REQUEST FOR PROJECT/PROGRAMME FUNDING FROM ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project/programme must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/programme document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to

The Adaptation Fund Board Secretariat
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ADAPTATION FUND

DATE OF RECEIPT:
ADAPTATION FUND PROJECT ID:
(For Adaptation Fund Board Secretariat Use Only)

PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

PROJECT/PROGRAMME CATEGORY:	**REGULAR PROJECT**
COUNTRY/IES:	**CAMBODIA**
TITLE OF PROJECT/PROGRAMME:	**ENHANCING CLIMATE CHANGE RESILIENCE OF RURAL COMMUNITIES LIVING IN PROTECTED AREAS OF CAMBODIA**
TYPE OF IMPLEMENTING ENTITY:	**MULTILATERAL IMPLEMENTING AGENCY (MIE)**
IMPLEMENTING ENTITY:	**UNEP**
EXECUTING ENTITY/IES:	**MOE**
AMOUNT OF FINANCING REQUESTED:	**4,954,273** (IN U.S DOLLARS EQUIVALENT)

Short summary

The climate change-induced hazard of erratic rainfall, which leads to droughts and floods, is decreasing agricultural productivity in Cambodia thereby increasing poverty levels. These events are predicted to increase under future climate change scenarios. Some of the most vulnerable communities in Cambodia are rural communities living in Protected Areas (PAs). This is because of the dependence of these communities on ecosystem services and a lack of alternative, climate-resilient livelihoods. As a result of the erratic rainfall and consequent decreasing agricultural productivity, these communities are increasingly reliant on forest ecosystems to provide supplementary food sources and income from collecting and selling non-timber forest products (NTFPs) and woodfuel. Widespread degradation of forest ecosystems, however, is reducing the efficacy of this adaptation response. The consequences of the climate change-induced hazard of erratic rainfall include: i) increased erosion as a result of floods which damages crop production; ii) crop failure as a result of drought; and iii) damaged infrastructure as a result of extreme rainfall events which limits access to urban markets. The Adaptation Fund (AF) project will use the ecoagriculture concept to build the resilience of rural Cambodian communities living in PAs to climate change. The ecoagriculture concept employs a "landscape approach to natural resource management that seeks to sustain agricultural/food production, conserve biodiversity and ecosystems and support local livelihoods". It will be implemented using two approaches: i) an extensive approach in which degraded forests will be restored into multi-use forests in Community Protected Areas (CPAs) at a landscape-level, by planting predominantly indigenous tree species that provide food, diverse NTFPs and a range of ecosystem services such as erosion control and water flow regulation; and ii) an intensive approach in which interventions include planting multi-use tree species along rice paddy boundaries and other existing cultivated areas to enhance crop productivity, establishing trial plots of drought-tolerant hybrid rice cultivars and intensifying/diversifying existing agricultural areas and introducing conservation agriculture practices. These interventions have been identified through extensive surveys of vulnerable rural communities living around CPAs i.e. they have been designed in response to community requests. The restoration component (extensive approach) will improve at least 1,875 ha of degraded CPA forest. The agricultural interventions (intensive approach) will intensify and diversify the agricultural production of at least 1,875 families living in communities around the CPA forest sites, benefiting at least 8% of families living around CPAs in all PAs in Cambodia. Further benefits as a result of landscape management to enhance ecosystem services will accrue in downstream communities, outside of CPA intervention sites. The increased agricultural productivity will provide communities with food and revenue and reduce the pressure on forests. This will make both the forests and the services they provide to local communities more resilient to climate change. The exact location of the intervention sites for the AF project will be established through a survey undertaken in 33 potential CPA sites in five PAs in the target area[1]. Based on preliminary results of

[1] A follow-up survey will be conducted in the selected CPA intervention sites, in preparation for the submission of the Full Project Proposal.

community surveys, suitable areas of degraded forest in CPAs range from 10 ha to 2,000 ha, and homegarden areas range from 0.2 ha to 1 ha per family. The AF project approach of restoring the natural capital of forests on which the communities depend, and intensifying agriculture using a limited area within PAs is a highly cost-effective approach to adaptation with numerous environmental, social and economic benefits. Protection of restored forests and agricultural areas, and thus the sustainability of the AF project interventions, will be ensured by: i) collaborating with communities, fostered by the AF project's consultative and participatory approach; ii) intensive training of local communities on climate change adaptation responses; iii) recommending revisions to policy and legislation, including recommended budget allocations; iv) establishing multi-use forests that will incentivise protection of the trees because of the value of the productive landscape; v) training communities on business plan development to ensure that alternative livelihoods are successfully implemented; vi) utilising the existing culture of protecting homegardens in Cambodia; vii) ensuring effective management and protection of restored landscapes; and viii) the legislative protection afforded by the formal inclusion of restored forests into CPA management plans. An upscaling strategy will be developed for implementing the AF project ecoagriculture approach in other CPAs in Cambodia.

PROJECT / PROGRAMME BACKGROUND AND CONTEXT:

1.1. Geographic and environmental context

Cambodia occupies 181,035 km^2 in the tropical Indochina peninsula of South-east Asia and shares borders with Laos, Vietnam and Thailand. The country is divided into 20 provinces (including districts, communes and villages) and four municipalities (including communes, quarters and villages). Its landscape is dominated by low-lying central plains which include the Tonle Sap Lake system and the uppermost part of the Mekong River Delta. These features are surrounded by the mountainous regions of the south-west, north and north-east (Figure 1). All rivers drain into the Mekong River or Tonle Sap Lake system with the exception of rivers in the south-west draining towards the coast.

Cambodia has a tropical monsoon climate. The wet season occurs from May to October when strong prevailing winds from the south-west bring heavy rains and high humidity. The dry season occurs from November to April when winds are weaker and humidity is low. Average annual rainfall ranges from 1,400 mm in the central lowlands to 5,000 mm in the coastal zone. The average temperature is 28 ºC, with a maximum monthly average of 38 °C in April and a minimum average of 17 °C in January[2]. A unique hydrological feature of Cambodia is the expansion of the Tonle Sap Lake system during the wet season[3]. During this period the lake expands from ~2,600 km^2 to ~16,000 km^2. This expansion is associated with reversal of flow in the Tonle Sap River which connects the lake to the Mekong River. In the wet season, water pushes in a north-west direction up the Tonle Sap River into the lake, swelling the size of the lake and flooding fields and forests in the floodplain. At the end of the wet season, the flow reverses and water drains from the lake down the Tonle Sap River into the Mekong River. Much of Cambodia's economy is dependent on the annual flooding of the Tonle Sap Lake and the Mekong River because the provision of freshwater and the deposition of nutrients by floodwaters are crucial for productivity of fisheries and agriculture (particularly rice)[4]. The intensity and duration of the flooding, however, varies markedly from one year to the next and has a pronounced effect on agricultural production. As rural Cambodian communities depend on this regular pattern of flooding, relatively early or late onsets of the wet season and longer lasting or higher intensity floods have considerable social, environmental and economic impacts.

In addition to natural hazards such as droughts and floods, environmental problems in Cambodia include the loss of ecosystem services and biodiversity, land degradation and deforestation. Forest cover of Cambodia is diverse and includes dry deciduous and moist deciduous rainforest, coniferous forest, moist evergreen forest, moist mountain forest, dwarf evergreen forest, flood forest, bamboo forest and mangroves. A significant portion of Cambodia's forest falls within PAs and CPAs, and these forests provide important livelihood opportunities and ecosystem services to communities living in and dependant on them. Such services include the provision of food, NTFPs, timber and woodfuel for sustainable use and income generation. Typical NTFPs include fruits, resin, fibre, rattan, medicinal

[2] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[3] Ibid.
[4] Ibid.

plants, honey, mushrooms, yams and spices. The NTFP Working Group has a list of over 60 NTFPs collected and used by the community of the Srey Thom CPA in Phnom Prech PA. It is estimated, however, that more than 100 NTPS are used for subsistence use and commercial sale. In Kampong Thom Province, rattan collection is estimated to be worth US$ 600 per household per annum, while resin collection is valued at US$ 300 per household per annum[5]. Malva nuts are the most valuable NTFP collected by rural communities in the Virachey NP of Ratanakiri Province, with the annual harvest estimated to be worth US$ 131 per household[6].

Additional services provided by forests include climate regulation, water purification and the regulation of water flow in the Mekong River Basin. Although the deforestation rate in Cambodia has decreased recently due to the implementation of a number of forestry reforms, it still remains high when compared to the average global rates. Between 1990 and 2005, the annual average deforestation rate was 1.4%, which is almost three times the global average. Prior to 1960, forests covered 73% of Cambodia's total land area. By 2006, forest cover was reduced to 58%[7]. Major drivers of deforestation include: i) expansion of agricultural and urban land as a result of an increasing population; ii) commercial logging; iii) illegal logging which is responsible for up to 94% of the total deforestation[8]; iv) firewood collection; v) forest fires; vi) a lack of transparency in the land/forest concession system; vii) unsustainable harvesting by concessionaires; and viii) poor management. Recent efforts have, however, been made by the Cambodian government to counteract these drivers. The government has cancelled at least 15 forest concessions since 1999 and reduced the total area under logging concessions by ~3,4 million ha[9]. However, limited financial resources and institutional capacity hinder the implementation of anti-logging laws and hamper efforts to further limit the number of timber concessions. As a result, deforestation and biodiversity losses still continue to undermine the resilience of Cambodian forest ecosystems to the threats of climate change[10].

[5] Tola, P. *et a*l. 2010. Economic Importance of Non-Timber Forest Products. Case Studies on Resin and Rattan in Kampong Thom Province, Cambodia.
[6] Rural Livelihoods and Natural Resource Development Research Programme. 2010. Social Landscapes and rural Livelihoods: Cambodian Communities in Transition. Phnom Penh: The Learning Institute.
[7] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[8] EC. 2006. Cambodia – European Community Strategy Paper. http://www.eeas.europa.eu/cambodia/csp/07_13_en.pdf. [Accessed 2 September 2011].
[9] FAO. 2010. Country Report: Cambodia. Global Forest Resources Assessment, Food and Agriculture Organisation, Rome.
[10] Wingqvist, G.O. 2009. Cambodia Environmental Change and Policy Brief. Environmental Economics Unit, University of Gothenburg, Sweden. Available from http://www.sida.se/Global/Countries%20and%20regions/Asia%20incl.%20Middle%20East/Cambodia/Environmental%20Policy%20Brief%20Cambodia.pdf. [Accessed 7 September 2011].

Figure 1: Relief map of Cambodia showing the 20 provinces.

Assessments of biodiversity in Cambodia are limited by a lack of recent data. Approximately 100 terrestrial mammals have been recorded within Cambodia of which 49 taxa are listed by the International Union for Conservation of Nature (IUCN) as "globally threatened", "near-threatened" or "data deficient". Some 500 bird species have been recorded for Cambodia but data from neighbouring countries suggest that over 600 species are likely to occur. Birdlife International lists 39 Cambodian bird species as "globally threatened" or "near-threatened". Estimates of Cambodia's fish species range from 800-1,200 varieties. No rigorous surveys have been made of reptile and amphibian biodiversity in Cambodia. However 28 known species of reptile have been listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as "threatened". Over 2,300 species of seed plants have been listed, but this number is considered an underestimate given the diversity of flora in the neighbouring countries of Laos, Thailand, and Vietnam[11]. Much of the biodiversity is preserved within PAs, where threats include habitat loss and over-exploitation.

There are 23 PAs in Cambodia, covering 18% of the country's surface. These include National Parks (NPs), Wildlife Sanctuaries (WSs), Protected Forests, Protected Landscapes and Multiple Use Areas[12]. The Tonle Sap Lake is protected as a Biosphere Reserve, and there are four Ramsar (Wetlands of International Importance) sites: Boeng Tanle Chhma, Koh Kapik, Prek Toal and a northern section of the Mekong River in Stung Treng Province. Threats to PAs include: i) unrestricted grazing by livestock; ii) unmanaged fishing; iii) illegal logging; iv) collection of woodfuel and NTFPs; v)

[11] MoE. 2002. National Biodiversity Strategy and Action Plan.
[12] ICEM. 2003. Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region. International Centre for Environmental Management. Indooroopilly, Queensland, Australia. 148 pp. http://www.mekong-protected-areas.org/cambodia/docs/Cambodia_nr.pdf.

population growth and migration; and vi) habitat degradation and disturbance resulting from human activities[13].

Cambodia has maintained its network of PAs since 1925 when forests surrounding the Angkor Wat temples were declared NPs, becoming the first PAs in South-east Asia. In the period 1953-1969, following independence from French rule, 12% of Cambodia was protected within NPs or WSs and natural resources were promoted as a national asset[14]. However, during the period of instability and conflict from 1970-1992, PA management was abandoned and much of the existing infrastructure destroyed. Extensive areas were deforested to increase agricultural output, to sell timber and to improve visibility for security reasons[15].

In the relative stability that followed a peace settlement in 1991, Cambodia entered an era in which PAs were re-established. However, at the same time the use of forest resources was promoted by the coalition government and extensive concessions were awarded to commercial logging companies. Illegal logging also continued in some areas[16]. After the 1998 election the new government took steps to reverse this trend by withdrawing or suspending concessions, by increasing efforts to combat illegal logging[17] and by establishing new PAs[18]. In 1993, 23 sites covering ~3,3 million ha were formally designated as PAs by Royal Decree. The Ministry of Environment (MoE) is the government agency assigned the mandate of managing PAs. The Royal Government of Cambodia (RGC) established the PA Law in 2008, which directs PA management. An additional seven Protected Forest sites covering ~1,3 million ha were added to the PA network by the Ministry of Agriculture, Forestry and Fisheries (MAFF). By 2010, over 25% of Cambodia was under some form of legal protection[19].

Most PAs in Cambodia are in remote regions with little surrounding commercial development and few livelihood options. Over 87% of the communities living in and around PAs have a “medium” or “high” poverty rating[20,21]. The findings of a Research Programme on Local Livelihoods in Protected Areas (2006-2009) indicated that the average income of rural communities living in and around PAs was derived from NTFPs, crop farming and raising animals. The research programme reported that these communities are faced with food supply problems[22]. In addition, diseases and malnutrition are widespread. Most of the communities are unable to access health care services, and the level of hygiene education is poor. The development of private sector agro-industry projects has altered the landscape by removing forest cover, thereby exacerbating food shortages for communities dependant on the forests, disease and the effects of natural disasters such as droughts and floods.

Despite this, PAs tend to attract human settlement as they contain much of the nation’s remaining ‘free’ natural resources. As a result, most PAs in Cambodia are experiencing rapid population growth through immigration[23]. A geo-spatial survey conducted in 2009 indicated that approximately 45% of deforestation had occurred within PAs, highlighting the challenges in enforcing PA laws[24]. Demand for wildlife products, unrestricted livestock grazing, woodfuel collection, unregulated fishing and

[13] MoE. 2002. National Biodiversity Strategy and Action Plan.
[14]ICEM.2003. “Protected areas and development: Lessons from Cambodia”. Cambodia National Report on Protected Areas and Development, Review of Protected Areas and Development in the Lower Mekong River Region.
[15]ICEM. 2003. Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region. International Centre for Environmental Management. Indooroopilly, Queensland, Australia. 148 pp. http://www.mekong-protected-areas.org/cambodia/docs/Cambodia_nr.pdf.
[16]Ibid.
[17]Ibid.
[18]MoE. 2009. Cambodia Environment Outlook. Ministry of Environment, Phnom Penh, Kingdom of Cambodia.
[19]Ibid.
[20]ICEM. 2003. Cambodia National Report on Protected Areas and Development, review of Protected Areas and Development in the Lower Mekong River Region.
[21] Where poverty is defined by rural Cambodians as the inability: i) to be certain that one can use as much local natural resources as necessary for household purposes; or ii) to be able to sell sufficient natural resources or produce to purchase basic necessities, or iii) to be certain of land tenure and security. Asian Development Bank. December 2001. Participatory Poverty Assessment: Cambodia. Phnom Penh.
[22] Rural Livelihoods and Natural Resource Development Research Programme. 2010. Social Landscapes and Rural Livelihoods: Cambodian Communities in Transition. Phnom Penh: The Learning Institute.
[23]For example, each year Ream National Park yields US$ 1.24 million in economic benefits from fishing, harvesting forest products and farming. This amounts to US$ 233 annually for each household, which is more than two thirds of the average family income of about US$ 316. ICEM. 2003. Cambodia National Report on Protected Areas and Development, review of Protected Areas and Development in the Lower Mekong River Region.
[24]https://www1.nga.mil/Newsroom/Pathfinder/nov_dec_09/Pages/DeforestationAnalysisComplementsCambodiaConflictAssessment.aspx. [Accessed 13 April 2011].

encroachment by infrastructural developments all present challenges to PA management[25,26]. Cambodia's PA Law makes provision for the potential role that local communities and indigenous groups may play in natural resource management. As a result of this law CPAs have been established. The main objective of CPAs is to designate local communities who can access the areas, thereby preventing outsiders intruding and degrading the forests. CPA Management Committees are established to co-ordinate activities such as sustainable management and use of NTFPs by local communities so that natural resources are not depleted. By the end of 2011, 100 CPAs totalling 127,634 ha had been established, benefitting 23,500 families from 188 villages surrounding the CPAs.

1.2. Social and economic context

In 1991, Cambodia entered a period of relative stability after two decades of conflict and economic isolation. Since then, development priorities have focused on ensuring peace and security, reducing poverty, rebuilding institutions, and establishing a stable macro-economic environment[27]. Cambodia's population in 2011 was ~14.8 million people, growing at a rate of 1.7% per annum[28]. Despite economic growth in the last decade, the per capita income is below that of neighbouring countries. The Gross Domestic Product (GDP) ranks 188th of 227 countries, and the Human Development Index (HDI) of 0.5 is below the regional average. Approximately 84% of the population resides in rural areas[29] and is heavily dependent on forestry, agriculture and fisheries[30].

The extensive inland water system within the Tonle Sap Lake region supports the majority of Cambodia's population, who are particularly reliant on rice cultivation and freshwater fisheries. The incidence of poverty[31] remains high despite having declined from ~35% in 2004 to ~30% in 2007[32]. Food shortages are prevalent in rural areas where Cambodians rely heavily on natural resources for their income and livelihood. Approximately 39% of rural households generate 25% of their earnings from forestry and fishery resources and 16% rely on forestry and fisheries for at least 50% of their daily wages[33].

Agriculture is the most important sector of the Cambodian economy. The majority of agriculture is rain-fed subsistence agriculture, and as such is the most vulnerable sector to the impacts of climate change. Rice cultivation occupies 84% of the total agricultural land area and provides ~70% of the population's food requirements[34]. In 1990, approximately 1.9 million ha in Cambodia were devoted to rice production, 86% of which were rain-fed[35]. Other types of agriculture include shifting agriculture, commercial field cropping and homegardening, which includes growing fruit and vegetables around homesteads. Crop cultivation is largely dependent on traditional cultivars. In the late 1990s, almost 80% of Cambodia's agricultural land was cultivated with local, unimproved varieties of rice, maize, sesame, vegetables and sweet potato. New pests and pathogens have contributed significantly to lowered productivity. Modern agriculture has reduced the diversity of crops planted country-wide, with an emphasis on a limited number of commodity crops.

Livestock and animal production is another source of income and an important source of protein for the Cambodian people. Most rural households raise poultry and pigs for household consumption, and cattle are kept as agricultural draft power for tilling fields. In 1994, livestock resources were estimated to be as follows: 2.6 million cattle, 814,000 buffalo, 21,000 horses, 2 million swine and 10 million poultry[36]. Within the CPAs consulted in the survey as part of the AF Project Concept preparation (see

[25]ICEM.2003. Cambodia National Report on Protected Areas and Development, review of Protected Areas and Development in the Lower Mekong River Region.
[26]MoE. 2002. National biodiversity strategy and action plan.
[27] UNDP. 2008. Cambodia Annual Report. Phnom Penh, Cambodia. United Nations Development Program.
[28]Available from: www.cia.gov/ (2010 estimate). [Accessed 01 September 2011].
[29] Climate change country profile: Cambodia http://www.wpro.who.int/NR/rdonlyres/EF203FE3-0C6F-475F-B9C7-5C67364910E3/0/CAM2.pdf. [Accessed 02 September 2011].
[30]MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[31] Defined as less than US$ 0.63/day in 2002 (NPRS, 2002).
[32]RGoC. 2010. National Strategic Development Plan Update 2009 – 2013. Royal Government of Cambodia. http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_145085.pdf. [Accessed 5 September 2011].
[33]World Bank. 2006. Cambodia: Poverty Assessment.
[34] UNDP. 2008. Cambodia Annual Report. Phnom Penh, Cambodia. United Nations Development Program.
[35]MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[36] Ibid.

Annex II), agriculture in the form of crops and livestock was the largest source of income for community members.

Fisheries provide a major source of protein in Cambodia. Per capita consumption of fish is 60-65 kg/year[37] and fish provide approximately 75% of the population's animal protein intake. Cambodia is one of the world's largest freshwater fish producers[38] with an estimated capture rate of 400,000 tonnes/annum. Freshwater fisheries contribute approximately US$ 500 million, or 12% of Cambodia's GDP[39]. Over 6 million Cambodians are employed in fishing-related activities on at least a part-time basis. However, the fish catch-rate has been declining in the Tonle Sap region from 347tonnes/fisherman in 1940 to 196 tonnes/fisherman in 1995 to 116 tonnes/fisherman in 2008[40]. This is primarily the result of the decline in fish stocks caused by over-fishing.

Cambodia has a plentiful supply of aboveground **freshwater** resources during the wet season with an estimated annual flow of 471 km^3/year in the Mekong River[41]. There is, however, very little dry-season storage capacity in the country's dams and groundwater aquifers, resulting in significant variation in the availability of water for drinking, household use and irrigation between wet and dry seasons. The domestic water needs of rural Cambodians have been traditionally met using surface water and shallow-dug wells. When available, rainwater is used for drinking and cooking[42]. It is estimated that during the dry season, when surface and ground waters recede or dry out, approximately 43% of the population are reliant on untreated water sources, which are unsuitable for drinking[43]. In a 2006 survey, over half of respondents reported a shortage of water for household use and over 80% reported a shortage of water for agriculture[44].

Woodfuel is the primary source of **energy** for 95% of rural Cambodia households. Total woodfuel consumption was estimated to be ~6 million m^3 in 2010. This is 40% higher than in 1995. The woodfuel consumption to forest biomass increment was 0.02 in Kampong Thom province in 2004, indicating that woodfuel consumption is not a major driver of deforestation at the provincial scale. However, woodfuel consumption is said to lead to localised forest degradation around villages where collection is concentrated[45]. Petroleum and minor contributions of other biomass sources such as crop residues accounts for the remaining 5% of energy for rural Cambodian households. In response to the constant increase in electricity demand and abundant supplies of freshwater in the Mekong River, plans have been developed for increasing the number and size of hydro-electric power dams. Commercial size projects have been in operation since 1968. The current installed capacity is about 14 MW, while Cambodia's technical potential for hydropower has been estimated at 8,600 to 10,000 MW of installed capacity for the Mekong River, the Mekong tributaries and the coastal provinces. Hydro-electric power plants are being built in Kampot, Koh Kong, Pursat and Battambang provinces, with the highest capacity being 190 MW in Kampot province. The majority of the present electricity demand (i.e. 93%) is provided by diesel power plants. Offshore oil and gas exploration activities have been undertaken in Cambodia since the 1960s. Petroleum experts believe that Cambodia has a high potential for natural gas but exploration to date has not discovered reserves worth developing.

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[37] So Nam. 2010. Fisheries Resources in Cambodia - Current Status, Key Issues, Directions. International Centre for Environmental Management. http://www.icem.com.au/documents/envassessment/mrc_sea_hp/1inception/presentations/cambodia scoping workshop/pdf/Fisheries Resources in Cambodia - Current Status, Key Issues, Directions.pdf [Accessed 2 September 2011].

[38] Ahmed, M., Navy, H., Vuthy, L., Steneck, R.S. (1998) Socio-Economic Assessment of Freshwater Capture Fisheries of Cambodia: a Report on a Household Survey. Project for the Management of the Freshwater Fisheries of Cambodia, MRC Mekong River Commission Secretariat, Phnom Penh. 186 pp.

[39] So Nam. 2010. Fisheries Resources in Cambodia - Current Status, Key Issues, Directions. International Centre for Environmental Management. http://www.icem.com.au/documents/envassessment/mrc_sea_hp/1inception/presentations/cambodia scoping workshop/pdf/Fisheries Resources in Cambodia - Current Status, Key Issues, Directions.pdf. [Accessed 2 September 2011].

[40] Ibid.

[41] Encyclopedia of Earth. 2008. "Water profile of Cambodia." in Eds. Cutler J. Cleveland, Encyclopedia of Earth. (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth. Available from: http://www.eoearth.org/article/Water_profile_of_Cambodia. [Accessed 09 September 2011].

[42] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.

[43] UNDP Climate Change Country Profiles Cambodia. McSweeney, C., New, M., Lizcanol, G. 2009. Available from: http://country-profiles.geog.ox.ac.uk. [Accessed 3 September 2011].

[44] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.

[45] East Asia Summit/Energy Cooperation Task Force. Biofuel Database in East Asia. Available from: http://www.asiabiomass.jp/biofuelDB/cambodia/contents003.htm [Accessed 29 September 2011].

The development of **tourism** is recognised as a potential means of financing the preservation of Cambodia's natural resources and is considered one of Cambodia's main opportunities to build its economy[46]. The potential for rapid expansion of the tourism sector depends on maintaining intact ecosystems to provide aesthetically pleasing nature-based experiences[47].

PAs have an important role to play in the expansion of all sectors mentioned above, as does the institutional and policy context in which climate change projects are implemented.

1.3. Institutional and policy context

Cambodia ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 18 December 1995 and accepted the Kyoto Protocol on 22 August 2002. Cambodia's Initial National Communication (INC) to the UNFCCC was submitted in October 2002 and the preparation of the Second National Communication (SNC) began in January 2007 and should be finalised by the end of 2011. The RGC has taken a firm stance to support the Kyoto Protocol by indicating their commitment to addressing climate change risks and the MoE is the lead coordinating institution with the mandate to address climate change concerns. Additionally, to ensure effective and successful implementation of sustainable development-related programmes, the RGC has established a number of cross-sectoral national committees, such as the National Climate Change Committee (NCCC) established in 2006 and chaired by MoE with the Prime Minister as honorary chair. The NCCC serves as a policy-making body (comprising policy-makers from 19 ministries) which coordinates the development and implementation of plans, policies and measures to address climate change risks across Cambodia[48]. As such, the NCCC is the focal point for all climate change-related engagement within the RGC. Furthermore, the MoE established a Cambodia Climate Change Office (CCCO) in 2003, which was changed to the Cambodia Climate Change Department (CCCD) in 2009 and serves as a secretariat for the NCCC. The CCCD has the mandate to implement the UNFCCC and Kyoto Protocol by creating an enabling environment for effective climate change mitigation and adaptation.

At the national level, the government agencies with responsibilities related to climate change, natural resources and coastal ecosystem management and development include:

- The **Ministry of Environment** (MoE) which was established in 1993 and is responsible for environmental protection and natural resource management in Cambodia.
- The **Ministry of Agriculture, Forestry and Fisheries** (MAFF) which has an extensive network of staff at the national, provincial, district and commune levels. The Forestry Administration (FA) has the mandate for the management of Protected and Community Forests. Given this broad mandate, there is substantial overlap with the MoE in the perception of functions and responsibilities. It is noteworthy that the 2006-2010 Strategic Agriculture Development Plan does not take climate change adaptation or mitigation into account.
- The **Ministry of Water Resources and Meteorology** (MoWRAM) which has the responsibility of observing and managing all activities related to water resources and meteorology development and natural disasters.
- The **Ministry of Land Management, Urban Planning and Construction** (MLMUPC) which is responsible for the formulation of development plans and land use plans at the national- and local-levels.
- The **National Committee for Disaster Management** (NCDM) which was established in 1995, is an inter-ministerial body chaired by the Prime Minister. The members of the committee are drawn from all concerned ministries and the armed forces. NCDM plays a key role in disaster management, working both on disaster risk reduction/prevention and response preparedness.
- The **Ministry of Industry, Mines and Energy** (MIME) which is responsible for planning industrial water use and hydropower as well as water supply provision to provincial towns and administrating single-purpose schemes involving hydro-power.
- The **Ministry of Public Works and Transportation** (MPWT) which is responsible for construction of roads, infrastructure e.g. bridges and ports.
- The **Ministry of Rural Development** (MRD) which is responsible for: i) supplying small-scale water supply infrastructure to households; ii) primary health care; and iii) small-scale infrastructure in the rural areas in Cambodia. Although the MRD recognises the importance of adapting to

[46]MoE. 2002. National biodiversity strategy and action plan.
[47]Ibid.
[48] WikiADAPT, 2010. Available from: http://wikiadapt.org.

climate change, the strategic plan of the MRD does not take climate change adaptation or mitigation into account.

- The **Ministry of Health** (MoH), which is responsible for the development of the health sector for better health and well-being of Cambodians and thus contributes to poverty alleviation and socio-economic development. The Health Strategic Plan (2008-2015) of the MoH does not consider climate change impacts.
- The **Ministry of Tourism** (MoT) which aims to preserve the scenic beauty and natural resources of Cambodia.
- The **Council for the Development of Cambodia (CDC)** which is the principle contact between the RGC and all donor countries, organisations and NGOs working within Cambodia.

1.4. Observed climate hazards, trends and impacts

Due to years of conflict there are very few long-term climate observations, making it difficult to determine significant and reliable trends in climate or potential signs of climate change within Cambodia. Those observations that are available, including variability in Cambodia and South-east Asia over the recent past, are listed below:

- a declining trend in rainfall across South-east Asia between 1951-1998[49] (see Figure 2) although mean annual rainfall over Cambodia does not reflect any consistent increase or decrease since 1960[50];
- an increase in the frequency and severity of droughts, floods and windstorms in Cambodia[51];
- an increase in the frequency and intensity of extreme weather events across South-east Asia associated with El Niño over the past two decades[52];
- an increase in mean annual temperature of between 0.1 and 0.3 ºC per decade between 1951-2000[53]; and
- an increase in the frequency of hot days[54] and warm nights since 1960[55].

Figure 2 shows the variability in rainfall in South-east Asia between 1901-2005[56]. The red and blue lines show a descreasing rainfall trend from the 1950s to the late 1990s, with an increasing trend towards the present. Whilst not specific to Cambodia, the increasing trend in extreme events in four South-east Asian countries between 1960-2008, specifically floods/storms[57], is shown in Figure 3. Thailand and Vietnam border Cambodia to the west/north and east/south-east, respectively (see Figure 1).

[49] Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 469-506.
[50] UNDP Climate Change Country Profiles Cambodia. McSweeney, C., New, M., Lizcanol, G. 2009. Available from: http://country-profiles.geog.ox.ac.uk. [Accessed 3 September 2011].
[51] According to villagers' observations included in the NAPA (2006).
[52] Ibid.
[53] Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 469-506.
[54] 'Hot' day or 'hot' night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season.
[55] UNDP Climate Change Country Profiles Cambodia. McSweeney, C., New, M., Lizcanol, G. 2009. Available from: http://country-profiles.geog.ox.ac.uk. [Accessed 3 September 2011].
[56] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review.
[57] Ibid.

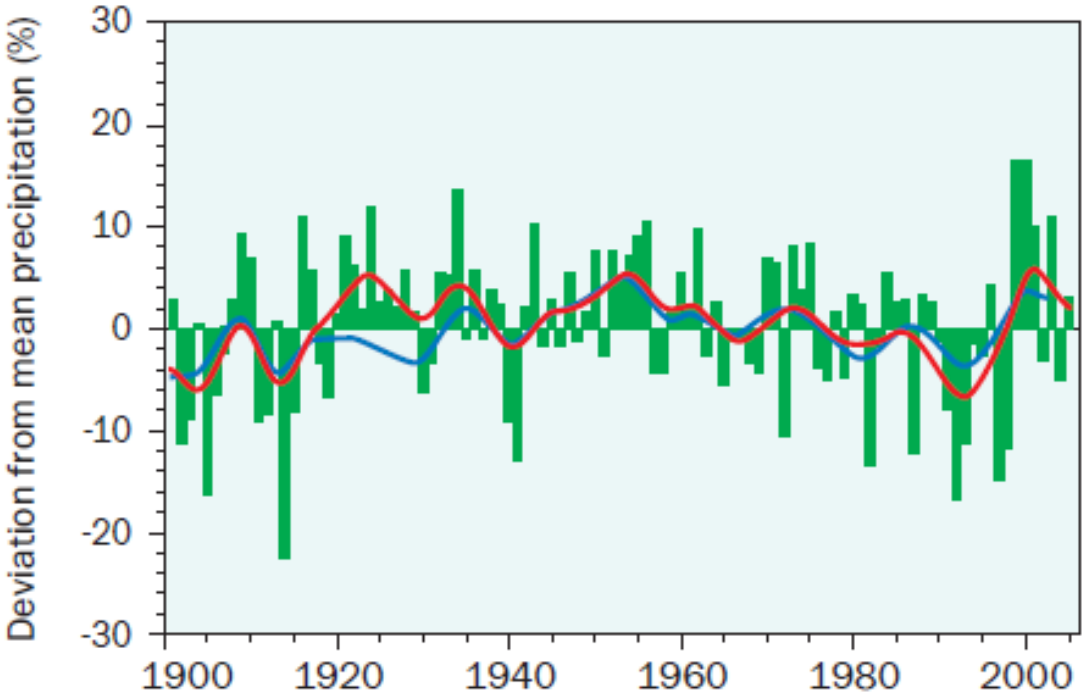

Figure 2: Annual precipitation variation in South-east Asia (1901-2005)[58].
Note: Mean precipitation (2455 mm) is computed from 1961 to 1990. Green bars indicate annual variations in precipitation. Coloured lines highlight decadal variation. The blue line is based on Global Historical Climatology Network data from the National Climatic Data Center. The red line is based on data from the Climatic Research Unit.

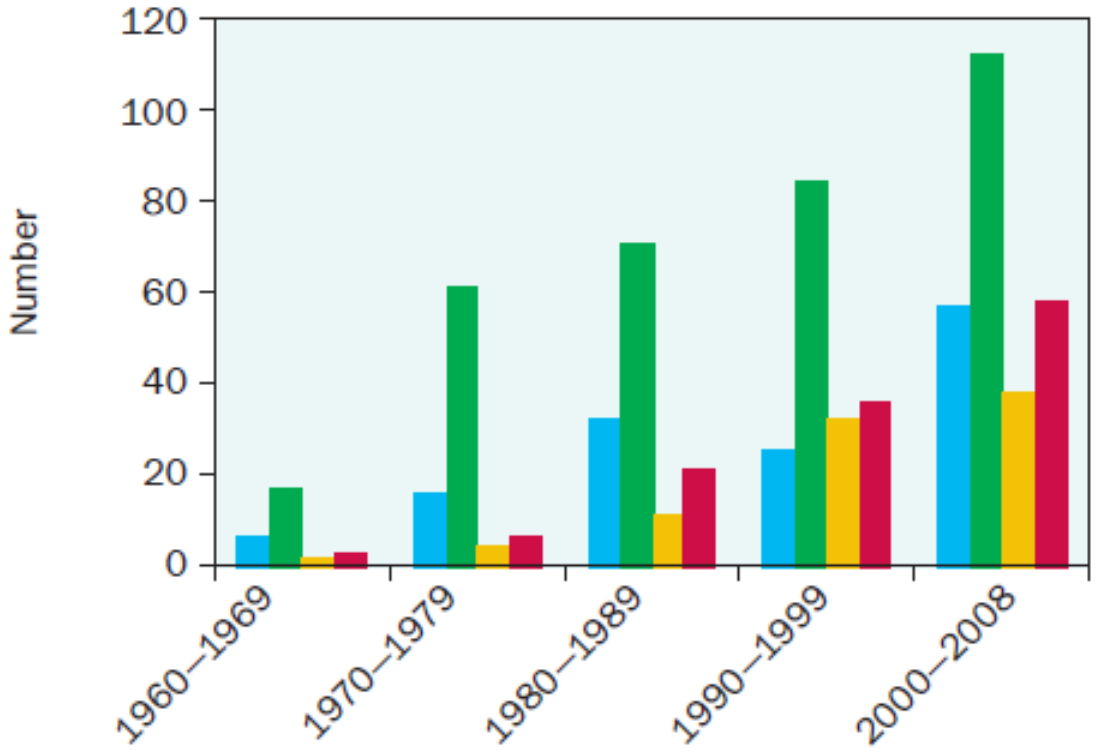

Figure 3: Increasing trend in floods/storms in four countries in South-east Asia (Blue = Indonesia; Green = Phillipines; Yellow = Thailand and Red = Vietnam)[59].

[58] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review.
[59] Ibid.

Episodes of droughts and floods are identified as the two main climate hazards experienced by the majority of provinces within Cambodia[60]. A significant factor in exacerbating the damage is that drought periods have been increasing followed by destructive flooding in the same province in the same year. The agricultural sector is most heavily affected by droughts and floods.

Droughts are less frequent than floods but are geographically widespread and affect a large number of people[61]. The household survey conducted as part of the NAPA report preparation in 2006 found that 71% of villagers nationwide had noticed an increase in the frequency of droughts in recent years. Interviews of local communities conducted within CPAs in the project target area as part of this AF project (see Annex II) indicated that more than 81% of the communities surveyed had experienced increasing droughts relative to the historical norm. These climate fluctuations impacted crop yield in all cases, with more than half of the communities experiencing losses of livestock as well. Communities estimated the costs of such losses as ranging from $200 to $2,000 per family per event; a significant loss in proportion to the annual income of such communities. The direct impact of drought is predominantly in terms of water stress on agricultural crop production, particularly rain-fed rice and vegetables. Nationally, droughts in 1995, 1996, 1998, 2001, 2002 and 2003 led to widespread crop failure and famine. The most severe drought in recent times occurred in 2002 affecting 2 million individuals. Approximately 62,000 ha were affected, resulting in damages and crop losses totalling US$ 21.5 million. From 1987-2007, droughts in Cambodia affected 6,5 million people and resulted in US$ 138 million in damages[62].

National rice production losses due to floods and droughts have been significant, contributing to food shortages in numerous provinces[63]. Figure 4 shows the total rice area affected by drought and flood in Cambodia over the period 1982-2000. In 1990 ~1.9 million ha were devoted to rice production in Cambodia, therefore in 1996 floods affected approximately 26% of the area under rice cultivation and in 1997, drought affected 21% of this area.

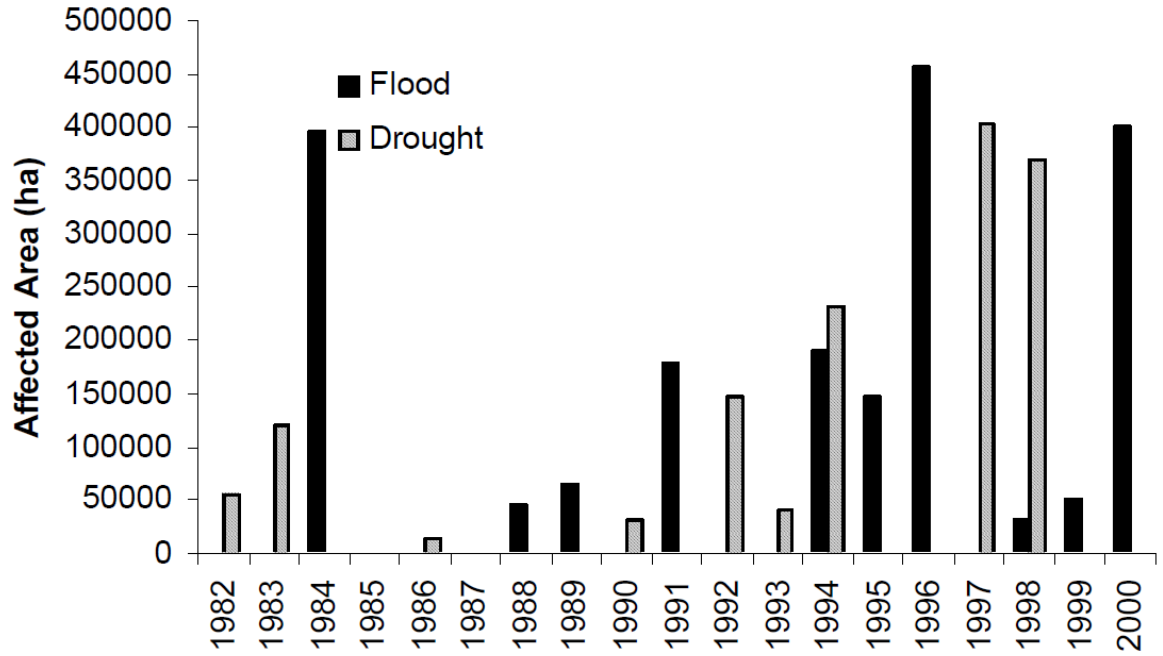

Figure 4: Area of rice affected by droughts and floods in Cambodia[64].

At the time of writing of this Project Concept, Cambodia was experiencing a major flooding event. Heavy rainfall began in late September 2011 and persisted to early October 2011. On 4 October

[60] National Committee for Disaster Management and Ministry of Planning. 2008. Strategic National Action Plan for Disaster Risk Reduction 2008-2103.
[61] Ibid.
[62] National Committee for Disaster Management and Ministry of Planning (2008) Strategic National Action Plan for Disaster Risk Reduction 2008-2103.
[63] MoE. 2005. Analysis of Policies to Address Climate Change Impacts in Cambodia.
[64] Ibid.

2011, the Prime Minister issued a press release stating that 170,000 families country-wide had been affected, 148 people had died and 800 schools, 364 religious pagoda sites and 75 health care centres had been flooded. Damage estimates to rice fields, roads and rural infrastructure had not been estimated, but were expected to be significant with long lasting impacts on agricultural production. At the time of the press release, rainfall was expected to continue, with a further pulse in flooding anticipated.

Historically major flooding events affecting a significant population occur approximately every five years, notably in 1961, 1966, 1978, 1984, 1991, 1996, 2000, 2001 and 2002. Additionally, the frequency of severe floods has increased since the 1990s. A household survey conducted as part of the National Adaptation Programme of Action to Climate Change (NAPA) preparation in 2006, found that 58% of villagers nationwide had noticed an increase in the frequency of floods in recent years. The most severe floods to date occurred in 2000 and resulted in 347 deaths. The floods affected 3.5 million individuals. The number of damaged houses was 317,975 of which 7,068 were destroyed. The total physical and direct damage was estimated at US$ 150 million. The 2000 floods were immediately followed by severe floods in 2001 causing the death of 62 people and an estimated US$ 20 million in damages. This event was followed by further flooding in 2002 resulting in 29 deaths and damages totalling US$ 14 million. From 1987-2007, flooding in Cambodia affected 9,6 million people resulting in 1,125 deaths and US$ 327 million in damages[65]. The September/October 2011 floods are said to be comparable to the floods of 2000.

Whilst little data is available on the degree of soil erosion in Cambodia and the project target areas, the available literature acknowledges that the extent of soil erosion leading to land degradation is a major concern[66]. Cambodia's forest cover has reduced from an estimated 73% in 1965 to 59% in 2006[67]. Loss and reduction of the vegetation cover leads to intensive runoff and erosion. In Mondulkiri province in the North-eastern Forests area, sheet erosion can be seen as silt which has collected behind cut logs and stumps in the fields, while rill erosion occurs in some fields only three months after clearing and burning the forest for farming. The amount of topsoil being lost, measured from the top of the remaining grass and tree stumps to the soil surface, is an estimated 1-1.5 cm. The fact that rill erosion has already begun in some places suggests that the yearly topsoil loss is a considerable problem. Farmers have reported that agricultural yield decreases about 20-25% in the second year of cultivation, and about 40-50% in the third year onwards as a result of the erosion. Soil loss through erosion can be observed at coffee and *hevea* farms where the natural vegetation cover has been completely cleared, leaving the soil surface uncovered between rows of young seedlings[68].

1.5. Climate change projections and predicted impacts

The lack of long-term climate observations is a constraint on the development of credible climate change projections for Cambodia. For example, although downscaled climate projections are available for neighbouring countries, such projections are not available for Cambodia[69]. Additionally, model simulations provide differing scenarios with regards to the projected changes in the amplitude of future El Niño events. El Niño influences monsoon variability in South-east Asia, a relationship which is also poorly understood, contributing to uncertainty in climate projections for this region. Despite these uncertainties, the following climate change predictions have been made for Cambodia:

- an increase in the frequency and intensity of flooding events due to more frequent episodes of heavy rainfall[70];
- an increase in mean annual rainfall across the country by 3-35% by 2100[71] with the magnitude of change varying spatially and temporally[72];

[65] National Committee for Disaster Management and Ministry of Planning. 2008. Strategic National Action Plan for Disaster Risk Reduction 2008-2103.
[66] Wingqvist, G.O. 2009. Cambodia Environmental Change and Policy Brief. Environmental Economics Unit, University of Gothenburg, Sweden. Available from http://www.sida.se/Global/Countries%20and%20regions/Asia%20incl.%20Middle%20East/Cambodia/Environmental%20Policy%20Brief%20Cambodia.pdf. [Accessed 07 September 2011].
[67] FAO website: http://www.fao.org/docrep/w7710e/w7710e04.htm. [Accessed 01 September 2011].
[68] Cambodia Soil report prepared by: Yang Saing Koma, Lecturer, Royal University of Agriculture of Chamkar Dong and Project Officer in Sustainable Agriculture, Japan International Volunteer Centre,Phnom Penh) (pdf file: 61 kb). Available online at http://www.unescap.org/rural/doc/sads/index.htm. [Accessed 09 September 2011].
[69] WikiADAPT, 2010. Available from: http://wikiadapt.org.
[70] INC, 2002 and the NAPA, 2006.
[71] This prediction and that within the second bullet point is based on the global warming scenarios SRESA2 (reference) and SRESB1 (policy) and General Circulation Models (GCM) CCSR and CSIRO (INC, 2002).

- an increase in mean annual rainfall along the coast of 2-6% by 2050[73];
- an increase in mean annual temperatures of 0.3-0.6 °C by 2025[74], of 0.7-2.7 °C by the 2060s and of 1.4-4.3 °C by the 2090s[75];
- a considerable increase in the number of 'hot' days and nights[76]; and
- sea level rise (SLR) of 0.18-0.56 m[77] by the 2090s.

The direct impacts of the above changes and knock-on effects on various sectors described will be as follows:

- **Greater variability in rainfall and river flow** leading to: i) decreased productivity in rain-fed agricultural crops; and ii) a greater frequency of droughts and floods.
- **Greater rates of runoff of water from the soil surface** as a result of increases in rainfall intensity. This will increase rates of soil erosion and reduce river flow in dry periods. The predicted increase in temperatures coupled with an increase in inter-annual and seasonal temperature variability will result in increased evaporation rates[78] and consequently, likely desiccation and hard-setting of soils (depending on soil type) and the drying up of freshwater bodies.

The impacts of climate change on key Cambodian sectors are likely to become increasingly significant. Productivity of the **agriculture** sector is likely to decrease as a result of: i) a decrease in rainfall and increase in temperature, leading to a decrease in rain-fed crop production; ii) an increase in topsoil losses via erosion; iii) a decrease in soil water content as a result of increased evaporation from soils; iv) a decline in surface water availability for livestock and irrigation purposes; v) a change in timing of the onset of the wet season resulting in planting of crops at inappropriate times; and vi) an increase in crop losses due to droughts and floods. This will impact negatively on food supply, income streams and livelihoods. Variations in rice production are significantly correlated with climate variability[79], and an increased frequency of droughts and floods considerably reduces rice crop productivity.

Management of the **water** sector will become increasingly difficult as the quality of water in rivers is reduced by erosion, as water supply from rivers is decreased during droughts and low base flows in the dry season and as flooding events increase. The **fisheries** sector may benefit from increased water availability in times of flood, providing higher nutrient levels and extending feeding grounds for fish. However, deterioration in water quality as a result of excessive erosion, or decreased flow in time of drought, will negatively impact this sector. Cambodian fish catches are increasingly being made up of species such as *Henicorhynchus* spp. ("trey riel" in Khmer) which are considered unstable because their abundance is largely driven by the annual flood pattern, as they grow quickly and die young. This emerging boom-and-bust cycle may be amplified by the higher hydrological variability predicted with climate change, bringing high year-to-year fluctuations in fish abundance, with years of high abundance followed by years of shortage[80].

The **energy** sector will be compromised by climate change as planned hydro-electric power generation is hampered through the siltation of dams and damage to turbines[81], by increasingly low

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[72] For example, lowland areas are likely to experience a greater increase in rainfall than in highlands.
[73] INC, 2002. Cambodia is presently preparing its Second National Communication to the UNFCC but this has not yet been made available. The IPCC projects an increase in temperature of between 1.5 and 3.7 ºC by 2100 for Southeast Asia as a region.
[74] Ibid.
[75] UNDP Climate Change Country Profiles Cambodia. McSweeney, C., New, M., Lizcanol, G. 2009. Available from: http://country-profiles.geog.ox.ac.uk. [Accessed 3 September 2011].
[76] Ibid.
[77] UNDP Climate Change Country Profiles Cambodia. McSweeney, C., New, M., Lizcanol, G. 2009. Available from: http://country-profiles.geog.ox.ac.uk. [Accessed 3 September 2011]. (Taken from the IPCC Working group I (The Physical Science Basis): Chapter 10 (Global Climate Projections) (Meehl et al., 2007). Regional sea-level projections are estimated by applying regional adjustments (Fig 10.32, p813) to projected global mean sea-level rise from 14 AR4 models.) The range represents the results of three different models, namely the SRES B1 (0.18 to 0.43 m), SRES A1B (0.21 to 0.52 m) and SRES A2 (0.23 to 0.56 m).
[78] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[79] Ibid.
[80] http://www.thefishsite.com/articles/805/climate-change-vulnerability-and-adaption-in-cambodia.
[81] Extensive deforestation and the resultant siltation of the Inga dams in the Democratic Republic of Congo resulted in a 70% decline of hydroelectric capacity. US$500 million was required to dredge and desilt the dams' canals and turbines (N Ligon, "Congo Colossus: The History, the Potential and the Environmental Impacts of the Grand Inga Hydropower Scheme," *Majani Media*, 2007, http://www.majanimedia.com/media/text/congocolossus.pdf.).

base flows in rivers during dry periods, and as a result of damage to infrastructure during floods. Other impacts on the energy sector are likely to include a reduction in the availability of woodfuel as an energy source due to the effects of climate change. This is as a result of a hotter and drier climate decreasing tree growth in times of drought and topsoil removal, limiting woodfuel availability in times of flood.

The **tourism** sector, which is only recently becoming a significant economic sector, will be negatively impacted by climate change due to *inter alia:* i) reduced water availability for consumption in tourism facilities in drought-prone areas[82]; ii) local extinction of wildlife unable to adapt to the changing climate, resulting in a reduction in wildlife viewing opportunities; and iii) extreme events damaging infrastructure and the reputation of the country as a safe destination.

These climate change-associated problems are expected to increase over time with detrimental impacts on food availability, livelihoods and economic development.

1.6. Non-climate change related threats

The vulnerability of rural Cambodian communities is exacerbated by the following non-climate related threats; i) strong dependence on rain-fed, unimproved agriculture; ii) strong dependence on rice; iii) high poverty levels; iv) deforestation; and v) resultant erosion.

The majority of agriculture in Cambodia is rain-fed subsistence agriculture, without inputs of water and nutrients, and is therefore vulnerable to extreme climate events, even in the absence of a changed climate. Crop cultivation is largely dependent on traditional cultivars i.e. unimproved varieties of rice, maize, sesame, vegetables and sweet potato. New pests and pathogens have recently contributed significantly to lowered productivity. Where modern agriculture has been introduced, this has reduced the diversity of crops planted, with an emphasis on a limited number of commodity crops. This has increased the dependence on rice, which occupies 84% of the total agricultural land area. Widespread poverty further limits the ability of rural communities to pursue alternative livelihoods, which are largely based on intact and functional forests. There has, however, been considerable deforestation in Cambodia since the 1960s[83]. Major drivers of deforestation include: i) expansion of agricultural and urban land as a result of an increasing population; ii) commercial logging; iii) illegal logging which is responsible for up to 94% of the total deforestation[84]; iv) firewood collection; v) forest fires; vi) a lack of transparency in the concession system; vii) unsustainable harvesting by concessionaires; and viii) poor management of forests. This has led to widespread degradation of forest ecosystems, upon which rural Cambodians (and particularly those within CPAs) are reliant for food, NTFPs, timber and woodfuel[85]. As a result, traditional Cambodian agricultural practices and the use of ecosystems as a resource base have become increasingly unsustainable through time. The causal chain of events is as follows:

- The cover of trees and grasses is reduced through degradation. Rates of woodfuel collection and levels of livestock stocking cannot be maintained as plant cover is reduced. As a result, these practices become increasingly unsustainable through time, further exacerbating degradation. A negative cycle of degradation is established.
- Soils are exposed to damage from sunlight and raindrop impact. This speeds up the decomposition rate and decreases the organic matter content in the soil. The process also brings about changes in the physical and chemical properties of soils. Clay dispersion and mineral crusting occur and the water and nutrient retention capacity are reduced[86].
- Surface runoff and soil erosion increase[87,88], and water quality of surrounding streams and rivers decreases with increased sediment load.

[82] Such as the Angkor Wat temples in the Siem Reap catchment area.
[83] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.
[84] EC. 2006. Cambodia – European Community Strategy Paper. http://www.eeas.europa.eu/cambodia/csp/07_13_en.pdf. [Accessed 2 September 2011].
[85] Rural livelihoods and Natural Resources Development Research Programme. 2010. Social Landscapes and Rural Livelihoods: Cambodia Communities in Transition. Phnom Penh: The Learning Institute.
[86] Cambodia Soil report prepared by: Yang Saing Koma, Lecturer, Royal University of Agriculture of Chamkar Dong and Project Officer in Sustainable Agriculture, Japan International Volunteer Centre,Phnom Penh) (pdf file: 61 kb). Available online at http://www.unescap.org/rural/doc/sads/index.htm. [Accessed 09 September 2011].
[87] Mills, A.J. and Fey, M.V. 2004. Effects of vegetation cover on the tendency of soil to crust in South Africa. Soil Use and Management 20: 308-317.

- There is less infiltration of rainwater into soil profiles, and consequently the 'sponge effect' of water catchments is reduced. This results in increased surface runoff and increased flow in rivers during wet seasons, but a concomitant reduction in river flow during dry periods.
- Water supply from rivers for domestic and agricultural use is consequently more variable and reduced during dry periods.
- Where riparian vegetation has been lost, the capacity of the river to slow down flood surges is reduced resulting in an increase in the incidence and frequency of floods as a result of deforestation[89].
- The availability of woodfuel as a source of energy for heating and cooking is considerably reduced as a result of deforestation and degradation.
- Agricultural productivity is reduced firstly because less water infiltrates into soils and growth of both crops and pastures is reduced and secondly because agricultural soil fertility is reduced as a result of erosion.
- Similarly, food supply from degraded forests is compromised because of reduced water infiltration and soil fertility. Furthermore, a decrease in agricultural productivity increases dependence on food supply from forests which increases pressure on these resources.

1.7. Description of the problem to be addressed

The problem that the AF project seeks to address is that the **climate change-induced hazard** of **erratic rainfall** is causing a reduction in agricultural productivity and forest-based income as a result of droughts and loss of topsoil during intense rainfall events/floods. This is increasing the vulnerability of rural Cambodian communities, particularly those living in PAs. The problem is exacerbated by the following underlying drivers of vulnerability: i) strong dependence on rain-fed, unimproved agriculture; ii) strong dependence on one crop, namely rice; iii) high poverty levels; iv) deforestation; and v) resultant erosion. The preferred response to addressing the identified problem is detailed below (Section 1.8).

1.8. Preferred response

The preferred response to the identified problem would be to build the climate resilience of rural Cambodian communities living in PAs through both extensive and intensive interventions which will enhance food supply and maintain ecosystem services. This will be achieved by employing the 'ecoagriculture' concept[90] which is defined as "a landscape approach to natural resources management that seeks to sustain agricultural/food production, conserve biodiversity and ecosystems and support local livelihoods". The concept will be implemented using two approaches:

- Extensive – restoring degraded forests in CPAs at a landscape-level by planting predominantly indigenous tree species that provide food and are particularly effective at stabilizing soils i.e. restoring natural capital.
- Intensive – conservation agriculture[91] interventions including: i) enrichment planting of rice paddy boundaries and other cultivated areas with multi-use tree species that will enhance crop productivity; ii) trial plots of several drought-tolerant hybrid rice cultivars in order to assess their potential yield and suitability for cultivation; and iii) intensifying and diversifying the cultivation of existing 'homegarden' or '*chamcar*' plots using adaptation farming techniques[92].

The **extensive approach** will restore the natural capital of degraded forests to benefit the surrounding communities. The scale of the intervention sites will be determined through the CPA surveys (see

[88] As a result, there is also an increase in flow in rivers during wet seasons, but a concomitant reduced flow in rivers during dry periods.
[89] Bradshaw, C.J. A.,Sodhi, N.S., Peh, K.S.H. and Brooks, B.W. 2007. Global evidence that deforestation amplifies flood risk and severity in the developing world. Global Change Biology, vol 13 no 11 pp 2379-95.
[90] Scherr, S.J., McNeely, J.A. 2008. Biodiversity conservation and agricultural sustainability: towards a new paradigm of 'ecoagriculture' landscapes. Phil. Trans. R. Soc. B. 363, 477-494.
[91] FAO defines 'conservation agriculture' as farming practices which have three key characteristics:
1. minimal mechanical soil disturbance;
2. maintenance of a mulch of carbon-rich organic matter covering and feeding the soil; and
3. rotations or sequences and associations of crops including trees which could include nitrogen-fixing legumes.

These characteristics are cross cutting aspects of the intensive interventions of the AF project.
FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.
[92] Hellen Keller International/Cambodia. 2003. Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.

Annex II). Based on preliminary results of the CPA surveys, the size of degraded forest areas in CPAs range from 10 ha to 2,000 ha. The AF project will aim to restore at least 1,875 ha of degraded forest (at an estimate cost of US$ 839 ha^{-1}) within at least three CPA intervention sites to build the climate change resilience of communities dependent on the forests.

The main priority of this intervention is to enhance the climate change resilience of communities reliant on CPA forests for the range of ecosystem services and livelihood opportunities described in Section I.1.1. By enhancing forest cover of degraded CPAs through restoration and establishing multi-use forests, the causal chain of events described in Section I.1.6, which ultimately leads to a reduced flow of food and ecosystem services from forests, will be halted. The multi-use forests will have trees with varying production cycles resulting in relatively uninterrupted supply of food throughout the year. This will reduce the vulnerability of surrounding communities to climate change. Depending on climate and other environmental characteristics, such as soil, there may be high and low seasons for harvesting various NTFPs.

The AF project activities will differ from ordinary restoration/reforestation interventions in Cambodia in that climate change considerations will be taken into account when restoring the degraded ecosystems. The restored multi-use forests will: i) produce more food, principally fruit, than the original forests; and ii) bind soils more effectively and provide more ecological services than, for example, a large-scale agricultural landscape. These services include water flow, timber provision, enhanced biodiversity, carbon sequestration, pollination, pest control and provision of medicine, fibre, resin and other NTFPs. The natural infrastructure established through the AF project will increase the resilience of vulnerable communities to climate change by buffering them from extreme events. The AF project will favour indigenous trees as: i) they are typically more effective at promoting soil regeneration; and ii) a high diversity of indigenous trees will enhance ecosystem resilience and stability over time. Annex III provides a list of trees suitable for use in establishing the restored forests. A group of particularly suitable trees that provide food and are effective at stablising soils include black-wood cassia (*Senna siamea*), Indian mulberry (*Morus alba*) and Indian lilac (*Azadirachta indica*). Commonly grown exotic fruit trees in Cambodian homegardens include mango (*Mangifera indica*), papaya (*Carica papaya*), cashew (*Anacardium occidentale*) and jackfruit (*Artocarpus heterophyllus*)[93,94]. To provide effective climate change adaptation and respond to an increased risk of soil erosion, damage to infrastructure and decrease in food supply, species with the following attributes will be preferentially selected for planting (see Annex III for a comprehensive list), i.e. species that:

- have very dense root systems and are particularly effective binders of soils[95];
- produce food products such as fruits, spices and nuts, including the valuable malva nut;
- are favoured by bees which produce honey;
- provide multiple other goods such as timber and NTFPs including fibre, resin and medicinal plants for traditional ceremonies which can be used to improve livelihoods;
- produce dense and nutrient-rich leaf litter that increases soil cover and regenerates soils through humus build up;
- provide nutrient-rich leaf litter for compost production as this will provide low-cost inputs into agriculture;
- are drought-resilient and able to persist under reduced soil water availability;
- produce sustainable woodfuel for cooking; and
- produce sustainable fodder as this will increase resilience of animal husbandry.

The **intensive approach** of the AF project will focus on the following interventions:

- enrichment planting of rice paddy boundaries and other existing cultivated areas with multi-use tree species that will enhance crop productivity and additionally provide NTFP's to farmers;
- establishing trial plots of several drought-tolerant hybrid rice cultivars in order to assess their yield potential and suitability for cultivation at each intervention site; and
- intensifying and diversifying existing agriculture practices and areas (including 'homegarden' or '*chamcar*' plots) by encouraging the cultivation of various beneficial crop species in combination

[93] Hellen Keller International/Cambodia. 2003. Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.
[94] HKI. 2000. Initial findings from the 2000 Cambodia National Micronutrient Survey.
[95] The presence of such species will increase the resilience of soil to erosive forces from an increased intensity of rainfall under a changed climate, and will also reduce the likelihood of climate change-induced extreme events such as landslides.

with the introduction of conservation agriculture adaptation practices such as rainwater harvesting, drip irrigation, green manuring and reduced tillage.

The intensive approach of the AF project will enhance the adaptive capacity of communities to climate change. Currently, climate change adaptation techniques are not widely implemented in Cambodia. It is noteworthy that the 2006-2010 Strategic Agriculture Development Plan does not take climate change adaptation or mitigation into account.

The introduction of beneficial multi-use tree species to existing cultivated areas will: i) improve the fertility, moisture-holding capacity and structure of agricultural soils; ii) protect crops from climate-related hazards such as drought, floods and wind; and iii) provide communities with additional benefits such as food, medicine, firewood and fodder[96,97,98,99]. Suitable tree species will be selected based on similar criteria to those described above for the extensive restoration of degraded forest, such as the ability to fix atmospheric nitrogen, stabilise soils, provide leaf mulch to the soil surface, and to provide diverse products such as food, firewood, timber, medicine and fodder (see Annex V for a comprehensive description of the preferred method of rice field enhancement). Rice yields in Cambodia are particularly low as a result of a reliance on non-improved rice varieties and low-input farming methods[100]. Rural communities are vulnerable to periodic rice shortages, particularly during periods of drought and flooding[101,102]. Enhancing the productivity of existing cultivated areas by introducing tree species which fix atmospheric nitrogen, reduce siltation and conserve water will reduce pressure on surrounding forests. This is because the practice of abandoning exhausted agricultural areas and clearing new fields will not be necessary if soil fertility and agricultural productivity can be maintained or increased[103,104].

The second intensive aspect of the AF project will focus on introducing drought-tolerant seeds of improved rice cultivars to establish trial plantings of ~100 ha at each intervention site. The suitability of these improved cultivars to the field conditions and farming techniques will be assessed at each site relative to traditionally grown varieties, with particular emphasis on the relative yield potential under conditions of water stress. The findings from these field trials and consultations with farmers will be used to assess the potential to upscale the distribution of improved drought-tolerant rice cultivars, which will increase the resilience of rice production to climate change impacts.

The third intensive aspect of the AF project activities will focus on intensifying and diversifying existing agriculture practices and areas (including 'homegarden' or '*chamcar*' plots) by encouraging the cultivation of various beneficial crop species in combination with the introduction of improved conservation agriculture practices such as green manuring and reduced tillage. Homegardens are common in rural communities. Plots are generally 30 m^2 in size and located around homesteads. Typical homegardens always have something to harvest on a daily basis. This has resulted in homegardens being labelled as the 'epitome of sustainability'[105]. Additionally, harvesting and maintenance operations in homegardens require less intensive labour from the community[106]. An advantage of homegardens is that they can be adapted to the size of land available[107]. The enhanced homegardens will provide constant and sustained supplies of food to dependent communities. An

[96] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.
[97] Peyre, A, Guidal, A, Wiersum, KF, and Bongers, F. 2006. Dynamics of homegarden structure and function in Kerala, India. Agroforestry Systems (2006) 66:101–115.
[98] Hellen Keller International/Cambodia. 2003. Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.
[99] "Climate change and African forest and wildlife resources" (African Forest Forum, Nairobi, Kenya, 2011).
[100] Simmons, L. and Nuberg, I. .2008. Exploring opportunities for integrating multipurpose trees on farms in Cambodia. *Asia-Pacific Agroforestry Newsletter* 33.
[101] Hellen Keller International/Cambodia. 2003. Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.
[102] McNaughton, A. 2002. Cambodia's experience and opportunities for domestic and international trade in organic agricultural products.
[103] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.
[104] Scherr, S.J., McNeely, J.A. 2008. Biodiversity conservation and agricultural sustainability: towards a new paradigm of 'ecoagriculture' landscapes. Phil. Trans. R. Soc. B. 363, 477-494.
[105] Kumar, B.M. and Nair, P.K.R 2004. The enigma of tropical homegardens. Agroforestry Systems 61: 135-152.
[106] Nair, P.K.R. 1984. Fruit Trees in Agroforestry. Working Paper. Environment and Policy Institute, East-West Center, Honolulu, Hawaii, USA.
[107] Peyre, A, Guidal, A, Wiersum, KF, and Bongers, F. 2006. Dynamics of homegarden structure and function in Kerala, India. Agroforestry Systems (2006) 66:101–115.

additional aspect of the project will be water use efficiency[108], with a focus on rainwater harvesting and Affordable Micro Irrigation Technology (AMIT)[109,110]. The AF project will encourage the production of a variety of crops such as kangkong (*Ipomoea aquatica*), mung bean (*Vigna radiata*), taro (*Colocasia esculenta*) and peanut (*Arachis hypogaea*) (see Annex VI for a comprehensive description of useful crops). Crops were selected based on criteria such as tolerance to drought or waterlogging, nutritional content, cost of production, market value, seasonality, compatibility with other crops, local familiarity with these crops and requests made in the CPA surveys[111,112,113]. Diversification of cultivated crops will reduce the prevalence of nutrition-related health issues and increase the climate resilience and food supply of subsistence farmers[114]. Nutritional deficiencies such as Vitamin A deficiency are widespread in Cambodia (predominantly affecting women and children) as a result of a heavily rice-dependent diet with insufficient intake of meat and vegetables[115]. The high reliance on rice as a staple crop also makes rural Cambodians susceptible to seasonal food shortages due to climate-linked crop failures, such as periods of drought or floods[116,117]. In diversifying agricultural production, the AF project will increase the resilience of rural Cambodian communities in the selected intervention sites.

The sustainability of the AF project will be ensured by:

- **Collaborating with communities to ensure that their needs with regards to climate change are met.** This will ensure that there is on-the-ground support for the AF project, thereby ensuring sustainability. Communities were surveyed to identify the major impacts of climate change, and the activities they viewed as necessary to overcome these problems. Impacts of climate variability were identified as: i) shortages of food and water; ii) damage to crop yields; iii) illness; iv) falling standard of living; v) damage to roads; and vi) less resin produced by trees. Communities suggested the following activities would enhance their capacity to adapt to these impacts of climate variability: i) training and assistance in climate-resilient farming techniques; ii) improvement of crop productivity; iii) training on and identification of climate-resilient crop species iv) preparing and delivering training courses on how to improve agricultural output; v) intensifying/diversifying existing agriculture practices and areas (including homegardens); vi) improving irrigation systems; vii) building roads; viii) digging ponds; ix) planting more trees to reduce erosion; x) raising awareness of adaptation benefits of forests; xi) establishing nurseries; xii) protecting and maintaining existing forest resources; xiii) strengthening patrols of CPA forests to stop illegal harvesting of NTFPs and timber; xiv) demarcating CPAs and raising awareness about CPAs; and xv) creating firebreaks to protect forests. The AF project has ensured that the needs of the community have been met by incorporating these activities into the project design.
- **Intensive training of local communities on climate change adaptation responses.** The established CPA Management Committees will be trained to oversee the adaptation interventions. These committees will by the end of the project have the requisite technical skills for expanding the adaptation interventions into other areas.
- **Recommending revisions to policy and legislation**, including recommended budget allocations, that will promote the protection of natural resources and the upscaling of the AF project's adaptation interventions.

[108] Pender. 2008. Agricultural technology choices for poor farmers in less-favoured Areas of South and East Asia. Occasional papers, Knowledge for development effectiveness. Asia and the Pacific Division, IFAD.
[109] AMIT can be defined as "slow and regular application of water directly to the root zone of plants through network of economically designed plastic pipes and low discharge emitters". IDE, 2001. Technical Manual for Affordable Micro Irrigation Technology (AMIT). International Development Enterprises, California, USA.
[110] AMIT are typically suitable for use on small and intensively farmed areas of ~0.1 – 0.4 ha. ITC. 2003. Low Cost Micro Irrigation Technologies for the poor. Intermediate Technology Consultants, United Kingdom.
[111] Mey Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf.
[112] See http://ecocrop.fao.org/ecocrop/srv.
[113] Agrifood Consulting International. 2005. Final Report for the Cambodian Agrarian Structure Study. Prepared for the Ministry of Agriculture, Forestry and Fisheries, Royal Government of Cambodia, the World Bank, the Canadian International Development Agency (CIDA) and the Government of Germany / Gesellschaft für Technische Zusammenarbeit (GTZ) by Agrifood Consulting International. Bethesda, Maryland.
http://agrifoodconsulting.com/ACI/uploaded_files/project_report/project_35_1220605826.pdf.
[114] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.
[115] HKI. 2000. Initial findings from the 2000 Cambodia National Micronutrient Survey.
[116] Hellen Keller International/Cambodia. 2003. Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.
[117] McNaughton, A. 2002. Cambodia's experience and opportunities for domestic and international trade in organic agricultural products.

- **Establishing multi-use forests that will yield goods** for commercial and domestic use for decades. The value of this new, productive landscape will incentivise protection of trees by the community.
- **Training communities on business plan development to ensure that alternative livelihoods are successfully implemented.** Changes to current land use practices will require implementation of alternative livelihoods such as ecotourism ventures. The AF project will ensure that communities are supported and trained in order to implement these changes sustainably.
- **Existing culture of protecting homegardens in rural areas in Cambodia.** The practice of maintaining homegardens in Cambodia is established in rural communities. The conservation agriculture interventions and restored forests will build on this culture of resource protection.
- **Ensuring effective management and protection of restored landscapes**. A portion of the budget has been dedicated to enhancing management practices in the restored forests and agricultural areas. This will include integrating climate change adaptation concepts into policies/legislation to avoid over-harvesting and illegal logging.
- **Legislative protection afforded by the formal inclusion of the restored forests into the CPA management plans**. The government is committed to protecting CPAs as per the PA Law. The inclusion of the restored forests into the CPA management plans will assist the government to fulfil this mandate. At the same time, collaboration with the government i.e. MoE Park Rangers, will make protection of the restored forests more effective.

The environmental, social and economic benefits of the restored forests are discussed in Section II.B. The cost-effectiveness of the approach is discussed in Section II.C.

1.9. Barriers

Addressing the hazard of erratic rainfall in the context of the non-climate change related root causes will require actions that overcome barriers to implementing the ecoagriculture concept to increase community resilience to climate change-induced impacts. Currently, **limited community awareness regarding climate change impacts and adaptation** represents an important barrier to the uptake of AF project interventions. The concept of restoring natural capital is not widely understood and there have been limited awareness raising activities undertaken within rural communities regarding climate change impacts and adaptation. As a result, rural communities are ill-equipped with the knowledge and tools to overcome worsening climatic conditions. **Limited technical capacity of local and national stakeholders to plan and implement the ecoagriculture interventions** means that there are not currently systems in place to ensure the successful implementation of ecoagriculture interventions. This is partly because adaptation based on natural infrastructure is a complex subject and requires considerable ecological expertise to be mainstreamed into the water, agriculture and environmental sectors. There is currently limited awareness of the benefits of climate change adaptation techniques such as ecoagriculture, and as mentioned in section 1.8 it is noteworthy that the 2006-2010 Strategic Agriculture Development Plan does not take climate change adaptation or mitigation into account. Existing and emerging agencies are therefore not equipped to lead large-scale monitoring efforts and/or generate coordinated landscape-scale resilient ecosystem projects. **Lack of physical and financial resources to adapt to climate change and climate variability** means that without the AF project communities will not be able to alter current practices to ensure successful adaptation to climate change. Rural communities in the target area are poor and lack the financial resources to safeguard themselves against current climate variability and future climate shocks using an ecoagriculture approach. These communities are dependent on ecosystem services and are thus highly vulnerable to the impacts of climate change. There is also limited understanding of the benefits of ecoagricultural approaches as a result of **limited demonstration of ecoagriculture approaches to enhance resilience to climate change**. This necessitates the implementation of the AF project to demonstrate the benefits of an ecoagricultural approach to climate change adaptation. While a limited number of projects are involved in reforestation activities, these projects have not focused specifically on species that provide food and prevent erosion of topsoil. As a result there have been no restoration trials undertaken that focus specifically on increasing the resilience of food supply to local communities and conserving topsoil under climate change conditions. Best practices for restoring species in ecosystems in order to specifically make communities more resilient to climate change are consequently lacking. Without access to replicable demonstrations, government decision-makers and resource users do not have the tools and knowledge necessary to decrease climate change vulnerability. With regards to upscaling the AF project, **the policy, strategy and legislative environment does not specifically support restoration and intensification approaches to**

increasing resilience of communities to climate change. Although the NAPA was prepared in 2006, to date there has been little integration of climate change into national development plans. The PA regulations have yet to be implemented because of a lack of financial resources at the national government level. **A lack of climate-related data** limits the effective assessment of climate change impacts in Cambodia, including downscaled projections[118], which in turn limits the planning of effective adaptation activities. The limited collection of climate-related data is a result of years of political conflict. Additionally, reliable forecasts of extreme weather events are not available in Cambodia[119] and thus such events often find communities largely unprepared. Rural communities rely mainly on indigenous communication channels, whereby villagers downstream hear the news of impending weather events from villagers upstream. The final barrier to successful implementation of the AF project is the **lack of secure land tenure**. The proportion of rural households lacking land for cultivation increased from 13% in 1997 to 20% in 2004. This problem is exacerbated by the issue of unclear property rights i.e. 80% of rural households owning land in 2004 were without land titles. Unsecure land titles inhibit investments in restoring natural capital and other measures to increase rural community resilience. This results in reduced agricultural productivity, low food supply and environmental degradation.

To overcome these barriers the project will provide the finance to undertake landscape-level restoration of degraded forests and diversify/intensify agriculture in and around CPA intervention sites. In doing so, awareness will be raised (through Components 1, 2 and 3; see Section II) of climate change impacts in local communities. The raised awareness, provision of trees, crops and rice for planting, technical training and implementation of the ecoagriculture approach (through Components 1 and 2) will encourage local communities to invest in the conservation of their restored landscapes and agricultural lands that yield multiple benefits and build their climate resilience. The demonstration of multiple benefits (with respect to building climate resilience) of landscape-level restoration and intensification/diversification of agricultural lands using useful species will be used to motivate local and national government to invest in upscaling such practices in other PAs across Cambodia. An upscaling strategy will be developed and policies that support budget allocations for the strategy will be promoted (including revisions where appropriate), addressing the policy, legislative and strategy barrier outlined above (through Component 3). This project will not explicitly address the lack of climate related data, however project activities will cater for an increase in the frequency and intensity of both droughts and floods, and studies will investigate the potential of an early warning system to ensure the ability of communities to prepare for extreme events. The project will work specifically within CPAs, which have been established to provide land tenure security, and will enhance the capacity of communities to protect their natural resources within CPAs through training and awareness raising. CPAs are assigned by the MoE to local communities under a long-term 15 year lease, which is renewable. Only CPA members can access and benefit from the proposed activities within their CPAs. Rights are recognized and stipulated in the PA Law (2008).

1.10. Site selection

Target areas for the AF project were selected based on: i) vulnerability of communities to the impacts of climate change; ii) adaptive capacity of communities; iii) dependence of the communities on ecosystem services; and iv) number of on-going climate change and development projects in the area.

The North-eastern Forests and Northern Plains regions, along with the Cardamom Mountains in the south-west, are the areas most vulnerable to the impacts of climate change in Cambodia (see Figure 5)[120]. These results were derived using the vulnerability assessment of the UNFCCC and a combination rating of the following: i) climate hazard; ii) human and ecological sensitivity; and iii) adaptive capability. Without intervention, food supply for rural communities in these regions will remain a major challenge.

[118] WikiADAPT, 2010. Available from: http://wikiadapt.org.
[119] NAPA, 2006.
[120] Yusuf, A.A. & Francisco, H. 2009. Climate Change Vulnerability Mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA), Singapore.

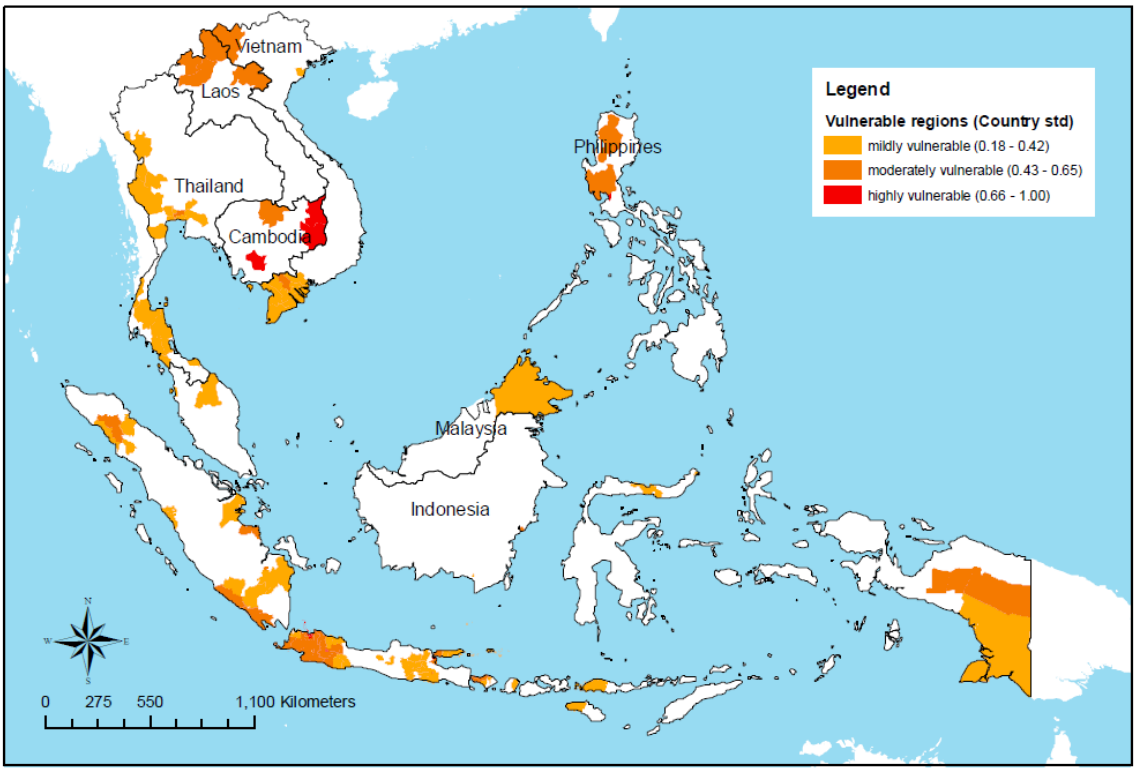

Figure 5: Map of the most vulnerable areas of South-east Asia.

The tribal communities in the North-eastern Forests are among the poorest in Cambodia. They are also highly vulnerable to anticipated climate change-induced increase in drought and flood occurrence as a result of their high dependence on climate-sensitive livelihoods and low adaptive capacities[121,122]. As in the Northern Plains target area, adequate food supply is difficult to attain and communities spend up to 70% of their income on food. Adaptation measures that enhance and sustain food supplies from restored forests will reduce the vulnerability of these communities to climate change-induced food shortages. While the Cardamom Mountains region is the focus of numerous development projects, the North-eastern Forests and Northern Plains regions of Cambodia have relatively few on-going projects (see Section II.F).

Climate change adaptation measures in PAs are highlighted as a requirement in Cambodia's Draft SNC, therefore PAs in the North-eastern Forests and Northern Plains regions of Cambodia were selected as target areas for the project. This decision, taken principally by the MoE, was supported by all stakeholders involved in the concept formulation phase of the AF project (see Annex IV). A brief description of the PAs in these target areas is provided in Annex I. The selected PAs (see Figure 6) are:

- North-eastern Forests target area: Virachey NP; Phnom Prech WS; Lomphat WS; and Namlear WS.
- Northern Plains target area: Kulen Promtheap WS; Phnom Kulen NP; and Beung Per WS.

[121] Based primarily on: Yusuf, A.A. & Francisco, H. 2009. Climate Change Vulnerability Mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA), Singapore.
[122] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.

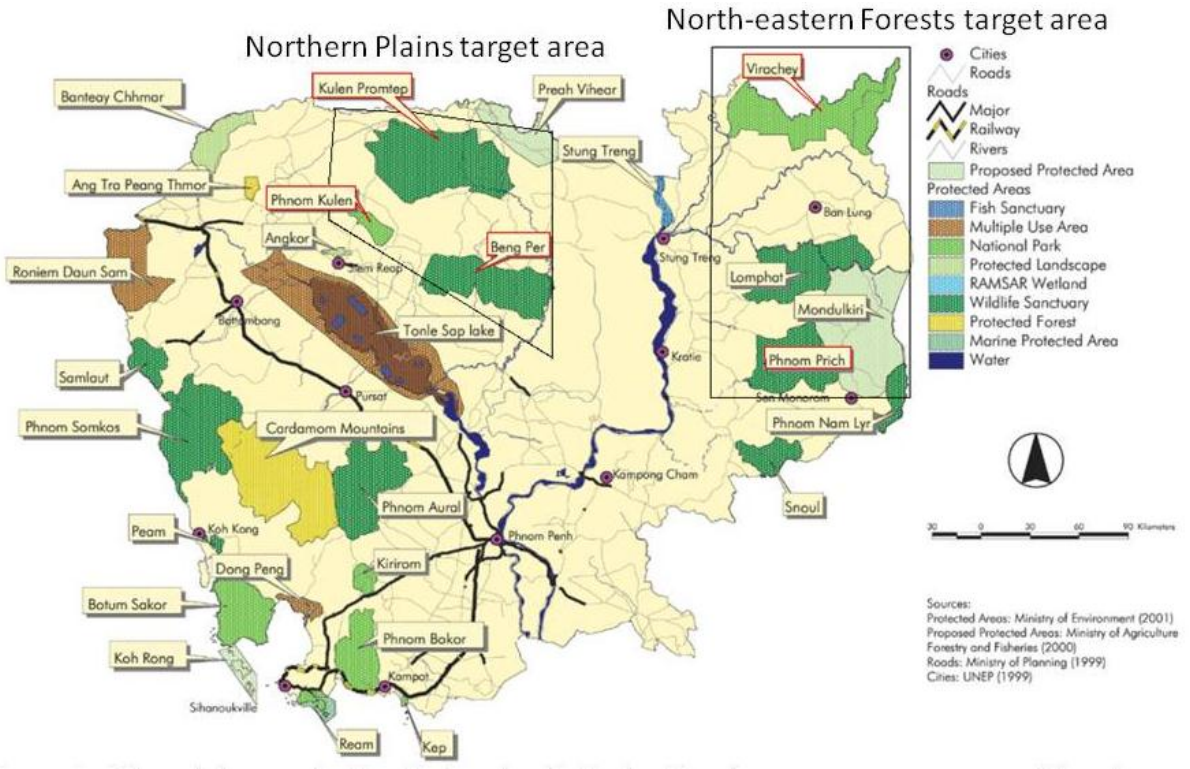

Figure 6: PAs within the AF project target areas[123].

Zonation of PAs is a requirement of the PA Law. This exercise, however, has not been undertaken as a result of a lack of finance at the national government level. All PAs will eventually be zoned into the following:

- Core Zone: A zone of delicate ecosystems and high value for conservation of rare, endangered, vulnerable and threatened animal and plant species.
- Conservation Zone: A zone next to the core zone, which is of conservation value for natural resources, ecosystem, slope, and natural landscape. Entry into this zone shall be by obtaining advance permission from the Natural Protection and Conservation Administration on site. Use of forest by-products for livelihood by the local community and indigenous ethnic minorities, which shall not cause harm to biodiversity, shall be under strict monitoring.
- Sustainable Use Zone: A zone of high value in national economic development that directly serves the purpose of management and conservation of the PA and contributes to promoting the standards of living of the local community and indigenous ethnic minorities.
- Local Community Zone: A zone that serves the economic and social development of the local community and indigenous ethnic minorities who already have on-going activities, including housing, farming and vegetable gardening. Issuance of permit or land title or permission to use the land in this zone shall be certified by the MoE.

Within the Sustainable Use and Local Community Zones, communities may apply to the MoE to have areas designated as CPAs. CPAs are patches of forest deemed valuable by the communities living in the PA. Until zonation of the PAs has been undertaken, any area within the boundary can be designated as an Economic Land Concession (ELC) as stipulated by the PA Law. These areas are used by private companies for commercial plantations. However, once an area has been declared a CPA, it cannot be granted as an ELC due to an agreement signed between the CPA Committee and the MoE. An agreement reached by the stakeholders involved in the concept formulation phase of the AF project was that only CPAs in which a secure land tenure exists will be considered as project intervention sites[124]. Lomphat and Namlear WSs do not have any established CPAs at the time of writing this Project Concept and therefore will not form part of the project. However, these PAs will be eligible for upscaling of activities should CPAs be established. The remaining five PAs contain 33 CPAs, i.e.:

[123] ICEM, 2003. Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 148 pp.
[124] Areas zoned as 'Community Zones' also provide a secure land tenure, however, there are no such zoned areas at present.

- 5 CPAs in Virachey NP;
- 3 CPAs in Phnom Prech WS;
- 1 CPA in Kulen Promtheap WS;
- 5 CPAs in Phnom Kulen NP; and
- 19 CPAs in Beung Per WS.

A survey of all 33 CPAs has been undertaken by the MoE with support from UNEP for the purposes of the AF project. The objective of the survey was to engage with the CPA Committees and communities to establish: i) the extent to which the climate hazard of erratic rainfall has affected food supplies; ii) the degree of degradation of forests in the CPAs; iii) the willingness of the community to support the project's concrete adaptation interventions; and iv) the species the community would like to be planted to enhance food supplies from restored forests. See Annex II for details of the survey. Based on the results, at least three CPA intervention sites containing degraded forest will be selected for implementation of the concrete adaptation activities. A second survey of these sites will be undertaken to refine the interventions and costing. This information will be included in the Full Project Proposal.

Preliminary results of CPA surveys

The AF project survey consulted 283 CPA Committee Management members over a two week period (from 17-28 September 2011) with financial and technical support from UNEP. Interviews and discussions were facilitated by ten (five teams of two) MoE staff members. This survey was undertaken specifically to gather information for this AF project, and was hampered by excessive rainfall in the PAs making road un-useable. Motorcycles were hired to reach the communities, or the CPA Management Committee members made their way to meeting points accessible to the MoE team members so that the interviews and discussions could be held.

Assessment of climate hazard (erratic rainfall):
The effects of droughts and floods on PA communities are evident in the responses to the survey questionnaires. CPA Management Committee members reported an increase in the number of episodes of these climate change-related events over their lifetimes, as well as in last five years. These events had a range of negative impacts including:
- shortages of food and water;
- damage to crop yields;
- illness;
- falling standard of living;
- damage to roads; and
- less resin produced by trees.

The cost of such events ranged from US$ 200 to US$ 2000 per family per event. The number of families per CPA ranges from 9 to 1,812 with an average of 318 families per CPA. Measures that have been taken to cope with economic losses and impacts of the climate hazard events include:
- migrating to new areas that are perceived to be less affected;
- increasing the collection of NTFPs from the CPA;
- borrowing food;
- selling livestock;
- reporting the impacts to villages or local authorities;
- replanting trees; or
- doing nothing because of a lack of means to intervene.

Assessment of the CPA:
The majority of the CPA Committee members were unable to easily assign values to NTFPs in the CPAs, however, estimates of US$ 279 and 512 per family per year were provided by two committees. The size of the CPAs range from 78 ha to 9,862 ha, with an associated range of degraded areas within the CPAs of 2 ha to 2,000 ha. Committee members suggested, *inter alia,* the following activities inside the CPAs to adapt to the impacts of droughts and floods:
- prevent erosion by planting more trees;
- raise awareness of the benefits of the forest;
- establish nurseries;

- prepare CPA action plan;
- demine the CPA (forests still contain mines from the previous decades of conflict);
- protect and maintain existing resources;
- strengthen patrolling groups to stop illegal harvesting of NTFPs and timber;
- demarcate the CPA so villagers and outsiders know which areas are protected;
- build dams; and
- create fire breaks.

The following were some of the suggested activities for areas outside of the CPAs:
- assistance with farming to increase the productivity in agricultural areas in and surrounding the villages;
- increase crop production;
- select crop species for villagers;
- prepare and deliver a course on agriculture;
- plant homegardens;
- build health centres;
- establish emergency rescue teams;
- set up irrigation systems;
- build roads; and
- dig ponds.

The community members requested support to restore degraded areas of CPAs with valuable tree species that produce NTFPs and timber, as well as to intensify/diversify homegardens and increase agricultural productivity outside of CPAs. The requested size of homegardens nearby residential areas and on areas designated by the community as farm land (i.e. outside of the CPA) was approximately 0.2 ha to 1 ha per family. This equates to a combined agricultural/homegarden area range of 8 ha to 1,000 ha depending on the number of families supported by the CPA. The revenue from crops and NTFPs that these homegardens would produce was estimated to be US$ 132 to US$ 350 per family per year, or US$ 62 to US$ 3,000 per ha per year. There were requests for training on establishing and maintaining these areas, to ensure maximum benefit in coping with droughts and floods. One CPA Management Committee requested a partner to invest in agriculture and tree planting to increase agricultural yields to adapt to climate change.

Table 1: Summary of preliminary results of CPA surveys.

Cost per family of climate change-induced droughts of floods	200 to 2,000 (US$)
Average number of families per CPA	318 (families)
Total cost to community per climate change-induced drought or flood in CPA survey area	63,600 to 636,000 (US$)
Size of CPA	78 to 9,862 (ha)
Value of CPA per family	279 to 512 (US$)
Area of degradation within CPA	2 to 2,000 (ha)
Requested size of homegardens near residential areas	0.2 to 1 (ha per family)
Requested size of homegardens near residential areas	8 to 1,000 (ha per community)
Value of agricultural produce from homegardens to be established per family per year	132 to 350 (US$)
Value of agricultural produce from homegardens to be established per ha per year	62 to 3,000 (US$)

PROJECT / PROGRAMME OBJECTIVES:

The AF project seeks to address the vulnerability of rural communities living in selected PAs in Cambodia to the climate change-induced hazard of erratic rainfall which is reducing food supplies as a result of an increased frequency of droughts and loss of topsoil during intense rainfall events and flooding. The overall **goal** of the AF project is to increase food supply and reduce soil erosion in communities surrounding at least three CPAs in Cambodia by: i) restoring at least 1,875 ha of degraded forests with plant species that are particularly appropriate for this goal; ii) enrichment planting of rice paddy boundaries and other cultivated areas with multi-use tree species that will

enhance crop productivity; iii) trialling plots of several drought-tolerant hybrid rice cultivars in order to assess their potential yield and suitability for cultivation; and iv) intensifying and diversifying the productivity of at least 1,875 family agriculture areas (including homegardens ranging in size from 0.2 ha to 1 ha) in communities living around the CPA forest sites. In this way, a new type of natural capital will be produced that is specifically tailored, using ecological and soil science expertise, to adapt local communities to climate change. The increased agricultural productivity from the conservation agriculture interventions will provide communities with food and revenue and reduce the pressure on forests, making the forests and the services they provide more resilient to climate change. The benefits of this landscape management to enhance ecosystem services will extend to downstream communities, beyond the CPA intervention sites. The **objective** of the AF project is consequently to enhance the climate change resilience of communities living around at least three CPA intervention sites, as well as downstream communities, to the climate change-induced hazard of erratic rainfall.

Selection of at least three CPA intervention sites will be based on the results of the survey of all 33 CPAs in the target area of the project. See Annex II for more details of the survey and Annex I for details of PAs and CPAs in the target area. The Full Project Proposal will include details of selected intervention sites. Past successes will be drawn on and upscaled where appropriate. The AF project will be driven by a consultative and participatory approach meaning local community knowledge will be important for shaping interventions and will be combined with current knowledge of proven technology and approaches for restoring natural capital and intensifying agriculture in PAs aimed at enhancing food supplies to communities in the short term i.e. within five years.

The AF project will deliver on this objective through three components, namely:

- Protocols for ecoagriculture interventions;
- Concrete ecoagriculture adaptation interventions; and
- Institutional capacity, awareness raising and upscaling of ecoagriculture interventions.

Component 1 will use bio-physical, ecological and socio-economic research to develop restoration and conservation agriculture protocols to be implemented in Component 2. This first component is necessary to ensure that the protocols are grounded in a participatory approach and capture indigenous knowledge, as well as being scientifically appropriate for the selected intervention sites. Component 2 will ensure that the restored forests and productive agricultural areas are maintained and the benefits maximised. Alternative livelihoods established through the AF project will increase the resilience of local communities to the effects of climate change. Component 3 will create an enabling environment for the ecoagriculture concept to be implemented in other PAs in Cambodia, through awareness raised at a local and national level, and an upscaling strategy supported by policy revision where required.

PROJECT / PROGRAMME COMPONENTS AND FINANCING:

The AF project **strategy** will be to implement a set of concrete ecoagriculture interventions to increase the resilience of communities living around at least three CPA intervention sites. The **approach** will be one of: i) extensive landscape-level restoration of at least 1,875 ha (in total) of degraded forests to restore natural capital thereby buffering communities from the impacts of climate change-induced floods and droughts, as well as providing food and stabilizing soils despite an increase in the frequency and intensity of climate change-induced droughts and floods; and ii) intensifying and diversifying agricultural productivity of at least 1,875 families to reduce crop vulnerability and ensure agricultural growth and poverty reduction. Conservation agriculture practices will be based on successful climate change adaptation techniques. The AF project activities will be based on the best available knowledge, technology and proven approaches regarding restoring natural capital and intensifying agriculture in PAs and will enhance food supply and conserve topsoil at the CPA intervention sites. This will be achieved within five years based on the growth of planted trees and crops (see Annexes III and VI). These activities will be supported by measures to build the capacity of local communities to restore and intensify agriculture to increase their climate change resilience as well as allow for replication and upscaling of the approach to other CPAs. This will ensure that benefits are sustained beyond the lifetime of the AF project.

The project's implementing agency currently advocates gender sensitivity and gender equality in all project implementation activities in the country. Gender mainstreaming is important for addressing the

Millennium Development Goals (MDGs). All MDGs currently not being achieved in Cambodia[125] have adverse effects for women. In addition, climate change increasingly hampers MDGs achievement and thus is likely to increase these negative effects on women[126]. Women are generally the primary collectors of water and woodfuel. An increase in the frequency of drought can affect time spent collecting water and woodfuel, which could jeopardise livelihoods, workloads and reduce school attendance. The knock-on effect of this is reduced opportunities for women to engage in income generating activities. It is therefore important that the project use a gender-sensitive approach that ensures representation of women within training workshops, demonstration activities and management committees[127].

The following table describes the project components, indicative outputs and outcomes. During the project formulation phase a thorough baseline study will be conducted. This will involve: i) collation of detailed information on climate change vulnerabilities and ecosystem status of the selected CPA intervention sites; ii) identification of knowledge gaps; iii) determination of appropriate community agricultural intervention sites and key adaptive measures; and iv) identification/verification of site specific drivers that undermine resilience and feasible adaptation responses.

PROJECT COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
Component 1: Protocols for ecoagriculture interventions.	Output 1.1: Information generated on climate change impacts and preferred ecoagriculture interventions through a consultative and participatory approach.	Technical expertise and a local enabling framework for forest restoration and conservation agriculture interventions that build climate resilience developed at CPA intervention sites through a consultative and participatory process.	260,000
	Output 1.2: Economic assessments undertaken to identify most appropriate ecoagriculture interventions and associated micro-finance and insurance products.		65,000
	Output 1.3: Forest restoration and conservation agriculture protocols developed for CPA intervention sites based on results from Output 1.1 and 1.2.		150,000
Component 2: Concrete ecoagriculture adaptation interventions.	Output 2.1: Capacity of local community for building climate resilience increased, including capacity to plan, implement and maintain ecoagriculture interventions under Output 2.2.	Multi-use forests established and maintained and agricultural practices diversified/intensified to supply a diverse range of food and stabilize topsoil, despite an increase in climate change-induced droughts and floods.	252,500
	Output 2.2: Forest restoration and conservation agriculture protocols implemented to build climate resilience (developed in Component 1) in CPA intervention sites.		2,647,500
	Output 2.3: Local communities' livelihoods enhanced and diversified through sustainable development of NTFPs and the promotion of sustainable alternative livelihood strategies.		295,000
	Output 2.4: Socio-economic and ecosystem monitoring of AF project impacts inside and outside of CPA		200,000

[125] The MDG most likely not to be achieved is MDG 1: eradicate extreme poverty and hunger.
[126] UNDP. 2009. Resource guide on gender and climate change.
[127] Data should identify for example women's and men's roles and responsibilities in the community, their access and control over land/resources/benefits, their inclusions in decision-making processes, as well as their particular capacities/knowledge and vulnerabilities/needs related to adaptation to climate change (UNDP. 2010. Guide book for designing and implementing gender-sensitive community-based adaptation programmes and projects).

	intervention sites.		
Component 3: Institutional capacity, awareness raising and upscaling of ecoagriculture interventions.	Output 3.1: Awareness increased at a local level of the importance of ecoagriculture for protecting and enhancing commercial and subsistence activities	Restoration and conservation agriculture interventions to build climate resilience of local communities mainstreamed into Cambodia's adaptation framework and related sector policies.	150,000
	Output 3.2: Ecoagriculture activities promoted through institutional capacity building and proposed revisions to policies, strategies and legislation.		90,000
	Output 3.3: National ecoagriculture upscaling strategy developed and institutionalised for CPAs in Cambodia		60,000
Component Total			4,170,000
Project/Programme Execution Cost[128]			396,150
Total Project/Programme Cost			4,566,150
Project Cycle Management Fee charged by the Implementing Entity			388,123
Amount of Financing Requested			**4,954,273**

PROJECTED CALENDAR:

The table below indicates milestone dates for the proposed project/programme

MILESTONES	EXPECTED DATES
Start of Project/Programme Implementation	2012
Mid-term Review (if planned)	2014
Project/Programme Closing	2016
Terminal Evaluation	2017

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience.

The AF project will comprise the following components:

Component 1: Protocols for ecoagriculture interventions.

Output 1.1: Information generated on climate change impacts and preferred ecoagriculture interventions through a consultative and participatory approach.

This output will focus on strengthening the knowledge base of firstly the effects of climate change on landscapes and production systems within Cambodian CPAs and secondly the appropriate adaptation solutions. These solutions will be informed by a consultative and participatory process which will prioritise ecoagriculture interventions developed in Output 1.2 for implementation under Component 2. The following activities will be implemented in this output:

- Undertake gap analyses and institutional mapping exercises in relevant government departments and research institutions to determine shortfalls in knowledge, planning and implementation of ecoagriculture interventions within CPAs.
- Set up research groups to conduct targeted research to fill the knowledge gaps identified in the above activity.

[128] This includes the Monitoring and Evaluation (M&E) costs. See Table 6 in Section III.C for further details.

- Develop and implement PhD and MSc projects in collaboration with Cambodian and international research institutions. These projects should be based on and further develop the findings of Component 1 of the AF project.
- Undertake bio-physical, ecological and socio-economic assessments of CPA intervention sites in order to understand resource use, agricultural production and adaptive capacity. This information will be used to identify the needs as well as understand the vulnerability of local communities under future climate change impacts/conditions. Geographical assessments of degraded forests of CPA intervention sites will be used to map erosion-prone areas in order to select site specific locations for ecoagriculture interventions.
- Use short- and medium-term climate forecast information to inform planting schedules in order to reduce the impacts of drought and heat stress on crop yields. This will reduce agricultural production risks. The most appropriate means of communication with farmers e.g. SMS via mobile phone, will be investigated and recommended to appropriate service providers.
- Evaluate the potential of naturally occurring local crop varieties, wild crop relatives as well as neglected and underutilised crops species to provide cultivars with improved tolerance to direct (erratic rainfall) and indirect (pests and diseases) climate change impacts using genetic analyses as well as community surveys.
- Evaluate the potential of drought-tolerant rice varieties for improving germination rates, growing periods, yields and rice quality relative to traditional varieties used by communities.
- Identify indigenous multi-use plant species tolerant to water-stressed soil conditions and suitable for restoring degraded forest areas. Species valuable for: i) consumption; ii) NTFPs; iii) animal husbandry; iv) soil stabilisation; v) increased soil fertility; and vi) cash crops will be prioritised.
- Undertake a hydrological/engineering study of water-catchment areas in CPA intervention sites to identify appropriate ecoagriculture and infrastructural interventions for enhancing water flow regulation and erosion control ecosystem services.
- Undertake geographical and agricultural assessments of rice paddy areas to determine appropriate multi-use tree densities and planting plans for maximising soil stability, nitrogen enrichment and water conservation.

The information collected in the above activities will be used to develop protocols for ecoagriculture interventions under Output 1.3 as well as a local community training course in Output 2.2. The protocols will therefore be driven be a consultative and participatory process. Furthermore, an upscaling strategy developed in Outcome 3 will be based on the information generated from these activities. The socio-economic assessments will use a gender-sensitive approach in which 50% of the people consulted will be women. This approach will ensure that gender equality is maintained through the AF project interventions. These assessments will build on results from the CPA surveys undertaken to date for the AF project, as well as the follow-up surveys of the selected intervention sites during development of the Full Project Proposal (see Annex II for description of the community surveys and questionnaire).

Output 1.2: Economic assessments undertaken to identify ecoagriculture interventions and associated micro-finance and insurance products.

This output will focus on prioritising ecoagriculture interventions as well as associated micro-finance and insurance products for implementation under Component 2. This will be based on the results of Output 1.1 as well as economic analyses and market assessments. This output will include the following activities:

- Identify locally available micro-finance and weather index-based insurance products for safeguarding farmers' agricultural productivity.
- Undertake an in-depth market assessment, where micro-finance and insurance are not available to determine the commercial viability of such products.
- If micro-finance and insurance are commercially viable, develop business plans based on the results of the above activity and distribute to relevant private sector players.
- Assess the effectiveness of local agricultural markets in each CPA. This will be used to provide recommendations to local authorities regarding investments needed for increasing market efficiency as well as relevant policy changes[129,130].

[129] Agrifood Consulting International and CamConsult (2006) Diagnostic Study, Phase 1 of Design, Agricultural Program, Cambodia, 2007-12 – Program Concept Document Final Report. Prepared forAusAID by Agrifood Consulting International. Bethesda, Maryland.

- Undertake a cost-benefit analysis of planting the tree and crop species listed in Annex III and IV, respectively, as well as tree and crop species identified during the CPA survey (Annex II).
- Assess the local socio-economic costs and benefits of ecoagriculture interventions identified in Component 1 through market assessments and other economic analyses.

The results of the above activities will be used for developing local-scale ecoagriculture interventions under Output 1.3, implemented in Component 2. These activities will also be important in guiding the upscaling strategy developed in Component 3.

Output 1.3: Forest restoration and conservation agriculture protocols developed for CPA intervention sites based on results from Output 1.1 and 1.2.

The information collected on natural resources, food supply needs, agricultural output, adaptive capacity and community vulnerability in Output 1.1, as well as the cost-benefit analysis undertaken in Output 1.2, will be used to develop the technical restoration and conservation agriculture protocols. These protocols will establish a local enabling framework used to guide: i) the selection of multi-use trees species as an ecoagricultural intervention for enhancing food supply, NTFPs and soil stabilisation; ii) the selection of suitable crop varieties/species and conservation agriculture techniques; iii) the development of alternative livelihoods which are climate-resilient; and iv) the development of a framework for supporting and training communities in forest restoration and conservation agriculture.

Stakeholder involvement will be an integral part of developing the technical protocols for forest restoration and conservation agriculture interventions. Throughout the process of developing protocols, regular consultations and meetings will be held with communities to ensure an inclusive and participatory approach which fosters community buy-in.

Component 2: Concrete ecoagriculture adaptation interventions.

The information generated under Component 1 will be used to implement on-the-ground forest restoration (i.e. establish multi-use forests) and conservation agriculture interventions in the targeted CPA intervention sites.

Output 2.1: Capacity of local communities for building climate resilience increased, including capacity to plan, implement and maintain ecoagriculture interventions under Output 2.2.

This output aims to increase the success and sustainability of ecoagricultural interventions implemented under Outputs 2.2 and 2.3. This will be achieved by training local authorities and communities to plan, implement and maintain interventions beyond the lifespan of the AF project through improved management (relevant to current management practices) of restored (i.e. multi-use) forests) and agricultural areas. An important aspect of the long-term sustainability of multi-use forests will be protection from degradation. Commercial and small-scale illegal logging for timber and woodfuel, as well as harvesting of food and NTFPs from CPA forests were identified as local community concerns during the Project Concept phase. This output will include the following activities:

- Develop a training course and adaptation toolkit for local farmers on maintaining agricultural production under climate change conditions. The training course will cover topics such as forest restoration, erosion control, fire management, tree crops and nursery management. It will also have a strong focus on the adaptation benefits of the ecoagriculture interventions. Specific skills to be transferred to local communities will include:
    - soil conservation techniques such as contour planting, ridge construction, reduced and zero-tillage systems for maintaining/improving soil structure and nutrient cycling as well as reducing vulnerability to erosion;
    - management of crop residues as a source of fodder production, or alternatively as a source of green manure to improve soil structure and fertility;
    - techniques for harvesting and storing rainwater for irrigating high-value or water-intensive crops, or alternately to sustain homegarden crops during periods of drought; and

[130] McNaughton, A. 2002. Cambodia's experience and opportunities for domestic and international trade in organic agricultural products.

- maintenance of water-efficient irrigation systems such as AMIT[131] to maximise the production of high-value or water-intensive crops.

- Train local authorities, agricultural extension officers and CPA committee members to implement the conservation agriculture protocols developed in Component 1 and to deliver the training course and use the adaptation toolkit developed by the AF project. Agricultural extension officers will advise farmers on: i) crop choices; ii) appropriate conservation agricultural practices; and iii) use and maintenance of AMIT, as well as transfer skills and communicate lessons learned to communities in areas situated away from intervention sites. Training on management techniques will include how to maintain soil stability, nutrition and water infiltration, and how to select crops in the face of climate change. This will be based on criteria such as compatibility with other species, ease of management, resilience to climate extremes and seasonality of production. Committee and community training will be gender-sensitive to ensure equal opportunities for all community members to learn and benefit from the AF project.
- Train local communities on the importance of protecting natural resources in order to ensure the sustainability of establishing multi-use forests.
- Strengthen systems for protecting and patrolling multi-use forests and other natural resource areas. This will entail: i) demarcating CPA boundaries of intervention sites; ii) strengthening co-ordination between local communities and MoE Park Rangers; iii) training local communities on relevant laws protecting their natural resources[132]; and iv) providing law enforcement equipment (e.g. radios). This is necessary to reduce illegal harvesting of NTFPs and timber. At present, CPA Management Committees co-ordinate patrols using community members of the CPA to prevent illegal activities. Transgressions are mostly from outsiders as opposed to CPA community members.

Output 2.2: Forest restoration and conservation agriculture protocols implemented to build climate resilience (developed in Component 1) in CPA intervention sites.

Within this output the climate change resilience of local communities will be increased by restoring degraded forests and intensifying/diversifying existing agriculture practices. This output will include the following activities:

- Establish community-managed local nurseries to supply climate-resilient plant species for intensification/diversification of agricultural production as well as establishment of multi-use forests. Nurseries will be responsible for seed collection, storage and sowing as well as plant propagation and planting. Cuttings will be collected for species that can be propagated vegetatively. For all other species, seeds will be collected. Seedlings and cuttings will be grown in nurseries until saplings are ready for out-planting.
- Restore degraded areas in CPAs[133] using multi-use forest species that supply a diverse range of goods for commercial as well as domestic use, including timber and NTFPs such as resin, medicine, fibre, nuts and fruit. Species that produce dense soil-binding roots will be planted first. Thereafter fast-growing, sun-tolerant and nitrogen-fixing species will be planted, such as the hairy-leafed apitong (*Dipterocarpus alatus*) and tosp mow lasto (*Flemingia macrophylla*) (see Annex III). These species will provide effective canopy cover to reduce the erosive action of raindrops. Increased litterfall from the canopy will enrich the soil and further enhance the establishment of other species planted for food supply, NTFPs, timber and woodfuel, such as black-wood cassia (*Senna siamea*), Indian mulberry (*Morus alba*), drumstick tree (*Moringa oleifera*), *Morinda citrifolia and Dasymaschalon lamentaceum* (see Annex III). Terraces will be used in certain areas to prevent soil erosion from extreme rainfall events[134]. Restored multi-use forests will provide an economic buffer against climate change damages. The benefits of this approach have been detailed in Sections I.1.8. and II.B.
- Enhance rice yields and climate resilience by planting multi-use trees around existing rice paddies. Species resilient to drought and water-logging as well as valuable for: i) consumption; ii) increased soil fertility (nitrogen fixing/leguminous species); and iii) NTFPs such as fruits, firewood

[131] Clements, R., J. Haggar, A. Quezada, and J. Torres (2011). Technologies for Climate Change Adaptation – Agriculture Sector. X. Zhu (Ed.). UNEP Risø Centre, Roskilde, 2011.

[132] Such as the Law on Environmental Protection and Natural Resources Management (1996), as well as the National Environmental Action Plan (1998-2002), the National Wetland Action Plan (1997) and the National Biodiversity Strategy and Action Plan (2002).

[133] Simmons and Nuberg. 2008. Exploring opportunities for integrating multipurpose trees on farms in Cambodia. Asia-Pacific. Agroforestry Newsletter 33 12-14.

[134] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.

and fodder will be selected. Potential species include *Leucaena leucocephala*, chres (*Albizia lebbek*), snaov (*Gliricidia sepium*), kra ngoung (*Dalbergia cochinchinensis*), thnong (*Pterocarpus indicus*), drumstick tree (*Moringa oleifera*) and *Acacia mangium*. The selection of species to be planted will be finalised based on community consultation. Approximately 40-80 trees will be planted along the embankments of each rice paddy at intervention sites. This will cost ~US$ 84-168[135]. The enrichment planting of rice paddies will provide multiple benefits, such as stabilisation of soils, reduced siltation, increased water infiltration rates, increased protection from floods, reduced evaporation, improved soil structure as a result of increased leaf mulch and improved soil fertility. This will increase the resilience of rice production[136] and strengthen food supply under climate change conditions, as well as provide alternative sources of income for communities[137].The benefits of this intervention are outlined in Annex V and Section II.B.

- Intensify/diversify farming practices and improve technologies for reducing water-use[138] using conservation agriculture protocols developed in Component 1. This will include techniques such as: i) planting of trees to prevent water logging, erosion and nutrient leaching from agricultural fields; ii) planting water-efficient crops and drought-resilient tree crops; iii) constructing terraces; iv) installing water-efficient irrigation systems (e.g. AMIT systems[139], drip irrigation); v) rainwater harvesting; vi) reduced tillage; vi) mulching with vegetation; and vii) green manuring. Crop configurations used will optimise light, water and space. For example, shade-tolerant species (such as kangkong, sweet potato or ginger) will be planted underneath species that require full sunlight (such as tomato, maize, mung bean, or tree species such as mango). AMIT in combination with conservation agriculture techniques such as vegetative mulching will maximise water efficiency and increase the resilience of local agriculture to drought[140,141,142,143]. The conservation agriculture protocols applied will contribute to adapting agricultural production to anticipated impacts of climate change by maintaining soil stability, improving soil organic matter and nitrogen content, conserving soil moisture, and increasing water infiltration resulting in increased crop production, diversity and climate resilience[144].
- Establish field trials of drought-tolerant rice varieties, based on the results of Output 1.1. A consultative process will be undertaken to identify farmers to establish and maintain trial plantings. A total of ~100 ha at each intervention site will be established. The field trials will be used to assess the suitability and cost-effectiveness of assorted drought-tolerant rice cultivars for improving rice yields and climate resilience.
- Construct dams/ponds and canals for increasing water supply for irrigation and preventing water logging, erosion and nutrient leaching after extreme rainfall events[145]. The feasibility of using these ponds/dams and canals for small-scale aquaculture projects will be investigated during

[135] This assumes a cost of tree establishment of ~$US 839/ha, based on:
- Agroforestry costs ~US$ 960 per ha in Bangladesh. Rahman, S. A., Paras, F. D., Khan, S. R., Imtiaj, A., Farhana, K. M., Toy, M. M., Akhand, M. B., Sunderland, T. 2011. Initiatives of tropical agroforestry to sustainable agriculture: A case study of Capasia Village, Northern Bangladesh. Journal of Horticulture and Forestry 3(4): 115-121
- Agroforestry in Cambodia costs ~US$ 300 - US$ 500 per ha in a 2011 project. Information obtained from the Wildlife Alliance in Cambodia.
- Woodland restoration costs ~US$ 1,750 per ha in Australia. Source: http://fotpin.hussat.com.au/docs/woodland-restoration-implementation-plan%20.pdf.
- Bottomland Forest restoration costs ~US$ 178 - US$ 267 per ha in a USA based project. National Research Council. 1991. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academy Press, Washington. DC.
- Spekboom Thicket restoration costs ~US$860 per ha in South Africa.

[136] Lowendor HS. 1982. Biological nitrogen fixation in flooded rice fields. Cornell international agricultural mimeograph. 1982

[137] Hellen Keller International/Cambodia. (2003) Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production.

[138] Pender. 2008. Agricultural technology choices for poor farmers in less-favoured Areas of South and East Asia. Occasional papers, Knowledge for development effectiveness. Asia and the Pacific Division, IFAD

[139] For example. AMIT systems such as a Small Baffle Drip Kit can irrigate up to 250m^2 and cost approximately US$ 20 per unit (IDE, 2001. Technical Manual for Affordable Micro Irrigation Technology (AMIT). International Development Enterprises, California, USA). The number of AMIT kits to be distributed, and the area which can potentially be irrigated, will be determined by overall budget and the number of families selected to benefit from the AF project.

[140] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.

[141] IDE, 2001. Technical Manual for Affordable Micro Irrigation Technology (AMIT). International Development Enterprises, California, USA.

[142] ITC. 2003. Low Cost Micro Irrigation Technologies for the poor. Intermediate Technology Consultants, United Kingdom.

[143] Clements, R., J. Haggar, A. Quezada, and J. Torres (2011). Technologies for Climate Change Adaptation – Agriculture Sector. X. Zhu (Ed.). UNEP Risø Centre, Roskilde, 2011.

[144] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.

[145] Ahmed and Lorica. 2002. Improving developing country food security through aquaculture development-Lessons from Asia. Food Policy, 27 (2) 125-141.

Output 1.2[146,147,148]. Water-efficient technologies/methods will be designed and developed based on a hydrological/engineering study of CPA intervention sites undertaken during Output 1.1.

- Establish fire breaks to combat fires in multi-use forests. Fires are predicted to increase in frequency and intensity as a result of drier and warmer conditions[149].
- Distribute drought-resilient seed stocks to local businesses that supply seeds to CPA communities.
- Establish woodlots for supplying woodfuel to local communities. Woodfuel supply has decreased in CPAs as a result of forest degradation related to over-harvesting as well as climate change-induced floods and droughts[150].
- Introduce appropriate post-harvest storage techniques (such as metallic grain silos and three layer hermetic bags) to reduce/prevent fungal infections and pest outbreaks after extreme rainfall events[151].
- Improve crop pest and disease management by using integrated pest management systems, and introducing crop varieties/species resistant to pests and diseases[152].

Output 2.3: Local communities' livelihoods enhanced and diversified through sustainable development of NTFPs and the promotion of sustainable alternative livelihood strategies.

This output will provide the foundation for local communities to develop sustainable alternative livelihood strategies. This will increase and diversify community income, consequently providing safety-nets and enhancing climate change resilience. As women are largely responsible for post-harvest operations, this output will have a strong emphasis on gender equality. This output will include the following indicative activities:

- Facilitate farmers' access to micro-finance and weather index-based insurance products where local companies or NGOs provide these financial services. This will be based on the results of the activities in Output 1.2.
- Develop business plans for alternative livelihood options identified in Component 1 for CPA intervention sites.
- Facilitate the integration of small-scale farmers into domestic, regional and global markets for high-value agricultural (HVA) products, in particular high value crops and NTFPs, in a sustainable manner. This will entail: i) conducting market chain analyses; ii) linking the CPA communities with NTFP Working Groups[153]; and iii) providing skills training in packaging/storage/post-harvest processing and marketing.
- Train local communities in CPAs where ecotourism is appropriate and desired to establish an enabling environment for the development of ecotourism projects.
- Establish sustainable alternative livelihoods, such as ecotourism operations, small-scale craft and vegetable businesses and NTFP enterprises based on products such as honey, resin, rattan and malva nuts.

Livelihood enhancement and diversification will encourage people to move away from unsustainable exploitation and degradation of natural resources and thereby increase social and environmental resilience to climate change. The majority of the efforts to support livelihood enhancement and diversification so far have tended to be supply-driven and focused on single, "blueprint" solutions[154].

[146] Dey et al. 2005. Status and economics of freshwater aquaculture in selected countries of Asia. Aquaculture Economics and Management, 9(1-2) 11-37
[147] Hishamunda et al. 2009. Commercial aquaculture in Southeast Asia: Some policy lessons. Food policy, 34(1) 102-107
[148] Prein 2002. Integration of aquaculture into Crop-Animal systems in Asia. Agricultural Systems, 71 (1-2) 127-146
[149] Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 148 pp.
[150] Guo 2007. Potential of woodlot establishment in meeting the practical and strategic gender needs of women in the upper west region of Ghana. Studies in Gender and Development in Africa (1) 21-42
[151] Antonio Acedo. Postharvest Technology for Fresh Chili Pepper in Cambodia, Laos, and Vietnam. International Cooperators Guide. AVRDC The World Vegetable Centre. Publication number 10-735
[152] Rahman, S. A., Paras, F. D., Khan, S. R., Imtiaj, A., Farhana, K. M., Toy, M. M., Akhand, M. B., Sunderland, T. 2011. Initiatives of tropical agroforestry to sustainable agriculture: A case study of Capasia Village, Northern Bangladesh. Journal of Horticulture and Forestry 3(4): 115-121.
[153] The Cambodia NTFP Working Group was initiated in 2006 to promote networking among community-based organisations and provide support for the development of NTFP-based enterprise and livelihood development.
[154] IMM, 2008. Sustainable Livelihoods Enhancement and Diversification – SLED: A manual for Practitioners. IUCN, International Union for the Conservation of Nature.

Output 2.4: Socio-economic and ecosystem monitoring of AF project impacts inside and outside of CPA intervention sites.

Within this output the socio-economic and ecological benefits of the AF project interventions will be monitored inside and outside CPA intervention sites. The likely benefits accruing in these areas are detailed in Section B. Activities will include the following:

- Identify target communities and areas for monitoring outside (downstream) the CPA intervention sites. The target communities inside the CPA sites will be identified when the intervention sites are selected.
- Develop socio-economic and ecological monitoring protocols, including SMART (Specific Measurable Attainable Relevant Time-bound) indicators and targets.
- Train local communities in target areas to undertake the baseline surveys and data collection activities detailed in the monitoring protocols.
- Conduct baseline surveys of: i) the target communities (socio-economic surveys); and ii) degraded forest ecosystems and agricultural landscapes (ecological surveys). These surveys will use statistically robust methodology to gather data in line with the SMART indicators.
- Implement a tool to measure the impact of the project. This tool will be developed during the Full Project Proposal formulation phase and implemented three times during the lifespan of the AF project (beginning, middle and end) to track the socio-economic and ecological benefits in community areas inside and outside of the CPA intervention sites.
- Collect data in a scientifically rigorous and statistically robust way in the target community areas, after implementation of the AF project interventions. Simple monitoring techniques will be used to measure *inter alia*: i) canopy cover of multi-use forest; ii) soil erosion using fixed metal marker stakes; iii) sediment load of local streams; iv) revenue from the sale of NTFPs; and v) revenue from the sale of agricultural products.
- Undertake an economic analysis of the direct and indirect (downstream) socio-economic, ecological and hydrological benefits in target community areas (inside and outside intervention sites), linking the benefits to specific AF project interventions. The results of this analysis will be used to guide the upscaling strategy developed in Output 3.3.
- Develop and implement (for the lifespan of the AF project) long-term socio-economic and ecosystem research protocols for multi-use forests and conservation agriculture practices in CPAs to quantify impacts of climate change and adaptation interventions on ecosystem goods and services. The socio-economic surveys will extend to communities (identified in the first activity of the output) beyond the CPA intervention sites. Information will be used to inform future management decisions as well as the upscaling strategy. Control sites in targeted CPAs will be integrated into these protocols.
- Compile a report of the initial results, motivating for funding to continue the long-term socio-economic and ecosystem research beyond the lifespan of the AF project.

Component 3: Institutional capacity, awareness raising and upscaling of ecoagriculture interventions.

This component aims to: i) raise public awareness of the effectiveness of ecoagricultural interventions for adapting to climate change; ii) increase institutional capacity to implement ecoagriculture interventions; and iii) build on the enhanced capacity and awareness in order to develop a successful upscaling strategy.

Output 3.1: Awareness increased at a local level of the importance of ecoagriculture for protecting and enhancing commercial and subsistence activities.

This output will be focused on increasing awareness at local and national levels of the importance of ecoagriculture approaches and ecosystem services for protecting economic communities against climate variability. Activities include:

- Raise public awareness of the impacts of climate change and the benefits of adaptive agricultural techniques. This will be achieved using signboards, posters, booklets and pamphlets that describe the importance of restored forests and diversified/intensified agricultural practices for enhancing community resilience to climate change.
- Produce a documentary film to promote the ecoagriculture approach implemented within CPA intervention sites.

- Design and implement an awareness raising campaign focused on climate change adaptation and the advantages of the ecoagriculture approach. This campaign will specifically target rural, isolated communities.
- Establish demonstration gardens, farmer field days and workshops as teaching tools. Link farmers from the intervention sites to Farmer Field Schools[155] where appropriate.
- Target local communities situated in CPAs away from intervention sites for an additional awareness raising campaign to ensure that the results of ecoagriculture interventions implemented in Component 2 filter through CPA communities. Activities under this step will include school/university as well as local community (i.e. older generation) field trips to sites where ecoagriculture interventions have been demonstrated in Component 2.
- Undertake education initiatives at schools and universities. These initiatives will be focused on raising awareness of climate change and how multi-use forests and agricultural practices which enhance ecosystem services can reduce the negative impacts of climate change.
- 'Train the trainers' - professionals (*inter alia* teachers and lecturers) will be trained to present information about climate change impacts and adaptive solutions.
- Develop a web-based data network portal to supply information about the ecoagriculture interventions to local government agencies responsible for policy and planning development as well as local stakeholders e.g. management committees and user groups. Public reports will be compiled and disseminated through this website to raise general awareness regarding the project and restoring natural capital. The website will be linked to appropriate learning networks such as the Climate Change Adaptation Knowledge Platform for Asia, UNEP's Global Adaptation Network (GAN), UNEP's regional adaptation network for Asia and Pacific; the Adaptation Learning Mechanism[156] (ALM) and WikiADAPT[157].
- Use a social networking site to promote: i) information generated in the project, and ii) the documentary film.
- Promote the species used in the AF project through Reducing Emissions from Deforestation and Forest Degradation (REDD) as well as sustainable management of forests, forest conservation and the enhancement of forest carbon stocks (REDD+). Correspondence will be maintained between REDD+ project managers and the AF project manager to facilitate the uptake of appropriate species by REDD+ projects.

Project summaries and concept notes will be distributed by the DRCPAD to the CPA Committee network. This will enable CPA communities to learn of the successes of the AF project as well as how these successes can be replicated in other CPAs.

Output 3.2: Ecoagriculture activities promoted through institutional capacity building and proposed revisions to policies, strategies and legislation.

This output will focus on building stakeholder capacity to incorporate ecoagriculture interventions into CPA management plans, as well as proposing revisions to policies, strategies and legislation where appropriate. Activities will include:

- Undertake capacity-building needs assessments to gauge the level of understanding of restoring natural capital and conservation agriculture amongst stakeholders at national and provincial levels. The assessments will use a gender-sensitive approach in which 50% of those consulted will be women. A set of training needs will be identified. Training course material and long term national and provincial training strategies will be developed and delivered to national and provincial institutions to increase their capacity to plan and manage ecoagriculture interventions.
- Conduct Participatory Rural Appraisals (PRAs) of local communities at all CPAs (100) in Cambodia to inform the upscaling strategy undertaken in Output 3.3. Information will be collated to determine the appropriateness of the AF project interventions and the specific adaptation needs of other CPAs. This will build the MoE database and raise awareness about the importance of restoring natural capital and implementing conservation agriculture practices to build climate change resilience in all CPA communities. CPA management plans of the selected CPA intervention sites will be updated to include climate change adaptation activities implemented in Output 2.1, ensuring long-term adaptation benefits.

[155] Farmer Field School approach is a group-based learning process first implemented by FAO. The goal is to increase agricultural productivity and empower principally small-scale farmers.
[156] See: http://www.adaptationlearning.net/.
[157] See: http://www.weadapt.org.

- Propose revisions to relevant national policies, strategies and legislation to incorporate the ecoagriculture approach and promote restoration as an adaptation measure for sustainable management of degraded ecosystems. Proposed revisions will promote upscaling of the project's adaptation interventions, and propose altering budgets where appropriate. This will be undertaken in collaboration with local authorities, management committees, water user groups, NGOs and local forest user groups. Policies that support the strengthening of CPA Management Committee mandates will be promoted. Such policies will provide support for on-the-ground activities and contribute towards ensuring the sustainability of AF project interventions.
- Encourage co-ordination and collaboration with other restoration projects at national and provincial levels. Collaboration between projects will contribute to the replication and upscaling of ecoagriculture activities as well as the effective use of financial and human resources.
- Conduct multi-stakeholder consultations on land tenure to generate a report with recommendations on how to encourage local communities to invest in the ecoagriculture approach. This will be achieved through the Participatory Rural Appraisals (PRAs) in all 100 existing CPA communities, as well as in communities surrounding areas identified by the Ministry of Environment as potential CPAs.

Output 3.3: National ecoagriculture upscaling strategy developed and institutionalised for CPAs in Cambodia.

This outcome of the AF project will focus on creating a national level strategy for upscaling the ecoagriculture approach. This will align with the MoE's goal to increase the number of CPAs in Cambodia from 100 to 120 by the end of 2015, and ultimately to 150. The project will integrate interventions and knowledge developed in Components 1 and 2 into national policies and development planning to create an enabling policy and strategy environment. On the basis of this, a strategy (additional to that developed in Output 3.2) to ensure integration of the lessons learned into national policy will be developed. This will be achieved through the following activities:

- Undertake a gap analysis of national development plans and policy to determine the extent to which ecoagriculture approaches are included.
- Identify existing entry points for proposed revisions which incorporate ecoagriculture approaches at a national scale.
- Establish an inter-ministerial (incorporating MoE, MAFF, MRD, MLMUPC, MoT, NCDM and CDC) and multi-partner (NGOs, private sector & local representatives) task group to facilitate the development of the upscaling strategy.
- Identify successful ecoagriculture adaptation interventions from Components 1 and 2, and ensure that these are incorporated into the proposed national strategy revisions.
- Prepare a summary report and policy briefs promoting the AF project and ecoagriculture approaches.
- Distribute the summary report and policy briefs to ministries, including the MoE, MAFF, MRD, MLMUPC, MoT and NCDM.
- Institute a national education programme to promote lessons learned from demonstrations in intervention sites. This will be done using appropriate media (radio, television, websites, printed media, agricultural extension officers and websites).

Technical guidance provided by the AF project in combination with the leveraging capacity of the adaptation task group will support policies that secure budget allocations for the strategy (including revisions where appropriate). This will assist replication of successful project adaptation interventions at a national scale. Replication of appropriate interventions could, for example, be facilitated by ministerial declarations and revision of the legislation of PAs where barriers to replication are identified.

There are certain requirements which will influence the identification of suitable PA sites in which to implement the ecoagriculture interventions at a national scale. The suggested characteristics of target areas that are needed for successful upscaling are:

- sites with secure land-use rights;
- sites in which communities will be able to enjoy immediate benefits in the short term;
- sites in which farm inputs such as machinery and crop chemicals are available;
- sites which have access to the facilities required for training and capacity building; and
- communities which have established pathways for the dissemination of knowledge.

B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities.

Climate variability is already reducing agricultural productivity as well as the flow of food supplies from forests and agricultural fields. This situation is likely to be exacerbated by predicted climate change-induced increases in drought and flood occurrence. This AF project aims to remedy this situation through its ecoagriculture approach focussed on restoring degraded areas to multi-use forests, planting multi-use tree species along rice paddy boundaries and other existing cultivated areas, establishing trial plots of drought-tolerant hybrid rice cultivars, and intensifying/diversifying existing agricultural areas. The benefits of this approach are detailed below.

Benefits to communities within target CPAs

Direct benefits from the AF project will include: i) improved food supply; ii) an enhanced safety net (in terms of natural resources) during times of hardship (drought, flood and death)[158]; iii) reduced soil erosion; iv) increased NTFPs from multi-use forests; v) increased, timber and woodfuel; vi) enhanced recreation and tourism opportunities; vii) improved post-harvest storage techniques; viii) improved crop pest and disease management; ix) increased awareness and understanding of ecoagriculture practices; and x) training on how to maintain the multi-use forests and agricultural areas. Indirect benefits will include: i) pollution reduction; ii) watershed protection (flood control); iii) improved soil fertility; iv) nutrient cycling; v) micro-climatic regulation (long-term); vi) carbon storage and vii) protection of biodiversity[159]. Communities within CPA intervention sites will immediately perceive the short-term benefits of an intensified multi-crop system, which will include:

- enhanced and diversified food supply as well as benefits such as improved health;
- improved livelihoods and diversified income sources including access to markets and facilitation to micro-finance and weather index-based insurance information;
- decreased loss of crops due to climate-related hazards; and
- decreased impact of climate-related hazards such as floods as a result of decreased run-off.

Direct and indirect use values will support economic activity and human welfare within communities. These factors are important for the quality of life of rural communities.[160] The social, economic and environmental benefits of the this project will reach at least 1,875 families within intervention sites situated in areas identified as most vulnerable to the impacts of climate change in Cambodia's PAs (see target area selection in Section I.1.10).

Benefits to areas outside of the immediate target CPAs

Benefits of the AF project interventions to communities outside the CPA intervention sites include:

- improved water quality for downstream water users as a result of interventions that reduce soil erosion (e.g. tree planting and the establishment of multi-use forests, terracing, pond/dam construction);
- increased water flow in rivers and streams for downstream water users as a result of interventions that increase infiltration into soil properties (e.g. tree planting and fire management);
- enhanced awareness of local communities and local authorities of the role of secure land tenure provided by CPAs in promoting long term adaptation investments;
- enhanced public awareness of climate change and appropriate adaptation interventions through a public awareness raising campaign, as well as training of local authorities and agricultural extension officers;
- increased adoption of adaptation interventions (e.g. introduction of drought-resilient crop species) by communities outside CPA intervention sites as a result of information sharing between CPA communities resulting from community field visits to CPA intervention sites as well as general public awareness raised by the AF project; and
- greater trade in agricultural produce and natural resource products generated by the AF projects' intensive agriculture activities and establishment of multi-use forests.

[158] Fiona Paumgarten. The role of non-timber forest products as safety-nets: A review of evidence with a focus on South Africa. GeoJournal (2005) 64: 189–197

[159] Camille Bann 2003. An Economic Analysis of Tropical Forest Land Use Options, Ratanakiri Province, Cambodia http://203.116.43.77/publications/research1/ACF4B.html

[160] Balmford, Andrew, et al., 2002. "Economic reasons for conserving wild nature." *Science* 297: 950-953.

Increased watershed protection and increased carbon storage will benefit 5,000 to 9,000 families[161] outside of the targeted CPAs. Benefits will contribute to improving socio-economic wellbeing and building resilience of CPA communities to the impacts of climate change. Without the project's proposed interventions, food supply for rural communities in these areas will remain a major challenge which will be further exacerbated by climate change.

Participation will be a key factor during the planning and implementing phases of this project. A participatory and livelihoods approach involving the community will create awareness and knowledge sharing. Effective participation in the project will form the basis of long-term consensus building.

Gender equality will be a focal point of training and skills development in this project. Women will gain the skills and exposure needed to increase their representation in community structures such as CPA Management Committees and local user groups. At a national level, the socio-economic benefits to be delivered by the AF project will include increased awareness and technical capacity of policy-makers and government institutions with regards to forest restoration, conservation agriculture and alternative climate change adaptation approaches.

Benefits from the project will accrue at different timescales. For example, certain tree species used for NTFPs, timber and resin will only produce fruit or harvestable timber 10-20 years after restoration implementation. Alternatively, fast growing fodder and vegetable crops will produce more immediate benefits. Specific short (1 year), medium (5 years) and long-term (>10 years) expected benefits of this project for Component 1 – 3 are described below:

Table 2: Short, medium and long-term social, economic and environmental benefits of the AF project.

Component	Social benefits	Economic benefits	Environmental benefits
Component 1: Protocols for ecoagriculture interventions.	**Short- to long-term:** • Increased knowledge and technical expertise on forest restoration, conservation agriculture and additional climate change adaptation approaches. • Increased technical and managerial capacity for developing and implementing plans for efficient adaptation approaches to climate change. • Increased gender equality and representation by women within community structures (50% of those selected for skills development will be women). • Increased skills in resource economics focused on cost-benefit analyses of different climate change adaptation approaches.	**Short- to long-term:** • Increased profit margins will be realized as a result of increased and resilient crop, NTFP and rice yields resulting from increased forest stewardship and restoration as well as intensified conservation agriculture areas and practices. • Increased financial returns as a result of business plans developed to facilitate establishment of alternative livelihoods. • Further increases in household incomes will be realized as a result of diversified livelihoods. • Increased financial stability during times of hardship (drought, floods or deaths). • It is likely that these benefits will only be fully realized during component 2 (see below). • Reduced agricultural risk through the provision of short- and medium-term	**Short- to long-term:** • Increased protection of natural resources as a result of increased awareness of climate change impacts. • Increased security around forest areas as a result of buy-in from the community. • Increased number of management committees focused on promoting sustainable/conservation agriculture approaches. • Increased knowledge of forest and agricultural ecosystems through PhD and MSc projects.

[161] Cambodia National Report on Protected Areas and Development. Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 148 pp.

		climate forecast information.	
	Medium-to long-term: • Increased potential to diversify livelihood strategies.		
Component 2: Concrete ecoagriculture adaptation interventions.	**Short- to long-term:** • Enhanced food supply. • Improved livelihoods through adoption of multiple livelihood strategies and diversified incomes, food sources, skills and social institutions[162]. • Increased knowledge through training provided on the ecoagriculture approach. • Increased supplies of NTFPs such as medicinal plants and fodder. • Increased resilience of animal husbandry as a result of increases in fodder production. • Increased utilization of priority crops with multiple health and particularly nutritional benefits. • Decreased flooding intensity as a result of decreased water runoff.	**Short- to long-term:** • Increased profit margins as a result of increased yields and resilience of NTFPs (medicinal and aromatic plants) as well as increased crop yields[163]. • Facilitation of micro-finance to farmers to increase agricultural production. • Increased household incomes through increases in NTFPs (fodder, medicinal and aromatic plants) from restored forests. Benefits include US$ 17 ha^{-1} yr^{-1} resulting in a net present value of US$ 697 over 90 years (discounted at 6%) and a value of US$ 1,530 (not discounted)[164]. • Benefits from intensified/diversified conservation agriculture includes US$ 930 per ha per crop cycle averaged over 17 different crop species (ranging from US$ 204 for coconut to US$ 4,968 for citrus per ha per year) (see Annex VI). • Provision of water for irrigation using adaptation techniques such as drip irrigation, AMIT and through the construction of dams, ponds and canals. • Reduced loss of harvest through improved post-harvest storage techniques and improved crop pest and disease management.	**Short- to long-term:** • At least 1,875 ha of degraded forest will be restored. • Reduced deforestation and overutilization of forest resources through the i) provision of NTFPs from multi-use trees; ii) intensified/diversified production within agricultural areas; and iii) provision of woodfuel from woodlots. • Protection and sustainable use of the forest and its resources resulting in enhanced biodiversity. • Reduced erosion through the use of terracing. • At least 1,875 ha of existing agriculture areas (including homegardens) intensified/diversified and restored as functioning conservation agriculture croplands using ~17 crop species. • At least 1,875 ha of rice paddies will be bordered with nitrogen-fixing trees. • At least 300 ha of drought-tolerant rice will be trialled.
	Medium- to long-term: • Decreased number of malnourished families. • Increased cultural, recreational and tourism opportunities. • Strengthened forest safety nets providing forest resources during events such	**Medium- to long-term:** • Sustained and resilient crop yields in dry years where conventional agricultural approaches would have limited success[166] as well as sustained and resilient crop yields in wet years, comparable to conventional	**Medium- to long-term:** • Increased maintenance and provisioning of ecosystem services such as carbon sinks, water flow regulation, erosion control, pollination and soil fertility[171]. Within five years, forest restoration can result in a decrease in soil

[162] Fiona Paumgarten. The Role of non-timber forest products as safety-nets: A review of evidence with a focus on South Africa. GeoJournal (2005) 64: 189–197.
[163] Dumanski, J., R. Peiretti, J. Benetis, D. McGarry, and C. Pieri. 2006. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv.P1: 58-6.
[164] Camille Bann 2003. An Economic Analysis of Tropical Forest Land Use Options, Ratanakiri Province, Cambodia http://203.116.43.77/publications/research1/ACF4B.html.

	as droughts, floods or death[165].	agricultural approaches. This is achieved with less fertilizer and other inputs and therefore reduced costs[167]. • Reduced production costs within 3 to 5 years as a result of increased organic matter and nitrogen fixing bacteria[168]. Nitrogen fixers can save a farmer US$ 20-48 (and up to US$ 200 in the case of *Leucaena leucocephala*) (see Annex V). • Increased forest services including watershed benefits of US$ 76 ha^{-1}, biodiversity benefits of US$ 511 ha^{-1} and carbon storage of US$ 7 ha^{-1} over 90 years (discounted at 6%)[169]. • Increased soil carbon by 5-15%. An increase of one tonne of soil carbon in degraded cropland soils may increase crop yield by 10 to 20 kg ha^{-1} for maize[170].	erosion by 6-30%[172] as well as a reduction in surface run-off by 20%[173]. After five years, converted agricultural plots may reduce surface runoff by 75-85% and soil erosion by 85-95%[174]. • Increased amount and quality of habitats for animals and plants. • Increased organic matter in agricultural areas as a result of reduced soil erosion, increased crop yields and plant growth[175]. • Increased soil carbon sinks as a result of decreased erosion and increased crop yields[176]. • Enhanced carbon sequestration contributing to mitigation of climate change[177]. • Increased soil quality in terms of organic matter, and nutrients (N, P, K, Ca, and Mg) resulting from feedback mechanisms associated with increases in plant biomass and grain yields[178,179] related to nitrogen-fixing trees and conservation agricultural practices.
	Long-term: • Increased supplies of timber, woodfuel and NTFPs such as resin, malva nuts and fibres. • Increased health as a result of decreased flooding,	**Long-term:** • Increased profit margins as a result of increased and resilient NTFPs such as malva nuts, timber and crop yields[180]. After 15 to 20 years fruit can be harvested	**Long-term:** • Increased forest and crop species diversity creating resilience to climate change and sustained ecosystem functioning and services[185].

[166] Dumanski, J., R. Peiretti, J. Benetis, D. McGarry, and C. Pieri. 2006. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv.P1: 58-6.
[171] Dumanski, J., R. Peiretti, J. Benetis, D. McGarry, and C. Pieri. 2006. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv.P1: 58-6.
[165] Fiona Paumgarten. The Role of non-timber forest products as safety-nets: A review of evidence with a focus on South Africa. GeoJournal (2005) 64: 189–197.
[167] Ibid.
[168] Ibid.
[169] Camille Bann 2003. An Economic Analysis of Tropical Forest Land Use Options, Ratanakiri Province, Cambodia http://203.116.43.77/publications/research1/ACF4B.html.
[170] Sodhi and Ehrlich: Conservation Biology for All. http://ukcatalogue.oup.com/product/9780199554249.do
[172] Liu, J., Li, S., Ouyang, Z., Tam, C., & Chen, X. (2008). Ecological and socioeconomic effects of China's policies for ecosystem services. Proceedings of the National Academy of Sciences of the United States of America, 105(28), 9477-82. doi: 10.1073/pnas.0706436105.
[173] Brauman, K.A., Daily, G.C., Duarte, T.K., Mooney, H.A., 2007. The nature and value of ecosystem services: An overview highlighting hydrologic services. Annual Review of Environment and Resources 32, 67-98.
[174] Ibid.
[175] Dumanski, J., R. Peiretti, J. Benetis, D. McGarry, and C. Pieri. 2006. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv.P1: 58-6.
[176] Ibid.
[177] Ibid.
[178] Sae-Lee S, Vityakon P, Prachaiyo B. 1992. Effects of trees on paddy bund on soil fertility and rice growth in Northeast Thailand. Agroforestry Systems 18 (3) 213-223.
[179] FAO http://www.fao.org/DOCREP/006/Y4751E/y4751e0k.htm.
[180] Dumanski, J., R. Peiretti, J. Benetis, D. McGarry, and C. Pieri. 2006. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv.P1: 58-6.

	reduced soil erosion and increased soil fertility. • Increased water availability from sustained river flow during dry periods resulting from improved water infiltration. • Increased resistance and resilience to the impacts of climate change.	from malva nut trees resulting in benefits of US$ 131 per household per harvest[181]. Collection of other long-term products such as rattan and resin can contribute US$ 600 and US$ 300 respectively per household after >10years[182]. Sustainable timber harvesting from restored communities will result in long term (10-30 yrs) benefits of US$ 24 ha^{-1} yr^{-1} resulting in net present value benefits of US$ 247 ha^{-1} over 90 years (discounted at 6%) and US$ 2,160 ha^{-1} (not discounted). Overall for a range of NTFPs including malva nuts, rattan and resin, benefits of US$ 366 ha^{-1} yr^{-1} resulting in a net present value of US$ 3,922 over 90 years (discounted at 6%) and US$ 32,940 over 90 years (not discounted) will be gained[183]. • Increased rice production and yields from watershed benefits such as protection from flooding and soil erosion resulting from restored forests and conservation agriculture lands. • Reduced costs associated with flood damage (infrastructural damage and livelihood losses). A 10% increase in natural forest area can lead to a decrease in flood frequency between 4% and 28%, and to a decrease in flood duration at the country scale of between 4 % and 8%[184].	
Component 3: Institutional capacity, awareness raising and upscaling of ecoagriculture interventions.	**Short- to long-term:** • Increased awareness and technical capacity of policy-makers and government institutions regarding forest restoration and conservation agriculture. • Increased capacity of professionals (*inter alia* teachers and lecturers) to	**Medium-to long-term:** • Sustainable and resilient yields of crops, NTFPs, timber and woodfuel for the medium- and long-term income generation.	**Long-term:** • Further long-term reductions in deforestation and forest degradation associated with increases in ecosystem services.

[185] Isbell, F. 2010. High plant diversity is needed to maintain ecosystem services. Nature Letters doi:10.1038/nature10282
[181] Rural Livelihoods and Natural Resources Development Research Programme, 2010. Social Landscapes and Rural Livelihoods. Cambodian Commmunities in Transition. Phnom Penh: The Learning Institute.
[182] Tola et al., 2010. Economic Importance of Non-Timber Forest Products.
[183] Camille Bann 2003. An Economic Analysis of Tropical Forest Land Use Options, Ratanakiri Province, Cambodia. Available from: http://203.116.43.77/publications/research1/ACF4B.html. [Accessed 4 November 2011].
[184] Brauman, K.A., Daily, G.C., Duarte, T.K., Mooney, H.A., 2007. The nature and value of ecosystem services: An overview highlighting hydrologic services. Annual Review of Environment and Resources 32, 67-98.

	present information about climate change. • Increased public climate change awareness through education initiatives at schools and universities. • Increased gender equality at a national level (50 % of participants involved will be women). • Increased capacity of local authorities to develop and implement restoration and agriculture plans using evidence-based protocols. • Increased awareness on the importance of improving resistance and resilience to climate change in the target CPA communities as well as in other rural communities through an awareness raising campaign including *inter alia* a documentary film on the success of the ecoagriculture approach.		

C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

The selected adaptive measures contained in the AF project consist mainly of a series of targeted activities designed to restore natural capital and achieve a sustainable and resilient increase in agricultural productivity as a means to reduce the vulnerability of rural Cambodian communities. The identified activities are no-regret[186], low cost and concrete with tangible benefits. As part of the development of the INC and the NAPA, analyses were undertaken to prioritize adaptation interventions. Multi-criteria analyses were undertaken as part of the NAPA process in order to prioritize actions according to their potential for positive effects on economic development, social capital and environmental management. Cost-effectiveness was a criterion used to measure economic development. As such, the actions proposed by the NAPA are not only the most urgent and most pressing, but have also been assessed to be cost-effective. The activities undertaken in the AF project are prioritised in the NAPA (see Section II.D) and as such are already identified as cost-effective by the RGC.

The targeted interventions are based on recognised best practices from the ecological sciences and known to be cost-effective. The interventions are also based on those listed among the 400 different adaptation measures identified in the UNEP-GEF McKinsey Report[187] on the Economics of Climate Change Adaptation. The conservation agriculture interventions are low-input, high value activities that will reduce the vulnerability of rural communities[188]. Importantly, these are compatible with PAs as they are highly intensive without further impacting on natural ecosystems. Together these two approaches will contribute to the Green Economy[189] which is of global importance. Additionally, the AF project approach will build on the existing climate change structures set up under the Least

[186] No-regret options are those that are justified by current climate conditions and further justified when climate change is considered, e.g. pollution reduction in water supplies will be beneficial if water supplies decrease as a result of climate change. Lim. B, and E. Spanger-Siegfried. 2004. Adaptation policy frameworks for climate change: developing strategies, policies and measures. Cambridge University Press, Cambridge, UK pp 253.

[187] The McKinsey Group, 2010. Shaping Climate-Resilient Development. http://www.mckinsey.com/App_Media/Images/Page_Images/Offices/SocialSector/PDF/ECA_Shaping_Climate%20Resilent_Development.pdf. [Accessed 2 September 2011].

[188] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.

[189] UNEP, 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers. http// www.unep.org/greeneconomy. [Accessed 4 November 2011].

Developed Country Fund (LDCF) projects, further enhancing cost-effectiveness. This will be further developed in the Full Project Proposal formulation.

Cost-benefit analyses undertaken in the UNEP-GEF McKinsey Report demonstrate clearly that a country can prevent much of its expected losses through relatively low cost measures. The expected benefits of restoration and intensification included in Components 1 and 2 are inversely proportional to the costs of such activities i.e. they are low cost but have high benefits. Ecosystem services provided by restored ecosystems are difficult to value, however, there is growing evidence of the cost-effectiveness of these measures. Restoring the natural capital of forests has multiple benefits for communities. It is anticipated that the benefits will greatly exceed the costs and help prevent climate change-induced losses (see section II.B). Training on the maintenance and improved management (relative to current management practices) of multi-use forests and agricultural areas will further ensure the cost-effectiveness of the AF project adaptation interventions.

Table 3 below presents a summary of the costs and benefits of the AF ecoagriculture interventions and alternative interventions for adapting to the hazard of erratic rainfall (which is resulting in a decrease in food supplies and an increase in soil erosion). It is evident from the information in Table 3 that the interventions selected for implementation in the AF project are the lowest cost interventions.

Table 3: Costs and benefits of the AF Project and alternative interventions.

AF Project interventions	AF Project cost	Tangible Adaptation Benefits	Loss averted	Alternative interventions and trade-offs
Restoring natural capital to increase food supplies from forests and reduce soil erosion – i.e. establish groves and forests[190,191,192,193,194] that provide food and are particularly effective at stabilizing soils. Enrichment planting of the border of rice paddies and other existing cultivated areas with multi-use tree species and legumes to fix atmospheric nitrogen and enhance crop productivity[195]. Conservation agricultural practices which intensify and diversify agriculture practices and areas	US$ 1,573,125 (1,875 ha x US$ 839 ha^{-1})[201] US$ 200,625 (1,875 ha x US$ 107 ha^{-1}) US$ 844,350 (1,875 ha x US$ 153 ha^{-1} + US$ 150,000 for irrigation + US$	• Increased food supply. • Additional benefits such as increased NTFPs, woodfuel and fodder. • Increased agricultural production. • Reduced loss of harvest through improved post-harvest storage techniques and improved crop pest and disease management. • Hundreds of years of sustainable supply of food, NTFPs and timber. • Reduced erosion[204]. • Reduced water use as a result of	• Food insecurity. • Health problems associated with malnutrition. • Erosion of topsoil. • Water losses as a result of excessive runoff and minimal infiltration into the soil profile. • River siltation.	• ***Intensify agricultural production through increased inputs of pesticide, herbicide and fertilizer.*** Trade off i) Agricultural input of pesticides, herbicides and fertilizer: - has high costs; - requires agricultural extension support which has a cost implication to government; - has negative environmental impacts; and - can still result in crop failure from climate change hazards. ii) Agricultural input of overhead irrigation (as opposed to AMIT): • has high costs[205,206]; • requires agricultural extension support

[190] Agroforestry costs ~**US$ 960** per ha in Bangladesh. Rahman, S. A., Paras, F. D., Khan, S. R., Imtiaj, A., Farhana, K. M., Toy, M. M., Akhand, M. B., Sunderland, T. 2011. Initiatives of tropical agroforestry to sustainable agriculture: A case study of Capasia Village, Northern Bangladesh. Journal of Horticulture and Forestry 3(4): 115-121.
[191] Agroforestry in Cambodia costs ~**US$ 300** - **US$ 500** per ha in a 2011 project. Information obtained from the Wildlife Alliance in Cambodia.
[192] Woodland restoration costs ~**US$ 1,750** per ha in Australia. Source: http://fotpin.hussat.com.au/docs/woodland-restoration-implementation-plan%20.pdf. [Accessed 4 September 2011].
[193] Bottomland Forest restoration costs ~**US$ 178** - **US$ 267** per ha in a USA based project. National Research Council. 1991. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academy Press, Washington. DC.
[194] Spekboom Thicket restoration costs ~**US$860** per ha in South Africa.
[195] See Annex V
[201] Average value taken from references in footnotes 190-194.

(including 'homegarden' or '*chamcar*' plots) by encouraging the cultivation of various beneficial crop species in combination with the introduction of improved cultural practices such as rainwater harvesting, drip irrigation, green manuring and reduced tillage[196]. Drought tolerant rice varieties trialled at each intervention site[197,198,199,200].	407,475 for package of additional conservation agriculture activities)[202] US$ 29,400 (300 ha x US$ 98 ha^{-1})[203]	drought-tolerant species and efficient irrigation techniques. • Increased soil moisture content. • Additional benefits such as decreased river siltation and increased river flow. • Long-term sustainable livelihood strategies for vulnerable communities. • Increased climate change knowledge at the community level (on maintaining agricultural productivity under a changed climate) as well as general public levels (through an awareness raising campaign).		which has a cost implication to government; • requires maintenance[207]; and • can still result in crop failure from climate change hazards. • ***Import staple foods such as rice.*** <u>Trade off</u> i) Importing food has high costs with increasing risks of further hikes in prices. ii) A strong reliance on imported staple food results in limited national and local food security. • ***Set up new manufacturing industries to provide alternative livelihoods.*** <u>Trade off</u> i) Potential reduction in food producers and food supplies. ii) Reliance on very robust global markets. iii) Costly to implement. iv) Negative environmental impacts. **<u>These options were rejected</u>** because of high costs or limited impacts in isolation. In addition, some options presented negative environmental impacts or had limited

[204] 27% of Drylands in Africa are affected by soil degradation of different degrees. In Madagascar, average loss from soil erosion is estimated at **US$ 143 – US$ 215** per ha per year (year equivalent), whilst in Zimbabwe the financial cost of erosion is **US$ 29 –US$ 71** per ha per year on arable land and **US$ 80** per year on grazing land. Darkoh, M.B.K., 1996. The Human Dimension of Desertification in the Drylands of Africa. Journal of Social Development in Africa 11 (2): 89-106.
[205] The cost of irrigation system development varies according to the type of irrigation technology. For surface irrigation the cost ranges from ~**US$ 1,000** - **US$ 1,500** per ha, and for sprinkler irrigation from ~**US$ 1,500** - **US$ 2,000** per ha. The rehabilitation cost of irrigation, depending on the condition of the old system, can vary between **US$ 500** - **US$ 1,500** per ha. Source: http://www.fao.org/nr/water/aquastat/countries_regions/mozambique/index.stm. [Accessed 4 November 2011].
[206] Investment costs for new irrigation schemes in Africa are substantial, varying between ~**US$ 5,000** - **US$ 25,000** per ha, and are on average much more expensive than similar investments in Asia. IAC Report. 2004. Realising the promise and potential of African Agriculture. Chapter 3 African agriculture production systems and productivity in perspective.
[196] See Annex VI.
[197] Cost of establishing rice plantations in Kenya: ~**US$ 35** per ha. Source: http://www.agribusinessweek.com/tips-on-growing-hybrid-rice/. [Accessed 4 November 2011].
[198] Cost of establishing rice plantations in Philippines: ~**US$ 181** per ha. Source: http://www.agribusinessweek.com/tips-on-growing-hybrid-rice/.
[Accessed 4 November 2011].
[199] Cost of establishing rice plantations in Philippines: ~**US$ 112** per ha. Source: http://rbvergara.files.wordpress.com/2008/06/hybrid-rice-research.pdf
. [Accessed 4 November 2011].
[200] Cost of establishing rice plantations in Philippines: ~**US$ 65** per ha. Source: http://www.asiarice.org/sections/whatsnew/Philippines86.html. [Accessed 4 November 2011].
[202] Including terraces, dams/ponds/canals, firebreaks, stock, small scale woodlots, post-harvest storage facilities and pest and disease management.
[203] Average value taken from references in footnotes 197-200. Research costs included in Output 1.1.
[207] Maintenance costs are ~**US$ 500** per ha per year. Available from: http://www.fao.org/nr/water/aquastat/countries_regions/mozambique/index.stm. [Accessed 4 November 2011].

				long-term sustainability under future climate change conditions. This is in comparison to restoring natural capital and intensifying/diversifying agriculture using conservation agriculture principles, which is a relatively low cost option, is compatible with PAs and will provide benefits to vulnerable communities after the project lifetime.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

Addressing food supply is a high-priority under Cambodia's sustainable development strategies. The AF project will contribute towards achieving the objectives of the following strategies and plans:

- **National Sustainable Development Strategy (NSDS, 2009),** particularly the objectives on: i) poverty alleviation and food security; ii) gender equality; and iii) sustainability use of natural resources and the environment. The AF project will contribute to nine of the 15 **Environmental Quality Objectives** for Cambodia contained in the NSDS, i.e. Productive Land Resources; Rich Forest Resources; High Quality Ground- and Surface Water Resources; Rich Biodiversity; Limited Influence on the Climate; Non-Toxic Environment; Good Living Environment; Efficient Use of Natural Resources and Limited Waste Generation; and Limited Impact from Natural Disasters.
- **National Strategic Development Plan (NSDP, 2006-2010)**. The NSDP is a broad framework that aims to harmonise sustainable development efforts and the effectiveness of aid. The NSDP has been updated (2009-2013) to address Cambodia's main priorities, including climate change. The NSDP's main purpose is to implement the **Rectangular Strategy (RS)** for Growth, Equity and Efficiency adopted by the RGC in which the Government's priority goals and strategies are aimed at the reduction of poverty and the achievement of **Cambodia's Millennium Development Goal (CMDG)** targets. The AF project will contribute to the achievement of Goal 1 (extreme poverty and hunger eradication) and Goal 7 (environmental sustainability).
- **National Adaptation Programme of Action to Climate Change (NAPA, 2006),** specifically the priorities 2b (Rehabilitation of Upper Mekong and Provincial Waterways), 3a (Vegetation Planting for Flood and Windstorm Protection) and 3f (Promotion of Household Integrated Farming). Priority 2b will be partially achieved through the restoration of forests in the catchment of the Upper Mekong River. Priority 3a will be partially achieved through the restoration of forests in a number of degraded CPA sites, which will stabilize soils and contribute to reducing the impact of floods. Priority 3f will be partially achieved though the intensification and diversification of existing agriculture practices and areas (including homegardens and green manuring methods). The AF project will therefore create an enabling environment for the full achievement of the NAPA goals.

In addition, the AF project is consistent with the following legal, policy, planning and institutional efforts directly linked to sustainable development:

- 1994-95 "National Programme to Rehabilitate and Develop Cambodia" (NPRD);
- 1996-2000 "First Five Year Socio-Economic Development Plan" (SEDP-I);
- 2001-2005 "Second Five Year Socio-Economic Plan" (SEDP-II);
- 1998-2002 "National Environmental Action Plan" (NEAP);
- Interim Poverty Reduction Strategy Paper;
- Article 59 of the Constitution of Cambodia;
- establishment of the MoE in 1993;
- Royal Decree on the Creation and Designation of Protected Areas;
- Law on Environmental Protection and Natural Resource Management; and

- Sub-decrees on Pollution Control, Environmental Impact Assessment (EIA), Land Law, Mineral Law and Forestry Law.

The AF project is well aligned with the national **Strategic Agriculture Development Plan** and the **Strategy for Agriculture and Water** (2006-2010), particularly the following objectives:
- mobilize natural resources: water, land, soil;
- mobilize human and financial resources;
- empower people and communities; and
- increase productivity of agriculture.

Cambodia's food security strategies are captured within the **RS**, the corner stone of the **NSDP**. The AF project aligns well with the first pillar i.e. Enhancement of the agricultural sector: improving agricultural productivity and diversification. The AF project will therefore contribute to achieving Cambodia's agricultural and food security goals.

Whilst not development plans, the AF project interventions are in line with the following programmes related to forestry and degradation:
- **National Forest Program** (Forestry Administration, MAFF); and
- **National Action Plan to Combat Land Degradation and Desertification** (MAFF).

The project will be aligned with the National Adaptation Plans (NAPs) processes as approved by the Durban Decision[208] on the NAPs for LDCs adopted in December 2011, which will enable LDCs, including Cambodia, to set up a continuous, long-term, progressive and iterative planning process for adaptation. This alignment will increase the long term sustainability of project interventions. Finally, the MoE has sent endorsement for the UNEP umbrella programme to support the preparation of the 3rd National Communication to the UNFCCC. The AF project will support this process through the knowledge generation activities.

E. Describe how the project / programme meets relevant national technical standards, where applicable.

There are no relevant national technical standards for tree planting, forest restoration or conservation agriculture related to climate change in Cambodia. As such, international best practice standards will be followed throughout the AF project. All intervention activities will be implemented in strict adherence with the requirements of the Environmental Impact Assessment (EIA) process. According to the August 1999 sub-decree following the December 1996 Law on Environmental Protection and Natural Resource Management (11 Chapters, 27 Articles, Approved 24 December 1996), EIAs are required for projects of varying type and scale. Of relevance to forestry is the clearing of land for: i) concession forestry; ii) logging; and iii) agricultural and agro-industrial land. The clearing of > 500 ha of any land covered by forest and the clearing of any coastal or flood forests requires an EIA (Annex of Sub-decree No 72 ANRK.BK. Date 11, August 1999). As the land on which AF project activities will be implemented is degraded, and these degraded forests will be restored, the AF project will not require an EIA. The MoE is the government department assigned to review all EIAs and will therefore ensure that all relevant regulations are adhered to. A preliminary EIA will be undertaken in the course of Full Project Proposal formulation as per UNEP standards.

Interventions designed to provide technology transfer, training or that include local community participation will be conducted in adherence with Cambodia's labour codes and gender equality targets. Further details will added in the Full Project Proposal.

F. Describe if there is duplication of project / programme with other funding sources, if any.

There is no duplication of project funding with other sources. The information in Table 4 provides a brief description of climate change-related projects in Cambodia with a focus on PAs. Opportunities for creating synergies for achieving cost reductions have been noted. The sharing of knowledge generated by the AF project and the projects noted below will be an important component of the close

[208] See: http://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cop17_nap.pdf.

working relationships (between the respective Project Managers) established. These potential synergies will be elaborated on in the Full Project Proposal once the exact locations of the intervention sites are known. Communications are ongoing with the following projects in particular:

- Wildlife Alliance Southern Cardamoms Reforestation Programme;
- Wildlife Conservation Society (WCS) Tmatboey Community-based Ecotourism project; and
- United States Agency for International Development (USAID) Helping Address Rural Vulnerabilities and Ecosystem Stability (HARVEST) project.

The list in Table 4 is not exhaustive and will be further developed, specifically in relation to the geographic region of implementation, during development of the Full Project Proposal.

Table 4: Climate change-related projects in Cambodia.

Project & Funding Institution	Objective	Potential Synergies
Cambodia Community Based Adaptation Programme (CCBAP). **Funded by Swedish International Development Agency (Sida) and launched in January 2011.**	This program is intended to minimise the impacts of climate change on poverty reduction targets in Cambodia. This will be accomplished by reducing the vulnerability of the rice-farming sector to climate-induced changes in water availability. The project also aims to increase the capacity of NGOs, CBOs, and local communities to implement community adaptation measures.	**No duplication.** The AF project will capitalise on capacity building achieved through CCBAP as well as the resulting increase in awareness in the importance of climate change adaptation.
UNDP Cambodia - Establishing Conservation Areas Landscape Management (CALM) in the Northern Plains.	This project aims to address the loss of biodiversity in the Northern Plains of Cambodia through: • raising awareness of biodiversity considerations into provincial land use and management processes; • demonstrating specific interventions at four sites; and • strengthening institutional capacity for biodiversity management at the four sites. The project thus aims to integrate biodiversity objectives into the tourism, forestry, agriculture and fishing sectors.	**No duplication.** While this project has the same regional focus as one of the AF project target areas, intervention sites will not overlap. The awareness of the importance of biodiversity will be capitalised on in the AF project, which will contribute indirectly to biodiversity of the Northern Plains region.
UNDP Cambodia - Sustainable Forest Management (SFM) and the Development of Bio-energy Markets to Promote Environmental Sustainability and to Reduce Green House Gas Emissions in Cambodia.	This project aims to integrate sustainable community-based forest management into national policy and to create an infrastructure for sustainable bio-energy technologies that reduce CO_2 emissions. Rate of deforestation will be reduced by strengthened community-based management and by reducing demand for woodfuel.	**No duplication.** The AF project will capitalise on the capacity building in strengthening policy related to sustainable community-based forestry.
Cambodia Climate Change Alliance (CCCA).	The CCCA is the leading climate change facility in Cambodia. The two main aims of the CCCA are: • to support capacity development and institutional strengthening in climate change adaptation and mitigation; and • to offer direct assistance to vulnerable or affected communities by enhancing resilience to climate change.	**No duplication.** The AF project will capitalise on the capacity being built through the CCCA.

Pilot Programme for Climate Resilience (PPCR).	The PPCR aims to facilitate the integration of climate risk and resilience into developmental planning and implementation and to strengthen capacity within relevant national and regional bodies.	**No duplication.** The AF project will capitalise on the capacity being built through the PPCR.
UNDP- IFAD Promoting climate-resilient water management and agricultural practices.	This project aims to reduce the vulnerability of Cambodia's agriculture sector to climate-induced changes in water vulnerability and to enhance food security by strengthening the sector's adaptive capacity. This will be accomplished by enhancing public and institutional awareness of climate change, demonstrating climate-resilient practices in agriculture and water management and by mainstreaming climate change responses into provincial and communal plans.	**No duplication.** The AF project is focussing on PAs, however there will be synergies with the agriculture-based activities as well as the raising of awareness of food security issues with relevance to climate change.
Regional Climate Change Adaptation Knowledge Platform for Asia and Asia Pacific Adaptation Network.	The Climate Change Adaptation Knowledge Platform is an initiative which supports and shares research on climate change adaptation, policy making, capacity building and information sharing to assist Asian countries to adapt to climate change impacts. The initiative also facilitates capacity strengthening and climate change adaptation at local, national and regional levels and works in partnership with existing networks and initiatives.	**No duplication.** The AF project will use the Climate Change Adaptation Knowledge Platform to share knowledge gained and best practice guidelines at local, national and regional levels.
UNEP Least Developed Countries Fund Project, partnering with MoE.	The LDCF project aims to reduce coastal vulnerability to climate change impacts on agricultural systems and natural ecosystems within the coastal zone. The project will include institutional capacity strengthening, adaptation planning, increasing coastal resilience and improving the livelihoods of coastal communities.	**No duplication.** The LDCF project is being implemented in the coastal zone. The AF project will build on the capacity strengthening and climate change adaptation awareness raising.
The Cambodia UN-REDD National Programme.	The Cambodia UN-REDD National Programme aims to support Cambodia to be ready for REDD+ implementation including development of necessary institutions, policies and capacity.	**No duplication.** The AF project will provide restoration protocols and results to be used in the REDD+ programmes.
WWF Srepok Wilderness Area Project (SWAP).	This project aims to protect biodiversity and provide sustainable livelihoods to local communities by developing an eco-tourism initiative in the Srepok wilderness area in north-eastern Cambodia. This will be accomplished by: • developing sustainable management regimes for the harvest and utilisation of natural resources in partnership with local communities; and • developing a small pilot site for protection and restoration of biodiversity which will be used as a site for ecotourism initiatives. Successful models can be upscaled and replicated in other parts of Cambodia.	**No duplication.** The SWAP was implemented in Protected Forests in the Mondulkiri Province, but was completed in 2010. The AF project will build on the successes of the WWF project, including the raised awareness of the importance of biodiversity and sustainable harvesting of NTFPs.
Forest Carbon Partnership Facility (FCPF).	In 2011 Cambodia submitted a REDD Readiness Preparation Proposal (R-PP) to the FCPF. This proposed initiative would use REDD+ finance and incentives to conserve extensive areas of forested land as an alternative to the granting of Economic Land Concessions (ELC).	**No duplication.** The AF project will provide restoration protocols and results to be used in the REDD+ programmes.
Asian Development Bank Greater Mekong Subregion Core Environment	The project will enhance transboundary cooperation for preventing and mitigating fragmentation of biodiversity rich forest landscapes of the Cardamom Mountains	**No duplication.** The AF project, depending on the location of the intervention sites, will contribute towards the objectives of the

Program and Biodiversity Conservation Corridors Initiative (CEP-BCI).	and Eastern Plains Dry Forest in Cambodia, Triborder Forest areas located in southern Lao PDR, and the Central Annamites in Vietnam.	CEP-BCI by enhancing biodiversity at the restoration sites.
Fauna & Flora International (FFI) projects	FFI is implementing numerous projects in Cambodia including: • Cambodian Elephant Conservation Group; • Cambodian Crocodile Conservation Programme; • University Capacity Building Project; • Coastal and Marine Conservation Project; • Cardamom Mountains Wildlife Sanctuary Programme; and These projects focus on primarily on biodiversity conservation, and secondly on landscape restoration.	**No duplication.** The AF project intervention sites will not overlap with the FFI projects sites, will are generally in the Cardamom Mountains or at the coast.
USAID HARVEST project	The project aims to increase food availability and access by bolstering productivity of agriculture, fisheries and forestry; strengthening value-added chains; and creating private-sector led rural employment. The program will benefit 70,000 households and will maximize working relationships with the government, private sector allies, CBOs and NGOs.	**No duplication.** The HARVEST project is being implemented on the northern slopes of the Cardamom Mountains, with plans to expand north of Tonle Sap Lake in the Northern Plains region. Agricultural aspects of the HARVEST project will be used to guide the AF project.
WCS Tmatboey Community-based Ecotourism Project	The project aims to conserve the globally threatened large waterbirds found at Tmatboey, using the ibises as 'flagships', by establishing a local community-based tourism enterprise that directly links revenue received to long-term species conservation.	**No duplication.** While the Tmatboey Community-based Ecotourism Project is being implemented in the Kulen Promtep Wildlife Sanctuary, the AF project will be focused on restoration in CPA. If the Thmatbeutheun krosinm CPA is selected as an AF project intervention site, awareness raised through the WCS project will be capitalised on.
Wildlife Alliance Southern Cardamoms Reforestation Programme	The programme aims to reverse the cycle of poverty by helping poor landless farmers gain access to land, capital, skills and markets. The goal of the community agriculture and ecotourism projects is to help farmers achieve stable food security while at the same time generating enough cash so that they can raise their standard of living and have access to health care and education.	**No duplication.** The AF project will not be implemented in the Cardamom Mountains. The community agriculture component of the project, however, will be used to guide the conservation agriculture aspects of the AF project.
Technology Needs Assessment (TNA)	The project aims to produce Technology Needs Assessments and Technology Action Plans including for Adaptation which will be used as roadmaps for policy making for specific priority sectors and to access international sources of funding for the implementation of priority activities.	**No Duplication** The AF project will link with the TNA project to facilitate the knowledge management components of the project.

G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Lessons learned will be captured and disseminated through Outcome 3.1. Reports detailing the lessons learned will be compiled and will target: i) the general public; ii) CPA Committees and communities; and iii) relevant government ministries. The AF project will build partnerships with national and regional centres of excellence in socio-economic and ecological research through the PhD and MSc projects, to obtain information regarding international best practices in the field of restoration targeting climate change adaptation. The AF project will thus generate knowledge based

on international best practices and indigenous practices that will be transferable to other parts of Cambodia through the activities in Outcome 3.3.

Awareness will be increased at a local community level of the importance of ecoagriculture for protecting and enhancing commercial and subsistence activities. Local communities, community leaders and decision-makers will be informed of the urgent need to take concrete adaptation measures that are low cost and no-regret. This will be achieved using signboards, posters, booklets and pamphlets. A documentary film will be produced to promote the concrete interventions implemented under Component 2, in an attempt to promote these interventions across the country. Demonstration gardens, farmer field days and workshops will be established as teaching tools. Communities away from the intervention sites will also be targeted to ensure a broader awareness of interventions. Education activities at schools and universities will be undertaken, focused on raising awareness of climate change and how multi-use forests and agricultural practices which enhance ecosystem services can reduce the negative impacts of climate change. University and school field trips to intervention sites will be used to demonstrate the success of interventions.

The project will disseminate lessons learned electronically via a web-based data network portal, which will supply information about the ecoagriculture interventions to local government agencies responsible for policy and planning development as well as local stakeholders. This may also be extended to international learning platforms such as the Climate Change Adaptation Knowledge Platform for Asia, the ALM, UNEP's (GAN) and WikiAdapt. Disseminating project results is useful to: i) inform future projects in best practices; ii) effectively overcome information barriers to the uptake of adaptation measures; and iii) prevent duplication of efforts. The project is likely to be a valuable global case study for restoring natural capital and enhancing agricultural practices to increase food supplies and decrease soil erosion in restored forests. The AF project will use a social networking site to promote information generated in the project as well as to promote the documentary film.

To facilitate the management of knowledge management components of the AF project, a close working relationship will be established with the Technology Needs Assessment implemented by UNEP. This will ensure effective and efficient sharing of lessons learned on the benefits of the ecoagriculture approach.

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation.

A mission to Cambodia was undertaken to collect information for the development of the AF Project Concept. Relevant stakeholders were consulted regarding the adaptation interventions most appropriate for the PAs identified as being most vulnerable to the impacts of climate change. Guidance and information generated as a result of the consultations was utilised to develop the AF Project Concept. Consultations were held with the following stakeholders (see Annex IV for the mission report):

- MoE, including the departments of Research and Community Protected Area Development (RCPAD), Climate Change (CCD), Wildlife Sanctuary, and National Parks;
- Ministry of Agriculture Forestry and Fisheries (MAFF);
- Ministry of Planning (MoP);
- Ministry of Rural Development (MRD);
- Ministry of Water Resources and Meteorology (MoWRM);
- National Committee for Disaster Management (NCDM);
- National Mekong Committee;
- Cambodia Development Resource Institute;
- World Wildlife Fund for Nature (WWF);
- Clinton Foundation;
- Wildlife Conservation Society (WCS);
- International Union for Conservation of Nature (IUCN);
- Fauna and Flora International (FFI);
- Wildlife Alliance;
- Cambodia Non-Timber Forest Working Group;
- Cambodia Rural Development Team (CRDT); and
- Centre for People and Forests (RECOFT).

As a result of the above consultations, agreements were concluded with MoE on the regional focus of the AF project. A field survey was undertaken within three CPAs in three PAs in the Northern Plains target area. Based on discussions with the three CPA Committees, it was decided that wider consultation of all CPA Committees in the project target area was required. A survey has been planned and a questionnaire developed (see Annex II). The survey results will be used to focus the interventions on the needs of the target area communities. This focus will ensue that the restored forests become valued community assets. At least three communities in the target area will be selected to host intervention sites. A second survey of these intervention sites will be undertaken to gather further details required to tailor the restoration activities to the sites. This information will be included in the Full Project Proposal.

I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Funding is being requested for the implementation of interventions to restore natural capital and achieve a sustainable and resilient increase in agricultural productivity as a means to reduce climate change vulnerability of rural Cambodian communities. The total funding required for this project is US$ 4,954,273 including project management and project execution fees. Sustainable transformation of the agriculture sector necessitates combined action on food supply, development and climate change, and will require large-scale investments to meet the projected costs. Uncertainties about potential losses, catastrophic risks and increased costs of inaction associated with climate change indicate that immediate and more aggressive transformative action is needed. Financing is thus urgent[209]. The recent flood mentioned in Section I.1.4 highlights this point. The interventions are divided into three components described below.

Component 1: Protocols for ecoagriculture interventions.

***Baseline (without AF Resources)*:**
Rural Cambodian communities are highly dependent on natural resources. The adaptive capacity of these communities is low, which is largely attributable to high poverty levels. Poverty limits the ability of communities to change present behaviour and adopt new approaches to overcome climate change impacts. The poorest communities in Cambodia are the highland tribal groups located in the provinces of Ratanakiri, Mondulkiri, Kratie and Stung Treng[210], which form part of the North-eastern Forests target area. Attaining adequate food supply for these communities is difficult. Up to 70% of children in the province of Ratanakiri are stunted, implying chronic malnutrition[211]. In order to provide adequate climate change adaptation measures, namely enhanced food supply and erosion control from restored forests and conservation agriculture practices to intensify and diversify food production, effective planning is required to ensure that projects are not vulnerable to climate change-induced impacts. This necessitates the need to develop planting protocols to guide implementation of climate change ecoagriculture adaptation interventions. Presently such protocols are not being developed. CPA management plans do not include restoration (largely due to a lack of finance), and where trees are being planted, this is not being directed by a cost-benefit analysis to ensure that benefits are maximised. There is a general weak knowledge base of climate change impacts on landscapes and production systems, and a lack of studies being implemented to better understand how to adapt to the expected changes. There are few projects on which local and national stakeholders can build on and design restoration and conservation agriculture protocols, even though vegetation planting for flood protection is called for in the NAPA.

***Additional (with AF Resources of US$ 475,000)*:**
The first component of the AF project will comprise research and activities that result in the development of technical protocols and a local enabling framework that will guide the implementation of activities in Component 2. These protocols will be community-driven and developed through a consultative and participatory process, ensuring that the resource utilization and community needs are taken into account, considering the impact of an increase in the frequency and intensity of climate

[209] FAO. 2011. "Climate-Smart" Agriculture – Policies, Practices and Financing for Food Security, Adaptation and Mitigation. Food and Agriculture Organisation, Rome.
[210] National Institute of Statistics. 2004. Cambodia Socio-Economic Survey. Royal Government of Cambodia, Phnom Penh, Cambodia. CITED in the World Bank, 2006, Cambodia : Poverty Assessment
[211] Hamade, P. 2003. Indigenous Peoples Food Diary: Ratanakiri, Cambodia, 2002–2003. Health Unlimited, United Kingdom.

change-induced droughts and floods. They will be evidence-based through the inclusion of indigenous knowledge and best practice activities aimed at restoring natural capital. Research will be undertaken to ensure that the most appropriate measures are developed. This will include gap analyses and institutional mapping exercises in relevant government departments and research institutions to determine where there are shortfalls in knowledge and capacity which will aid implementation of interventions. Targeted research to address the identified gaps and shortfalls will be undertaken through the development and implementation of PhD and MSc projects in collaboration with Cambodian and international research institutions. Vulnerability assessments will ensure that interventions are ecologically appropriate and will counter the climate change-induced impacts of droughts and floods. Studies on: i) the use of climate forecasting information to alter crop planting times[209]; ii) the use of new, locally occurring crop varieties; iii) climate-resilient rice varieties; iv) the availability of micro-finance and weather index-based insurance for farmers; v) hydrology/engineering of water catchment areas; and vi) geographical/agricultural assessments of agricultural areas will be undertaken. Additional research activities under this component include economic studies to assess the feasibility of ecoagriculture interventions and associated micro-finance and insurance products. Finally, the results of this research will be used to develop the most appropriate conservation agriculture and forest restoration protocols. Gender sensitivity will be an important aspect of the development of the protocols, ensuring that women are consulted and their needs taken into account. These activities will ensure that the restored forests and agricultural homegardens are beneficial to the communities and increase their resilience to the impacts of climate change.

Component 2: Concrete ecoagriculture adaptation interventions.

***Baseline (without AF Resources)*:**
Presently, communities across Cambodia employ a range of different coping mechanisms in response to climatic hazards and variability. However, these mechanisms are limited in their effectiveness. During the preparation of the NAPA, villagers were interviewed regarding their coping mechanisms. It was found that approximately 17% of the 684 households interviewed do not adjust their planting regimes in response to flooding and drought events. During drought events, 24% of interviewees organise religious ceremonies in the hope that such ceremonies will bring rain and 17% reduce the amount of water they use for personal hygiene purposes. Most of the existing coping mechanisms have proved to be unsuccessful such as shifting planting dates. The success of shifting planting dates is restricted as a result of limited weather forecasts at a local scale.

Cambodia is seeking to increase overall food supplies through agricultural development which will reduce vulnerability to climate change through enhanced food supply. However, without ensuring adaptation measures to attenuate floods, control soil erosion and enhance drought resilience rural communities will still be at risk from such climate hazards which will decrease the availability of food supplies. Whilst CPAs are afforded protection through the PA Law, there are few efforts to restore degraded areas. Outside CPAs, where restoration is being implemented, it is not being undertaken with specific purposes of increasing food from the restored sites. The current interventions will not be sufficient to address the impacts of climate change-induced erratic rainfall on food supplies. The on-the-ground project activities on which the AF project interventions will build on will be detailed in the Full Project Proposal, once the exact location of the intervention sites is known.

***Additional (with AF Resources of US$ 3,395,000)*:**
The AF project will increase local community capacity to build climate resilience, as well as plan, implement and maintain ecoagriculture interventions. This will be achieved through the development of a training course and adaptation toolkit for use by local farmers on maintaining agricultural production under climate change conditions. Training will include: i) soil conservation techniques; ii) management of crop residues as fodder or green manure; iii) irrigation techniques; and iv) rainwater management. This training will be delivered by local authorities, agricultural extension officers and CPA committee members, who will be trained through the AF project. The trained individuals will then have the capacity to train further individuals. Through this training local communities will become aware of the importance of protecting natural resources which will help to ensure the success and sustainability of the AF project interventions. Systems for patrolling and protecting the multi-use forests established through the AF project will be strengthened, which will reduce illegal harvesting of NTFPs and timber. The funding required for Output 2.1 is US$ 252,500.

The AF project will restore natural capital and incorporate conservation agricultural practices to reduce the vulnerability of rural Cambodian communities to climate change-induced declines in food supplies. Interventions will be implemented at sites with the greatest vulnerability to climate change impacts and greatest potential for successful forest restoration and diversified agricultural activities. These sites will be identified through the CPA survey (see Annex II). The interventions will focus on sustainable crop management, soil management, forest restoration, conservation agriculture systems and capacity building. The AF project will be separated into extensive and an intensive approaches.

The extensive approach will entail restoring degraded forests in CPAs at a landscape-level by planting predominantly indigenous tree species that provide food and are particularly effective at stabilizing soils. These restored multi-use forests will supply a diverse range of goods for commercial use as well as domestic use, including timber and NTFPs such as resin, medicine, fibre, nuts and fruit. While the full benefits of this approach will not be immediate, the long term social and ecological benefits of planting and trees to restore natural capital are numerous. Trees can enhance water infiltration rates and decrease soil erosion. In Cambodia, where food insecurity is high, the availability of NTFPs during periods of low agricultural output will ensure increased food supply and resilience to climate change for communities. Increased availability of NTFPs will also diversify income sources which will improve livelihoods and build climate change adaptation capacity[212]. While the comprehensive social and environmental benefits of reduced vulnerability to floods and improved soil fertility are difficult to quantify, the long term increased financial benefits from increased availability of NTFPs have been estimated[213] at US$ 366 ha^{-1} yr^{-1}. Considering that the cost of establishing trees to restore natural capital has been estimated[214,215,216,217,218] at only US$ 839 ha^{-1} (a once-off expense), this approach is a highly cost-effective adaptation plan. The communities involved in the AF project will be trained on the restoration of forests in order to increase climate change resilience. This will include the development of horticultural skills necessary to propagate tree seedlings in nurseries as well as techniques of planting and establishing seedlings in degraded ecosystems. To ensure the success and sustainability of the AF project, local communities will be involved in all aspects of the forest restoration implementation. This will foster a sense of participation which will result in the trees being valued by community members, increasing the sustainability of AF interventions. CPA Management Plans will be updated with the appropriate management practices to maintain the multi-use forests. Patrols will be enhanced to prevent over-harvesting of restored forests by intruders. The funding required for this aspect of Output 2.2 (the restoration of 1,875 ha of degraded forest to multi-use forest) is US$ 1,573,125.

The intensive approach will include three approaches. Firstly, enrichment planting of rice paddies to increase availability of soil nitrogen by introducing multi-use and leguminous species which fix atmospheric nitrogen, which will enhance agricultural yield and soil fertility. In addition to nutritional benefits for rice paddies, communities will also benefit from the various ecological services that trees provide (as outlined in the extensive approach above). The estimated cost of planting tree borders around rice paddies is ~US$107/ha (see Annex V), which is a cost effective measure if the long-term benefits to soil structure and nutrition and agricultural yield are considered. Beneficiary communities will be involved in all stages of the AF project. An understanding of the potential benefits of trees on soil quality and agricultural yield will ensure the sustainability of AF interventions. Training on maintenance of the trees will strengthen sustainability. The AF project is more likely to achieve success because it adds to, rather than alters, common local agricultural practices. The funding required for this aspect of Output 2.2 (planting multi-use tree species along rice paddy boundaries and other existing cultivated areas to enhance crop productivity) is US$ 200,625.

[212] FAO. 2010 “Climate-Smart” Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation.
[213] Camille Bann 2003. An Economic Analysis of Tropical Forest Land Use Options, Ratanakiri Province, Cambodia http://203.116.43.77/publications/research1/ACF4B.html. [Accessed 4 November 2011].
[214] Agroforestry costs ~**US$ 960** per ha in Bangladesh. Rahman, S. A., Paras, F. D., Khan, S. R., Imtiaj, A., Farhana, K. M., Toy, M. M., Akhand, M. B., Sunderland, T. 2011. Initiatives of tropical agroforestry to sustainable agriculture: A case study of Capasia Village, Northern Bangladesh. Journal of Horticulture and Forestry 3(4): 115-121.
[215] Agroforestry in Cambodia costs ~**US$ 300** - **US$ 500** per ha in a 2011 project. Information obtained from the Wildlife Alliance in Cambodia.
[216] Woodland restoration costs ~**US$ 1,750** per ha in Australia. Source: http://fotpin.hussat.com.au/docs/woodland-restoration-implementation-plan%20.pdf. [Accessed 4 September 2011].
[217] Bottomland Forest restoration costs ~**US$ 178** - **US$ 267** per ha in a USA based project. National Research Council. 1991. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academy Press, Washington. DC.
[218] Spekboom Thicket restoration costs ~**US$860** per ha in South Africa.

Secondly, intensifying and diversifying crop production in homegardens will enhance community resilience to erratic rainfall as shortfalls in food supply due to failure of specific crops will be buffered by food sources from other species. Planting highly nutritious crops that have various environmental benefits such as soil improvement (see Annex VI for suggested crops) will increase productivity per ha, ensure a more nutritious and diverse diet for communities, and increase food supply during times of erratic climate. A participatory investigative approach will ensure that only crops which communities currently cultivate or which they eager to begin cultivating will be promoted by the AF project. This will ensure local buy-in of the concept. Rural Cambodian women and children are particularly affected by nutrient deficiencies[219] and would benefit from diverse and nutritious homegardens. The introduction of beneficial multi-use species to existing cultivated areas will improve the fertility, moisture-holding capacity and structure of agricultural soils, protect crops from climate-related hazards such as drought, floods and wind, and provide communities with additional benefits such as food, medicine, firewood and fodder. Communities will be educated on maintenance techniques and the benefits of diversified and improved farming practices to ensure the sustainability of the intervention. The intensification and diversification of existing homegardens is estimated to cost between US$ 70 and US$ 280 per ha. The mean market value of diversified crops has been estimated at US$ 930 (see Annex VI) per ha per crop cycle. Communities will also benefit from increased food supply and climate resilience of systems. To ensure the success of these interventions, and to ensure that communities are able to adapt to climate change, various additional activities will be necessary. The project will construct dams/ponds and canals to increase water supply, and prevent erosion, waterlogging and nutrient leaching after extreme events. The AF project will also establish fire breaks, distribute drought-resilient seed stocks to businesses, establish woodlots to reduce illegal timber-harvesting, introduce appropriate post-harvest storage techniques, and introduce improved crop pest and disease management systems. The funding required for these aspects of Output 2.2 is US$ 844,350 (US$ 286,875 for the intensification/diversification of 1,875 ha of existing agricultural areas; US$ 150,000 for cost-effective irrigation of the crops (i.e. AMIT); and US$ 407,475 for the package of additional conservation agriculture activities[220]).

Thirdly, new strains of climate-resilient rice will be trialled in selected target areas. A consultative process will be undertaken to identify farmers to establish and maintain trial plantings, and a total of ~100 ha at each intervention site will be planted. These field trials will be used to assess the suitability and cost-effectiveness of assorted rice cultivars for improving rice yields and climate resilience. The funding required for this aspect of Output 2.2 (trialling drought-resilient varieties of rice) is US$ 29,400.

Local community livelihoods will be enhanced and diversified through sustainable development of NTFPs and the promotion of sustainable livelihood strategies. This will be achieved through: i) facilitation of farmers access to micro-finance and weather index-based insurance products; ii) development of business plans for alternative livelihood options; iii) integration of small scale farmers into domestic, regional and global markets for high-value agricultural products; iv) in areas which are conducive to ecotourism, training of local communities to establish an enabling environment for the development of ecotourism projects; and v) development, promotion and establishment of sustainable alternative livelihood strategies. The funding required for Output 2.3 is US$ 295,000.

The final aspect of this component will require monitoring of the impacts of the AF project outside of the CPA intervention sites. This will entail: i) identifying target communities and areas for monitoring; ii) developing socio-economic and ecological monitoring protocols; iii) training of communities to conduct baseline surveys; ii) undertaking of baseline surveys; iii) development of tools to measure project impact; iv) collection of data in a scientifically rigorous way and v) undertaking an analysis of the socio-economic and ecological benefits in the target community areas. This monitoring is required to evaluate the indirect benefits of the AF project to communities outside of the target areas, which will strengthen the uptake of the ecoagriculture approach at a national level. The funding required for Output 2.4 is US$ 200,000.

Component 3: Institutional capacity, awareness raising and upscaling of ecoagriculture interventions.

[219] Available from: http://www.who.int/nutrition/publications/WHO_WFP_UNICEFstatement.pdf.
[220] Including terraces, dams/ponds/canals, firebreaks, stock, small scale woodlots, post-harvest storage facilities and pest and disease management.

***Baseline (without AF Resources)*:**
Since Cambodia ratified the Kyoto Protocol in 2003, the government has taken considerable steps towards the implementation of the UNFCCC by implementing activities designated in the INC and the NAPA. As a result, there has been an increase in awareness among decision-makers that climate change risks to Cambodia are substantial and will impact all sectors of the economy. The government has recognised restoration and reforestation of degraded land as an important adaptation measure for the country. However, no Cambodian climate change adaptation project has yet fully adopted this approach. Reforestation projects in the country are being implemented with a view to achieve mitigation rather than adaptation. As a result, existing sectoral policies need to be strengthened to include benefits arising from natural capital restoration approaches.

There is presently inadequate knowledge about climate change in Cambodia. This particularly applies to restoration activities aimed at adaptation, which have yet to be implemented in the country. Knowledge regarding cost-effective adaptation is currently weak, partly because information and knowledge management systems have yet to be developed to learn from project experiences.

***Additional (with AF Resources of US$ 300,000)*:**
With additional AF funding of US$ 300,000, resilient forest restoration and conservation agriculture as a means of climate change adaptation will be promoted for mainstreaming into sectoral policies and strategies through the Climate Change Strategy and Action Plan, which is currently being developed. This plan will engage with many sectors and policies and therefore be an effective avenue for mainstreaming natural capital restoration principles. Technical expertise will be provided to propose the incorporation of climate change adaptation into those policies where budget allocations are provided. To facilitate this, a multi-party and inter-ministerial task force will be formed to develop a national strategy for upscaling of restoration and conservation agriculture interventions.

As there is limited climate change adaptation awareness in the country, particularly in rural areas, awareness raising on the benefits of restoring natural capital and sustainable and diversified agricultural practices will be undertaken. Awareness will be increased at a local community level of the importance of ecoagriculture for protecting and enhancing commercial and subsistence activities. Local communities, community leaders and decision-makers will be informed of the urgent need to take concrete adaptation measures that are low cost and no-regret. This will be achieved using signboards, posters, booklets and pamphlets. A documentary film will be produced to promote the concrete interventions implemented under Component 2, in an attempt to promote these interventions across the country. Demonstration gardens, farmer field days and workshops will be established as teaching tools. Communities away from the intervention sites will also be targeted to ensure a broader awareness of interventions. Education activities at schools and universities will be undertaken, focused on raising awareness of climate change and how multi-use forests and agricultural practices which enhance ecosystem services can reduce the negative impacts of climate change. University and school field trips to intervention sites will be used to demonstrate the success of interventions. The project will disseminate lessons learned electronically via a web-based data network portal, which will supply information about the ecoagriculture interventions to local government agencies responsible for policy and planning development as well as local stakeholders. This may also be extended to international learning platforms such as the Climate Change Adaptation Knowledge Platform for Asia, the ALM, UNEP's (GAN) and WikiAdapt. Disseminating project results is useful to: i) inform future projects in best practices; ii) effectively overcome information barriers to the uptake of adaptation measures; and iii) prevent duplication of efforts. The project is likely to be a valuable global case study for restoring natural capital and enhancing agricultural practices to increase food supplies and decrease soil erosion in restored forests. The AF project will use a social networking site to promote information generated in the project as well as to promote the documentary film. Correspondence will be maintained between REDD+ project managers and the AF project manager to facilitate the uptake of appropriate tree species used in the AF project by REDD+ projects.

Within this component ecoagriculture activities will also be promoted through institutional capacity building. To achieve this, a capacity building needs assessment will be undertaken to gauge the level of understanding of restoring natural capital and conservation agriculture amongst stakeholders at national and provincial levels. Participatory Rural Appraisals (PRAs) of local communities will be conducted at all CPAs in Cambodia to inform an upscaling strategy devised by the AF project. Revisions to relevant national policies, strategies and legislation will be proposed which will incorporate the ecoagriculture approach and will promote adaptation via restoration. These proposed

revisions will promote the upscaling of the project's adaptation interventions. The AF project will also encourage co-ordination and collaboration with other restoration projects at national and provincial levels. This will contribute to the replication and upscaling of project interventions, as well as the effective use of financial and human resources. To generate recommendations on how to encourage local communities to invest in the ecoagriculture approach, multi-stakeholder consultations on land tenure will be conducted.

The final aspect of this component will be to develop and institutionalise a national ecoagriculture upscaling strategy for CPAs in Cambodia. A strategy to ensure integration of the lessons learned into national policy will be developed by: i) undertaking a gap analysis of national development plans and policy to determine the extent to which ecoagriculture approaches are included; ii) identifying existing entry points for proposed revisions which incorporate ecoagriculture interventions at a national scale; iii) establishing an inter-ministerial (incorporating MoE, MAFF, MRD, MLMUPC, MoT, NCDM and CDC) and multi-partner (NGOs, private sector and local representatives) task group to facilitate the development of the upscaling strategy; iv) identifying successful ecoagriculture adaptation interventions from Components 1 and 2, and ensure that these are incorporated into the proposed national strategy revisions; v) preparing and distributing a summary report and policy briefs promoting the AF project to relevant ministries (including MoE, MAFF, MRD, MLMUPC, MoT and NCDM); and finally vi) instituting a national education programme to promote lessons learned from demonstrations in the intervention sites, using appropriate media such as radio, television, websites, printed media, agricultural extension officers, and websites.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project implementation.

Please note that the project arrangements detailed below will be further developed during the development of the Full Project Proposal.

As requested by the Royal Government of Cambodia (RGC), UNEP will be the Multilateral Implementing Entity (MIE)[221] for the AF project. UNEP has significant experience in implementing projects of this nature (see description at the end of this section).

The designated Implementing Partner of the AF project will be the MoE. The MoE hosts the National NCCC and the CCCD. The NCCC was established in 2006 and is responsible for *inter alia*: i) coordinating the implementation of climate change activities in Cambodia; ii) developing climate change policies, strategies, legal instruments, plans and programs; and iii) integrating climate change concerns into relevant government policies, strategies and legal instruments. The Committee is cross-sectoral and multidisciplinary and is composed of high-level government representatives (Secretaries and Under-Secretaries of State) of 19 Ministries, including the Ministry of Finance (MOF), and government agencies. The CCCD is responsible for *inter alia*: i) planning and policy formulation; iii) implementation of the UNFCCC; iii) assessment of new technologies on climate change adaptation and greenhouse gas emission mitigation; and iv) capacity building and awareness raising. Together with the Department of Research and Community Protected Area Development (DRCPAD) of the General Department of Administration for Nature Conservation and Protection (GDANCP), the NCCC and CCCD will be ultimately responsible for the timely delivery of inputs and outputs and for coordinating the activities of the other responsible parties in the AF project. An organogram depicting the AF project management arrangements is shown in Figure 7.

The **Project Board (PB)** will be responsible for making management decisions for the AF project. In addition, the board will: i) undertake project assurance (monitoring and evaluation); ii) ensure

[221] The following implementation services under the MIE modality will be provided by UNEP for the AF project: i) overall coordination and management of UNEP's MIE functions and responsibilities, and the facilitation of interactions with the AFB and related stakeholders; ii) oversight of portfolio implementation and reporting on budget performance; iii) quality assurance and accountability for outputs and deliverables at the project development phase, during implementation and on completion; iv) receipt, management and disbursement of AF funds in accordance with the financial standards of the AF; v) information and communication management, including maintaining Management Information Systems and specific project databases to track and monitor progress (financial and substantive) of project implementation; vi) oversight and quality assurance of evaluation processes for project performance and ensuring that lessons learned/best practice are incorporated to improve future projects; and vii) general administration and support costs including legal services, procurement and supply management, IT, and human resource management.

performance improvement; and iii) ensure accountability and learning. The PB will comprise of designated senior technical representatives (Director Generals) from relevant ministries (e.g. MoE and MAFF), and representatives from local District Administrator offices. The Project Manager will serve as secretary to the PB. The PB will approve annual work plans and procurement plans, and review project periodical reports as well as any deviations from the approved plans.

The **Project Manager (PM)** will be responsible for the overall management of the AF project. The PM will ensure that the project is run transparently and effectively in accordance with AF and UNEP guidelines and approved work plans and budgets. The PM will receive project support from additional staff members within MoE. Additional details regarding the functions of the PM will be provided in the Full Project Proposal.

A **Chief Technical Advisor (CTA)** will be hired to assist the PM and provide technical guidance on the implementation of the AF project. The CTA will: i) conduct quality assurance and technical review of project outputs (e.g. studies and assessments); ii) assist in drafting TORs for technical consultancies and supervision of consultants work; iii) assist in monitoring the technical quality of project M&E systems, including annual workplans, indicators and targets; iv) provide advice on suitable approaches and methodologies for achieving project targets and objectives; v) provide a technical supervisory function to the work carried out by any other technical consultants hired by the AF project; and vi) assist in knowledge management, communications and awareness raising. The CTA position will be filled through a transparent and competitive recruitment process that will commence as soon as the Full Project Proposal is approved. The CTA will be utilised full-time during the first year and thereafter involvement of the CTA will be reduced[222]. In this way, the AF project will strengthen and establish in-country capacity and ensure that project activities are sustainable after the project lifetime.

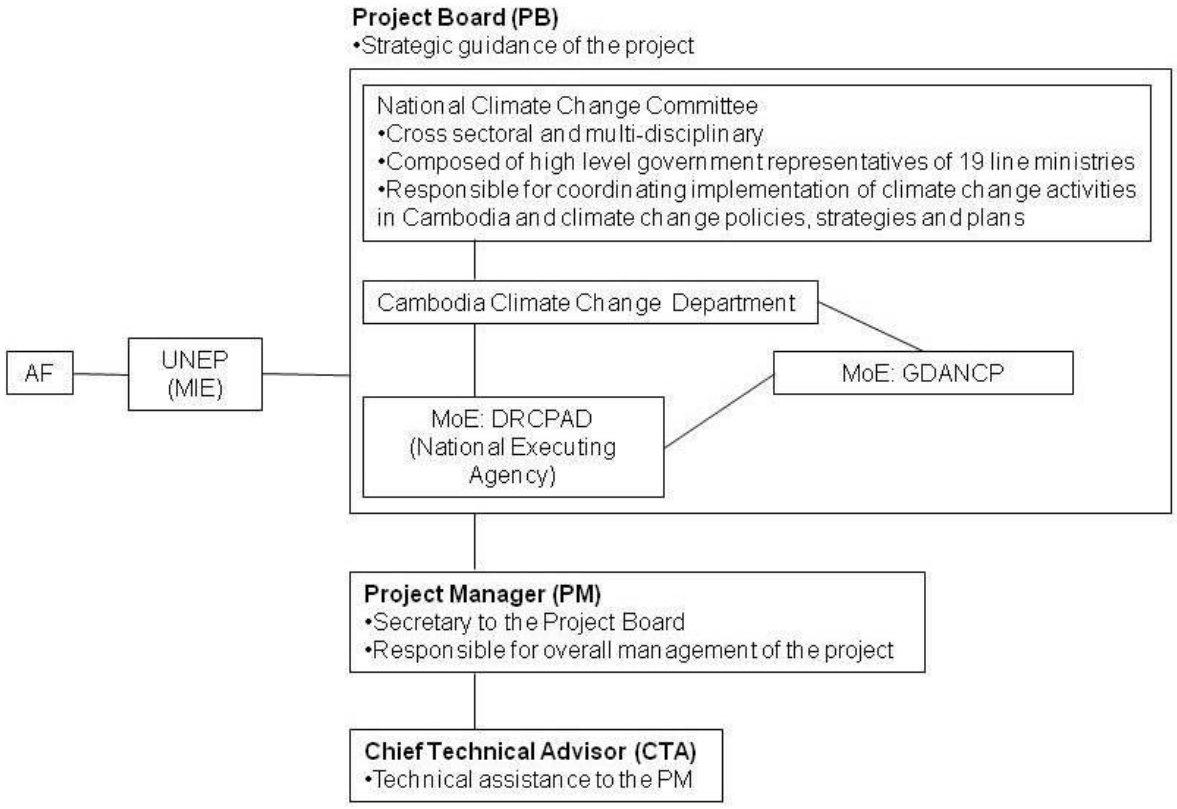

Figure 7: AF project management arrangements.

[222] As part of the exit strategy, the amount of time the CTA will be contracted for will be reduced over the project lifetime. For example, the CTA will likely work full-time in Year 1, and the time worked by the CTA will then be reduced for the following years, which will be approved by the PM.

B. Describe the measures for financial and project risk management

During the development of the Full Project Proposal, the risks listed in Table 5 will be further analysed and elaborated upon in a full risk log.

Table 5: Risks to the AF project.

Identified Risks	Risk rating	Mitigation Measures
Current climate and seasonal variability and/or hazard events result in poor restoration results or agricultural yields.	Medium	• Current climatic variability will be taken into account in the planning of the restoration process. • Drought- and flood-resilient species will be used. • Techniques to assist plant growth particularly in the seedling/sapling phases and to reduce risk of damage from climate change hazard impacts will be used. • Species will be planted in appropriate seasons to reduce risk of hazard impact. • Diversity in planted crops will reduce this risk,
Intervention sites may be sold for Economic Land Concessions.	Low	• Intervention sites will be in CPAs which are protected under the PA Law.
Disagreement amongst stakeholders with regards to demonstration site selection.	Low	• Intervention sites will be selected using an agreed upon list of criteria to ensure the selection is transparent and equitable. • There will be a participatory approach to the AF project, particularly with regards to intervention site selection.
Communities may not adopt activities during or after the AF project.	Medium	• The interventions will be institutionalised within MoE to ensure sustainable delivery post-project implementation. • Capacity building and training of the CPA communities will be undertaken to improve their awareness and understanding of the benefits of the activities.
Loss of government support may result in lack of prioritisation of AF project activities.	Low	• Regular stakeholder consultation and involvement will be undertaken to ensure that government maintains its commitment and considers the AF project as a support to its forestry and agriculture programmes.
Institutional capacities and relationships are not sufficient to provide effective solutions to climate problems that are complex and multi-sectoral.	Medium	• Project design will include the development of institutional capacity. This will ultimately lead to the development of an appropriate institutional framework for analysing climate change impacts on food supply, altering policy and implementing interventions.
Capacity constraints of local institutions may limit the ability to undertake the research and interventions.	Medium	• Human resource capacity will be developed as required. • Collaboration and exchange between local institutions and international research institutes will be initiated. • A CTA will work closely with the AF PM to ensure timely delivery of project outputs.
Priority interventions implemented are not found to be cost-effective.	Low	• Cost-effectiveness is a core principle in the implementation of adaptation measures. Detailed information will be recorded regarding cost-effectiveness. This will be widely disseminated and will be of use to future adaptation initiatives in Cambodia.
Lack of commitment/buy-in from	Medium	• A stakeholder engagement plan will be

local communities may result in failure of intervention sites.		developed during the inception phase. • Community stakeholders will be consulted during the CPA surveys leading into the Full Project Proposal development to ensure their buy-in into the AF project. • A bottom-up approach integrating the community into the AF project's development and implementation phases will be followed.

C. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The AF project will comply with formal guidelines, protocols and toolkits issued by the AF, UNEP and the RGC. UNEP will develop a **Supervision Plan** during the project's inception phase which will be distributed and presented to all stakeholders during the Inception Workshop. The emphasis of the Supervision Plan will be on outcome monitoring, learning and sustainability and financial management. Project risks and assumptions will be regularly monitored by UNEP. Risk assessment and rating is an integral part of the Project Implementation Review (PIR). The quality of the project's M&E will also be reviewed and rated as part of the PIR. Appropriate financial parameters will be monitored annually to ensure the cost-effective use of financial resources.

The AF project will undergo an independent **Mid-Term Evaluation** at the mid-point of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify corrective actions if needed. It will: i) focus on the effectiveness, efficiency and timeliness of project implementation; ii) highlight issues requiring decisions and actions; and iii) document initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for improved implementation during the final half of the project's term.

An independent **Final Evaluation** will take place three months prior to the project's end date in accordance with UNEP guidance. The Final Evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the Mid-Term Evaluation, if any such correction took place). The Final Evaluation will assess the impact and sustainability of results, including their contribution to capacity development and the achievement of adaptation benefits.

An **Annual Project Review/Project Implementation Review** (APR/PIR) will be prepared to monitor progress made since the project's start and in particular for the previous reporting period. The APR/PIR includes, but is not limited to, reporting on the following:

- progress on the project's objective and outcomes – each with indicators, baseline data and end-of-project targets (cumulative);
- project outputs delivered per project outcome (annual);
- lessons learned/good practice;
- annual Work Plan and expenditure reports; and
- project risk and adaptive management.

Periodic monitoring will be conducted through visits to the intervention sites undertaken by relevant staff from UNEP. Visits will be jointly conducted based on the agreed schedule to assess project progress first hand. A summary of the M&E costs is provided in Table 6:

Table 6: Monitoring and evaluation costs of the AF project.

Type of M&E activity	Responsible parties	Budget US$ (Excluding project team time)	Time Frame
Measurements of means of verification (baseline assessment)	Oversight by Project Manager; Project team; CTA	20,000	First quarter of year 1
Direct Project Monitoring and Quality Assurance including progress and financial reporting, project revisions, technical assistance and risk management	Project Manager and Project team; UNEP; External consultants (i.e. evaluation team)	(supported from staff costs included in Project execution, and from MIE fee)	Quarterly, half-yearly and annually and as needed
Evaluations (Mid-term review and Independent terminal evaluations)	Project Manager and Project team; UNEP;	60,000	At midpoint and at end of project implementation
Audit	Project Manager and Project team; UNEP;	15,000	Annually at year end
Inception meeting, field visits and steering committee meetings	Project Manager and Project team; UNEP;	5,000	Inception meeting within first 2 months and bi-annual PSC meetings (and sub-committee meetings)
TOTAL indicative cost		US$ 100,000	

Note: The costs indicated here do not include the costs associated with UNEP staff. Such costs will be covered by the MIE fee.

D. Include a results framework for the project proposal, including milestones, targets and indicators.

Detailed results framework with Specific, Measurable, Achievable, Realistic and Time-based (SMART) indicators, their baseline and targets will be prepared during the preparation of the Full Project Proposal to be submitted to the AF Board for approval.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT[223]

Dr Tin Ponlok Deputy Director General Ministry of Environment	Date*: 27* December th 2011 (see a copy of the LoE in Annex VII)

The Letter of Endorsement is attached as Annex VII.

B. IMPLEMENTING ENTITY CERTIFICATION

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (2006) and subject to the approval by the Adaptation Fund Board, understands that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Ibrahim Thiaw, Director, Division of Environmental Policy Implementation , UNEP. Implementing Entity Coordinator 	
Date: *11 January 2012*	Tel. and email:ibrahim.thiaw@unep.org; +254 20 7624782, ibrahim.thiaw@unep.org
Project Contact Person: Ermira Fida, UNEP-GEF Adaptation Portfolio Manager	
Tel. And Email: + 254 20 7623113; ermira.fida@unep.org	

[221] Each Party shall designate and communicate to the Secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

ANNEXES

ANNEX I: BACKGROUND INFORMATION ON PROTECTED AREAS IN ADAPTATION FUND PROJECT TARGETS AREAS.

Two target areas were selected for the Adaptation Fund (AF) project (Figure 8):

- **North-eastern Forests**: Lowland deciduous forests and limited dry evergreen forest generally associated with sandstones and basalts respectively. The area has low population densities and is dominated by natural and modified landscapes used for forestry, the maintenance of biological diversity, and limited agriculture. Ethnic groups living in this area include the Tampoun, Brao, Rhade, Stieng and Khmer.
- **Northern Plains**: Lowland dry evergreen and associated deciduous forests on sandstones. The region has low population densities and natural and modified landscapes used for forestry, the maintenance of biological diversity, and limited agriculture. Ethnic groups living in this area include Khmer, Pear, Kouy and Stieng[224].

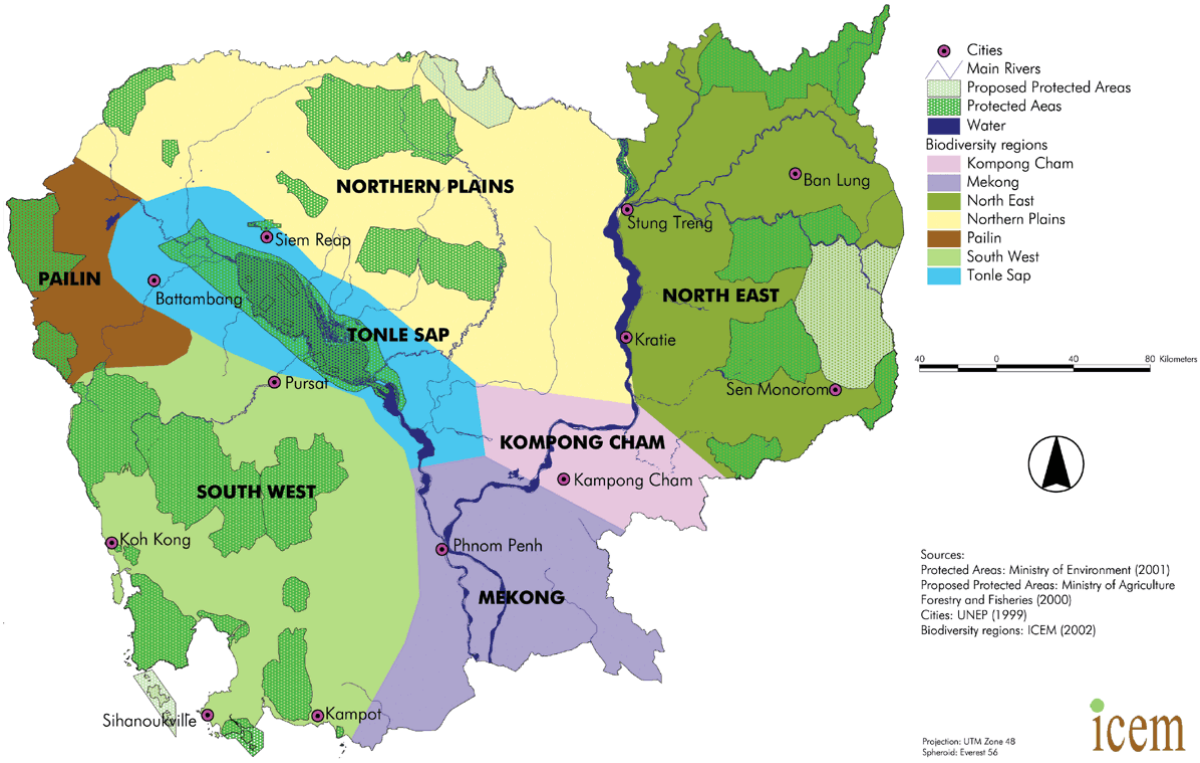

Figure 8: Biodiversity regions of Cambodia[225].

These target areas were selected based on: i) the low adaptive capacity of resident rural communities to the effects of climate change[226]; and ii) the high dependence of these communities on ecosystem-based services[227].

Protected Areas (PAs) within the target areas are:

- **North-eastern Forests target area**: Virachey National Park (NP); Phnom Prech Wildlife Sanctuary (WS); Lomphat WS; and Namlear WS.

[224] ICEM, 2003. *Cambodia National Report on Protected Areas and Development.* Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 148 pp.
[225] Ibid
[226] Based primarily on: Yusuf, A.A. & Francisco, H. (2009). Climate Change Vulnerability Mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA), Singapore.
[227] MoE. 2002. Cambodia's Initial National Communication under the United Nations Framework Convention on Climate Change.

- **Northern Plains target area**: Kulen Promtheap WS; Phnom Kulen NP; and Beung Per WS.

Community Protected Areas (CPAs) were considered for the placement of intervention sites because of their secure land tenure. As a result Lomphat and Namlear WSs were excluded from the site selection process since they had no CPAs. Figure 9 shows the PAs that were considered for intervention site placement.

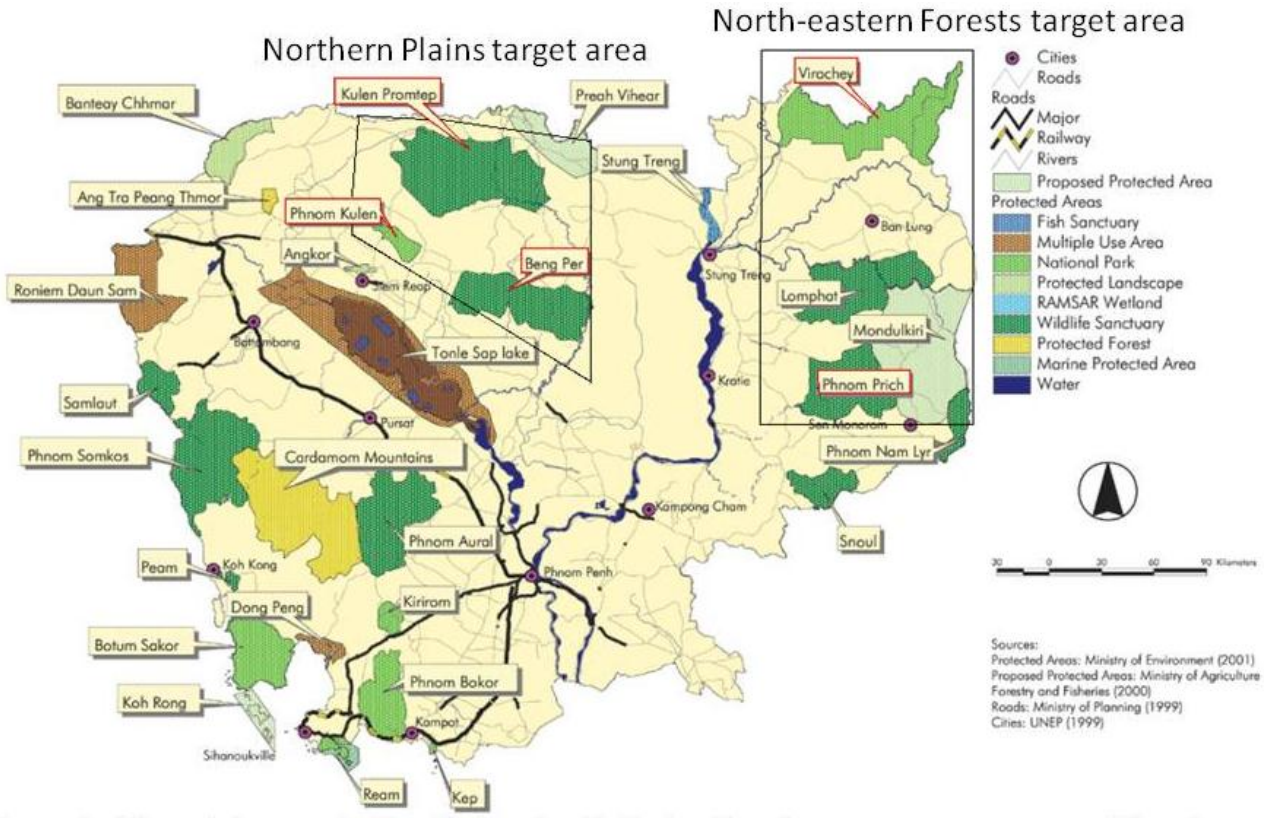

Figure 9: PAs containing CPAs within the AF project target areas[228].

A brief description of the PAs with potential intervention sites is provided below.

Virachey National Park

Virachey National Park in north-eastern Cambodia is one of the top priority areas for conservation in Southeast Asia. The park covers 332,500 ha and is one of only two Cambodian ASEAN Heritage Parks. It was created under the Royal Decree Concerning the Creation and Designation of Protected Areas, issued on the 1st of November 1993, and is under the administration of the Ministry of Environment of Cambodia. The park occurs in the most inaccessible part of Cambodia and comprises of pristine dense semi-evergreen lowlands, montane forests, upland savannah, bamboo thickets and occasional patches of mixed deciduous forest. The elevation ranges from 400 m to 1,500 meters above sea level. There are currently five Community Protected Areas (CPAs) supporting 1,346 families, covering a combined area of 18,395 ha.

Table 7: CPAs in Virachey National Park.

CPA	No. of families	Size (ha)
Yorn Center	9	550
O'toung	390	9,862
O'khampha	190	2,382
O'tabok	87	2,800

[228] ICEM, 2003. *Cambodia National Report on Protected Areas and Development.* Review of Protected Areas and Development in the Lower Mekong River Region, Indooroopilly, Queensland, Australia. 148 pp.

G'Urcay	670	2,801

Phnom Prich Wildlife Sanctuary
Phnom Prich Wildlife Sanctuary is located in eastern Cambodia. PPWS was established in 1993 by Royal Decree. The area has, however, been a protected forest reserve since 1962 when it was set aside as a refuge for endangered Kouprey (*Bos sauveli*). It is roughly 225,000 ha in size and forms one of the largest remaining relatively undisturbed landscapes in mainland Asia. The wildlife sanctuary is under threat of hunting and forest clearance. WWF is currently supporting government conservation efforts in the sanctuary. It is notable for its rich habitat diversity, including the following forest types: hilly evergreen (10% of forest), open dry dipterocarp woodlands (50% of forest) and semi-evergreen (remaining 40%) forests. This wealth of ecosystems is due to the sanctuary's very diverse elevation structure, varying between 80 m to 640 m above sea level. This variation has created a rich, intricate mosaic of forest habitats. There are currently three CPA's supporting 373 families in an area of 7,687 ha.

Table 8: CPAs in Virachey National Park.

CPA	No. of families	Size (ha)
Sre Thom Mleung	132	3,000
Ronouk Khgeng	80	1,734
Pouhoung Poutong	161	2,953

Kulen Promtep Wildlife Sanctuary
Kulen Promtep Wildlife Sanctuary is approximately 402,500 ha and is the largest PA in Cambodia. It was established in 1993 to protect Kouprey habitat. It is part of the Northern Plains Dry Forest Priority Corridor with elevations ranging from ~180 m to 550 m above sea level. The wildlife sanctuary is covered by lowland forest and contains the largest swamp in the Cambodia. Threats include deforestation. There is currently one CPA supporting 222 families in an area of 1,763 ha.

Table 9: CPAs in Kulen Promtep Wildlife Sanctuary.

CPA	No. of families	Size (ha)
Thmatbeutheun krosinm	222	1,763

Phnom Kulen National Park
Phnom Kulen National Park is located in the Phnom Kulen mountain massif in Siem Reap Province. It was established in 1993 and covers 37,500 ha. The area originally consisted of primary forest. However, human activities have led to the clearing of the original vegetation and resulted in the replacement of primary forests with secondary scrubland vegetation consisting of shrub morphs and lianas. There are currently five CPA's supporting 980 families in an area of 980 ha.

Table 10: CPAs in Kulen Promtep Wildlife Sanctuary.

CPA	No. of families	Size (ha)
Preyphnom Kduoch	63	78
Preyphnom Manos	99	230
Preyphnom	158	270
Preyphnom Popel	59	96
Chop Tasok	48	306

Beng Per Wildlife Sanctuary
Beng Per Wildlife Sanctuary is located in Kampong Thom, Siem Reap and Preah Vihear provinces. Established in 1993 and covering an area of 242,500 ha, the wildlife sanctuary forms the southern end of the Northern Plains Dry Forest Priority Corridor. The natural vegetation consists of forests and

shrublands. The sanctuary is threatened by deforestation. There are currently 19 CPA's supporting 8,143 families in a combined area of 44,701 ha.

Table 11: CPAs in Beng Per Wildlife Sanctuary.

CPA	No. of families	Size (ha)
Chiork Beungprey	158	1,500
Beung Totil	308	2,587
Prey Thom	692	2,440
Anlong Krang	325	401
Chumareach	314	1,800
Chroppou Rongreung	230	1,988
Chhomprey	197	1,981
Phnom Preah lean	76	1,869
O'Pangna	476	5,487
O'Chhengchhen	206	2,295
Beung Tonle Mreachh	158	1,722
Korki prohornk	132	1,524
Skor Mreach	642	3,449
Chom Thlork	948	4,684
Tropeungprey Thom	534	2,334
Chhom Pen	128	1,891
Damnakchankhan	253	2,117
Damnak Knachtrach	554	1,832
Phnom Balang	1,812	2,800

ANNEX II: COMMUNITY PROTECTED AREA SURVEY PLAN (17-28 SEPTEMBER 2011).

Context:
Meetings were held during the UNEP International Consultants' June 2011 mission with committee members of the following three Community Protected Areas (CPAs):

- Thmatbeutheun Krosinm in Kulen Promptheap Wildlife Sanctuary (WS);
- Preyphnom in Phnom Kulen National Park (NP); and
- Chiork Beungprey in Beung Per WS.

Committee members were asked questions about observed changes in climate and forest degradation in and outside of CPAs. The concepts of homegardens and adaptation restoration were discussed. Based on the feedback and discussions held, it was evident that wider consultation of CPA communities using a consistent and structured questionnaire was required in order to finalise the proposed interventions and intervention sites for the Adaptation Fund (AF) project.

Two clusters of Protected Areas (PAs) were decided on as the target area of the project based on the low adaptive capacity of communities and high vulnerability to the effects of climate change[229]. These clusters are:

- North-eastern cluster:
  - Virachey NP;
  - Phnom Prech WS;
  - Lomphat WS; and
  - Namlear WS.
- Northern plains cluster:
  - Kulen Promtheap WS;
  - Phnom Kulen NP; and
  - Beung Per WS.

As secure land tenure is a requirement for Adaptation Fund (AF) projects, only CPAs were considered for project interventions[230]. Lomphat and Namlear WS do not have any established CPAs meaning they will not form part of the project at the time of proposing this AF project. The remaining five PAs contain 33 CPAs (see Annex A for full details):

- 5 CPAs in Virachey NP;
- 3 CPAs in Phnom Prech WS;
- 1 CPA in Kulen Promtheap WS;
- 5 CPAs in Phnom Kulen NP; and
- 19 CPAs in Beung Per WS.

The above CPAs were visited from 17-28 September 2011 and the consultations held with the CPA committees. Based on the feedback and discussions, at least three of the most appropriate CPAs will be selected as intervention sites for the AF project.

Criteria used for site selection:
Approved and pending AF Full Proposals and Project Concepts were reviewed in order to gain an understanding of the requirements for AF projects to be approved. Guided by this review, the purpose of the survey is to gather information from the consulted CPA committees on the:

- relevance of the project hazard (erratic rainfall) to the particular CPA;
- willingness of the committee (speaking on behalf of the community) to support the concrete project adaptation interventions;
- cost effectiveness of a range of adaptation interventions to manage the hazard;
- cost of climate change impacts on the communities; and
- level of degradation within the CPA.

[229] Based primarily on: Yusuf, A.A. & Francisco, H. (2009). Climate Change Vulnerability Mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA), Singapore.
[230] Areas zoned as 'Community Zones' also provide a secure land tenure, however there are no such zoned areas at present.

While at least three sites will be selected from the CPAs consulted (based on the review of approved AF project), visiting all 33 CPAs in the target area has numerous advantages. The consultations have:

- formed a very solid platform of stakeholder engagement which will be very useful for meeting the AF Board requirements;
- increased the knowledge base for the project, particularly with regards to alternative interventions, costs of interventions and species to use in the project;
- built awareness of the adaptation restoration concept in the communities;
- provided information for upscaling the project when funds become available through other avenues; and
- built a useful knowledge base for the Ministry of Environment (MoE), particularly the Department of Research and Community Protected Area Development (DRCPAD).

Method:
A questionnaire was devised (Annex B) which was used to gather the required information. The same questions were asked to all CPA committees in order to compare responses. These responses will be used to rank the CPAs in terms of suitability for project interventions. The information will also be used to further refine interventions and provide detail for the AF Full Proposal. The questionnaire will be translated in Khmer and the answers translated into English.

Timing:
Five teams consisting of two DRCPAD staff members each conducted the consultations from 17-28 September 2011. As the consultations took place in the wet season, the roads were in a poor condition, which slowed the progress of the consultations. The roads in the Virachey NP and Phnom Prech WS were in a particularly poor state. Motorcycle were required in order to access the CPAs in these PAs. The consultations took three weeks to complete. The answers to the question were translated and sent back to the UNEP over the course of the consultations.

Budget:
Funding was required for the following (US$):

Car rental (including petrol)	3,000
Motorcycle rental (US$30 x 2 x 4 x 8 (one day per CPA))	1,920
Food (US$30 x 8 x 21 days)	5,880
Accommodation (US$15 x 4 (2 per room) x 21)	1,260
Miscellaneous (e.g. gift for CPA Committee, photocopying)	940
TOTAL	**13,000**

Attachments:

Annex A: Details of all CPAs in the target area.
Annex B: CPA questionnaire.

Annex A: Details of CPAs consulted

PA	CPA	No. of families	Size (ha)	Supporters	Remarks
Phnom Prech WS	Sre Thom Mleung	132	3000	WWF	Continued Support
	Ronouk Khgeng	80	1734	WWF	Continued Support
	Pouhoung Poutong	161	2953	WWF	Continued Support
Lomphat WS				Birdlife	Assessment process
Virachey NP	Yorn Center	9	550	BPAMP	No supporter
	O'toung	390	9862	BPAMP	No supporter
	O'khampha	190	2382	BPAMP	No supporter
	O'tabok	87	2800	BPAMP	No supporter
	GUrcay	670	2801	BPAMP	No supporter
Kulen Promtheap WS	Thmatbeutheun krosinm	222	1763	WCS	Continued Support
Phnom Kulen NP	Preyphnom Kduoch	63	78	FAO	No supporter
	Preyphnom Manos	99	230	FAO	No supporter
	Preyphnom	158	270	FAO	No supporter
	Preyphnom Popel	59	96	FAO	No supporter
	Chop Tasok	48	306	FAO	No supporter
Beung Per WS	Chiork Beungprey	158	1500	CFRP	No supporter
	Beung Totil	308	2587	Mlupbaitong	No supporter
	Prey Thom	692	2440	FAO	No supporter
	Anlong Krang	325	401	MoE	No supporter

	Chumareach	314	1800	MoE	No supporter
	Chroppou Rongreung	230	1988	ADRA	No supporter
	Chhomprey	197	1981	ADRA	No supporter
	Phnom Preah lean	76	1869	ADRA	No supporter
	O'Pangna	476	5487	MoE	No supporter
	O'Chhengchhen	206	2295	MoE	No supporter
	Beung Tonle Mreachh	158	1722	MoE	No supporter
	Korki prohornk	132	1524	MoE	No supporter
	Skor Mreach	642	3449	MoE	No supporter
	Chom Thlork	948	4684	MoE	No supporter
	Tropeungprey Thom	534	2334	MoE	No supporter
	Chhom Pen	128	1891	World Vision	No supporter
	Damnakchankhan	253	2117	World Vision	No supporter
	Damnak Knachtrach	554	1832	MoE	No supporter
	Phnom Balang	1812	2800	MoE	No supporter
Namlear WS					No CPA

Annex B: CPA Questionnaire

PA name	
CPA name	
Date	
Time started	
Time finished	
MoE representatives	
CPA attendees	Please fill in the Attendance List (attached)

Assessment of climate hazard (erratic rainfall)
Drought

1. Has there been an increase in drought episodes over the lifetime of the committee members?
2. Has there been an increase in drought episodes over the last 5 years?
3. What time of year have these episodes been in?
4. What impact has this had on the community?
5. What impact has this had on agricultural production?
6. What impact has this had on the forest in the CPA?
7. What dollar value has this impact had?
8. What has the community done as a result of these challenges?

Storms and heavy rainfall

9. How would the community define a storm and heavy rain period?
10. Has there been an increased in the number of storms and heavy rainfall periods over the lifetime of the committee members?
11. Has there been an increased in the number of storms and heavy rainfall periods over the last 5 years?
12. What time of year have these episodes been in?
13. What impact has this had on the community?
14. What impact has this had on agricultural production?
15. What impact has this had on the forest in the CPA?
16. What dollar value has this impact had?
17. What has the community done as a result of these challenges?

Assessment of the CPA

18. What is the CPA used for?
19. Can the committee put a dollar value to this use?
20. Are there areas that are degraded in the CPA?
21. What percentage of the CPA is degraded?
22. What are the sizes of these degraded areas in ha?
23. What is the cause of this degradation?
24. If the community had funding, what changes would they make in the CPA to protect against the impacts of droughts / storms and high rainfall described earlier?
25. How long would these changes take to make, and what resources would be required (building material, nursery/trees etc.)? What would these changes cost?
26. If the community had funding, what changes would they make outside of the CPA, around where they live, to protect against the impacts of droughts / storms and high rainfall?
27. How long would these changes take to make, and what resources would be required (building material, nursery/trees etc.)? What would these changes cost?

Assessment of the project concept

28. Does the community grow homegardens i.e. areas of mixed fruit trees, medicinal plants, vegetables, timber trees etc?
29. Where do they grow these homegardens?

(*Explain basic project concept*): If approved, the project will provide funding to plant degraded areas of forest with fruit, fibre and resin trees, medicinal plants, other NTFP trees, vegetables and timber for firewood and general. The degraded areas of varying sizes will become productive homegardens densely planted with a range useful tree and plant species. These areas will provide a consistent supply of NTFPs and wood throughout the year, even in times of drought. In times of heavy rainfall, the forest floor and soil will be protected from erosion. Another way of describing this is called 'enrichment forestry'. The project will be implemented as a trial in most likely two CPAs in the north-eastern and northern PAs in Cambodia. If the trial proves to be successful, the concept may be expanded to other areas.

30. Would the CPA committee and community support the idea of planting homegardens, and would they take care of them and ensure they are properly managed and not cut down?
31. Where would the community like homegardens to be planted?
32. What size would the community prefer?
33. What would be the dollar value of such a size of densely packed trees providing NTFPs and timber? How much would it be worth to the community?
34. What species would they like planted in such a homegarden? Please fill in the list provided. Please provide as much detail and as many species as possible.
35. Would the community like homegardens planted in the CPA?
36. How would the homegardens be managed in the CPA?
37. Who would the benefits (NTFP, wood) go to?
38. Would the management of the homegarden be included in the CPA management plan?
39. Does the community view the planting of homegardens as described above as a useful way of coping with the challenges of droughts/storms and heavy rainfall, given the value of the homegardens producing NTFPs and wood throughout the year, and the impact of droughts/storms on agricultural production discussed earlier?
40. What other actions could you suggest to protect specifically the forest against the challenges posed by an increase in droughts/storms?
41. What other actions could you suggest to protect the community in general against the challenges posed by an increase in droughts/storms?

Akun jann.

CPA meeting attendance list

CPA Name:
Date:

Name	CPA/Community position	Age	Gender (M/F)

Species list for planting into CPA

Species	Use (Fruit, fibre, resin, other NTFP, timber, fire wood)	Local or exotic?	Approximate height (m)	Time from planting until useful (i.e. bearing fruit) in months or years

ANNEX III: TREE SPECIES LIST.

The table below presents a list of tree species that are likely to be appropriate for the homegarden interventions planned for the AF project. This list will be expanded in the Full Project Proposal and the most appropriate species will be selected at the beginning of project implementation based on expert advice. Trees have been prioritised based on their climate change adaptation value and properties such as food production, soil stabilisation, drought tolerance and other NTFPs. Indigenous trees are listed first followed by exotic trees with properties which would be beneficial to the community and the degraded ecosystems in which they will be planted.

Scientific or available name	Indigenous	Exotic	Food	Soil Stabilisation	Drought tolerant	Fodder	Apiculture (Honey)	Soil Fertility[231]	Medicines	Resin	Fibre	Mulch/leaf litter	Timber	Woodfuel	Charcoal	Crop cover/Shade	Description of bio-phyiscal parameters
Senna siamea	x		x	x		x		x	x			x	x	x	x	x	A medium-sized, evergreen tree (up to 18 m). Altitude 0-1000 m; mean annual temperature between 20-31 ºC; mean annual rainfall: 400-2800 mm. Performs best on deep well-drained fertile soils with pH 5.5-7.5, but will grow on degraded lateritic soils provided drainage is not impeded. The species is intolerant of saline soils.
Morus alba	x		x	x		x		x			x	x	x	x		x	A medium-large tree (up to 35 m). Altitude 0-3300 m; mean annual temperature 0-43 ºC; mean annual rainfall: 1500-2500 mm. The plant grows on a variety of soils ranging from sandy loam to clayey loam, but prefers deep, alluvial, loamy soil with sufficient moisture and pH 6.0-7.5.
Bambusa spp.	x		x	x		x						x					An evergreen multi-stem grass (bamboo) up to 25-35 m tall and culm diameters of 8-10 cm. Altitude 0-2000m; mean annual temperature 8 - 36 ºC; mean annual rainfall:1200-2500 mm. Good species for restoration of forest areas and stabilizing eroding areas. This species is one of the best bamboos for windy sites due to the strength of the culms.
Morinda citrifolia	x		x						x				x	x		x	An evergreen shrub (3-10 m). Altitude 0-1500 m; mean annual temperature unknown; mean annual rainfall: 1500-3000 mm. In areas where the plant is cultivated, the soil is usually well structured and of volcanic origin (Java), but it may be poor and ferralitic (Cambodia). The plant also occurs on infertile, degenerated soils, sometimes badly drained or with a very low water-retention capacity and a deep water table.

[231] Soil fertility – refers to species that increase the nutrient content of the soil (e.g. nitrogen fixing species).

*Afzelia xylocarpa**	x		x					x	x				x				A large deciduous tree (15-30m). Altitude: 500- 900 m; mean annual temperature: 15-35 ºC; mean annual rainfall: 1000-2500 mm. Occurring on well-drained flatlands or transitional zones between evergreen and dry open dipterocarp forest.
*Dasymaschalon lamentaceum**	x		x										x				A shrub, (1-4m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown. This species is normally found in secondary forests and at the edges of dense forests.
*Cinnamomum cambodianum**	x		x						x				x	x			A large tree from (15-25 m). Altitude: below 1500 m; mean annual temperature: unknown; mean annual rainfall: unknown. This species is distributed in wet, dense, piedmont forests.
*Sterculia lychnophora**	x		x										x	x			A large tree from (18-25 m). Altitude: above 1700 m; mean annual temperature: unknown; mean annual rainfall: unknown. This species is distributed in wet, dense, piedmont forests.
Calamus spp.	x								x		x		x				Perennial clustering, moderate-sized, high-climbing, evergreen rattans with canes reaching a length of 100 m. Altitude 0-800 m; Grows for 6 years before the first harvest and needs 15 years before full production.
Albizia saman		x	x			x		x		x		x	x	x	x	x	A large semi-deciduous tree from (up to 60 m). Altitude: below 0 -1300 m; mean annual temperature: 20-35 ºC; mean annual rainfall: 600-3000 mm. Found on neutral to moderately acid soils and can grow on soil with pH as low as 4.6. It grows on light or heavy soils and tolerates infertile or waterlogged conditions.
Borassus flabellifer		x	x		x						x	x	x	x		x	A large solitary, pleonanthic, dioecious palm (25-40 m). Altitude: below 0 -800 m; mean annual temperature: 30-45 ºC; mean annual rainfall: 500-5000 mm. It can be found on any kind of soil, preferring soils rich in organic material
Cajanus cajun		x	x	x		x	x	x			x	x		x		x	Short-lived perennial (1-5 years) shrub, (0.5-4 m). Altitude: unknown; mean annual temperature: 18-38 ºC; mean annual rainfall: 400-2500 mm. The major soils are alluvials, Vertisols and Alfisols, which range in pH from 5 to 7 or more. It is sensitive to salinity and has not been produced on saline soils. It is also susceptible to water logging.
Feronia limonia		x	x			x			x	x			x	x			A deciduous, slow-growing tree (unknown size). Altitude: below 0-450 m; mean annual temperature: unknown; mean annual rainfall: unknown mm. Throughout its range there is a diversity of soil types, but it is best adapted to light soils.
Gliricidia sepium		x	x	x		x	x	x			x	x	x	x	x	x	A small to medium sized tree (2-15 m). Altitude 0-1600 m; mean annual temperature 15-30 ºC; mean annual rainfall: 600-3500 mm. Grows on a range of soil types from pure sand to deep alluvial lake-bed deposits. In much of its natural range the soils are acidic (pH 4.5-6.2); however, where parent material is limestone, the soils are slightly alkaline. It performs well on marginally saline vertisols but will not tolerate very acidic soils.

Jatropha curcas		x	x	x		x		x	x	x				x			A small tree (up to 6 m). Altitude 0-500 m; mean annual temperature 20-28 ºC; mean annual rainfall: 300-1000 mm. Grows on well-drained soils with good aeration and is well adapted to marginal soils with low nutrient content. On heavy soils, root formation is reduced. Also used as a bio-diesel
Leucaena leucocephala		x	x	x	x	x	x	x		x	x		x	x		x	A small tree (up to 5 m). Altitude 0-2100 m; mean annual temperature 25-30 ºC; mean annual rainfall: 650-3000 mm. Performs optimally on calcareous soils but can be found on saline soils and on alkaline soils up to pH 8; it is not tolerant of acid soils or waterlogged conditions. L. leucocephala is known to be intolerant of soils with low pH, low phosphorus, low calcium, high salinity, high aluminium saturation and water logging and has often failed under such conditions.
Pithecellobium dulce		x	x			x	x	x		x			x	x		x	A medium tree (10-15 m). Altitude 900-1800 m; mean annual temperature 0-48 ºC; mean annual rainfall: 250-1650 mm. Found on most soil types including clay, limestone, and wet sand with a brackish water table. The tree is rated highly tolerant to soil salinity and impoverished soils. It grows best on well-drained, deep, fertile loamy agricultural soils.
Sandaricum koetjape		x	x	x									x				A medium-large tree (up to 50 m). Altitude up to 1000 m, prefers podzolic soils in both humid and seasonal climates, prefers high rainfall but can tolerate dry seasons.
Sesbania grandiflora		x	x			x		x		x	x	x	x			x	A small tree (8-15 m). Altitude 0-1000 m; mean annual temperature 22-30 ºC; mean annual rainfall: 800-4000 mm. It can be grown on a wide range of soils including those that are poor and waterlogged. It tolerates saline and alkaline soils and has some tolerance to acidic soils down to pH 4.5.
Sesbania rostrata		x	x	x		x		x						x			A short-lived perennial (1-3 m). Altitude 0-1600 m; mean annual temperature unknown; mean annual rainfall: unknown. Occurs naturally in marshes, floodplains, on muddy river banks and the edges of pools, but has also been recorded in open savanna. It tolerates waterlogged soils and flooding to over 1 m deep. In cultivation, S. rostrata is almost always associated with wet rice.
Tamarindus indica		x	x			x	x					x	x	x		x	A large evergreen tree (up to 30 m). Altitude 0-1500 m; mean annual temperature up to 47 ºC; mean annual rainfall: 350-1500 mm. Soil type: It grows in most soils but prefers well-drained deep alluvial soil.
*Dialium cochinchinense**	x		x										x			x	A medium sized tree (up to 30 m). Altitude 0-300 m; mean annual temperature unknown; mean annual rainfall: unknown. Occurs in evergreen and deciduous (dipterocarp) forest with a canopy varying from dense to open.
Manilkara zapota		x	x			x			x				x				A large, evergreen forest tree (more than 30 m). Altitude 0-2000 m; mean annual temperature below 42 ºC; mean annual rainfall: 1250-2500 mm. Soils can be well-drained, slightly alkaline, medium-textured loams; however, M. zapota will tolerate a wide range of soil types from drier sands through to heavy clays with marginal drainage.

Dimocarpus longan		x	x									x	x	x		x	A small-medium sized tree (9-12 m). Altitude 150-450 m; mean annual temperature 15 ºC; mean annual rainfall: unknown. Thrives best on a rich sandy loam and nearly as well on moderately acid, somewhat organic, sand. It also grows to a large size and bears heavily in oolitic limestone. In organic muck soils, blooming and fruiting are deficient.
Carissa congesta		x	x			x			x				x	x			A straggly, woody, climbing shrub (3-5 m). Altitude 0-1800 m; mean annual temperature unknown; mean annual rainfall: unknown. The plant grows on sand or limestone. In India, it grows wild on the poorest and rockiest soils and is grown as a hedge plant in dry, sandy or rocky soils. It is most fruitful on deep, fertile, well-drained soil but if the soil is too wet, there will be excessive vegetative growth and lower fruit production.
Acacia mangium		x	x	x		x		x			x		x	x	x	x	A large evergreen tree (25-35 m). Altitude 0-800 m; mean annual temperature 18-28 ºC; mean annual rainfall: 1500-3000 mm. Prefers deeply weathered or alluvial soils.
Azadirachta indica	x		x	x		x		x	x	x			x	x	x	x	A medium tree (15-30 m).Altitude 0-1500 m; mean annual temperature up to 40 ºC; mean annual rainfall: 400-1200 mm. It grows on a wide variety of neutral to alkaline soils but performs better than most species on shallow, stony, sandy soils, or in places where there is a hard calcareous or clay pan not far below the surface. It grows best on soils with a pH of 6.2-7.
Moringa oleifera		x	x	x	x	x	x		x	x	x	x		x		x	A small to medium tree (up to 10 m). Altitude 0-1000 m; mean annual temperature 12.6-40 ºC; tolerates rainfall as low as 500 mm per year. Adapted to a wide-range of soil types but does well in well drained clay or clay loam without prolonged water logging. Prefers a neutral to slightly acidic soil reaction, but it has recently been introduced with success in Pacific atolls where the pH is as high as 8.5.
*Albizia lebbeck**	x			x	x	x		x	x					x			A medium tree (15-30 m). Altitude: below 1800 m; mean annual temperature: 20-35 ºC; mean annual rainfall: 600-2500 mm (can survive with as little as 300 mm of annual rainfall). This species grows well on fertile, well-drained, loamy soil.
Pinus merkusii	x			x				x	x	x			x	x		x	A large tree (50-70 m). Altitude: 0-2000 m; mean annual temperature: 21-28 ºC; mean annual rainfall: 1000-3500. Growing well on many different types of soil, such as sandy and red soils, and in varying climates
Acacia auriculiformis		x		x				x					x	x	x		A medium evergreen tree (15-30 m). Altitude: below 0 -1000 m; mean annual temperature:24-38 ºC; mean annual rainfall: 650-6000 mm. Found most commonly on clay soils, it exhibits the ability to grow in a variety of soils including calcareous sands and black cracking clays, seasonally waterlogged soils, sandy loams and coral rag. It can also tolerate highly alkaline and saline soils, pH ranging between 4.3 and 9.

Crotalaria juncea		x		x	x			x			x					An herbaceous, laxly branched annual, (1-3.5 m). Altitude: below 0-900 m; mean annual temperature: 9-30 ºC; mean annual rainfall: 170-200 mm. Found on light, loamy well-drained soils are preferred; on low-lying or clay soils it achieves vigorous growth. A pH of 5-8.4 is a suitable range.
*Dipterocarpus alatus**	x			x				x			x		x				A medium-large tree (up to 40 m). Altitude: below 0-500 m; mean annual temperature: unknown; mean annual rainfall: unknown mm. The tree prefers alluvial soils.
Flemingia macrophylla	x			x	x	x		x				x	x	x		x	A woody, deep-rooting, tussock-forming shrub (1-4 m). Altitude 0-2 000 m; mean annual temperature: unknown; mean annual rainfall: 1100-2850 mm. Found naturally on both on clay and lateritic soils. The species has an outstanding adaptation to acid (pH 4.6) and infertile soils with high soluble aluminium (80% saturation). It can tolerate fairly long dry spells and is capable of surviving on poorly drained soils with water logging.
Peltophorum pterocarpum		x		x		x	x	x				x	x	x		x	A medium-large deciduous tree (15-24 m). Altitude 0-1600 m; mean annual temperature 22-32 ºC; mean annual rainfall: 1500-4500 mm. The tree prefers light to medium free draining alkaline soils although it also tolerates clay soils.
Ceiba pentandra		x				x	x				x	x	x				A large deciduous tree (60-70 m). Altitude: below 0-900 m; mean annual temperature: 18-38 ºC; mean annual rainfall: 750-3000 mm. Found on deep permeable, volcanic loam, free from water logging.
Erythrina variegata	x					x			x		x		x				A deciduous tree, 3-27 m. Altitude 0-1200 m; mean annual temperature 20-32 ºC; mean annual rainfall: 1250 mm. Occurs in evergreen and deciduous (dipterocarp) forest with a canopy varying from dense to open.
Khaya senegalensis		x				x			x	x	x		x	x			A medium deciduous evergreen tree (15-30 m).Altitude 0-1800 m; mean annual temperature 24-31 ºC; mean annual rainfall: 400-1750 mm. Tolerant to a wide range of soil conditions, from neutral to very strongly acidic and from very well-drained, coarse sandy loam to somewhat poorly drained clay. Prefers neutral, deep, sandy loam soil that is well drained. Such fertile conditions are often found in alluvial soils.
*Aquilaria crassna**	x								x	x			x				A medium-large tree (15-40m). Altitude: 300-900 m; mean annual temperature: unknown; mean annual rainfall: unknown mm. Generally in moist areas, along streams and rivers, and on hill sides. Species occurs sparsely in primary and secondary forest, and usually on ferralitic soils with shallow to moderately deep layers.
*Gardenia ankorensis**	x				x				x				x				A short tree (up to 10 m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown. Able to grow on most soils.
*Pterocarpus macrocarpus**	x				x				x				x				A medium-large tree (10-30 m). Altitude: up to 700 m; mean annual temperature: unknown; mean annual rainfall: unknown. Prefers well drained, light textured soils with shallow depths and little humus.

*Dysoxylum loureiri**	x								x				x				A large tree (20-35m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown. It usually on basalt, sandstone, and sandy clay soils. Especially abundant along the southwest coast and adjacent highlands of Cambodia.
*Fagraea fragrans**	x								x				x			x	An evergreen, medium-large tree (up to 20 m). Altitude: below 800 m; mean annual temperature: unknown; mean annual rainfall: unknown. Usually found in semi deciduous forests and rarely in dense or open forests. The tree prefers sandy soils that are periodically inundated along streams or rivers
*Shorea cochinchinensis**	x								x	x			x				A deciduous, medium-large tree (10-30m). Altitude: 50-1000m; mean annual temperature: unknown; mean annual rainfall: unknown.
*Hopea helferi**	x									x			x	x			A medium to large tree (8-25 m). Altitude: below 700 m; mean annual temperature: unknown; mean annual rainfall: unknown. The species requires wet and deep soils, often grows along streams.
*Garcinia hanburyi**	x								x				x				A medium sized tree (10-20 m). Altitude: up to 800 m; mean annual temperature: unknown; mean annual rainfall: up to 2500mm. Found in the dense and secondary forests of Cambodia.
*Cananga latifolia**	x								x				x				A small tree (8-25 m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown. This species is distributed in wet, dense, piedmont forests.
Hopea odorata	x								x	x			x				A large, evergreen tree (up 45 m). Altitude: 0-300 m; mean annual temperature: 25-27 ºC; mean annual rainfall: more than 1200 mm. In most of its natural distribution area it is found in lowland tropical forests on deep, rich soils, often along streams and rivers.
*Dipterocarpus alatus**	x							x		x			x				A medium-large tree (40+ m). Altitude: 0-500 m; mean annual temperature unknown; mean annual rainfall: unknown. The tree prefers alluvial soils.
Eucalyptus camaldulensis		x					x		x		x		x	x	x	x	A large tree (20-50 m). Altitude: 0-1500 m; mean annual temperature 3-40 ºC; mean annual rainfall 250-2500 mm. Grows best on deep, silty or loamy soils with a clay base and accessible water table. Tolerates water logging and periodic flooding. It is one of the species found to be most tolerant to acid soils.
Eucalyptus tereticornis		x					x				x		x	x	x	x	A large tree (45+ m). Altitude 0-1000 m; mean annual temperature 2-32 ºC; mean annual rainfall: 500-3500 mm. Will grow on a variety of soils, with a preference for deep, well-drained soils of fairly light texture, including alluvial soils, silts and clays. A neutral or slightly acidic pH is suitable, but not a strongly acidic one.

Eucalyptus urophylla		x									x		x	x	x		A large tree (up to 45 m). Altitude 350-3000 m; mean annual temperature 8-29 ºC; mean annual rainfall: 1000-1500 mm. Develops best on deep, moist, well-drained, acidic or neutral soils derived from volcanic or metamorphic rock. Also commonly found on basalt, schist and slates, but rarely on limestone.
*Dalbergia cochinchinensis**	x				x								x				A large tree (25-30m). Altitude: 400-500 m; mean annual temperature: unknown; mean annual rainfall: 1200-1650 mm. Able to grow on most soils, preferring deep sandy clay soil and calcareous soil.
*Dalbergia oliveri**	x												x				A medium to large tree (10-35m). Altitude: 0-900 m; mean annual temperature: unknown; mean annual rainfall: unknown mm. Generally in moist areas, along streams and rivers, and on hill sides. Trees prefer loam soil but can tolerate well-drained, heavy, acidic clay soils.
*Diospyros cruenata**	x												x	x			A medium to large tree (8-35m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown.
*Diospyros bejaudii**	x												x				A medium evergreen tree (10-20m). Altitude: unknown; mean annual temperature: unknown; mean annual rainfall: unknown. Found in dense and semi-dense forests of Cambodia, where it is endemic.
Tectona grandis		x						x	x				x	x	x		A large deciduous tree (30+ m). Altitude 0-1200 m; mean annual temperature 14-36 ºC; mean annual rainfall: 1200-2500 mm. Their most suitable soil is deep, well-drained, fertile alluvial-colluvial soil with a pH of 6.5-8 and a relatively high calcium and phosphorous content. The quality of growth, however, depends on the depth, drainage, moisture status and the fertility of the soil. Does not tolerate water logging or infertile lateritic soils.

*Indicates rare species, listed by Cambodia Tree Seed Project or IUCN threatened species list.

Core references

Cambodia Tree species Project.2004. Available online at http://www.treeseedfa.org/cambodia_monograph.htm. [Accessed 8 September 2011].
AgroForestry Tree Database. Available online at http://www.worldagroforestry.org. [Accessed 8 September 2011].
FAO - Food and Agriculture Organization of the UN Ecocrop Database http://ecocrop.fao.org/ecocrop/srv/en/cropFindForm [Accessed 6 November 2011].

ANNEX IV: MISSION REPORT.

UNEP Adaptation Fund project: Cambodia Mission Report
International consultant: Mike Jennings, C4 EcoSolutions
Dates of mission: 20 June – 3 July 2011

Project title: Enhancing climate change resilience of local communities living in forests and watersheds in protected areas of Cambodia.

A mission was undertaken by the international consultant to Cambodia to gather information to develop a Cambodia Project Concept for submission to the Adaptation Fund (AF) Board. Meetings were held in Phnom Penh with a range of Government departments and NGOs operating in and around Protected Areas. A field visit was undertaken to the Northern Plains region, where meetings were held with Management Committees of three Community Protected Areas (CPAs). Details of the key stakeholders who were consulted and actions taken during the mission are presented below (See Table 1 for a full meeting schedule):

- Meetings were held with the following departments in the Ministry of Environment: General Department of Administration for Nature Conservation and Protection;
- Department of Research and Community Protected Area Development;
- Climate Change Department;
- Wildlife Sanctuary Department; and
- Department of National Parks.

- Meetings were held with the following Government departments:
  - Ministry of Agriculture Forestry and Fisheries;
  - Ministry of Planning;
  - Ministry of Rural Development;
  - Ministry of Water Resources and Meteorology;
  - National Committee for Disaster Management;
  - National Mekong Committee; and
  - Cambodia Development Resource Institute.
- Meetings were held with the following NGOs:
  - World Wildlife Fund;
  - Clinton Foundation;
  - Wildlife Conservation Society;
  - International Union for Conservation of Nature;
  - Fauna and Flora International;
  - Wildlife Alliance;
  - Cambodia Non-Timber Forest Working Group;
  - Cambodia Rural Development Team; and
  - Centre for People and Forests.
- Meetings were held with Ms. Ermira Fida (UNEP, Chief of GEF Adaptation Unit, Climate Change Adaptation Department) during which the requirements of the AF Board were discussed. It was during these meetings that it was decided not to submit a Project Concept, but rather a Full Project Proposal.
- A field trip was undertaken during which meetings were held with committees of the following CPAs:
  - Thmatbeutheun Krosinm in Kulen Promptheap Wildlife Sanctuary (WS);
  - Preyphnom in Phnom Kulen National Park (NP); and
  - Chiork Beungprey in Beung Per WS.

  Committee members were asked questions regarding changes in climate, forest degradation in and outside of CPAs, and homegardens.

Based on the feedback from the field trip and discussions held, it was evident that wider consultation of CPA communities using a consistent, structured questionnaire was required in order to finalise the proposed interventions and intervention sites. A survey plan is being prepared. The information gathered will be included in the Full Project Proposal.

Table 1: Cambodia Adaptation Fund UNEP mission meetings:

No.	Date	Time	Name	Organization	Position	Contact	Card
1	21/06/11	15h00-16h00	Ros Chor	MoE, GDANCP, DRCPAD	Deputy of Department	Ros.chor@yahoo.com; 012986098	No
			Heng Heng	MoE, GDANCP, DRCPAD	Chief of Office	Honghong73@yahoo.com; 012705060	No
			Poux Bunthet	MoE, GDANCP, DRCPAD	Staff	kethbunthet@yahoo.com; 012973887	No
			Kim Sarin	MoE, GDANCP, DRCPAD	Deputy of Department	kimsarin@gmail.com;012864045	Yes
			Srey Morona	MoE, GDANCP, DRCPAD	Director	sreymorona@yahoo.com; 097821854	Yes
			Ouk Navann	MoE, GDANCP, DRCPAD	Deputy Director General	navannouk@yahoo.com; 011845845	Yes
2	22/06/11	09h00-10h00	Phan Kamnap	MAFF, FA, Community Forest Office	Chief	phankamnap@yahoo.com; 012846994	Yes
3	22/06/11	10h00-11h00	Ou Ratank	WWF	Rattan Project Manager	Ratank.ou@wwf.panda.org; 012886086	Yes
4	22/06/11	11h00-12h00	Dr Tin Ponlok	MoE, GDANCP, CCD (CCCA)	Deputy Director General	etap@online.com.kh; 012915351	Yes
			Thy Sum	MoE, GDANCP, CCD	Director	cceap@online.com.kh; 023218370	Yes
5	22/06/11	15h30-16h30	Sony Oum	FFI	Project Coordinator	sony.oum@gmail.com; 012308988	Yes
6	22/06/11	16h30-17h00	Linda Rosengren	FFI, REDD	Regional Programme Manager	Linda.rosengren@fauna-flora.org	No
7	23/06/11	10h00-10h30	Nuth Chansokha	Ministry of Planning	Under Secretary of State	nchansokha@yahoo.com; 012373838	Yes
8	23/06/11	11h00-11h30	Hour Limchhun	Clinton Foundation	National Coordinator	hlimchhun@clintonfoundation.org; 011728738	Yes
9	23/06/11	11h30-13h00	Lic Vuthy	Forest and Environment Specialist	Consultant	licvuthy@yahoo.com; 012967865	Yes
10	23/06/11	14h30-15h00	Sy Ramony	MoE, GDANCP, Wildlife Sanctuary Department	Director	Ramony@online.com.kh	Yes
11	23/06/11	15h00-16h00	Mark Gately	WCS	Country Programme Director	mgately@wcs.org; 012807455	Yes
			Ashish Joshia Ingthy John	WCS	Community Conservation Management Advisor	ajohn@wcs.org; 012738526	Yes
12	23/06/11	16h00-17h00	Sokkheng Novin	MoE, GDANCP, Dept National Parks	Director	gdancp@yahoo.com	Yes
13	23/06/11	17h00-17h30	Khem Rogden	MoE, GDANCP, DRCPAD	Staff	011267966	No
14	24/06/11	09h00-10h30	Edwin Payuan	RECOFTC	Country Program Coordinator	edwin@recoftc.org; 077901995	Yes
			Hou Kalyan	REFOFTC	Training Coordinator	kalyan@recoftc.org; 012839955	Yes
15	24/06/11	10h30-11h30	Kimsreng Kong	IUCN	Senior Program Officer	kimsreng.kong@iucn.org; 012888847	Yes
			Sun Kong	IUCN	Field Coordinator	kong.sun@iucn.org; 012755501	Yes
16	24/06/11	14h30-15h00	Kol Vathana	Cambodia National Mekong Committee	Deputy Secretary General	kol_vth@cnmc.gov.kh; 012388502	Yes
17	24/06/11	16h30-17h00	Koy Ra	Cambodia Development Resource Institute, National Resource and Environment Program	Program Coordinator	ra@cdri.forum.org.kh; 012873432	Yes
			Kim Sour	CDRI, NRE Program	Research Associate	sour@cdri.forum.org.kh; 012867278	Yes
18	24/06/11	17h30-18h00	Samnang Sar	Mekong Carbon	President	sarsamnang@yahoo.com; 012481169	Yes

19	27/06/11	09h00-10h00	Sun Mao	Cambodian Rural Development Team	Executive Director	sun_mao@crdt.org.kh; 012635865	Yes
			Hean Pheap	Cambodian Rural Development Team	Operations Manager	hean_pheap@crdt.org.kh; 012674160	Yes
20	27/06/11	10h30-12h00	Khou Eang Hourt	Cambodian NTFP WG	National Network Facilitator	khou_eanghourt@yahoo.com; 012954627	Yes
21	27/06/11	14h00-16h00	Edwin Payuan	RECOFTC	Country Program Coordinator	edwin@recoftc.org; 077901995	2nd
			Hou Kalyan	REFOFTC	Training Coordinator	kalyan@recoftc.org; 012839955	2nd
22	27/06/11	16h00-17h30	Ouk Navann & team	MoE, GDANCP, DRCPAD	Deputy Director General	navannouk@yahoo.com; 011845845	2nd
23	28/06/11	08h30-09h30	Ev Sambath	Ministry of Rural Development, Dept of Rural Health Care	Deputy Director	sambath_ev@yahoo.com; 012668968	Yes
24	28/06/11	10h30-11h30	Ken Serey Rotha	MoE, GDANCP	Deputy Director General	ken.rotha@gmail.com; 077989112	Yes
25	28/06/11	11h30-12h30	Dr Tin Ponlok	MoE, GDANCP, CCD (CCCA)	Deputy Director General	etap@online,com.kh; 012915351	2nd
			Thy Sum	MoE, GDANCP, CCD	Director	cceap@online.com.kh; 023218370	2nd
26	28/06/11	13h00-14h30	Lic Vuthy	Forest and Environment Specialist	Consultant	licvuthy@yahoo.com; 012967865	2nd
27	28/06/11	15h00-15h30	Crawford Prentice	Nature Management Services	Consultant	crawford.prentice@gmail.com; +60(12)2095794	Yes
28	28/06/11	15h30-16h30	Berry Mulligan	FFI	Operations Manager	berry.mulligan@fauna-flora.org; 012533105	Yes
			Matt Maltby	FFI	Project Officer	matt.maltby.ffi@gmail.com; 023220534	Yes
29	28/06/11	16h30-17h30	Sau Sereymony	Ministry of Water Resources and Meteorology	Secretary of State	sausereymony@gmail.com; 012815711	Yes
30	28/06/11	17h30-18h00	Ma Norith	National Committee for Disaster Management, Information and International Relations	Director, Advisor to NCDM	ma.north@ncdm.gov.kh; 077897070	Yes
31	01/07/11	14h00-15h00	Lesley Perlman	Wildlife Alliance	Program Manager	lperlman@online.com.kh; 012900473	No
32	01/07/11	15h30-16h30	Berry Mulligan	FFI	Operations Manager	berry.mulligan@fauna-flora.org; 012533105	2nd
			Matt Maltby	FFI	Project Officer	matt.maltby.ffi@gmail.com; 023220534	2nd

ANNEX V THE COST, ECONOMIC BENEFIT AND ECOLOGICAL BENEFITS OF PLANTING NITROGEN FIXING TREES AROUND RICE PADDIES.

Suggested leguminous tree and shrub species to plant	Cost of planting[232]	Cost of fertiliser without nitrogen fixing trees for a high yield rice crop	Financial benefit of reduced fertilizer use due to planting of leguminous trees[233]	Ecological benefits of nitrogen fixing trees
Leucaena leucocephala, *Albizia lebbek* (chres), *Gliricidia SEPIUM* (SNAOV), *DALBERGIA COCHINCHINENSIS* (KRA NGOUNG), *PTEROCARPUS INDICUS* (THNONG), *MORINGA OLEIFERA* and *Acacia mangium*	Approximately 0.12 ha of trees will be planted for every ha of rice paddy. The cost of establishing trees[234] has been estimated at ~ US$ 839 ha^{-1} so the cost of establishing a border of nitrogen fixing trees around rice paddies would be ~US$107 per ha of rice paddy. The intervention aims to target 2500ha of agricultural land, which would cost ~US$267500. A suggested average agricultural land use of 0.5-1ha of rice paddy per family[235] means that this intervention would benefit between 2500 and 5000 families.	In 2004 N fertiliser costs were approximately US$ 0.40/kg[236]. Rice farmers on high yielding farms require 100-300kg N per ha per crop cycle, which equates to ~US$ 40 - 120 per ha per crop cycle.	Legumes contribute 50 -120 kg N/ha per crop cycle (up to 500 kg N / ha in the case of *Leucaena leucocephala),* so assuming N costs US$ 0.4ha^{-1} then nitrogen fixers could save the farmer US$ 20-48 ha^{-1} per crop cycle(and up to US$ 200 ha^{-1} in the case of *Leucaena leucocephala*).	The availability of soil nitrogen and other nutrients is essential to increase crop yields[237]. Leguminous nitrogen fixing plants have been found to increase soil pH, organic matter, and nutrients (N, P, K, Ca, and Mg), which is beneficial to grain yields and biomass, provided the trees do not shade the rice plants[238,239]. By introducing nitrogen fixing trees the efficiency of nutrient inputs is improved, so a higher yield is possible with less fertilizer input. Less fertilizer input means reduced emissions from fertilizer production, and has the added benefit that farmers have to spend less money on improving soil quality. In addition to the nutritional benefits, this conservation agriculture approach ensures protection of soils due to the presence of leaf litter, which reduces the effects of both drought and flood. Trees help with food supply, and increase the adaptability of agricultural systems to climate change by diversifying production as well as diminishing effects of extreme weather events such as heavy rains and droughts, as well as preventing soil erosion, stabilizing soils, and increasing infiltration rates.

[232] FAO http://www.fao.org/docrep/u2246e/u2246e06.htm.
[233] Lowendor HS. 1982. Biological nitrogen fixation in flooded rice fields. Cornell international agricultural mimeograph. 1982
[234] See Table 1 for a breakdown of the cost of tree establishment.
[235] Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf suggest that each family has 0.5-1ha of agricultural lands.
[236] March Irrigation Scheme, Kampong Cham Province, Cambodia (October 2004).
[237] FAO 2010 "Climate-Smart" Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation.
[238] Sae-Lee S, Vityakon P, Prachaiyo B. 1992. Effects of trees on paddy bund on soil fertility and rice growth in Northeast Thailand. Agroforestry Systems 18 (3) 213-223
[239] FAO http://www.fao.org/DOCREP/006/Y4751E/y4751e0k.htm.

ANNEX VI: PROPOSED CROP SPECIES TO PROMOTE INTENSIFICATION AND DIVERSIFICATION OF EXISTING HOMEGARDENS THROUGH IMPROVED CONSERVATION AGRICULTURE PRACTICES.

Estimates of production costs and gross return values of each crop obtained from Agrifood Consulting International (2005) Final Report for the Cambodian Agrarian Structure Study. Prepared for the Ministry of Agriculture, Forestry and Fisheries, Royal Government of Cambodia, the World Bank, the Canadian International Development Agency (CIDA) and the Government of Germany / Gesellschaft für Technische Zusammenarbeit (GTZ) by Agrifood Consulting International. Bethesda, Maryland. http://agrifoodconsulting.com/ACI/uploaded_files/project_report/project_35_1220605826.pdf

Key: Growth forms/ life forms: 1. Grass/ Leafy Veg, 2. Shrub, 3. Tree, 4. Climber, 5. Root/tuber, 6. Annual, 7. Perennial

Social or environmental uses: 1. Cereal, 2. Legume, 3. Vegetable, 4. Fruit, 5. Medicinal or cultural value, 6. Industrial/construction, 7. Roots/tubers, 8. Fodder, 9. Climate adaptation benefits (e.g. soil fertility, drought or waterlogging tolerance), 10. Highly nutritious, 11. Seed.

Scientific name	Common name	Growth form/ life form	Material costs ($/ha)[240]	Labor ($/ha) [241]	Total production costs ($/ha)[242]	Gross returns ($/ha)[243]	Social or environmental uses	Reasons for inclusion
Cocos nucifera	Coconut palm	3, 7	21	55	76	204	4, 5, 6	This crop can be grown in combination with other crops to diversify production and increase food supply. Production costs are low and it was identified as a neglected and underutilised species[244] in Cambodia. Criteria used to identify these priority species included prevalence of local and national use (i.e. cultural acceptance), traditional knowledge of cultivation, potential for export, scientific knowledge and nutritional value.
Anacardium occidentale	Cashew	3, 7	18	85	104	646	4, 9	Can be grown in combination with other crops for diversity and is adapted to tolerance of erratic rainfall. Identified as a neglected and underutilised species in Cambodia[245].

[240] Agrifood Consulting International (2005) Final Report for the Cambodian Agrarian Structure Study. Prepared for the Ministry of Agriculture, Forestry and Fisheries, Royal Government of Cambodia, the World Bank, the Canadian International Development Agency (CIDA) and the Government of Germany / Gesellschaft für Technische Zusammenarbeit (GTZ) by Agrifood Consulting International. Bethesda, Maryland. http://agrifoodconsulting.com/ACI/uploaded_files/project_report/project_35_1220605826.pdf.
[241] Ibid.
[242] Ibid.
[243] Ibid.
[244] Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf.
[245] Ibid.

Citrus spp.	Oranges, lime, mandarin	3, 7	121	124	245	4969.98	4, 5, 9	This crop is water stress resistant and has been identified as an underutilised species in Cambodia[246].
Durio zibethinus	Durian	3, 7	77	198	274	1167	4, 7	Can be grown with other crops for diversification and intensification of agriculture. Has been identified as an underutilised species in Cambodia[247]
Manihot esculanta	Cassava	2, 7	73	105	177	375	6, 7, 9	Highly nutritious, low maintenance, highly productive, used extensively already.
Glycine max	Soya bean	2, 6	93	61	153	422	2, 6, 8, 9, 10	Highly nutritious, has a wide range of uses, and stabilises and improves soil fertility.
Ipomoea batatas	Sweet potato	2, 6	57	59	116	332	7, 8, 10	Can be grown in combination with other crops for diversification of agriculture. Identified as a neglected species in Cambodia[248].
Solanum melongena	Eggplant	1, 6	87	31	118	1375	3, 5, 10	This will increase food supply as it is nutritious and easy to grow on small scale. Growing it in combination with other crops will diversify farming practices.
Vigna radiata	Mungbean	1, 6	75	47	122	352	2, 9	This species has positive benefits for soils, as it is nitrogen fixing. Identified as a neglected species in Cambodia[249].
Zea mays	Maize	1, 6	87	47	134	708	1, 6, 8	Highly productive, high energy content, capable of high yield in small areas to intensify agriculture.
Arachis hypogaea	Peanut, ground nut	1, 1	85	54	139	327	2, 6, 9, 10	This species is nitrogen fixing (see Annex V for the importance of nitrogen fixers in agricultural systems) and can be grown in combination with other crops to diversify agriculture. Identified as underutilised species in Cambodia[250].
Ipomoea aquatica	Kangkong	1, 6	103	46	149	433	3, 9, 10	This crop grows easily and is highly nutritious, highly productive, and already used extensively in Cambodia. Can be grown in combination with other crops for diversification.
Sesamum indicum	Sesame	1, 6	138	41	180	681	5, 6, 9, 11	High profit returns, can tolerate broad climatic parameters.
	Vegetables (lettuce, cabbage, tomato,	1, 6	90	69	159	1035	3, 10	Growing a combination of vegetables at different times of year will diversify output and make communities more resilient to failed crops. Nutritious and easy to grow on small scale.

[246] Ibid.
[247] Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf.
[248] Ibid.
[249] Ibid.
[250] Ibid.

	cabbage, cauliflower)							
Colocasia esculenta	Taro	1, 6	n/a	n/a	n/a	n/a	5, 7, 8, 9, 10	Widely utilised already, and tolerant of erratic climate. Has various uses and has been identified as a neglected and underutilised species in Cambodia[251]
Zingiber officinarum	Ginger	2, 6	n/a	n/a	n/a	n/a	5, 7, 10	This species has a high yield per area (1.5-7.5 t/ha for dried ginger and up to 38 t/ha for green ginger)[252]and has a high market value. Identified as a neglected species in Cambodia[253]
Nephelium lappaceum	Rambutan	3, 7	n/a	n/a	n/a	n/a	4	Useful food plant. Identified as a neglected and underutilised species in Cambodia[254]
Momordica charantia	Bitter Gourd	1, 6	n/a	n/a	n/a	n/a	3, 5, 9	Widely utilised in Cambodia and can be grown in combination with other crops. Medicinally useful and can tolerate erratic climate[255].
Min value			**18**	**31**	**76**	**204**		
Max value			**138**	**198**	**274**	**4969**		
Average			**80**	**73**	**153**	**930**		

[251] Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf.
[252] http://ecocrop.fao.org/ecocrop/srv.
[253] Meyer A, Glaser, S, Hager V. Assessment of neglected and underutilised species (NUS) in Cambodia http://www.agrofolio.eu/agrofolio/uploads/files/final/Agrofolio_assessment_Cambodia.pdf.
[254] Ibid.
[255] http://ecocrop.fao.org/ecocrop/srv.

ANNEX VII: LETTER OF ENDORSEMENT.

KINGDOM OF CAMBODIA
NATION-RELIGION-KING

COUNCIL OF MINISTERS
Ministry of Environment

No: 464/C MoE

Phnom Penh, 27 December 2011

Letter of Endorsement by Government

To: **The Adaptation Fund Board**
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for the project "Enhancing Climate Resilience of Rural Communities Living in Protected Areas of Cambodia"

In my capacity as designated authority for the Adaptation Fund in Cambodia, I confirm that the above national project proposal is in accordance with the Royal Government of Cambodia national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Cambodia.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by the United Nations Environment Programme (UNEP) and executed by the Ministry of Environment (MoE), Royal Government of Cambodia.

Sincerely Yours,

Tin Ponlok,
Deputy Director General,
Ministry of Environment
DA for the Adaptation Fund in Cambodia

Seen and approved
Senior Minister, Minister of Environment

H.E. Dr. Mok Mareth

No. 48, Samdech Preah Sihanouk, Tonle Bassac, Chamkarmon, Phnom Penh, CAMBODIA Fax: 855 23 21 25 40, Phone: 855 23 21 39 06