using (different) appropriate techniques for each. The choice of the scale at which to undertake assessment and monitoring work, and the choice of appropriate methods for each scale, are key issues to be considered in any integrated management planning effort for peatland forests.

Critical elements to be considered in undertaking peatland status and resource assessments to inform integrated management planning for peatland forests include:

Scale: Given the hydrological complexities and inter-connectedness of the peatland ecosystems, peatland resource assessments should be undertaken at a spatial scale compatible with the scale of information required to facilitate integrated management planning, e.g. at the river basin level. Subsequent monitoring should also be undertaken at the same level. Whenever possible, an integrated inventory, assessment and monitoring programme for peatlands should be developed and conducted at the river basin level.

Aggregating data: Since peatland inventory, assessment and monitoring in SE Asia will be constrained by the scale and availability of information, practitioners are encouraged to aggregate data wherever possible rather than attempt to disaggregate data. This is possible when subsequent analyses draw on data from larger scales (e.g. combining data collected at 1:10,000 scale to represent a composite image at 1:50,000 scale) rather than smaller scales where issues of accuracy and precision will likely constrain effective analysis.

Tools and methodologies: In addition to on-the-ground assessment and monitoring (which can be time- and cost-prohibitive at the regional and national scales), modern earth observation (EO) systems and remote sensing offer considerable potential for peatland resource appraisals over large geographical scales, using a variety of techniques.

Global initiatives such as the *GlobWetland I* project (Box 5) have demonstrated that existing and future EO technology can play an important role in obtaining suitable information to support the mapping and inventory of wetlands (including peatlands) as a basis for management-oriented assessment and monitoring.

Box 5. GlobWetland and the Global Wetland Observation System (GWOS)

In 2003, the European Space Agency in collaboration with the Ramsar Secretariat launched the *GlobWetland I* project in order to demonstrate the current capabilities of EO applications to support inventorying, monitoring, assessment of wetlands ecosystems. The project was carried out from 2003 to 2008 in close collaboration with several regional, national and local conservation authorities and wetland managers, involving 52 different wetlands across 21 countries on four continents. This large range of wetlands conservations agencies and wetland sites provided an excellent test bed to assess the potential of EO technology to be applied in different conditions.

The main conclusion of the *GlobWetland I* project is that EO technology can be a cost-effective and very productive tool for the Ramsar Convention including *inter alia* for the management of peatlands. The Scientific and Technical Review Panel (STRP) of the Ramsar Convention recognised the huge value of this tool in the implementation of the Convention at all scales from global to regional, national and local scales and strongly recommended its use.

The results of *GlobWetland I* were presented at the Ramsar COP11 (2012, Bucharest). Resolution XI.6, paragraph 15 from this Conference welcomed "...the establishment by the Ramsar Secretariat of new Memoranda of Cooperation with the European Space Agency (ESA), concerning the *GlobWetland-II* wetland observing system."

The overarching objective of the *GlobWetland II* project is to contribute to the setting-up of a Global Wetlands Observing System (G-WOS) (as called for in Strategy 1.2 of the Ramsar Strategic Plan 2009-2015). The *GlobWetland II* project aims principally at developing a G-WOS (Global Wetland Observation System) pilot information system. The system consists of maps and system software. The GW-II system software comprises 3 components: a remote sensing component for tasks like satellite image pre-processing, land use/land cover classification, change detection; a GIS component e.g for the indicator computation; and a Web-GIS component for the permanent access to the maps and information data that have been produced during the lifetime of the project or provided by users and partners. A presentation on the *GlobWetland II* Mapping Software can be downloaded from www.globwetland.org

Source: www.globwetland.org

In Myanmar, remote sensing techniques have been used to identify possible peatland areas through image interpretation (Box 6).

Box 6. Peatland Assessment in Myanmar using Remote Sensing

A peatland assessment was conducted in Shan State, Myanmar, from 10 to 12 December 2012. The assessment was carried out in Heho, Inle Lake and Pintaya regions, all three of which are located in the Shan highlands.

The survey was carried out in cooperation with the Forest Resource Environment Development and Conservation Association (FREDA), which is the SEApeat project partner in Myanmar. 13 participants (1 from Vietnam, 2 from GEC Malaysia and 10 from Myanmar) took part in this exercise.

Remote sensing techniques were used to identify the possible peatland areas through image interpretation. To familiarize participants with the system, a short course on peatland identification using remote sensing was conducted by Vietnamese soil expert, Dr Le Phat Quoi. The training modules can be downloaded from www.aseanpeat.net

The assessment/ground-truthing was conducted using observation of peatland vegetation, information gathered from local farmers, and soil samples. Samples were taken using a peat auger and gauge auger. In the Heho region, the areas selected for peat assessment were largely on existing agricultural land. Beside rice paddies, cabbage, garlic and potato are grown in the area.

A total of 7 locations were assessed. Almost all the peat in this region was found beneath a layer of mineral soil. At Inle Lake, 4 locations were selected, but only one was identified as peatlands. In the other areas the peat is mixed with some clay and therefore could not be classified as peatlands. Two sites were selected for assessment in Pintaya, but only one location was sampled using auger, while the other was assessed by observation only.

A de-briefing of the fieldwork was held on 14 Dec 2012, followed by a short discussion with FREDA management and staff. Dr. Quoi presented the field assessment as well as some recommendations on the potential areas for future peat assessments.

Source: www.aseanpeat.net

Additional surveys were carried out between 15-27 February 2014; involving detailed surveys of the area in and around Inle Lake in Shan State with sampling and peat depth assessments in more than 70 locations.

A total of 9021 hectares of peatland was identified comprising three separate types:

1. Lake-margin peatlands up to three meters thick along the shores of Inle Lake
2. Floating peatlands between 50cm to 1.5m thick floating on the surface of the lake. These are subdivided into two—natural floating peatlands and modified floating peatlands used as floating gardens for the cultivation of tomatoes and other vegetables.
3. Calcareous spring mound peatland found in Taung Bo Gyi Village in the northwest corner of the Inle Lake wetland. This peatland has been formed over thousands of years around an active spring fed by calcium rich groundwater. It has formed a mound of peat about 6.5 m thick and covers about three hectares. Mound spring peatlands are very rare and this is one of the first to be described in Asia.

A basin-level Integrated Inventory, Assessment and Monitoring Programme can provide a sound basis for the management of peatland forests.

Such a programme should give priority to the following:

Action 1.2.1: Ensure that the integrated inventory, assessment and monitoring programme is developed and implemented at the appropriate spatial scale (e.g. the catchment/river basin level) required to facilitate integrated management planning. It should be sufficiently robust to be able to capture the hydrological complexities and inter-connectedness of the peatland forest ecosystems within, and to determine the status of, and detect change in, the peatland resources and services.

Action 1.2.2: Explore opportunities to access information available through global earth observation systems and remote sensing tools, to assess large-scale (regional and national levels) status and trends in peatland quality.

Action 1.2.3: At the catchment/basin and site levels, where possible, develop and use remote sensing techniques to identify possible peatland forest areas through image interpretation. This should be followed by ground-truthing to determine that the identified area meets the agreed definition to be classified as a peatland forest.

Action 1.2.4: Analyse findings from the inventory, assessment and monitoring to establish status and trends of the peatland forest ecosystem at the various levels. Disseminate these findings, in an appropriate format, to all relevant stakeholders to advice management, planning and decision-making related to peatlands.

Theme 2: Education and Public Awareness on the Importance of Peatland Forests

In order to ensure that the importance of, and need for, an integrated management planning approach to peatland forests is fully understood, it is important to develop and implement education, training and public awareness programmes focusing on peatland forests at all levels within a country.

The Ramsar Convention's *Communication, Education, Participation and Awareness (CEPA) Programme 2009 – 2015* (Resolution VIII.31, COP8, 2008) provides a framework for the development and enhancement of wetlands education and public awareness through which peatland education and public awareness can be delivered.

Investment in CEPA will increase the number of informed advocates, actors and networks involved in peatland management and build an informed decision-making and public constituency. This is especially important in any effort to integrate the management planning of peatland forests into broader policy and planning frameworks, for example, at the basin and national levels, because the target audience for such a Plan is much larger than if the focus was just at the individual site level.

It is important to increase the knowledge, skills and understanding of all stakeholders in order to build the consensus needed to bring about the desired results. Stakeholders (e.g. government administrations, research institutes, the private sector, NGOs, local communities and individuals) need to understand the various issues, respect each other's views and work together. At the Agusan Marsh in the Philippines, CEPA actions have targeted a range of stakeholders (Box 7).

Box 7. CEPA: Targeting a range of stakeholders in the Agusan Marsh, Philippines

The Agusan Marsh in the Philippines is one of the most important freshwater marshlands in the country. It is believed to hold about 15% of the country's freshwater swamp forest and resources.

As part of their efforts to promote the integrated management of the peatland forests in the area, they developed and implemented a number of *Information, Education and Communication Campaigns* targeted at a range of stakeholders. These included:

- **Community** dialogues for the sustainable use and protection of peatlands in 9 Barangays with confirmed peatlands;
- The Wetlands Caravan project, to mobilize **communities** for the conservation of Agusan Marsh and Wildlife Sanctuary;
- Lectures and presentations for the **Municipal Councils** from the 6 municipalities with confirmed peatlands, and **Wildlife Enforcement officers**;
- Video on "Saving and Protecting Philippine Peatlands" for a **general audience**;
- Production of peatland materials, such as comics entitled, "Juan Meets the Least Famous Forest" for **school children**, leaflets on "Care for Peatlands", and tarpaulins printed with information on what is peat, why manage peat and functions and uses of peatlands in English, Bisaya and Waray versions for a **general audience**;
- Staging of a peatlands exhibit for a **general audience**;
- Piloting the "Peatlands Ecosystems Awareness Tour" (PEAT) with the Caraga Young Artist for a **general audience**;
- A series of training programs on Peatlands Assessment and Management for **national agencies, local government units and local communities**;
- A series of Seminar Workshops on the *Protection and Sustainable Use of Peatlands through the Prevention and Suppression of Wild land Fires* for the **fire fighters** of municipalities concerned;

- Philippine Peatland Summit which provides a platform for experience sharing of best management practices among the participants from **national agencies, local government units concerned and the communities around peatlands**.

Source: *Workshop on the Integrated Management Plans for Peatlands in Southeast Asia*, 9-10 July 2012, Cherating, Pahang, Malaysia.

2.1 Develop a National Peatland CEPA Action Plan

A National Peatland CEPA Action Plan, focused on increasing awareness and understanding about the importance of, and need for, integrated management planning for peatland forests, can help to garner support for, and encourage the participation of all the relevant stakeholders at the various levels of planning and decision-making. Ideally, the National Peatland CEPA Action Plan should be a sub-set of the National Action Plan for Peatlands (NAP) currently being developed/revised by each SE Asian Member State. In this way, it is linked directly to the implementation of the NAP and serves as one of the series of tools needed to support the implementation of the NAP. The provisions within the National Peatland CEPA Action Plan should also be linked to the National CEPA Plan of Action, where it exists.

In developing and implementing a National Peatland CEPA Action Plan, it is important that all parties share a common understanding of what is meant by the acronym CEPA, "Communication, education, participation, and awareness", and also the terms "training" and "capacity-building". The definitions in Box 8 are intended to give a sense of what practitioners in this field commonly mean by these terms.

Box 8. Understanding what is meant by the terms "communication, education, participation, awareness, capacity-building and training"

Communication is a two-way exchange of information leading to mutual and enhanced understanding. It can be used to gain the involvement of 'actors' and stakeholders and is a means to gain cooperation of groups in society by listening to them first and clarifying why and how decisions are made. In an instrumental approach, communication is used with other instruments to support peatland conservation, to address economic constraints, and to motivate action.

Awareness brings the issues relating to peatlands to the attention of individuals and key groups who have the power to influence outcomes. Awareness is an agenda-setting and advocacy exercise that helps people to know what and why this is an important issue, the aspirations for the targets, and what is being and can be done to achieve these.

Education is a process that can inform, motivate, and empower people to support peatland conservation, not only by fostering changes in the way that individuals, institutions, business and governments operate, but also by inducing lifestyle changes. It may take place in both formal and informal settings. Education in the broadest sense is a life-long process.

Training is the process of increasing or strengthening specific knowledge, skills, attitudes and behaviours that can be taken back to the workplace. It may take place in both formal and informal settings.

Capacity-building includes a range of processes by which individuals, organizations and institutions develop abilities for effective implementation of wise use of wetlands. Abilities include inter alia facilities, funding and resources, infrastructure, enabling environments, etc.

Participation is the active involvement of "stakeholders" in the common development, implementation and evaluation of integrated management plans for peatland forests. Levels and kinds of participation can be highly variable, depending upon both the specific context and the decisions of the individuals and institutions leading the process.

The advice presented above is based, in part, on the *Mainstreaming Biological Diversity* publication (produced by UNESCO, the Convention on Biological Diversity, and IUCN).

Source: *Resolution X.8 Programme on communication, education, participation and awareness (CEPA) 2009-2015 of the Convention on Wetlands (Ramsar, Iran, 1971)* (Ramsar COP10, Changwon, 2008)

In terms of advancing integrated management planning for peatland forests in SE Asia, the most critical elements of any National Peatland CEPA Action Plan are Communication, Capacity building and Participation. Each of these is discussed in detail below.

2.2 Communicate Effectively

The main objectives of communication are to build trust between all stakeholders, build consensus, and ensure transparency in decision-making and in the implementation of actions. The end result of a successful communication effort is that all stakeholders are motivated to act to achieve a common vision or goal. The success or failure of any integrated peatland planning and management effort depends on this.

2.3 Build Capacity in Peatland Management

The main objective of capacity building is to improve the quality of decision-making, sector efficiency and managerial performance in the planning and implementation of sector programmes and projects (IHE-UNDP, 1991). For tropical peatlands, this can be obtained by improving knowledge on the functions and characteristics of these peatlands so that more sustainable management strategies can be developed and implemented. Capacity building should focus on the following elements (Ritzema and Wolters, 2001):

- Creating an enabling environment with appropriate policy and legal frameworks;
- Institutional development, including community participation, and;
- Human resources development and strengthening of management systems.

In this respect, capacity building is as much a process as a product (Kay and Terwisscha van Scheltinga, 2003). These three elements of capacity building can be addressed by the following activities:

- promotion of partnerships;
- involvement of stakeholders;
- integration of the various disciplines;
- acquiring new knowledge;
- dissemination of knowledge; and
- implementation of the newly acquired knowledge and skills.

Capacity building is a complicated process as many stakeholders, organisations as well as individuals are involved, i.e.:

- Research organisations and universities (Box 9);
- International, national and regional government organisations, acting as the principal funding agencies, but also the users of the end-products;
- Private companies: both as co-developers of the knowledge (as they bring in their experiences) and users of the end products;
- NGO's: also as co-developers of the knowledge (as they bring in their experiences) and users of the products.

Box 9. Capacity Building through Joint Research – The STRAPEAT Project

This 3-year STRAPEAT Project (December 2001 – November 2004) involved twelve European and Southeast-Asian research organisations in a multi-disciplinary research project, focused on doing research to better understand the complicated peatland ecosystems, and to actively implement strategies for practical use in critical peatland areas in Borneo. Capacity building was an integral part of the activities. 17 indicators were defined to assess the effects of these capacity-building activities, including conference presentations, the number of graduate MScs and PhDs, papers published in international journals, external funded projects, market surveys, and workshops, seminars and symposia.

The findings revealed the following improvements:

Human resources development: Increased knowledge on the natural resource functions
A the start of the project, two workshops for the project partners and representatives of the local research organisations were organised, one in Palangka Raya, Kalimantan, Indonesia and one in Sibu, Sarawak, Malaysia. Project partner meetings were organised every following year to review the ongoing research activities, to reach internal consistency, to update the research agenda, to integrate the various disciplines and to exchange information between partners and the local stakeholders. To enhance the exchange of information, a web site was developed (www.strapeat.alterra.nl). To train partners and at the same time to guarantee that the research is of academic quality, the partners embedded research activities in their formal education system. To present the project results to the international research community and to discuss the results with them, an international symposium and workshop was organised. That the research findings are of high academic quality is illustrated by the number of presentations and papers produced by the project partners.

Institutional development: participation of stakeholders in setting the research agenda and dissemination of the results ("wise use principles")
A series of annual seminars/workshops with local stakeholders was organised in Southeast Asia to inform stakeholders on the research findings, to interact with them on the research agenda, etc. To mark the end of the project, presentations of key outputs were made in a series of seminars/workshops held in Kuching, Sarawak, Malaysia, Palangka Raya, Central Kalimantan and Jakarta, Indonesia. Participants, both from the private and public section, agreed upon a 'Statement' on "Wise Use of Peatlands in Central Kalimantan, Indonesia" (Wösten, 2005). This statement was distributed widely, among others, through the website. The funding agency, the European Union, selected the project to illustrate international cooperation for sustainable development.

Enabling environment: dissemination of the wise use principles to all stakeholders
Partner meetings were often held in conjunction with other symposia and/or workshops, in Europe and in Southeast Asia. This allowed the partners to present and discuss their findings with other

scientists interested in tropical peatlands. This has resulted in a huge number of conference presentations and papers in both conference proceedings as well as in international journals. The outputs were the results of working together as a group for some years: partners were clearly stimulated by the internal consistency as well as openness for the ideas of other partners and stakeholders. In the follow-up project, RESTORPEAT (www.restorpeat.alterra.nl), the capacity building activities are enhanced even further.

Source: Ritzema, H. *et.al*., 2006. *Capacity Building for Sustainable Management of Peatlands in the Humid Tropics: From Research to Application*. (http://webdocs.alterra.wur.nl/internet/peatwise/docs/phase3/Papers/Capacity%20Building%20for%20Sustainable%20Management%20of%20Peatlands%20in.pdf)

2.4 Enhance the Participation of Stakeholders

Resolution X.8 The Convention's Programme on communication, education,participation and awareness (CEPA) 2009-2015 (Ramsar COP8, Valencia, 2008) calls on countries to give high priority to the participation of stakeholder groups with cultural or economic links to wetlands or those communities who depend on the wetlands for their livelihoods and recommends that this is promoted at the national level. For more information and case studies on strengthening participation of local communities in the management of wetlands see *Ramsar Convention Secretariat, 2010. Participatory skills: Establishing and strengthening local communities' and indigenous people's participation in the management of wetlands. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 7. Ramsar Convention Secretariat, Gland, Switzerland.* (www.ramsar.org).

A comprehensive National Peatland Forest CEPA Action Plan is vital to support the implementation of integrated management plans for peatlands.

Action 2.1.1: Formulate a National Peatland Forest CEPA Action Plan, ideally as a subset of the National Peatland Action Plan, to support communications, education, participation, awareness-raising and training efforts on the integrated management of peatland forests.

Action 2.1.2: Incorporate the elements of the National Peatland CEPA Action Plan in the training, education and outreach programmes of national or sub-national agencies responsible for peatland management.

Action 2.1.3: Encourage major stakeholders to collaborate to integrate peatland forest CEPA strategies into all relevant regional, national, catchment and local, and other appropriate sectoral policies, strategies, plans and programmes, such as those for biodiversity conservation, water management, fisheries, poverty reduction and climate change, as well as educational policies and curricula.

Action 2.1.4: Where appropriate, integrate peatland forest CEPA strategies in the business of national, provincial/state and site level wetland, biodiversity, forestry, agriculture, irrigation, power generation, mining, tourism and fisheries committees, and other relevant policy and planning committees where they exist.

Action 2.1.5: Ensure that catchment/river basin planning and management documents include CEPA as central processes in the delivery of overall water and peatland forest management objectives.

Action 2.1.6: Give attention to the effectiveness of communication and information-sharing systems among all relevant stakeholders, for example government ministries, departments and agencies such as education, land and water management, agriculture, and forestry; business and industry players; and local communities. Where necessary, develop mechanisms to address any shortcomings.

Action 2.1.7: Recognize and support the role of peatland education centres and other environment centres as catalysts and key actors for CEPA activities that promote the objectives of integrated peatland forest management. Develop and enhance the capacity of these centres to deliver high quality CEPA programmes.

Action 2.1.8: Undertake a review on current national needs and capacities in the areas of peatland forest CEPA, and use this to define training and capacity-building priorities within the National Action Plan for Peatlands, including training for the CEPA National Focal Points under the Ramsar framework. Incorporate a continuous system of monitoring and evaluation to ensure that capacity building activities are conducted efficiently and effectively.

Action 2.1.9: Develop guidelines, including decision support systems, training modules and programmes focusing on integrated peatland management, and promote the use of these for professional and in-service training of planners and managers, at both practitioner and trainer levels.

Action 2.1.10: Ensure that resources (expertise and funding) are made available to support the training and capacity building of peatland planners and managers.

Action 2.1.11: Use newly-acquired research knowledge to develop new university curricula to train students and professionals on the management of tropical peatland forests.

Theme 3: Policy and Legislative Instruments to Support the Integrated Management of Peatland Forests

At the national level, the two key documents that can and should guide the integrated management planning of peatlands and peatland forests are the National Wetland Policy, which all Ramsar Parties are encouraged to develop, and the National Action Plan for Peatlands, called for in the ASEAN Peatland Management Strategy. Where such policies/plan do not exist, land use planning (or related local plans) can be used to promote the integrated planning and management of peatlands.

3.1 National Wetland Policy

A National Wetland Policy (NWP) may be separate policy document or may form a clearly-identifiable component of other policy or planning documents (e.g. national environmental action plans or national biodiversity strategies and action plans). The NWP can provide a framework to enable and support the integrated management of peatland forests, and to ensure that peatland conservation and wise use is considered in sectoral policies, plans, programmes and projects. A National Wetland Policy can also drive the formulation or modification of sectoral policies, plans, programmes and projects to the benefit of peatland forest ecosystems.

In the Ramsar Strategic Plan 2009 – 2015, Key Result Area 1.3.i states: "National Wetland Policy or equivalent instruments fully in place alongside and integrated with other strategic and planning processes by all Parties, including poverty eradication strategies, water resources management and water efficiency plans, coastal and marine resource management plans, national forest programmes, national strategies for sustainable development, and national policies or measures on agriculture".

Currently, and where they exist, the national wetland policies of the SE Asian countries do not adequately address the integration of wetland (including peatland) considerations into the broader policy and planning frameworks, e.g. in sectors such as water resources development and agricultural development, and in thematic areas such as economic planning, land-use planning and development master planning at the various levels of government.

More often than not, this is because the policy development process did not include a sufficiently robust review of the existing legal, institutional and legislative frameworks in the country to ensure that these are generally compatible with the wise use of peatlands. Such a review should cover laws and institutions not only at the national level, but also at the sub-national and supra-national (i.e. regional economic integration organizations) levels, and identify sectoral legal and institutional measures which directly or indirectly affect wetlands.

A National Wetland Policy can provide a framework to enable the integrated management of peatland forests, and to ensure that peatland conservation and wise use is considered in, and informs, sectoral policies, plans, programmes and projects.

Priority actions that should be taken to address the shortcomings identified above include:

Action 3.1.1: Where a National Wetland Policy exists, this should be reviewed against the approaches and actions recommended in these Guidelines, and modified, as needed, to ensure that peatlands can be integrated more fully into the broader policy and planning frameworks in the country. If necessary, undertake an in-depth review of the existing legal and institutional frameworks, and sectoral legal and institutional measures which directly affect wetlands to ensure that these are generally compatible with the wise use of peatlands.

Action 3.1.2: Where a National Wetland Policy does not exist, the approaches and actions recommended in these Guidelines should be used to:

a) Advice and inform the development of a National Wetland Policy; or
b) Recommend changes to existing policy frameworks that directly affect peatlands to ensure that peatland considerations are incorporated into future revisions/updates; and
c) Recommend changes to existing strategies, plans and programmes that directly affect peatlands to ensure that peatland considerations are incorporated into the implementation of these.

3.2 National Action Plan on Peatlands (NAPs)

The NAPs provide the respective countries with their national focus, and identify agencies involved, funds and requirements for implementing activities towards the sustainable management of peatlands. Indonesia, Malaysia, Philippines and Viet Nam, which are participating countries of the ASEAN Peatland Forests Project, have already developed their NAPs and are currently in the process of implementing their plans. Brunei Darussalam, a supporting country to the APFP with its own funding, is currently revising their NAP. Other ASEAN Member States are in the process of developing their NAP, with support from the SEApeat project.

The following approaches will ensure that these NAPs support the integrated management of peatlands forests:

- Frame NAPs within the context of national and sub-national sustainable development policies and plans as well as relevant thematic policies and plans such as the National Biodiversity Strategy and Action Plan (NBSAP),), the National Wetland Policy, and the National Climate Change Policy/Strategy/Plan. To facilitate this, a review of the relevant policies, strategies, plans, legislation and incentives that impact – positively or negatively - on peatlands should be undertaken to inform both the development of the NAP, and to inform revisions or updates of the National Wetland Policy, where this exists.

- The NAPs should also give priority to the restoration of degraded peatland forests as this is an area of key concern in SE Asia (see Theme 4: Wise Use of Peatland Forests, item 4.3 Restoration Strategies for Peatland Forests). After-use plans for peatlands used for forestry, agriculture and other uses should include best practice measures for the restoration of an optimal range of biodiversity and ecosystem services.

- The NAPs should ensure that Protected Area Management policies and strategies capture globally- and nationally-important peatland forest sites. Important peatland forest sites that do not meet the protected area criteria should be protected using other relevant policy and/or legal instruments. Examples of these include water catchment areas protected under the water resources legislation or river basin management frameworks, and nature reserves protected under provincial or local level land-use frameworks. At the Klias Forest Reserve in Sabah, Malaysia, the Bukau Api Api area that lies outside the existing FR was proposed for designation as a Conservation/Protection Area under the Forest Enactment 1968 to protect its unique biodiversity and to allow for integrated management of the entire peatland ecosystem.

Frameworks that exist under multi-lateral environmental agreements and biodiversity-related global and regional agreements, while they offer limited legal protection, can be used to focus management attention on globally-important peatland forests. Examples of such agreements include:

- **Wetland Site of International Importance (Ramsar Site)** under the Ramsar Convention: The largest peatland Ramsar Site in SE Asia is Wasur National Park in Indonesia, which covers a total area of 413,810 ha. Other Ramsar Sites in SE Asia that contain significant tracts of peatland forest include the Lower Kinabatangan-Segama Forest Reserve in Malaysia (i.e. Kulamba WR; 20,628 ha), and Phru To Daeng Swamp Forest in Thailand.
- **Important Bird Area (IBA)** under BirdLife International: An example of this is the South-East Pahang peat swamp forest in Malaysia (MY18).
- **ASEAN Heritage Park** under the ASEAN Declaration on Heritage Parks, 2003: examples of these are the Tasek Merimbun ASEAN Heritage Park in Brunei Darussalam which harbours a wealth of biodiversity and a unique peatland forest ecosystem, and U Minh Thoung National Park, Vietnam.
- **Man and Biosphere (MAB) Site**: an example of this is Giam Siak Kecil-Bukit Batu in Riau, Indonesia which was declared a MAB Site in 2009. This peatland area produces sustainable timber, and contains two wildlife reserves which are home to the Sumatran Tiger, Tapir, Elephant and Sun Bear.

National Action Plans on Peatlands should be framed within the context of national conservation and sustainable development policies, strategies and plans (including NBSAPs) to support the integrated management of peatlands forests.

Action 3.2.1: In developing the NAP, priority should be given to undertaking a review of conservation and sustainable development policies and strategies, and the relevant thematic and sectoral policies, strategies, plans and legislation that impact on peatlands and peatland forests. Where necessary, propose amendments to ensure that the relevant policy, planning and legislative frameworks adequately capture approaches and actions to enable an integrated approach management planning of peatland forests. Review commitments at the regional and international level related to the conservation and sustainable management of peatlands and incorporate these into the NAP.

Action3.2.2: Incorporate the approaches and actions defined in these Guidelines into the NAP development or revision processes, to provide a framework for the implementation of an integrated approach to management planning for peatland forest.

Action 3.2.3: Give priority attention to the restoration of degraded peatland forests, with particular focus on the restoration of hydrological functions.

Action 3.2.4: Where feasible and possible, promote and ensure the development of after-use plans for peatlands used for forestry, agriculture and other uses, and include best practice measures for the restoration of an optimal range of biodiversity and ecosystem services.

Action 3.2.5: Review the national protected areas system to assess if priority peatland forest systems are included the protected area network. The focus should be on creating a network of peatland forest protected areas to conserve and maintain vital ecosystem services. Gaps in the representation of peatland forest ecosystems in the protected area network should be addressed.

Action 3.2.6: Explore opportunities to designate globally-important peatland forests under international or regional-level conventions, agreements or treaties to focus management attention on these areas.

3.3 Strengthen Other Policies, Plans and Legislation to Protect Peatlands

To facilitate an integrated approach to management planning for peatlands, peatland considerations need to be incorporated into the broader policy, planning and legislative frameworks, particularly those with potential to impact - negatively or positively - on peatland ecosystem services. Examples of thematic policies and strategies that should be targeted are those related to biodiversity (such as the National Biodiversity Strategy and Action Plan), climate change, poverty reduction, disaster management and economic development; sectoral policies and strategies include those dealing with forestry, water and agriculture.

National, sub-national and local planning frameworks are should also be targeted as they provide opportunities to deliver positive outcomes for peatlands at the different levels within a country. Examples of these include regional, provincial and local level development plans, river basin management plans, regional economic development plans, and local-level master plans for development.

Legislation is an important tool to ensuring compliance with existing policies and plans that have the potential to impinge on peatland ecosystem services. Environmental Impact Assessment (EIA) legislation is one of the key tools to mitigate adverse impacts to peatlands. Other tools include legislation pertaining to wildlife protection, protection of water catchments, water resources and protected areas, and pollution control, e.g. on the control of effluent discharge into waterways.

Peatland considerations need to be incorporated into the broader policy, planning and legislative frameworks, particularly those with potential to impact - negatively or positively - on peatland ecosystem services.

Action 3.3.1: Promote uptake of the National Action Plan for Peatlands by agencies, organizations and individuals responsible for the development of policies, plans and legislation that impact on peatland ecosystem services.

Action3.3.2: As necessary, organize training workshops to build capacity within these agencies, organizations and individuals on issues related to peatland management. These workshops should include training on the use of integrated tools and approaches to support decision-making related to peatlands (such as those described in Section 4.5 below).

Action 3.3.3: Prepare information and guidance material (e.g. policy briefs, information sheets on best management practices, and guidelines) targeted at various thematic and land-use sectors (e.g. climate change, disaster management, water, agriculture and forestry) to advice policy and planning.

Theme 4: Wise Use of Peatland Forests

Note: This section does not deal with all the aspects of the wise use of peatland forests. Readers are directed to Ramsar Wise Use Handbooks (www.ramsar.org) for detailed information, guidelines and case studies on a range of elements related to wetland (including peatland) wise use at the site, national, regional and international levels.

The focus in this section is on strategies and actions to mitigate the main impacts arising from the drivers of change for peatland forests in SE Asia (see Part 1.2.3 for a detailed explanation of the common issues and concerns relating to peatland forests in SE Asia).

The main impacts identified by SE Asian Member States (in no order of priority) are as follows:

1. Degradation and loss of peatland forests and their services, including biodiversity
2. Peatland fires and transboundary haze
3. Carbon losses

The five strategies described below, if applied in tandem with those discussed in the other six themes in these Guidelines, can aid in mitigating these impacts:

1. Restore peatlands
2. Regulate hydrology and water
3. Reduce human-induced greenhouse gas emissions from peatlands and protect their carbon stores
4. Promote best practices and the sharing of knowledge, technology and resources
5. Use a range of tools and approaches for the integrated management of peatland forests

Each of these strategies is discussed in detail below.

4.1 Restore Peatlands

Peatland restoration comprises all deliberate actions that initiate or accelerate the recovery of a degraded peatland to a former, better state. It is important to understand that restoration is not a substitute for protecting and ensuring the wise use of peatlands and peatland forests, i.e., the potential to restore a peatland is not a justification or suitable trade-off for the continued degradation of peatlands. Furthermore, while restoration can play an important role in enhancing peatland benefits, experience shows that a "restored" peatland rarely provides the full range and magnitude of services delivered by a peatland that has not been degraded.

In the past, some peatland restoration efforts have failed due to, among other things, narrow objectives which focus on one benefit or a partial suite of benefits. The inability to recognize or appreciate the potential for achieving multiple benefits across sectors has, in some cases, precluded cost-effective, participatory approaches to wetland restoration that may be more successful in recovering benefits and delivering more sustainable outcomes for people and the ecosystem. The failure to recognize these multiple benefits often greatly undermines the rationale for peatland restoration and compromises future well-being.

The relative importance given to various peatland benefits derived from restoration activities will depend to some extent on the degree of information available to decision-makers and wetland managers. When considering peatland restoration opportunities, an adequate evidence base is needed to demonstrate and communicate the full suite of benefits and their relevance across sectors.

In order to ensure greater equity and the long-term sustainability of wetland restoration outcomes, an Ecosystem Approach is often best suited to effectively manage the design and implementation of restoration activities as well as prioritize the inevitable trade-off in benefits. The Ecosystem Approach is a strategy for the integrated management of land, water, and biological resources that promotes conservation and sustainable use in an equitable way (Finlayson *et. al.* 2011). The Ramsar Convention's concept of wise use is perhaps the oldest example of the Ecosystem Approach among the intergovernmental processes concerned with the conservation and sustainable development of natural resources. In addition to understanding ecological processes within the context of the larger watershed or river basin, peatland restoration projects and programmes must be designed and implemented with the aim of fostering multi-sectoral cooperation and stakeholder participation to allow for the pooling or leveraging of knowledge and resources, the resolution of long-term governance issues, and equitable socio-economic development. Under these circumstances, peatland restoration can be a "win-win" proposition that, with limited resources, enhances the quality of life for both people and nature.

The CBD's Ecosystem Approach (http://www.cbd.int/ecosystem/principles.shtml) outlines twelve principles, two of which are particularly relevant to wetland restoration considerations. Principle 1 recognizes that sectors often have different economic, cultural and societal needs which determine the benefits they seek from wetland restoration activities. It therefore encourages communication and collaboration among different sectors in order to establish common ground, determine the types of activities to be undertaken, and equitably manage the trade-offs between multiple benefits. Principle 3 encourages sectors and stakeholders to consider the impacts of wetland restoration activities on other ecosystems and in the context of the wider landscape.

Most peatland exploitation in SE Asia involves drainage. Change to the hydrological regime of the peatland is therefore the biggest challenge in any peatland restoration effort. Most peatlands are dependent on surface- or groundwater. Therefore, a peatland can also be affected by hydrologic interventions outside the area itself that impact on water levels, dynamics or quality in the peatland itself. The latter is obvious in case of pollution or eutrophication of incoming surface water. Less obvious, but often equally important, is decreased groundwater inflow into the peatland as a result of drainage or water extraction in the hydrological catchment. This may lead to increasing rainwater influence, acidification, eutrophication, vegetation changes, and the loss of rare species, even though the water *levels* are hardly affected.

The first goal in restoration is to limit further degradation. When active peat growth cannot be re-installed, limiting further degradation is the highest goal that can be achieved. A peatland without peat accumulation remains subject to peat degradation and oxidation. This eventually leads to the total disappearance of the peat, the peatland, and the peatland associated functions. The primary method for limiting further degradation is to restore the original wetness as early and as well as possible. If the peatland is only recently drained, and peatland soil hydraulics and relief have not yet been affected, restoration measures can be restricted to making the drainage structures ineffective, e.g. by damming, filling-in ditches or by destroying subsurface drainage pipes. Additionally measures for re-establishing flora and fauna may have to be taken.

Restoration deals with three main questions:

1. What do you want to have back?
2. Is it possible to get that back?
3. What do you have to do to get it back: what measures are necessary to reach the restoration objective?

Any peatland restoration effort has to begin by identifying areas for restoration planning. Generally two scenarios are envisioned: a site is already chosen and the best approaches are developed for that site; or a restoration policy is set, and suitable locations are assessed and chosen for action. In either case, this is followed by a process to develop and implement restoration projects. Box 10 provides a checklist for peatland restoration project planning and management.

The catalysts for initiating wetland restoration activities are present at a number of levels, from obligations under international treaties to local opportunities and community-based initiatives. The recognition that wetland restoration has relevance across multiple sectors is dependent on a broad understanding and awareness of these opportunities. The need for awareness extends both across and among government departments or socio-economic sectors and vertically within the same departments and sectors. Examples of policy sectors where peatland restoration can play a role include, among others, climate change, economic investment, development planning, housing, sanitation and water resources, food production, transport and education. Governments need to encourage dialogue and leadership across these sectors to ensure that social, economic and environmental benefits are delivered.

Box 10. Checklist for Peatland Restoration Project Planning and Management

1. Define the problem and acquire general understanding.
2. Collect sufficient baseline data to identify problems and to estimate success chances.
3. Use the support of qualified technical experts, agencies, and organizations for planning
4. Identify goals and objectives.
5. Focus on the restoration of a possibly self-sustaining ecosystem.
6. Clarify budget issues.
7. Clarify legal requirements on local, regional, national and international level.
8. Identify and engage private or official stake holders.
9. Enable public participation.
10. Consider possible risks and uncertainties.
11. Establish consensus about the projects mission.
12. Identify measurable indicators to verify the project performance.
13. Design monitoring and management plans.
14. Test critical procedures in small scale experiments to minimize risks of failure.
15. Realize the operational availability of the site.
16. Organize trained supervision of work.
17. Employ well trained operator and workers.
18. Implement restoration measures.
19. Follow safety regulations.
20. Stick to the time scale.
21. Check if expected objectives can be achieved.
22. Correct emerging problems.
23. Modify unattainable objectives
24. Document intermediate project stages.
25. Check adequacy of the monitoring program.
26. Investigate the extent to which project goals and objectives are achieved.
27. Consider if critical peatland components and functions have been restored.
28. Analyse ecological, economic, and social benefits realized by the project.
29. Identify future management and maintenance requirements.
30. Organise management and maintenance.
31. Share learned lessons with interested parties on:
- duration of each project phase and the total project,
- costs and cost-effectiveness of each project phase,
- total costs of the project.

Source: *Global Peatland Restoration Manual* (draft, 2008) by Martin Schumann & Hans Joosten. (www.imcg.net)

Importance of planning for after-use

The sustainable use peatlands for economic purposes requires planned after-use. There are several options for after-use of peatlands following economic use, including agriculture, forestry, recreation and wildlife habitat and biodiversity provision (nature conservation). The exact nature of after-use should be determined by the relevant planning authority and specified in the planning consent and license to operate. Peatlands used for nature conservation may also require rehabilitation measures to restore them to a condition in which they can maintain their biodiversity and reduce CO_2 emissions. The choices available for after-use will depend on peatland type and former management as well as the condition of the 'used' peatland. In terms of after-use options, peatlands may be managed using rewetting (see Section 4.3 below), rehabilitation or restoration measures. Forest land on peat can be re-wetted after deforestation. Re-wetting and re-vegetating with indigenous species can also be achieved in tropical peatlands after deforestation, drainage or fire. Efficient procedures should be adopted to ensure that peatlands are not simply abandoned in a degraded state when their economic use ceases.

The rapid rate of degradation of peatland forests in SE Asia necessitates urgent action at the national level to restore peatlands. The effects of climate change (e.g., sea level rise, temperature increases, and changes in flood and drought patterns) are also increasingly impacting the quality and delivery of peatland forest services. The continued degradation of wetlands will result in a further reduction in benefits and thus negatively impact human health and well-being into the future.

Immediate and appropriate measures are needed to recognize the full suite of environmental, cultural and socio-economic benefits from peatland restoration.

Action 4.1.1: Develop a Peatland Forest Restoration Plan as a subset of the National Action Plan for Peatlands. The Peatland Forest Restoration Plan should incorporate planning measures for after-use following economic use of peatland forests. Undertake periodic assessments of the Restoration Plan, and revise/update the Plan, as needed.

Action 4.1.2: Establish appropriate legal and institutional mechanisms to enable the successful delivery of the Restoration Plan, and allocate sufficient resources to implement the Plan.

Action 4.1.3: Develop and implement restoration projects in priority peatland forest areas.

Action 4.1.4: Prevent further drainage and degradation of abandoned peatlands and target them for restoration as either government initiatives or as government projects with industry support.

4.2 Regulate Hydrology and Water

Conventional peatland utilization requires a lowering of the water table. As peat largely consists of water, peatland drainage leads to subsidence and compaction of the peat. Consequently, the peat's hydraulic properties change, which may decrease the peatland ecosystem's capacities for water storage and regulation. Peatland drainage leads to oxidation of the peat layers that are no longer saturated with water. As a result, drained peatlands lose a few millimetres or up to several centimetres of peat per year, depending on the climate. These losses are accelerated by the addition of lime, fertilizers and sand or clay, as well as by water and wind erosion and by peat fires. The resulting lowering of the peatland surface necessitates a continuous deepening of the drainage ditches, which again enhances peat oxidation and further lowers the peatland surface.

Peatland management activities that influence the level, quantity and quality of water on site, in the surrounding landscape and at the catchment/basin level should:

1. Keep or restore water levels and flow regimes as close to the natural reference conditions as possible.
2. Carry out drainage and other management practices only to the extent required and avoid unnecessary deterioration in the quality and quantity of ground and surface waters.
3. Ensure that impacts of long-term drainage, peat removal and/or subsidence management activities will be limited to an extent that hydrological management can be implemented in a cost-effective way as part of an after-use strategy.

At the U Minh Thuong National Park in Vietnam efforts are underway to develop and implement an appropriate water management scheme regulate water tables as a means to prevent peatland fires (Box 11).

Box 11. Integrated Fire and Water Management for Ecosystem Restoration, U Minh Thuong National Park, Vietnam

Large areas of peatlands in Vietnam have been converted to agricultural production and exploited for fertilizer production. The two largest remaining peatlands are in the U Minh Ha and U Minh Thuong regions in the Lower Mekong Delta. U Minh Thuong is one of the last significant areas of peatland forest remaining in Lower Mekong Delta.

A system of dykes and canals in and around the core zone was constructed for fire control. As a result, the core zone is dissected by six canals and surrounded by two more, while the buffer zone contains more than 21 canals. While fire is a natural part of the ecology of *Melaleuca* forest, an inappropriate hydrological management regime at the national park has led to low water levels during the dry season and drying out of the peat layer, thereby increasing the frequency and severity of fires, several of which occurred in 2002. In 2000 the total area of peatlands in the National Park was about 6,000 ha; about 3,500 ha of this were lost to fires in 2002.

Between 2010 and 2011, with support from ASEAN Peatland Forests Project, a peatland restoration project was conducted to develop an appropriate water management scheme to restore the degraded peatlands. Assessments were carried out to determine the characteristics of the peat and mineral soils (pore space, capillary force), changes in topography, and the hydrological regime, and to map the canal and dyke systems and land cover.

The results of these assessments were used to divide the Park into three water management zones:
Zone A: High topography: dry soil at the surface, but soil still moist enough
Zone B: Medium topography: soil always moist
Zone A: Low topography: inundated from 20 – 40 cm

The key management approach was to limit flooding during the rainy season and regulate the water levels in the dry season. Water levels were set to not exceed 50 cm in depth to retain high moisture content in the upper peat layer throughout the year. Water levels are adjusted using the existing dyke system and sluices.

Initial application of the integrated fire and water management regime at U Minh Thuong National Park has shown promising results but further research is needed to improve the current management system.

Sources: Site Nomination for Peat Site Profiles in Southeast Asia: U Minh Thuong National Park (www.aseanpeat.net) & Proceedings of the *Workshop on the integrated Management Plans for Peatlands in Southeast Asia*, 9-10 July 2012, Cherating, Pahang, Malaysia.

The role of peatlands in water regulation depends on maintaining the integrity of their unique hydrology that is independent of but linked to that of adjacent wetlands and the wider landscape.

Efforts to manage the hydrology and water systems linked to peatlands should consider the following:

Action 4.2.1: Drainage of peatlands must take into account the importance of water quality, quantity and flow dynamics in the peatland itself and in adjacent and downstream locations.

Action 4.2.2: Water management on peatlands should be based on the best available knowledge and techniques and carried out according to international conventions and regional and national legislation and priorities.

Action 4.2.3: All drainage activities should include effective flood and sediment control measures.

Action 4.2.4: Measure water quality and quantity standards against, and set in terms of, baselines of recognized standards on site and in surrounding areas.

Action 4.2.5: Ensure that any drainage necessary be kept to a minimum to enable current and future land use and maintenance.

Action 4.2.6: Ensure that peatland use does not result in the creation of vastly different surface levels that would make hydrological restoration difficult to achieve in a cost-effective way.

Action 4.2.7: Carry out regular re-evaluation to ensure that best water management outcomes are achieved, using up-to-date practices and based on the results of continuing water quality, quantity and catchment monitoring.

Action 4.2.8: Involve stakeholders at all stages of the development process for management planning and decision-making related to peatland use, particularly when considering the environmental water requirements of peatlands.

More guidance can be found in *Resolution X.19 Wetlands and river basin management: consolidated scientific and technical guidance* (Ramsar COP10, Korea, 2008) (www.ramsar.org)

4.3 Reduce Human-induced Greenhouse Gas Emissions from Peatlands and Protect their Carbon Stores

Peatlands are dependent on climate, especially rainfall and temperature, for their formation and maintenance. Under certain conditions peatlands may contribute to climate change processes by the release of carbon dioxide or methane to the atmosphere. Greenhouse gas exchange between the atmosphere and peatlands exhibits much spatial and temporal variation related to differences in ecology, hydrology and management.

Peatland planning and management should avoid increasing and, wherever possible, reduce human-induced greenhouse gas emissions from peatlands and protect their carbon stores through:

- Planning and adopting management strategies, regimes and technologies that protect carbon stores and minimise greenhouse gas emissions from peatlands.
- Planning and implementing peatland management and after-use actions, such as rewetting of drained peatlands, that achieve lower greenhouse gas emissions than from current or previous use and increase the potential for greenhouse gas sequestration.
- Preventing unnecessary and illegal expansion of peatland utilisation.
- Monitoring carbon stores and greenhouse gas emissions from peatlands in order to obtain information on the impacts of different management regimes and promote 'best practice'.
- Ensuring that carbon values of peatlands are taken into account in peatland management planning.
- Obtaining further information on the impact of peatland management on climate change processes and vice versa.

Rewetting of drained peatlands

Peat oxidation leads to increased emissions of GHGs (CO_2 and N_2O) and nitrates (which may over-fertilize adjacent surface waters). Rewetting of peatlands has the highest priority for addressing for mitigating CO_2 emissions from peat oxidation and peatland fires (Parish *et al.*, 2008).

The rewetting of drained peatland involves the partial or entire reversal of former anthropogenic drainage by elevating the average annual water table. The aim is to achieve permanent water saturation of the entire peat body by raising the water table to close to or above the peat surface and by reducing the amplitude of water level fluctuations. If feasible, deep and permanent flooding should be avoided, because deep water cannot be colonized easily by emergent vegetation. In tropical peatlands, temporary pools and flooding can also stabilize water levels (large storage capacity) (Dommain et. al., 2010). Rewetting is achieved by reducing water losses from the site by decreasing surface drainage, surface runoff, sub-surface seepage, groundwater extraction, and evapotranspiration, and by, where relevant, increasing the water supply from the catchment. Box 12 presents an account of a peatland rewetting project from Central Kalimantan, Indonesia.

Box 12. Rewetting of tropical peat swamp forest in Sebangau National Park, Central Kalimantan, Indonesia

Sebangau National Park is a 90,882 ha area peat swamp forest that was previously a Production Forest logged from 1970 to 1995. After 1995, illegal logging became rampant. Numerous canals were dug by illegal loggers to transport logs out of the peat swamp forest and these accelerated water-flow from the peatland, causing peat drainage and decomposition along with the release of associated greenhouse gases (GHG).

The WWF-Indonesia Sebangau Project was aimed at reducing the GHG emissions from peat decomposition by rewetting the drained peatland, by constructing dams in the drainage canals. Construction of the dams began with pilot activities in 2004, and scaled-up these activities in 2008. By 2010, with funding support from two German sponsors, Deutsche Post and Krombacher, the project had built 434 dams in the Bakung, Bangah, and Rasau River sub-catchments in the eastern part of Sebangau National Park.

In addition to reducing GHG emissions, restoration of natural hydrological conditions is expected to result in the recovery of the peat swamp forest ecosystem in Sebangau. Rewetting the peat will support vegetation regrowth, enabling the recovery and expansion of wildlife populations including

the endangered Bornean orangutan. The project area is an important orangutan habitat. A survey conducted between 2006 and 2007 showed a population of around 5,400 individual orangutans in Sebangau National Park.

Local communities have been involved in the project since its inception due to the importance of the project area for fishing and *jelutung* sap (wild rubber) collection. Three extended families in the nearby village of Kereng Bangkirai claim traditional management rights over the three Sub-catchments and for four generations families have depended on fishing in marshlands and tributaries of the Sebangau River for their livelihoods. Communities, especially the fishermen who fish intensively in the area, were consulted on the design of dams. In the canals which are frequently used for fishing and transporting *jelutung* sap the dam is made with a spillway, so that boats can still pass. Communities are also involved in the construction and maintenance of dams.

Source: WWF-Indonesia (2012). Rewetting of tropical peat swamp forest in Sebangau National Park, Central Kalimantan, Indonesia. 111 pp.
https://s3.amazonaws.com/CCBA/Projects/Rewetting_of_Tropical_Peat_Swamp_Forest_in_Sebangan_National_Park/SNP+Peat+Rewettting+Project+-+CCB+PDD+-+V01.pdf.pdf

Restoration of a peatland site can only reduce GHG emissions to zero if the entire area can be adequately rewetted. The experiences in Indonesia have shown that, especially in the tropics, complete rewetting is often very difficult or even impossible to achieve because drainage has induced irreversible changes in peatland relief. Stronger soil subsidence immediately adjacent to drainage channels results in the formation of 'mini-domes' in between strongly subsided areas, which prohibits full rewetting over large areas. The areas that are not sufficiently rewetted will continue to emit GHGs until a new hydrological equilibrium is reached.

U Minh Thuong National Park in Viet Nam took 6 years to rewet. However, experts suggest that achieving full rewetting will often take several decades. This implies that restoring degraded peatlands cannot compensate for peat swamp conversion on a hectare-by-hectare basis. To compensate for emissions of newly drained peatlands, much larger areas of degraded peatland landscapes will have to be subject to long-term rewetting and reforestation.

There is no universal strategy to rewet drained peatlands, as conditions differ widely. The most important technical criteria for rewetting are:

- **Water availability:** The assessment of water availability may require addressing climate, peat hydraulic conditions, drainage infrastructure, water regime, topography and the hydrogeology and hydrology of the peatland's hydrological catchment.
- **Land use:** This covers land both inside the peatland and in its hydrological catchment area. If current land use requires drainage, partial rewetting can be considered or land use can be changed to paludiculture (Box 13). If ensuring the water supply for rewetting requires a reorganization of land use within the hydrological catchment, it is necessary to check feasibility and costs and involve stakeholders.
- **Relief:** The water level that can be established is highly dependent on the peatland's relief and topography. Also, without active peat removal the relief of a peatland may have changed substantially by subsidence, peat oxidation and fire. To achieve the best effect, the average annual water level must be raised to near the surface over the largest possible area of the peatland.
- **Tree growth:** In tropical peat swamps, the presence of (large) trees is a prerequisite for optimal rewetting (Dommain *et. al.,* 2010).

Water availability and relief are often the most important factors determining 'rewetability'. These factors may have changed to such an extent that optimal rewetting may become impossible. However, partial rewetting will still reduce environmental risks such as fires.

Box 13. Keep wet peatlands wet: paludiculture

Paludicultures (Latin '*palus'* = swamp) are land management techniques that cultivate biomass from wet and rewetted peatlands under conditions that maintain the peat body, facilitate peat accumulation and sustain the ecosystem services associated with natural peatlands. Paludicultures help stop peat oxidation and simultaneously provide sustainable harvests from peatlands.

Paludicultures use only that part of net primary production that is not essential for peat formation. In the temperate, subtropical and tropical zones, i.e. those zones of the world where plant productivity is high, peat is generally formed by below-ground roots and rhizomes. Peatlands by nature support vegetation whose aboveground plant material can be (selectively) harvested without substantially harming peat formation.

Paludicultures make use of any biomass from wet and rewetted peatlands, from spontaneous vegetation on natural sites to artificially-established crops on rewetted sites. For this reason, paludicultures may have a double role to play in climate change mitigation; they avoid greenhouse gas emissions (by preventing peatlands from being drained or by rewetting drained peatlands) and the biomass produced may replace fossil raw materials and fossil fuels. Besides being used for food, feed, fibre and direct combustion, the biomass from paludicultures can be used as a raw material for industrial biochemistry, for producing high quality liquid or gaseous biofuels and for synthesizing pharmaceuticals and cosmetics. An obvious paludiculture practice is the collection of food for direct consumption. In Indonesia and Malaysia, local communities collect sago palm products from wet peatlands. Other traditional low-intensity uses include hunting and fishing. Especially in tropical peatlands, fisheries are a major economic activity. Aquaculture of indigenous fish species can be an attractive land-use option and offer economic incentives for local communities in areas where many drainage canals must be blocked for hydrological restoration.

Even if peat formation is a very slow process, rewetting, which is a precondition for paludicultures, converts drained peatlands into peat forming ecosystems and transforms them into sinks for carbon and soil nutrients and filters of water.

Source: FAO and Wetlands International (2012). *Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use* (2nd edition). Hans Joosten, Marja-Liisa Tapio-Biström & Susanna Tol (eds.), http://www.fao.org/docrep/015/an762e/an762e.pdf

Appropriate and integrated management planning can protect the carbon store in peatlands, and suitable after-use methods of re-wetting and re-vegetating can decrease greenhouse gas emissions and create conditions for carbon sequestration and peat formation.

Action 4.3.1: Take into account the most recent scientific information on greenhouse gas fluxes in the formulation of peatland management plans.

Action 4.3.2: Protect and conserve the carbon stores and carbon sequestration functions of peatlands in accordance with the requirements of international conventions and national statutory requirements. Management plans should include mitigation measures to maximize peat carbon stores and minimize greenhouse gas emissions.

Action 4.3.3: Peatland managers should carry out carbon 'life cycle' analyses and use this information in designing management activities.

Action 4.3.4: Peatland after-use should have low CO_2 emission rates and increased carbon sequestration potential, taking into account the long time-scale involved and the other services provided by peatlands.

Action 4.3.5: Enhance scientific information, awareness and understanding of the relationship between peatlands and climate change and how this will contribute to responsible management explained by:

- providing information on the importance of peatland management in relation to climate change to public, corporate and government decision makers
- encouraging the research community to provide clear science-based information

Action 4.3.6: Investigate the potential of peatland rehabilitation and other after-use for reducing emissions from peatland degradation as a means to compensate for carbon emissions elsewhere (e.g. peat-based industry). Carbon offsets could be a means for the peat based industry to enhance carbon neutrality of its products.

4.4 Promote Best Management Practices and the Sharing of Knowledge, Technology and Resources

Best Management Practices (BMPs) are defined as practices, based on known science, that are determined to be the most efficient, practical, and cost-effective measures identified to guide a particular activity or to address a particular problem. BMPs can be developed to guide specific management activities e.g. habitat restoration, erosion control, and riverbank protection, or for specific sectors, e.g. forest plantations on peat, and agricultural activities on peat.

Through the ASEAN Peatland Forests Project (APFP) and the SEApeat Project, a series of technical workshops on BMPs were organized in June 2011 and May 2012, aimed at building capacity for sustainable peatland management in SE Asia by promoting and showcasing best management practices at the SE Asia regional level.

Examples of landuse-related BMPs for peatlands include the Roundtable on Sustainable Palm Oil's *RSPO Manual on Best Management Practices (BMPs) for Management and Rehabilitation of Natural Vegetation Associated with Oil Palm Cultivation on Peat*, the *RSPO Manual on BMPs for Existing Oil Palm Cultivation on Peat* (http://www.rspo.org/en/Peat_Best_Practice_Manual), and the best management practice information sheets produced by the Malaysian Palm Oil Board (www.palmoilis.mpob.gov.my). The Global Environment Centre's poster on *Best Management Practices on Integrated Tropical Peatland Management* is a good tool to use to enhance awareness of peatland planners and managers (www.aseanpeat.net).

To advance an integrated approach to the management of peatlands, the development of BMPs based on land use practices in peatlands should be encouraged, as in the example of the RSPO manuals above. Areas that should be considered for the development of such BMPs are water resources development, and forestry and agricultural activities on peatlands.

Sharing of knowledge, technology and resources: SE Asian countries can benefit from sharing knowledge with each other given that they enjoy common environmental, geographical, climatic, cultural and social features. Governments in these countries should therefore seek to collectively create enabling environments for knowledge sharing and technology diffusion to enhance peatland management, and maximize the returns on investment in these areas. Knowledge networking on peatlands could be used as an effective strategy for decision making as well as the selection of appropriate technologies for development of peatlands. Adapting global knowledge and selecting the most appropriate technologies to the local environment will require sharing information and resources, and conducting research to choose the best among alternatives. In this regard, collaboration among SE Asian countries on research and development becomes necessary for adapting new technologies for the long-term sustainability of peatlands and peatland forests.

Peatland planners and managers should be encouraged to adopt best management practices, and to share knowledge, technology and resources, to maximize returns on investment in peatland management.

Action 4.4.1: Encourage and support the collation of best management practice information and expertise across the range of sectors, such as water, agriculture and forestry, that impact on peatlands and peatland forests. These should be compiled into a set of practical guidance on Best Management Practices to support efforts to integrate peatland management into broader policy and planning frameworks.

Action 4.4.2: Develop a core multi-disciplinary group of experts from across the SE Asia region to take the lead on national and regional peatland issues of concern, and to provide technical advisory support, as needed, on implementing best management practices to promote the integrated management of peatlands.

Action 4.4.3: Share best management practice information and expertise amongst stakeholders involved in peatland management, including conservation organisations and the peat industry, for example, via the existing websites such as www.aseanpeat.net and via existing peatland research network sites such as RESTORPEAT and SEApeat (see Section 5.1 below).

Action 4.4.4: Promote the inclusion of best management practices for peatlands into technical guidance and advice developed by the Ramsar Convention, CBD and UNFCCC to enhance the integration of peatland considerations into the broader policy and planning frameworks at the global, regional and national levels.

Action 4.4.5: Encourage and invest in the development and application of innovative technology to support integrated management planning for peatlands, e.g. the use of earth observation and remote sensing systems for peatland assessment and monitoring.

Action 4.4.6: Enable the sharing of knowledge, technology and resources on peatlands and peatland management, e.g. through research networks, workshops, collaborative projects, exchange programmes, and collective actions.

4.5 Use a Range of Tools and Approaches for the Integrated Management of Peatlands and Peatland Forests

A range of tools and approaches are available, within the framework of the Ramsar Convention and in other international and regional frameworks, to support efforts to integrate peatland forest management into the broader policy and planning frameworks.

One such example is the **High Conservation Value Forest (HCVF)** (Box 14), which has been developed to aid in identifying critical ecosystems and can be easily applied to peatland forests to identify priority peatland ecosystems.

Box 14. Assessment of High Conservation Value Forest (HCVF) and Other Habitats

High Conservation Value Forests are those areas of forest that need to be appropriately managed in order to maintain or enhance the identified High Conservation Values. A High Conservation Value Forest may be a small part of a larger forest, for example a riparian zone protecting a stream that is the sole supply of drinking water to a community or a small patch of a rare ecosystem. In other cases, the High Conservation Value Forest may be the whole of a forest management unit, for example when the forest contains several threatened or endangered species that range throughout the forest. Any forest type – boreal, temperate or tropical, natural or plantation can potentially be a High Conservation Value Forest, because High Conservation Value Forest designation relies solely on the presence of one or more High Conservation Values.

Significant guidance is available on the application of the HCV concept through the 'HCVF Toolkit' (Jennings *et al.*, 2003). This includes case studies and a practical methodology to be used at a national (or regional or sub-national) level for defining High Conservation Values. Note that this approach can be used for other ecosystems and habitats besides forests.

High Conservation Value Forest (HCVF) is defined as: The forest necessary to maintain or enhance one or more High Conservation Values (HCVs):

- HCV1 - Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species).
- HCV2 - Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance.
- HCV3 - Forest areas that are in, or contain rare, threatened or endangered ecosystems.
- HCV4 - Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control).
- HCV5 - Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health).
- HCV6 - Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

Source: www.fsc.org

Peatland forests provide a range of ecosystem services, such as habitat for endangered wildlife, hydrological regulation, and locations of cultural or archaeological importance. Where these values are considered to be of outstanding significance or critical importance, the peatland forest can be defined as a High Conservation Value Forest (HCVF).

The key to the concept of High Conservation Value Forests is the identification of High Conservation Values (HCVs), because their presence determines whether a forest is designated a High Conservation Value Forest. High Conservation Values were first defined by the Forest Stewardship Council for use in forest certification, but the concept is increasingly being used for other purposes, including conservation and natural resource planning and advocacy, landscape mapping, plantation development and in the purchasing policies of major companies.

The HCVF concept has recently begun to appear in the discussions and policies of government agencies and institutional donors. The HCV concept has also been applied in the Roundtable on Sustainable Palm Oil's *Principles and Criteria for Sustainable Palm Oil Production* (Box 15).

This rapid uptake reflects the elegance of the concept, which has moved the debate away from definitions of particular forest types (e.g. primary, old growth) or methods of timber harvesting (e.g. industrial logging) to focus instead on the values that make a forest particularly important. By identifying these key values and ensuring that they are maintained or enhanced, it is possible to make rational management decisions that are consistent with the protection of a peatland forest area's important ecosystem values.

Box 15. RSPO's Principles and Criteria for Sustainable Palm Oil Production related to Peatlands

Principle 4: Use of appropriate best practices by growers and millers

Criterion 4.3: Practices minimise and control erosion and degradation of soils.
Indicator **4.3.4** Subsidence of peat soils shall be minimised and monitored. A documented water and ground cover management programme shall be in place
Guidance: For existing plantings on peat, the water table should be maintained at an annual average of 50cm (between 40 - 60cm) below ground surface measured with groundwater piezometer readings, or an annual average of 60cm (between 50 - 70cm) below ground surface as measured in water collection drains, through a network of appropriate water control structures e.g. weirs, sandbags, etc. in fields, and water gates at the discharge points of main drains (Criteria 4.4 and 7.4).

Indicator 4.3.5 Drainability assessments shall be required prior to replanting on peat to determine the long-term viability of the necessary drainage for oil palm growing.

Guidance : Where drainability assessments have identified areas unsuitable for oil palm replanting, plans should be in place for appropriate rehabilitation or alternative use of such areas. If the assessment indicates high risk of serious flooding and/or salt water intrusion within two crop cycles, growers and planters should consider ceasing replanting and implementing rehabilitation.

Guidance: Plantations on peat should be guided at least to the standard set out in the *'RSPO Manual on Best Management Practices (BMPs) for existing oil palm cultivation on* peat'*, June 2012* (especially water management, fire avoidance, fertiliser use, subsidence and vegetation cover).

Criterion 4.4 Practices maintain the quality and availability of surface and ground water.
Indicators:
- An implemented water management plan.
- Protection of water courses and wetlands, including maintaining and restoring appropriate riparian buffer zones.

Guidance: The Water Management Plan will:
- Taking account of the efficiency of use and renewability of sources.
- Ensuring that the use of water does not result in adverse impacts on other users.
- Avoiding contamination of surface and ground water through run-off of soil, nutrients or chemicals, or as a result of inadequate disposal of waste including POME.
- Appropriate treatment of mill effluent and regular monitoring of discharge quality, which should be in compliance with national regulations.

National interpretation should refer to national guidelines or best practice and where appropriate include performance thresholds for requirements such as the size and location and methods of restoration of riparian strips or acceptable maximum runoff levels.

Criterion 5.2 The status of rare, threatened or endangered species and other High Conservation Value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and operations managed to best ensure that they are maintained and/or enhanced.

Indicator 5.2.1 Information shall be collated in a High Conservation Value (HCV) assessment that includes both the planted area itself and relevant wider landscape-level considerations (such as wildlife corridors).

5.2.2 Where rare, threatened or endangered (RTE) species, or HCVs, are present or are affected by plantation or mill operations, appropriate measures that are expected to maintain and/or enhance them shall be implemented through an action plan.

5.2.3 There shall be a programme to regularly educate the workforce about the status of these RTE species, and appropriate disciplinary measures shall be instituted in accordance with company rules and national law if any individual working for the company is found to capture, harm, collect or kill these species.

Principle 7: Responsible development of new plantings

Criterion 7.4 Extensive planting on steep terrain, and/or marginal and fragile soils, including peat, is avoided.

Indicator 7.4.1 Maps identifying marginal and fragile soils, including excessive gradients and peat soils, shall be available and used to identify areas to be avoided.
Indicator **7.4.2** Where limited planting on fragile and marginal soils, including peat, is proposed, plans shall be developed and implemented to protect them without incurring adverse impacts.

Guidance: Planting on extensive areas of peat soils and other fragile soils should be avoided (see Criterion 4.3). Adverse impacts may include hydrological risks or significantly increased risks (e.g. fire risk) in areas outside the plantation (see Criterion 5.5).

Criterion 7.8 New plantation developments are designed to minimise net greenhouse gas emissions.

Indicator 7.8.1: The carbon stock of the proposed development area and major potential sources of emissions that may result directly from the development shall be identified and estimated.

Guidance: GHG identification and estimates can be integrated into existing processes such as HCV and soil assessments. The RSPO carbon assessment tool for new plantings will be available to identify and estimate the carbon stocks. It is acknowledged that there are other tools and methodologies currently in use; the RSPO Emission Reduction (ERWG) working group will not exclude these, and will include these in the review process. The RSPO PalmGHG tool or an RSPO-endorsed equivalent will be used to estimate future GHG emissions from new developments using, amongst others, the data from the RSPO carbon assessment tool for new plantings. Parties seeking to use an alternative tool for new plantings will have to demonstrate its equivalence to the RSPO for endorsement.

7.8.2: There shall be a plan to minimise net GHG emissions which takes into account avoidance of land areas with high carbon stocks and/or sequestration options.

Guidance : Growers and millers should plan to implement RSPO best management practices for the minimisation of emissions during the development of new plantations. Growers are strongly encouraged to establish new plantings on mineral soils, in low carbon stock areas, and cultivated areas, which the current users are willing to develop into oil palm. Millers are encouraged to adopt low-emission management practices (e.g. better management of palm oil mill effluent (POME), efficient boilers etc.) in new developments. Growers and millers are encouraged to consider setting up Conservation Set Aside (CSA) areas or buffer zones in order to minimise the net emissions from the development / the carbon loss from any cleared HCS areas.

Source: *RSPO Principles and Criteria for Sustainable Palm Oil Production Including Indicators and Guidance*, April 2013

Biodiversity Offsets

Biodiversity offsetting is a process to improve long-term biodiversity, whilst enabling environmentally sustainable development and local economic growth. A biodiversity offset is a way to demonstrate that an infrastructure project can be implemented in a manner that results in no net loss or a net gain of biodiversity.

The Business and Biodiversity Offsets Programme (BBOP) defines biodiversity offsets as “measurable conservation outcomes of actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people’s use and cultural values associated with biodiversity".

To be an offset, these conservation outcomes should be quantifiable, since the purpose of a biodiversity offset is to demonstrate a balance between a project’s impacts on biodiversity and the benefits achieved through the offset. This involves measuring both the losses to biodiversity caused by the project and the conservation gains achieved by the offset.

Biodiversity offsetting provides an efficient and transparent way to ensure there is biodiversity gain through development. It is a more standardised system that allows for better project planning, helping developers deliver their long-term environmental obligations in one transaction. For landowners, offsetting can provide a better financial return for creating and managing land for wildlife.

Biodiversity offsetting does not replace or undermine existing habitat protection laws. Developers still follow the mitigation hierarchy, so it will only apply to sites appropriate for development and even then only after on-site avoidance and mitigation measures have been taken. In addition, biodiversity is often of local importance therefore offsetting will be kept local where ecologically practical.

There is no single best way to design and implement biodiversity offsets. However, BBOP has defined a general eight step framework for a typical prospective offset design process (Table 6) that can help developers satisfy the Principles. In addition, offset designers can be guided by the Standard on Biodiversity Offsets (www.forest-trends.org), which will help them plan and implement an offset that meets best practice. More detailed material can be found in the handbooks on offset design, implementation and other associated material at http://bbop.forest-trends.org/pages/guidelines.

Table 6. 8-step Framework for a Typical Prospective Offset Design Process

Orientation	
Step 1: Review the development project's scope and activities	• Understand the purpose and scope of the development project and the main activities likely to take place in the different stages of its life cycle. • Identify key decision 'windows' and suitable 'entry points' for integration of biodiversity offsets with project planning.
Step 2: Review legal framework and / or policy context for a biodiversity offset	• Clarify any legal requirement to undertake an offset and understand the policy context within which a biodiversity offset would be designed and implemented. • Explore government and lending institutions' policies, as well as internal company policies, so the offset can be designed to meet these.
Step 3: Initiate stakeholder participation process	• Identify stakeholders at an early stage and establish a process for their effective involvement in the biodiversity offset design and implementation.
Determining development impacts and biodiversity offset needs and opportunities	
Step 4: Determine the need for a biodiversity offset based on residual adverse effects by the development	• Identify biodiversity components in the area that will be affected by the development project. • Determine the potential significance of impacts on biodiversity and design steps to limit impacts (use mitigation hierarchy: avoid, minimise, if relevant rehabilitate). • Determine residual impacts that need to be offset.
Step 5: Quantify residual losses in biodiversity	• Decide on methods for calculating biodiversity losses and gains to show that 'no net loss' will be achieved through the biodiversity offset. • Calculate the residual biodiversity losses.
Step 6: Assess the biodiversity gains that could be achieved at potential offset locations	• Identify a range of potential biodiversity offset locations and activities. • Compare likely biodiversity gains and select preferred locations and activities for more detailed offset planning.
Designing the biodiversity offset: gains and select offset options (location and activities)	
Step 7: Finalise offset design: calculate biodiversity gains and make final selection of suitable offset locations and activities.	• Quantify biodiversity gains using the same metrics used to calculate the losses. • Finalise the selection of the offset location(s) and activities that are planned to result in no net loss of biodiversity, and to ensure adequate compensation to affected communities.
Step 8: Record the offset design and enter implementation process	• Record a description of the offset activities and location(s), including the final biodiversity 'loss / gain' account. • Prepare a biodiversity offset management plan to guide implementation and demonstrate how no net loss of biodiversity will be achieved, how stakeholders will be satisfied and how the offset will contribute to any national requirements and policies.

The steps above, undertaken by the company / consultants are part of a typical prospective offset design process. (Note: This offers an illustrative approach. Offset planning is usually more iterative than linear; so the order of events may vary depending on the circumstances.)

Integrating the value of water and wetlands into decision-making: The Economics of Ecosystems and Biodiversity (TEEB)

The Economics of Ecosystems and Biodiversity (TEEB) is an international initiative to draw attention to the benefits of biodiversity. It focuses on the values of biodiversity and ecosystem services, the growing costs of biodiversity loss and ecosystem degradation, and the benefits of action addressing these pressures. The TEEB initiative has brought together over five hundred authors and reviewers from across the continents in the fields of science, economics and policy.

The TEEB initiative has demonstrated the usefulness of presenting evidence on the values of nature and targeting the messages to different audiences. Understanding and communicating the economic, social and cultural value of ecosystem services (many of which nature provides for "free") is crucial to fostering better management, conservation and restoration practices.

The 2013 *The Economics of Ecosystems and Biodiversity for Water and Wetlands* report underlines the fundamental importance of wetlands in the water cycle and in addressing water objectives reflected in the Rio+20 agreement, the Millennium Development Goals and forthcoming post 2015 Sustainable Development Goals. The report presents insights on both critical water-related ecosystem services and also on the wider ecosystem services from wetlands, in order to encourage additional policy momentum, business commitment, and investment in the conservation, restoration, and wise use of wetlands.

It defines a practical 6-step stepwise approach to assessing the values of wetlands, which seeks to help decision makers through the development of a stepwise approach to navigate through the available options for integrating ecosystem services in local and regional management (Box 16), and explores the different types of tools and instruments used in decision-making by explaining how the value of water and wetland ecosystem services can be better integrated into the design of these governance and market approaches, thus providing a stronger basis for promoting wetlands and the water and other services they provide.

Box 16. 6-step approach to assessing the values of wetlands

Step 1: Specify and agree on the problem with stakeholders
Step 2: Identify which ecosystem services are most relevant (to the decision to be made and covering the key stakeholders)
Step 3: Identify the information needs and select appropriate methods, as the study design determines what kind of information you get
Step 4: Assess expected changes in availability and distribution of ecosystem services
Step 5: Identify and appraise policy options based on the analysis of expected changes in ecosystem services
Step 6: Assess social and environmental impacts of policy options, as changes in ecosystem services affect people differently

The order of the steps as outlined is flexible and can be adapted to the specific circumstances of the investigated site. More detailed information on the TEEB stepwise approach can be found in the report *TEEB for Local and Regional Policy Makers* and in the book *TEEB in Local and Regional Policy and Management*, both available on the TEEB website.

Source: Russi D., ten Brink P., Farmer A., Badura T., Coates D., Förster J., Kumar R. and Davidson N.

(2013) *The Economics of Ecosystems and Biodiversity for Water and Wetlands*. IEEP, London and Brussels; Ramsar Secretariat, Gland. (www.teebweb.org)

For detailed guidelines and case studies on the wise use of wetlands (including peatlands), refer to the Ramsar Handbook Series, Technical Reports and other guidance available at www.ramsar.org

Managing trade-offs in ecosystem services: Cross-sectoral and ecosystem-based approaches to peatland management - such as catchment/river (or lake or aquifer) basin-scale management, and integrated coastal zone management - that consider the trade-offs between different peatland ecosystem services are more likely to ensure sustainable development than many existing sectoral approaches.

Focusing on single provisioning ecosystem services (such as forestry or agriculture) in isolation from regulating services (such as flood control or carbon storage) has frequently resulted in policy failures. By ignoring regulating services, the capacity to fulfil long-term goals of sustainable peatland ecosystem management, e.g. maintaining agricultural productivity, conserving biodiversity and reducing the rate of climate change may be seriously jeopardized.

The 2011 United Nations Environment Programme (UNEP)'s *Managing Trade-offs in Ecosystem Services* (www.unep.org) report presents an ecological perspective on regulating services and demonstrates the role of economics in developing methodologies to manage trade-offs between provisioning and regulating services. Building on the analysis, the paper proposes a general framework for managing these trade-offs using a landscape-based approach, which can be applied to support an integrated approach to management planning for peatlands.

The tools and approaches listed above are just a sample of those available to support the integrated management of peatlands and peatland forests. A detailed assessment of the full range of available tools and approaches is likely to generate additional material to support efforts by peatland planners and managers.

A range of tools and approaches are available to support efforts to integrate peatland forest management into the broader policy and planning frameworks.

Action 4.5.1: Undertake a detailed assessment of the tools and approaches available to support the integration of tropical peatland management into the broader policy and planning frameworks at the national level. Disseminate the findings to all relevant stakeholders.

Action 4.5.2: Organize training workshops for peatland planners and managers to enable them to use the available tools and approaches.

Action 4.5.3: Support the development and implementation of new and innovative tools and approaches to support the integration of tropical and subtropical peatlands and peatland forests into the broader policy and planning frameworks, and in response to issues related to peatland management.

Action 4.5.4: Establish pilot sites in priority peatland areas to demonstrate a range of tools and approaches for the integrated management of peatlands.

Theme 5: Research Networks, Regional Centres of Expertise, and Institutional Capacity

The lack of knowledge and understanding regarding the peatland ecosystem has been identified by SE Asian countries as one of the key challenges to efforts to take an integrated approach to the management of peatlands. The lack of hard scientific data on peatland ecosystem functions hinders efforts to identify the broad, cross-cutting measures needed to manage the peatland ecosystem at a scale that is appropriate to enable the system to continue to provide services. This limitation has been highlighted by the several multilateral environmental agreements, in the Millennium Ecosystem Assessment (www.maweb.org), and by various other national, regional and international entities.

SE Asian nations faces enormous challenges in terms of halting peatland degradation and loss in the years ahead, not just in terms of implementing the many actions that are set down in the various peatland-related policy and planning documents, but in many cases, in deciding what action is appropriate. The decisions that need to be taken in the next few years will have far-reaching consequences for peatlands and peatland forests and therefore must be based on thorough knowledge of the problems, interactions and dependencies involved. This kind of knowledge will only be available by conducting relevant and rigorous scientific research.

Additionally, it is necessary for countries to review and ensure that they have in place the necessary institutional capacity to support the integrated management of peatlands. It is also necessary to provide peatland managers and those responsible for policy and planning related to the utilisation of peatlands with improved access to information and training facilities, in order to enhance their capacity.

Three over-arching strategies are recommended to address these challenges.

5.1 Participate in Research Networks related to Peatlands

Research networks hold plenty of potential to advance knowledge and understanding about peatlands, not least in the opportunity they provide for communication between researchers and end-users.

Additionally, research networks are increasingly regarded as an important policy instrument to close the research gap between the North and the South. Paragraph 48 of the 'The Future We Want' statement from the Rio+20 Conference (2012, Rio de Janeiro, Brazil) states, "We recognize the important contribution of the scientific and technological community to sustainable development. We are committed to working with and fostering collaboration among the academic, scientific and technological community, in particular in developing countries, to close the technological gap between developing and developed countries and strengthen the science-policy interface as well as to foster international research collaboration on sustainable development." (www.rio20.un.org).

Below are examples of some of the peatland-specific networks that are working at the global, regional and national level.

The EU-funded **CARBOPEAT** (*Carbon-Climate-Human Interactions in Tropical Peatlands: Vulnerabilities, Risks and Mitigation Measures*) project aims to improving understanding of tropical peatlands and how their destruction could contribute to climate change. The project partners, who come from Europe as well as Malaysia, Indonesia and Vietnam, work to disseminate the latest knowledge on these valuable ecosystems to those who are responsible for managing them. The

CARBOPEAT project seeks to identify key issues and critical gaps in the understanding of tropical peatland carbon dynamics, analyse implications for policy, and formulate guidelines for optimising the tropical peat carbon store that can be understood readily by policy-makers and decision-takers in both European and Southeast Asian countries.
(http://www.geog.le.ac.uk/staff/sep5/tropeat/carbopeat/index.html).

The **RESTORPEAT** Project aims to coordinate international activities that address global and regional issues of carbon balance, water management, biodiversity conservation and poverty alleviation related to restoration and management of tropical peatland; provide access to existing knowledge and expertise and conduct targeted research on restoration of tropical peat swamp forest to promote sustainable livelihoods of local people; and provide a scientific and technological framework for knowledge transfer and human capacity development related to restoration of tropical peatland to developing countries.
(http://www.splu.nl/restorpeat/p_frameset.htm)

The Southeast Asia Peat Network (**SEApeat**) is an information network that links up individuals and groups working on peat related areas i.e. management, conservation, research and sustainable use. It utilizes e-mail and a web site on the Internet to exchange and disseminate information among network members. It maintains a database on resource persons to promote networking among peat experts (or organizations) who work in the Southeast Asia region and provide resources to managers and researchers in peatland management. Its Peat Site Profiles database aims to increase the awareness of the public and peatland managers regarding existing peat sites, and to help promote peatland areas with best management practices and encourage information exchange among peatland managers (www.aseanpeat.net).

The Sustainable Wetlands Adaptation and Mitigation Program (**SWAMP**) is a collaborative effort by the Center for International Forestry Research (CIFOR), the USDA Forest Service (USFS) and Oregon State University with support from the US Agency for International Development (USAID). To better understand the C-dynamics in wetland ecosystems in Indonesia, SWAMP is employing robust scientific approaches and methodologies to generate knowledge that is relevant to policymakers and practitioners regarding the sustainable management of wetlands in the face of changing global climate and livelihoods of local community (http://www.cifor.org/swamp/home.html).

Promoting peatland research can help planners and managers to advance their knowledge and understanding about peatlands, to identify priorities for future research, and to promote a multi-disciplinary approach to peatland research that benefits policy and planning.

Action 5.1.1: Participate in the existing peatland networks to promote multi-disciplinary peatland research and programme cooperation, share knowledge and information and improve understanding of the character, functioning and values of tropical and subtropical peatland ecosystems.

Action 5.1.2: Seek opportunities to develop cooperative scientific and management studies at the regional and national levels to fill the identified gaps in the knowledge required to inform the integrated management planning of peatlands.

Action 5.1.3: Encourage the development of collaborative projects and programmes on issues related to the integrated management of tropical and sub-tropical peatlands between SE Asian countries and organizations or institutes in the developed countries.

Action 5.1.4: Seek opportunities for cooperative research to further elucidate the role of peatlands in mitigating the impacts of global climate change, in line with the gaps in knowledge identified by the comprehensive review of "Wetlands and climate change: impacts and mitigation" submitted to Ramsar COP8 (www.ramsar.org).

Action 5.1.5: Facilitate research and the transfer of technologies on peatland restoration and rehabilitation to advice and inform policy and planning related to the management of degraded peatlands, and support efforts to identify and implement actions to restore peatland ecosystem services.

Action 5.1.6: Encourage research into, and development of, appropriate sustainable paludiculture systems on peat, for example, the production of sago and the culture of indigenous fish species.

5.2 Establish Centres of Peatland Excellence at the National and Regional Level

A Centre of Excellence (CoE) can be described as an entity that, in addition to performing its own routine work, has an additional role in improving its own expertise and knowledge resources so that in turn, it can help others to improve. A CoE works to ensure the availability of sound and up-to-date scientific information in its particular area or areas of expertise, as well as to provide experts, where needed, to assist with efforts within its region of operations.

Within the SE Asia region, there are centres currently working at the national and/or regional level on aspects related to the management of peatlands. Some of these are described below:

Tropical Peat Research Laboratory Unit, Sarawak, Malaysia
Established in 2008, this centre aims to develop the scientific knowledge and understanding on responsible management and wise use of tropical peatlands; create a comprehensive database on tropical peatlands; strengthen local and international research collaborations; enhance competency of researchers on tropical peat research; and enhance advisory or consultancy services on tropical peatlands. The Unit's activities include projects to determine the carbon balance of tropical peatland to generate scientific information for the sustainable development, management and conservation of tropical peatlands. Currently the Unit has joint research collaborations with several universities from Japan, the Asia and Japan Flux Groups, and the Japan Forest Research Institute.

Centre for Tropical Peat Swamp Forest Restoration and Conservation, Sumatra, Indonesia
This is a partnership of stakeholders in tropical peatland based in Pekanbaru, Sumatra. It promotes integrated research and action through action plans and programmes such as:

1. Restoration of Logged Over Forest Areas for Promotion of Sustainable Local Community Livelihoods and Ecosystem Services of Temiang Village in Bukit Batu Forest Block in The Giam Siak Kecil Bukit Batu Biosphere Reserve, Riau, East Sumatra.
2. Development of Meranti Batu (*Shorea uliginosa*) for Promotion of Bio-resources Conservation and Bio-ethanol Production by Communities Involvement in the Degraded Peat Swamp Forest Ecosystem in Riau, East Sumatra.

Centre for International Forestry Research (CIFOR), Bogor, Indonesia
The CIFOR is dedicated to advancing human well-being, environmental conservation and equity by conducting research to help shape policies and practices that affect forests in developing countries, and enable more informed and equitable decision making about the use and management of forests in less-developed countries. Its multidisciplinary approach considers the underlying drivers of deforestation and degradation which often lie outside the forestry sector: forces such as agriculture, infrastructure development, trade and investment policies and law enforcement. Through joint

collaborations with scientific institutions, CIFOR is currently undertaking field research to assess carbon stocks in peatland forests in 23 peatland forest sites across Indonesia.

Individually, these and other such centres contribute valuable knowledge and information to support the management of peatlands. However, in order to better address the critical gaps in knowledge, information and capacity in the SE Asian countries, a more concerted effort is needed to ensure that these centres contribute relevant information and knowledge in a timely manner to meet the needs of the end-users, i.e. the peatland planners and managers.

At the national level, the creation of a network of 'Centres of Excellence' that brings together multi-disciplinary partners from academia, industry, government and non-governmental organizations could help to connect sound research with technological know-how and strategic investment. Such a network can perform targeted research and development based on needs identified by the end-users, and enable researchers and students to work with beneficiary communities to accelerate the creation, transfer and application of new knowledge and technological innovations.

At the regional level, centres dedicated to multi-disciplinary research in various aspects of peatland management, can serve as Centres of Excellence to promote and coordinate collaborative research among the SE Asian countries, and to conduct capacity-building activities for peatland planners and managers.

'Centres of Excellence in Peatlands' can provide expertise, training and sound, up-to-date scientific information to peatland planners and managers to inform and advice policy, planning and management of peatlands.

Action 5.2.1: Identify Centres of Excellence in tropical peatland management, operating at the national, regional and global levels, and make this information available to peatland planners and managers.

Action 5.2.2: Establish a *Network of Centres of Excellence in Peatlands* at the national level to accelerate the creation, transfer and application of new knowledge to increase capacity for the integrated management of peatlands. Support the development of new Centres of Excellence dedicated to advancing the integrated management of peatlands.

Action 5.2.3: At the regional level, create a network of Centres of Excellence dedicated to promoting collaborative research on common issues of concern, to facilitate the sharing of knowledge and technology, and to build capacity among peatland planners and managers in the SE Asian countries.

Action 5.2.4: Enhance cooperation between the national /regional Centres of Excellence and global centres/networks of wetland/peatland expertise to promote the transfer of technology and knowledge, and to garner support for the efforts at the regional and national level.

5.3 Enhance Capacity of Institutions at the National and Local Levels

An integrated approach to the planning and management of peatlands is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of peatland ecosystems. Such an integrated approach requires peatland planners and managers to acquire new knowledge and skills to enable them to make informed choices and contribute to the decision-making process.

A key obstacle for many developing countries is a lack of capacity for identifying challenges and priorities for the sustainable use of peatlands and their implications for development, formulating policy responses and implementing strategies. There are many dimensions to this challenge – the lack of capacity to monitor and collect information on peatland degradation, for environmental risk assessment, to make the economic case for sustainable peatland management and development, for cross-sectoral co-ordination, and for environmental fiscal reform.

Putting the integrated management planning of peatlands on everyone's agenda calls for innovative approaches to engage all the stakeholders who shape policy development and investment decisions. Capacity-building approaches at the national and local levels therefore have to go beyond the traditional focus on environment ministries and their role in environmental protection. It has to include the finance, planning and sectoral ministries as well as non-governmental actors such as civil society, academia, local communities and the private sector.

Development co-operation agencies and environment agencies at regional and international levels can play an important role in helping build these capacities. More effective development support can be achieved by ensuring greater ownership and leadership by developing countries and greater interest by development support providers in using and strengthening developing countries' own financial and planning systems. These processes are themselves a way of building capacity. At the same time, development support providers also need to evaluate, build and strengthen their own capacities to provide effective support to developing countries heading along the green development path.

The approach is cyclical – capacity development is a long process and regular reviews are necessary to monitor progress and feed information back into the process. The cross-cutting nature of the peatland ecosystem demands innovative approaches that shape policy development and investment decisions and make stakeholders aware of the important contribution of sustainable development of peatland resources to development. Achieving this requires a broad range of skills and knowledge among individuals and organisations and an enabling environment that supports this process (e.g. national policies, legislation, institutional frameworks, accountability and transparency).

The Organisation for Economic Co-operation and Development (OECD)'s *Greening Development: Enhancing Capacity for Environmental Management and Governance* policy guidance document defines a framework for incorporating the environment in capacity-building efforts at the national and sectoral levels. This framework can be applied to efforts to build capacity in integrated management planning for peatlands.

The OECD framework reflects a shift from the traditional view of capacity development as a purely technical process to one that recognises the importance of country ownership at different levels in government and society. The report thus advocates the application of country systems as entry points for capacity development for the environment.

The document outlines a number of specific interventions to be considered when building capacity at the national level for effective integration of environmental issues into national development plans, national budgetary processes and key economic sector strategies, and interventions to be considered by development assistance agencies when providing assistance to developing countries (Box 17).

Box 17. Enhancing Capacity for Environmental Management and Governance – Specific Interventions at the National and Regional/International Level

National level

Use multi-year development planning processes. Multi-year development planning processes are common in many developing countries. These are an attractive vehicle for systematically incorporating green growth and green development into the national and sectoral planning and budgetary allocations. The capacity needed for fulfilling this potential is mainly about effective governance, institutional mechanisms to provide environmental input into the national development planning process, and the skills for framing environmental issues in the language of the policy maker and other stakeholders.

Develop key actors' technical skills. Environment ministries must have the skills to compete for national resources in the shift from project funding to funds which are pooled in sector or national budgets. Ministries will need to be able to argue the case for the environment in terms that budget planners can understand, i.e. presenting the costs and benefits of specific actions within technically sound budget submissions. This requires a good understanding of the different stages of the budget cycle.

Encourage the participation of non-government actors. The active participation of those outside the government creates accountability, facilitates learning and enshrines citizens' rights of engagement in planning processes. This participation should go beyond simple consultation to real engagement – a process that requires a range of organisational and individual capacities.

Build functional and technical skills. Focus on building, firstly, functional capacities, such as a good understanding of the basic elements of the national planning process, including who provides input and participates in deliberations, how and when; and secondly, technical capacities, such as for collecting robust analytical data to support the case for integrating the environment into national development plans.

Plan and target efforts carefully. Plan for the long haul, but target early efforts to where the most difference can be made – seeking out and building relationships with "champions", and exploiting win-win opportunities.

By Development Assistance Agencies

View capacity development for the environment as underpinning all development support. Capacity development for environmental management must be seen as a cross-cutting strategic issue. Capacity development therefore must never be an afterthought, but rather a focal point at all levels of design, implementation and valuation.

Collaborate across domestic agencies. When possible, development assistance agencies should work with their counterparts in the environment agency or ministry to exploit the comparative advantages of different agencies within the country.

Harmonise approaches among development support providers. Given the large number of development and environment agencies operating in developing countries, a well-coordinated and harmonised development support approach is necessary in order to ensure effective programme delivery, facilitate exchange of information, and avoid duplicated efforts.

Nurture local ownership. A successful capacity development programme needs to be aligned with the environmental priorities of the developing country in order to secure ownership, oversight and management of the support.

Focus on results. Development support providers need to monitor and evaluate their activities. This will enable them to incorporate lessons learned into subsequent activities and identify new and emerging environmental issues that need to be addressed.

Implement best practice guidelines. These guidelines could help development support providers to understand key principles and tools required in delivering effective support for capacity development for greening national systems.

Reflect and learn. Development support providers need to assess their own capacity needs requirements in order to effectively provide support to developing countries on enhanced capacity for environmental governance.

Source: Organisation for Economic Co-operation and Development, 2012. *Greening Development: Enhancing Capacity for Environmental Management and Governance.* (http://uscib.org/docs/OECD_Greening%20Development%20Enhancing%20Capacity_24Jan2012.pdf).

At the national level, capacity development should go beyond technical input and awareness-raising at the individual level to focus on building capacity at all three levels of planning and management: Individual capacity, organizational capacity, and the enabling environment (see Table 7).

Table 7. Capacity development at the national level

	Enabling environment	**Organisational level**	**Individual level**
Overall capacity objective	Develop regulatory frameworks for environmental governance, rule of law and property rights. Improve inter-institutional co-ordination	Develop organisational performance and environmental management capabilities.	Improve understanding of environment-development linkages. Develop technical skills (e.g. economic and environmental assessment). Support long-term commitment.
Examples of specific interventions	Support legislative, policy and regulatory reforms. Develop guidelines on environmental management. Monitor and review environmental management systems.	Develop internal guidelines on environmental management. Conduct institutional monitoring and evaluation.	Create awareness and provide basic skills development. Provide training on environmental management tools and valuation techniques.
Cross-cutting intervention	Raise awareness about the benefits of good practice. Create platforms for debate and policy dialogue between key stakeholders (i.e. professional networks or conferences to review and discuss states of practice). Improve co-ordination procedures on e.g. the inclusion of environmental sustainability in government policies. Support pilot projects that test proposed capacity building initiatives. Award schemes that identify and appreciate best practice.		

Source: Adapted from OECD, 2006. The Challenge of Capacity Development: Working Towards Good Practice, DAC Guidelines Reference Series, OECD, Paris. (http://www.oecd.org/dac/governance-development/36326495.pdf).

For detailed guidance on initiating capacity development programmes at national, regional and local levels, see Gevers, G.J.M. and Koopmanschap, E.M.J., 2012. *Enhancing the Wise Use of Wetlands. A Framework for Capacity Development*. (http://www.ramsar.org/pdf/cop11/doc/cop11-doc34-e-capacity.pdf).

Capacity development requires an integrated set of activities at various levels (enabling environment, organizational and individual) over a longer period of time, following a structured capacity development strategy or action plan. The capacity development strategy/action plan should be a subset of the National Action Plan for Peatlands (NAP) discussed in Section 3.2. Finally, it is very important to realise that capacity development programmes need a long-term commitment in order to be successful.

Individuals and organizations across the sectors related to peatland management planning need to acquire new knowledge and skills to enable them to adopt an integrated approach to decision-making within an enabling environment that supports the implementation of integrated approaches.

Action 5.3.1: Develop and implement a national-level capacity development strategy/action plan to enhance capacity in peatland planning and management at the various levels (enabling environment, organizational and individual). The Strategy/Plan should be based on an assessment of capacity needs at the each level, to support the implementation of the National Action Plan for Peatlands (NAP).

Action 5.3.2: Periodically review capacity needs at the various levels (enabling environment, organizational and individual) and develop new actions to address needs that have not been captured in the capacity development strategy/plan.

Action 5.3.3: Revise/update the capacity development strategy/action plan in line with revisions to/updates of the National Action Plan for Peatlands (NAP).

Theme 6: Regional and International cooperation

SE Asia is home to the largest area of peatlands in the world. The total area of peatlands in SE Asia is estimated to be about 25 million hectares (ha), comprising 60% of the world's tropical peatlands and roughly one-tenth of the entire extent of the global peatland resource. Ensuring the effective management of this globally-important resource in the face of limitations in knowledge, resources and capacity is a daunting task for any one SE Asian country to undertake alone.

Many of the impacts that arise from the degradation of tropical peatlands, such as air pollution and carbon emissions, have regional or global implications, and should therefore be addressed through joint efforts by the regional or international communities.

Enhancing cooperation at the regional and international level can help maximize returns on investment in actions to manage peatland ecosystems and resources. Cooperation at the bilateral, regional and international level facilitates dialogue and exchange, and promotes the implementation of international conventions, standards and best management practices.

Additionally, efforts at the regional level can contribute more effectively to the delivery of international agreements and treaties such as the Ramsar Convention, CBD (and in particular its Programme of Work on the biological diversity of inland waters), and the UNFCCC, to name a few.

6.1 Enhancing Regional Cooperation

The Goal of the ASEAN Peatland Management Initiative speaks directly to enhancing regional cooperation: '*To promote sustainable management of peatlands in the ASEAN region through collective actions and enhanced cooperation to support and sustain local livelihoods, reduce risk of the fire and associated regional haze and contribute to global environmental management*.'

Focus Area 12 of the *ASEAN Peatland Management Strategy* (APMS) defines four operational objectives to enhance cooperation at the regional level:

1. Promote exchange of expertise in addressing peatland management issues.
2. Establishment of centres of excellence in the region for peatland assessment and management.
3. Contribute to the implementation of other related agreements and regional cooperation mechanisms.
4. Enhance multi-stakeholder partnerships to support peatland management.

The actions proposed under Part 5 of these Guidelines concerning cooperative action on research, knowledge sharing and technology transfer, and the establishment of centres of excellence for peatland management provide avenues to enhance regional and international cooperation between and among SE Asian countries to deliver the APMS's operational objectives.

Existing collaborative mechanisms under the ASEAN framework such as the ASEAN University Network, and the Science and Technology Research Partnerships for Sustainable Development (SATREPS) can help facilitate collaborative research and promote the 'transfer of technology' on aspects related to the integrated peatland management.

At the sub-regional level, ASEAN Member States can collaborate through frameworks such as the Mekong River Commission (Cambodia, Lao PDR, Thailand and Viet Nam), and the East ASEAN Growth Area (BIMP-EAGA) comprising Brunei, Indonesia, Malaysia and the Philippines.

6.2 Enhancing International Cooperation

Article 5 of the **Ramsar Convention** states, "The Contracting Parties shall consult with each other about implementing obligations arising from the Convention especially in the case of a wetland extending over the territories of more than one Contracting Party or where a water system is shared by Contracting Parties. They shall at the same time endeavour to coordinate and support present and future policies and regulations concerning the conservation of wetlands and their flora and fauna." 9 the 10 ASEAN Member States (excluding Singapore) are Parties to the Ramsar Convention, and through this platform, can engage with, and participate in, collaborative initiatives / research with organizations and experts in the field of peatland management, and access data and information from agencies and organizations across the globe.

There are a number of international peatland initiatives that work on various disciplines related to peatland management:

The **IUCN Peatland Thematic Group**'s work aims to highlight the benefits of peatland ecosystems and explore new funding opportunities for peatlands based on ecosystem services. The group encompasses a truly international network of experts to share good practice, build consensus on

science and encourage national strategies for action to deliver peatland conservation and restoration. The purpose of the Group is to, among others, provide good practice advice and information aimed at peatland conservation/restoration action to support delivery of biodiversity, climate change and water objectives; support knowledge exchange with/between partners on peatland management and funding opportunities; and support countries in adopting strategic policies for peatlands and to assess progress of peatland ecosystem management towards biodiversity and climate change targets.

The **Global Peatland Initiative** (GPI) is a partnership between NGOs, scientists, research institutes and the private sector that provides a means to identify, develop and fund projects essential to achieve the 'wise use' of peatlands globally. The GPI was formed in response to the Ramsar Guidelines for Global Action on Peatlands (GGAP) to 'foster national, regional and international partnerships of government, private sector and non-government agencies to fund and implement actions in support of such strategies'. The GPI contributes to international policy frameworks such as conventions (e.g. CBD, Ramsar) and International Treaties and Strategies (e.g. Kyoto Protocol and Wise Use Guidelines) through activities that contribute to the science base, enhancing access to information, and developing and supporting local and international capacity.

The **International Mire Conservation Group** (IMCG) is an international network of specialists who promote, encourage and, where appropriate, co-ordinate the conservation of mires and related ecosystems; and enhance the exchange of information and experience relating to mires and factors affecting them. The network encompasses a wide spectrum of expertise and interests, from research scientists to consultants, government agency specialists to peatland site managers. The network currently has over 550 contacts in almost 60 countries.

The **UN FAO Organic Soils and Peatlands Climate Change Mitigation Initiative**, launched in 2012, is an informal network of organizations and people committed to reducing emissions from peatlands and safeguarding the other vital ecosystem services peatlands provide. Institutions currently involved in the initiative include FAO, Wetlands International, Greifswald University, IUCN UK, Global Research Alliance on Agricultural Greenhouse Gases, the Center for International Forestry Research (CIFOR), Global Environment Centre (GEC), the International Centre for Integrated Mountain Development (ICIMOD), Michael Succow Foundation and the University of Helsinki.

Enhancing cooperation at the regional and international level can help maximize returns on investment in actions to manage peatland ecosystems and resources.

Action 6.1: Explore opportunities to undertake collaborative actions at the regional and international level to ensure the successful implementation of the ASEAN Peatland Management Strategy, in cooperation with peatland stakeholders and other interested parties.

Action 6.2: Promote collaborative action for peatland management through existing political and economic cooperation frameworks such as the Brunei Darussalam-Indonesia-Malaysia-The Philippines East ASEAN Growth Area (BIMP-EAGA), and the Mekong River Commission.

Action 6.3: Ensure that peatland issues are fully addressed in the discussions and resolutions prepared for the meetings of the Conference of the Parties and subsidiary bodies of the Ramsar Convention. These issues should also be taken into account, where appropriate, in other multilateral environmental agreements, notably CBD and UNFCCC, including consideration of joint action plans on peatlands.

Theme 7: Implementation and support

7.1 Adopting Good Governance and Effective Law Enforcement

'Governance' is the exercise of power or authority – political, economic, administrative or otherwise – to manage resources and affairs. It comprises the mechanisms, processes and institutions, through which stakeholders and individuals can express their interests, exercise their legal rights, meet their obligations and reconcile their differences. 'Good governance' means competent management of a resource and affairs in a manner that is open, transparent, accountable, equitable and responsive to people's needs. Good governance and law enforcement can contribute to the responsible management of peatland and peatland forest resources.

Objectives for the good governance of peatland management should include the following:

1. Regulatory frameworks and legislation at regional, national and subnational levels to ensure the responsible management of peatlands.
2. Policies on peatland management that follow the principles of sustainable use, including, for example, transparent and open processes for decision-making.
3. Peatland planning and management based on sound scientific knowledge.
4. Voluntary mechanisms (for example, certification) that complement legislation, regulatory frameworks and statements of responsible management principles in relevant international agreements.
5. Principles, criteria or guidance that provide the greatest guarantee for maintaining peatland ecosystem services in the event that the actions under the National Action Plan for Peatlands (NAP) overlap or conflict with those of other mechanisms (e.g. economic incentives) provided to industries/sectors involved in peatland use (e.g. agriculture and forestry).

7.2 Adopting a Multi-Stakeholder Partnership Approach

Multi-Stakeholder Partnerships (MSPs) are partnerships that create lasting and meaningful impact at all levels of action. They are meant to promote a more holistic approach to development and better governance. The concept of MSP as an instrument for achieving development goals is sound, particularly when stakeholders with unique complementary strengths or core competencies add value to development efforts and pool their resources and assets in solving problems.

MSPs are unique in both character and substance. They are generally directed at the problems and challenges of sustainable development, from environment protection and management, to social inclusion and sustainable economic growth. They are about sharing not shifting risks; finding innovative ways to pool resources and talents based on each parties' core strengths; and designed and maintained over time in such a way as to deliver mutual benefits for all collaborating parties. MSPs pursue a shared vision, maintain a presumption in favour of joint problem-solving, promote a work ethos that exploits mutual self-interest, and adds value beyond that achievable by any one party alone.

But while many laud the virtues of MSPs, most are struggling to make them work. The central challenge seems to revolve around the nurturing of a working relationship based on trust, mutual respect, open communication, and understanding among stakeholders about each other's strengths and weaknesses.

The concept of MSPs is not new to the SE Asian countries. Many policy and planning processes and documents recognise the importance of creating MSP platforms to promote constructive dialogue and consensus-taking among all stakeholders, but in practice, two critical stakeholder groups – Local people and Indigenous communities – are rarely represented.

Engagement of Local People and Indigenous Communities: The ultimate goal of local community engagement in the decision-making and implementation processes involved in peatland management is to provide a sense of participation which in turn helps local people understand the key issues and priorities. In return, other stakeholders, especially private sector and government agencies, will discover, understand and appreciate better, local knowledge, viewpoints, skills and practices.

Objectives for ensuring the active participation of local people include:

- Integrate peatland management into the larger context of landscape- and community-based land use planning and show how:
  - Stakeholders can contribute to the decision making and implementation processes.
  - Peatland managers and planners can provide stakeholders with opportunities to contribute to the planning and management processes under existing frameworks for land use planning in the region and strive to improve these.
- Apply open and transparent planning and management procedures, including dissemination of information, early in the planning process and stress the significance of peatlands to local people and the importance of considering and including their views.
- Consider possible alternatives for peatland after-use that provide the best possible advantages for local people and the environment.

Multi-Stakeholder Partnerships at the National and Sub-national Level

Wetland-related committees at the national, state/provincial and local level provide the ideal platform to operationalize the MSP approach to management planning for peatlands and peatland forests.

National Wetland/Ramsar Committees, such as those that have been set up in many of the SE Asian countries, can encourage and establish support from many sectors and stakeholders. The Committee can greatly assist in avoiding and resolving conflicts in peatland management.

At the state/provincial level, a State Wetlands Committee provides a good platform to facilitate a MSP approach to the management of all wetlands in the state. In Sabah and Sarawak in Malaysia, State Wetlands Management Committees were established to oversee the implementation of international projects related to wetlands, and the management of the state's Ramsar Site(s). Each Committee is chaired by the State Secretary, who heads the state's civil service. The Committee consists of representatives from all the various jurisdictions of government, and academia, but does not include representatives from civil society.

At the site/local level, MSPs can be convened as informal or formal processes. An example of the latter is the Loagan Bunut National Park Special Park Committee (SPC) in Sarawak, Malaysia. The concept of a SPC was been adopted at the legislative level in Sarawak through the inclusion of a provision within the National Parks and Nature Reserves Ordinance, 1998, which states:

(1) The Controller may constitute a Special Park Committee, which shall be headed by a Park Warden to assist the Controller in the protection and management of a national park or a nature reserve, and to promote public appreciation and enjoyment thereof.

(2) A Special Park Committee shall consist of not more than twelve members, and shall comprise park officers, Honorary Wild Life Rangers appointed under section 8(1) of the Wild Life Protection Ordinance, 1998 [Cap. 26], any other persons residing near a national park or a nature reserve and such other persons, who, in the opinion of the Controller, would be able to assist him in the protection and management of a national park or a nature reserve.

The Loagan Bunut SPC provides a platform for collaboration between all the relevant stakeholders in the management of the protected area, and serves as mechanism through which benefits can be channelled to local people and indigenous communities. The committee was initiated in 2003; committee members comprise park management, local community leaders, government agencies, NGOs & representatives from the plantations operating in the area.

Multi-Stakeholder Partnerships at the Regional Level

The development of MSPs at the regional level is a challenge, but within the ASEAN region, there is one example that stands out as having potential for replication to serve peatland management planning.

The e-ASEAN Task Force, which is a forum comprising both government and private sector representatives with a stated objective to look for ways to pool comparative advantages, is an example of MSP within the ASEAN framework. Although the private sector are not signatories to the e-ASEAN (inter-governmental) Framework Agreement, their input to the overall design has been significant (Box 18). This model could potentially be replicated, with the inclusion of civil society representatives at the appropriate level, to support the implementation of the ASEAN Peatland Management Strategy.

Box 18. e-ASEAN Initiative

Development Aims
ASEAN Member States believe they must embrace the development and use of Information and Communications Technology (ICT) if they are to sustain economic growth and remain competitive in the global market place. ASEAN leaders thus agreed to promote collective efforts to complement national development strategies in this sector.

The e-ASEAN Initiative establishes a region-wide approach to making comprehensive use of ICT in business, society, and the government. In November 2000, ASEAN governments signed the e-ASEAN Framework Agreement to facilitate the establishment of the ASEAN Information Infrastructure. While its stated objectives include the intention to promote cooperation between the public and private sectors, there is no further outline of respective roles in the document. In the consultative phase of the initiative however, private sector input was sought and had a significant influence. There was however little or no input from civil society.

The **e-ASEAN Task Force** was created in 1999 to develop a broad and comprehensive action plan. It is the only advisory body to ASEAN that is composed of representatives from the public and private sectors, and explicitly states its intention to allow the private and public sectors to bring their respective comparative advantages together. The action plan itself includes a number of pilot projects across a range of enabling environment, hardware and software initiatives, most with strong private sector involvement. Several of these are, in themselves, formal MSP arrangements.

Again, however, the opportunity to strengthen the partnerships with civil society involvement seems to have been largely missed.

Partners

- Governments of the 10 ASEAN Member States
- Private sector representatives of e-ASEAN Task Force and consultative groups
- Partners in individual pilot projects including national government, local and international companies

The Partnering Process

There were several stages to the process of partnership development, comprising a consultative phase and on-going forum, international agreements, and an action plan. At the enabling environment level, the governments of ASEAN Member States have a formally signed agreement governing interconnectivity and technical inter-operability among their telecommunication systems and equipment, and have established working mechanisms and an action plan for promoting applications. At a consultative level, private sector representatives of e-ASEAN Task Force and consultative groups were able to introduce a strong private sector perspective into the subsequent action plan. In some cases pilot projects within the action plan have formal partnering agreements e.g. the "e-learning for life" project of Coca Cola, UNDP and the Government of Malaysia.

Outcomes and Value Added

The framework agreement, Task Force and action plan are proving to be important catalysts to both harmonising and promoting the initiatives in the region. The strong involvement of the private sector, which is unusual in ASEAN inter-governmental fora, is seen as significantly improving the effectiveness of the outcomes. There is, though, some criticism levelled at the on-going rigidity of the ASEAN processes with respect to genuine partnerships and the absence of meaningful civil society input in the e-ASEAN process.

Source: *Multi-Stakeholder Partnerships Issues Paper*, Global Knowledge Partnership, 2003. (http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2117.pdf)

Good governance, effective law enforcement and Multi-Stakeholder Partnerships can contribute to the responsible management of peatland and peatland forest resources.

Action 7.1.1: Update legislation governing peatlands periodically and enforce it appropriately and effectively.

Action 7.1.2: Ensure that peatland planners and managers act in accordance with national legislation, international agreements and sustainable use principles.

Action 7.2.1: Build on and accelerate public-private partnerships, focusing on the actions to ensure the integration of peatland considerations in planning and development related to the use of peatland resources.

Action 7.2.2: Encourage the inclusion of Multi-Stakeholder Partnership (MSP) approaches in national and sub-national policy and planning documents related to peatland management. Ensure that local and indigenous communities are adequately represented, and at the very least, that their views are solicited to inform the deliberations.

Action 7.2.3: Within the framework of the ASEAN Peatland Management Strategy,

- Establish a Peatland Task Force within the ASEAN Framework Agreement.
- Develop and provide generic guidance on how develop and to evaluate MSPs, to enable the key lessons to be drawn out and best management practices to be documented.

7.3 Financing an Integrated Approach to Peatland Management Planning

All of the actions recommended in these Guidelines will need to be financed. To facilitate the shift from the current, largely site-based approach to management planning for peatlands to an ecosystem-based approach, peatland planners and manager will need access to more resources.

By and large, agencies and organizations that are directly responsible for peatland conservation and management in developing countries tend to be under-resourced, both in terms of manpower and finances, and this is not likely to change in the near future. New and innovative financing options need to therefore be identified and accessed to support the implementation of the approaches and actions recommended in these Guidelines.

Climate-related finance options offer perhaps the best available opportunity for SE Asian countries to access global financing for tropical peatland conservation and management. With international climate change policy moving from the Kyoto framework to a more inclusive international regime, a wide spectrum of financial options are emerging, some of which are directly applicable to tropical peatlands and peatland forests.

Table 8 presents a summary of climate finance options available to developing and industrialized countries respectively, for peatland conservation, rehabilitation and sustainable use.

Table 8. Summary of climate finance options for peatland conservation, rehabilitation and sustainable use

Status of Finance Opportunity	**Climate finance opportunities for peatland activities**	
	Developing/non-Annex I countries	**Industrialized/Annex II countries**
Current and operational	*REDD+ capacity building and planning:* Significant bilateral and multilateral funding for REDD+ readiness. Mostly directed at national governments.	*Accounting under Art 3.4 of the Kyoto Protocol:* Expanded accounting options for Annex I countries which may create domestic policies and measures to protect or restore peatlands.
	Current CDM: Scope limited to afforestation and reforestation projects on peatlands but very limited demand for credits.	*Voluntary market:* Wide scope for all activities including re-wetting. Double counting can easily be avoided by cancelling Kyoto units for any relevant voluntary market projects. Weak demand for credits.
	Voluntary market: Wide scope for afforestation, reforestation and REDD+ (including rewetting). Weak demand for credits.	For the EU, various policy frameworks such as the EU Water Framework Directive and the EU LIFE-Programme.
Recognized but additional decisions needed and not yet operational	*REDD+ market mechanisms and results based finance:* The need to finance emission reductions or removals under REDD+	*Joint Implementation (JI):* Current JI rules prevent most JI LULUCF projects. A CMP decision needs to change JI rules to include LULUCF projects that

	recognized but details still being negotiated.	decrease emissions by sources.
	Nationally Appropriate Mitigation Actions (NAMAs): NAMAs have been proposed and could include peat projects. Some finance is starting to flow to NAMAs but further work is needed to fully implement the NAMA concept and identify sufficient sources of finance.	*Domestic offsetting in the EU under the EU ETS:* Article 24(a) of the EU ETS allows for the creation of domestic offsets from a wide range of activities that could include peatlands. However the EC still has to make this, including the inclusion of LULUCF offsets operational.
	Green Climate Fund: The Green Climate Fund has been established but is not yet financed or operational. Finance for peatlands should be within its mandate.	*EU Policies:* The post 2012 Common Agricultural Policy (CAP) includes a set of proposals to shift focus to environmental protection and low-carbon policies. This includes a proposal to allocate 30% of the budget for direct payments to farmers to support measures beneficial to climate and the environment.
May be possible but additional decisions needed	*Expanded CDM:* There is a SBSTA work program to expand eligible LULUCF projects which could extend to peat.	

Source: FAO and Wetlands International (2012). Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use (2nd edition). Hans Joosten, Marja-Liisa Tapio-Biström & Susanna Tol (eds.), http://www.fao.org/docrep/015/an762e/an762e.pdf

Recent developments under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (KP) have produced several options for reducing emissions from peatlands and leveraging finance in the short- and mid-term. For developing (non-Annex I) countries, progress on methodological issues and financing related to reducing emissions from "deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks (REDD+)", holds opportunities for integrated peatland interventions (Box 19).

The emerging climate finance concept of nationally appropriate mitigation actions (NAMAs) and cooperative approaches to agriculture are also promising incentives for actions to reduce emissions from peatlands. Even the Clean Development Mechanism (CDM), thus far an instrument limited to afforestation and reforestation, may slowly change. The land use, land-use change and forestry (LULUCF) and peatland related changes in the international regulations have been kick-started by developments in the voluntary markets, in particular the Verified Carbon Standard (VCS), which in recent years has offered respectable solutions for many of the technical challenges LULUCF projects face.

Box 19. Financing Options for Developing (non-Annex I) Countries

A. The Clean Development Mechanism (CDM)

The CDM can be used to generate Certified Emission Reductions (CERs) from climate-friendly projects in developing countries. Under the CDM LULUCF activities are currently limited to afforestation and reforestation projects, that means that credits can currently only be generated by net removals by sinks. This could include afforestation and reforestation of wet peatlands (e.g. with swamp forest tree species). Conservation, rehabilitation and improved management of non-forested peatlands are thus not (yet) eligible under the CDM. There is, however, scope for future expansion

after a recent request at CMP[1]7 in 2011 to the Subsidiary Body for Scientific and Technological Advice to initiate a work programme on inclusion of further LULUCF activities under the CDM, with a draft decision planned for CMP9 in 2013. This request creates an opportunity to include more types of emissions reductions from peatlands in the CDM. The current rules to account for permanence (i.e. the loss of carbon stock after a credit has been issued for the removal) have also caused problems for CDM afforestation and reforestation projects. Applying the same rules to new CDM LULUCF project activities would create similar problems for the new activities. However, the permanence rules for afforestation and reforestation are currently being re-visited.

B. Reducing Emissions from Deforestation and Forest Degradation (REDD+)

REDD+ is currently focused on forests so it can apply to peatland forests. REDD+ activities in peatlands are those activities that reduce or prevent GHG emissions by protecting the forest on undrained peat and by the rewetting and revegetation of drained peat forests. In the tropics, peatland forests are being drained and cut at an alarming rate. REDD+ is therefore a promising framework to finance emissions reductions from peatlands. There is significant mitigation potential in several countries, in particular Brazil, Indonesia, Malaysia, Papua New Guinea, Thailand and Viet Nam, and in other countries rich in peat swamp forests that have not yet been subject to large-scale peat swamp deforestation and degradation.

REDD+ negotiations are progressing rapidly and multilateral and bilateral funding is readily available for capacity building and technical assistance. Long-term finance of REDD+ performance is, however, still under debate. A number of options exist for interim results-based finance (i.e. payments for achieved emission reductions or increased removals) including the *World Bank's Forest Carbon Partnership Facility* and bilateral support from the governments of Norway and Germany among others. More work is also needed on some methodological issues, although solutions do exist.

One of the methodological challenges for REDD+ is the inclusion of the peat/soil carbon pool in REDD+ reference /reference emission levels – the benchmark that will be used to assess performance and results-based finance. COP[2]17 adopted a decision on methodological guidance for REDD+, which states that countries that wish to participate in the REDD+ should include all significant carbon pools and activities (i.e. also organic soils) in their reference level. Including organic soils will enable generating significant emission reductions and potential finance if the country is able to reduce emissions from peatlands (which may require rewetting drained peatlands). If the area of drained peatland, however, keeps expanding or already drained and emitting peat swamps are not rewetted, the significant and potentially increasing emissions from peatlands may swamp emission reductions from other pools, effectively eliminating the prospects of receiving results-based REDD+ finance.

C. Nationally Appropriate Mitigation Actions (NAMAs)

NAMAs seek to scale-up developing country ambitions by matching comprehensive, results-based mitigation interventions with adequate climate finance, technology support and capacity building. NAMAs – open to all mitigation sectors – provide an important vehicle for broad management of organic soils and wetlands, allowing the combination of conservation, restoration and good practices into a coherent programme. COP17 reiterated the invitation to all developing countries to submit NAMA proposals that will seek international funding. COP17 further clarified the key components for NAMA reporting which includes the identification of a national implementing entity, a projection of costs and time, the amount and type of international support required, an estimate of emission reductions to be achieved, and other indicators of implementation. There is no deadline for NAMA

[1] Conference of the Parties serving as the Meeting of the Parties. The annual UN conference and decision making body for the Kyoto Protocol.

[2] Conference of the Parties. The annual UN conference and decision-making body for the UNFCCC.

submissions, yet the earlier a country positions itself for NAMA interventions, the more accessible it becomes for potential funders, ranging from developed countries to international development agencies and banks, to private sector entities.

While the NAMA concept is still emerging it is expected that any peatland related NAMA will have to be established using robust data and relying on stringent MRV which will still require considerable effort and time. To date, developing countries are attracting bilateral donors for NAMA feasibility studies and NAMA pilots across sectors. This funding should extend to peatland NAMAs. The following SE Asian countries have considerable GHG emissions from peatlands and could consider developing peatland NAMAs: Indonesia, Malaysia, Myanmar, Thailand and Viet Nam.

D. Green Climate Fund (GCF)

The Green Climate Fund (GCF) is expected to become the central multilateral fund for climate change. It will channel a significant portion of the annual US$100 billion that developed countries have committed to mobilize from both public and private sources by 2020 to support climate activities in developing countries. Once fully operational, the GCF will fund both mitigation and adaption activities.

Its operation should extend to activities that support the conservation, rehabilitation, and sustainable use of peatlands in developing countries. The details of how the GCF will disburse funding is still being determined, but will include direct access to the GCF by developing country governments, funding to NAMAs and funding of private sector initiatives. The GCF could explicitly cover opportunities for peatland projects given the disproportionate role of peatlands in climate change, but it is unclear if the GCF will be operated with this level of specificity. Alternatively, if the GCF decisions do not identify specific sectors to fund Parties and observers will at least need to ensure that the GCF remains broad enough to include peatlands.

E. Adaptation

The UNFCCC adaptation framework may facilitate peatland-related assistance and funding, in particular for least developed countries (in SE Asia: Myanmar), which receive on-going support with developing their National Adaptation Plans (NAPs). Other current and future adaption funding may be available for peatland conservation or restoration, though it should be noted that adaptation has traditionally been chronically underfunded. The GCF is meant to provide a new and additional source of funding for adaptation.

F. Agriculture

Agriculture has been very slow in being incorporated into the negotiations for the next climate change agreement. Discussions are on-going in the *Ad Hoc Working Group on Long-term Cooperative Action* under the Convention on the establishment of a technical work programme for agriculture in SBSTA. This would be the first step towards inclusion of agriculture into the future climate mechanism. Organic soils and peatlands are agro-ecosystems with large mitigation potential and thus merit particular attention in the agriculture programme.

Source: FAO and Wetlands International (2012). *Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use (2nd edition). Hans Joosten, Marja-Liisa Tapio-Biström & Susanna Tol (eds.),* http://www.fao.org/docrep/015/an762e/an762e.pdf

One of the important actions agreed under the *ASEAN Peatland Management Strategy 2006-2020* is to explore the use of polluter-pay and user-pay schemes, tax incentives or other options to generate sustainable resources to support the implementation of the Strategy.

The *Development of Financing and Incentive Options for Sustainable Management of Peatland Forests in SEA: A Report for Policymakers* report, produced in January 2013 (www.gec.org.my), presents a review of the existing and potential financing and economic incentive options at the SE Asia regional and country level to support the protection and sustainable management of peatlands.

The report covers three main areas:

1. Assessment of the financial and environmental effectiveness and viability of the incentive systems in combating peatland forest degradation and climate change.
2. A comparative study, on the most suitable incentive schemes based on country priorities to support forest protection and sustainable management of peatlands.
3. Development of the most suitable financing and incentive schemes into simple guidelines for use in ASEAN Member States.

It sets out guidelines for a potential strategy for deploying economic instruments to prevent fires and avoid peatland degradation for five ASEAN Member States: Brunei Darussalam, Indonesia, Malaysia, the Philippines and Viet Nam. The guidelines for each country strategy incorporate the general principles outlined in the report, but also take into account the specific national and provincial policies and programmes that are relevant to peatland conservation that has been

informed by:

- Institutional capacity at national level.
- Significance of the peatland resource in terms of area, location and quality.
- Existing policy framework as it relates to land-use and especially peatland.
- Previous experience with economic incentives.

Each country analysis is set out in terms of a country profile in tabular format, and two diagrams which, respectively, give an overview of the most appropriate incentive and financing schemes in the policy cycle and a 'Road Map' which identifies future short term (within 5 years); medium term (5-10 years); and long term (more than 10 years) actions. Box 20 presents the main recommendations for the adoption of financing and economic incentives in Viet Nam, the Philippines, Malaysia, Indonesia and Brunei Darussalam.

Box 20. Main Recommendations for the Adoption of Financing and Economic Incentives in Viet Nam, the Philippines, Malaysia, Indonesia and Brunei Darussalam

Viet Nam and the Philippines

In the short term, with funding from development agencies, international NGOs and eco-tourism ventures, user incentives for alternative livelihoods that avoid fire should be developed and implemented in pilot project sites at high value peatland sites. In Viet Nam payments to households to protect peatland resources in the U Minh Thuong and U Minh Ha National Parks should be made under the Green and Red Book system. In the Philippines, the opportunity to redirect existing agricultural and forestry subsidy payments to promote the wise use of peatlands should also be explored. In the medium term, PES schemes supported potentially by REDD+ finance may be deployed to protect the national peatland resource. Reforestation of degraded peatlands may be possible under climate finance mechanism of CDM.

Malaysia

Malaysia has extensive peatland areas, much of which has been exploited for agriculture, forestry and other land uses. Thus an ambitious state and national programme to promote the wise use of peatland is required and should be based around a hypothecated user tax or 'CESS tax'. This

approach would impose higher taxes on unsustainable uses such as oil palm production on peat and reinvest the income in financial incentives to support the wise use of peatlands. Given the strong support for the deployment of green taxation and other incentives by the government in Malaysia such an approach may be implementable in the short term (within 5 years). Reforestation of degraded peatlands that have become marginal for agriculture may also be possible under the climate finance mechanism of CDM. In the medium term, additional funding for peatland conservation may be sourced from REDD+.

Indonesia
Indonesia has the most extensive peatland resource in Southeast Asia. Although much of it has been exploited for agriculture and forestry, there remain extensive areas of undeveloped peatland, especially in Sumatra and Kalimantan. As in the case of Malaysia, an ambitious provincial and national programme to promote the wise use of peatland is required using a hypothecated user tax. Given the particular institutional problems and complex governance processes determining land-use policy in Indonesia, adoption of this approach is likely to be in the medium term (5-10 years). Reforestation of degraded peatlands that have become marginal for agriculture may also be possible under the climate finance mechanism of CDM. In the medium term, additional funding to protect undeveloped peatland areas for conservation may also be possible from REDD+ finance.

Brunei Darussalam
Brunei has extensive peatland areas of which 80% are believed to be in good condition, such as the Kuala Belait Peatland. Major threats are infrastructure development and construction, sand mining, drainage and subsequent risk of fires. There is no specific agency responsible for peatlands but most areas come under the control of the Forest Department and are protected or managed sustainably under National Forest Policy. Brunei has recently ratified the UNFCCC and in the medium to long-term funding from REDD+ or other carbon payments may provide a sustainable source of income for peatland protection and management. The rich diversity of birds, orchids, insects and amphibians on peatland areas, together with good transport links and stable government should attract a steady stream of eco-tourists which may also provide income for local communities who might otherwise seek to exploit the peatlands unsustainably. It can be anticipated that the threat to peatlands from exploitation for timber and development for commodity production may increase significantly should revenues from oil and gas fields dwindle, so it is important that efforts are made now to raise awareness of the value of peatlands and to incorporate peatland conservation into relevant land-use and climate change policies.

Source: *Development of Financing and Incentive Options for Sustainable Management of Peatland Forests in SEA: A Report for Policymakers* (www.gec.org.my).

To facilitate the shift from the current, largely site-based approach to management planning for peatlands to an ecosystem-based approach, peatland planners and manager will need to access new financing options.

Action 7.4.1: Undertake an analysis of all potential policy-tools or sources of funding at the national level, and assess the cost-effectiveness potential approaches by exploring key issues such as displacement effects, additionality, and impact on employment and the regional economy.

Action 7.4.2: Periodically review new forms of incentives and financing that may evolve in response to local and national priorities and needs, to identify opportunities to tap additional sources of funding.

Action 7.4.3: Raise the relative priority of projects related to integrated management planning for peatlands in requests for international cooperation and assistance on biodiversity conservation and climate change from bilateral donors and international financial organizations.

References cited in the Guidelines

Anderson, J.A.R. and Muller, J. (1975). Palynological study of a Holocene peat and a Miocene coal deposit from NW Borneo, Review of Paleobotany and Palynology, 19: 291-351.

Bezuijen, M.R., Webb, G.J.W., Hartoyo, P. and Samedi. (2001). Peat swamp forest and the false gharial (*Tomistoma schlegelii*) in the Merang River, eastern Sumatra, Indonesia. Oryx 35: 301-307.

DOA, Malaysia. 2004. Peta Guna Tanah Malaysia.
http://www.doa.gov.my/senarai-peta-yang-disediakan-doa

Dommain, R., Couwenberg, J. & Joosten, H. 2010. Hydrological self-regulation of domed peat swamps in South- East Asia and consequences for conservation and restoration. Mires and Peat, 6(05): 1–17.

Finlayson, C.M., Davidson, N., Pritchard, D. and Milton, G.R. and Mackay, H. (2011). The Ramsar Convention and ecosystem-based approaches to the wise use and sustainable development of wetlands. Journal of International Wildlife Law and Policy 14, 176-198.

Harris, N.L., Brown, K., Netzer, M., Gunarso, P. and Killeen, T.J. (2013). Projections of oil palm expansion in Indonesia, Malaysia and Papua New Guinea from 2010 to 2050.
http://www.rspo.org/file/GHGWG2/6_emission_scenarios_from_land_use_change_Harris_et_al.pdf

Hooijer, A., Silvius, M., Wösten, H. and Page, S. (2006). PEAT-CO_2, Assessment of CO_2 emissions from drained peatlands in SE Asia, Delft Hydraulics report Q3943.

Hooijer, A., Page, S., Canadell, J.G., Silvius, M., Kwadijk, J., Wösten, H. and Jauhiainen, J. (2010). CO_2 emissions from drained peat in Southeast Asia Current and future CO_2 emissions from drained peatlands in Southeast Asia. Biogeosciences, 7, 1505–1514, 2010
www.biogeosciences.net/7/1505/2010/

Hope, G., Chokkalingam, U. and Anwar, S. (2005). The stratigraphy and fire history of the Kutai Peatlands, Kalimantan, Indonesia. Quaternary Research, 64(3) 407-417.

Strack, M. ed. 2008. Peatlands and Climate Change. Jyväskylä, International Peat Society. 223 pp.

Maas, E.F. and Tie Y.L. (1980). Agriculture capability: map 8 [map] / Compiled by E. F. Maas and Tie Yiu Liong; drawn by the staff of Drawing Office, Soil Survey Division. Malaysia: Department of Agriculture, Sarawak, 1980.

Ministry of Natural Resources and Environment Malaysia. (2011). National Action Plan for Peatlands.

Posa, M.R.C., Wijedasa, L.S. and Corlett, R.T. (2011). Biodiversity and Conservation of Tropical Peat Swamp Forests. BioScience 61: 49–57. American Institute of Biological Sciences. Vol. 61 No. 1.

MA. (2005). Millennium Ecosystem Assessment. Ecosystems and Human well-being: wetlands and water synthesis. World Resources Institute, Washington, D.C.

Neuzil, S.G. (1997): Onset and rate of peat and carbon accumulation in four domed ombrogenous peat deposits, Indonesia. In: J.O. Rieley and S.E. Page (Eds), Biodiversity and Sustainable Management of Tropical Peatlands, Samara, Cardigan, UK: 55-72.

Page, S.E., Rieley, J.O. and Wüst, R. (2006). Lowland tropical peatlands of Southeast Asia. In: Martini, P., Martinez-Cortizas, A. and Chesworth, W. (Eds) Peatlands: basin evolution and depository of records on global environmental and climatic changes, Elsevier, Amsterdam (Developments in Earth Surface Processes series): 145-172.

Page, S.E., Rieley, J.O. and Banks, C. (2011).Global and regional importance of the tropical peatland carbon pool. Global change Biology 17 no 2,pp798-818.

Page, S., Wüst, R. and Banks, C. (2010). Past and present carbon accumulation and loss in Southeast Asian peatlands. PAGES news, Vol 18, No 1, April 2010.

UNDP Malaysia (2006). Malaysia's Peat Swamp Forests. Conservation and Sustainable Use. 33pp. www.aseanpeat.net

Wetlands International. 2010. A quick scan of peatlands in Malaysia. Wetlands International-Malaysia: Petaling Jaya, Malaysia. 50pp.