

Forests and Climate Change Working Paper 7

**Forests and Climate
Change in the
Asia-Pacific Region**

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Acronyms

ACM	adaptive co-management
ADB	Asian Development Bank
AF	Adaptation Fund
APP	Asia-Pacific Partnership on Clean Development and Climate
APT	ASEAN Plus Three
AR4	fourth assessment report
ASEAN	Association of South East Asian Nations
AWG-LCA	Ad-hoc Working Group on Long-term Cooperative Action
CDM-AR	Clean Development Mechanism-Afforestation/Reforestation
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCI	Biodiversity Conservation Corridors Initiative
CEP	Core Environment Program (GMS)
CERs	certified emission reductions
CFUG	community forest user group
CNCCP	China's National Climate Change Programme
DoF	Department of Forestry (Lao PDR)
DPRK	Democratic People's Republic of Korea
FAP	Forestry Action Plan (China)
FCPF	Forest Carbon Partnership Facility
FIP	Forest Investment Program
GAR	global assessment report
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GFEP	Global Forest Experts Panel
GtC	gigatonnes of carbon
GMO	genetically modified organisms
GMS	Greater Mekong Subregion
ICTF	Indonesian Climate Change Trust Fund
IEA	International Energy Agency
IFCA	Indonesia Forest Climate Alliance
INC	Initial National Communication (Myanmar)
IPCC	Intergovernmental Panel on Climate Change
IUFRO	International Union of Forest Research Organizations
KFS	Korea Forest Service
LDCF	Least Developed Countries Fund
LULUCF	land use, land use change and forestry
MAF	Ministry of Agriculture and Forestry (LAO PDR or Timor-Leste)
MARD	Ministry of Agriculture and Rural Development (Viet Nam)
MoU	memorandum of understanding
MtC	million tonnes of carbon
NAPA	national adaptation programme of action
NCCP	National Climate Change Programme (China)
NCEA	National Commission for Environmental Affairs (Myanmar)
NEC	National Environment Commission (Bhutan)
NEEDS	National Economic, Environment and Development Study
NESDP	National Economic and Social Development Plans (Thailand)
NFP	national forest programme
NWFP	non-wood forest product
ppm	parts per million
PES	payments for environmental services

PIF	Pacific Islands Forum
PNG	Papua New Guinea
PTD	participatory technology development
REDD	reducing rmissions from deforestation and forest degradation in developing countries
RIL	reduced impact logging
R-PIN	readiness plan idea note
RPP	readiness preparation plan (Nepal)
ROK	Republic of Korea
RUPES	rewarding upland poor for environmental services
SAARC	South Asian Association for Regional Cooperation
SACEP	South Asian Cooperative Environment Programme
SCCF	Special Climate Change Fund
SFC	Sarawak Forestry Corporation (Malaysia)
Sida	Swedish International Development Cooperation Agency
SNV	Netherlands Development Organization
SRES	special report on emissions scenarios
tCO ₂ eq	tonnes of carbon-dioxide equivalent
TFRK	traditional forest-related knowledge
TWGF&E	technical working group on forestry and the environment (Cambodia)
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UN-DRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WALFA	West Arnhem Land Fire Abatement Project
WCS	Wildlife Conservation Society

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Foreword

This publication is one of a series of publications produced by the Forests and Climate Change Programme of FAO in an effort to strengthen countries' capacities to mitigate and adapt to climate change through actions consistent with sustainable forest management. The primary objective of this study is to provide an overview of the actual and potential impact of climate change on forests and forest dependent people in the Asia-Pacific region, of climate change mitigation opportunities in the forestry sector, and of needs for effective national and regional responses.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007) highlights the urgent need for mitigation action now to avoid serious consequences of climate change. It also indicates that even if countries successfully reduced their greenhouse gas emissions now, climate change would continue for some time, so adaptation measures would continue to be needed. The United Framework Convention on Climate Change is in the process of negotiating both a second commitment period to the Kyoto Protocol to take effect after 2012 and further commitments of Parties under the Convention. Forests feature prominently in the negotiations by virtue of the fact that the sector accounts for an estimated 17.4% of global GHG emissions and has significant mitigation potential. While most countries have developed national climate change strategies and plans, evidence is that few countries have strategies for addressing climate change mitigation opportunities and adaptation needs in their forestry sector. It is important that climate change strategies be well embedded into countries' national forest programmes – that is the policy, legal, institutional and governance framework for forests.

The study examines the major issues and developments related to climate change impacts and responses in the region as regards forests and highlights related opportunities for regional action to address gaps and needs. FAO is working through its Regional Forestry Commissions as well as other regional and sub-regional processes to encourage regional cooperation in the area of forests and climate change.

This publication is intended to provide a point of departure for identifying and catalyzing regional action to complement and enhance national efforts. The publication will be of interest to specialists and policy-makers in forestry and climate change in the Asia Pacific region as well as forest managers, students and general audiences interested in learning more about forests and climate change in the region.



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Executive summary

There is now global consensus that climate change is a real and significant threat strongly related to anthropogenic causes. The implications are arguably even more relevant for the Asia-Pacific than other regions given its high population levels, large numbers of poor and otherwise vulnerable people and the richness of biodiversity and ecology among its highly diverse countries. It is also a region with some of the greatest potential – both in terms of carbon sequestration capacity and the human resources – to contribute to both mitigation and adaptation efforts. One of the key areas of focus on the current international climate change stage is the role of forests. The significance of this single factor in mitigating, or potentially hastening the process of climate change, is coming to be fully realized. In light of this, and the particularly close linkage between communities in the Asia-Pacific region and the forests upon which many depend, it is imperative that forests play a central role in efforts to manage or adapt to climate change.

The development of climate change-related policies, as well as the status and approaches to forest management in the context of climate change, vary widely throughout the region. While Asia and the Pacific have seen an increase of forest cover, when disaggregated, it is clear that this is largely due to an ‘outlier’ effect – the ambitious reforestation policies of a small number of countries, namely China, India and Viet Nam. The rest of the region and Southeast Asia in particular, continue to experience high rates of deforestation.

This has implications for potential mitigation and adaptation strategies, and particularly for regional and international efforts to develop mechanisms, such as Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD)¹ to stem the drivers of deforestation and degradation. A number of non-Annex I countries in the region, such as the Philippines and Indonesia, are being highly proactive despite having no obligation. They are undertaking emission reduction initiatives, reforestation and afforestation efforts and seeking stronger regional cooperation in tackling trans-boundary fire and pest management issues. Other countries have taken less initiative, in some cases due to limited forest area already under protected status, or preoccupation with more imminent post-conflict concerns as in the case of Afghanistan or Timor-Leste.

Capacity limitations critically restrict the degree to which countries can engage with climate change issues. There is a need to harmonize regional capacity levels and strengthen coordination and sharing of knowledge as well as mitigation and adaptation technologies. This will require financing. While this analysis indicates that there are such financing mechanisms, countries tend to perceive them as insufficient or unreliable. These factors influence the degrees to which countries integrate forestry and climate change policies within broader development frameworks.

Although forests have been recognized worldwide as a key part of the global response to climate change, many Asia-Pacific countries still have not integrated climate change strategies within national forest policies, laws and institutions. Forestry-related climate change initiatives are emerging nonetheless, and there is widespread evidence that countries are defining their own, unique country-specific strategies to harness the potential of forests for climate change mitigation and adaptation.

Adaptation Strategies

Forests can contribute to climate change adaptation by providing environmental services; they protect watersheds and provide a buffer against landslides, tsunamis and natural disasters. In rural areas they are also essential sources of resources and products that enhance the livelihoods of local communities and indigenous peoples and hence their resilience to change; whether such change is

¹ The United Nations Framework Convention on Climate Change (UNFCCC) negotiations on policy approaches and positive incentives for REDD are ongoing; however inclusion of conservation, sustainable management of forests and enhancement of carbon stocks (i.e. REDD+) as activities that could be eligible for compensation under an eventual REDD framework is one area of the current draft text on which Parties have reached agreement. As such, the scope of REDD is not yet decided, but can be expected to include REDD+. In this paper the term REDD is synonymous with REDD+.

induced by the climate or by other factors beyond their control. Planned adaptation can help ensure that forests continue to provide these services while avoiding negative impacts on the ecosystem and the wider landscape. In the Asia-Pacific region, approaches to forest-based adaptation to climate change include:

- Adaptive management allows forest managers to adopt different options as impacts occur and local conditions change.
- Ecosystem-based adaptation emphasizes the protection and improved management of natural ecosystems like forests, wetlands and coastal habitats.
- Social and community forestry approaches are being incorporated into national adaptation strategies, in recognition of their contribution to strengthening local livelihoods and diversifying income sources.
- Mangrove planting and restoration in countries like Thailand and Viet Nam serve to expand forest area along the coast, which both sequesters carbon and may decrease vulnerability to the impacts of extreme weather events.
- Agroforestry and propagation of non-wood species is a cost-effective adaptation strategy that increases food security and develops forest resources.
- Food security programmes and other agricultural adaptation initiatives can be expected to enhance forest-based mitigation efforts indirectly by providing economic alternatives to forest resources in the event of extreme weather events caused by climate change.

Mitigation Strategies

Forest-based mitigation of climate change can be achieved in three direct ways:

- Firstly, through the maintenance of existing forests, thus addressing the source of emissions from the forest sector;
- Secondly, through the restoration of lost carbon stocks from degraded or cleared forests, rectifying the negative impact that the forest sector has had in terms of emissions in recent years; and
- Thirdly, through the creation of new forest areas, thus increasing the potential of forests to act as a sink for greenhouse gases.

Asia-Pacific countries are employing a number of forest-management strategies to enhance the sector's contribution to climate change mitigation through these three channels, including:

Afforestation, reforestation and forest restoration: A number of countries have initiated and implemented large-scale afforestation programmes. For example, the National Mission for Green India, a core programme of India's National Action Plan for Climate Change, aims at doubling the area to be taken up for afforestation/ecorestoration in the next ten years, taking the total area to be afforested or restored to 20 million hectares resulting in increased sequestration of 43 million tonnes CO₂e annually (MoEF 2010a). China's Government announced to the UNFCCC that it aims to increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic metres by 2020 from the 2005 levels, as a core element of its climate change strategy.

Reducing Emissions from Deforestation and Forest Degradation in Developing Countries: REDD is widely acknowledged by Asia-Pacific governments as a significant element of climate change mitigation strategies, which also has the potential to generate income, modernize the forestry sector and contribute to national climate change adaptation strategies. REDD-related activities are multiplying throughout the Asia-Pacific region, via private sector initiatives and publicly-funded programmes with bilateral and multilateral donors. For example, the UN-REDD programme is working to build REDD readiness and capacity in Cambodia, Indonesia, Nepal, Papua New Guinea, the Philippines, the Solomon Islands and Viet Nam.

Forests and climate change in the Asia-Pacific Region

Globally, the forestry sector has significant mitigation potential, but is estimated to account for 17.4 percent of global greenhouse gas (GHG) emissions. Research has shown that the Asia-Pacific region is the major source of global forest-related emissions, more than sub-Saharan Africa or Latin America. This is due in large part to deforestation, but unsustainable logging operations in

Southeast Asia are also considered to be a significant source of emissions (Griscom *et al.* 2009; Putz *et al.* 2008). Many Asia-Pacific countries have developed, or intend to develop, national strategies to respond and adapt to climate change. This review was undertaken with two key objectives in mind:

- Firstly, to assess the status of national and regional strategies for addressing climate change mitigation opportunities and adaptation needs through the forestry sector; and
- Secondly, to explore the implications of the growing importance of climate change for forests and forestry policy in the region.

This document examines the current and emerging issues and developments related to forests and climate change in the region. Strategies to address the significant, but largely unknown, impacts of accelerated, human-induced climate change on the forestry sector and forest-dependent people are emerging independently in all Asia-Pacific countries. These strategies are naturally shaped by the diverse range of social, political and economic national contexts. Their success depends upon the capacity for countries to overcome longstanding challenges regarding forest governance. Climate change strategies must be closely aligned with national forest policies and the legal and institutional mechanisms underlying forest governance.

Forest policy in the region will also depend, to an unprecedented degree, on cross-border cooperation, policy harmonization and open, transparent sharing of forest-based information. Historically, forest management has been regarded by most governments in the region as an element of national sovereignty. In the emerging era of climate-dominated forest policy, this will remain the case. However, sovereignty issues will no longer be based on mutual threats at national borders, but on a shared need to safeguard the lives and livelihoods of citizens against external factors, beyond the control of any individual state.

1. Background

Trends in forest and land use in the region

Between 1990 and 2010 the forests of Southeast Asia contracted in size by 3.32 million hectares, an area greater than that of Viet Nam (FAO 2010a).

Forest cover: From 1990 to 2010, there has been a net increase in forest cover for the Asia-Pacific region of about 0.7 million hectares (FAO 2010a). This is mainly due to large-scale afforestation in China, which, along with India and Viet Nam has instituted an ambitious afforestation programme. In contrast, primary forests in many areas of the region are declining rapidly, despite the efforts of countries to establish protected areas, institute logging bans and develop plantations on cleared and degraded lands to reduce pressure on natural forests (see Annex 3). For example, the average forest loss in the seven years following the institution of Thailand's logging ban was comparable with forest loss during the seven years preceding the ban (Ongprasert 2008).

Land-use change: Market forces and national policies have in many cases established sets of perverse incentives, leading to the degradation or conversion of forests to other land uses. In addition, it is generally easier to establish commercial plantations on cleared natural forest land than on degraded or marginal lands as timber revenue can be used to offset start-up costs. This contributes to an increasing trend of forest conversion for agriculture, commercial plantations, mining and urban development.

Drivers of deforestation: Rates of deforestation are highest in Southeast Asia, where forest cover decreased by 0.41 percent *per annum* between 2000 and 2010, compared to a 0.36 percent annual decrease in Oceania, a 0.28 percent annual increase in South Asia and an annual increase of 1.16 percent in East Asia (FAO 2010a). A key driver of deforestation throughout the region is agricultural expansion for industrial and food crops, which in turn is being driven by population growth and a growing global demand for biodiesel, foodgrain and cash crops such as rubber, sugar cane and coffee (Wertz-Kanounnikoff and Kongphan-Apirak 2008).

Extractive activities such as timber production and mining, and the infrastructure development that accompany such industries, are also significant causes of deforestation. Growing populations in the region underlie the need for agricultural and urban expansion. Poverty and insecure livelihoods compound the impact of population pressure. Furthermore, governance-related factors such as overregulation, opaque bureaucracy, interdepartmental competition and under funding obstruct efforts to address these problems. Pressures from outside the region are often at the root of the imbalances that lead to forest clearance and mismanagement. Global markets do not recognize the values inherent in standing, natural forests, except in terms of their removal and potential conversion to alternative use.

Drivers of degradation: The extent of forests managed sustainably remains very low. A main driver of forest degradation in the Asia-Pacific region is intensive logging, which gives very little attention to the long-term sustainability of wood production and the provision of ecosystem services. (FAO 2010b). Subsistence collection of fuelwood, construction timber and non-wood forest products (NWFPs) also contribute to degradation in the region, where over a third of biomass removed from forests is in the form of fuelwood for subsistence purposes (FAO 2006). Unclear land tenure and use rights often underlie this degradation, as forest-dependent peoples are deprived of the incentives to manage forests sustainably with a long-term vision. Illegal logging contributes not only to deforestation, but to degradation as well, particularly in and around protected forest areas.

Forest ownership: Sixty-eight percent of forest resources in Asia is currently state owned, while 25 percent is owned by communities or indigenous peoples, according to a 2009 report that analysed data from nine Asian countries, accounting for 90 percent of Asia's tropical forests (RRI 2009). The area of forest land designated for community use increased by 45 percent between 2002 and 2008 (RRI 2008). Recognition and security of access, use and management rights by local communities are critical to sustainable management and avoiding forest degradation. This does not necessarily imply the recognition of legal ownership, but usually necessitates the validation of customary use rights where appropriate. There is an important distinction to be drawn between cases such as Papua New Guinea, where local people enjoy full legal recognition of their tenure over forest lands, and those such as Nepal, where communities can secure long-term use rights over

forest resources. In both cases, the right to use and benefit from forest products, including timber and carbon credits, is to a large extent independent of the issue of land ownership.

Key demographic developments and implications for land and resource use

Population growth: The population of the Asia-Pacific region is expected to grow by 600 million between 2010 and 2020, reaching a total of 4.2 billion people (FAO 2009a). Population pressure is expected to continue to escalate the rate of land clearance for agricultural production and other purposes.

Increasing wealth: In high-income countries, such as Brunei Darussalam, Singapore and Taiwan, Province of China, household incomes are increasing rapidly. This has led to stabilization, and thereafter a decrease, in the reliance on natural forests for subsistence products, as fuel, construction and agricultural needs can be met through alternative sources. As higher incomes lead to reduced dependency on forests for daily subsistence and livelihoods, the intimate connection between people and forest ecosystems steadily weakens. Simultaneously, other forest-related values (i.e. biodiversity and watershed protection) are increasing in importance, along with the recognition that forest policy and practice in neighbouring countries has cross-border impacts.

Residual poverty: Six-hundred and forty million people in the Asia-Pacific region live on less than US\$1/day, a high percentage of whom live in and around forested areas (ADB 2007). This suggests a strong prerogative to mainstream livelihoods and poverty reduction strategies within forest management planning. It also underlines the importance of the active involvement and buy-in of local communities as vital components in sustainable forest management strategies.

Industrialization: The economies of many Asia-Pacific countries, particularly in Southeast Asia,² are shifting towards the development of value-added manufacturing industries and services. A significant shift from the agriculture to the services sector is noticeable in all of the sub-regions with the exception of the Pacific Island countries. Between 2006 and 2015, total employment in agriculture is projected to contract by nearly 160 million, with employment in industry and services expanding by 172 million and 198 million, respectively (ILO 2007). This will lead to a further decline in the proportion of people employed in agriculture, and in the contribution of agriculture to domestic incomes. The expansion of industry is also placing increased pressure on forest areas, as they are cleared for mining activities and infrastructure development.

Energy consumption: Energy consumption is increasing exponentially throughout the region, especially in the heavily populated and increasingly wealthy economies of countries such as China and India. Globally, woodfuels comprise about 7 percent of the world's total primary energy consumption. Of this, approximately 44 percent is in Asian countries (Trossero 2002). Despite the increasing adoption of fossil fuels, the total number of people in the Asia-Pacific region dependent on fuelwood as their primary energy source remains high.

Water consumption: Agriculture significantly outpaces industrial and domestic use of water, and remains the sector with the highest water consumption rate in the Asia-Pacific region. Water scarcity will impact the expansion of agriculture and industry, and inhibit economic growth in countries facing freshwater shortages, especially Australia, China, India, Mongolia and Pakistan (UNESCAP 2008). Water is currently free or heavily subsidized by governments for farmers, encouraging inefficient use and waste. Water pricing for agricultural use is a politically explosive policy which is likely to become unavoidable over the next decade.

Forest products, and contribution of the forest sector to national GDPs

The Asia-Pacific region is the world's leading exporter of tropical wood (FAO 2010b). Estimates of the forestry sector's contribution to national GDPs remain low relative to other industrial sectors. It should be noted that these estimates do not account for related activities such as wood processing that may generate significant income but are not currently accounted for as an output of the forestry sector. The forestry sector in the region continues to grow – both China and India nearly quadrupled

² Indonesia, Malaysia, Thailand and the Philippines.

their imports of wood products between 1990 and 2006 (FAO 2009a). For country-by-country data on timber and non-timber forest production and economic value, see Annex 3.

NWFPs generate billions of dollars annually in revenue on global markets. The Asia-Pacific region is a major contributor to this sector; its exports account for about 40 percent of the global NWFP trade, in terms of total value (Hansda 2009). In some cases (e.g. high-demand NWFPs such as bamboo, rattan or medicinal plants), there is a shift from the manual collection of wild NWFPs towards their domestication and commercial cultivation. This is driven by financial motivations, but is also partially attributable to decreasing forest area and the resulting decline in supply.

Social and cultural values of forests

Subsistence use of timber and NWFPs: An estimated 200 million people in the Asia-Pacific region depend on NWFPs for income, as well as for subsistence needs including medicine, food, fuel and construction materials. Although NWFPs are rarely the primary source of food for local communities and indigenous peoples, they can help provide additional nutritional and financial supplements to remote rural communities. It is expected that subsistence use will gradually decline in the future, as populations become increasingly connected with national and global markets and as access to substitute products improves. Timber and scrubwood is still widely used for household subsistence purposes in the region. Nearly three-quarters of wood produced in the region is burned as fuel, and South Asia remains the only global region where this proportion is not declining (FAO 2009a).

Indigenous peoples: Most indigenous peoples in Asia and the Pacific live within and around forested areas. Their dependence on forests for sustenance and their cultural connection to the land ensures that indigenous issues will remain inseparable from forest management and conservation in the region. Fifteen million indigenous people worldwide are stateless, and in many cases are denied the rights and benefits of full citizens. By failing to recognize and safeguard indigenous interests, countries stand to lose a wealth of indigenous knowledge regarding forests, forest products and forest management. However, indigenous peoples' political groups and lobbies have gained prominence in the region in recent years. This has led to the development of national policies such as the India Forest Rights Act of 2006 and the Philippines' Indigenous Peoples' Rights Act, as well as to the adoption of the UN Declaration on the Rights of Indigenous Peoples (UN-DRIP) by most countries in the region.

Forest management and agroforestry systems as part of traditional integrated land-management systems: There is a long history of traditional agroforestry practices throughout the region, exploiting the complementary relationships between certain food crops and tree species. This leads to a number of ecological and livelihood co-benefits, including effective land use, enhanced soil and pest management, the maintenance of biodiversity and local genetic variation as well as increased food security for local communities and indigenous peoples.

Community forestry: Community forestry has been gaining momentum and official recognition in recent years throughout the Asia-Pacific region. New laws and guidelines have been passed recently in Cambodia and Viet Nam, building on the experiences of countries like Nepal and the Philippines where community forestry has been well established for decades. The importance of local people as both managers and decision-making stakeholders in regional forests is gaining acceptance in international fora (see Box 1).

Gender: Women have traditionally been responsible for collecting fuelwood and NWFPs in most societies in the region, and continue to contribute substantially to forest management and protection. However, they are largely still excluded from decision-making processes regarding the management and use of forests. Those working directly with communities (i.e. government staff, extension officers, NGO workers) must take greater responsibility for identifying and responding to gender disparities in the use and management of forests, and the ways in which the benefits from forests are distributed within communities.

BOX 1

Snapshot – community forest management in Asia and the Pacific

Viet Nam: A new Forest Protection and Development Law was passed in 2004, which provided the first legal framework for community forest management. Since then, this Law has enabled the transfer of nearly 17 000 hectares of natural forests to communities.

Cambodia: Community forestry guidelines (*Prakas*) were issued in 2006, creating a process by which communities could legally register themselves as community forests. Today, more than 280 communities have over 220 000 hectares under community forest management.

Thailand: Community forestry has been recognized as a forest management strategy since the national logging ban was instituted in 1989. A Community Forestry Bill was drafted in 1993, but has yet to be passed due to difficulty reaching consensus on key provisions, such as allowing community forestry to be established in protected areas.

Indonesia: A variety of social forestry-related approaches have been employed since 1998, when the period of *reformasi* began. Despite the successes of individual projects and efforts, political and legal barriers continue to prevent social forestry from being mainstreamed in national policy.

Lao PDR: Several pilot projects have been undertaken related to community forestry, or village-based participatory sustainable forest management – which has expanded in Lao PDR beyond the initial two provinces it was piloted in.

The Philippines: Community-based forest management is the recognized national strategy for sustainable management of forest resources.

Nepal: Community forestry has been implemented in Nepal for over 30 years. Today, 1.25 million hectares of forest are being managed by close to 14 500 forest user groups. Thirty-five percent of Nepal's forests are thus in the hands of 33 percent of Nepal's total population.

Source: RECOFTC – The Center for People and Forests 2010

BOX 2

Forest ecosystem services

- Protection from natural disasters – Forests can prevent or reduce the damage caused by flooding, landslides and tsunamis.
- Carbon storage and sequestration – Forests act as carbon sinks, preventing the release of the element in the form of carbon dioxide, a potent greenhouse gas.
- Biodiversity conservation – Natural forests are home to half the world's species and contain an unparalleled variety of habitats.
- Water – In certain circumstances, forests may protect watersheds, regulate groundwater flow and improve water quality.
- Soil conservation – Forests enhance soil quality and control erosion.

Source: Chaudhury (2009)

Key environmental services provided by forests in the region

Environmental and ecosystem services of forests: The Millennium Ecosystem Assessment (2003) refers to three types of ecosystem services that directly benefit peoples' well-being: 1) providing products (e.g. food, fuelwood, medicine); 2) regulating services (e.g. water purification, climate or erosion control); and 3) cultural services (e.g. recreation, spiritual, religious) (MEA 2003). All of these are important in the Asia-Pacific region.

Demand for forest environmental services in the Asia-Pacific region is increasing (FAO 2010b). As household incomes increase and reliance on forest products decreases, there is a steady shift in the way forests are valued, with environmental services gaining in significance (see Box 2) (FAO 2009a).

Experience with payments for environmental services (PES) schemes: The Asia-Pacific region has relatively little experience with payment for environmental services (PES) schemes. Most ongoing efforts are small, donor-driven PES pilot projects (though at present a PES-related decree is pending in Viet Nam). National policies continue to serve as the chief vehicle for forest protection, while the use of market mechanisms remains relatively new and untested (Wertz-Kanounnikoff and Kongphan-Apirak 2008).

Experiences so far have highlighted the existence of barriers to the initiation and expansion of PES schemes. One major barrier is unclear land tenure, making it difficult to determine which stakeholders are the rightful beneficiaries of service payments. Furthermore, high initial transaction costs, poor access to information and high opportunity costs from other forms of land use make PES projects unrealistic and unattractive prospects for many communities (Milne and Niesten 2009).

2. Impacts of climate change and adaptation options

Evidence of climate change and future scenarios of climate change in the region

Asia

Surface temperature: The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (AR4) indicates that past and present climate trends in Asia point to an increase in air temperature at ground level of between 1-3 °C over a century. North Asia shows the most pronounced increases in surface temperature (Gruza and Rankova 2004). The retreat of glaciers and thawing of permafrost have been unprecedented in recent years. In addition, the duration of heatwaves in many Asian countries has become significantly longer (Cruz *et al.* 2007; Tran *et al.* 2005).

Precipitation: Two separate trends are observed with regard to precipitation in the region. In general, the frequency of intense rainfall events in many parts of Asia has increased, causing an increase in the number and severity of floods, landslides, debris and mud flows. However, the number of rainy days has actually decreased, along with the total annual amount of precipitation (Zhai and Pan 2003; Gruza and Rankova 2004; Zhai 2004; Lal 2003). The combination of these trends means not only that less rainfall reaches croplands, but also that a lower proportion of this precipitation can be retained and used, because so much of it is lost in surface runoff in short, intense downpours. The increase in flooding events is therefore linked to an increase in the frequency of drought events in rural areas.

Sea-level rise: In coastal areas of Asia, the current rate of sea-level rise is reported to be between 1-3 millimetres/year, which is slightly greater than the global average (Woodworth *et al.* 2004). A rate of sea-level rise of 3.1 millimetres/year has been reported over the past decade compared to 1.7 to 2.4 millimetres/year over the twentieth century as a whole (Rignot *et al.* 2003). This suggests that the rate of sea-level rise has accelerated in recent years, relative to the long-term average.

Future scenarios: Rising surface temperatures are projected to have diverse impacts on the different sub-regions of Asia. There continues to be a lack of consensus on the changes in glacial ice cover in the Himalayas (including the Tibetan Plateau). In general, however, there is evidence that most Himalayan glaciers are shrinking in area and thickness, though the extent and nature of shrinkage have not changed significantly over the last 100 years. The patterns of glacier behaviour vary across the region with higher retreat rates documented in the east, possibly due to the effects of Elevated Heat Pump (IGREC 2009).

Warming surface temperatures, in combination with other natural and anthropogenic stresses, are likely to increase the risk of extinction for many flora and fauna species in Asia. Rapid sea-level rise will deteriorate coastal ecosystems, cause coastal erosion and will increase the flood risk in populous coastal cities including Bangkok, Ho Chi Minh City, Jakarta, Karachi, Manila, Mumbai and Shanghai.

An increase in the occurrence of extreme weather events, including heat waves and intense rainstorms, is projected for South Asia, East Asia and Southeast Asia (Walsh 2004; Kurihara *et al.* 2005). The 2-4 °C projected rise in sea-surface temperature for East Asia, Southeast Asia and South Asia is predicted to result in an increase of 10-20 percent in the intensity of tropical cyclones (Knutson and Tuleya 2004). Existing coastal protection strategies are likely to be inadequate to cope with these storms.

Climate change will exacerbate the stresses on water resources which are already set to rise due to population growth, economic growth and land-use change, including urbanization. The IPCC expects, with a high degree of assurance that the availability of freshwater in Central, South, East and Southeast Asia, particularly in large river basins, will decrease due to climate change. This trend could adversely affect more than a billion people in Asia by the 2050s.

Australia and New Zealand

Surface temperature: Since 1950, there has been warming of between 0.4-0.7°C, with more heatwaves, fewer frosts, more rain in northwest Australia and southwest New Zealand, and less rain in southern and eastern Australia and northeastern New Zealand. The offshore islands of Australia and New Zealand have also recorded significant warming.

Extreme weather: Australian droughts have become hotter since 1973 (Nicholls 2004). From 1950-2005, extreme precipitation events have increased in northwestern and central Australia and over the western tablelands of New South Wales, but have decreased in the southeast, southwest and central east coast (Gallant *et al.* 2007).

Future scenarios: Within 800 kilometres of the Australian coast, a mean warming (relative to 1990) of between 0.1-1.3°C is likely by 2020, 0.3-3.4°C by 2050 and 0.4-6.7°C by 2080. In New Zealand, a warming of between 0.1-1.4°C is likely by the 2030s and 0.2-4.0°C by the 2080s. The frequency of heavy rainfall is likely to increase, especially in western areas (MfE 2004).

The global projection of mean sea-level rise by 2100, relative to 2000, is 0.18-0.59 metres, disregarding uncertainties in carbon cycle feedbacks and the possibility of faster ice loss from Greenland and Antarctica (Meehl *et al.* 2007). These values would apply to Australia and New Zealand, but would be further modified by as much as ± 25 percent due to regional differences (Gregory *et al.* 2001). By 2030, the productivity of agriculture and forestry sectors is projected to decline over much of southern and eastern Australia, and over parts of eastern New Zealand, due to increased occurrence of drought and fire.

The Pacific

Surface temperature: The rate of increase in air temperature in the Pacific during the twentieth century exceeded the global average with data showing a global mean temperature increase of around 0.6°C. Mean sea level rose by about 2 millimetres/year, although sea-level trends are complicated by local tectonics and El Niño-Southern Oscillation events.

The annual number of hot days and warm nights increased in the South Pacific from 1961 to 2003, while decreases have been observed in the annual number of cool days and cold nights, particularly in the years after the onset of El Niño (Manton *et al.* 2001; Griffiths *et al.* 2003). Recent studies also indicate that the frequency and intensity of tropical cyclones originating in the Pacific have increased over the last few decades (Fan and Li 2005).

Future scenarios: For the South Pacific, Lal (2004) has indicated that the surface air temperature by 2100 is projected to be at least 2.5°C higher than the 1990 level. Sea-level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thereby threatening vital infrastructure, settlements and facilities that support the livelihoods of Pacific island communities.

Vulnerability of forests and forest communities to climate change

Climate change adaptation strategies in the forestry sector are a response to both the biophysical and social vulnerability of forest ecosystems. The biophysical vulnerability of forest ecosystems can be assessed according to the biomes where forests exist and the ecological niches that they occupy. However, assessment of social vulnerability is more site- and context-specific (Adger *et al.* 2004). In the Asia-Pacific region, the dynamism of regional economies and the high population densities in and around many forest ecosystems (in comparison to other regions) means that the vulnerability of both ecosystems and communities to change is a highly complex field of study. Climate change complicates matters still further.

Forest ecosystems respond to two main climate drivers: temperature and precipitation. Mean precipitation and temperature are key determinants of the ecological niche to which plant species are suited. If precipitation and temperature patterns shift permanently over coming years, then the species composition of many forest ecosystems will change, with unpredictable impacts on associated fauna and on local livelihoods. The physical risks of climate change may result in reduced forest outputs, increased fire risk, pest outbreaks, drought, windthrow damage, ice storms and weed invasion (Williams and Liebhold 2002; and Irland 2000). However, forest ecosystems are

not only sensitive to changes in precipitation and temperature, but also to such anthropogenic drivers as land-use change, pollution and invasive species (IPCC 2007b).

The vulnerability of forest ecosystems largely determines the vulnerability of forest communities. The lack of diversity in livelihood options makes forest communities all the more vulnerable to the impacts of climate change on the natural resource base (IUFRO 2009). Additionally, a narrow focus by policymakers on the conservation of forests, as a consequence of climate change as a driver of policy, may further limit the access of forest communities to resources. This may initiate or exacerbate conflicts between different interest groups with regard to conservation efforts, climate change mitigation and the needs of forest communities.

Indigenous peoples comprise a significant proportion of the communities most vulnerable to the impacts of climate change on forests. By the Asian Development Bank's (ADB 2009) estimates, they make up half of the world's poorest individuals, and more than half of these people live in Asia. Sixty million indigenous peoples in the Asia-Pacific region are forest-dependent. They are considered society's poorest on the basis of social indicators such as life expectancy, maternal mortality, education, nutrition and health (ADB 2009). They have few income-generating opportunities and limited influence on the development of national policies that are ostensibly for their benefit. Climate change adds to the set of challenges faced by indigenous peoples due to the expected impacts on the forest ecosystems on which most of them depend.

The vulnerability of mangrove ecosystems is particularly relevant to the Asia-Pacific region, which is home to a larger area of this unique forest type than either Africa or Latin America. Mangroves are unlikely to shift polewards as a result of temperature increases, but will suffer reduced photosynthetic and growth rates due to temperature stresses (McLeod and Salm 2006). Increased frequency of extreme events may result in shifts in species composition but the greatest threat to ecosystem integrity is from projected sea-level rise. Mangroves potentially could move inland to cope with sea-level rise, and are consequently likely to expand rapidly in some areas such as Australia's Northern Territory. However, in much of the rest of the region, such expansion is blocked either by infrastructure, or by the lack of necessary sediment, particularly in reef-based island archipelagos in Melanesia and Papua New Guinea.

The protection that mangroves provides to coastal communities in the face of storms and other extreme events underlines their value in reducing the vulnerability of coastal communities in Asia and the Pacific to climate change. However, because mangroves are often viewed as being of low economic value, there is considerable pressure to clear mangroves for other uses. Shrimp aquaculture accounts for the loss of 20 to 50 percent of mangroves worldwide (Primavera 1998). Indonesia, which has the world's largest intact mangroves, is projected to lose 90 percent of mangrove areas on the islands of Java and Sumatra by 2025 (Bengen and Dutton 2003).

Potential impacts of climate change, climate variability and extreme events on forests and implications for sustainable development

The IPCC Fourth Assessment Report highlighted the potential impacts of climate change on forest ecosystems. Increased surface temperatures of more than 2°C above pre-industrial levels are very likely to result in substantial changes in the structure and function of forest ecosystems (Fischlin *et al.* 2007). New findings indicate that negative impacts of climate change on forests may be more severe than previously believed and that the potential positive impacts have been overestimated. The negative impacts will include biome redistribution, increased forest fire occurrence and accelerated infestation of weeds and other pests.

The International Union of Forest Research Organizations (IUFRO) led and coordinated the Global Forest Experts Panel (GFEP) initiative. A product of the GFEP report: *Adaptation of forests and people to climate change: a global assessment report* (GAR) (Seppälä *et al.* 2009). For simplicity, the report grouped the many global emission scenarios developed by the IPCC into four clusters as follows:

Unavoidable: Represents an artificial, deliberate freeze of atmospheric CO₂ concentration relative to the year 2000. Although unrealistic, this cluster allows for assessment of minimal impacts and minimum adaptation requirements.

Stable: Characterized by major technological changes that result in declining CO₂ emissions and a new equilibrium towards the end of the century.

Growth: With major technological changes but without stringent climate policies, emissions are expected to continue rising even after 2100, resulting in a climate system that will be out of equilibrium for centuries thereafter.

Fast growth: Represents accelerating growth of global emissions relative to the year 2000 that exceeds the highest emission projections of the *Special report on emissions scenarios* (SRES).

According to the GAR, forest ecosystems are sufficiently resilient to adapt to impacts of limited climate change under the *stable* cluster. But in semi-arid to arid climates forest productivity is projected to decline.

Under *growth* and *fast growth* clusters forest ecosystems in semi-arid to arid climates are projected to diminish in productivity to a point where forests are no longer viable. However, in humid climates, forests are projected to continue to expand up to a threshold. When warming reaches 3°C relative to pre-industrial conditions, there is a greater than 40 percent risk that terrestrial ecosystems become net sources of carbon, thereby instigating a positive feedback loop which will accelerate climate change even more.

The report also makes separate climate change impact, adaptation and vulnerability assessments specifically for boreal, temperate, subtropical and tropical forest biomes as follows:

Boreal forests: Expected to shift polewards, with grassland expanding into areas formerly occupied by boreal species. Under the *growth* scenario, boreal forests in Northeast Asia will increase in productivity, but will also be subjected to increased disturbance from fire and insect infestations. Carbon emissions from thawing permafrost in northern boreal forests, under the *growth* scenario, will further accelerate climate change.

Temperate forests: Longer growing seasons under all scenarios. However, net productivity under *growth* and *fast growth* scenarios may actually be reduced as a result of increased prevalence of drought, fire, airborne pollutants, forest fragmentation and invasive alien species. For example, in Australia, productivity is already declining due to water scarcity and drought.

Subtropical forests: The subtropical domain contains many key biodiversity hotspots in the Asia-Pacific region, whose endemic species are predicted to decline, leading to cascading changes in ecosystem structure and function. Fire frequencies are expected to increase, but unlike in boreal and temperate forests these fires are expected to diminish as increasingly dry conditions lead to reduced fuel accumulation.

Tropical forests: These are particularly climate-sensitive. For instance, small changes in climate could affect timing and intensity of flowering and seeding events, with negative impacts on forest biodiversity and ecosystem services. Forest fragmentation and deforestation mean that species mobility is reduced, and therefore risk of climate-induced extinction is increased. A substantial decline in tropical forest (and hence global) biodiversity is anticipated.

Biome redistribution modelling generally shows decreases in the area covered by boreal forests and arid lands and expansion in the area covered by grasslands and tropical broadleaf and temperate mixed forests (Malcolm 2003). The boreal region of North Asia has been identified as having high potential vulnerability to climate change in the long term (Kirschbaum and Fischlin 1996) and is expected to shift polewards. Changes in productivity are likely to lead to an overall increase in temperate forest area close to the poles. Productivity in some subtropical woodlands could increase due to higher atmospheric CO₂ (an effect known as CO₂ fertilization) but this may be offset by reduced longevity of the species affected (Bugmann 2009). In other areas, higher evaporation and lower rainfall could decrease productivity.

A rapidly-changing climate gives species that are suited to a wide range of climatic conditions opportunities to invade new areas (Dukes 2003), leading to accelerated spread of invasive species, such as *Leucaena* spp. and *Eupatorium* spp., already known to have adverse impacts on biodiversity in subtropical forests in South Asia. Other species with tendency to invade, such as *Acacia* spp., which are widely planted in Southeast Asia but have not yet had significant negative impacts on local ecosystems, may become invasive. In cooler latitudes, such as northern China, insect pests will cause increasing damage to forest plantations, and major infestations can and will alter the carbon sequestration of forest stands (Volney and Fleming 2000).

The Asia-Pacific region is extremely diverse but can be broadly divided into countries following one of three development paths, with correspondingly different impacts on forest ecosystems over time. In countries where industrialization is gaining ground, such as Malaysia and Republic of Korea, agricultural expansion has slowed while mining, urbanization and infrastructure development are becoming more significant causes of deforestation. In countries largely dependent on agriculture, pressure to convert forests will increase. In post-industrial societies such as Japan and New Zealand, where populations are relatively stable or declining, ecosystem services from forests will be a major concern and thus provide a strong policy incentive for maintaining forest area and productivity (FAO 2009a).

Based on the two most dominant development paths (industrializing or agricultural), it is likely that natural forest loss will be the trend in most countries of the region for the next two decades, according to FAO's *State of the world's forest report, 2009*. The apparent increase in forest area (3 million hectares more than the year 2000) is largely due to China's and Viet Nam's afforestation programmes. FAO's 2010 *Global forest resource assessment 2010* indicates that among Asia-Pacific's sub-regions, only East and South Asia registered net increases of forest area for the period 2000-2010, while Oceania and Southeast Asia registered net decreases. Low- and middle-income but forest-rich countries will experience declining forest area due to agricultural expansion. Demand for wood and NWFPs will continue to increase along with increasing population (FAO 2009a). Continuing forest loss will impede a number of ecosystem services such as: mitigation of floods and droughts, soil preservation, nutrient cycling, agricultural pest control, biodiversity maintenance, protection from coastal erosion, partial stabilization of climate and moderation of extreme weather, water purification and recreational, cultural and spiritual benefits (Daily *et al.* 1997; Millennium Ecosystem Assessment 2003). A decline in forest ecosystem services leads to greater inability of societies, especially forest-dependent communities, to fulfil basic livelihood needs and can result in deepening poverty, deteriorating public health and conflict (Fischlin *et al.* 2009).

Rapid economic growth characterized by urbanization and industrialization will likely further drive the increase in existing high demand for wood products in Asia (Fischlin *et al.* 2007). FAO (2009b) estimates the overall demand for forest products in Asia and the Pacific will double by 2030. Carle and Holmgren (2008) indicate that Asia will have the highest increase of area of planted forests until 2030. The region is indeed becoming an important exporter of wood products. China has overtaken Europe as the leading exporter of furniture. Since 2005, Viet Nam has also been a major exporter of wooden furniture. Another emerging driver of deforestation there is the expansion of large-scale commercial crops, including oil palm. In addition, intensive forest utilization could likely lead to the loss of much of its original forests and biodiversity by 2100 (Sodhi *et al.* 2004).

Adaptation needs in the region (forests, forest communities, related infrastructure)

Adaptation needs vary depending on local conditions. There is an inherent degree of uncertainty in anticipating climate change impacts on forests. Climate change may even result in the development of new forest ecosystems (Innes *et al.* 2009). Although many models may be used to predict impacts at the continental, regional and local scales, their predictive capacity is limited to the general direction of change, not the specific impacts of this change. Due to such uncertainty, adaptation measures need to be diverse, flexible and robust. In most cases, where uncertainty is high, a portfolio of measures rather than a fixed strategy will be required to reduce the risk of unintended negative impacts (Locatelli *et al.* 2008). The adaptation needs for the forest sector discussed below, are based on IUFRO's global assessment report on forest and human adaptation to climate change (Seppälä *et al.* 2009).

Combine traditional forest-related knowledge and formal forest science

Traditional forest-related knowledge (TFRK), practices and institutions have developed over generations as forest-dependent people continuously adapt to changing environmental conditions within forest ecosystems. Traditional forest and water management practices are particularly relevant to climate change adaptation. Expanding markets and the consequent development of

institutions and infrastructure have contributed to the erosion of traditional cultures and TFRK. This may have negative impacts on the understanding of ecosystem goods and services provided by forests and hence to the value that local people ascribe to these services. TFRK and customary forestry practices will become increasingly relevant, but increasingly scarce, sources of experience for adaptive management. TFRK should therefore be recorded, translated and synergized with formal forest science, before it is lost.

During the IUFRO Kunming Conference in China in 2007, governments in the region were urged to mainstream TFRK into sustainable forest management and poverty alleviation development strategies, policies, and legislation, as well as to pursue multidisciplinary and participatory research to help solve the immediate and practical problems faced by indigenous peoples and local communities (Parrotta *et al.* 2009). In Malaysia, for instance, as younger generations of indigenous peoples lose interest in TFRK, significant practices have been recorded on film for posterity (SGPPTF 2007). Rerkasem *et al.* (2009) discuss how the indigenous forest and land management skills of the Karen and Lua in Thailand, the Tai Lue in Lao PDR and the Hani in China, that have been successfully integrated into agroforestry extension programmes, can become more widely applicable.

Increase participatory reform and flexibility in forest-related bureaucracies

Standard operating procedures in forest bureaucracies need to change. For adaptation approaches to be useful and successful, Locatelli *et al.* (2008) stress two key changes that are required. Firstly, forest-dependent people need to be recognized, to be drawn into the discourse and to contribute to official decision-making. This calls for changing attitudes among forestry personnel and strengthening feedback mechanisms within forestry-related bureaucracies.

In Yunnan, Southwest China, a pilot study in participatory technology development (PTD) for an official programme of sloping land conservation shows how such approaches have materially benefited local communities and indigenous peoples as well as engendered their support for the government's reforestation efforts. He *et al.* (2009) discuss how PTD linked with conservation creates opportunities for the incorporation of indigenous skills and knowledge into what were previously state-led, top-down conservation and development programmes, provided there is flexibility and local participation in all stages of the planning process.

Because of the local nature of adaptation measures, it is also critical for adaptation frameworks to allow forest managers flexibility of options and a degree of 'freedom to fail', within reasonable boundaries, as part of an experimental and iterative learning approach in pursuit of desired goals (Locatelli *et al.* 2008). This is in recognition of the fact that, not only is the sustainable management of ecosystems complex (Harris 2007), but similar ecosystems may behave differently and unpredictably to the same external stresses (Savory and Butterfield 1999). For example in the experience of Nepal and some Indian states, community-based forest management groups have sole control over management decision-making and are recognized as legal entities. Improved stakeholder feedback and policies informed by field experience have resulted in better benefit flows to these communities, more autonomy and better quality resources for local people (Poffenberger 2000). This has led, in turn, to increased resilience of communities to change of any kind, and a quicker response to the adaptation needs of forest ecosystems. This responsiveness will become increasingly important as the impacts of climate change become apparent.

Maintain/enhance biodiversity as a key ecosystem service

Forest biodiversity is a key factor in the adaptive capacity of forest ecosystems and in maintaining ecosystem services and livelihood products provided by forests (Noss 2001; Drever *et al.* 2006). Climate change will alter forest ecosystems in many ways. These include changes in species composition and structure, disturbance regimes (e.g. fire, insect infestation, natural disasters), productivity and physical habitats. Some of these changes may result in the local or absolute extinction of certain species in the long term.

Forest managers must therefore avoid negative impacts on biodiversity as a key aspect of sustainable forest management. Specific management interventions for maintaining biodiversity

include the prevention of disturbances such as fire (managing fuel load, prescribed burning) or maintenance of their natural cycles, particularly in arid and semi-arid forest areas. The prevention of invasive species and diseases is also crucial for maintaining biodiversity, through quarantine regimes and phytosanitary procedures. Another option is to assist forests adapt after a perturbation by establishing priority species according to planned ecological succession (Locatelli *et al.* 2008).

Increasing landscape connectivity through the establishment and preservation of corridors, and reducing forest fragmentation, is important to facilitate natural progression and succession within ecosystems. Connectivity and corridors increase the ability of species to adapt through migration and the maintenance of genetic diversity.

Guariguata *et al.* (2010) propose measures to increase genetic diversity in managed forests, both in natural and planted forests. In managed natural forests, for instance, logging gaps may be planted with a variation of seedlings to maximize genetic diversity. Tree plantations may be planted with a range of genotypes, seed sources and age classes to increase their capacity to adapt to expected future climate conditions. Plantation management strategies which mimic natural conditions and shun monocultures are advocated to take into account climate change adaptation requirements (Roberts 2009). Throughout the region, traditional home gardens have included drought-resistant fruit trees to provide a source of livelihoods during drought years when other crops fail (Boven and Morohashi 2002).

Create/enhance robust management strategies and extensive communication networks

The uncertainty of the eventual impacts of climate change underlines the need for robust, sustainable forest management strategies that can achieve the desired objectives under a wide range of future scenarios. This requires active and responsive management; hence a laissez-faire or non-interventionist approach to forest management and conservation is inappropriate for effective climate change adaptation. As noted above, community-based management strategies are an important tool for ensuring responsiveness. These management strategies must also consider the projected increase of forest disturbance regimes in the form of fire, pests and diseases and must be flexible enough to incorporate and respond to new information. Effective adaptation requires the formation of extensive communication networks for monitoring the effectiveness of strategies at local, national and regional levels. These communication networks in turn require corresponding investments in infrastructure, capacity building and institutional development.

Improve intersectoral coordination

Policies from agriculture, transportation and land-use sectors will exert significant influence on the forest sector. Forest adaptation should not ignore the many anthropogenic drivers of forest change that originate in other sectors: developments in agriculture, energy, transportation, conservation and macroeconomic policies can have dramatic effects on the incentives to destroy or degrade forests. For example, reforestation and afforestation are key elements of the climate change adaptation strategy. However, such a strategy could lead to the lowering of water tables, adversely affecting water supply for power generation and irrigation. At the same time, tree planting activities may have a positive effect on local communities through, for example, a reliable fuelwood supply (Lasco *et al.* 2010). The case of New Zealand is a good example of intersectoral coordination at the national level. Although New Zealand does not have a national forest policy, the national government does develop national policies that influence the forest sector as a product of consultations with other departments at the earliest possible stage in policy formulation.

Mainstream forest adaptation into policy

In order to mainstream forest-based climate change adaptation strategies at the country level, National Forest Programmes (NFPs) must explicitly address both the role of forests for reducing vulnerability to climate change at the national level and the importance of increasing the adaptive capacity of forests themselves. NFPs include a wide range of approaches in forest policy formulation and implementation at the national and subnational levels. They are a commonly agreed-upon framework for sustainable forest management that allows for the implementation of

internationally agreed-upon concepts and obligations and access to international funding support. Unfortunately, forests play a secondary role in most adaptation policies (Kalame, 2009), despite their importance. But, there are examples of country adaptation strategies that do include forests, e.g. Bangladesh and Samoa (Locatelli *et al.* 2008).

Incorporate new actors and new modes of governance

Many institutions and sectors are becoming increasingly concerned about forest-based climate change adaptation strategies from the local to the global scale. They include local forest-dependent communities, commercial or industrial forest stakeholders, ecotourism ventures, conservation and development NGOs, national agencies concerned with forests, power generation agencies and industries, agriculture and food sectors, disaster risk reduction organizations, intergovernmental organizations, international research/development organizations and funding agencies. Adaptation policies should aim at linking these diverse actors with those engaged in forest conservation and management.

This poses fresh challenges for policy design. These challenges can be addressed by new modes of governance that utilize policy networks and adopt a flexible mix of policy instruments from traditional regulation, incentives, voluntary agreements and knowledge-based instruments, enabling experimentation in the face of uncertainty and the rapid international convergence on best practices.

Forest management options in the context of climate change adaptation

Adaptive management involves systematically learning from past experiences in order to plan for the future. It refers to the integration of design, management and monitoring practices to test assumptions for adaptation and learning (Salafsky *et al.* 2001). Adaptive management of forests for climate change is consistent with sustainable forest management (IUFRO 2009).

The primary aim of adaptive management is to improve the resiliency and adaptive capacity of forests against climate change impacts by reducing stresses on forest ecosystems (Nabuurs *et al.* 2007). One measure would be to maintain dispersed and viable populations of individual species to lessen the risk of catastrophic events that may cause extinction (Fischlin *et al.* 2007). Adaptive management also leads to conservation of biodiversity and reduced vulnerabilities to climate change (Nabuurs *et al.* 2007).

Several adaptation strategies and practices may be incorporated into the adaptive management framework such as: establishing mixed species rather than monoculture planted forests, changing rotation periods, salvaging dead timber, shifting to species more productive in altered climatic conditions, taking action to minimize fire and pest damage, connecting corridors and adjusting production objectives to altered wood size and quality (Spittlehouse and Stewart 2003), reducing damage to remaining trees, practicing reduced-impact logging, employing soil conservation practices and using wood in a more carbon-efficient way (Cruz *et al.* 2007).

As stated earlier, local communities and indigenous peoples depend on forests for a wide range of ecosystem services. However, the sectors depending on forest ecosystem services are often not involved in forest adaptation. Instead it is often in the hands of stakeholders with few links to those directly benefiting from ecosystem services or bearing the consequences of their loss (Locatelli *et al.* 2008, Robledo 2005). This further highlights the need for a refinement of the adaptive management strategies in a shift towards adaptive co-management (ACM) of forests. ACM recognizes the importance of active stakeholder participation and aims to consistently improve management policy and practice by continuous monitoring and learning from operational experience (Nabuurs *et al.* 2007). ACM can address uncertainty by helping forest managers adjust the structure and functioning of forest ecosystems, thus resisting the harmful impacts and exploiting the opportunities created by changing climate (Seppala *et al.* 2009). Moreover, ACM maintains openness and transparency in all stages of the planning process (Raison 2002).

ACM has already yielded positive results in several cases in the region. Two well-documented ACM experiences in Sumatra's Bary Pelepat and Kalimantan's Pasir in Indonesia demonstrate how applying ACM through the facilitation of researchers has assisted local groups and institutions in

jointly addressing forest resource and management problems, while contributing to shared learning (Kusumanto *et al.* 2005). In Nepal, the use of ACM has been successful in helping community forest user groups (CFUGs) become more effective and responsive learning institutions, and eventually, more active and successful in meeting organizational goals. The ACM process in this case also resulted in the emergence of a variety of innovations in monitoring practice and power-sharing mechanisms (Khadka and Vacik 2008). In the Philippines, in areas where community-based forest management has been supported by administrative and extension agencies, it was easier to facilitate ACM in new sites. Although not without its share of problems, the communities were thus able to exert influence over the type and delivery of extension services within the ACM process (Hartanto *et al.* 2003).

Estimations of adaptation costs

Adapting to climate change involves a significant transition with far-reaching economic implications. Full economic assessments of the costs associated with adaptation allow countries to prioritize strategic measures and anticipate the associated development impacts. To date, knowledge on anticipated adaptation costs, particularly those costs specific to the forestry sector, remains highly limited and imprecise.

Since 2006, there have been only five global studies estimating climate change adaptation costs for developing countries. The World Bank initially produced an estimate in 2006 for the period 2010-2015 and this has since been extended until 2030. The first study estimated annual costs of between US\$9-41 billion globally, based on the costs of climate-proofing foreign direct investments, gross domestic investments and official development assistance flows. The Stern Review later the same year estimated the cost at between US\$4-37 billion per year. Oxfam (2007) updated the figures to >US\$50 billion per year by extrapolating the Bank's estimates and factoring in costs from National Adaptation Programmes of Action (NAPAs) and donor-assisted projects. UNDP (2007) pegged its estimate at US\$86-109 billion annually which included poverty reduction strategies and measures for improved disaster response. The UNFCCC released its estimate in 2007 at US\$27-66 billion per year until 2030. The UNFCCC estimates were influential in discussions on funding assistance for climate change adaptation (Parry *et al.* 2009).

Adaptation costing for natural ecosystems is based on the premise that autonomous adaptation will not be enough (Fischlin *et al.* 2007), hence planned adaptation is necessary to avoid potential negative impacts on biodiversity and ecosystem services. Adaptation costing for ecosystems is apparently problematic because of the uncertainty in establishing impacts, although some qualitative adaptation costs were made for certain ecosystems and regions (Parry *et al.* 2009). There are many guiding principles in estimating adaptation costs but there are very few cases of measures implemented purely as climate change adaptation. These are usually local to regional and context-specific estimations, which make extrapolation to larger scales inappropriate (Parry *et al.* 2009). The most recent effort to systematically come up with downscaled estimates of adaptation costs, particularly for India's forests, was done by Ojea *et al.* (2009). Their methodology linked vulnerable areas associated with climate change to implementable adaptation options. Based on decreasing net primary productivity and SRES B2 scenario, they estimated adaptation costs for India's forests at US\$239.78 million to about US\$1.5 billion annually until 2085.

3. Mitigation options and issues

Reduced emissions from deforestation

Between 1850 and 1995, 75 percent of total carbon emissions in South and Southeast Asia were due to the clearing of forests for permanent crops. This trend is set to continue, even though deforestation rates in tropical Asia have declined since the 1990s (Houghton and Hackler 1999). Efforts to reduce deforestation in the Asia-Pacific region should therefore be integral to a well-rounded climate change mitigation strategy. Avoiding deforestation will maintain existing carbon stocks and sink processes, thus avoiding and reducing emissions (Niles *et al.* 2002).

Strategies for avoiding deforestation depend upon the drivers of deforestation in each context. However, there appear to be four clear categories of mitigation strategies for avoiding deforestation (see Peskett and Harkin 2007), which include:

- Strengthening existing policy and legislation for forest protection.
- Reclassification of land-use zones or renegotiating concessions.
- Modification of agriculture or infrastructure programmes to reduce pressure on forests.
- Implementation of economic incentives through PES, or disincentives such as taxes or fines.

To date, most REDD demonstration projects have adopted a ‘concession model’ for reducing deforestation (Myers Madeira 2009). That is, contracts are negotiated with concessionaires who hold the timber extraction rights to an area. In Indonesia, this model of site-level REDD project has been by far the most common (*ibid.*). Relatively few REDD projects have been implemented that directly engage local resource users, who tend to be involved in ‘unplanned’ deforestation.

Physical mitigation potential

The mitigation potential of avoiding deforestation is enormous. Recent studies suggest that within the forestry and land-use sector, avoided deforestation is the mitigation strategy with the greatest potential for emissions reductions (Sathaye *et al.* 2005). It is estimated that 17.4 percent of global anthropogenic emissions derive from the forestry sector, including from deforestation, decomposition of biomass after harvesting, peat fires and decay of drained peat soils (IPCC 2007a).³ The potential impact of curbing deforestation is great, especially in the case of natural habitats that store high amounts of carbon, such as peatlands. For example, Gullison *et al.* (2007) argue that if present deforestation rates were halved by 2050 and then maintained at that level until 2100, this would avoid release of up to 20 gigatonnes of carbon (GtC) this century, or around 12 percent of total reductions required from all sources in order to stabilize emissions at 450 parts per million (ppm).

The potential contribution of the Asia-Pacific region to emissions reductions from avoided deforestation is great. For example, in the period 2000-2010, an average of 724 000 hectares of primary forest was lost every year. Despite the continuing increase in total forest area, due to plantation establishment in East and South Asia, the rate of loss of primary forest as a percentage of total forest area actually increased, compared to the previous decade, from 0.48 percent/year to 0.50 percent/year (FAO 2010a). Based on figures from the 1990s, Houghton and Hackler (1999) estimated that emissions of between 170-660 million tonnes of carbon (MtC) could be prevented each year, if deforestation rates were halved.⁴

Economic mitigation potential

The maintenance of existing tropical forests will likely yield enormous economic benefits in the future. In addition to contributing to climate change mitigation, benefits of forest maintenance include: conservation of biodiversity (which has both intrinsic value known as ‘existence value’,

³ CO₂ annual average emissions from land-use change, mostly from deforestation, were estimated to be 1.6 ±0.8 GtC/year for 1989-1995 (Sathaye *et al.* 2005), while other estimates suggest a range of 1.2-1.9 GtC/year for the early 1990s (Foley and Ramankutty 2004). These may now be considered high, as estimates on carbon flux due to deforestation were revised down in 2003 to 700 MtC/year from the previous estimate of 1.4 GtC/year (see Sathaye *et al.* 2005).

⁴ This is a rough calculation based upon Houghton and Hackler’s figure in 1999 of 100-200 MgC/ha lost as a result of deforestation in Southeast Asia.

and offers potential benefits from future use known as ‘option value’); contributions to human health (through natural medicine, reduced air pollution from forest fires); and contributions to livelihoods (e.g. through harvesting of NWFPs).

A recent report, “The economics of ecosystems and biodiversity”, argues that large upfront investments in conservation and REDD now could save trillions of dollars of ecosystem services in the future (Sukhdev 2008). This includes the value of NWFPs, erosion prevention, fire prevention, pollination, carbon storage, existence value and recreational and ecotourism use. The value is even higher if one accounts for the maintenance of biodiversity, spiritual and cultural areas, disease protection and provision of water (ibid). However, the opportunity cost of reducing deforestation cannot be ignored, especially given the increase in competing interests for forest land and related resource use. This means that prices paid to service providers for emissions reduced or carbon sequestered (US\$/tCO₂eq) will need to be substantial enough to offset competing opportunities.

In the Asia-Pacific region, oil-palm plantations are the most significant emerging alternative land-use strategy. In the case of this commodity, the opportunity cost of not establishing plantations on degraded forest land with mineral soils, which stores relatively little carbon, has been calculated at US\$3 963/hectare (Fogarty 2009). To offset this opportunity cost, carbon credits would have to be priced at over US\$21/tCO₂eq. However, in the case of peatlands, while the opportunity costs of not planting palm oil are higher (US\$4 265/hectare), the emissions avoided by protecting the forests are also higher. In this case, a carbon price of US\$4.19/tonne would be sufficient to offset opportunity costs (ibid).

The lesson here is that there will be costs associated with avoiding deforestation under carbon financing initiatives such as REDD, but that these costs will vary depending upon the economic value of proposed alternative land uses (determined to a considerable extent by current and expected commodity prices), the price of carbon per tonne, the carbon content of the forest in question and the rate at which this forest can sequester carbon in the future. Thus, the cost of implementing carbon projects will depend upon the situation in individual countries as well as the potential benefits of forest conservation, whether direct or indirect, as discussed.

Risks and co-benefits

Maintenance of existing forests is not just beneficial for avoiding emissions, but also for protecting them from the impacts of climate change. Gullison *et al.* (2007) argued that maintenance of intact forest may help to avoid the risk of forest fire-related to fragmentation of forests, droughts and increased tree mortality and flammability. Forest-use restrictions associated with carbon projects have the potential to cause local communities and indigenous peoples to lose access to resources that are essential to their livelihoods. This has led to a push for more inclusive, pro-poor options for carbon projects. The current shift in focus from REDD to REDD+ is a case in point (e.g. Peskett and Harkin 2007; Peskett *et al.* 2008). Carbon sequestration activities must be coupled with streams of long-term positive benefits to local stakeholders, to ensure that potentially negative social impacts are averted and that avoided emissions are sustainable. However, risks for the poor may yet emerge as a result of the type of benefit streams that are offered by local governments or carbon project mediators, such as incentives for intensification of agriculture outside of forested areas.

Another risk that will require resolution on a case-by-case basis is that conflicts will arise over the allocation of benefits from forest carbon projects, particularly if land tenure and rights to carbon-related revenue are not clearly determined. Clarification of rights before implementation will therefore be essential for achieving equitable and ethical outcomes (see Angelsen 2008). Finally, measures need to be taken to ensure that REDD and other carbon project funds should not reward those who have been acting illegally by clearing forest.

Some observers have suggested that carbon projects may lead to displacement of the pressures that result from food, timber and biofuel production to ecosystems that contain low carbon levels (Miles and Kapos 2008). The least productive ecosystems may thus become increasingly threatened, because the availability of such areas is greater and the opportunity costs associated with their use are lower. To minimize such risks, it will be necessary to prioritize carbon investments to ensure that maximum biodiversity and social benefits are achieved, over and above the emissions avoided.

Distributional impacts

A key debate in REDD policy is whether contracts between buyers and sellers are to be implemented through national governments in a centralized fashion, or through subnational entities such as local governments, communities or individuals. The former centralized approach may lead to greater administrative efficiency and reduced risk of 'leakage' (displaced deforestation) due to national-level monitoring; but the latter will likely ensure a closer link between payments (and thus involved local communities and indigenous peoples) and REDD activities. Thus, a decentralized approach may ensure that local stakeholders are more fairly compensated and that funds are not captured by national entities (Peskett and Harkin 2007).

However, if such decentralization involves the creation of separate 'forest carbon accounts' at the community level, all of which would need to be monitored and verified by third parties to a standard which would ensure investor confidence, the transaction costs of such a system would be impossible to sustain. Revenue distribution may instead be done on the basis of verified management 'inputs' (i.e. implementation costs) such as data collection and forest patrols, rather than payment for 'outputs' in the form of hard-to-verify carbon accounts (Skutsch *et al.* forthcoming).

While the link between revenue and performance at the national scale must be in the form of achievement of credible, measurable, emission reduction targets in order for REDD+ to be part of an international climate change mitigation strategy, the link between performance and payment at the local level can be more prosaic. For example, in Nepal's National Community Forestry program, CFUGs enter into agreements with local forestry officials in the form of five-year management plans, including participatory forest inventory. Distribution of REDD+ revenue on the basis of verified adherence to such plans is a potentially equitable benefit sharing mechanism (Vickers, in press). However, countries in the region without such a system of secure rights to use and manage forests would need to implement the necessary forest governance reforms prior to the initiation of such a mechanism. For example, Viet Nam is currently exploring the potential links between its nascent community forestry programme and REDD+ benefit distribution (UN-REDD Programme Vietnam 2010).

Enhanced carbon sequestration from afforestation, reforestation and other strategies

There is a suite of strategies to create carbon sinks through forestry. Some of these strategies are:

- Afforestation: Establishment of planted forests on lands that historically have not been forested
- Reforestation: Planting of new forests on land that had tree cover recently
- Forest restoration: Restoring degraded forests through assisted or natural regeneration; protecting secondary and other degraded forests to allow them to regenerate naturally; or mechanical/ infrastructural means, such as damming canals that drain peatlands.
- Modification of forest management practices to increase sequestration: Including prevention of fires, changing harvesting rotations and practices (e.g. reduced impact logging).
- Adoption of agroforestry practices: Increasing tree cover on agricultural or pasture lands.
- Urban forestry: Planting trees in 'vacant areas' for urban green space.
- Increasing soil carbon: Soil restoration and woodland regeneration, no-till farming, introduction of cover crops and set-asides (Lal 2004).

Many such projects fall under the Clean Development Mechanism-Afforestation/Reforestation (CDM-AR) provisions of the Kyoto Protocol (IPCC 2000). Herein, carbon sequestration resulting from afforestation and reforestation since 1990 is eligible for such credits during the first commitment period (i.e. 2008-2012), and carbon sequestration in other pools, such as soil organic carbon and peatlands, could become tradable for the subsequent commitment periods (Liu *et al.* 2004). Some may also become part of the REDD+ mechanism as described above, depending on the final outcome of negotiations under the UNFCCC Ad-hoc Working Group on Long-term Cooperative Action (AWG-LCA) (RECOFTC and FAO 2010).

Physical mitigation potential

There is significant mitigation potential to be realized through reforestation and forest restoration projects globally, and in the Asia-Pacific region in particular. An aggressive global programme of reforestation and natural regeneration could potentially restore forests on 700 million hectares over the next 50 years (Chazdon 2008). A particular opportunity in the Asia-Pacific region is the restoration of degraded peatlands (see Box 4). In Southeast Asia, 70 percent of all anthropogenic emissions result from degraded peatlands (Wetlands International 2009); thus restoration of drained peatlands should be a major component of the region's climate change mitigation strategy, capable of avoiding emissions of hundreds of MtCO₂eq/year (Joosten 2009).

Between 2000 and 2100, reforestation and forest restoration may account for 25-50 percent of the total mitigation potential from the forest sector (Sathaye *et al.* 2005). Globally, this could represent 11-55 GtC sequestered by 2100, depending on factors such as carbon price and land availability. The potential for achieving gains in these areas in the Asia-Pacific region are excellent, as large areas of abandoned secondary forest may become available for restoration programmes (Silver *et al.* 2000); and countries are beginning to put ambitious forest reforestation and restoration programmes in place. For example, India's forest policy requires it to move towards covering 33 percent of its land area by forests and trees, China intends to expand its forests by 117 million hectares by 2050, and up to 150 million hectares of degraded land suitable for forestry are available for similar programmes in the rest of Asia (see Sathaye *et al.* 2005). This potential for forest expansion is reflected in the high reforestation and afforestation rates that have already been seen in China; enough to cause net increases in forest cover for the entire Asia-Pacific region in the period 2000-2005 (FAO 2006).

BOX 4

Restoration of peatlands

The restoration of peatlands could be a vital component of mitigation strategies. Peatlands are the most concentrated stocks of terrestrial carbon. They cover only 3 percent of the world's surface, but store 500 Giga tonnes (Gt) of carbon, which is equivalent to twice the carbon stock that is held in the world's forests (Joosten 2009). Southeast Asia contains 15 percent of the world's peatlands, yet emissions from degraded peatlands in this region constitute 70 percent of its anthropogenic emissions (Wetlands International 2009).

Peatlands that have been drained become major sources of GHGs, and are now responsible for 6 percent of total global anthropogenic emissions, according to the 2008 emissions inventory for peatlands presented to UNFCCC in 2009 (*ibid*). Indonesia is by far the world's top emitter in this category followed closely by other countries in Asia and the Pacific, including China, Malaysia and Papua New Guinea. Logging of peat swamp forests, when followed by the establishment of deeply drained oil-palm and pulpwood plantations, is the root cause of these emissions, particularly in Southeast Asia. However, many logged peatland forests are simply left as wastelands, and could be easily restored by blocking drainage canals that were used to transport logs (Wetlands International 2009).

Thus 'peatland rewetting' represents a significant emissions reductions strategy (Trumper *et al.* 2009), which could prevent emissions in the order of hundreds of MtCO₂eq/year (Joosten 2009). Wetlands International has called for a REDD-like mechanism to provide incentives for the restoration of degraded peatlands, which may be entirely deforested but still contain huge carbon stocks. Such a strategy is indeed the central idea behind a REDD pilot project in Central Kalimantan Province in Indonesia.

However, it is important to note that net increased levels of reforestation do not necessarily translate into increased levels of forest carbon. Plantations store significantly less carbon than natural forests; one study estimates 250 tC/hectare are stored in natural forests versus 50 tC/hectare in fast growing plantations (Pagiola and Bosquet 2009). If natural forests are cut and replaced with planted forests, carbon stocks will decrease (even though sequestration rates are likely to increase). Replacing natural forests with planted forests could have other negative consequences, so in general should be avoided. Nonetheless, it has been estimated that over half of tropical plantations globally have been established on land cleared of its natural forests (Brown 2000).

Carbon sequestration projects that involve fast-growing forests accumulate carbon more quickly than if the land were under natural forest. For example, fast-growing plantations accumulate 5 tC/hectare/year, while healthy, natural forests accumulate about 2.5 tC/hectare/year (Swallow *et al.* 2007); regenerating forests could absorb as much as fast-growing plantations, especially when soil carbon is considered (Silver *et al.* 2000). However, absorption rates do not continue indefinitely. Research suggests that tropical reforestation has the potential to serve as a carbon offset for between 40 to 80 years (*ibid.*).

Changes in forest and land management practices also represent a significant opportunity for carbon sequestration. This type of strategy may also be considered as ‘avoided degradation’, which is discussed below. Changes in forestry rotations and burning practices entail changes in carbon stocks. A notable example is the case of savannah burning in Northern Australia,⁵ where indigenous communities have taken an active role in fire management to avoid intense late dry-season burns. “A hectare burnt in May releases half the greenhouse emissions of a hectare burnt in a hot November wildfire” (ABC 2006); meaning that prolonged early dry-season burning can ‘thicken’ savannah and sequester carbon. This has resulted in voluntary carbon abatement agreements with indigenous communities in Arnhem Land, Northern Territory (see Box 5).

Finally, the carbon sequestration potential of urban forestry is potentially substantial. For example, one study from the United States of America estimates that its existing urban forests absorb 22.8 MtC/year (Nowak and Crane 2001). Retaining forest areas in and around expanding cities in the Asia-Pacific region and increasing urban tree cover where possible would help to maintain and increase forest carbon stocks.

BOX 5

Carbon abatement through community-based fire management in Australia’s Northern Territory

In Australia’s Northern Territory, an agreement to reduce greenhouse gas emissions caused by large bushfires has been made between indigenous communities and a local company called Darwin Liquefied Natural Gas. The agreement is implemented in partnership with Aboriginal traditional owners and local government, and it enables local indigenous ranger groups to manage fire using traditional skills and knowledge, in such a way that GHG emissions are reduced.

This project, known as the West Arnhem Land Fire Abatement Project delivers numerous benefits in addition to reduced emissions. It supports local culture and traditional land management, protects threatened biodiversity and provides valuable employment to local communities (more than 100 part-time jobs), which in turn provides social and economic benefits.¹ In all, Darwin Liquefied Natural Gas will provide around US\$1 million/year for the next 17 years to Aboriginal traditional owners of western Arnhem Land to implement a fire-burning strategy.

⁵ See www.nailsma.org.au/projects/indigenous_carbon_abatement.html

Economic mitigation potential

The price of carbon is a major determinant of the economic feasibility of forest carbon projects and thus of investment levels in such projects (Sathaye *et al.* 2005). There are usually opportunity costs associated with project implementation, as well as administration and implementation costs, which will vary from country to country. Inevitably, interventions with low opportunity costs and potential to profit from the carbon market will be more successful.

For example, the opportunity cost of restoring many degraded peatlands is low, because large areas are left abandoned after logging operations and are not economically productive (Wetlands International 2009) and present a potentially significant economic opportunity for emissions reductions through restoration. However, restoration may be hampered by the more immediate economic returns from planting palm oil on drained peatlands. This will continue to be a serious issue until there is sufficient compensation for maintaining and enhancing peatlands. The value of palm oil as a commodity is an important factor. In Indonesia, palm oil generated export revenue of £7.64 billion in 2008 (MacKinnon 2009). This significant revenue potential led, in 2009, to Indonesia lifting a ban on the establishment of oil-palm plantations on peatlands, releasing up to 2 million hectares of peatland forest for future plantation. In 2010, however, the government re-imposed a two-year suspension of all new oil-palm plantations on converted peatland, as part of the Norway-Indonesia REDD+ partnership, worth US\$1 billion to the country. In the long run, it is far from clear how and whether such a moratorium can be maintained. The value of carbon stored in peatlands therefore needs to be translated into immediate economic incentives to the Government of Indonesia and other forest stakeholders, to counter the opportunity costs of conversion (Sheil *et al.* 2009). There is a danger that the cost of maintaining these incentives year-on-year could spiral.

Risks and co-benefits

Two broad approaches for reforestation and restoration projects exist: relying on measures that more closely mimic nature (e.g. assisted natural regeneration and natural restoration of native forests); and establishing industrial plantations, seeking to sequester carbon at the fastest rate possible. The latter entails a number of environmental and social risks, in particular that natural forests will be cleared for economically profitable plantations (see Brown 2000). The former, more 'environmentally friendly' type of strategy offers significant opportunities for co-benefits such as biodiversity conservation and support for local livelihoods.

Risks of plantation-style reforestation and afforestation

One of the key risks of plantations is associated with changes to hydrological cycles. Significant impacts on local hydrologic cycles have been observed, however broader impacts have yet to be predicted at regional or global scales (e.g. Trabucco *et al.* 2008). For example, predicted impacts in China of reforestation/afforestation on runoff volumes show potential decreases of 54 percent in drier areas to less than 5 percent in more humid areas (*ibid.*). Thus, it will be vital to consider implications of afforestation/reforestation on local and regional water resources, which in turn have implications for local livelihoods and food security. Another environmental risk of plantations is that some tree species (e.g. pines, eucalypts and teak) may under certain conditions cause soil erosion by suppressing the ground vegetation, especially if they are planted as dense monocultures on steep slopes. Furthermore, monoculture plantations entail reduced genetic diversity and a heightened vulnerability to pests, climate change and a range of other potential threats.

Afforestation projects also potentially compete with land that would otherwise be productive for agriculture. For example, in China concerns have been expressed about farmers' loss of land due to aggressive state-led reforestation and afforestation programmes (Xu *et al.* 2010). Reforestation and afforestation could, therefore, constrain local livelihoods and reduce incomes from agriculture in some areas. However, this could be minimized if reforestation projects are also accompanied by equally intensive efforts to improve agricultural practices and yields (Niles *et al.* 2002). Funding for sustainable agriculture should, therefore, be a vital component of reforestation and afforestation programmes, which may simultaneously lead to additional reduced emissions from improved practices and increased soil carbon on agricultural lands (*ibid.*).

Co-benefits

Potential environmental co-benefits of afforestation/reforestation/restoration projects are: additional carbon sequestration is achieved in soils where reforestation occurs and if new forests are sustainably managed, then demand for timber and fuelwood products from existing natural forests may decrease, thus avoiding deforestation and degradation of valuable natural forests (Niles *et al.* 2002). In addition, both reforestation efforts and plantation establishment can contribute to biodiversity conservation by connecting natural forest areas across fragmented landscapes (Beaulieu *et al.* 2006). In such cases, plantations can aid propagation of shade-adapted late successional species, and enable gene flow between otherwise separated native forest patches (*ibid.*). However, plantations have a high risk of failure if only one or a few tree species are planted (Chazdon 2008). Reforestation projects will have a lower risk of failure if they provide for species and genetic diversity within the stand and/or landscape level as well as favour use of native over exotic species. In most AR/CDM projects approved to date in the region, including those in China, India and Viet Nam, the practice has instead been to promote exotic plantations of *Acacia* or *Eucalyptus* spp., with very limited environmental co-benefits.

Increased forest cover can also bring vital social and economic benefits, at both regional and local scales. For example, restored or new forests can protect soil and water resources thereby making a positive contribution to agricultural productivity and water supply for irrigation, human use in cities and hydropower. The economic value of such 'environmental services' has been quantified in numerous recent studies (e.g. Sukhdev 2008). In the local context, projects to restore or replant forests can also yield livelihood benefits by: providing wages to local farmers and communities to participate in restoration or management activities and improving the diversity and condition of forests so that they provide valuable livelihoods benefits such as NWFPs (see CIFOR 2000; Chazdon 2008).

Distributional impacts

Carbon sequestration mitigation strategies are most likely to affect indigenous peoples, local communities and farmers living adjacent to lands that are slated for restoration, reforestation or establishment of plantations. They may be required to modify their existing forest and land-use patterns, and their resource rights may be affected in the process (see Angelsen 2008). Depending upon compensation arrangements, and the nature of CDM, REDD or other contractual obligations, this could either benefit or disadvantage local stakeholders. Ideally, local stakeholders would be able to access a new income stream by selling carbon credits. Ultimately, the distribution of benefits will be dependent on national legislative and socio-political context. However, if afforestation/reforestation projects impose costs but do not benefit local rights-holders there will be a risk of project failure and negative social consequences and project failure. The Vietnamese Government has acknowledged that forest carbon sequestration strategies, whether REDD or CDM, depend on the support and participation of local people for success (Nguyen *et al.* 2010) and this understanding will have a significant bearing on government policy for distribution of revenues from forest carbon projects and markets.

Conservation of natural forests

The majority of forest cover in the Asia-Pacific region is natural (79 percent), rather than plantation (21 percent) (Houghton 2005). However, most reported gains in forest area and condition in the region are confined to planted forests. The natural forest area decreased at the rate of 0.48 percent per year during the 1990s and by 0.50 percent per year during the 2000s, while planted forest area increased at annual rates of 2.02 percent and 2.85 percent during 1990-2000 and 2000-2010 respectively (FAO 2010a). Conservation of natural forest resources is therefore a critical component of climate change mitigation strategies in the region. Furthermore, natural forests should be of high priority because they contain more biomass than plantations or agroforestry systems: that is, natural forests contain 250 tC/hectare versus 90-120 tC/hectare and 50 tC/hectare for agroforestry systems and plantations, respectively (Pagiola and Bosquet 2009).

One strategy under REDD is to strengthen existing policies and measures for the protection of natural forests. This refers to projects that seek to strengthen law enforcement and protection of

areas that are already designated for conservation, or designated to remain as natural forest (Peskest and Harkin 2007). Such areas are often subject to the pressure of ‘unplanned’ deforestation and degradation, resulting from activities such as encroachment by local farmers, developers or illegal logging. This mitigation strategy therefore entails improving the management of areas that are intended to remain forested such as community forests, forest commons, protected areas, or forest estate (i.e. government-owned forest that is not under concession). Management strategies could include enforcement of protected areas through patrols and monitoring; promotion of sustainable forest management in forest commons and concessions; prevention of forest conversion for oil-palm or pulpwood plantations; and reduction of wild fire (Silver *et al.* 2000).

Physical mitigation potential

While natural forests are valuable for their carbon stocks, this does not necessarily translate into their carbon sequestration potential. A rule of thumb used by Swallow *et al.* (2007) for the humid tropics indicates that natural forests contain about 250 tC/hectare and accumulate about 2.5 tC/hectare/year. Short rotation plantations have one-fifth of the carbon stocks, but they accumulate carbon at twice the rate of natural forests. Thus, the mitigation potential of unthreatened natural forests, both in terms of emissions avoided and carbon sequestered, is relatively low. The value of conserving natural forests in the context of climate change is therefore at least partially related to *the suite of benefits they provide* which are important for adaptation, including their role in supporting biodiversity conservation, sustaining human-use values (utilitarian, aesthetic, spiritual etc.), and buffering the impacts of climate change. Therefore, it could be strategic to concentrate non-carbon sources of funding to protect unthreatened natural forests, which have little or no potential for accessing carbon funds, in order to achieve important primary goals like biodiversity conservation (Miles and Kapos 2008).

Economic mitigation potential

Making the case for natural forest conservation in financial terms can be difficult. However, as the literature suggests (e.g. Sukhdev 2008), the problem is not that natural forests lack economic value – rather, that forest values are not accounted for in conventional economic analyses and decision-making. A full valuation of benefits provided by natural forests will therefore be essential in making the case for forest conservation in financial terms.

The long-term economic benefits of preserving natural forests are potentially huge, given the high and increasing value of threatened biodiversity, the potential for revenue from nature-based ventures and ecotourism and the role of forests in averting climate change impacts (*inter alia* their role in maintaining rainfall patterns, and in buffering human populations from extreme weather events). Natural forests also provide essential economic benefits to local communities and indigenous peoples, which derive income, food and medicine from harvesting both timber and NWFPs. Where harvesting is sustainable, ‘multiple-use approaches’ to natural forest protection may represent a significant economic opportunity for local communities and other stakeholders (Guariguata *et al.* 2010).

Risks and co-benefits

A vital co-benefit from protection of natural forests is the conservation of biodiversity. Natural forests are, in over 90 percent of cases, more species-rich than plantations (Stephens and Wagner 2007), and it has been suggested that carbon abatement payments can be used to assist the conservation of threatened wildlife (Venter *et al.* 2009; Miles and Kapos 2008). In Hunter and Calhoun’s ‘triad approach to land allocation’ (1996), they suggest that native forest reserves be managed first and foremost for conservation and restoration of biological diversity. Management of these forests should be centred on identified biodiversity hotspots of global and national significance, as biodiversity conservation is the most significant co-benefit of natural forest protection. This view is shared by Miles and Kapos (2008), who argued that decisions over REDD investments should be harmonized with a biodiversity conservation priority-setting process.

In addition to biodiversity conservation, protection of natural forests can secure and enhance local livelihoods through the provision of NWFPs, pasture for livestock, timber for construction,

fuelwood (CIFOR 2000). The implications of this are significant: hundreds of millions of people in the Asia-Pacific region live in rural areas and are dependent on natural forests. In many areas, the knowledge, skills, social customs and traditions associated with NWFPs have been passed from one generation to another. Thus, natural forests are also closely linked to repositories of social, cultural and spiritual knowledge and values. Natural forests are also resources for outdoor recreation and aesthetic values.

A key dimension in the protection of natural forests is the role of communities and local stakeholders. The role of communities is becoming increasingly important, particularly their actions to improve forest management and prevent illegal logging, forest degradation and encroachment; or to enhance carbon sequestration. There is much potential for carbon projects to be implemented in community-owned forests or in forests that are used by communities, which together comprise around 28 percent of forests globally (Chhatre and Agrawal 2009). Chhatre and Agrawal (2009) also show that the combination of larger forest areas and greater local autonomy lead to better outcomes for carbon storage and livelihoods. Thus, there are potential synergies between forest carbon sequestration projects and initiatives to decentralize decision-making and strengthen community ownership over forests. There is also evidence that harnessing community forest management is also an effective and financially competitive climate change abatement strategy (Karky and Skutsch 2009).

Distributional impacts

The local opportunity costs of protected areas are relatively well documented in existing literature, while regional and macro-opportunity costs, for example socio-economic impacts of protected areas, are less well understood; see Brosius (2004); Bruner *et al.* (2004); Naughton-Treves *et al.* (2005) and West *et al.* (2006). In protecting natural forests through REDD-type schemes, patterns of social impact similar to those observed in protected areas are likely to occur. It will therefore be vital for project activities to assess and take measures to mitigate any negative impacts that forest protection may have on local livelihoods.

Reduced emissions from forest degradation

Forest degradation that leads to carbon emissions in the region is significant, especially in South and Southeast Asia. Degradation results from human activities such as shifting cultivation, logging, grazing and fuelwood extraction, as well as natural causes such as forest fires and pests or diseases (Houghton and Hackler 1999; Griscom *et al.* 2009). Degradation can be reduced through improved forest management practices such as: fire and pest control; adoption of reduced impact logging; reduction of fuelwood collection, grazing management etc. It is vital that degradation be addressed, not only for its impact on emissions but also for its capacity as precursor to or catalyst of deforestation (Streck *et al.* 2009).

A key policy challenge is that the IPCC has not yet developed an official definition for degradation. Griscom *et al.* (2009) recommend the following definition: *A direct, human-induced reduction in the forest carbon stocks from the natural carbon carrying capacity of natural forest ecosystems which persists for a specified performance period and does not qualify as deforestation.*

Physical mitigation potential

Carbon losses due to degradation reach at least a similar magnitude to those from deforestation in some regions, including Southeast Asia (Asner *et al.* 2005; Griscom *et al.* 2009). The magnitude of emissions from degradation is estimated at 30 percent of total emissions from the forest sector globally (TNC 2009).

Therefore, changes to tropical forest management practices that reduce degradation could contribute significantly to climate change mitigation. Estimates of carbon emissions from the degradation of forests (expressed as a percentage of the emissions from deforestation) range from 5 percent in the world's humid tropics (Achard *et al.* 2004) to 25-42 percent for tropical Asia (see Houghton 2005). In some cases, the loss of carbon from forest degradation was calculated to be larger than that from deforestation. Indeed, Houghton (2005) argues that the decline in average forest biomass in Asia (a 35 percent decline in the 1990s) was likely the result of degradation,

primarily from logging. However, he also cautions that the data remain unreliable due to the difficulty of identifying and measuring changes in biomass.

One major cause of degradation is logging, and this often opens the way to other forms of degradation such as fire, grazing and fuelwood collection (Griscom *et al.* 2009). Logging converts primary forests of high biomass to secondary forests of lower biomass. Putz *et al.* (2008) show that changes to conventional logging practices in tropical production forests could achieve emissions reductions equivalent to at least 10 percent of those that may be achieved by curbing tropical deforestation. Globally, they find that 0.16 GtC could be retained per year through altered management of production forests, such as improvement of rotation and infrastructure planning, and enhanced forest harvesting operator training in order to reduce the collateral damage that results from selective logging. The adoption of certification of forest management and forest products may have positive impacts, particularly given that 99 percent of production forests in the tropics is not certified (Griscom *et al.* 2009). Certification would mean reducing the impacts of logging, the area of logging and logging rates. Reduced Impact Logging (RIL) involves techniques such as directional felling and cutting of vines from trees; it is designed to minimize damage to surrounding areas. RIL methods may directly decrease carbon emissions per unit of wood extracted by 30 percent to 50 percent (TNC 2009).

Other major causes of degradation are fire and fuelwood collection, although they have been difficult to quantify (Griscom *et al.* 2009). Fuelwood harvesting accounts for 40 percent of global wood removals from forests (FAO 2006). Fires also have the potential to release an enormous volume of emissions, although it is difficult to distinguish between fires that cause deforestation, versus fires that cause degradation (see Griscom *et al.* 2009). Reducing fuelwood use may be an excellent strategy for decreasing forest degradation, but fuelwood can also be used as a substitute for fossil fuels, in which case it can be classified as an emissions reduction strategy. These trade-offs should be recognized in the development of mitigation strategies.

Economic mitigation potential

Reduced forest degradation helps to ensure that forest productivity can be sustained in the long term. Thus benefit flows from forests will be maintained, with support to both the logging industry and local livelihoods. This appears to be a win-win situation, however short-term costs may accrue for those who presently benefit from degradation (e.g. those who claim degraded land and gradually convert it into permanent farms for crops and livestock or those who apply unsustainable forest-harvesting practices).

Perhaps the most significant economic gains to be made in reducing degradation come from fire suppression. Studies have revealed that undesired fires cause significant losses for farmers, such as loss of cattle forage and fencing as well as losses of timber, wildlife, buildings and livestock; they also compromise human health, income-generation opportunities and infrastructure. Billions of dollars could therefore be saved in avoiding the collateral damage of fires.

Risks and co-benefits

Local livelihoods could be strengthened and improved through community- or household-level participation in forest management to reduce degradation. Such community-based or decentralized approaches should therefore be a key strategy in reducing degradation (Chhatre and Agrawal 2009). In addition, reduced degradation is likely to provide benefits such as improved soil and water quality, and availability of NWFPs that enhance local livelihoods. Other potential co-benefits of community-based forestry are strengthened local institutions and improved governance of forest resources, ultimately contributing to poverty alleviation (Chhatre and Agrawal 2009).

In the case of logging, if adoption of RIL or certification is pursued as a strategy to reduce degradation, a number of social and governance benefits may emerge (Griscom *et al.* 2009). For example, improved forest management for certification could likely lead to local conflict resolution, clarification and strengthening of land tenure, introduction of measures to prevent unauthorized activities and fires, a long-term commitment to sustainable forest management and greater market access along with higher product prices. One risk associated with the certification process, apart from its high transaction costs, is that local capacity may not exist in developing countries to effectively implement the new management systems. Unless international support is

provided in such cases, the potential role of certification in encouraging sustainable forest management could be undermined.

Distributional impacts

Most beneficiaries of current forest management practices that lead to degradation (e.g. communities, logging companies) will incur additional costs from efforts to reduce degradation⁶. However, they also stand to gain significant socio-economic and environmental benefits from improved forest management. As described in section 3.1, carbon-based payments to communities for changed forest management practices may provide an additional income source (see Karky and Skutsch 2010). Such a system is particularly suited to countries such as Nepal, where local communities already enjoy secure forest use and management rights.

Substitution of harvested wood products for other materials and of wood fuels for fossil fuels

Biomass energy can be used to replace fossil fuels, thereby reducing GHG emissions from fossil fuel. The avoided emissions of a biomass energy system are equal to the fossil fuels replaced minus the emissions resulting from the biomass energy system (IPCC 2000). Under such a system, fuelwood production must be carefully managed so that forests maintain a constant carbon stock. There are two main approaches to fuelwood production: sustainable harvesting of fuelwood from natural forests and commercial harvesting from intensively managed plantations. Both approaches may play a role in increasing substitution of fossil fuels with renewable fuelwood.

In some natural forests, sustainable fuelwood production can be achieved by harvesting certain tree species in a way that allows regrowth from the stumps, so that the next round of biomass is produced (see Liu *et al.* 2004). Through this coppicing practice, forests can be used continuously for fuelwood production. The management of woodlands and forests for fuelwood and charcoal production can be a practical and important emissions reductions strategy, greatly expanding potential for carbon mitigation from forestry (Sathaye *et al.* 2005). The advantages of this strategy may be greater in arid or marginal lands, where food production and plantation potential are low.

Commercial forest plantations for the production of wood and wood fibre-based commodities play a key role in forestry (Hunter and Calhoun 1996). This approach is best centred on highly productive lands with relatively low value or potential value as habitat for rare or sensitive species due to their small tract size and/or history of past land use.

In addition to wood fuel, other kinds of biofuels are also being utilized to replace fossil fuels. These include palm oil (for biodiesel), sugar cane (for ethanol production), *Jatropha curcas* (biodiesel) and other crops including canola (rapeseed) and sugar beet. Emission reduction outcomes from burning biofuels are mixed, depending upon the yield of fuel as a percentage of raw product, their efficiency as fuels and the conditions under which they are produced and delivered from producer to consumer. For example, clearing land to make way for oil-palm plantations, especially on peat soils, can result in huge emissions that far exceed any gains from consumption of the resulting biofuel. Alternatively, biofuels that make use of waste biomass grown on degraded lands offer immediate, sustainable emissions reductions (Fargione *et al.* 2008).

Finally, using wood products to replace other materials in furniture and construction may enable carbon sequestration, although it is unclear whether this will achieve emissions reductions. Other non-wood products like bamboo and rattan also sequester carbon and may offer greater potential (FAO 2009a).

Physical mitigation potential

The potential for emissions reductions through fuel substitution depends upon the efficiency of existing fossil fuel-powered plants. In the case of Australia, Polglase and Stein (2001) estimated that burning coal to produce electricity releases eight times more CO₂ into the atmosphere than using wood residues from forests. However, studies of the situation in developing countries, where

⁶ Holmes *et al.* (2002) have shown that the application of reduced impact logging practices can generate higher financial revenues than conventional operations.

coal-fired power stations are less efficient, suggest that the net emissions of CO₂ may be up to 30 times higher from a coal-fired power station than from biomass fuels (ibid). Thus, the use of biomass fuels (especially low grade waste biomass) could offer significant emission reductions in developing countries.

The mitigation potential of harvested wood products as substitutes for non-renewable, energy-rich products is difficult to estimate. One multi-country study suggests that up to 10 percent of emissions from fossil fuels and cement production could be sequestered annually (Hashimoto *et al.* 2002). However, more recent studies have examined the entire life cycle of wood products, and have calculated the fossil fuels consumed during timber harvesting, transport, processing and construction (see Ingerson 2010). The conclusion from Ingerson's work is that increased use of wood products will not achieve any significant emission reductions (and may even cause net emissions). Further research is required and mitigation potential will depend upon country contexts.

Economic mitigation potential

As the cost of fossil fuels rises, biomass and wood fuels are likely to become more competitive and profitable. In Brazil, this is already the case, where ethanol production is an economically viable substitute for petrol. However, the cost of biofuels is not strictly an economic cost. Rather, it has implications for food production and food prices, which negatively affect the poor (see below). Commitments made by governments in the Asia-Pacific region, notably India and China, to obtain a proportion of domestic energy requirements from biofuels, are already helping to stimulate the planting of energy crops in other countries such as Viet Nam and Indonesia. The potential of such ventures to meet regional energy needs as well as to sustain economic viability at the local level is unproven. On the other hand, potential profits from substituting wood products for other materials are unclear. Sustainable timber harvesting for wood products can be made profitable, but whether it can achieve net carbon sequestration at sufficient scale is context-dependent and requires further research.

Risks and co-benefits

Biofuel crops are controversial because they can occupy land that would otherwise be used for food production. This is an issue that affects decision-making and commodity prices at local, regional and global levels. For example, the 'food crisis' in 2007 (when the global food price index rose 40 percent) was shown to be associated with increased European Union and United States of America demand for biofuels, which may have displaced food production (see O'Sullivan 2008). This assertion is still controversial, but it may be necessary for countries or regions to consider land-use caps to limit biofuel production.

The case of using natural forests to produce fuelwood is different, because many forested lands are not suitable for agriculture and provide multiple additional benefits that timber or biofuel plantations do not (e.g. provision of NWFPs for local livelihoods, watershed services, biodiversity conservation services). Therefore, wood harvested selectively from stands of natural forest would be one approach to using biomass fuels (Liu *et al.* 2004). Nevertheless, land-use caps in the case of production forestry for fuelwood may also need to be considered given food production pressures. This would place a limit on the annual magnitude of emissions avoided from fossil fuel combustion (Sathaye *et al.* 2005).

One risk of promoting biomass fuels and timber products to substitute for other materials is that plantations may become favoured over the preservation of natural forest. If forests are cleared to make way for plantations, then this would have a negative impact upon emissions reduction goals, because carbon stocks in natural forests are much higher than in plantations (Swallow *et al.* 2007). Another risk of promoting wood fuels is that overharvesting will lead to increased forest degradation and emissions. Thus, strong control of harvesting should be an essential component of policy to promote fuelwood use.

Distributional impacts

As stated above, local communities and indigenous peoples could significantly benefit from efforts to manage natural forest for fuelwood production, especially through community forestry arrangements.

Improvement of fuelwood efficiency and supply

Proper management of the supply and demand for fuelwood can help to reduce emissions (TNC 2009; Griscom *et al.* 2009; Hofstad *et al.* 2009). For example, reduced harvesting of fuelwood will only lead to emissions reductions if fuelwood is not replaced by fossil fuels (Houghton *et al.* 1999). Further research is needed to make explicit links between fuelwood management and reduced degradation in forests. This will help to determine the most suitable policy framework for this type of mitigation strategy (Griscom *et al.* 2009).

Demand side management options primarily involve increasing the efficiency of fuelwood burning for cooking and heating. This may be achieved through replacement of existing woodstoves with more energy-efficient ones, or with those that burn other biomass-derived fuels such as methane from agricultural waste. Supply-side options entail changes in land and forest management and may include afforestation and/or reforestation (planting tree species that are most appropriate for burning on cleared or degraded land); agroforestry or new systems of planting to include trees and shrubs with crops and pasture; and the planting of windbreaks and hedgerows, which serve to protect crops, improve productivity and also provide fuelwood (TNC 2009).

Physical mitigation potential

The International Energy Agency (IEA) estimates that global fuelwood use contributes approximately 2 percent of total global emissions (IEA 2006). This is roughly equivalent to the emissions from the transport sector in the European Union (see Griscom *et al.* 2009). In addition, biomass combustion produces the bulk of carbonaceous aerosols, which may exacerbate the effects of climate change (see Hofstad *et al.* 2009). In this light, and given that people's dependence upon fuelwood is unlikely to decrease significantly in the near future, efforts to increase the efficiency of fuelwood burning are essential measures in climate change mitigation. This has been recognized only recently, and methodologies are now being developed through the CDM and the Voluntary Carbon Standard for calculating carbon credits from the introduction of efficient cook stoves or stoves that use biogas (*ibid.*).

The potential contribution of biogas is also notable. For example, the Netherlands Development Organization (SNV) supports biogas projects globally and asserts that market-based uptake of domestic biogas systems is on the rise, especially in Africa and Asia (SNV 2009). The most established biogas project (and registered as a CDM project) is in Nepal, where 200 000 units have been installed. Each unit reduces emissions by 7.00 tCO₂eq/year/plant (CDM 2005).

Economic mitigation potential

At the household level, increased stove efficiency can reduce labour time for fuelwood collection and money spent on wood and charcoal. In Cambodia, this produced total household savings of US\$2.5 million on charcoal purchases between 2003 and 2006 (GERES 2006). The Cambodia stove project also created 265 additional jobs. In this light, projects supporting fuel-efficient stoves are economically viable and do not require external funding (except where increasing access for the poor is a primary objective). From a supply-side perspective, there are significant livelihood benefits associated with village plantations and community forestry that have been discussed already.

Risks and co-benefits

The major co-benefit of fuel-efficient stoves is a reduction of health risks associated with soot or black carbon emissions in households. Improvement of urban air quality is also a benefit, especially in countries like India (Venkataraman *et al.* 2005). Other benefits include improved access to energy and reduced time and money spent (mainly by women) on gathering and purchasing fuelwood (GERES 2006).

Benefits from the management of fuelwood supply are usually associated with the introduction of community-based forestry, which can secure new revenue and resources for communities. The devolution of forest management to local communities has been proven to be effective and it provides communities with a basis to further strengthen local institutions, organizational capacity and control over natural resources (Griscom *et al.* 2009). Another benefit associated with

increasing local fuelwood production, especially through strategies like agroforestry, is the development of a more diverse, productive and sustainable land-use system (TNC 2009).

Distributional impacts

Households that burn wood and biomass fuels would benefit most from interventions to improve fuelwood supply and burning efficiency. In India, where 80 percent of households rely on biomass and wood fuel, the impacts of increasing stove efficiency and fuelwood supply are potentially great (Venkataraman *et al.* 2005). However, it is the poor who mostly rely on fuelwood for their energy source (Hofstad *et al.* 2009). This means that special funding and targeted programmes (e.g. micro-finance) will be required to ensure that the poor can acquire and benefit from new stoves, and/or biogas plants (SNV 2009).

Possible negative consequences to forests from mitigation efforts outside the forest sector

The emphasis on replacing fossil fuels with biofuels may have the most obvious negative consequence on forests. Of particular interest is the rapid expansion of oil-palm plantations, which compete with natural forests.

The commitment of various governments to reduce their GHG emissions quickly has fuelled the fast growing demand for oil-palm biodiesel. The European Union mandates 10 percent of its fuel use to be biodiesel by 2020 (although this is now under review). China and India target 15 and 20 percent biodiesel use in their economies, respectively, by 2012.

The conversion of natural forests into biomass plantations has many potential implications ranging from biodiversity loss (Robertson and van Schaik 2001; Aratrakorn *et al.* 2006; Chey 2006; Peh *et al.* 2006), to impacts on local communities (Sandker *et al.* 2007). In addition, conversion of primary forests to oil-palm plantations results in net carbon emissions (Reinjders and Huijbregts 2008).

Rising biodiesel demand from other countries has fuelled the conversion of natural forests and peatlands into oil-palm plantations in Indonesia and Malaysia. The process releases vast amounts of carbon to the atmosphere, further accelerating climate change. In May 2010, in explicit acknowledgement of this risk, the Government of Indonesia declared a two-year moratorium on forest and peatland conversion as part of an agreement with the Government of Norway for a US\$1 billion fund for preserving Indonesian forests.

Another mitigation/adaptation measure that poses negative impacts on forests is the construction of large dams, mostly for irrigation and hydropower production. Currently, China ranks first while India is third among the world's large dam constructors. China opened its Three Gorges Dam along the Yangtze River in 2006, considered the world's largest. It inundated 632 square kilometres of agricultural, forest and grassland ecosystems considered to be areas of high biodiversity (Wu *et al.* 2004) in exchange for a steady and cleaner source of electricity. China is also planning to construct the world's highest dam in Tibet, upstream of the Brahmaputra River, causing considerable fears of water scarcity among Indian and Bangladesh officials.

4. Adaptation-mitigation synergies and trade-offs

Adaptation and mitigation have historically been treated as conceptually separate climate change strategies. Recently, synergies between the two have begun to be explored, especially in the domain of Land Use, Land Use Change and Forestry (LULUCF).

Adaptation and mitigation in the context of climate change are conceptually distinct, as underlined by the definitions assigned by the IPCC. Adaptation is defined as “adjustment in natural or human systems in response to natural or expected climatic stimuli, or the efforts which moderate harm or exploit beneficial opportunities”. Mitigation is defined as “any anthropogenic intervention to reduce sources or enhance the sinks of GHGs”. This has resulted in mitigation and adaptation being distinguished in spatial, temporal and socio-economic terms. Mitigation has been associated with globally-coordinated efforts with a focus on long-term implications, the burden of which lies upon developed nations. Adaptation, on the other hand, concerns the immediate need for vulnerability reduction at the local level, the burden of which will mainly fall on developing and least developed nations which are least able to cope (Ayers and Huq 2009).

Mitigation’s dominance of the climate change agenda has resulted in a response framework that is largely scientific, technical and environmental. International discussions often shy away from defining or incorporating adaptation, along with its implications for sustainable development. Little attention is given to vulnerability as a function of political, economic and social factors. Instead, adaptation is generally considered as the response to adverse impacts resulting simply from exposure to environmental pressures (Pielke *et al.* 2007; Ayers and Huq 2009). Perspectives have recently shifted and adaptation has gradually been brought onto an equal footing with mitigation, as a result of the general acceptance that severe adverse impacts will be unavoidable. This recognition was first translated into policy at the 2001 COP-7 meeting in Marrakech with the creation of three new funds for adaptation. In 2007, during COP-13 in Bali, adaptation was elevated to equal status with three other core building blocks of climate change policy: mitigation, technology transfer and financing.

Particularly in developing countries within the Asia-Pacific region, synergies between adaptation and mitigation measures have recently been explored, aiming to identify win-win options for climate change policy and seeking opportunities to explicitly include adaptation objectives in mitigation projects (Klein *et al.* 2007; Wilbanks *et al.* 2007). Venema and Rehman (2007) argue that synergy between mitigation and adaptation is intrinsic to the ecosystem-oriented approach articulated by the World Summit on Sustainable Development.

Synergies are most clearly evident in the LULUCF sector. Forestry, in particular, is relevant to climate change adaptation strategies, with its contribution to biodiversity conservation and livelihood resilience, and to mitigation through enhanced CO₂ sequestration (Ravindranath 2007). Agroforestry offers the highest potential for carbon sequestration among land uses identified by the IPCC, owing to the large area currently devoted or potentially available for such use. The conversion of row crops or pasture into agroforestry systems can greatly enhance stored carbon above and below ground as well as increase farmers’ economic benefit (Verchot *et al.* 2007).

Sections 2 and 3 both contain numerous references to community-based approaches to forest management. It is therefore no surprise to learn that some of the clearest practical linkages between adaptation and mitigation strategies have emerged in the field of community forestry. For example, since 2008 FAO has been supporting Nepal’s National Agricultural Research Council and other government bodies in a climate risk management project. A key element of the project’s strategy is to explore synergy between the economic resilience and adaptive capacity that CFUGs confer on their members and their potential to contribute successfully to forest-based mitigation strategies under REDD (FAO 2009f). Many others have noted this synergy in South Asia (Karky 2009; Ravindranath 2007) and a common understanding of community forestry both as an element of REDD methodology and a local-level adaptation strategy is taking root in the region.

Another adaptation policy that improves carbon sequestration is the protection and improved management of ecosystems that serve as buffers against extreme weather events, particularly coastal habitats such as wetlands and mangrove forests (World Bank 2009).

REDD is a clear example of a strategy to address climate change which combines mitigation and adaptation elements. So, although synergies do indeed exist with win-win outcomes, even these require optimal mixes of adaptation and mitigation elements. Trade-offs exist between these two sets of objectives based on a number of complex factors, such as the exhaustibility of forest resources and the conflicting needs and interests of stakeholders (Dang *et al.* 2003). There are also a number of instances of conflicting approaches to adaptation and mitigation. Many adaptation options, such as improved flood defences, are known to increase energy use, hence interfering with GHG reduction efforts. Relocation of vulnerable communities, for example from low-lying coastal zones in the Mekong Delta, to currently forested areas further inland, is a central feature of Viet Nam's National Target Plan for Climate Change Adaptation. These plans, if followed through, will conflict directly with the country's strategy to implement REDD nationwide.

The IPCC concludes that, on the global scale, there is insufficient information to ascertain whether investment in adaptation could, in effect, buy the time required for mitigation efforts to deliver results, nor what level of investment would be required to achieve this (Klein *et al.* 2007). However, Dang *et al.* (2003) argue that it is possible to set a national climate policy that takes into account the synergies and trade-offs between adaptation and mitigation. A proper national framework for integrating adaptation and mitigation strategies for ecosystems, resources and sectors should be the first priority for climate change policy-makers.

5. Climate change policy and strategy issues

Forestry coverage in national and regional climate change strategies

Countries across the region are at various stages of developing their national climate change strategies. The extent and nature of forest coverage varies considerably and this affects the strategies pursued by each country. Some have been very proactive in engaging with climate change issues and incorporating mitigation and adaptation measures within national policies and legislation. Examples include: Bangladesh with designated climate change focal points in all of its key ministries, Cambodia's early establishment of pilot REDD projects, China's large-scale afforestation programmes, Indonesia's early vision of REDD as the future driver of national forest policy and the Philippines' implementation of measures to reduce GHG emissions despite being under no obligation to do so. Some countries such as Brunei Darussalam and Singapore have much less forested land that is not already under some form of protection and thus lack incentives for significant involvement. Others, such as Afghanistan and Timor-Leste, recently emerging from conflict, simply lack the resources or are preoccupied with other pressing priorities that divert attention from climate change activities.

The Asia-Pacific region includes many of the countries most vulnerable to the negative effects of climate change, juxtaposed against those with the potential to contribute significantly to global mitigation efforts. This dichotomy is evident even within individual countries, such as Australia, China, India and Indonesia.

Almost every eligible country in the region has completed a National Adaptation Program of Action (NAPA). Coastal ecosystems (including mangrove forests) and agriculture are common priority areas. Throughout the diverse region, there is growing recognition that both adaptation and mitigation can be achieved through participatory approaches to sustainable forest management.

For many countries, the prospect of an international REDD mechanism and the funding currently available for REDD readiness, has resulted in a plethora of projects to assess mitigation options and prepare countries for effective and equitable REDD implementation. Most countries support a combination of national and subnational approaches, and see the growing number of studies and pilot projects as important inputs in the development of national REDD strategies.⁷

Country contexts: Integration of climate change issues into forest policy, legal and institutional frameworks, challenges and needs

This section summarizes national efforts to integrate climate change issues within domestic forest policies, laws and institutions, along with the key challenges for countries to realize the potential role of forests in addressing climate change. For more details on specific policy measures, laws and institutions relevant to climate change mitigation and adaptation, see Annex 2.

Afghanistan

Due to the severe internal disturbances in the country, little attention has been paid to date to the impacts of climate change in Afghanistan. It is not yet clear what role forestry will play in climate change mitigation. The Ministry of Agriculture, Irrigation and Livestock is tasked with climate change issues. The National Environment Protection Agency, established in 2005, has begun work on this topic but further capacity building is required for implementing agencies before they can undertake climate change-related activities.

⁷ Annex 1 provides a country-wise overview of national and regional climate change strategies, NAPAs and overviews of projects, programmes and initiatives related to forests and climate change.

Challenges, needs and options

Uncontrolled logging and overgrazing, on account of failures to enforce both formal national laws and customary regulations, have resulted in severe environmental degradation across Afghanistan and has made fuelwood unavailable to many households. Forest-based climate change mitigation activities offer significant opportunities for this war-torn country to supplement livelihoods of the poorest sectors by enhancing access to basic energy for food and household purposes. Tree husbandry is one activity to which none of the warring factions have any objections, and women can generate income from nursery-related activities as well as fuelwood collection for sale at the village-level. Short-rotation plantations for energy purposes could allow for the generation of carbon credits from carbon sequestration and fossil energy substitution while at the same time increasing incomes from timber, fuelwood and NWFPs.

There is an urgent need to create effective village-level institutions with the capacity to manage tree-planting activities, local-level natural resource management and benefit distribution. The expertise accumulated by Bangladesh, India and Nepal in creating and empowering village-level institutions would be of much use if transferred to the Afghan context. It would also be a valuable example of regional collaboration.

Australia

Australia's National Forest Policy Statement commits Australia's entire 149 million hectares of forest estate to sustainable management, whether public or private, of natural or planted forests. Following the spirit of the Policy Statement, a framework for scientifically-based plantation management was prepared in 1996 and has been subscribed to by all subsequent Australian governments. Australia also offers a range of domestic education and training opportunities for all aspects of forest management as well as substantial educational opportunities and support for other countries in the region. Pursuing the national goal of strengthening controls against large-scale clearing of forest, some states (e.g. Queensland and New South Wales) have enacted legislation that aims to encourage revegetation and rehabilitation of appropriate native vegetation.⁸

Australia prepared its National Climate Change Adaptation Framework in April 2007 at the request of the Council of Australian Governments. It serves to guide decision-makers in government, business and communities to understand and incorporate climate change adaptation into policy and operational decisions. In the medium-term goal of five to seven years, the framework aims to build Australia's capacity to deal with climate change impacts and reduce vulnerability in key sectors like commercial forestry. This has given birth to the National Climate Change and Commercial Forestry Action Plan (2009-2012).

Challenges, needs and options

The Australian Government employs a certification scheme for timber and forest products, which obliges forest managers to demonstrate the sustainability of their production strategies. This is also used for restricting the import of illegal timber and other forest products into Australia. Australia is likewise promoting certification elsewhere in the Asia-Pacific region. Subnational governments are experimenting with various arrangements to encourage payment and investment in environmental goods and services. South Australia has introduced a framework for the rights to derive benefits from sequestered carbon in forests, while Western Australia has produced a series of tree-farming development plans for delivering environmental services.

Australia's Department of Climate Change is playing an active role in promoting REDD in developing countries through its International Forest Carbon Initiative, an A\$273 million fund which aims to build capacity and create momentum for successful implementation of REDD, particularly in Indonesia and Papua New Guinea. This is in addition to Australia's contribution to the World Bank's Forest Carbon Partnership Facility. In 2008-2009, the Initiative included the Asia-Pacific Forestry Skills and Capacity Building Program to assist Asia-Pacific countries increase forest management expertise and improve forest carbon sequestration performance. Another A\$5 million is set aside by the Australian Government for the forest industries to adapt to

⁸ Specific policies include the Queensland Vegetation Management Act (1999) and the New South Wales Native Vegetation Act (2003).

the effects of climate change and to build industrial capacity in order to overcome the negative effects of climate change on the forest-based market mechanisms in the country.⁹

Bangladesh

No formal changes in forestry law have taken place since the enactment of the National Forest Policy of 1994. However policy-level changes are being sought through the overarching Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009, not only in the forestry sector but in all concerned sectors. Existing laws may invite amendments only if they inhibit the implementation of this Plan.

As an indication of the importance placed on climate change, the highest level body, the National Environment Committee, responsible for providing strategic guidance on matters related to climate change, is headed by the Prime Minister. Every ministry has a designated climate change focal point. The Ministry of Environment serves as the primary implementing agency for the BCCSAP. A national climate change fund has been set up with voluntary contributions from the country's development partners subject to the condition that contributions to this fund would be additional to regular funding.

Challenges, needs and options

The BCCSAP has identified agricultural and settlement expansion, clear-felling for plantations, unregulated and unscientific logging practices, conflicting policies and revenue-driven forestry practices as key drivers for loss of forests over the past few decades.

The country is committed to developing its forest resources for climate change mitigation and is exploring all avenues including REDD (MOEF 2008). While Bangladesh is considered to have the core institutional competence required for operationalizing climate change-related forestry activities, its capacities for monitoring, reporting and verification of REDD will require further development.

Bhutan

While Bhutan's National Forest Policy of 1974 has seen few changes in subsequent decades, a new draft has been developed and currently awaits approval by Cabinet.

In Bhutan, the National Environment Commission (NEC) is the highest institution responsible for dealing with climate change issues in the country. The responsible nodal ministry is the Ministry of Agriculture and Forests under which the Department of Forests deals with specific climate change issues related to forests. The National Reforestation Strategy of 2008 seeks to contribute to climate change mitigation by rehabilitating degraded watersheds, promoting social and community forestry, and maintaining a minimum of 60 percent of land under forest cover in perpetuity (as enjoined in the National Forest Policy). Bhutan is also examining options associated with engaging in PES initiatives in the context of climate change.

Challenges, needs and options

The NEC recognizes the uncertainty of Bhutan's ability to gain from an international REDD mechanism and, in the case that the country can benefit, the urgent need for a national forest inventory for verification of forest stocks and sequestration and storage capacities for GHGs. Particularly, concerns have been expressed that countries such as Bhutan that have a history of sustainable forest management will not benefit from REDD as much as those countries that have a poorer record of retention of high quality forest cover. The slow trend towards forest tenure reforms in Bhutan requires acceleration. Plantations established near communities could be more productively managed if linked explicitly to community forest management groups and an incentive scheme based on carbon sequestration.

Brunei Darussalam

Currently, Brunei Darussalam lacks a National Climate Change Strategy and climate change has yet to be integrated into its main forest policy, the Forest Act (revised in 2003). However, the

⁹www.daff.gov.au/forestry/national/forest_industries_climate_change_research_fund

country's forest management strategy employs various projects, activities and initiatives that accomplish climate change mitigation and adaptation goals (UN 2002).

Brunei's Ninth National Development Plan emphasizes conservation of forests. In the past, National Development Plans have funded efforts to restore degraded forest lands – less for the sake of improving carbon stocks than to adhere to the national slogan “Keep Brunei Always Green”. There is little incentive to develop PES schemes, as 46 percent of Brunei's forests have already been designated protection forests in recognition of the environmental services they provide.

Challenges, needs and options

Fire management is a crucial issue for Brunei's forests, as forest fires are a threat to the tropical forests that cover 55 percent of the country, and are a major source of atmospheric pollution. The country currently collaborates with Malaysia on combating forest fires.

Although Brunei Darussalam has banned export of timber logged from its forests, its forest policies encourage consumption of imported rather than domestic timber. This demand may be placing pressure on forest resources in other countries. As a Non-Annex I country, Brunei is not committed to reduce its GHG emissions, and there is little indication that Brunei is considering climate change mitigation and adaptation in its forestry policies. Indeed, Brunei only ratified the Kyoto Protocol in August 2009, a few months before CoP15.

Cambodia

Cambodia's Rectangular Strategy for Growth, Employment Equity and Efficiency Phase II (2008) includes climate change as a challenge to be addressed as part of the country's broader forestry reform agenda (RGC 2008). Adapting to climate change and mitigating its effects on forest-based livelihoods is a strategic objective of the recently drafted National Forest Program. Carbon-based financing mechanisms including the CDM and REDD are being explored as sustainable sources of forestry sector financing (FA 2009a).

The Forestry Administration under the Ministry of Agriculture, Forestry and Fisheries is leading REDD programme development and implementation. A Forestry, Climate Change and Innovative Financing Group, under the Technical Working Group on Forestry and the Environment, was created in September 2008 to support the Forestry Administrations's work on REDD and the CDM. A process to develop a national REDD Readiness Roadmap, building on Cambodia's Forest Carbon Partnership Facility Readiness Plan Idea Note (FCPF R-PIN) and informed by REDD pilots and related projects, is underway. Two government-approved REDD pilots, in Oddar Meanchay Province in the northwest and Mondulkiri Province in the southeast, are receiving technical support from PACT Cambodia and the Wildlife Conservation Society (WCS) respectively. The Forestry Administration has been authorized as the sole legal seller of carbon credits from forestry projects in Cambodia, giving much-needed clarity to investors.

Cambodia's UN-REDD partner country status provides it with access to networking and knowledge sharing opportunities through the UN-REDD Programme's online community of practice.¹⁰

Challenges, needs and options

Integration of REDD into Cambodia's national forest programme is based on the assumption that carbon credit systems will be viable and that REDD revenues will provide financial incentives to local communities and government agencies to implement forest conservation policies (FA 2009b; FA 2008). These incentives are currently clearly lacking, particularly in comparison with the history of Economic Land Concessions provided to domestic and foreign investors and developers. Prospects for long-term REDD financing at the global level, how funds might be distributed and associated impacts are still unclear. Costs of REDD implementation are also largely unknown.

¹⁰ The UN-REDD Programme's partner countries have access to many benefits of the Programme, such as networking, participation in regional workshops and knowledge sharing, as well as observer status to the UN-REDD Programme Policy Board. As the Programme mobilizes more resources, partner countries will be chosen to become pilot countries based on criteria that are currently being developed.

Given these uncertainties, there is a danger that strong government support for REDD and a proliferation of donor-funded projects could unduly raise expectations of rewards in the near future, leading to potential disillusionment.¹¹

Increased discussion, research and accessible information about the costs, risks and potential benefits of REDD for different stakeholders are needed to help reduce the risk of creating unrealistic expectations. This would also be an important input into the development of a comprehensive REDD programme that includes strategies to address the issue of upfront costs for prospective beneficiaries. Continued piloting of programmes to increase potential earnings from community forestry, such as community-based production forestry as piloted by the WCS in Mondulkiri, could also increase prospects of successful REDD implementation indirectly. Frameworks that enable access to a package of financial incentives to manage forests sustainably can make community forestry more appealing and effective as a poverty reduction strategy, while also reducing the risk of overdependence on income from carbon credit sales.

Limited institutional capacity and financial resources have delayed demarcation of forest areas and decentralization of management to local communities as introduced under the 2002 Forestry Law (FA 2008). This has left large areas of forest open to uncontrolled encroachment and conversion. Monitoring of emissions reductions and distribution of associated benefits will be very difficult if these institutional weaknesses are not addressed.

China

China's National Climate Change Programme (CNCCP) was introduced in 2007 with an emphasis on a nationwide tree-planting and afforestation campaign, as well as the introduction of new efforts to enhance restoration and protection. In early 2010, the government announced to the UNFCCC that it aims to increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic metres by 2020 from the 2005 levels, as a core element of its climate change strategy.

Under its Collective Forest Reform policy, China has introduced a series of reforms aimed at privatization and allocation of forest-use rights. These will fundamentally influence China's new initiatives in afforestation and forest conservation under the National Climate Change Programme (NCCP). Key existing forestry programmes to combat climate change under the NCCP include, among others, the Natural Forest Protection Program, the Conversion of Cropland to Forest Program and the Wildlife Conservation & Nature Reserve Development Program. In 2009, China finalized a Forestry Action Plan (FAP) to deal with climate change mitigation, though implementation has yet to begin. The FAP provides a framework for forestry activities to contribute to climate change mitigation as well as to provide strong political and technical support for further development of carbon sequestration forestry.

China was the first, and for four years the only, host of an afforestation/reforestation project under the CDM, in the Pearl River Watershed in Guangxi Province. In 2009, another CDM project was approved in Sichuan Province claiming to be the first forest carbon project to deliver community and biodiversity benefits simultaneously.¹²

Challenges, needs and options

Schemes for tree planting and protection of collective forests have been criticized because the compensatory payments due to farmers have not been fully delivered. In the future, tensions are likely to emerge related to top-down approaches to land-use allocation versus approaches that are more consistent with private property regimes. Significant efforts will be required to ensure participation of local stakeholders (i.e. farmers and landowners) in future land-use and forestry reforms.

International projects to strengthen institutions, policy and law for forest governance are underway in China (e.g. the China Forest Tenure project supported by FAO and the European Union). Implementation of reforms to date has been limited by the capacity of local government

¹¹ A lack of clarity about how and when anticipated revenues will be distributed to community members has been reported as a source of conflict among stakeholders involved in the REDD pilot project being implemented in Oddar Meanchey Province (Hou, 2010)

¹² See www.chinacsr.com/en/2009/11/27/6669-sichuan-forest-carbon-sink-project-successfully-registered-at-unfccc/ Sichuan Forest Carbon Sink Project Successfully Registered at UNFCCC, November 2009.

bodies and by inconsistencies among various government strategies.¹³ Furthermore, there is currently no government consensus regarding strategy and processes for forest tenure development.

Early signs of an emissions trading policy and associated institutions are emerging. In 2008, a formal emissions trading scheme for trade in sulphur dioxide emissions permits was launched, in collaboration with the Chicago Climate Exchange. The Tianjin city government has also initiated the sale of carbon credits that result from energy efficiency improvement projects through the voluntary market.

Democratic People's Republic of Korea (DPRK)

According to the DPRK 2003 State of the Environment report, the government has taken action to restore forests damaged by floods, droughts and illegal logging and sustainably manage them by adopting a number of Cabinet decisions and laws. The government has developed a Ten-year Plan for Afforestation/Reforestation to rehabilitate 2 million hectares of degraded forests. As a result, the Korean Central News Agency of the DPRK reports that over 130 000 hectares of forest have been created and hundreds of kilometres of rivers and streams improved every year.

Challenges, needs and options

Deforestation is a major issue. In 1990, DPRK had 9.02 million hectares of forests, or 74.2 percent of the land area. Its initial communication to the UNFCCC assumed that 10 000 hectares of forests are cleared annually for agricultural use, far greater than the annual reforestation rate. The document also noted that the quality of forest is low in terms of canopy cover and tree health. It is noteworthy that the DPRK receives a significant amount of technical advice and support from the Republic of Korea in the fields of both climate change and forestry, without which the DPRK would have little exposure to international policy discussions.

Fiji

The current forest management framework is provided by Fiji's National Forest Inventory, Forest Policy Statement and National Forest Program. The trend of these policies is away from timber production and towards conservation and multipurpose sustainable forest management. Approximately 330 000 hectares of forests are under a form of protection-oriented management.

Fiji is committed to implementing adaptation measures on the effects of climate change at the community level. It has applied for project funding for the establishment of a Climate Change Unit within the Department of Environment. The Unit will be charged with coordinating a multisectoral team and climate change adaptation projects, as well as providing research and technical advice to the Government of Fiji.

India

Over the last decade an institutional framework with designated agencies dealing with well-defined areas of climate change has evolved in India. The highest body, the National Council of Climate Change is headed by the Prime Minister and the coordinating ministry is the Ministry of Environment and Forests (MoEF). The MoEF has assigned specific studies to core institutions to achieve three core objectives and has helped set up the Indian Network of Climate Change Assessment (INCCA) that links 127 research institutes across the country (MoEF 2010a). The first objective is to develop a comprehensive knowledge base on issues related to climate change for decision-making. Secondly, the study will enable the integration of the concerns of key stakeholders in the preparation of an action plan on climate change. Finally, it will provide scientific knowledge and build the capacity of institutions by training new researchers in various aspects of climate change. The National Council of Climate Change is also in the process of developing adaptation frameworks for identification of vulnerabilities and risks. The report on India's GHG emissions for 2007 was released in May 2010 by INCCA; it indicates that India is now ranked fifth after the United States, China, the European Union and the Russian Federation in global GHG emission with a net GHG emission of around 1.7 billion tonnes of CO₂ equivalent and that the forests of India sequestered 67.8 million tonnes of CO₂ in 2007 (MoEF 2010b).

¹³ FAO (2009e). Available at [ftp.fao.org/docrep/fao/012/k5453e/k5453e00.pdf](ftp://ftp.fao.org/docrep/fao/012/k5453e/k5453e00.pdf)

India's National Action Plan on Climate Change was developed with the intention of achieving national growth objectives through measures that enhance climate change mitigation and adaptation. A mission approach has been adopted with eight sectoral national missions. Prominent among them, the National Green India Mission aims at doubling the area to be taken up for afforestation or restoration in India in the next ten years to 20 million hectares, resulting in an increased sequestration rate of 43 million tCO₂-e annually (MoEF 2010b). The national goal is to bring the area under forest and tree cover to 33 percent of the total land area. India currently has two afforestation/reforestation CDM projects, in Andhra Pradesh and in Haryana, with more being processed.

In its submissions to the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) related to 'Organization and Methods of Work in 2010', India has expressed its support for launching a climate change adaptation fund for the least developed countries of South Asia. India also plans to implement REDD by utilizing public funds rather than depending on carbon markets (MoEF 2010c). In order to develop methodologies and procedures for assessing and monitoring REDD+ activities, a Technical Group as well as a REDD coordinating committee have been set up under the MoEF (MoEF 2010d).

Challenges, needs and options

Technology development and extension has in some cases faced considerable opposition including from within the NGO movement. The introduction of new technologies, particularly Genetically Modified Organisms (GMO), to enhance biomass productivity and carbon sequestration are a case in point. Some observers recommend the establishment of an autonomous regulatory framework to provide rigorous testing and dialogue on the costs and benefits of emerging technologies.

Tenure reforms also pose a serious challenge. Under the recently enacted Forests (Rights) Act, ownership rights over forest lands that were being farmed by tribal or forest dwellers as of 13 December 2005 have been granted to those who primarily reside in forests and who depend on forests and forest lands for livelihood purposes. Though it constitutes a significant milestone in the advancement of indigenous peoples' rights, the implementation of this law has been slow.

Indonesia

As the world's greatest emitter of GHGs from forestry and land-use change, Indonesia has placed its forest resources at the forefront of its climate change mitigation and adaptation strategies. Despite considering REDD to be just one of many mitigation options, and focusing its attention on other crucial areas where forest management can mitigate climate change (improved fire management, tackling illegal logging, rehabilitating degraded lands and restoring forest ecosystems), Indonesia is notably the world's first country to develop legal regulations for REDD programmes.

Climate change concerns are being actively integrated into Indonesia's forestry institutions and the country is currently reviewing its forest carbon laws in order to reduce inconsistencies and duplication (Creagh 2010). The Ministry of Forestry has been tasked with developing REDD policy and strategy, and has established a climate change working group within the department, which is supported by a number of international donor agencies and technical advisors under the Indonesia Forest Climate Alliance (IFCA) (MoFor and IFCA, 2008). Indonesia, along with Pakistan, is one of the few countries in the region that is integrating climate change mitigation and adaptation within its overarching National Development Plans (UNFCCC 2010). The UN-REDD Programme in Indonesia has recently launched its 'quick-start' programme and identified priorities for its work in Indonesia, including the selection of Central Sulawesi Province as a pilot site. Most recently, the Norway-Indonesia REDD+ partnership, launched in May 2010, entails US\$1 billion of additional funds to help the country prepare for and implement its national REDD programme.

Challenges, needs and options

Illegal logging, forest fires and the establishment of industrial plantations remain key sources of forest carbon emissions. While Indonesia has laws and policies to address these issues, its main challenge is ensuring that its laws and policies governing the management of forest resources achieve their desired results (Wardojo and Nur 2002). Currently, this is hindered by weak law enforcement, corruption, overlapping and contradictory laws and policies, and lack of awareness of

them. Governance reform and strengthened law enforcement are crucial for ensuring that Indonesia's efforts to halt deforestation succeed (Chrystanto and Justianto, 2002).

Likewise, integration of climate change issues into forest policies must occur at all levels of government. Indonesia's current philosophy for REDD is "National-level accounting with sub-national implementation", which means that the subnational level must be able to reduce deforestation rates, and policies at the local and district levels must be aligned with national ones. Indonesia has a host of demonstration activities from which to learn. Currently, there are an estimated 40 projects in various stages of development that claim to be REDD pilots in some respect, most with stated goals of piloting systems that can be scaled-up in national REDD implementation. However, only four are recognized by the central government as official REDD pilots. Some subnational projects, notably the Ulu Masen REDD project in Aceh with technical support from Fauna and Flora International, have suffered from their failure to integrate into national REDD strategy and coordinate with the IFCA.

Japan

Japan's updated Nationwide Forest Plan, 2008 sets quantitative targets for carbon sequestration. In 2010, forest carbon sequestration is expected to achieve a 3.9 percent national emissions reduction (from 1990 levels). Changes in forestry will be achieved through the National Campaign on Fostering Beautiful Forests, the Act on Special Measures for Promotion of Thinning and the Basic Plan for Forest and Forestry.

While domestic forestry does not play a large role in Japan's climate change strategy, its international engagements with the forestry sector in the Asia-Pacific region are potentially significant. Japan is an Annex 1 country that has demonstrated strong capacity for, and commitment to, dealing with climate change through development of new institutions, policies and technologies, and implementation of monitoring and accounting systems for emissions. Core aspects of Japan's climate strategy are technology innovation and assistance to developing countries. As revealed in late 2009, Japan also intends to seek emissions credits from overseas through mechanisms like the CDM.

Challenges, needs and options

Institutional capacity in Japan for forest management is high. Property rights do not appear to be contested, which makes forest management more straightforward. Schemes are currently being developed for the award of domestic carbon credits from forestry. A key issue is how to regulate industry in order to achieve emissions targets. This has hindered attempts to establish a domestic emissions trading scheme.¹⁴

Japan's international and domestic climate change policy experienced a significant shift in 2009 under the Hatoyama Administration, and has paved the way for compulsory national emissions reductions targets.¹⁵ By contributing to an enabling global environment for the establishment of an international REDD mechanism, this could have important implications for the forest-based climate change efforts of developing countries in the region.

Lao PDR

Climate change is not yet integrated into Lao PDR's key forest policies and laws, but inclusion of REDD in the most recent Forestry Strategy 2020 indicates it is beginning to be considered in forest management.¹⁶ The recently amended Forest Law (2007) tacitly supports efforts to realize the adaptation and mitigation potential of forests by reducing deforestation and conversion of natural

¹⁴ See www.wupperinst.org/uploads/tx_wiprojekt/ikkatai2.pdf Current status of Japanese climate change policy and issues on emission trading scheme in Japan.

¹⁵ See www.eai.nus.edu.sg/BB491.pdf The Hatoyama Administration and Japan's climate change initiatives. By Lam Peng Er, *EAI Background Brief No. 491*.

¹⁶ FS 2020 is the official document guiding forestry sector development in line with national plans and strategies for socio-economic development and environmental conservation (e.g. National Growth and Poverty Eradication Strategy). FS 2020 implementation is guided by five-year implementation plans, the development of which is supported by the Japanese International Cooperation Agency.

forests. The government has also introduced orders and decrees further targeting key drivers of deforestation and forest degradation (Merz *et al* 2003).

Efforts to integrate climate change mitigation in forestry institutions in Lao PDR are also underway. The Department of Forestry (DoF), under the Ministry of Agriculture and Forestry (MAF), is tasked with guiding the development of a REDD strategy and overseeing its implementation.¹⁷ An interministerial REDD Task Force, chaired by the Director-General of the DoF, was established in 2008 to coordinate activities that inform and support the national REDD strategy. Units within the DoF are also taking steps to build climate change into their respective work programmes.

Lao PDR has received funding from the Forest Carbon Partnership Facility (FCPF) for the development of its Readiness Preparation Proposal, which will form the basis of an eventual national REDD strategy.

Challenges, needs and options

Lao PDR faces a severe shortage of human resources with the education and skills needed to develop and implement effective adaptation and mitigation measures. This constrains Lao PDR's ability to make informed decisions about the role of forests in climate change. At the same time, an influx of funding for REDD projects is placing considerable demands on the relatively few individuals with requisite expertise. Lao PDR has signed Memorandums of Understanding (MoUs) worth approximately US\$50 million, but is constrained by the human resources needed to operationalize the projects.

Improved coordination is urgently needed among the growing number of donors and agencies implementing climate change activities, in order to maximize the limited human resources available. Working groups and task forces have been created to bring the various climate change stakeholders together. These efforts could be strengthened by moving beyond information exchange towards an increased focus on coordination (Troockenbrodt 2010).

The government recognizes weak communication and oversight as obstacles to effective forest policy implementation and has taken steps to address these issues.¹⁸ Continued work to increase transparency, combined with a more concerted effort to identify incentives for subnational authorities and enforce measures that encourage policy implementation will be needed in order to implement REDD effectively at the national scale.

Malaysia

Forests and forest products in Malaysia are under the ownership and management of state governments, while the federal government is responsible for trade policies on forest products and provides technical assistance and training to states. The National Forestry Council is the highest body with the mandate on forestry in Peninsular Malaysia. In Sabah, for example, forests are managed by the Sabah Forestry Department. Sabah also has its own forest research and development division and forest management agency. Sarawak also has its own state Forest Department, which has internal structures to conduct research and forest management. In 2004, the Sarawak Forest Department devolved powers to the Sarawak Forestry Corporation (SFC), a private company owned by the government and responsible for the management of forest resources and timber administration (Chan 2008).

Aside from the National Forestry Act, Malaysia has an array of policies and legislation relating to biodiversity and forest resources management (e.g. the National Environmental Policy of 2002, national conservation strategies in federal and state governments, National Policy on Biological Diversity of 1998, National Agriculture Policy and other master plans for protected areas). Timber concessionaires in Malaysia are required to designate community use zones within licensed forest areas. Sabah's licensing agreements for concessionaires include local communities in classification

¹⁷ Development of the National Climate Change Strategy and the national REDD strategy are not directly linked, due in part to distinct sources of funding for the separate efforts. However, it may be that the DoF's work on REDD will be reported in the NCCS as a mitigation effort.

¹⁸ Examples include disseminating laws to local authorities, the private sector and local people, and sending senior forestry officials to all provinces when a new Order is introduced (DOF 2008; Tong 2009).

of forest areas. In Sarawak, the law allows community access rights to collect forest products for subsistence.

From 2005 to 2009, Malaysia conducted a series of multistakeholder consultations towards drafting a national climate change policy, which aims to mainstream climate change measures, integration of balanced adaptation-mitigation responses and strengthening of institutional and implementation capacity, emphasizing adaptive capacity in the face of expected climate change impacts.

Challenges, needs and options

Logging remains a major concern in efforts to reduce rates of deforestation and forest degradation in Malaysia. According to government figures in Peninsular Malaysia, annual forest loss ranged from a low of 7 847 hectares in 1995 to a high of 170 842 hectares in 1996. Sarawak Forestry Department statistics show that average area logged per year between 1983 to 1990 was around 220 000 hectares. For the whole of Malaysia, FAO estimates a loss of 400 000 hectares from 1990 to 1995.

Malaysia has been a key global player in timber trade since the 1960s. With Malaysia's inclusion in the ASEAN-China Free Trade Agreement, natural forests are expected to suffer greater pressure due to increasing demand for timber and non-timber forest products in the region. This may be exacerbated by the fact that no national forest policy exists in Malaysia but is instead delegated to state governments. This set-up may hinder the development of a national approach to sustainable forest management.

While state jurisdiction may circumscribe the rules governing customary land rights as in the cases of Sabah and Sarawak, in practice, there is inadequate recognition of the rights and forest conservation roles of the diverse indigenous peoples in Malaysia who rely on the forest for subsistence.

Maldives

The Third National Environment Action Plan, which lays down the current policies and priorities, identifies the protection of natural vegetation and ecological communities in the islands as an important target to be achieved between 2009 and 2013. Through this plan, Maldives seeks to move towards resilient islands and rich ecosystems and become a carbon-neutral nation. With regard to forestry, the emphasis is on biodiversity conservation, which is recognized as a core business of province, island and atoll government offices. All atolls are expected to have continuous tree planting campaigns from 2011 onwards and regulate the cutting of trees. The plan also seeks to reverse the decline in natural vegetation, ecological communities and the ecosystem services they provide through appropriate development programmes, land-use planning and regulations to control felling of trees by 2010 (MoHTE. 2009).

In Maldives, the nodal ministry for planning and implementation of climate change activities is the Ministry of Housing, Transport and Environment. There is no forestry-related action in the National Adaptation Programme of Action (NAPA). The President himself deals with climate change issues. All ministries are required to review the legislative and regulatory frameworks under their jurisdiction, identify impediments to biodiversity conservation and incentives that encourage biodiversity loss and remove the impediments within two years (end of 2011).

The Government of Maldives, the European Union and the World Bank Group signed a tripartite MoU establishing the Maldives Climate Change Trust Fund designed to build resilience to climate change. The Fund has received US\$8.8 million from the European Union for the Government of Maldives to carry out priority projects relating to climate change adaptation and mitigation.¹⁹ Other Maldives environmental management projects include the Planning for Adaptation to Global Climate Change Project, the Mainstreaming Adaptation to Climate Change Project and the Implementation of Adaptation Measures in Coastal Zones.²⁰

¹⁹web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:22531481~menuPK:2246552~pagePK:2865106~piPK:2865128~theSitePK:223547,00.html

²⁰www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/05/21/000333037_20080522000427/Rendered/INDEX/434180PAD0P10817376B01OFFOUSE0ONLY1.txt

Challenges, needs and options

Maldives is severely challenged by shortages of qualified personnel in implementing agencies. It is also one of the world's most severely climate-affected nations. If climate change impacts proceed at the upper range of IPCC estimates, adaptation activities will be constrained by rising sea levels and the resulting loss of land area.

Mongolia

The National Forestry Programme began in 1998 as a comprehensive policy framework for the sustainable development and conservation of all forest types in Mongolia. It adopted an intersectoral approach to planning and evaluation yet was flexible enough to account for local diversities.

In 2001, the Revised National Forest Policy was drafted to modernize the forestry sector. Specifically, it aimed to prevent deforestation and desertification, modernize wood-processing techniques, maintain ecological balance, develop institutional capacity and support technology transfer and research extension.

Myanmar

Climate change has not been integrated into Myanmar's forestry policies and laws, though the need to mainstream REDD in national forest management plans has been raised by Myanmar representatives in regional fora (Htwe 2009). Preparation of Myanmar's Initial National Communication (INC) to the UNFCCC is underway. Myanmar is also in the process of developing a NAPA (Htwe 2009). This will likely include protection and restoration of mangrove forests as a priority.

The National Commission for Environmental Affairs (NCEA) under the Ministry of Forestry is Myanmar's UNFCCC focal point and is leading preparation of the INC. The Department of Meteorology and Hydrology under the Ministry of Transport is overseeing development of Myanmar's NAPA. An integrated assessment to inform the NAPA has been undertaken with inputs from six working groups, including one on biodiversity and forestry led by the Academy of Forestry Sciences (Htwe 2009).

Challenges, needs and options

Myanmar is well known for its history of forest management practices that ensured sustainable production of high quality teak during the first half of the twentieth century. However, the country has experienced a steep decline in forestry skills and stable governance systems; as a result, forest institutions now lack the capacity required to implement forest policy effectively (FAO 2009a; Thaug 2009).

National efforts to prevent illegal and unsustainable logging are complicated by the fact that most timber trade occurs in areas under the *de facto* control of minority ethnic groups and outside of the government's effective reach with respect to law enforcement and policy implementation (Global Witness 2009). Myanmar will have a national election in the second half of 2010. Depending on the process and outcome of the election, there may be increased opportunities for bilateral support of forest-based climate change activities, possibly providing some of the resources needed to improve policy implementation.

Nepal

The forestry sector is viewed by Nepal as playing a pivotal role in national climate change mitigation and adaptation strategies. The current forest policy of Nepal is captured in the three-year interim plan for 2007 to 2009 that advocates legal and institutional reforms, employment and income generation through forest-based participatory activities and equitable access to these resources for the poorest sectors of society. Nepal's tenth five-year plan was launched in May 2010 and continues these policies, yet still makes no reference to the role of the forest sector in climate change mitigation and adaptation (NPC 2010).

The Ministry of Environment Science and Technology is the focal ministry for climate change issues while the Ministry of Forests and Soil Conservation provides the overall national leadership on forest-related climate change issues in the country. The Department of Forests, Department of

National Parks and Wildlife Conservation and the Department of Forest Research and Survey provide the technical support for policy formulation and undertake implementation.

Nepal was one of the first countries in the region to submit an R-PIN to the World Bank's FCPF. It recently became a partner country of the UN-REDD Programme. The country submitted its Readiness Preparation Plan (RPP) to the FCPF in April 2010. The estimated cost for the implementation of the RPP is around US\$7.5 million (MFSC 2010). This effort was led by the Ministry of Forest and Soil Conservation through the multistakeholder REDD Working Group, including significant contributions from civil society organizations and representatives of CFUGs. Nepal has entered into an agreement with Finland for updating the Forest Resource Assessment dataset.

Challenges, needs and options

Over the last two decades, there has been a significant decrease of forest cover in Nepal from 4.82 million hectares in 1990 to 3.64 million hectares in 2005. This is in addition to widespread forest degradation caused by grazing and felling for timber and fuelwood. The intensity of degradation is higher in forests under direct government management as compared to those managed by the local communities (Gautam *et al.* 2004). Losses are severest in the Terai region where nearly 80 000 hectares of forest have been encroached for agriculture and settlements (MFSC 2008).

The main readiness tasks identified in Nepal's R-PIN are further development of sustainable forest management, adoption of green accounting in national budgeting, equitable benefit sharing, linking forest management with livelihoods, better forest law enforcement, effective monitoring and evaluation, devolving power and resources to local governments without compromising on quality of management and capacity building of all stakeholders.

Even though Nepal has a number of capable institutions, capacity building for REDD is still a challenge with respect to operationalizing monitoring, reporting and verification. Another important task is to scale-up forest tenure reforms and address the problem of benefit capture of forest resources by the elite.

New Zealand

New Zealand does not have a specific national forest policy as governments over the last two decades have adopted a cross-sectoral approach to resource management. In 2002, New Zealand enacted its Climate Change Response Act which provided the legal mandate for New Zealand to ratify the Kyoto Protocol and meet its obligations under the UNFCCC. Additionally, there are multiple policies not directly linked to climate change that may also positively contribute to climate change adaptation and mitigation within the forestry sector.

New Zealand has a number of public institutes, universities, companies and individuals providing forestry-related research. Environmental services not traditionally recognized by the market are increasingly being recognized as having monetary value. New Zealand's national emissions trading scheme is the most advanced in the region and explicitly includes emissions and reductions from the forestry sector. The first sale of forest-based carbon credits occurred in 2009. However, this was preceded by a protracted dispute over the government's initial unilateral assertion of the right to trade in forest-based carbon credits. This was a foretaste of inevitable similar disputes between governments and forest right-holders around the region.

Challenges, needs and options

Although indigenous forests represent a considerable amount of stored carbon, it is not yet known if this reservoir is expanding or declining. Information on the extent and physical attributes of indigenous forests is being strengthened as a result of international climate change reporting requirements and the use of satellite imagery. A Carbon Monitoring System was designed to address this.

Planted forests cover 1.8 million hectares and timber is considered by New Zealand as a plantation crop. Investments in commercial forestry plantings have dwindled over the last ten years and conversion of plantations to other land uses has been significant since 2005.

Pakistan

High priority is being given to addressing climate change in Pakistan. This is demonstrated in part by the creation of the Prime Minister's Committee on Climate Change in 2005. Its 2005 State of the Environment Report states that the forestry and land-use sector accounts for 7 percent of CO₂ emissions and is an important target sector for mitigating climate change. The Pakistan Environment Protection Act of 1997 provides the regulatory framework for climate change-related actions and mandates the Ministry of Environment as the responsible agency for all climate change-related activities via the implementing arm of the Pakistan Environment Protection Agency. A report from the Task Force on Climate Change, formed in 2008, seeks to facilitate formulation of national climate change policy and is expected to be released in 2010.

In addition, Pakistan is the only country in South Asia to have sought assistance from the UNFCCC in conducting a National Economic, Environment and Development Study (NEEDS) of its technological and financial capacity to engage in mitigation and adaptation activities. Pakistan along with Indonesia is one of the few countries in the region that is in the process of building climate change mitigation and adaptation within its overarching National Development Plan. At present, the CDM is the only financial and policy instrument being used in Pakistan. The Ministry of Environment recently granted approval to 21 CDM projects, although none are under the afforestation/reforestation methodology, while an additional 60 CDM projects are in various stages of completion, underlying the need for the process to be accelerated (UNFCCC 2010).

Challenges, needs and options

Given its largely agrarian economy, Pakistan is highly sensitive to climate change, particularly in sectors relating to water, food and energy security. The Government of Pakistan's Vision for 2030 (2007) pays particular attention to these issues and provides guidance on how best to address them and meet national objectives by 2030.

The forests of Pakistan are vulnerable to climate change, which affects their distribution and composition as well as their productivity. Biological control of forest pests and diseases has been recognized as a critical adaptation measure. Pakistan also seeks to preserve the ecological processes and emphasizes corridor management to permit natural migration to more suitable habitats as the climate changes (MoE 2003). Pakistan has limited institutional and financial capacities for adapting to climate change, therefore enhancement of its adaptation capacity should be given the highest priority.

Papua New Guinea (PNG)

PNG's Forestry Act was passed in 1991 with subsequent amendments in 1996 while its initial communication to the UNFCCC was issued in 2000. Over the last 20 years, forest-related laws have evolved towards increasing government control, but implementation and enforcement of regulations remain a challenge given tensions that exist among various stakeholders. Government control has also diminished resource management rights of customary landowners (UN-REDD Programme PNG 2009).

PNG's forest authority has drafted a reforestation policy recognizing the crucial need for reforestation to fulfil the government's commitments under the Kyoto Protocol. The Government of PNG has established an Office of Climate Change and Environmental Sustainability and has been an active partner in the Coalition of Rainforest Nations, both bodies encouraging participation in the UN-REDD Programme where PNG is considered to have a lead role. However, PNG's Office of Climate Change has suffered a blow to its credibility after reportedly selling millions of dollars worth of REDD carbon credits to carbon traders without approval from forest owners in 2009.

Challenges, needs and options

The foremost challenge faced by PNG's forest sector lies in halting rapid deforestation by integrating conservation and sustainable development. Comprehensive land-use and development planning has also been long overdue (Shearman *et al.* 2008). In order to address deforestation, there is an imperative for the logging industry to proceed under a revised regulatory framework that strictly adheres to principles of ecological impact, sustainability and equitability (*ibid.*). Given PNG's complex tenurial conditions (e.g. customary landholders possess land rights but this does

not include the rights to benefit from forest carbon projects), leadership and active coordination is required to balance the competing interests of the government, landowners, industry, conservationists and local communities.

Philippines

The Philippines has been a regional leader in addressing climate change. In 1991, the Philippine Government established an Inter-Agency Committee on Climate Change made up of 15 government agencies and representatives of NGOs. In 1997, it was one of the first countries in the world to create a National Action Plan on Climate Change. Despite being a Non-Annex I Party with no obligations to do so, the Philippines has begun to implement mitigation measures to limit its GHG emissions, and in October 2009 passed a Climate Change Act that mainstreamed adaptation and mitigation into government policy (see tonyocruz.com/?p=2536).

Contemporary forestry policy in the Philippines can be traced to Presidential Decree 705 of 1975, otherwise known as the Forestry Reform Code of the Philippines. In 1992, the National Integrated Areas System Act established a comprehensive system of integrated protected areas for biodiversity conservation. In 1992, a community-based forest management programme was integrated within upland community programmes to ensure sustainable forest-related development. In 1997, the Indigenous People's Rights Act was enacted and was a regional landmark in recognizing the rights of indigenous peoples to their ancestral domains, which usually included forest lands.

In February 2007, the Presidential Task Force on Climate Change was formed. It was tasked with addressing the issue of climate change, planning adaptation to impacts and mitigating emissions. In October 2009, the Climate Change Act was enacted. The law created the Philippine Climate Change Commission, the lead government agency tasked with mainstreaming climate change policy into government programmes and activities. On the international stage, the Philippines was one of the first developing countries to submit an initial national communication to the UNFCCC in 2000 and is in the process of drafting its second communication. The Philippines recently became a partner country of the UN-REDD Programme.

Challenges, needs and options

The country's natural resource policies, while emphasizing a specific sector, may have unintended impacts on other sectors; hence the need for an intersectoral approach to policy design. Typically, results and benefit monitoring and evaluation are insufficient once implementation of policies and programmes have begun. For this reason, empirical evidence of policy impacts *vis-à-vis* sectoral baseline status is unavailable. Despite having relatively more available climate change information, the Philippines still has insufficient data to systematically link environmental changes with trends of climate change (Lasco *et al* 2008).

Republic of Korea (ROK)

A major component of the Korea Forest Service (KFS) vision for the twenty-first century is 'reinforcement of the carbon cycle economy', through strategies such as expanding carbon sinks, facilitating the timber industry, promoting forest biomass for energy generation and establishing a framework for carbon credits. ROK's Fifth National Forest Plan 2008-2017 states that the KFS "targets the voluntary emission reduction, strengthening the forest function as carbon sinks". The KFS has announced that it will create 1.25 million hectares of new forest by 2013; however a specific carbon sink policy or strategy is not specified (Yoon 2007).

Challenges, needs and options

A carbon incentive scheme has been proposed to provide compensation to forest owners for changing harvesting rotations to increase carbon sequestration. The KFS is investing heavily in overseas timber plantations, some of which will be used to generate carbon credits through the CDM. Indeed, in 2009, the Minister of Forests announced his intention to build a "green hub in

East Asia through globalization of forest administration”, signifying that ROK intends to invest in reforestation projects overseas. Such projects already exist in China, Mongolia and Indonesia.²¹

ROK timber plantations in the Asia-Pacific are a regional issue, as timber imports from developing countries are significant. The ROK wood products industry is large and may be affected by reduced supply due to REDD implementation elsewhere. Positive interventions with timber certification are a possibility.

Samoa

The Ministry of Natural Resources, Environment and Meteorology, Samoa's lead agency for climate change, collaborates through multistakeholder bodies in devising climate change-related policy. This consensus-building approach was employed in developing the First National Climate Change Summit in May 2009.

Traditional land use and cultivation in Samoa employ a style of agroforestry mixing root crops, tree crops and trees planted for either conservation or cultural significance. However, the shift to a cash economy combined with simultaneous population growth has forced a change towards intensified cultivation at the expense of the forest. Reversing deforestation through sustainable management and forest resource development were the target components of the 1993 National Environmental Management and Development Strategies. Samoa's fundamental forestry legislation documents are the Forest Act of 1967 and the Forest Regulation of 1969.

Singapore

Singapore possesses about 2 000 hectares of land that can be defined as forest (FAO 2010a). This area is managed mainly for conservation of biodiversity with recognition that forested areas also provide services such as soil and water conservation. However, despite its low forest cover, Singapore has high potential to contribute to the climate change mitigation role of tropical forests through lending expertise and capacity to its neighbours in managing their tropical forests resources. This is in line with Singapore's role as a 'hub' for developing sustainable development solutions and for the carbon services sector, as private companies open offices to base their operations supporting CDM and forest carbon projects in Asia.

Challenges, needs and options

On the domestic front, Singapore's National Climate Change Strategy (2008) and Sustainable Development Blueprint (2009) state a goal to maintain good ambient air quality – a goal that Singapore cannot accomplish without cooperation from Indonesia in reducing forest fires. Smoke and haze from these fires consistently impacts the air quality in Singapore, often reducing visibility for motorists and endangering public health. Singapore is a signatory to the ASEAN Agreement on Transboundary Haze Pollution, and has cooperated with Indonesia to address this issue through several initiatives.

Solomon Islands

The Forest Resources and Timber Utilization Act of 1969 and its subsidiary laws are the only legal tools available to the Ministry of Forestry, which now promotes a policy of sustainable forest management. The Coalition for National Unity and Rural Advancement administration established the Ministry for Environment, Conservation and Meteorology in 2008, with a key role being to serve as focal agency for initiatives relating to climate change. In February 2010, Solomon Islands became a partner country of the UN-REDD Programme.

Challenges, needs and options

The foremost challenge in the country's forestry sector lies in abating its high timber extraction rate and improving the quality of forest harvesting. With its annual population growth rate of 3.5 percent, one of the world's highest, and lacking in land suited for cultivation, more pressure is

²¹www.koreaittimes.com/story/kfs-create-more-jobs-through-low-carbon-green-growth 'KFS to Create More Jobs through Low Carbon, Green Growth' Korea IT Times, January 2009.

being exerted on the remaining forests. This is compounded in part by a tenure system that sees most forest land under indigenous or tribal ownership. A further key constraint is lack of expertise, technology and financing in government agencies.

Sri Lanka

Sri Lanka's policy of Caring for the Environment (2003-2007) details a path to sustainable development, which recognizes the importance of the forestry sector in the context of climate change. It proposes a number of strategies including adoption of conservation approaches and sustainable resource use, participatory approaches to forest management, demarcation of forest boundaries, strengthening of production of timber, propagation of non-timber species and promotion of agroforestry (Keller 2009).

The Ministry of Environment and Natural Resources and subdepartments such as the Department of Forest Conservation and Department of Wildlife Conservation are the main implementing agencies responsible for climate change issues. Since 2009, Sri Lanka has been developing a national climate change adaptation strategy with support from the Asian Development Bank (ADB). The project includes associated formulation of public information and awareness strategies as well as capacity building. It is expected to be completed by October 2010.

The Climate Change division of the Ministry of Environment of Sri Lanka is expected to submit its Second National Communication on Climate Change to the UNFCCC by the end of 2010 focusing on six main areas of environment which are national circumstances, GHGs, Adaptation & Vulnerability to Climate Change, Mitigation of Climate Change, Technology Transfer and on Research, Education, Training and Networking.²² Sri Lanka recently became a partner country of the UN-REDD Programme.

Challenges, needs and options

Sri Lanka has classified its national forest estate under the two main categories of Conservation and Multiple-use. Multiple-use designated forests are to be managed by local communities with state assistance. However, this management transition needs to be accelerated as it may provide a key vehicle for climate change mitigation.

Carbon sequestration through plantations such as rubber and coconut also offers very good opportunities, as these are established industries and have the potential to sequester large amounts of carbon in short periods of time (4.12 tC/hectare/year) (Herath 2009).

Taiwan, Province of China

Taiwan's bid to participate in the UNFCCC as an observer came in November 2009 amidst opposition from the People's Republic of China and its participation has yet to be finalized. In spite of this, Taiwan has instituted a comprehensive environmental protection framework that is in compliance with UN environmental conventions and protocols.²³

Forest policy in Taiwan has evolved since 1932 from integrated management with the introduction of natural parks, to conservation management with the enactment of laws promoting wildlife conservation and prohibiting timber exploitation in natural forests, to embarking on programmes of sustainable forest management. At present, logging is restricted to commercial plantations and the Forest Bureau continues to afforest and reforest throughout the island. The government pays participating landowners in afforestation and reforestation projects a total of US\$16 000 over a period of 20 years, as a means of mitigating the impact of liberal trade on farmers and fostering the expansion of forests.

Challenges, needs and options

As a rapidly developing economy, Taiwan has high potential to contribute to climate change adaptation and mitigation financing and technology transfer in the Asia-Pacific region. Taiwan is highly vulnerable to the impacts of a changing climate, buffeted by strong typhoons every year.

²² climatechange.lk/SNC/snc_index.html

²³ ivy1.epa.gov.tw/unfccc/english/04_our_efforts/061_policy.html (Towards UNFCCC, Taiwan Environmental Protection Agency)

Thailand

Thailand has recognized changes (including climatic) in the environment and natural resource bases as an important trend in its National Economic and Social Development Plans (NESDP) for both the periods of 2007-2011 and 2011-2016. Local communities are prominent in the current NESDP as both agents of positive change and intended beneficiaries. Improving livelihoods through participatory approaches to reducing deforestation and increasing and improving the quality of forest cover is also a key element of Thailand's early plans for REDD (MNRE 2009).

The Thailand Greenhouse Gas Management Organization oversees efforts to reduce GHG emissions from all sources, but has remained focused on urban emissions in practice. The National Park, Wildlife and Plant Conservation Department is leading Thailand's REDD readiness efforts, with collaboration from the Royal Forest Department. Thailand's R-PIN was approved in March 2009 and in 2010 Thailand signed an agreement with the World Bank for US\$200 000 to continue readiness work in Thailand under the FCPF.

Challenges, needs and options

In Thailand, mistrust between authorities and communities has constrained implementation of community forestry as a key strategy to improve forest management (FAO 2009c). Ongoing conflict over land use continues to weaken relations between communities and the Royal Thai Government (Janchitfah 2009a; 2009b). With respect to mitigation, this is exacerbated by a negative perception of REDD shared by many Thai NGOs.

Without support to improve relations with local communities, government-led programmes to reduce emissions from deforestation and forest degradation will face difficulties. Methodologies and guidelines for engaging local people, and related capacity building are needed for government at various levels. Regulations that prohibit harvesting forest products in protected areas are an important driver of forest-based conflict between communities and the Royal Thai Government, and have also contributed to a long delay in the passing of Thailand's Community Forestry Bill (FAO 2009c). This issue remains unresolved and inhibits experimentation with participatory forest management models to inform climate change planning.

Timor-Leste

Timor-Leste is still in the early stages of formulating its national policies, having gained independence only in 2002. Two agencies share environmental responsibilities: the State Secretariat for the Environment, under the Ministry of Economy and Development, and the Ministry of Agriculture and Fisheries (MAF), which among other duties is tasked with forest and biodiversity conservation under the Secretary of State of Agriculture and Forestry.

A National Forest Policy has been drafted but the legislation and regulations to support this remain pending. The MAF and the National Directorate of Coffee and Forestry, supported by FAO and the Netherlands Partnership Programme, drafted the National Forest Policy, which was subsequently approved following a series of public hearings. Legislation for the implementation of participatory forestry practices is also under decentralized review (World Bank 2009).

Challenges, needs and options

In addition to a dearth of guiding legislation and policy, there is similarly limited information and analysis of forest sector changes and potential climate change-related impacts. Insufficient legislation, weak implementation of existing legislations and policies, lack of coordination among institutions and lack of human capacity are overriding constraints. The World Bank assessment found that while certain aspects of the Rio Convention have been covered in Timorese sectoral policies and regulations, issues such as climate change and land degradation have yet to be addressed. Further to weak legislation are difficulties in implementation given limited public awareness and political will.

Tonga

Tonga currently has limited forest resources (approximately 6 500 hectares) found mainly in Eua National Park on steep and inaccessible slopes. Much of Tonga's former forests are now planted with coconut (considered as a forest species in Tonga), occupying 74.4 percent of its total land area.

The Forest Act of 1961 is the foundational legislation, and it was only in 2006 that Tonga requested FAO assistance in developing a National Forest Policy. In August 2008, a draft policy was developed to sustainably manage forests in Tonga as well as to pursue forest conservation and biodiversity. Tonga has designated its Ministry of Environment and Climate Change as the national designated agency for all climate change projects.

In 2008, Tonga participated as a country pilot in the World Bank's Pilot Program for Climate Resilience, which aims to provide programmatic finance for national climate resilient national development plans, sustainable forestry and mangrove protection.

Tuvalu and Kiribati

Tuvalu and Kiribati have taken active positions in the UNFCCC processes due to the threat of sea-level rise and consequent inundation. Two uninhabited islands in the Kiribati chain have in fact already disappeared due to sea-level rise. The State of Tuvalu especially gained prominence in the recent COP15 negotiations for its bold assertions for a legally binding outcome. Consistent with this position, Tuvalu, along with Bolivia, Venezuela and Sudan, rejected the Copenhagen Accord. As small Pacific island nation states, Tuvalu and Kiribati have no significant forest areas and both nations lack national forest policies to date.

Vanuatu

Vanuatu established its National Advisory Committee on Climate Change in 1989. It is the lead agency mandated to coordinate all climate change initiatives or programmes emanating from the UNFCCC processes. The New Forestry Act was enacted by Parliament in 2001, replacing the Forestry Act of 1991, and thus serves as the foundation of Vanuatu's current National Forestry Policy, which is mandated to "ensure the sustainable management of Vanuatu's forests to achieve greater social and economic benefits for current and future generations".

Although current drivers of deforestation and forest degradation remain low, they are expected to increase in the coming years as roundwood supply from Solomon Islands decreases. The challenge to the forestry sector is in sustainable financing and good implementation of the Department of Forestry's vision and strong commitment to sustainable forest management. This is potentially challenged by the fact that there are no government-owned forest lands in Vanuatu. Forest-land ownership by indigenous landowners may prove to be an advantage if sustainable traditional practices are harnessed in the pursuit of sustainable forest management. Vanuatu submitted an R-PIN to the World Bank's FCPF in 2008, which was subsequently approved.

Viet Nam

Climate change is not yet explicit in Viet Nam's forest policies and laws, though the contribution of forest protection programmes to adaptation and mitigation is recognized in its first national communication to the UNFCCC (MONRE 2003). Viet Nam's recent policy shift from promoting forest exploitation for national economic growth, towards a more holistic recognition of the social and ecological benefits of healthy forests further supports important elements of its emerging forest-based adaptation and mitigation plans.

In 2008, the Ministry of Agriculture and Rural Development (MARD) developed an Action Plan Framework for Adaptation to Climate Change. At MARD's request, the Department of Forestry is now developing an Action Plan to respond to climate change for the forestry sector including provisions on REDD. For Viet Nam, REDD is one part of its wider strategy to improve forest management and reduce rural poverty, and related activities are beginning to be integrated into existing forestry institutions. Under Viet Nam's REDD Programme, pilot activities will be implemented in two districts of Lam Dong Province. Viet Nam's R-PIN for the FCPF was among the first to be approved. It is also one of the pilot country programmes for UN-REDD and was the first to officially launch the national programme.

Challenges, needs and options

Most forest users in Viet Nam recognize only the direct economic value of felled timber and have yet to account for the environmental values of forests or the impacts of their extractive activities (FAO 2009d; Nguyen 2009). Limited experience with sustainable management of forests and environmental stewardship puts many of the intended beneficiaries of forest-based adaptation and mitigation efforts at a disadvantage and will reduce the effectiveness of these efforts if not addressed.

Progress in allocating rights to forest users is needed in order to move forward with implementation of national programmes and pilot projects. Ensuring benefits for forest users will be a condition for achieving these objectives and will be very difficult without clear rights that are recognized and widely understood.²⁴ A related study has been recently conducted by the United Nations Development Programme (UNDP) under the UN-REDD Programme (see www.unredd.net/index.php?option=com_docman&task=doc_download&gid=1409%Itemid=53).

²⁴Allocation of forest land to households has also been a key element of payment for forest environmental services implementation in Lam Dong Province (Pham 2009).

6. Financing and technology transfer

One of the key global challenges in tackling climate change is the need to finance climate change mitigation and adaptation efforts by developing countries. The Kyoto Protocol, and most recently COP-15, have articulated this need and taken measures to address it. Specifically, the UNFCCC has assigned the design and operation of financial mechanisms to the Global Environment Facility (GEF), which is guided by the Subsidiary Body on Implementation in setting its policies, programme priorities and eligibility criteria for funding. Two such funds, the Special Climate Change Fund (SCCF) and Least Developed Countries Fund (LDCF), have been established under the UNFCCC and the Adaptation Fund (AF) has been set up under the Kyoto Protocol.

At present there are four international financial sources potentially accessible to developing countries: (1) multilateral development agencies; (2) bilateral development agencies; (3) financial mechanisms of the Convention, including the GEF Trust Fund, the SCCF, the LDCF and the AF; and (4) overseas development assistance. Given the relative newness of climate change funding to developing countries, a study by UNFCCC suggests that while the actual amounts of finance flows entering developing countries can increasingly be monitored, the effectiveness of this financing in meeting its identified goals remains an area for further study (UNFCCC 2010).

Current estimates for the total global costs of implementing adaptation and mitigation measures range from US\$721.13 million by 2030 to US\$6.8 billion by 2012 (UNFCCC 2010). There is wide variation in the level of funding being allocated by countries and it tends to be based on respective climate change contexts, identified vulnerabilities, scope of activities planned and the status of existing climate change policies, instruments and mechanisms.

Financial needs assessments: The UNFCCC has launched a programme to enable financial needs assessments as part of its National Economic, Environment and Development Study (NEEDS) for climate change projects. NEEDS will provide information to Non-Annex I Parties on the implementation costs of mitigation and adaptation measures and identify appropriate financial and regulatory instruments to support them. From the Asia-Pacific region, four countries have requested UNFCCC assistance in conducting NEEDS studies: Indonesia, Pakistan, the Philippines and Maldives. In the UNFCCC initial summary report of 2010 results were obtained from all of these countries with the exception of Maldives. The completion of these needs assessments is a high priority action for both South and Southeast Asia.

Findings from the recent UNFCCC study suggest that while the GEF financial mechanism is recognized by countries as a potential financing source, they are hesitant to rely on it. Many countries express concern that financing levels will be variable and subject to voluntary contributions from developed countries. Despite the acknowledged need for external support to developing countries in implementing mitigation and adaptation measures, national budgets continue to serve as the primary source of financing at local and national levels. The burden this places on developing country economies may prove to be one of the most serious challenges facing the sustainability of climate change measures in the region (UNFCCC 2010). Several countries have indicated that their budgetary contributions to climate change activities are low or, in some cases, non-existent. In these cases, the failure to mainstream climate change activities within national development plans results in limited allocation of resources to them, as well as limited financial support from project-based contributions (UNFCCC 2010). Given the reliance of many countries on national sources of funding, there is a need to further examine mechanisms and sources of internal support. Some suggested potential mechanisms for support include tax revenue, national health insurance levies and investment from the banking and private sector.

The question of scale and national versus local-level projects emerged in the findings from the Philippines' assessment. The results suggest that while domestic financing for climate changes exceeds that from external sources, national funding capabilities remain limited. As a result, local-level climate change mitigation and adaptation projects initially intended for national-level scaling up rarely expand beyond project sites given insufficient budgetary resources (UNFCCC 2010).

Other funding sources: Other sources of external funding identified as existing or potential sources of climate change activity funding include: the United Nations Environment Programme (UNEP); UNDP; the GEF; funds available under the Convention (i.e. the LDCF); the CDM; the

AF; the SCCF; multilateral agencies such as the World Bank and ADB; regional development funds; the European Community; and bilateral donors such as the Swedish International Development Cooperation Agency (SIDA) and the United States Agency for International Development (USAID) (UNFCCC 2010).

The Forest Investment Program (FIP) is a targeted program under the Strategic Climate Fund to support developing countries' REDD efforts. It provides up-front bridge financing for readiness reforms and public and private investments identified through national REDD readiness strategies and other national plans for the management of forests. Additionally, it contributes to multiple benefits such as biodiversity conservation, protection of the rights of indigenous peoples and local communities, poverty reduction and rural livelihood enhancements. In 2010, the FIP Sub-Committee approved seven countries as pilot countries, including Indonesia and Lao PDR from the Asia-Pacific region.

In addition to the better known sources of climate change-related funding there are a number of examples of innovative in-country initiatives. One example is the Indonesian Low-Carbon Development Fund, which aims to leverage and match public and private sources of funding that support low-carbon development. The Fund seeks to coordinate private funding to deliver large-scale capital investments, and to thereby increase confidence in the government's commitment to long-term efforts to mitigate climate change. The initiative is an innovative way of leveraging private funding and may serve as a model for other countries in the region.

Least Developed Countries Fund: One of the main potential sources of funding is the LDCF established under the UNFCCC at the seventh session in Marrakech and managed by the GEF. The Fund addresses the special needs of the 48 LDCs, which are especially vulnerable to the adverse impacts of climate change. In the Asia Pacific region the LDCs include: Afghanistan, Bangladesh, Bhutan, Cambodia, Kiribati, Lao PDR, Maldives (graduating in 2011), Myanmar, Nepal, Samoa, Solomon Islands, Timor-Leste and Vanuatu. Funding available to LDCs includes the development of NAPAs, intended to identify urgent and immediate climate change needs. As of 2008, the GEF had mobilized voluntary contributions of about US\$172 million for the LDCF; its target in the next four years is to reach US\$500 million, which is the amount estimated by the UNFCCC needed to finance NAPA implementation (GEF 2008).

BOX 6

Indonesia: integrating climate change within development planning

Indonesia has taken steps toward a coordinated approach for managing both climate change activities and ensuring that related finances received externally are harmonized with the country's priorities. The government has established the Indonesian Climate Change Trust Fund (ICTF), which seeks to co-finance investments in adaptation and mitigation activities. The Fund will consist of grants from bilateral and multilateral development partners with an overall objective of promoting a coordinated national response to climate change in Indonesia. The specific objectives of the ICTF are: (1) to align official development assistance for climate change activities more closely with the development priorities defined by the government; (2) to improve the targeting of investments in climate change using decentralized structures; (3) to improve access to financing for priority investments in climate change from existing sources of funding; (4) to prepare a comprehensive policy framework for mitigation and adaptation; and (5) to facilitate private sector investment in climate change activities.

Source: UNFCCC (2010).

Technology transfer: In addition to the transfer of financial resources from Annex I countries to developing countries, there is a clearly articulated need for the transfer of climate change-related technology and associated capacity. A critical constraint, in addition to funds, for climate change mitigation and adaptation activities in developing countries is the significant gaps in available data as well as technological means of addressing them. Indicative of the importance of technology in addressing climate change has been the establishment in several countries of national committees for scientific and technological advice. Such facilities would potentially play key advisory roles in assisting governments to define and prioritize climate change needs and potential policy instruments.

A number of regional initiatives are addressing existing technological gaps. One is the Asia-Pacific Partnership on Clean Development and Climate, also known as the APP. The Partnership is an international non-treaty agreement between Australia, Canada, China, India, Japan, Republic of Korea, and the United States of America. It was announced in 2005 at an Association of South East Asian Nations (ASEAN) Regional Forum meeting and launched in 2006 at its inaugural meeting in Sydney. The Partnership outlines the intent of partner countries to cooperate on development and to transfer technology for the mitigation of climate change. At the time it was established and its workplan released, the Partnership was deemed “a ground-breaking new model of private-public taskforces to address climate change, energy security and air pollution” (APP 2009).

The intent of the Partnership is to create a “voluntary, non-legally binding framework for international cooperation to facilitate the development, diffusion, deployment, and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices among the Partners”. This is undertaken through concrete cooperation with the intent of achieving practical results and facilitating Partners' national pollution reduction, energy security and climate change objectives.

For bilateral technology transfers, several major regional initiatives exist. As part of its Japan Climate Change Initiative, Japan has made commitments to provide assistance to developing countries for transfer of energy-efficient technology, especially through the CDM. Australia, as part of its Adaptation to Climate Change Initiative, is investing US\$150 million over three years beginning in 2008 to support priority climate change adaptation needs in regional developing countries. The main emphasis of this programme is on neighbouring island countries, but policy and technical assistance is also being offered to other countries in the region (see www.usaid.gov/keywords/adaptation_initiative.cfm).

Finally, within the South Asia region, as technical assistance is increasingly being made available to India from sources like the International Monetary Fund, the World Bank and ADB as well as from select Annex 1 countries, there is increasing likelihood that India, under its commitments to the South Asian Association for Regional Cooperation (SAARC), will make these technologies available for free use by its LDC neighbours.

7. Regional and international collaboration

Association of Southeast Asian Nations (ASEAN)

In October 2009, the ASEAN Member State Ministers of Environment formed the ASEAN Working Group on Climate Change. The Working Group aims to promote closer regional cooperation and a more effective regional response to climate change (Lim 2009). Ministers also agreed to adopt the Singapore Resolution on Environmental Sustainability and Climate Change, affirming commitments to collaborate on a number of subregional issues related to forests and climate change (ASEAN 2009c). Key areas include reducing fires and trans-boundary haze, promoting sustainable forest management, combating illegal logging and associated trade and promoting peatland conservation and rehabilitation. The Agriculture Industries and Natural Resources Division is the focal point for forests and climate change at the ASEAN Secretariat. Other key areas in which ASEAN addresses forestry and climate change include: forestry and food security, knowledge-sharing, community forestry, illegal logging, and trade and REDD (ASEAN 2008, 2009b).

ASEAN Plus Three (APT)

Together, agriculture and forestry comprise one of the 20 areas in which cooperation between ASEAN Member States, China, Japan and Republic of Korea is being pursued within the APT forum. While collaborations to date have focused mainly on enhancing food security, climate change and promotion of environmentally sound technology are indicated to be key focal points of environmental cooperation under the ATP. Whether or not studies undertaken as part of the preparation of the East Asian Free Trade Agreement have adequately considered how to prevent or mitigate possible social and environmental consequences of increased subregional trade is not yet clear (ASEAN 2009a).

Greater Mekong Subregion (GMS)

GMS Core Environment Program (CEP) (2006-2015): To ensure economic development in the GMS that is environmentally sustainable, in 2005, the governments of Cambodia, China, Lao PDR, Myanmar, Thailand and Viet Nam established the GMS CEP, and its flagship component, the Biodiversity Conservation Corridors Initiative (BCI). ADB provides support for this ten-year programme. The Core Environment Program (CEP) is implemented by the Environment Operations Center, established in Bangkok, in 2006, with responsibilities for programme and project implementation and development; it provides expert knowledge and resources for governments and agencies in the region (ADB 2007). The CEP-BCI seeks to counter the increasing degradation and fragmentation of important natural areas and ecological systems, seeking to guarantee the region's ecological health by establishing land area economies of scale.

GMS Strategic Framework: A ten-year strategic framework for collaboration between the six GMS countries²⁵ was initiated in 2002 and supported by ADB. Work under the Strategic Framework has focused on enhancing private sector development and improving the subregion's competitiveness. The programme has been less successful in reducing poverty and mitigating the potential negative impacts of increased subregional connectivity (Goswami 2009). A mid-term review of the GMS Strategic Framework conducted in 2007 calls for a more balanced approach that "maximizes benefits and minimizes costs". Climate change is recognized within the Framework as one of many threats to economic growth, rather than a possible negative outcome of certain approaches to conducting trade and achieving economic growth (ADB 2007).

Pacific Islands Forum (PIF)

As early as 2000, the Pacific Islands Forum (PIF) had already established its Regional Forestry Programme to serve as a focal point for strengthening nationwide programmes for sustainable land use and forest management in the region. Its main objectives related to adaptation-mitigation are strengthening national capacity for sustainable forest management and promoting agroforestry,

²⁵ Includes Cambodia, China, Lao PDR, Myanmar, Thailand and Viet Nam.

biodiversity conservation and traditional forest-related knowledge, as well as community participation in the protection and utilization of watersheds.²⁶ In 2008, the PIF endorsed the Niue Declaration, the region's first declaration on climate change. Among many resolutions adopted, the Declaration committed PIF members to the fight against climate change and its human security impacts within a regional environment, with calls for international assistance.

South Asian Association for Regional Collaboration (SAARC)

A major subregional milestone in the field of climate change was the adoption of the SAARC Action Plan on Climate Change at the 15th SAARC Summit in August 2008 in Colombo. The 2008 Action Plan seeks to identify and create opportunities for climate change mitigation and adaptation activities achievable through regional cooperation and South-South support. The action plan also seeks to support the global negotiation process of the UNFCCC through a common understanding that would effectively reflect the concerns of the SAARC member states.

The South Asian Cooperative Environment Programme (SACEP)

Based in Colombo, SACEP is an intergovernmental organization that aims to promote and support protection, management and enhancement of the environment in the subregion through regional partnerships and collaboration. SACEP has decided to establish a South Asia Forum for Climate Change Challenges to Flora in South Asia to support and guide the development of regional and local strategic plans. This Forum will help develop strategies for addressing floral vulnerability to climate change through adaptation and promote research in its mitigation through carbon sequestration and storage in flora (SACEP, 2008).²⁷

²⁶ www.spc.int/forestry/

²⁷ www.sacep.org/html/docs_newsletter.htm

8. Summary and issues for consideration

The Asia-Pacific region is rich in diversity. This applies to the range of ecosystems and forest types covered, the governance systems and accompanying assortment of legal and regulatory instruments in place, the land-use systems employed and the wide range of cultures and traditional practices contained within the region. The region as a whole has the potential either to contribute to mitigating global climate change or, conversely, to accelerate deforestation and forest degradation, thus deepening the global threat. Despite the perceived failure of COP15 in Copenhagen to produce a globally acceptable post-Kyoto Protocol agreement for climate change management, important foundations have been laid. Most notably, there is broad consensus among Asia-Pacific countries that REDD should be incorporated in any future global agreement and that such a mechanism must address forest degradation and ensure social and environmental sustainability.

Over the past two decades the forest cover in the Asia-Pacific region has risen by about 0.7 million hectares due mainly to large-scale afforestation and reforestation in China, India and Viet Nam, but primary forests in many areas of the Asia-Pacific region are declining rapidly. The two main drivers of forest degradation in the region are rural poverty and weak forest governance. Poverty, in terms of low income, lack of access to alternative fuel sources and few employment opportunities, leads to continuing widespread dependence on fuelwood collection to sustain rural livelihoods. Over a third of the biomass removed from forests in the region is used for energy. Weak forest governance is manifested in the continuing failure to address illegal logging and forest conversion, despite legislation to control these practices being in the statute books in nearly all countries of the region over the past 20 years. Unclear land tenure and user rights often form a backdrop to the poor record of forest law enforcement and continuing degradation. There is a lack of direct accountability of law enforcement agents to the resources they are bound to protect: Less than one-quarter of forest resources is currently under formal ownership of, or management by, indigenous peoples or local communities.

The region, already the most populous in the world, is rapidly approaching the 4 billion mark, currently on target to reach this number before 2020. Increasing industrialization, urbanization and wealth put substantial demands on the forest resources; demands that are increasingly at odds with the needs of forest-dependent communities. An estimated 200 million people depend on NWFPs for income and subsistence.

Forests have the potential to contribute significantly to climate change strategies in the Asia-Pacific region, if management strategies are designed to be flexible and responsive to change. This will best be achieved by the expansion of community-based approaches to forest management. Mangrove ecosystems are particularly important to promote resilience of coastal zones and communities to rising sea levels, but such ecosystems are themselves highly vulnerable to climate change due to intense commercial pressure for conversion of these areas and the limited room for expansion.

REDD has attracted interest from a number of countries in the region, due to the prospect of significant new revenue streams for the forest sector. The mechanism has the potential to provide much-needed incentives to national governments for long overdue forest governance reforms. Strategies for avoiding deforestation would depend upon the drivers of deforestation in each context. Broad mitigation strategies for REDD include strengthening existing policy and legislation for forest protection, renegotiating commercial timber concessions, modification of agriculture and infrastructure programmes to reduce pressure on forests and implementation of economic incentives and sanctions for promotion of sustainable forest management. A particular opportunity in the Asia-Pacific region is the restoration of degraded peatlands, the destruction of which is the source of more than two-thirds of all anthropogenic emissions in Southeast Asia. However, restoration may be hampered by the high opportunity costs of foregoing quick economic returns from planting oil palms on drained peatlands.

Households that burn wood and biomass fuels would benefit most from interventions to improve efficient use of fuelwood, but special funding and targeted programmes will be required to ensure that the poor can acquire and benefit from new fuel-efficient technologies and sources of cheap, renewable and accessible fuel.

Other key issues to promote the successful contribution of the forest sector to strategies for addressing damaging climate change in the Asia-Pacific region include:

Involve local communities, indigenous peoples and local stakeholders: Local people and institutions should be rewarded for actions to improve forest management so that illegal logging, forest degradation and encroachment are deterred and carbon sequestration is enhanced. There is vast potential for such schemes to be implemented in community-owned forests or in forests that are used by communities.

Integrate adaptation and mitigation strategies: Adaptation and mitigation have conceptually been treated as separate but there are definite synergies between the two, particularly under the LULUCF sector, that need to be explored.

Harmonize economic and forest policies: In many countries, national strategies to promote forest-based mitigation of and adaptation to climate change, such as increasing forest cover and quality and supporting participatory forest management, are in conflict with strategies for national economic growth. These strategies need to be streamlined.

Develop policy through practical experience: Many pilot efforts on PES, REDD, community forestry, and other sustainable forest management strategies need to be undertaken and their experiences incorporated within decision-making and the development of national programmes.

Increase technical knowledge on sustainable forest management: There is a continuous need to promote the basic principles of sustainable forest management through forestry training institutions and services. Forestry is still treated in many countries as a static discipline but the uncertainties generated by climate change mean that assumptions must constantly be reviewed to ensure that forest managers and users have the basic skills necessary to implement practices in keeping with ecological and social sustainability.

Though beset with problems, the region will benefit from a long history of successful international collaboration. Technologically advanced countries in the region including Australia, Japan and New Zealand are willing to share resources and knowledge with other countries in the neighbourhood. The continued rise of developing economies with a similar propensity for cooperation such as China, India, Malaysia and Thailand, among others, gives hope for a robust, rapid, coordinated and appropriate response to the challenges of anthropogenic climate change.

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Annex 1: Overview of the role of forests in climate change strategies, national adaptation programmes of action (NAPAs) and other climate change initiatives

Afghanistan

NAPA/Other Adaptation Plan: NAPA submitted to the UNFCCC in September 2009.

Other Climate Change Initiatives: Green Afghanistan Initiative (GAIN): The government, supported by the United Nations, has initiated a number of steps to deal with climate change including the recently launched GAIN supported primarily by FAO, with the prime objective of putting in place relevant long-term policies and strategies (GAIN 2005).

Australia

Climate Change Strategy: The Carbon Pollution Reduction Scheme to be initiated in 2011 is intended to deliver carbon reduction targets and prepare the economy for the future and protect the environment.

NAPA/Other Adaptation Plan: Australia prepared its National Climate Change Adaptation Framework in April 2007 at the request of the Council of Australian Governments. It serves to guide decision-makers in government, business and communities to understand and incorporate climate change adaptation into policy and operational decisions. In the medium-term goal of five to seven years, the framework seeks to build Australia's capacity to deal with climate change impacts and reduce vulnerability in key sectors like commercial forestry. This has given birth to the National Climate Change and Commercial Forestry Action Plan (2009-2012):

www.climatechange.gov.au/government/initiatives/national-climate-change-adaptation-framework.aspx.

Other Climate Change Initiatives: International Forest Carbon Initiative: AUD200 million fund for REDD projects in developing countries. Through the Initiative, Australia aims to help build capacity and provide momentum for the REDD financial mechanism by fostering useful lessons in existing forest carbon initiatives. Current partners include Indonesia and Papua New Guinea: www.climatechange.gov.au/government/initiatives/international-forest-carbon-initiative.aspx

Bangladesh

Climate Change Strategy: The Bangladesh Climate Change Strategy and Action Plan (MOEF 2008) prioritizes adaptation in the short to medium term. Core objectives include food security, social security and health; disaster management; infrastructure development; research and knowledge management; mitigation and low carbon development; and capacity building and institutional development.

Forestry is included under mitigation and low carbon development through expansion of the social forestry programmes on to state-owned community lands and expanding the green belt along the coast with mangrove planting along shorelines (MOEF 2008).

NAPA/Other Adaptation Plan: The strategic goal and objective of Bangladesh's NAPA are to reduce the adverse effects of climate change including variability and extreme events such as the frequency of cyclones, while promoting sustainable development. The plan suggests appropriate coping mechanisms and recognizes the importance of community involvement in these projects.

Bhutan

Climate Change Strategy: Strategizing Climate Change for Bhutan aims to expand community forest management from 6 percent of forest lands by 2013 to 20 percent in the long run.

NAPA/Other Adaptation Plan: Bhutan's NAPA, completed in 2006, promotes community-based forest fire management and prevention through institutionalization and implementation of forest fire management systems at village levels (NEC 2006)

Brunei Darussalam

Other Climate Change Initiatives: Heart of Borneo Initiative: A commitment signed in 2007 between Indonesia, Brunei and Malaysia to sustainably manage 22 million hectares of forest on Kalimantan. Supported by the World Wide Fund for Nature (WWF).

Cambodia

NAPA/Other Adaptation Plan: Cambodia's NAPA prioritizes the water resources sector. Mention of the role of forestry in adaptation efforts is brief. Specified forest-based measures include community agroforestry in deforested watersheds and coastal areas, and the replanting and restoration of mangrove forests (MOE 2006).

Other Climate Change Initiatives: REDD Pilot Project in Oddar Meanchey Province: The Oddar Meanchey REDD project (OM-REDD) was introduced by the Forestry Administration (FA) in December 2007 and is being implemented in collaboration with the Clinton Climate Initiative, Community Forestry International (CFI), Terra Global Capital and PACT. OM-REDD is expected to generate offset credits equal to 8 million tonnes of CO₂ over the course of the project's 30-year lifespan. The project involves 13 community forests (50 villages, over 66 000 hectares), as beneficiaries of REDD revenues.

REDD Pilot Project in Mondulkiri Province: Cambodia's second REDD project, introduced in 2002, covers 187 698 hectares of the Seima Biodiversity Conservation Area (SBCA), one of the most important biodiversity hotspots in Cambodia and home to the indigenous Bunong minority. The project was developed by the Wildlife Conservation Society (WCS). It is expected to be an important demonstration of how REDD benefits can be shared with local people: www.wcscambodia.org/saving-wild-places/seima-forest/seima-protection-forest-declared.html

UN-REDD Observer Country: Provides access to networking and knowledge sharing through the UN-REDD Programme's online community of practice. Observer countries can also participate in global and regional workshops and have official observer status at UN- REDD Policy Board meetings.

China

Climate Change Strategy: China's National Climate Change Programme (NCCP) was introduced in 2007.²⁸ A key component of the CNCCP is a nationwide tree-planting and afforestation campaign, as well as the introduction of new efforts to 'enhance ecology restoration and protection' (Wang *et al* 2010).²⁹ In early 2010 the government announced to the UNFCCC that it aims to increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic metres by 2020 from the 2005 levels, as a core element of its climate change strategy.³⁰

Key forestry programmes to combat climate change under the NCCP are:³¹ the Natural Forest Protection Program (NFPP); the Conversion of Cropland to Forest Program (CCFP); the

²⁸ en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf China's National Climate Change Programme, National Development and Reform Commission, People's Republic of China, June 2007.

²⁹ en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf China's National Climate Change Programme, National Development and Reform Commission, People's Republic of China, June 2007.

³⁰ unfccc.int/files/meetings/application/pdf/chinaaccord_app2.pdf, January 2010 Letter from China Department of Climate Change to the UNFCCC.

³¹ en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf, China's National Climate Change Programme, National Development and Reform Commission, People's Republic of China, June 2007.

Sandification Control Program for areas in the vicinity of Beijing and Tianjin; the Key Shelterbelt Development Program in the northern, middle and lower reaches of the Yangtze River; and the Wildlife Conservation & Nature Reserve Development Program.

Other Climate Change Initiatives: China Green Carbon Fund (CGCF): Established in 2007, this fund taps into voluntary carbon markets and local willingness to support carbon offsetting, also mediated through the China Carbon Trade Web site: www.chinacarbontrade.com.cn/

China Climate Change Info-Net: Government-run Web site providing climate change information for the general public: www.ccchina.gov.cn/cn/index.asp

Clean Development Mechanism (CDM):

- 2005 – The first CDM forest carbon project registered under Kyoto Protocol regulations was implemented in the Pearl River Watershed in Guangxi.³²
- 2009 – A small-scale CDM forestry project approved in Sichuan Province. Claims to be the first forest carbon project to deliver community and biodiversity benefits as well.³³

Monitoring regime for measuring carbon credits from the China Green Carbon Fund Carbon Credit Afforestation: Currently being developed.

Second National Communication to the UNFCCC: A programme with the Chinese Government and UNDP is currently underway to prepare China's Second National Communication to the UNFCCC. This will involve documentation and analysis of all emissions data from 2005, including data from LULUCF.³⁴ The project was launched in March 2009.

India

Climate Change Strategy: India's National Action Plan on Climate Change (NAPCC), developed by the Prime Minister's Council on Climate Change (PMCCC), is aimed at achieving national growth objectives through measures that enhance climate change mitigation and adaptation. A mission approach has been adopted with eight sectoral national missions with the National Missions for Green India and for Sustaining the Himalayan Ecosystem at the core (PMCCC 2008). Under the Green India Mission, it is proposed to reforest/afforest 6 million hectares of degraded lands that would then sequester 3 million tonnes of carbon (11 million tonnes of CO₂) annually (Kishwan *et al.* 2009). The national goal is to bring the area under forest and tree cover to 33 percent of the total area. An initial corpus of US\$1 300 million has been earmarked for the programme which will then be scaled-up by leveraging more funds.

NAPA/Other Adaptation Plan: India's NAPCC places high importance on adaptation and seeks to protect the poor and vulnerable sections of society through an inclusive and sustainable development strategy.

Indonesia

Climate Change Strategy: Indonesia currently has a National Action Plan (NAP) for climate change, which is intended to guide various institutions in carrying out coordinated and integrated efforts to tackle climate change. The eventual National Climate Change Strategy (NCCS) is still being developed, and is intended to form Indonesia's national response in the absence of a binding global agreement on climate change.

³² Developing carbon sequestration forestry for mitigating climate change: practice and management of carbon sequestration forestry in China. By Wang Xiaoping, January 2010.

³³ www.chinacsr.com/en/2009/11/27/6669-sichuan-forest-carbon-sink-project-successfully-registered-at-unfccc/, Sichuan Forest Carbon Sink Project successfully registered at the UNFCCC, November 2009.

³⁴ www.ccchina.gov.cn/WebSite/CCChina/UpFile/File324.pdf, China's inventory of GHG emissions from LULUCF sector – terms of reference, Government of the People's Republic of China and United Nations Development Programme, December 2008; and www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=19074, Enabling China to prepare its second national communication to the UNFCCC, Climate Change Info-Net.

It is expected that forests will play a key role in the NCCS and Indonesia's overall mitigation strategy. Several mitigation strategies outlined in the existing NAP include:

- Prevention of illegal logging;
- Improved fire management;
- Forest and land rehabilitation in order to increase carbon absorption capacity and storage;
- Forest conservation, to enhance resilience to climate-related events;
- Expansion of plantation forests to increase carbon absorption capacity.

NAPA/Other Adaptation Plan: The NAPA acknowledges that conservation of forests will help Indonesia adapt to climate change, as forests provide valuable environmental services such as watershed protection, buffering against landslides, tsunamis and natural disasters, and providing resources and products to communities that enhance livelihoods and resilience.

Other Climate Change Initiatives: Norway-Indonesia REDD+ Partnership: Norway and Indonesia entered into a partnership in May 2010 to support Indonesia's efforts to reduce GHG emissions from deforestation and degradation of forests and peatlands. Norway will support these efforts with up to US\$1 billion based on Indonesia's performance, over the next seven to eight years.

Berau Forest Carbon Partnership: The Nature Conservancy has been working in Berau District of East Kalimantan on a pilot forest carbon partnership that TNC intends to be used as model for future REDD pilot efforts in Indonesia (TNC 2010).

GTZ Kalimantan REDD Project: The Government of Germany has pledged €27 million for a demonstration REDD project in three districts in Kalimantan: Kapuas Hulu, Malinau and Berau. Supported by GTZ, the project started in January 2010 and will continue until 2016.

Heart of Borneo Initiative: A commitment signed in 2007 between Indonesia, Brunei and Malaysia to sustainably manage 22 million hectares of forest on Kalimantan. Supported by WWF.

Indonesia-Australia Forest Carbon Partnership: The partnership fosters strategic policy dialogue on climate change, increases Indonesia's carbon accounting capacity and identifies and implements incentive-based demonstration activities. Through this partnership, Australia offers Indonesia access to data and expertise for use in forest inventory and carbon accounting systems.

Indonesia-Germany Cooperation: Forests and Climate Change Program: assets.wwfid.panda.org/downloads/district_germany.pdf

ITTO REDD Project in East Java: The International Tropical Timber Organization (ITTO) is funding a four-year project in the Meru Betiri National Park of East Java. The project will enhance forest carbon stocks through enhanced community participation in conservation and management, which are threatened by deforestation from illegal logging and encroachment. The project also aims to improve the livelihoods of local communities living inside the park by involving them in activities to avoid deforestation, degradation and biodiversity loss (ITTO 2009).

Jambi REDD Project: One of two Australian Government funded efforts, this A\$30 million project will be located in communal forests in Jambi Province on the island of Sumatra.

Kalimantan Forests and Climate Partnership: Funded by the Australian Government through the Indonesia-Australia Forest Carbon Partnership, this project was one of the first REDD demonstration activities. Located in Central Kalimantan, this project aims to prevent the deforestation of up to 70 000 hectares of Kalimantan's peatland forests while rehabilitating 200 000 hectares of degraded peat.

Leuser Ecosystem REDD Project – Aceh: This 2 million hectare REDD project in southern Aceh's Leuser ecosystem is being operated by Global Eco-Rescue, a private developer, in cooperation with the Government of Aceh: www.eco-rescue.com/files/leuser-project-overview.pdf

Reducing Emissions from Deforestation caused by the Oil Palm Sector in West Kalimantan: Fauna and Flora International's (FFI) second major REDD project in Indonesia aims to develop a REDD demonstration activity to reduce emissions from forest conversion caused by the oil-palm sector in the districts of Ketapang and Kapuas Hulu, West Kalimantan. This project is supported by the David and Lucile Packard Foundation (FFI 2010a).

Reducing Carbon Emissions from Deforestation in the Ulu Masen Ecosystem: Operated by FFI, with support from the Rainforest Alliance and Carbon Conservation International, this project

aims to reduce deforestation in the 750 000 hectare Ulu Masen ecosystem by 85 percent. It is projected to generate 3.3 million carbon credits annually, the revenues of which will go towards protecting the forest's biodiversity and supporting local communities (FFI 2010b).

UN-REDD Programme: The UN-REDD Programme in Indonesia has recently launched its 'quick-start' programme and has identified priorities for its work in Indonesia. It has identified the island of Sulawesi as its focal area.

Japan

Climate Change Strategy: Japan's climate change strategy focuses primarily on potential to reduce emissions through technological innovation in industry and changes to domestic energy and fuel consumption.³⁵

However, forestry has featured in Japan's climate change strategy through implementation of new forest management activities for a 'Low Carbon Society'.³⁶ These include: a six-year forest thinning promotion project (from 2007 to 2012); an Integrated Domestic Market of Emissions Trading scheme; and an Offsetting Credit scheme. The government intends to increase the use of locally-harvested wood for housing and utilization of biomass for energy.

Other Climate Change Initiatives: **Bilateral Support:** The Japanese Government supports sustainable forest management in several Asia-Pacific countries through its development arm, Japan International Cooperation Agency (JICA), e.g. the Forest Strategy 2020 Implementation Promotion Project (FSIP) in Lao PDR.

Center for Mountainous Area Revitalization: Will support issuance of carbon credits to forest owners and managers as a result of changed forest management activities. It will provide funding and technical assistance for forest management projects.³⁷

Climate Investment Fund and Cool Earth Partnership: Japan provides support to both initiatives, designed to assist developing countries to achieve emissions reductions, including through REDD (e.g. Indonesia).

Japan Center for Climate Change Actions (JCCCA): Aims to raise public awareness on climate change. The Center's Web site provides a timeline of policy change in relation to climate change in Japan.³⁸

Montreal Process: Participant. Focused on supporting sustainable forest management, especially in Asia.

Lao PDR

Climate Change Strategy: The Climate Change Office within the Water Resources and Environment Administration (WREA) is leading the development of Lao PDR's National Climate Change Strategy (NCCS). In May 2008 a National Steering Committee on Climate Change was established (by PM Decree 40) to develop the NCCS.

The Department of Forestry (DOF) has provided input for the NCCS. WREA and DOF coordinate on matters affecting forests and agriculture through the national REDD Task Force in order to strengthen climate change planning in Lao PDR (Clarke *et al.* 2010; Trockenbrodt 2010).

NAPA/Other Adaptation Plan: In May 2009, WREA launched Lao PDR's NAPA in collaboration with UNDP. Forestry is one of four sectors identified as being directly and severely affected by climate change. The 'priority one' adaptation needs for forests include: 1) continuing the slash-and-burn eradication and permanent job creation programmes and 2) strengthening capacity of village forestry volunteers in planting and management of village forests (WREA 2009).

³⁵ www.mofa.go.jp/POLICY/environment/warm/cop/initiative0905.pdf, Climate Change Initiative 2009.

³⁶ www.rinya.maff.go.jp/j/kikaku/hakusyo/20hakusho/pdf/20_e.pdf, Annual report on trends in forest and forestry, Forestry Agency, fiscal year 2008.

³⁷ www.rinya.maff.go.jp/j/kikaku/hakusyo/20hakusho/pdf/20_e.pdf, Annual report on trends in forest and forestry, Forestry Agency, fiscal year 2008.

³⁸ JCCCA Web site: www.jccca.org/content/view/1133/695/

Improving the Resilience of the Agriculture Sector in Lao PDR to Climate Change Impacts is the first Least Developed Country Fund (LDCF)-supported project to begin NAPA implementation. The project aims to minimize food insecurity resulting from climate change and reduce farmers' vulnerability to extreme flooding and droughts (GEF 2009).

Other Climate Change Initiatives: FCPF Readiness Mechanism: Lao PDR has received US\$200 000 from the FCPF for the development of its Readiness Preparation Proposal (R-PP). The R-PP will form the basis of an eventual national REDD strategy, which will be further guided and informed with inputs from REDD projects and pilot sites (Troockenbrodt, 2008).

Lao-German Climate Protection through Avoided Deforestation (CliPAD) Program: Initiated in January 2010 under the Technical Cooperation Module which contributes to the implementation of national strategies on forest conservation, climate change mitigation and poverty reduction. It supports the objectives of the Lao Forestry Strategy 2020 and the REDD R-PP. The focus of the CliPAD programme is on forests in and near nationally protected areas under acute or potential threat from destruction or land-use conversion combined with high GHG reduction potential and particular significance for species protection and water management in the region (MAF 2010).

Participatory Land and Forest Management Project for Reducing Deforestation: Aims to introduce a system for reducing deforestation in Northern Laos through consolidating the Community Support Program Tool (CSPT) which was used for supporting means of livelihoods in a sustainable manner as an alternative measure to stabilizing shifting cultivation within the FORCOM project (MAF 2010).

Program for Forest Resource Information Management in Lao PDR: A programme planned to improve Lao PDR's forest information management system with a view to contributing to sustainable forest and land management, as well as to mitigate climate change through establishing the ability for development and management of forest base maps using plural satellite information. Supported by JICA (MAF 2010).

Resource Center for Natural Resources and Climate Change: The Resource Center for Natural Resources and Climate Change at the National University of Laos' (NUoL) Faculty of Forestry was created in February 2010. Its aim is to meet growing demand from policy-makers for high quality information to inform climate change planning. The Resource Center is still in the process of securing funding required for full operation, and also plans to support additional research on natural resources and climate change issues once established.

Sustainable Forestry and Rural Development Project (SUFORD): Initiated in 2003, the overall goal of the project is to implement participatory sustainable forest management in natural production forests across the country. In its second phase, SUFORD has begun to review funding options and sources for REDD, and has conducted a series of test studies on carbon monitoring. SUFORD is financed by the Government of Finland and the World Bank (MAF 2010).

Wildlife Conservation Society (WCS) subnational REDD projects: WCS is working with the government to develop management plans for the Nam Et Phou Loey National Protected Area in Bolikhamxay Province. This includes the Nam Kading National Protected Area, under the Program of Work for Protected Areas. The projects will include assessing feasibility of subnational voluntary carbon market projects as sources of sustainable financing, while reducing deforestation and degradation, conserving biodiversity and improving local livelihoods (MAF 2010).

Maldives

Climate Change Strategy: The Third National Environment Action Plan, which lays down the current policies and priorities, identifies the protection of natural vegetation and ecological communities in the islands as an important target to be achieved between 2009 and 2013. Through this plan, the Maldives seeks to become a resilient island nation, with rich ecosystems, and a carbon neutral nation.

NAPA/Other Adaptation Plan: Completed in 2007, the Maldives' NAPA aims to present a coherent framework to climate change adaptation that enhances the resilience of natural, human and social systems and ensures their sustainability in the face of predicted climate hazards.

Myanmar

NAPA/Other Adaptation Plan: Myanmar's NAPA is being prepared with financial support from the LDCF and UNEP. A Biodiversity and Forest working group led by the Academy of Forestry Science is one of six working groups involved in the process (Htwe 2009, GEF 2007).

Other Climate Change Initiatives: Community Small Scale Reforestation Project in Mangrove Forest of Ayarwaddy Delta in Myanmar: This small-scale afforestation/reforestation CDM project is being formulated, with the objective of rehabilitating mangrove forests to mitigate climate change, conserve biodiversity and support the livelihoods of local communities (Kyaw and San 2009).

Nepal

NAPA/Other Adaptation Plan: Nepal's NAPA is being prepared by the Ministry of Science, Environment and Technology (MoEST). Nepal is lagging behind (41 out of 48 LDCs) in its NAPA preparation. This is due in part to a shortage of dedicated experts and scientific data. Forests and biodiversity are one of five key thematic areas on which climate change impacts will be assessed and adaptation measures recommended. Tourism, gender and infrastructure will cut across these themes

Other Climate Change Initiatives: FCPF Readiness Mechanism: Nepal has received US\$200 000 for the preparation of its FCPF Readiness Plan. This is being led by the Ministry of Forest and Soil Conservation (MFSC) with inputs from the government-civil society organization composed REDD Working Group.

Forest Carbon Early Action Pilot Project in Dang, Banke and Bardiya Districts: Carbon financing study in Nepal under the Forest Carbon Early Action Pilot Project–WWF (Nepal) and Winrock International: www.winrock.org.np/news/forestcarbon.php

Multistakeholder REDD Working Group: Focused on raising awareness about REDD and discussing Nepal's national position on REDD. Chaired by the Secretary of the MFSC, under the multisectoral/stakeholder REDD & Climate Coordination Committee. Supported by the World Bank.

Reducing Carbon Emissions through Community-managed Forests in the Himalayas: As part of a five-year international study, the International Centre for Integrated Mountain Development and Nepal's National Trust for Nature Conservation have trained communities to conduct carbon measurements in three regions of Nepal. The project successfully demonstrated that community-based carbon measurement, in accordance with IPCC standards, is feasible and can be used by communities to quantify their carbon sequestration levels in exchange for potential REDD payments. Additionally, the measurements revealed that significant amounts of carbon are being stored effectively as a result of sustainable forest management by CFUGs.

UN-REDD Observer Country: Provides access to networking and knowledge sharing through the UN-REDD Programme's online community of practice. Observer countries can also participate in global and regional workshops and have official observer status at UN-REDD Policy Board meetings.

New Zealand

Other Climate Change Initiatives: Permanent Forest Sinks Initiative (PSFI): Aims to give landowners sink credits in proportion to the carbon sequestered by their forests, binding through a 50-year contract. PSFI is expected to have wide-ranging benefits to land management in surpassing topics beyond climate-change.

Pakistan

Climate Change Strategy: The Pakistan State of Environment Report (2005) lists forestry and land-use sectors, accounting for 7 percent of CO₂ emissions, as important for mitigation of climate

change. Other strategic options include reforestation and protection of coniferous forests, plantations on low productivity agricultural lands, watershed plantations and reforestation of riverine forests (PEPA 2005).

NAPA/Other Adaptation Plan: Pakistan has sought assistance from the UNFCCC in conducting an assessment of its technological and financial needs for adaptation to climate change. The report is expected to be completed by mid-2010.

Republic of Korea

Climate Change Strategy: Since 1999 Republic of Korea has prepared National Climate Change Action plans every three years. The plans encompass three areas: (i) reduction of GHG emissions; (ii) adaptation to climate change; and (iii) international cooperation.³⁹

Singapore

Climate Change Strategy: The Singapore National Climate Change Strategy (NCCS) was completed in 2008. The National Climate Change Strategy (NCCS) offers little to no mention of investment in forest carbon as an offset strategy for Singapore, as Singapore, not being an Annex I country, is not obligated to reduce emissions. It does offer support for enhancing carbon sink potential of forests in the region. Specifically it supports efforts to preserve and restore carbon sinks through international, regional, bilateral and national platforms (MEWR 2008).

Other Climate Change Initiatives: ASEAN Agreement on Transboundary Haze Pollution: Entered into force in November 2003, with all ASEAN nations as signatories except for Indonesia and the Philippines. This binding Agreement requires parties to cooperate in developing and implementing measures to prevent and monitor transboundary haze pollution resulting from land and forest fires.

Sri Lanka

Climate Change Strategy: The Caring for the Environment (CFE) 2003-2007 Path to Sustainable Development recognizes the importance of the forestry sector with regard to climate change and proposes a number of strategies including: adoption of conservation and sustainable resource use, participatory approaches to forest management, recognition of local people as stakeholders, demarcation of forest boundaries, strengthening of timber production, propagation of non-timber species and promotion of agroforestry (Keller 2009).

Other Climate Change Initiatives: Climate Change Enabling Activity Phase II Project Report

UN-REDD Observer Country: Provides access to networking and knowledge sharing through the UN-REDD Programme's online community of practice. Observer countries can also participate in global and regional workshops and have official observer status at UN-REDD policy board meetings.

Thailand

Climate Change Strategy: Thailand completed a first draft of its National Climate Change Master Plan (2010-2019) in early 2009. The draft is now being reviewed internally among selected stakeholders.

The Public Policy Study Institute at Chiang Mai University was commissioned by the Office of Natural Resources and Environmental Policy and Planning (ONEP) and the Ministry of Natural Resources and Environment (MNRE) to draft the Master Plan with support from GTZ.

³⁹ Ilyoung, Oh. 2008. Status of the climate change policies in South Korea. EKC2008 Proceedings of the EU-Korea Conference on Science and Technology, Volume 124, pp. 485-493.

Other Climate Change Initiatives: Concepts and Appropriate Models for REDD for Sustainable and Just Forest Management in Thailand: The project involving a study of the interactions between local ecosystems, economies and livelihoods as well as local people's awareness, understanding and conceptions of REDD in areas where it may potentially be applied. The project also attempts to identify an effective REDD model for sustainable and equitable management of forest resources that is suitable in the Thai context. Implementation led by RECOFTC's Thailand Program is ongoing with support from the Thailand Research Fund.

FCPF Readiness Mechanism: Thailand's R-PIN was approved in March 2009. In February 2010, Thailand signed an agreement with the World Bank for US\$200 000 to continue readiness work in Thailand under the FCPF. The National Parks, Wildlife and Plant Conservation Department (DNP) under the Ministry of Natural Resources and Environment (MONRE) is now in the process of seeking additional inputs from a wider range of stakeholders to further inform the R-PIN.

Global Warming Forum (GFO): An informal multistakeholder forum for sharing information about climate change. The GFO is coordinated jointly by the Good Governance for Social Development Institute (GSEI) and the Thailand Research Fund.

Thai Working Group for Climate Justice: A civil society forum that brings together NGOs, academia and existing forestry and agriculture networks in Thailand, to discuss climate change developments and issues and advocate local community and indigenous rights.

Timor-Leste

Climate Change Strategy: The National Adaptation Plan of Action and an Initial National Communication plan are the starting points for initiating capacity building for climate change mitigation and adaptation.

Other Climate Change Initiatives: The Pacific Climate Change Science Program (US\$20 million, 2009 to 2011) is targeting Pacific island countries and East Timor to better prepare for the impacts of climate change.

Australia is investing AUS\$150 million over three years from 2008-2009 to meet high priority climate change adaptation needs in vulnerable countries in our region. Timor-Leste is one of the priority countries.

Viet Nam

Climate Change Strategy: Viet Nam's National Target Program (NTP) to respond to climate change was approved by the Prime Minister in December 2008. The NTP was prepared by an interministerial national steering committee to respond to climate change. This committee was led by the Ministry of Natural Resources and Environment (MONRE). In June 2009 MONRE released Climate Change, Sea Level Rise Scenarios for Vietnam. The scenarios it outlines are expected to serve as guidelines for ministries, agencies and local authorities in the design of their individual plans.

The NTP mandates relevant authorities including the Ministry of Agriculture and Rural Development (MARD), the ministry responsible for forest management as well as REDD, to assess sector-specific impacts and vulnerabilities, develop and implement plans of action and mainstream climate change within programmes and plans by 2015. As part of its own action plan, MARD is tasked with proposing "measures to develop protective forests (upstream forests and coastal forests) in accordance with climate change scenarios".

Other Climate Change Initiatives: Clean Development Mechanism (CDM): The Cao Phong Afforestation/Reforestation (A/R) CDM project is the first of its kind in Viet Nam, approved by the CDM Executive Board in 2008. Located west of Hanoi, the project aims to reforest just over 300 hectares of hilly terrain and provide income to local people through timber and carbon sales. The project has received technical support from JICA and financial support from Honda Vietnam.

FCPF REDD Readiness Mechanism: Viet Nam is now preparing to draft its R-PP for submission to the FCPF. The R-PP is a plan for REDD implementation in Viet Nam and will inform the development of Viet Nam's national REDD programme.

NGO Climate Change Working Group (CCWG): The CCWG is a network including both Vietnamese and international NGOs that facilitates information sharing, capacity building and coordination in relation to climate change responses. In particular, the CCWG has sought to support UNFCCC negotiators, inform national REDD planning with local perspectives and support the government in development of methods and strategies to implement pro-poor REDD: www.ngocentre.org.vn/ccwg

Payment for Forest Environmental Services (PFES) Pilot in Lam Dong: Since 2008 the Asia Regional Biodiversity Conservation Program (ARBCP) has been supporting Lam Dong Province to implement Viet Nam's policy on pilot PFES and supporting MARD to develop a national PFES policy informed by pilot implementation. The project aims to increase funding available for poverty reduction policies by channeling funds from users (e.g. hydropower plants, businesses downstream and ecotourism companies) to poor communities in forested areas. A site in the Da Nhim Watershed basin was recently established to pilot forest-based carbon offsetting and other climate change activities including working with MARD to develop a systematic response to enable farmers and forest managers to adapt: www.arbcp.com

Vietnamese NGOs & Climate Change: VNGOs & CC is a network of 70 national NGOs that aims to build local civil society groups' capacity to effectively integrate climate change adaptation and mitigation into existing and future work: www.srd.org.vn.

Annex 2: Forest policies, laws and institutions relevant to addressing climate change, issues and options

Afghanistan

Key Policies and Laws Relevant to Climate Change and Forests

The Environmental Law (2007): Provides a framework for the sustainable use, rehabilitation and conservation of Afghanistan's natural resources.

Environment Act (2005): Afghanistan's first environmental law, it provides the Afghan Government legal powers to protect its environment. Specifies administrative roles at the national level and coordination mechanisms with provincial authorities. Provides the framework for managing and conserving natural resources, biodiversity, drinking water, control of pollution, environmental education and tools for enforcement.

Institutions

The Committee for Environmental Coordination (2007): Established under Section 10 of the Environment Law 2007 with the objective of integration and coordination of environmental issues and the principles set out in the Environment Law 2007.

The National Environmental Advisory Council (2007): Established under Section 11 of the Environment Law 2007 with the purpose of advising NEPA on environmental matters of national public importance.

The Subnational Environmental Advisory Council (2007): Established under Section 12 of the Environment Law 2007 to advise provinces on environmental matters of local public importance.

National Environment Protection Agency (NEPA) (2005): Serves as the central environmental policy-making and regulatory institution in Afghanistan. Regulates, coordinates, monitors and enforces environmental laws for the benefit of all Afghan citizens.

Sources: Qazi (2008); UNEP (2009); www.afghan-web.com/environment/nepa.html

Australia

Key Policies and Laws Relevant to Climate Change and Forests

National Climate Change and Commercial Forestry Action Plan (2009-2012): Born out of Australia's National Climate Change Adaptation Framework (2007), it covers commercial tree plantations, wood production from native forests and processing facilities relying on raw material from production forests such as sawmills, papermills and board plants.

National Principles Related to Wood Production in Plantations (1996): Set the framework for scientifically-based sound plantation management subscribed to by all Australian states and territories.

Plantations for Australia – The 2020 Vision (1997): A strategic partnership between Australian governments and timber plantation and processing industries, agreed in 1997 and revised in 2002. Promotes an improved regional and comprehensive planning approach, enabling legislation, investor confidence, stakeholder engagement and identification of environmental services.

National Forest Policy Statement (NFPS) (1992): Forms the core policy of Australia's forest sector. Guides land and resource management in Australia, usually implemented at the state or territory level. All states and territories have respective legislation emanating from the NFPS to ensure conservation and sustainable forest management.

Regional Forest Agreements (RFAs): Frameworks for regionwide forest management in Australia. An RFA is a 20-year-long binding agreement between the Commonwealth and state

governments for a comprehensive, adequate and representative reserve system for the long-term conservation of native forests and sustainable management of commercial forests by forest-based industries and forest-dependent communities.

Institutions

Department of Climate Change and Energy Efficiency: Established on 8 March 2010 (previously the Department of Climate Change established in January 2007).

ANU Centre for Climate Law and Policy (CCLP): The world's first legal research centre devoted to climate change is hosted by the Australian National University (ANU). The ANU CCLP was established in response to a growing awareness of the legal dimensions of global warming.

Sources: DAFF (2006); www.climatechange.gov.au/

Bangladesh

Key Policies and Laws Relevant to Climate Change and Forests

The Environment Conservation Rules (1997): Provide guidelines on declaring an area as ecologically critical, on vehicles emitting smoke injurious to health and otherwise harmful pollution or degradation of the environment.

The Bangladesh Environment Conservation Act (1995): Legislates the conservation of environmental systems, improvement of environmental standards and control and mitigation and provides a framework for its implementation.

National Forest Policy (1994): The first National Forest Policy was adopted in 1979 with the objective of greater protection and conservation of the country's forest assets while developing its rural and industrial economies. The current forest policy, introduced in 1994, represents the first shift towards recognition of the importance of people's participation in forestry and sustainable development.

National Environment Policy (NEP) (1992): Formulated to enhance protection and sustainable management of the environment. The objectives of the Policy include maintaining ecological balance while simultaneously supporting national development and actively engaging in international environmental initiatives.

National Environment Management Action Plan (1992): Aims to promote better management of scarce resources and reverse trends of environmental degradation by building upon the general principles stated in the 1992 National Environment Policy and proposing concrete actions and interventions in a number of priority areas.

The Forest Act (1927): Provides for the constitution of Reserved Forests, Village Forests, Protected Forests and control over non-government forest land. It provides for the collection of duties on timber and other forest produce, control on the transportation of timber and other forest products, collection of drift and stranded timber, penalties and procedures, and the roles of forestry officers.

Sources: MOEF (1995, 1997, 2008)

Bhutan

Key Policies and Laws Relevant to Climate Change and Forests

National Environment Protection Act (2007): Provides for the establishment of an effective system for the conservation and protection of the environment through the National Environment Commission so as to manage and promote sustainable development in a just and equitable fashion.

Biodiversity Act (2003): Seeks to ensure the conservation and sustainable use of biological and genetic resources and promote equitable sharing of benefits.

Biodiversity Action Plan for Bhutan (2002): Outlines the status of biodiversity and describes the actions to be taken by the country to ensure the conservation and sustainable use of its biodiversity.

Environment Assessment Act (2000): Provides for the assessment of potential impacts of development planning, policies, programmes and projects on nature and the enforcement of measures to reduce adverse impacts and encourage sustainable environmental development.

Forest and Nature Conservation Act (1995): Provides for the protection and sustainable use of forests, wildlife and related natural resources for the benefit of present and future generations.

National Forest Policy (1991): Seeks to promote sustainable forest management, biodiversity conservation, participatory forestry, watershed management and forest-based industries and other cross-cutting objectives.

Institutions

National Environment Commission (NEC): The highest institution in Bhutan responsible for dealing with national climate change issues.

The Bhutan Trust Fund for Environmental Conservation (BTF): Created in 1991, it has set aside a reserve for strengthening forest management.

Sources: NEC (2006) : www.bhutantrustfund.bt/

Brunei

Key Policies and Laws Relevant to Climate Change and Forests

Forest Act (1934, amended in 1984. Revisions also completed in 2003): Provides legal basis for forest administration and management. Also prohibits persons from starting forest fires that endanger natural resources, property and human life.

Fifth National Development Plan (NDP): Brunei's National Development Plans have progressively included more provisions for forest protection and conservation. The Fifth NDP was the first plan to introduce forest conservation and protection policies, designating national forests as conservation, protection and production forests.

Ninth National Development Plan (2007-2012): Continued to provide for conservation and protection of Brunei's forest resources, but at the same time to move towards enhancing the GDP contribution of the forestry sector.

Section 277A of the Emergency Order (Penal Code Amendment, 1998): Prohibits open burning during dry seasons and prolonged drought, and imposes fines on open burning offences.

Institutions

Department of Environment, Parks and Recreation, Ministry of Development.

Policy, Legal and Institutional Issues

Forest Fire Management: There is a need for improved capacity to prevent and respond to forest fires, which are a major source of Brunei's carbon emissions.

Transboundary Haze Pollution: Forest fires from Kalimantan, Indonesia also cause problems with haze in Brunei.

Cambodia

Key Policies and Laws Relevant to Climate Change and Forests

Decision Number 699 (2008): Approves the Oddar Meanchey REDD (OM-REDD) pilot project endorsed by the Prime Minister on 26 May 2008. Designates the Forestry Administration as the seller of forest carbon, with support from Community Forestry International (CFI) outlined in an MOU. Further decides that carbon revenues from the OM-REDD project will be used to: 1) improve forest management; 2) provide maximum benefits to local communities that participate in the project; 3) support studies of potential sites for new REDD projects in Cambodia, and requires that revenues from the REDD project are channeled through the Technical Working Group on Forestry and the Environment (TWGF&E) for the first five years of the project. This policy has been a critical factor in the OM-REDD project's success.

Sub-decree Number 188 (2008): Designates the Forestry Administration as the responsible agency for assessing national forest carbon stocks, executing and regulating forest carbon trading and sales of forest carbon credits.

Rectangular Strategy for Growth, Employment, Equity and Efficiency – Phase II (2008): Cambodia's central national policy that guides its development. Emphasizes sustainable development and poverty reduction to be achieved through good governance and economic growth. Calls for enhancing management efficiency of reserved forests and ensuring their appropriate protection and development. Identifies climate change as a threat to growth and commits the government to take steps to address climate change under the section on forestry reform.

Sub-Decree on Community Forestry (2003): Indicates a shift from informal community forestry projects to the emergence of community forestry as a national strategy that is formally recognized and embraced by the government. A subdecree regulating timber and NWFPs permitted to be imported or exported was introduced in 2006. A further subdecree on granting user rights to cultivate plantations within state forests was issued in 2008. It sets out rules for granting rights to plant trees; however it does not include sustainable forest management guidelines.

Forestry Law (2002): The major legal instrument for the sector, defining forest land classifications, management systems, enforcement, fiscal and other regulatory mechanisms.

National Biodiversity Strategy and Action Plan (2002): Aims to ensure that benefits of sustainable biological resource use contribute to poverty reduction and improved quality of life for all Cambodians. Goals and actions for the forestry sector are to “ensure the sustainable protection, use and management of all wild plant, tree species and woodlands” and “improve the efficiency and sustainability of extraction, processing and use of forest products”.

Land Law (2001): Sets out a comprehensive system of land classification and landownership rights. Includes important provisions on social and economic land concessions (ELCs), indigenous land rights, land registration and land dispute resolution. Authorizes the enactment of a series of other subdecrees and legislation.

REDD Readiness Roadmap: The Cambodian Government is in the process of developing a national REDD Readiness Roadmap that is due to be completed in May 2010. It anticipated that this will be undertaken by an informal REDD working group led by the Forestry Administration, which includes representatives from key line agencies (e.g. the Ministry of Environment [MOE], the Fisheries Administration and the Ministry of Land Management, Urban Planning and Construction, development partners and civil society groups and reports to both the TWGF&E (the main forum for review by government and development partners) and the National Climate Change Committee (NCCC).

Institutions

Climate Change Office (within the Ministry of Environment): In June 2003, the MOE established a separate office called the Cambodia Climate Change Office or CCCO as cited in its declaration No.195 dated 23 June 2003. This office is responsible for all activities related to climate change.

Forestry Administration (FA): Responsible for forests, with the exception of protected areas and flooded forests. Responsible for REDD-related activities in Cambodia (e.g. a designated seller of carbon – see above).

National Climate Change Committee (NCCC): A high-level interministerial body that coordinates climate-related dialogue, including issues related to REDD such as carbon credit policy. The NCCC is chaired by the Minister of Environment and includes representation from 19 ministries. The Secretary of State of the Ministry of Agriculture, Forests and Fisheries (MAFF) is one of the NCCC's three vice-chairpersons.⁴⁰ Support for the NCCC is provided by UNDP, Danida, Oxfam and SIDA.

Technical Working Group on Forestry and the Environment (TWGF&E): A mechanism for government-donor coordination for supporting and strengthening development activities within forestry and the environment. The TWGF&E includes members from the FA; MAFF; MoE;

⁴⁰ The others being the Secretary of State of the Ministry of Industry, Mines and Energy and the Secretary of State of the Ministry of Water Resources and Meteorology.

Ministry of Economy and Finance; Ministry of Land Management, Urban Planning and Construction; Ministry of Industry, Mines and Energy; Ministry of Commerce; and Ministry of National Defense; also includes development partners, civil society groups and NGOs. The TWGF&E can also be called on to advise the FA on the sale of forest carbon as necessary (ref. Decision 699).

Forestry, Climate Change and Innovative Financing Group: Created under the TWGF&E to support the FA's work on REDD and the CDM.

Sources: Bradley (2009); RGC (2008); MOE (2006).

China

Key Policies and Laws Relevant to Climate Change and Forests

Emissions Trading (2005-2010): Early signs of an emissions trading policy and associated institutions have emerged. For example, in 2008 a formal emissions trading scheme for trade in sulphur dioxide emissions permits was launched, in collaboration with the Chicago Climate Exchange. In addition, the Tianjin City Government has initiated the sale of carbon credits that result from energy efficiency improvement projects through the voluntary market. These initiatives are expected to form the basis of a national emissions trading scheme to reduce GHG emissions.

China's Forestry Action Plan to Deal with Climate Change (2009): Establishes a framework for forestry activities that contribute to climate change mitigation and provides strong political and technical support for further development of carbon sequestration forestry. Includes a goal of increasing forest cover to 26 percent by 2050. The Plan has been created, but not implemented yet.

Central Committee and State Council Decision on Promoting Stable Agricultural Development and Continuously Increasing Income for Farmers (2009): Explicitly includes carbon sequestration forestry as a livelihood activity for farmers.

China's Action Program to Deal with Climate Change (2007): Established simultaneously with the National Leading Group on Climate Change (NLGCC), headed by Premier Wen Jiabao, China's National Climate Change Program was the first to be established by a developing country.

New Countryside Development Initiative (NCDI) (2006): Calls for more assistance to rural areas, stronger property rights and a more favourable policy environment for the rural poor (has direct implications for afforestation measures).

Statement on Measures for Operation and Management of Clean Development Mechanism (CDM) Projects (2005): Guides implementation of CDM projects.

Program of Action for Sustainable Development in China in the Early 21st Century (2003). Sets forth a long-term national planning agenda and strategy for action. Related to climate change is the objective to enhance public awareness on the subject, improve legislation on the management and protection of key natural resources, including the further development and adoption of innovative technologies such as advanced information processing and remote-sensing technology.

Resolution on the Development of Forestry (No. 9 Policy) (2003): Guides China's forest sector reforms. China has been undergoing reform to forest use rights and forest tenure over the last decade. In particular, the policy of Collective Forest Reform has been underway since 2000, but it was formalized in 2008. The aim of the reforms is to achieve privatization of forest use rights, which will be allocated either to individual households, small groups of households (called partnerships) or private companies. Only the forest use rights are to be privatized – not the land rights.

Tree Planting Initiative (2000): Involves payments to farmers in PES-like contracts. This ongoing initiative is supported by massive investment, reaching US\$59 billion by 2015.

Logging Ban (1998): Bans logging in both public and communally-held forests. In 2000, the ban was formalized through the establishment of 'public benefit forest' areas. The Forest Ecosystem Compensation Program (FECP) was also introduced in 2000 to compensate forest

owners for income lost due to the ban. The FECP has been implemented in 30 percent of all collective forests.

Forest Law of the People's Republic of China (adopted in 1984 and revised in 1998): Enacted to protect, cultivate and rationally utilize forest resources, as well as accelerate rates of afforestation and provide value to the watershed services provided by forests.

China's Agenda 21 – A White Paper on Population, Environment and Development in the 21st Century (1994): The government identified this as the beginning of its efforts to combat climate change and to achieve sustainable development.

Institutions

State Forestry Administration of China: Includes such departments and offices as: The Afforestation Department; The Carbon Management Office in the State Forestry Administration – Responsible for CDM forest carbon projects and China National Forestry Economics Development Research Center.

China Ministry of Finance: CDM Fund Management Center.

The Beijing Forest Carbon Administration

National Development and Reform Commission (NDRC): Responsible for energy planning and legislation and the National Action Plan to Deal with Climate Change (2007).

National Coordination Committee on Climate Change (NCCCC): Established in 2001. Comprises 17 ministries and agencies. Responsible for coordination of climate change policies and measures.

State Development Planning Commission: Prepares communications to the UNFCCC.

Development Research Centre of the State Council, International Cooperation Department: State-sponsored think tank responsible for policy writing and research, including work on climate change.

China Green Foundation: Co-founder of the China Green Carbon Fund.

Sources: State Forestry Administration (SFA) (2005, 2009).

Democratic People's Republic of Korea

Key Policies and Laws Relevant to Climate Change and Forests

Law on the Forest of DPRK (1992): Implements the state policy on forests by establishing rules for the creation, management and protection of all classes of forests and forest resources. Includes provisions on plans for the planting of trees, forest fire prevention, soil erosion control and proper management of commercial logging.

Cabinet Decision No. 57. Protection and Control Regulations of the Forest (1972): Aims to enhance forest productivity and its function for environmental protection, together with land and water protection, through the establishment and conservation of forests.

Cabinet Decision No. 86. Regulation on Forest Management (1972): Similar to the above in scope.

Sources: UNEP (2003).

India

Key Policies and Laws Relevant to Climate Change and Forests

Forest Rights Act (2006): Under this Act, ownership rights over forest lands that were being farmed by tribal or forest dwellers as of 13 December 2005, limited to 4 hectares, are granted to those who primarily reside in forests and who depend on forests and forest lands for their livelihoods.

National Environment Policy (2006): Objectives are conservation of critical environmental resources, intra- and intergenerational equity of use, integration of environmental concerns in economic and social development, efficiency in environmental resource use,

environmental governance and enhancement of resources for environmental conservation. The policy also covers climate change issues in its strategy and action plan.

State/Union Territory Minor Forest Produce (Ownership of Forest Dependent Community) Act (2005): Provides rights to minor forest produce to forest-dependent communities, including tribals, living in and around these forests.

Biological Diversity Act (2002): Formulated to conserve biological diversity, promote sustainable usage of components of biodiversity and the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

The Wild Life (Protection) Amendment Act, 2002: Provides for the protection of wild animals, birds and plants and related measures to protect the ecological and environmental security of India.

National Forestry Action Programme (1999): Identifies issues underlying the major challenges facing the forestry sector in line with the National Forest Policy (1988) and suggests strategies and an action plan to bring one-third area of the country under forest/tree cover and to arrest deforestation with the aim of achieving sustainable forest management.

Environmental Action Programme (1993): This programme was launched as a mechanism to assess and develop the environmental context in India, to analyse the existing environmental policies and programmes, to improve environmental services and incorporate environmental considerations into development programmes, and to identify organizational strengths in order to strengthen environmental management and incorporate strategic planning.

National Forest Policy (1988): The central objectives of this policy are to: maintain environmental stability; conserve natural heritage; increase forest cover substantially; meet the requirements for fuelwood, fodder, minor forest products and small timber of rural and tribal populations; increase the productivity of forests to meet essential national needs; encourage efficient utilization of forest products and streamline the active involvement of women in achieving these objectives; and minimize pressure on the country's existing forests.

Environment Protection Act (1986): An umbrella Act which seeks to ensure environmental stability and maintenance of the ecological balance including atmospheric integrity. It seeks to strengthen mechanisms for the protection and rehabilitation of the environment and related functions. It provides an independent check on the system of environmental management and the performance of public authorities working on environmental matters.

The Forest Conservation Act (1980): Regulates the diversions of forests for non-forestry purposes and has been a key tool for forest conservation in India ever since its enactment in 1980.

The Wildlife Protection Act (1972): Formulated to establish wildlife sanctuaries and national parks as well as to effectively control poaching and illegal trade in wildlife and its derivatives.

The Indian Forest Act (1927): Identifies different categories of forests such as reserve and protected forest and their protection and management.

Sources: MoEF (1993, 2010a); envfor.nic.in/nfap/

Indonesia

Key Policies and Laws Relevant to Climate Change and Forests

National Forest Policy (1990): Primarily seeks to guide forestry activities in supporting national development.

National Action Plan on Reduction of Disaster Risk (2007): Seeks to reduce risk factors that cause disaster, including those related to the environment and natural resources such as climate change. The Indonesian Government recognizes it is necessary to link this plan with climate change adaptation activities.

Basic Agrarian Law of 1960: This foundational law established a system of land rights, with the limiting condition that use of these rights would not be contrary to national interests. By establishing the pre-eminence of national interests, this law allowed the government to overrule local claims to landownership and award permits to timber and oil-palm companies.

1999 Forestry Law: In this revision of the 1967 Forestry Law, which originally established the state's authority over forest areas, the 1999 law created three categories of forests: conservation, protection or production. The Law mentions sustainable forest management and allows limited use of protection and production forests to communities living in and around forests.

REDD Regulations: Ministry of Forestry Regulation 68/2008 on REDD Demonstration Activities. This regulation outlines permission and approval procedures for REDD demonstration activities, so that REDD methodologies, technologies and institutions are practical and possible to evaluate.

Ministry of Forestry Regulation 30/2009 on Procedures for REDD: Regulates procedures on the implementation of REDD including requirements that should be fulfilled by developers, verification and certifications, and terms and conditions of REDD's implementing bodies.

Ministry of Forestry Decision 36/2009 on Procedures for the Granting of Utilization of Carbon Sequestration or Sinks in Production Forest and Protected Forest: Regulates the permission procedures of REDD projects through carbon sequestration and storage. It includes revenue sharing, application, collection, depositing and utilization procedures of revenues from REDD projects.

Presidential Instruction No. 4/2005 on Illegal Logging: Calls for accelerating the elimination of illegal tree cutting in forest areas throughout Indonesia – which would result in reduced emissions from illegal logging.

Presidential Instruction No. 2/2007 concerning Revitalization and Rehabilitation of Sustainable Peat Land: Provides for the reversion of approximately 1.1 million hectares of former peatland to its natural state.

Government Regulation No. 4/2001 on Environmental Damage Control and or Environmental Pollution Related with Forest and Land Fire: Forbids all kinds of forest and land fires and stipulates cooperation with other Southeast Asian Countries on formulating ASEAN national and regional haze action plans and related technical programmes.

Institutions

National Council on Climate Change (Presidential Regulation No. 46/2008): This high-level council was created in recognition of the need for high-level coordination of climate change issues. It is chaired by the President and its membership consists of ministers from relevant ministries.

Ministry of Forestry: Formulates REDD policies, coordinates REDD programmes. Also hosts the Research and Development Agency (FORDA).

Ministry of National Development Planning: Coordinates development planning in all sectors in order to achieve national development objectives.

Indonesia Forest Climate Alliance (IFCA): Study group formed in 2007, consisting of ministry experts, and researchers from national and international institutions. The group was tasked with analysing how a REDD scheme can work as a practical carbon emission reduction mechanism.

National Working Group on REDD: Consisting of representatives from relevant sectors and stakeholders, the group will be tasked to oversee REDD implementation.

National Commission on the CDM: Established in 2005, within its first two years of work, the commission had approved 24 CDM project proposals, nine of which were registered by the UNFCCC.

Japan

Key Policies and Laws Relevant to Climate Change and Forests

Domestic Emissions Trading Scheme (pending): Efforts are currently underway to develop a domestic emissions trading scheme which will include carbon credits from forestry.

Japan Climate Change Initiative (2009): States that action will be taken to: provide assistance to developing countries for transfer of energy efficient technology, especially through the CDM; conduct global climate change monitoring, e.g. through the Climate Change Impacts Monitoring and Assessment Network (CCIMAN); provide leadership and capacity building at the

Asia-Pacific level to tackle climate change, e.g. through creation of the Asia-Pacific Network of Global Change Research (APN); conduct awareness-raising campaigns on climate change; and help tackle illegal logging in timber-producing nations.

Action Plan for Achieving a Low-Carbon Society (2008): In order to halve global GHG emissions by 2050 with the aim of achieving a low-carbon society, it is essential that all countries, not only the major economies, address this issue. Japan sets the long-term goal of reducing 60 to 80 percent of its current level of emissions by 2050.

Climate Change Policy Law (2002): Approves ratification of the Kyoto Protocol. The Kyoto Protocol came into force in Japan 2005. This was followed by a Kyoto Target Achievement Plan in 2008.

Law on Promoting Green Purchasing (2000): Attempts to regulate timber imports to combat illegal and unsustainable logging in the region. Implementation started in 2006.

Law for 'Promotion of Measures to Cope with Global Warming (1999): The law was designed in response to the COP3 meeting in Kyoto, and prescribes actions for national and local governments, industry and citizens.

Global Warming Prevention Headquarters: Established inside the Cabinet for implementation of the Kyoto Protocol.

Institutions

Ministry of Agriculture Forestry and Fisheries: Its Forestry Agency is responsible for developing and implementing forest management activities for reduced emissions and carbon sequestration.

Ministry of Environment: Responsible for policy development and implementation, especially regarding climate change impacts and adaptation measures.

Ministry of Foreign Affairs: Responsible for leading climate change negotiations internationally.

Sources: www.mofa.go.jp/policy/environment/warm/cop/index.html. (accessed 18/08/2010)

Lao PDR

Key Policies and Laws Relevant to Climate Change and Forests

Forest Strategy 2020 (FS 2020): Official document guiding development of the forestry sector in accordance with national socio-economic development plans and environmental conservation measures. Basis for formulation of annual and medium-term forestry-related work plans of both the government and cooperation programmes and projects. FS 2020 identifies the following policy areas as requiring continued effort: national land policy and land-use planning; village-based natural resource management for poverty eradication; sustainable participatory management and processing of NWFPs; improved performance of the timber- and wood-processing industries; and temporary and permanent closure of forest lands for conservation purposes.

Forestry Law (2007): In 2007 was amended as part of the government's wider effort to reduce deforestation and forest degradation. The amended law includes new provisions to discourage conversion of natural forests and reduce illegal logging. Relevant changes include reducing the natural forest conversion area from 10 000 to 1 000 hectares; increasing the degraded forest area allocated for plantation development from 3-100 hectares to 10-500 hectares; establishing principles concerning plantation concessions for prohibiting log and lumber export; prohibiting logging permit issuance at the provincial level; and clarifying responsibilities and mandates for the Department of Forest Inspection.

PM Order No. 9 (2007): Provides clear guidelines for the development of villages and village clusters, including for definition, financing and land-use planning.

PM Order No. 30 (2007): Sets out clearer, stricter measures to control logging and wood processing than the preceding PM Decision No. 25. PM Order No. 30 calls for strong coordination between relevant central and local government agencies in order to improve the effectiveness of

forestry conservation for financial development and reduce dependence on revenue generated from forest exploitation in the context of financial development activities.

PM Decree N° 59 on Sustainable Management of Production Forest (2002): In addition to providing for delineation of production forest and management planning, acknowledges the participation of villages in all aspects of production forest management.

NLMA Instruction No. 546: Provides collective ownership and land titling of village use forest and commonly used agriculture areas. Together with implementation of new land and forest use planning and allocation, it aims to provide for a clearer and more secured resource base for community management of these forest lands.

Ministry of Agriculture and Forestry Regulation on Village Forest Management (2001): Consolidates existing provisions concerning village forests such as classification of village forest, and harvesting of logs for housing and social welfare construction activities. Collection of NWFPs for sale is also recognized for the first time, with the condition that management plans are formed and approved.

Institutions

Department of Forestry (DOF): Responsible for guiding development of the national REDD strategy.

Department of Forest Inspection (DOFI): The DOFI was created under the MAF in January 2008 with a mandate to investigate forest crimes, file charges and make arrests. The current forest law enforcement strategy mentions REDD, and the DOF is currently planning specific training on REDD awareness and the DOFI's potential role.

Forest Inventory and Planning Division (FIPD): A Forest Resource Information Management Centre has been set up under the FIPD with support from the Japanese Government. The Centre is expected to produce a national baseline for REDD, as well as to provide much-needed equipment, capacity building and training for Lao staff in close collaboration with the National Forest Inventory design (Clarke 2010). The FIPD is under the DOF.

Government of Lao PDR-Donor Sub-working Group on Forestry (FSWG): Established at the Joint Working Group on Agriculture, Rural Development and Natural Resources Management in February 2006 in order to enhance coordination between the government and donors as well as between donors in the forestry sector.

National Land Management Authority (NLMA): The NLMA is responsible for land planning in Lao PDR. This includes monitoring concessions and plantation development, though information on concessions is generally lacking. The NLMA is represented in the REDD Task Force and other examples of coordination between the two agencies are listed in Lao PDR's FCPF Readiness Plan Idea Note (R-PIN).

REDD Task Force: Interministerial body to coordinate, facilitate, support and provide strategic direction for REDD activities that support the national strategy.

REDD Working Group: A smaller group including the REDD Focal Point in the DOF, the Director of FIPD and three international advisors from Finland and Japan (who fund Lao PDR's two largest forest initiatives). Supports the REDD Task Force through activities such as setting agendas, arranging workshops and meetings, and providing supporting documentation to donors.

Sources: MAF - LPDR (2007); DOF (2008); Tong (2009); Clarke (2010).

Malaysia

Key Policies and Laws Relevant to Climate Change and Forests

Environmental Quality Act 1994: Provides for the protection and enhancement of environmental quality in all segments of the environment as well as control and prevention of pollution: faolex.fao.org/docs/pdf/mal13278.pdf

National Forestry Act: Fundamental forest legislation of Peninsular Malaysia which forms the basis for forest classification and management, including the determination of permanent forest estates: www.agc.gov.my/agc/Akta/Vol.%207/Act%20313.pdf

Sabah Forest Enactment of 1968: Provides for the creation of forest reserves, their use and management as well as for control of cutting and removal of forest produce from publicly owned land which is not a forest reserve: www.forest.sabah.gov.my/policies/legislation.asp

Sarawak Forest Ordinance of 1958: www.sarawakforestry.com/htm/aboutus.html

Kuala Lumpur Declaration on Environment and Development 1992: Malaysian declaration which upheld the principles of sustainable development, recognizing the responsibility of developed countries for the deterioration of the environment on the one hand while also underscoring the need for sustained economic growth and development of developing countries: www.cbd.int/doc/ref/cop-07/cop-07-md-01-en.pdf

National Environmental Policy 2002: Integrates the three elements of sustainable development: economic, social and environmental protection as a framework for continuing Malaysia's economic, social and cultural progress and enhancement of quality of life through environmentally sound principles and sustainable development: www.doe.gov.my/en/content/national-policy-environment

National Policy on Biological Diversity 1998: Aims to conserve Malaysia's rich biodiversity premised on the principles, among others, that conservation ethics are deeply-rooted in the religious and cultural values of Malaysians and that biodiversity is a natural heritage which should be managed sustainably for society and future generations: www.arbec.com.my/NBP.pdf

Maldives

Key Policies and Laws Relevant to Climate Change and Forests

Maldives National Strategy for Sustainable Development (2009): This strategy was formulated with the vision that the country should become carbon neutral by 2020. One of its seven goals is to support climate change adaptation through urban tree planting and sustainable forestry production.

Third National Environment Action Plan (2009): The Third National Environment Action Plan provides the policy framework for carrying out environmental management in the Maldives. Apart from protecting coral reefs and human inhabited areas from the risk of rising sea level as a result of climate change, the Plan identifies the protection of natural vegetation and ecological communities in the islands as important targets to be achieved between 2009 and 2013. Also, the Plan seeks to regulate felling of mature trees by 2010.

The State of Environment Report (2004): The report is aimed at making environmental information easily accessible to all stakeholders and addresses five key environmental issues of climate change and sea-level rise, freshwater resources, waste management, air pollution and biodiversity conservation.

National Biodiversity Strategy and Action Plan of the Maldives (2002): Calls for the development and adoption of policies and a legal framework as well as codes of practices for the sustainable use of timber resources in the country and the implementation of ecosystem rehabilitation programmes like agroforestry and reforestation. The plan also ensures the conservation of endemic wetland plants and mangrove species through the creation of botanical gardens and national parks.

Environmental Protection and Preservation Act of Maldives: Seeks to protect the natural features and environment of the Maldives from pollution and establishes a regulatory framework for their protection.

Sources: Ministry of Home Affairs, Housing and the Environment (2002); MHTE (2009).

Mongolia

Key Policies and Laws Relevant to Climate Change and Forests

Revised National Forest Policy (2001): Aims to modernize the forestry sector. Specifically, to prevent deforestation and desertification, modernize wood-processing techniques, maintain ecological balance, develop institutional capacity and support technology transfer and research extension.

National Forestry Programme (1998): Responds to the growing need for better forest management in a market economy context. Provides the framework for the state policy on forestry and identified major objectives toward sustainable forest resource management. It was reviewed in 2001.

The Law on Forest Fire Prevention and Control (1996): Details requirements for setting up protection measures against forest fires both at local and central levels of government.

Law on Fees for Forest Harvesting (1995): Regulates fees for harvest of forest timber and fuelwood by citizens, economic entities and organizations, and procedures for payment of associated fees.

Law of Forest (1995): Emphasizes protection, proper utilization and use-categorization of forests. Bans clear-cutting, decentralizes logging quotas and classifies forests into strictly protected forest (8.4 million hectares), protected forest (7.9 million hectares) and utilization forest (1.2 million hectares).

Constitution (1992): States that the land, forest, flora and fauna and other natural resources are commonly owned by Mongolian citizens and shall enjoy state protection and as well as ownership, a theme that can be traced to earlier legislation on natural resources reaching back to 1921.

Myanmar

Key Policies and Laws Relevant to Climate Change and Forests

Myanmar Forest Policy (1995): Provides the basis for laws and rules pertaining to forest exploitation and preservation, and the development and capacity building of supporting institutions. The Myanmar Forest Policy identifies among others the following priority areas: protection of soil, water, wildlife, biodiversity and the environment; sustainability of forest resources for present and future generations; basic needs of the people for fuel, shelter, food and recreation; and participation of people in the conservation and use of forests.

Myanmar Forest Act (1992): Myanmar's central forest law. Based on the previous Burma Forest Act (1902), the current law establishes the implementation of forest policy nationally and policies regarding environmental preservation, the promotion of public participation, supporting the population's basic needs including domestic fuel needs as well as the meeting of international commitments related to the environment and forest policy. The Myanmar Forest Act provides the Forest Department with additional law enforcement measures to manage forest resources.

Forest Rules (1995): Released in 1995 to guide forest management in accordance with the Myanmar Forest Act and in harmony with the Myanmar Forest Policy.

Myanmar Agenda 21: Developed following the 1992 World Earth Summit in Rio de Janeiro as an instrument to implement the Myanmar Forest Policy in accordance with both the socio-economic and ecological values of forests. Myanmar Agenda 21 identifies the following five priority programme areas:

- Accelerating sustainable development of forest resources;
- Developing the forestry sector to meet basic needs;
- Promoting efficiency in the production of forestry goods and services;
- Strengthening forestry policy, legislation and institutions;
- Enhancing people's participation in forestry development and management.

National Forest Master Plan (2001): Establishes the forestry context in Myanmar between 2001/2002 and 2030/2031. Includes a wide range of activities to achieve the objectives of sustainable harvesting of high-value teak, preventing forest degradation, conservation and increased earnings from export of value-added products.

National Code of Practice for Forest Harvesting (1998): Introduced in 1998 to guide sustainable forest management.

Community Forestry Instructions: Issued by the Forest Department in 1995 to promote community participation in forestry. Around 600 agreements have been signed with communities throughout the country.

The Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994): Guides implementation of policies on protecting wild flora and fauna and natural areas to fulfil international convention obligations and enable research. The rules to implement the law were released in 2002.

Institutions

Ministry of Forestry: Oversees forest management and provides guidance to the following bodies: the Forest Department, the Myanmar Timber Enterprise, the Dry Zone Greening Department, the Planning and Statistics Department, the Institute of Forestry, the National Commission for Environmental Affairs (NCEA).

Sources: FAO (2009b); Thaug (2009); Htwe (2009).

New Zealand

Key Policies and Laws Relevant to Climate Change and Forests

Emissions Trading Scheme (2009): Introduces a price on GHGs to provide an incentive for people to reduce emissions and enhance forest sinks.

Carbon Monitoring System (2004): Aims to advance New Zealand's reporting commitments under the UNFCCC to the Kyoto Protocol and to provide a framework for national-scale biodiversity reporting for indigenous forests and shrublands.

Climate Change Response Act (2002): Sets the legal framework to allow New Zealand to ratify the Kyoto Protocol and meet its obligations under the UNFCCC.

Resource Management Act (RMA) (1991): New Zealand's principal law for land management, soil, water, air resources, the coast and pollution control. It is primarily implemented by local governments.

Conservation Act (1987): Requires the Department of Conservation to develop conservation management strategies for the integrated management of natural and historic resources, including the Crown-owned indigenous forests.

Forestry Rights Registration Act (1983): Provides for the creation of forestry rights by the proprietor of land to establish, maintain and harvest a crop of trees on the land.

Forests Act (1949): Promotes sustainable management of indigenous forest, mostly applicable to private lands. Required the registration of sawmilling of indigenous timber; also that logs for milling were sourced from government-approved certificates of title.

Sources: MAF - NZ (2007)

Nepal

Key Policies and Laws Relevant to Climate Change and Forests

Collaborative Forest Management Guideline (2003): The Ministry of Forest and Soil Conservation approved the CFM guidelines as a means to strengthen local stakeholder involvement in forest management.

Leasehold Forest Policy (2002): The policy provides the framework for the management of private forests, and those of community user groups or corporate bodies for purposes such as production of timber, ecotourism, wildlife farming and agroforestry.

Nepal Biodiversity Strategy (2002): Intended to serve as a guide to all government organizations, the private sector and civil society groups for the protection of biological diversity in Nepal. A participatory approach is adopted in the implementation of its action plan; the Nepal Biodiversity Trust Fund has been set up in order to finance and manage the financial aspects of the strategy's implementation.

Revised Forestry Sector Policy (2000): This policy calls for sustainable forest management in the hills and mountains areas with 25 percent of income generated from government-managed forests going to village development committees and district development committees.

Ecologically fragile forests are managed as protected forests with no harvest extracted from them. The policy also provides for the formation of forest user groups in order to encourage community forest management.

Environment Protection Act (1997): Has legal provisions for a clean and healthy environment and to minimize the adverse impacts of environmental degradation on human beings, wildlife, plants, nature and other physical resources. The Act also calls for the protection of the environment through sustainable management of natural resources.

Forest Rules (1995): Provides CFUG status as independent and self-governing entities. The Rules also mandate nationwide expansion of community forestry, providing utilization and management rights to local communities, and establishing a framework of accountability and community development.

Community Forestry Directives (1994): Issued in 1994 to enable community management of state forest resources.

Forest Act (1993): Replaced the previous legal provisions for forest management and ushered in the concept of community ownership and management of forests. The provisions of the Act are executed through the Forest Rules (1995), Private Forest rules (1981), Panchayat Forest Rules (1978), Panchayat Protected Forest Rules (1978) and Leasehold Rules (1978).

Nepal Environment Policy and Action Plan (1993): Developed in response to the United Nations Conference on Environment and Development (UNCED) in 1992; it stipulates an assessment of the country's environmental issues and to provide a multisectoral framework for environmental management.

Master Plan for the Forestry Sector Nepal (1989): Provides a 25-year policy and planning framework for forestry in Nepal. Community and private forestry are the main emphasis.

National Parks and Wildlife Conservation Act (1973): The Act outlines the management of national parks for conserving wildlife and their habitat and regulates hunting of wild animals.

Forest Nationalization Act (1957): Returned the ownership and management of large-scale private forest lands and those areas of common forest lands that had not been already legally recognized as communal lands to the state. Reasserted the government's legal authority over forest and woodlands.

Sources: Department of Forests (DOF) www.dof.gov.np; Department of National Parks and Wildlife Conservation (DNPWC) www.dnpwc.gov.np; Nepal Environmental Policy and Action Plan (NEPAP) 1993 (accessed from www.cleanairinitiative.org/portal/node/1565).

Pakistan

Key Policies and Laws Relevant to Climate Change and Forests

National Environmental Policy (2005): Provides an overall framework and various guidelines to address sectoral and cross-sectoral environmental issues such as: pollution, waste management, forestry, biodiversity, climate change, energy, agriculture, multilateral agreements, poverty, health, population, gender, trade, local governance and natural disaster management. The Policy seeks to protect, conserve and restore Pakistan's environment and improve the life of its citizens through sustainable development.

State of Environment Report (2005): A milestone document for environmental protection in Pakistan. It recognizes the importance of forestry and land use for climate change mitigation and identifies agroforestry as an option with high potential and low costs.

National Forest Policy (2001): Serves as the umbrella policy for guiding federal, provincial and territorial governments in the management of renewable natural resources. It seeks to identify and remove constraints to their sustainable management through the active participation of all the concerned agencies and stakeholders, especially women, children and other vulnerable groups.

Pakistan Environmental Protection Act (1997): This Act provides for the protection, conservation, rehabilitation and improvement of the environment, including the prevention and control of pollution, and promotion of sustainable development approaches. It lays down the framework for the establishment and work plan for the Pakistan Environmental Protection Council

and the Pakistan Environmental Protection Agency, and defines the function and powers of federal and provincial agencies, and the establishment and management of provincial sustainable development funds.

National Conservation Strategy (1992): This strategy seeks to integrate natural resource conservation concerns within all aspects of Pakistan's economic sector. The document proposes conservation of natural resources through sustainable development and improved efficiency in the use and management of natural resources including greater public partnership.

Forest Laws: Forests are largely governed by the provinces and territories under their own specific laws that generally provide for management of forest lands and regulate the removal of forest products from these lands.

Wildlife Laws: Like forestry, wildlife is under the jurisdiction of the provinces, which have their own specific laws for protected areas and the regulation of hunting.

Institutions

Pakistan Environment Protection Agency: Responsible for implementing the Pakistan Environment Protection Act, 1997. As it is attached to the Ministry of Environment (MOE) it also provides technical assistance to the MOE for formulation of environmental policy and programmes.

Technical Committee on Agriculture, Forestry and Livestock: Constituted under the CDM Authority in order to facilitate forestry-related activities in the CDM market.

Pakistan Environmental Protection Council: The Council, set up in 1984, is an apex organization at the national level for formulation and implementation of the national environmental policy and programmes.

Pakistan Environmental Protection Agency: This agency is the Federal Department responsible for the formulation of national policy responses to environmental challenges and implementing the Pakistan Environmental Protection Act.

Sources: www.pakistan.gov.pk; www.environment.gov.pk.

Papua New Guinea

Key Policies and Laws Relevant to Climate Change and Forests

Forestry Act (1991): Established an autonomous Forest Authority replacing the former Department of Forestry. The Act provided tighter controls in acquisition of land for forest management. The Act was given flesh by the succeeding 1991 National Forest Plan and 1993 National Forest Development Guidelines.

Logging Code of Practice (1996): Protects forests against illegal logging and addresses maintenance of forest productivity and the economic viability of forestry sector operations.

Institutions

Office of Climate Change and Environmental Sustainability: Established under the Prime Minister's Office. Partially as a result of PNG's role as the co-chair of the Coalition of Rainforest Nations, the Office was established to undertake domestic action on tackling climate change challenges. Recently however, the Office has been embroiled in a controversy over selling millions of dollars worth of REDD carbon credits to carbon traders without approval in 2009.

Source: www.forestry.gov.pg.

Philippines

Key Policies and Laws Relevant to Climate Change and Forests

Presidential Decree 705. The Revised Forestry Code of the Philippines (1975): Provides the country's fundamental forestry laws and policies; reinforced the use of licence/lease agreements to utilize natural resources.

DENR Administrative Order No. 15-90. Regulations Governing the Utilization, Development and Management of Mangrove Resources (1990): Enacted to sustain optimum

productivity of mangrove resources by conserving, protecting, rehabilitating and developing remaining mangroves, more with corporate collaboration than individual initiatives.

Republic Act No. 7586. National Integrated Protected Areas System Act (1992): Regarded as the main strategy in biodiversity conservation through the establishment of a comprehensive system of integrated protected areas.

Executive Order No. 263. The Community-Based Forest Management Program (1995): Integrated and unified different upland community programmes and projects to ensure the sustainable development of forest land resources.

Republic Act No. 8371. Indigenous People's Rights Act (1997): Recognizes, protects and promotes the rights of indigenous cultural communities to their ancestral domains to ensure economic, social and cultural well-being.

Republic Act No. 7942. Philippine Mining Act (1995): Promotes rational exploration, development, utilization and conservation of all mineral resources.

Republic Act No. 9367. Biofuels Act (2006): Promotes the use of alternative transport fuels.

Administrative Order No. 171. Creation of the Presidential Task Force on Climate Change (PTFCC) (2007): Formation of a task force to address the issue of climate change, mitigate its impacts and lead in adapting to these impacts.

Albay Declaration on Climate Change (2007): Establishes the commitment of local government support to mainstream climate change adaptation within government programmes and activities.

Republic Act 9729. Climate Change Act (2009): Enacted to establish the framework programme for climate change, creating the Climate Change Commission for the mainstreaming of climate change policy within government programmes and activities.

Source: Chan Robles Virtual Law Library, www.chanrobles.com/virtuallibrary1.htm.

Republic of Korea

Key Policies and Laws Relevant to Climate Change and Forests

Low Carbon and Green Growth Movement (2009): Initiative to create 50 000-plus jobs in the forest sector as part of ROK's economic stimulus package.

System of Economic and Environmental Accounting: Currently under development as a strategy for developing a 'green GDP' in 2010. This has led to the economic valuation of the 'public value' of ROK's forests (which includes value of carbon sinks) as 9.7 percent of the GNP in 2000. However, recreational and watershed values were found to be higher than forest carbon values. Nevertheless, such valuation and green accounting efforts pave the way for implementation of PES schemes for forest conservation.

Legislation for a mandatory cap-and-trade scheme for CO₂ emissions from business (2008): Introduced following initial planning in 2002 and pilot projects in 2006. By late 2010 this will lead to a domestic carbon market, with carbon credits available to be purchased through the country's stock exchange. Carbon credits will be generated by renewable energy suppliers and other emissions-reducing projects. A government fund which will be established to encourage and finance such projects. A total of 641 organizations are now involved in the emissions trading scheme, each with its own binding emissions targets.

Second Comprehensive Action Plan on Climate Change (2002-2004): Supports actions indicated in the First Comprehensive Action Plan on Climate Change.

First Comprehensive Action Plan on Climate Change (1999-2001): Outlines implementation of Kyoto measures.

Institutions

National Commission on Sustainable Development (2008): Formed to enforce the Framework Act on Sustainable Development.

Inter-Ministerial Committee on UNFCCC: Established in 1998 and headed by the Prime Minister. This is the primary institution for dealing with climate change. It is composed of specialists and members of various ministries and government agencies as well as the industrial sector, and is responsible for devising and implementing specific UNFCCC measures.

Other relevant departments and committees:

- Special Committee on Countermeasures for Climate Change;
- Presidential Committee on Green Growth;
- Ministry of Agriculture and Forestry;
- Ministry of Environment;
- Environmental Management Corporation;
- Korea Forest Service.

Institutions conducting research on climate change:

- Korea Energy Economics Institute;
- Korea Environment Institute: conducting research into 'green accounting';
- Korea Forest Research Institute;
- Northeast Asian Forest Forum;
- Climate Change Research Center at the Korea Forest Research Institute.

Sources: FAO (2007); Sung-Deuk Choi and Yoon-Seok Chang (2004).

Singapore

Key Policies and Laws Relevant to Climate Change and Forests

National Climate Change Strategy (2008): Outlines Singapore's comprehensive response to climate change. It specifically addresses actions to be taken on mitigation, adaptation, building competencies and participating in international efforts.

National Climate Change Committee: Established in 2001, and expanded in 2006 when Singapore became signatory to the Kyoto Protocol. The Committee is tasked with addressing climate change by raising awareness on the impacts and opportunities arising from climate change; building Singapore's competency to respond to climate change; promoting greater energy efficiency and less carbon-intensive energy in key sectors; and understanding Singapore's vulnerability to climate change and adaptation actions needed.

ASEAN Agreement on Transboundary Haze Pollution: Entered into force in November 2003, with all ASEAN nations as signatories except for Indonesia and the Philippines. This binding Agreement requires parties to cooperate in developing and implementing measures to prevent and monitor transboundary haze pollution resulting from land and forest fires.

The National Parks Board Act (Chapter 198A): The National Parks Board Act is an Act to establish the National Parks Board, to provide for its functions and powers and for associated matters. The Act was revised in 1997 to transfer property, rights and liabilities to the Parks and Recreation Department of the National Parks Board.

The Parks and Trees Act (Chapter 216): The Parks and Trees Act provides for planting, maintenance and conservation of trees and plants within national parks, nature reserves, tree conservation areas, heritage road green buffers and other specified areas, and for related matters.

Sustainable Singapore: A Lovely and Liveable City: Singapore's 2009 Sustainable Development Blueprint was developed based on the findings and recommendations of the Inter-Ministerial Committee on Sustainable Development.

Institutions

National Parks Board (NParks): Controls, administers, and manages Singapore's national parks, nature reserves and public parks.

Sources: MEWR (2010); NCCC (2010).

Sri Lanka

Key Policies and Laws Relevant to Climate Change and Forests

National Policy on Elephant Conservation (2006): Seeks to ensure long-term survival of elephants in the forests of Sri Lanka through a satisfactory resolution of human-elephant conflict, better habitat management and control of poaching.

National Policy on Wetlands (2005): Gives effect to the National Environmental Policy and other relevant sectoral policies and international treaties in the management and upkeep of wetlands of importance.

National Watershed Management Policy (2004): Aims at conservation, rehabilitation and management of watersheds through people's involvement.

National Environment Policy (2003): Aims to promote the sound management of Sri Lanka's environment balancing the needs for social and economic development and environmental integrity. It also aims to manage the environment by linking the activities, interests and perspectives of stakeholders and to assure environmental accountability.

The National Policy on Wildlife Conservation (2000): Calls for the protection of wildlife resources through promoting conservation, maintaining ecological processes and life sustaining systems, managing genetic diversity and ensuring sustainable utilization and sharing of equitable benefits arising from biodiversity. It emphasizes the need for effective protected area management with the participation of local communities.

National Forest Policy (1995): Provides directions for protecting the remaining natural forests of the country in order to conserve biodiversity, soil and water resources. The forests under the jurisdiction of the Forest Department are reclassified and placed under four management systems ranging from strict conservation, non-extractive use, management of multiple use forests for sustainable production of wood and management of forests with community participation.

National Environment Act (1980): Mandated the establishment of the Central Environmental Authority and made provisions with respect to the powers, functions and duties of that Authority for the protection and management of the environment and for matters connected with it.

Felling of Trees (Control) Act No 9 (1951): Provides for the prohibition, regulation or control of the felling of trees in the whole of Sri Lanka and their eventual marking, offences and related penalties.

Sources: MENR (2010); www.climatechange.lk

Taiwan, Province of China

Key Policies and Laws Relevant to Climate Change and Forests

Forest Management and Administration Policy (1991): Aims for new tree plantation, protection of forests in general and implementation of a multipurpose National Forest Management Plan.

Wildlife Conservation Act (1989): Enacted for the conservation of wildlife, protection of species diversity and maintenance of natural ecosystem balance.

National Park Law (1972): Enacted with the aim of preserving Taiwan's unique natural scenery, wild fauna and flora and historic sites and providing public recreation and areas for scientific research. Created seven national parks administered by the Ministry of Interior.

Forestry Act (1932): Enacted to preserve forest resources, the natural functions of forests and their economic viability.

Source: Council of Agriculture Executive Yuan: Forestry Bureau, dongshih.forest.gov.tw/mp.asp?mp=3

Thailand

Key Policies and Laws Relevant to Climate Change and Forests

National Economic and Social Development Plan (NESDP): The NESDP is a five-year cross-sectoral framework for economic and social development that includes agriculture and forestry. As such, forest development programmes must be consistent with the NESDP. Thailand's 10th NESDP (2007-2011) recognizes changes in the environment and natural resources as one of five major trends that present both opportunities and constraints for national development.

Forest Sector Master Plan (FSMP) (1993): Completed in 1993, but was never endorsed. The government is now developing a revised FSMP. The first draft is not yet complete.

Community Forestry Bill (1993): Since 1993, several versions of a Community Forestry Bill to promote community forestry in Thailand have been drafted; however government approval has

been delayed due to difficulties in reaching consensus. A key issue of contention is whether or not community forests can be established in protected areas.

National Park Act: Covers the determination of National Park land, the National Park Committee, as well as protection and maintenance of National Parks. Article 6 allows the Department of National Parks, Wildlife and Plant Conservation to declare an area as a National Park without consideration of the customary rights of villagers living in and around the area. In 1989 the Act was amended by Royal Decree to prohibit all forest activities in National Parks and empower forestry officials to enforce regulations.

Logging ban: Thailand's national ban on logging in natural forests was introduced in 1989 as a result of widespread awareness of the adverse effects of intensive forest exploitation; it remains in force today. Since the logging ban, the overall objectives of forest policy in Thailand have been geared towards conservation.

Institutions

Ministry of Environment and Natural Resources (MNRE): Oversees preservation, conservation and rehabilitation of natural resources and the environment, including management and sustainable use of resources. Key forestry departments under the MNRE include:

- The Department of Marine and Coastal Resources – responsible for conservation and rehabilitation of coastal flora and fauna, including mangrove forests.
- The DNP – responsible for protected areas. The DNP is leading REDD readiness efforts in Thailand.
- The Royal Forest Department (RFD) – responsible for forest reserves, natural terrestrial forests outside of protected areas.

Thailand Greenhouse Gas Management Organization (TGO): Established in 2008, it is responsible for implementing reductions of GHG emissions in Thailand. The TGO is the Designated National Authority for verifying, reviewing and issuing Letters of Approval for and monitoring CDM projects. It further acts as a national information clearing house for information related to GHGs and provides related capacity building for the government and the private sector. The TGO has so far concentrated primarily on industrial emissions.

Sources: FAO (2009c); Janchitfah (2009a); Sutthisrisinn and Noochdumrong (1998).

Timor-Leste

Key Policies and Laws Relevant to Climate Change and Forests

East Timor National Development Plan (2002). Served as the primary guiding document for national development from 2002 until 2007.

Policy and Strategic Framework for Agriculture, Forestry and Fisheries (2004). Documents the overall framework for achieving the objectives of the National Development Plan. It describes constraints and approaches for sectors such as forestry, fisheries and agriculture.

Other relevant laws are:

- UNTAET Reg. No. 2000/19 on protected areas;
- UNTAET Reg. No. 2000/17 on prohibited logging and the export of wood products;
- Law No. 5, 1990 on Conservation of Biological Resources and Their Ecosystems.

Institutions

- Capacity Development Coordination Units (CDCU);
- National Directorate of Environmental Services (DNSMA);
- Ministry of Agriculture Fisheries and Forestry (MAFF);
- University of Timor Leste (UNTL).

Viet Nam

Key Policies and Laws Relevant to Climate Change and Forests

The Forestry Development Strategy 2006-2020: Endorsed February 2007. It introduces a new comprehensive concept of what the forest sector comprises, including providing environmental services, protection of the environment, biodiversity conservation and poverty reduction. The Strategy identifies the following three objectives: establishment and management of 16.24 million hectares of land for forestry; increase the ratio of land with forest up to 42-43 percent by 2010 and 47 percent by 2020; ensure wider participation from multiple stakeholders.

Law on Forest Development and Protection (2004): Recognizes ‘village population communities’ as recipients of rights to effectively manage forests and acknowledges customary practices and culture as the basis for assigning forests to village population communities. Though the impacts of the new law are not yet clear, once implemented it could have positive implications for distribution of benefits from REDD activities.

Action Plan Framework for Adaptation to Climate Change in the Agriculture and Rural Development Sector Period 2008-2020: Focuses on stability and safety for residents in river delta and mountainous areas, on agricultural production and food security, and maintenance of dyke and infrastructure systems for disaster prevention and mitigation. Planned activities involving forests include:

- Studying impacts of climate change on forests and proposing adaptation measures.
- Developing policies and mechanisms for management, protection, development and sustainable use of forests.
- Promoting cooperation and integration of climate change actions in programmes and plans for implementing multilateral commitments on environmental protection (e.g. Action Plan on Desertification Prevention, CITES).
- Developing a research and planning programme for forest protection and management to protect sea dykes and coastal areas.

Institutions

Ministry of Agriculture and Rural Development (MARD): Responsible for forest management, protection and development nationwide.

MARD Steering Committee for Climate Change Adaptation and Mitigation: Created in 2008, it is responsible for developing and implementing climate change mitigation and adaptation policies and activities in the agriculture and rural development sector and is supported in this effort by the Standing Office for Climate Change Mitigation and Adaptation.

Department of Forestry (DoF): Under MARD. It has rights to manage, develop and exploit products from plantation forests and is responsible for protecting natural forest resources, managing forest products and implementing laws to protect forests. The DoF is leading preparation of Viet Nam’s REDD programme, pending the establishment of forestry-related Departments and Divisions within a new Forestry Directorate.

Forest Sector Support Partnership (FSSP): Agreement between the Government of Viet Nam and 19 donors (now 25) signed in November 2001 to support implementation of the Forest Sector Development Strategy. The Coordination Office of the FSSP is coordinating Viet Nam’s National REDD Network, initiated in September 2009 under Viet Nam’s UN-REDD programme.

Sources: MARD (2008); GOV (2004, 2007, 2008).

ANNEX 3: Key forest products, economic value and contribution of the forest sector to national GDPs

Country	Timber production 1 000 m ³	Timber value US\$1 000	NWFP production (tonnes) ⁴¹	NWFP value US\$1 000	Total value US\$1 000	Forestry sector ⁴² % contribution to GDP
Afghanistan	863	152 126	5 380	15 483	167 609	0.1
Australia	29 826	1 178 600	-	-	1 178 600	0.8
Bangladesh	1 269	23 574	60 372	199 757	223 331	1.7
Bhutan	277	6 404	176 830	27	6 431	6.9
Brunei	100	3 162	-	-	3 162	0.1
Cambodia	-	-	39 661	21 586	21 586	2.9
China	135 435	4 946 290	4 366 100	-	4 946 290	1.3
India	4 724	216 667	2 040 570	179 132	395 799	0.9
Indonesia	11 257	2 159 679	-	-	2,159,679	2.5
Japan	22 334	2 864 500	49 009	34 506	2 899 006	0.7
Lao PDR	7 424	61 157	-	-	61 157	3.0
Malaysia	24 014	2 150 000	-	-	2 150 000	3.0
Maldives	-	-	-	-	-	-
Mongolia	448	314	-	-	314	0.2
Myanmar	43 060	889 894	1 500 000	11 761	901 655	0.3
Nepal	119	5 610	-	-	5 610	4.3
New Zealand	24 687	647 179	8 901	18 240	665 419	2.1
Democratic P.R. Korea (DPRK)	8 692	114 450	-	-	114 450	2.5
Pakistan	33 904	1 494 087	4 029 615	33 807	1 527 894	0.4
PNG	8 364	6 330	-	-	6 330	6.7
Philippines	541	60 994	-	-	60 994	0.5
Singapore	-	-	-	-	-	0.2
Republic of Korea (ROK)	4 074	216 071	232 432	937 990	1 154 061	1.1
Sri Lanka	6 642	81 280	-	-	81 280	1.0
Taiwan, P.O.C.	-	-	-	-	-	-
Thailand	49	59	-	-	59	0.8
Timor-Leste	-	-	-	-	-	0.4
Viet Nam	23 735	169 367	323 759	289 507	458 874	2.4

Source: FAO (2005). *Global forest resources assessment*.

Figure 17. Removals of wood products 1990-2005, Figure 18. Removals of non-wood forest products 2005, Figure 19. Value of wood and non-wood forest products removal 2005

FAO 2009a. State of the World's Forests. Table 6: Forestry sector's contribution to employment and gross domestic product, 2006. <ftp.fao.org/docrep/fao/011/i0350e/i0350e04f.pdf> (Accessed 19 March 2010)

⁴¹ These figures are a summary of the NWFP figures provided in FRA 2005, which FAO had separated out by category to account for the varied nature of NWFPs (fodder, medicinal materials, honey, etc.). All are included here except animals, in order to keep the unit (tonnes) consistent.

⁴² These data are derived from gross-value added from roundwood production, wood processing and pulp and paper.

ANNEX 4: Overview of forest resources in the Asia-Pacific region

Country	Forest extent (km ²) ⁴³	Primary forests (km ²)	Modified, semi-natural forests	Plantation forests (km ²)	Forest area change % /year	% publicly owned
Afghanistan	8 670	n/a	n/a	n/a	-2.9	100
Australia	1 636 780	-0.1		-0.1	-0.1	72.0
Bangladesh	8 714	0	5 920	2 790	-0.3	98.2
Bhutan	31 950	4 130	27 800	20	0.3	100
Brunei	2 780	2 780	0	0	-0.7	100
Cambodia	104 470	3 220	100 660	590	-1.9	100
China	1 972 900	116 320	1 542 890	313 690	2.3	100
India	677 010	0	644 750	32 260	0.0	98.4
Indonesia	884 950	487 020	363 940	33 990	-1.9	100
Japan	248 860	45 910	99 550	103 210	0.0	41.9
Lao PDR	161 420	14 900	144 280	2 240	-0.5	100
Malaysia	208 900	38 200	154 970	15 730	-0.6	93.4
Maldives	9	0	0	0	0	-
Mongolia	102 520	47 330	54 070	1 120	-0.8	100
Myanmar	322 220	0	313 730	8 490	-1.3	100
Nepal	36 360	3 490	32 340	530	-1.4	99.9
New Zealand	83 090			0.2	0.2	63.4
Democratic P.R. Korea (DPRK)	61 870	8 520	53 350	0	-1.9	100
Pakistan	19 020	0	15 840	3 180	-2.0	66.0
PNG	294 370			-0.5	-0.5	3.1
Philippines	71 620	8 290	57 130	6 200	-2.0	89.5
Singapore	23	20	0	0	0.0	100
Republic of Korea (ROK)	62 650	0	49 010	13 640	-0.1	30.0
Sri Lanka	19 330	1 670	15 710	1 950	-1.4	92.5
Taiwan, P.O.C.	N/A	N/A	N/A	N/A	N/A	N/A
Thailand	145 200	64 510	49,700	30 990	-0.4	86.8
Timor-Leste	7 980	0	7 550	430	-1.3	33.0
Viet Nam	129 310	850	101 510	26 950	2.1	56.1

Sources: FAO. 2006. *Global forest resources assessment*. Figure 4. Change in extent of forest and other wooded land 1990-2005, Figure 5. Ownership of forest and other wooded land 2005. UNESCAP. 2009.

⁴³ United Nations Millennium Development Goals Indicators (online database, accessed in August 2008); FAO 2006 (online database, accessed in July 2008).

