

Kingdom of Cambodia
Ministry of Environment

**Climate Change Governance for Land Use Planning in
Cambodian Coastal Areas – A Case Study in Sihanouk Ville**

MOE, 2014

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Abbreviation

ADB	Asian Development Bank
CARP	Coastal Adaptation and Resilience Planning Component
CCCA	Cambodia Climate Change Alliance
CCD	Climate Change Department
CLUP	Community Land Use Plans
D&D	Decentralization and De-concentration
DANIDA	Danish Development Agency
DCSUP	District Committee for Spatial and Urban Planning
ELC	Economic Land Concession
GDP	Gross Domestic Product
GHG	Green House Gas
IPCC	Inter-governmental Panel for Climate Change
FC	Fishery Community
FWUC	Farmer Water User Committee
MAFF	Ministry of Agriculture, Forestry, and Fisheries
MOE	Ministry of Environment
MEF	Ministry of Economy and Finance
MOP	Ministry of Planning
MOWRAM	Ministry of Water Resources and Meteorology
MPWT	Ministry of Public Works and Transport
NCCC	National Climate Change Committee
NCMDCA	National Committee for Management and Development of Coastal Area
NAPA	National Adaptation Program of Action to Climate Change
NCDM	National Committee for Disaster Management
NGO	Non-Governmental Organization
NSDP	National Strategic Development Plan
PCSUP	Provincial Committee for Spatial and Urban Planning
PDP	Provincial Department of Planning
PBMCCLUP	Policy Brief for Mainstreaming Climate Change into Land Use Planning
RS	Rectangular Strategy
SEZ	Special Economic Zone
SNC	Second National Communication
SNAP-DR	Strategic National Action Plan for Disaster Risk Reduction
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention for Climate Change
WB	World Bank

I. Introduction

Climate change increasingly becomes one of the defining factors to sustainable socio-economic development across the World (UNDP, 2011), as modeling of climate change impacts by various international organizations and IPCC points to a continued rise of global mean surface temperature and the increased intensity and frequency of extreme climate change variables and events. Floods, droughts, storm surges, cyclones, heat waves and saline intrusion have already had adverse effects on many economic sectors, damaging social, economic and physical infrastructure, and causing loss of human life. As a result climate change might impact macro-economic performance by reducing GDP growth (by 6.7%) and poverty reduction achievement especially in the developing countries like Cambodia (ADB, 2009). The ADB study (2009) estimated a potential decline of 50% in agricultural productivity by 2100 compared to the 1990 baseline.

Cambodia coastal areas will be exposed to the climate change risk and impacts, though the vulnerability index (MOE, 2010) shows relatively less vulnerability to climate change than other areas in the central plain and northeast of Cambodia. However, this could be a biased assessment as SLR was not integrated in this vulnerability assessment. The expected increase in global warming and its associated climate extremes will put the coastal areas at risk (SoE, MOE 2014). Among many sectors, land use plans and master plans will be affected by climate related factors. Given the potential implications of climate change impacts on land use planning, this present note reviews the gap in climate change governance and provide policy recommendations for effective integration of climate change in land use planning and land use plans. The methodology is based on compilation of existing literature and publications, conducting interviews and discussion with key officers, and organizing consulting workshop to finalize the work. The policy recommendations are proposed for Preah Sihanouk as a case study, but they may be relevant to other coastal provinces of Cambodia. A Technical Assistance can be proposed to build capacity and other enabling environment conducive to engage the Ministry of Land Management, Urban Planning and Construction and sub-national entities in climate change planning and integration in land use plans using Preah Sihanouk as a pilot project. Experience gained during its implementation can be replicated to other coastal provinces and elsewhere in Cambodia.

II. Demography, Natural Resources, and Socio-Economics in Sihanouk Ville

Cambodia has a coastline of 435km stretching across four provinces, namely Kampot, Kep, Preah Sihanouk, and Koh Kong. Preah Sihanouk is situated in the middle between Kampot and Koh Kong provinces about 230 km from Phnom Penh. It has a total area of 2,587km² and consists of four districts, namely Sihanouk Ville, Prey Nop, Stoeng Hav and Kampong Seila (the latter district has just been transferred from Koh Kong Province).

2.1 Natural resources and environment

Each coastal province is endowed with distinguished inland ecosystems, marine and estuarine ecosystems, and agricultural landscape. Sihanouk Ville is known for its beaches, several beautiful off-shore islands, and natural scenic views of mangroves and swamp forests, which are

important characteristics for tourism destinations. Its natural features include Ream National Park with extensive mangroves, coral reefs, seagrass beds, and malaleuca swamp forest, which are home to rich diversity of life, especially marine fish. There are six important natural features in Preah Sihanouk: islands, mangrove forests, malaleuca and swamp forests, coral reefs, seagrasses and seaweeds, river mouths and mudflats, and sandy and rocky beaches. Its forest cover consists mainly of secondary forest and the deforestation will further reduce the forest cover in favor of other various economic activities such as urban and housing development, Special Economic Zone, industries, resorts and agriculture.

2.2 Demography

Preah Sihanouk has a total population of about 200,000 with a population density of around 77 person/km². Its population is relatively young with an active population of 54% (PDP, 2013). Preah Sihanouk district experiences a rapid urban development driven by tourism, influx of newcomers and foreign investors.

Table 2. Population

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	62,263	58,816	62,513	70,321	72,049
1802	Prey Nop	93,755	86,669	89,238	90,091	91,736
1803	Stoeng Hav	16,382	15,727	15,177	16,190	16,193
1804	Kampong Seila	18,370	17,774	15,040	15,605	16,667
18	Total	190,770	178,986	181,968	192,207	196,645

Commune Database 2010, Provincial Department of Planning

Table 3. Percentage of Population with age between 18-60

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	54.42	56.99	56.20	56.25	57.47
1802	Prey Nop	49.41	50.32	48.81	49.32	51.39
1803	Stoeng Hav	52.83	53.03	55.22	54.95	57.51
1804	Kampong Seila	50.12	44.39	52.13	50.82	51.55
18	Total	51.40	52.16	52.16	52.45	54.14

Commune Database, Provincial Department of Planning

2.3 Social and economic Aspects in Cambodia and Preah Sihanouk

The Cambodia economy has achieved stable growth for the period 1994-2011 with GDP growth rate of 6-7% annually (NSDP 2014-18). National statistics has revealed that there is a slight change in the GDP structure where contribution from industry and service sector grows faster than the agriculture sector. It was estimated that the agricultural sector grew at 4.2% annually during 2009 and 2012 and is projected to grow at 4% by 2017, while industry and services sector grew at 9.2% and 5.5% during the same period

and they are expected to grow at 8% and 7.2%, respectively, by 2017 (NSDP, 2014). It is worth noting that the Cambodian economy base remains narrow, confined to garment, construction, tourism and agriculture. It depends on foreign direct investment (FDI) and Official Development Assistance (ODA) to meet its investment targets. Investments have been steady for the last several years accounting for 25% of GDP. Total Foreign Direct Investment peaked at 900 Million US\$ in 2007, it slowed down during the global crisis in 2008 and peaked again in 2010. Owing to this overall good macro-economic performance, the country poverty rate has been reduced from 39% in 1990 to around 19.8% in 2011 (NSDP, 2014). This stable growth will make Cambodia become middle income country (USD 1,075) by 2030 and high income country by 2050 (GRSIII).

There is no disaggregated data to estimate the share of provincial GDP compared to the country GDP. Owing to its geographical location connected with the sea, Preah Sihanouk province is considered one of the development poles that can drive country growth due to its high potential industry and service sectors. It has a big international port and cargo handling facilities, good infrastructure with asphalt road and railroad, airport, and it has established 6 Special Economic Zones¹ (SEZ). Industry and service sector have been steady and will become important sources of revenues for the province. Current industry includes port, coal-powered plants, oil terminals, oil refinery plant, garment and footwear factories, brewery factories, and oil and gas extraction terminals. Key service sector includes tourism, residential development, construction, restaurants and entertainment. Some important agricultural produce include oil palm, sugar cane, rice, mango, durian, and cassava, though it is still relatively less significant compared to the other coastal provinces. With high potential economic growth and job opportunity, the income and livelihoods of people in Preah Sihanouk will be improved and better than that in other provinces. A proxy poverty rate in Preah Sihanouk is lower than the national average amounting to 11.9% (NSDP, 2014). The decline in number of houses with thatched roofs and the increase in number of houses with zinc and tile roof is an indication of increased family income in the province (see table 4 and 5). Access to electricity and tap water is estimated at 60% and 26%, respectively, where Preah Sihanouk and Stoeng Hav districts have better access to both services.

Table 4. Percentage of Housing with thatched roofs

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	2.88	2.93	2.33	2.21	1.77
1802	Prey Nop	24.87	21.79	19.00	17.25	12.75
1803	Stoeng Hav	22.72	16.78	13.81	8.27	8.44
1804	Kampong Seila	33.91	27.32	22.52	23.26	16.89
18	Total	17.92	15.36	12.96	11.34	8.60

Commune database

Table 5. Percentage of housing with zinc roof

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	72.89	73.81	69.30	66.81	67.63

¹The six SEZs include SNC SEZ (Sangkat Betran), Stung Hav SEZ (Sangkat Otres), Sihanoukville SEZ 1 (Stung Hav district), Sihanoukville SEZ 2 (Betrang commune), Sihanouk Ville Port SEZ (Tumnop Rolork), Kampong Som SEZ, (Village 4 Otres Commune) (JICA, NIPPON KOEI, 2010).

1802	Prey Nop	64.89	66.32	68.79	74.78	78.84
1803	StoengHav	66.67	70.90	71.52	73.13	71.00
1804	Kampong Seila	54.79	59.17	61.06	63.76	69.37
18	Total	66.85	68.63	68.53	70.72	73.17

Commune database

Table 6. Percentage of population having access to electricity

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	88.87	90.91	87.36	88.66	89.56
1802	Prey Nop	19.53	22.50	25.10	30.19	40.89
1803	StoengHav	67.72	68.89	75.77	75.57	79.49
1804	Kampong Seila	10.02	14.26	18.60	23.78	22.43
18	Total	47.18	49.53	50.87	55.47	60.88

Commune database

Table 7. Percentage of population having access to tap water

Code	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	46.67	47.00	50.19	52.91	55.10
1802	Prey Nop	3.25	3.83	2.90	2.42	0.00
1803	StoengHav	9.78	59.40	64.63	65.10	67.75
1804	Kampong Seila	7.07	4.58	1.30	0.00	0.00
18	Total	19.29	23.86	24.72	26.46	26.38

Commune database, Provincial Department of Planning

Table 8. Percentage of population having access to pumping well.

កូដ	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	7.70	11.53	7.90	8.18	9.40
1802	Prey Nop	25.78	22.91	33.74	35.62	35.87
1803	StoengHav	8.43	11.94	10.74	14.02	13.35
1804	Kampong Seila	38.20	41.22	33.91	49.92	50.15
18	Total	19.09	19.74	22.66	24.67	25.23

Commune database

Table 9. Percentage of population using rain water

កូដ	Municipality/District	2007	2008	2009	2010	2011
1801	Preah Sihanouk	11.13	5.67	0.83	3.10	3.01
1802	Prey Nop	2.82	2.02	2.81	3.63	2.11
1803	StoengHav	7.56	5.12	3.27	4.15	2.74
1804	Kampong Seila	6.05	6.05	4.59	6.95	6.36
18	Total	6.46	3.95	2.30	3.75	2.86

Provincial Department of Planning

III. Climate Change Impacts and Risk in Preah Sihanouk

3.1 Climate conditions

Climate in Cambodian coastal areas is influenced by the south-west monsoon starting from May to October and North-east monsoon starting from November to February. Two corresponding seasons are observed-dry and wet. The wet season begins in May or June and last until October when the dry season follows until April. Coastal provinces have a minimum average temperature of 22.5°C and a maximum average of 33.8°C. Annual rainfall in Preah Sihanouk ranges between 2000 and 3000mm, which is double the average annual rainfall in the central plains.

3.2 Overview of Global Climate Change Observation and Projection

The global mean surface temperature has increased since the late 19th century, and it is observed that the first decade of 21st century has been the warmest (IPCC 2014). A total global increase of 0.85°C was observed over a period 1880-2012 and an increase of 0.72°C was recorded over the period 1951-2012. The IPCC Fifth Assessment Report (AR5) has revealed that the numbers of cold days and nights have decreased and the numbers of hot days and nights have increased globally since about 1950, indicating a trend of extreme events with potential negative effects on socio-economic development and human health across the planet.

Cambodia's mean surface temperature has increased by 0.8°C compared to 1960 (SNC) and it is projected to increase at a rate of 0.013 °C to 0.036°C per year, where the rate of temperature increase is high in central Cambodia and in the North East of Cambodia (0.036°C per year) and low in the high altitude areas of South West region (0.013°C per year), including the coastal areas (SNC, 2010). The number of cold days and cold nights has decreased by 5.2% and 12.6%, respectively. Future projections suggest that these trends will continue, with the average annual temperature rising by 0.7-2.7°C by the 2060s and 1.4-4.3°C by the 2090s throughout the year (IFAD, 2013). By the 2090s, rainfall during the rainy season is anticipated to increase by up to 31% in the June-August period and by up to 42% in September-November. During December-February, however, rainfall is projected to decrease by up to 54% (IFAD, 2013). This means that coastal province will be exposed to increased frequency of drought,

heavy rain, and storm surges, including increased saline intrusion and sea level rise. Possible extreme weather² and abrupt change in climate variables are expected to occur though they are less predictable and varies from season to season.

Global warming would cause sea level rise (SLR) as a result of melting of ice sheets and thermal expansion of the ocean. The AR5 suggests that it is likely the rate of SLR has increased with a global rate of 1.7mm/year between 1901 and 2010, and the rate was observed higher at 3.2 mm/year between 1993 and 2010. The rate of SLR in 21st century is projected to increase further ranging between 0.24m to 0.63 m compared to the rate observed during 1971 -2010 for the lowest and highest Representative Concentration Pathways³ (RCP) scenarios respectively (Table 10). Studies by CSIRO for the Asia Pacific region have confirmed a similar range of approximately 3–16 cm by 2030 and 7–50 cm by 2070 (CSIRO 2006).

Table 10: AR5 global mean sea level (m) increase projections^[5]		
	2046-2065	2081-2100
Scenario	Mean and likely range	Mean and likely range
RCP2.6	0.24 (0.17 to 0.32)	0.40 (0.26 to 0.55)
RCP4.5	0.26 (0.19 to 0.33)	0.47 (0.32 to 0.63)
RCP6.0	0.25 (0.18 to 0.32)	0.48 (0.33 to 0.63)
RCP8.5	0.30 (0.22 to 0.38)	0.63 (0.45 to 0.82)

Source: AR5, 2014

The amount of sea-level rise in Asia Pacific region is largest (600-950 mm) for the RCP 8.5 scenario and smallest (300-600 mm) for the RCP 2.6 scenario by the end of the century, and the projections indicate slightly lower for the coast of Cambodia than the offshore (ADB, 2014).

3.2 Analysis of Climate change impacts and Sector Implications in Preah Sihanouk

Global warming resulting from increased GHG emissions in the atmosphere is the key driver of climate change⁴. Drought, floods, strong wind, cyclones and climate related extremes will have negative effects on almost all sectors causing reduction of GDP and economic growth. However, climate change will have smaller impacts on economic sectors compared to the impacts of other drivers (AR5 2014). According to AR5, population change, age, technology, lifestyle, regulations, governance, poverty and other aspects of socio-economic development will have an effect on supply and demand of consumer goods and services that cause larger impact compared to the impact of climate change. This is true and must be taken into consideration when one deals with climate change in the Cambodia's situation (MOE, 2013). Uncertainty is another factor faced by decision makers in optimal planning and budgeting of climate change response in a cost effective manner. Notwithstanding difficulties, there are potential win-win

²Weather is the day-to-day state of the atmosphere in terms of temperature, moisture content and air movements.

³ The RCPs have four GHG concentration (not emissions) trajectories adopted by the IPCC for its Fifth Assessment Report (AR5). The four RCPs, RCP2.6, RCP4.5, RCP6, and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values (+2.6, +4.5, +6.0, and +8.5 W/m², respectively).

⁴Climate change is a long term observation of change in weather for a period of 10 years, 30 years or more.

solutions that can address climate change and at the same foster sustainable development. Below is description of climate change impacts on several key economic sectors⁵ based on a review of literatures and international publications, and especially a recent IPCC Fifth Assessment Report.

A. Agriculture

Agriculture remains an important contributor accounting for 28% of the GDP providing the main source of income for large rural population (CDRI, 2012). However in Preah Sihanouk, agriculture does not have a large share of GDP contribution. A study by JICA in 2010 indicated a low percentage of private investment in agriculture (0.3%) compared to the size of investments in industries, oil/gas exploitation and refinery terminals (16%) and tourism (70%). Though now agriculture is not important for GDP contribution in a monetary term, it is still important staple food for rural farmers and it can be improved through diversification and skill improvement that will enhance productivity sufficient not only for local economy and rural livelihoods, but also for export. Agro-industrial crops such as cassava, sugar cane, rubber and oil palms are already cultivated with success along the road 4 and mountain slope areas, which can be processed for export. Rainfed rice is grown in the low-lying areas, especially in the polder system of Prey Nop district, which yields around 2.5t/ha (MOE/CARP, 2012).

Despite improvement, agricultural productivity remains low compared to neighboring countries and this would be further affected by climate change (NAPA, 2006). Climate change can have potential impact on agriculture because of rising temperature, longer drought, heavy rainfall and its distribution, sea level rise, and strong wind. For every 1°C increase in minimum temperature rice yields would be decreased by 10% (IFAD, MOE, 2013), while drought can reduce rice yield by 14%. Hot weather is also favorable for pest outbreak and new diseases causing low productivity. No data are available to assess the impact of drought on agriculture in Preah Sihanouk, but water shortage is a real problem for both agriculture and domestic consumption in several communities, especially in the low-lying areas of Prey Nop and Kampong Seila districts. SLR may not be an immediate threat to agriculture for the next 30 years or so, however in certain low-lying areas such as in Prey Nop polder system crops will be vulnerable to the flood from the sea during the maximum tide and SLR that can overspill the current level of the sea dykes. Prey Nop polders were rehabilitated to increase crest level by technical and financial support of NGOs and MOWRAM (MOE, 2013), which is one of the adaptation measures to deal with SLR. Polders can be built in other agricultural areas provided EIA is conducted before construction begins. Other measures include introduction of short-term and saline resistant varieties, construction or rehabilitation of irrigation and drainage system, enhanced water management and farming techniques, diversification of crops such as coconut trees, mangoes, and oil palms. Land use planning can also help to designate agricultural areas with climate related hotspots (drought, sea level rise, saline intrusion and wind) and inform respective agencies to take necessary measures to reduce the impacts.

B. Water Resources

Water is critical for all sector developments, where the agriculture sector consumes a large proportion of total water consumption. Water quantity and quality depends on precipitation pattern, vegetation cover, temperature, soil and geographic characteristics. Climate change and climate variables such as precipitation pattern, evaporation and drought can affect ground and surface water availability. A shift in

⁵Most important sectors that are likely to be affected by land use and climate change.

the onset⁶ of the wet season and mini drought events will implicate the optimal time for planting crops, especially rice as irrigation and drainage system is sparsely accessible for year round. Irrigation infrastructure is available for only 20% of all agricultural land (NSDP 2014) and thus much of it depend on rain. Besides, rising water consumption pattern by various sectors and imbalanced development through uncontrolled land use practice, logging, hydropower and irrigation development, and pollution will put pressure on water resources.

In Preah Sihanouk city water for domestic use relies on two main sources: Kbal Chay river and a city reservoir, where the former contributes around 70%. The expected increase in precipitation will be a benefit of climate change, but the uncontrolled development in Kbal Chay and its watershed areas will put this benefit in doubt. There is a polder system constructed in Prey Nop with the main objective to control sea tide rather than to irrigate paddy rice. No irrigation is built for other crops such as oil palm and sugar cane, which rely on rain water. Hard adaptation measures can include waste management and sewage infrastructure development, irrigation and drainage infrastructure development, and construction of additional sea dykes and reservoirs in the hotspots⁷ of climate risks. Soft measures may include capacity building of relevant stakeholders and government agencies, formation or strengthening of water user communities, forestry and fishery communities, development of environmental management plans for city reservoir and Kbal Chay waterfall, improved institutional coordination, promoting integrated watershed management, and conservation and reforestation of forest cover. These all together can have co-benefits for both socio-economic development and climate change response.

C. Tourism

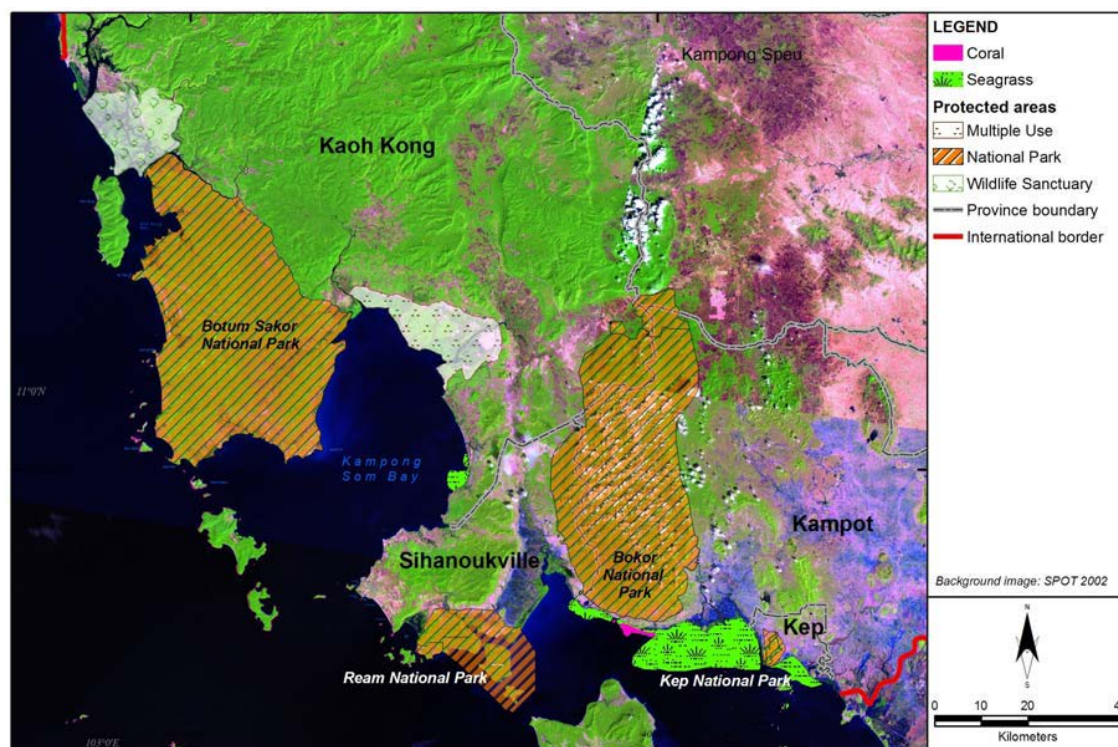
Tourism is one of the fast growing sectors in Cambodia owing to rich cultural assets, natural resources, diversity of landscapes and coastal scenic view (ADB, 2009). Tourism contribution to GDP increased three folds during 2009-2012 and reached US\$ 2.2 billion in 2012. Foreign tourist arrival was estimated at 4.2 million in 2013 (MOT, 2014) and is expected to reach 6.5 million by 2018 (NSDP 2014).

Preah Sihanouk is the third most popular tourist destination and is among K4⁸ tourism plan defined by tourism development strategy (ADB, 2009). Foreign and domestic tourism arrivals are on the increase due to its premier white sandy beaches and beautiful intact islands. It has Ream National Park, mangrove forest, sea grass and coral reef which are also suitable for ecotourism development. Its 119.5 km beaches possess a number of good quality beaches suitable for tourism development, namely O Chheuteal beach, Sokha beach, Independence beach, Hawaii beach, Otres beach, Samdech Hun Sen beach, Victory beach, Prek Troeng beach, and Koh Pous (ADB, 2009). There are 22 islands under jurisdiction of Preah Sihanouk administration, 10 of which has been open for visit and overnight stay.

⁶A shift in the onset of the wet season and mini drought during the wet season represent a challenge for effective planning of rice planting in the right time.

⁷The areas with scarce freshwater, saline and sea level rise intrusion, lack of irrigation and drainage system, and frequent strong winds and storm surges.

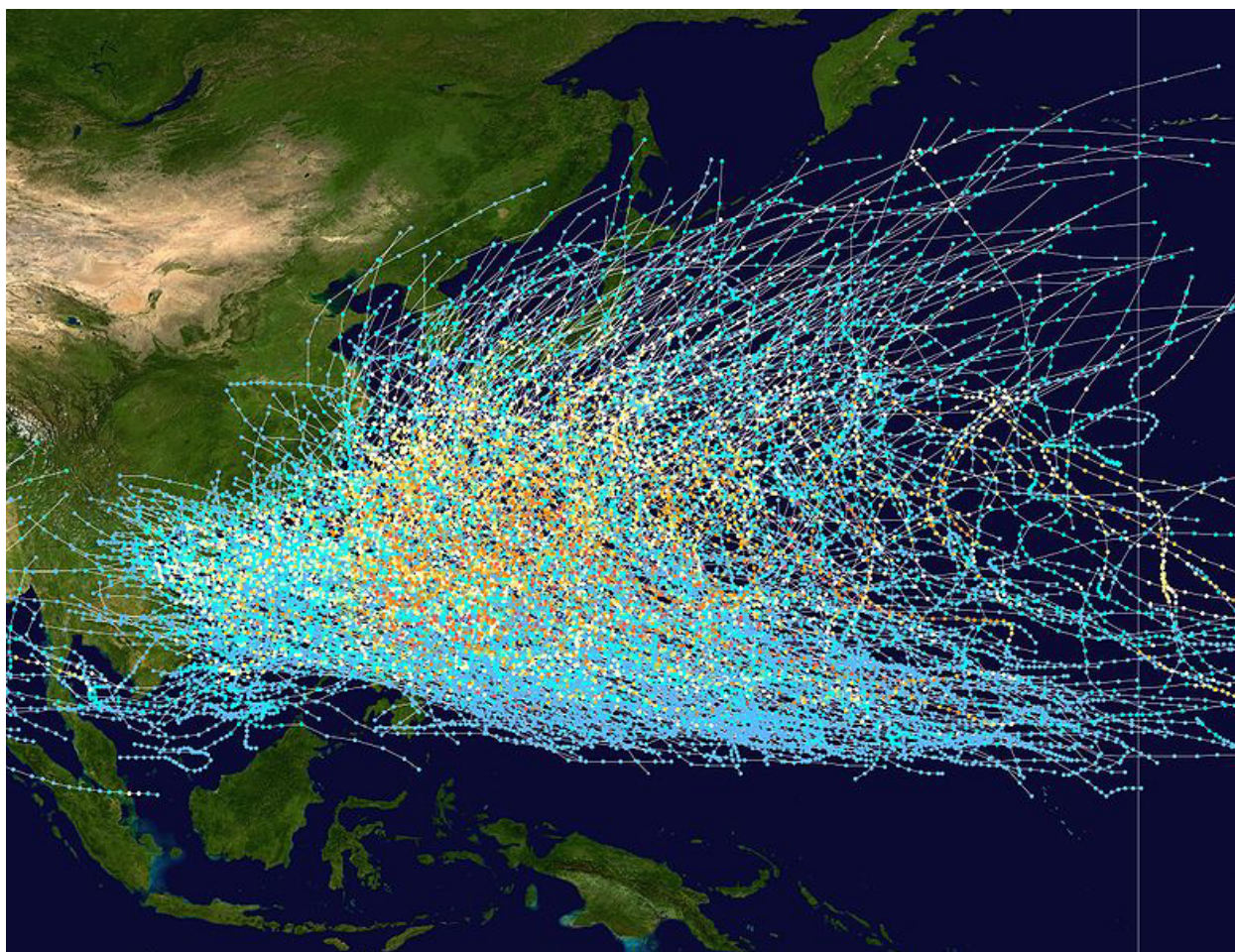
⁸K4 assigned to four coastal provinces beginning with alphabet K, namely Kep, Kampot, Koh Kong and Kampong Som (now Preah Sihanouk).



Source: DANIDA 2006.

Climate change can disrupt tourism development through climate related events: erosion, landslide, cyclone and storm surges, SLR, heavy rain, and heat waves. Cambodian coastal areas are not within typhoon track (Wikipedia, 1980-2005) though some strong wind and heavy rain have been observed during the wet monsoon period. Heavy rain and storm surges may cause damage to tourism infrastructure and disrupt tourist arrivals. Impacts of heat waves on humans have not been observed yet but may occur in the future along with increased number of hot days and nights. SLR together with sea tide can flood many beaches and small islands, though may not be an immediate threat for the next 20-30 years. A 1m increase in SLR may flood about 25,000 ha (IFAD, 2013), and most of the beaches with gentle slopes in Preah Sihanouk would be flooded by tide and SLR. Moderate erosion has been recorded in several beaches such as in O Chheu Teal and O Tres beaches perhaps due to human activities such as uncontrolled construction of hotels, restaurants and seawalls (MOE/DHI, 2014), and this will be further implicated by climate change.

A number of adaptation options can be implemented to mitigate impacts on tourism industry. Early warning and disaster management plan should be adopted with the participation of relevant agencies such as MOE, MOWRAM, MOT, MAFF, NCDM, and Provincial authority to respond to any extreme events such as storm and floods. A setback regulation may be introduced as part of land use planning and construction permit in the coastal areas. A land use plan can define areas for tourism development that is more resilient to climate change impacts and can adapt to many climate events such as SLR, floods, erosion, landslide, and cyclones. Sea wall embankments can be built in areas exposed to storm surge and erosion.



Source: http://en.wikipedia.org/wiki/File:Pacific_typhoon_tracks_1980-2005.jpg (Cambodia is affected by a blue dot which is categorized as a tropical depression having a speed of around 63km/hour).

D. Infrastructure and Urban Development

Infrastructure development is an important backbone for economic growth, economic efficiency and competitiveness. That is why the Rectangle II of RSIII (2014) continues to focus on rehabilitation and development of physical infrastructure, which comprises of four components: development of transport and urban infrastructure, water resources and irrigation system management, electrical power development, and development of information and communication technology.

Climate related events such as heavy rain, prolonged floods and storms already causesignificant damage to road, transmission lines, and other infrastructure, especially in the central plains of Cambodia (NCDM, 2010).In 2009, Typhoon Ketsana hit Cambodia causinglarge damage to houses, rice crops,and infrastructure,with a monetary loss estimated at about USD 132 million and the amount of USD 191million required for the recovery (NSDP 2014).Impact of climate change on coastal infrastructure is not yet of similarconcern as in the central plains, but with the increased warming in the future it will likely be exposed to erosion, land slide, flooding, especially because of heavy rain, storms,high sea tide⁹ and future SLR.Infrastructure such as road, hotels and sewage system close to the beach is easily vulnerable to these climate phenomenon.

⁹Sea tide in Preah Sihanouk is relatively lower than that of in Koh Kong.

Setback regulations, flood risk assessments and disaster management can be introduced for all infrastructure development, including tourism related facilities and buildings. Climate change and green concept should be taken into consideration in design and engineering of tourism building and facilities so that they become more climate-resilient and has low risk of damage.

E. Land Use Plan

Land use planning is a public policy regulation to assign land and natural resources for different purposes to meet country development and environmental objectives. Like climate change, land use planning is a cross-sectoral issue requiring participation of many relevant agencies. Socio-economic development is the main driver of change in land use and resources allocation, but climate change can have indirect implications on societal choices how land can be efficiently used. First drought, floods, wind, soil characteristics, water resources, forest, biodiversity are key parameters for development options which define land use practice and cause land use change. Secondly, climate change can cause people to migrate from high risk areas to low risk areas, therefore it increases pressure on land and its resources.

Table : Land Use Type

Land use types	Area (ha)			
	Sihanoukville	Kep	Koh Kong	Kampot
Urban settlement	263	0	442	159
Village settlement	2334	244	1,206	4,816
Airfield	0.4	0	12	0
Wet season rice	13,737	2,291	10,126	48,578
Rice with villages	107	0	3,588	109,836
Flooded rice	0	0	1,747	0
Cropland	1,921	776	1,948	5,754
Irrigated crop land	0	133	54	817
Orchard	877	67	388	790
Rubber plantation	324	0	0	53
Swidded agriculture	1,049	1436	14612	2036
Evergreen forest	67,657	0	86,906	145,017
Coniferous forest	0	0	4,363	0
Deciduous forest	0	0	13,258	52,190
Dry deciduous forest	0	0	4,479	7,282
Mixed forest	0	0	18,994	1,575
Riparian forest	48	0	1,379	986
Secondary forest	13,478	2455	66,581	11,682
Mangrove forest	2,853	2	30,047	185
Rear mangrove forest	5,258	1113	19,867	5,619
Grass land	169	120	51,510	7,336
Abandoned field covered by grass	14,495	429	28,770	13,544
Shrub land	5,554	84	139,095	31,279
Lake	80	3	188	170
Reservoir	18	0	3	223
River	94	0	585	425
Shrimp farming	1,193	770	899	3,188
Sand bank	38	10	54	26
Rock outcrop	525	6	465	47
Total	132,072	9,939	501,566	453,613

Source: IUCN 2011

The Ministry of Land Management, Urban Planning and Construction (MLMUPC) prepared a national strategy for coastal zones and established land use master plans for Phnom Penh, Preah Sihanouk, Kampot, Battambang, and Kep (NSDP 2014). Climate change is now mainstreamed into different national development plans and sector plans, including policy and regulations. There is still little progress for integration of climate change in land use master plans and guidelines. Opportunity exists to integrate climate change in land use planning by improved institutional coordination, capacity building, amendment of guidelines and regulations for climate change assessment and consideration in land use planning, and increased budget for development of land use master plans at national and sub-national levels.

F. Fishery and Marine Resources

Fish provides the main protein intake for Cambodian diet and plays an important role in maintaining food security in Cambodia. Climate change is one of the factors causing degradation of ecosystems, where around 15-40% of species potentially facing extinction after only 2°C of warming (FAO, 2008). Ocean acidification is a direct result of rising carbon dioxide levels, which will have major effects on marine ecosystems such as coral reef bleaching, with possible decline in fish diversity and stocks. Increased SLR will flood large part of mangrove and saline intrusion can further move inland to some freshwater system, for example, the Mekong River and the Tonle Sap Lake, and this would have adverse impact not only on marine fishery, but freshwater fish ecology and species composition. There is no data to confirm the impact of SLR on fishery resources, which points to the need for the respective agencies to set up monitoring system on the relationship between SLR, fresh water and marine water and fisheries. Conservation of wetland and mangrove, promoting sustainable fishery management, and strengthening fishery communities, are among adaptation measures with high co-benefits in response to climate change.

IV. Overview of Climate Change Governance and Gaps in Cambodian Coastal Areas

4.1 Institutional Structure and Legal Framework

The Ministry of Environment (MOE) has a broad mandate to promote, manage and conserve sustainably Cambodian natural resources and environment, and to play a leading role in development and implementation of climate change policy, programs and activities in coordination with relevant line ministries, stakeholders and civil society. The MOE serves as a focal point to the UNFCCC and other climate related agreements such as the Kyoto Protocol. The National Climate Change Committee (NCCC) was established and chaired by the Minister of Environment to coordinate and promote cooperation among line ministries and stakeholders and to guide, endorse and monitor climate change policy planning and implementation across various sectors. However the NCCC may have limited influence at the sub-national levels. A Climate Change Department was established under MOE to carry out technical work and support implementation of climate change programs and projects at different levels. A Climate Change Technical Team and Technical Working Groups with members seconded from various departments of line ministries were also set up to mobilize inputs and human resources for implementation of climate change components and activities. The MOE structure is now under review aiming to improve institutional capacity that can better respond to the new emerging environment,

development and climate change problems. In light with this structure improvement, the CCD may be upgraded to include additional responsibility and functions to fulfill Cambodian obligations under UNFCCC and climate related international agreements, and to implement effectively climate policy and plans.

There is not yet a clear institutional structure for climate change planning and coordination at the sub-national levels. Climate change offices are not yet established in the provincial department of environment, though some form of coordination mechanism was setup as part of implementation arrangement for several project initiatives such as those funded by UNEP and CCCA. For the Coastal Adaptation and Resilience Planning (CARP-CCCA) and Vulnerability Assessment and Adaptation Program for Climate Change within the Coastal Zone of Cambodia considering Livelihoods Improvement and Ecosystems (VAAP), a shared National Working Group of Focal Points and four Provincial Technical Working Groups for Climate Risk Assessment (PTWG) were established in the coastal provinces. PTWG comprises representatives of key provincial departments (DOE, DOT, DLMUPC, DOWRAM, and all Provincial Districts) and is chaired by a deputy governor. It is not sure if these working groups will continue according to the current Project terms of reference after project completion, but these working groups can be transformed into a permanent coordination mechanism at the sub-national levels (DHI, 2013) with additional members representing other line departments such as department of planning, fishery department, forestry department, including civil society and private sector.

For climate change to be integrated in land use plans at the provincial level, there must be a good coordination and decision making procedures for climate change integration among several government entities such as the National Committee on Spatial and Urban Planning (NCSUP 2012), the Provincial Sub-committee for Spatial and Urban Planning (PSSUB), and the National Committee for Management and Development of Cambodian Coastal Areas (NCMDCC)¹⁰.

It is important to note that good governance and public administration reforms are being pursued under the RSIII and NSDP 2014-18. The National Committee for Democratic Development (NCDD) plays a leading role in implementation of the Organic Law and National Program for Sub-national Democratic Development (MOI, 2010). Decentralization and De-Concentration reform (D&D) and Organic Law requires all ministries to transfer appropriate functions to the provincial departments, including the recruitment of staff for the provincial offices (NSDP 2014). However progress is still slow and only a few ministries start to plan the transfer due to the lack of financial clarity, capacity and political commitment. Obviously environment and climate change planning and decision making, including budget allocation, is among priority sectors specified in the Sub-Decree on the Processes of Transfer of Functions (2012) to be transferred to the provincial administration (PA), therefore any proposed institutional coordination and planning process must be considered as an integral part of this D&D reform.

There is no specific climate change law or regulations governing climate change violation or offences, but rather a legal framework will be improved by updating institutional arrangement, financing arrangements, and mainstreaming of climate change across sectors (NSDP, 2014). Climate change

¹⁰ Established in 2012, the NCMDCC is chaired by the Prime Minister as honorary chair and the Minister of MLMUPC as a chair. The Minister for Environment and Minister of Tourism serve as deputy chairs. The NCMDCC has 22 members assigned from various national agencies and provincial authorities (all four coastal provincial governors). Its main objective is to promote sustainable and responsible management and development of coastal areas.

planning has already been integrated in the National Strategic Development Plan and Sector Plans of line ministries. A very comprehensive Cambodia Climate Strategic Plans (CCCSP) and the Climate Change Action Plans have been adopted by the Prime Minister which will guide implementation of specific climate change projects and activities at national and local levels. Prospect for a separate climate change law may be feasible to reflect the gaps in several sector laws, but more study is needed to avoid repetition or overlapping with existing laws and regulations. At the provincial level, climate change activities can be integrated in the provincial development plans, department plans, or commune council development plans. Initial effort was made for inclusion of climate change response in the commune development plans of Prey Nop district (Preah Sihanouk) and Mondol Seima (Koh Kong) under the CARP-CCCA which can be replicated in other districts of Preah Sihanouk, but also other parts and provinces of Cambodia.

4.2 Existing national policy, programs and provincial development plans addressing climate change

4.2.1. National Policy and Plans

This section provides an update on climate change response in national policy and strategies in addition to the policy brief published recently (MOE, 2013). A number of national policies and development plans already begins to include climate related action and response owing to coordination effort of the CCD of MOE (MOE 2013). The high level of national policy is the Government Rectangular Strategy Phase III (RSIII) which provides a comprehensive policy framework for formulation of National Strategic Development Plans, sector development plans, and the sub-national development plans. The RSIII has maintained four strategic rectangles with expansion of scope, improved policy, and added priorities. The RSIII continues to pursue and strengthen sustainable development path by promoting economic growth, creating jobs, promoting equitable distribution of growth, and ensuring effective public institutions and management of natural resources. Concerning environment and climate change, the RSIII calls for sustainable management of natural resources, strengthening adaptation capacity for reducing climate change impacts, and implementation of National Policy on Green Development and National Strategic Plan for Green Development 2013-2025.

The National Strategic Development Plan 2014-18 recognizes the challenge of environment and climate change that may hinder sustainability of Cambodia's economic growth and social development, and has devised very broad strategies and actions to mitigate its impacts.

Built on previous achievement, the NSDP 2014-18 has a focus on implementation of the recently adopted Cambodia Climate Change Strategic Plan (MOE 2013) and Green Development Strategy. The NSDP set out specific activities for five years implementation as the following:

- Put in place and implement national monitoring and evaluation systems for climate change projects.
- Create a knowledge management system for collection, analysis, and dissemination of data/knowledge, including knowledge of local communities on climate change.
- Improve a greenhouse gas inventory system: data collection, storage, analysis and modeling.
- Establish a national registration system for greenhouse gases reduction mechanisms, and foster implementation of appropriate mitigation activities (AMA) and greenhouse gas-reduction activities under different mechanisms within various priority sectors that provide multiple benefits.

- Mobilize funds and technical assistance for implementing the main activities outlined in the action plan and strategic plan to address sector climate change issues of the relevant ministries/institutions, including research activities, to support policy development.
- Coordinate and enhance capacity and public awareness on climate change at national and local levels.
- Coordinate developing a national adaptation plan and develop implementation strategies for addressing medium- and long-term adaptation needs.

At present implementation of climate change programs and projects depend very much on external funding, and its future flow from various sources remains favorable for Cambodia for the next 5-10 years since considerable amount of money has been pledged by the developed countries at the COP18. Government budget for MOE is still low compared to other ministries (even less than the Ministry of Women Affairs), though it has a trend of increase (NSDP 2014). Mobilization of funding has been proposed under the CCCSP through the creation of national climate funds with capital seeds derived from various sources (CCCSP 2013).

Concerning green development MOE will promote harmony between economic and environmental development by encouraging green investments, creating more green jobs, transferring green technologies, promoting economic reforms enabling green incentives (especially green taxes, green finance, green credit and green micro- and macro-finances), and human resource training and green education. Green development can build synergy with climate change response, but lack of funding and capacity may downplay the intended goals.

There is a general lack or absence of sector strategies or policy statement relating to climate change outlined in NSDP 2014-18, although some line ministries already adopted Sector Climate Change Strategic Plans and Sector Climate Change Action Plans prior its adoption. Climate change is a cross-cutting problem which cannot be solved by just MOE since many climate change adaptation and mitigation projects and programs can be better implemented by sector ministries such as MAFF, MOWRAM, MOH and MLMUPC. Therefore each ministry should have its own plans and resources to address climate change in their specific policy, strategy and actions, including annual workplan and budget plan, which should be reviewed and endorsed through the coordination of the NCCC before integration in the NSDP.

Concerning land management and reform, MLMUPC identified a number of constraints encountered during previous NSDP, which include limited participation and responsibility of relevant institutions and the technical officers, especially for land management and urban planning, delay in adoption of land use plans and master plans due to disputes, and limited role of sub-national working groups in implementation of land identification, land management and social land concessions. It further suggests the need for the effective implementation of Cambodia's coastal zones management and development through the Circular on the Coastal Zone Management and Development, and adoption and implementation of integrated strategy for Cambodia's coastal zone and Preah Sihanouk Master Plan. However it does not mention a word on potential climate change impacts and consideration in land use planning, and how climate change would be addressed during the fifth legislature. The absence of climate related policy statement in NSDP may discourage active participation in climate change planning and decision making for land management sector.

4.2.2 Provincial Policy and Plans

Preah Sihanouk Provincial Development Plan 2011-2015 (PSPDP) was developed under the coordination of Provincial Department of Planning (DOP), which guides all provincial sector development plans. All provincial departments have to develop five year plans to meet the socio-economic needs while being in conformity with the national policy goals and agenda such as the NSDP and RSIII. Like other sectors, climate change responses should be included in PSPDP by the Provincial Environmental Department (PED) and other relevant provincial departments using existing coordination mechanism and experience developed for the CCCU by CARP and VAAP.

The PSPDP consists of three main chapters, namely socio-economic situation, development framework, and monitoring and evaluation framework for development. Analysis of climate change situation was provided under a section “Disaster Management and Climate Change” by highlighting some immediate climate related threats such as floods, storms, thunders, and fire, which indicates a good prospect of climate change integration in PSPDP. There is a need however to broaden climate analysis in other sectors of climate relevance such as agriculture, water resources, forest, fisheries, tourism and land use plans, and appropriate response is devised accordingly. Notwithstanding the gap, the current PSPDP proposed a set of climate related objectives and strategies as the following:

Objective 2.2.3.4.1: The population has been protected and rescued during the disasters

- Strengthening information dissemination for the population;
- Strengthening Disaster Management Committee;
- Change rice species according to seasonal calendar;
- Selection of short-term agricultural crops;
- Planting diversity of crops;
- Cooperation and sharing information on cyclone with neighboring countries and devise appropriate measures;
- Dredging rivers;
- Emergency response and rescue plan;
- Educating people to protect from thunders; and
- Awareness raising about thunders.

Objective 2.2.3.4.2: Providing information on adaptation and mitigation measures about climate change

- Information dissemination about climate change and its impacts; and
- Organizing forum on climate change, adaptation measures, and mitigation of impacts.

It is important to note though some sectors missed climate consideration in their development analysis, some of the proposed objectives and strategies seem responsive to climate change. For example irrigation sector suggested a number of strategies as the following:

- Rehabilitation and construction of drainage system;
- Rehabilitation and construction of additional reservoirs;
- Creation and strengthening water user communities;
- Rehabilitation and maintenance of sea wall dikes;
- Expansion of sea wall protection dikes.

Likewise protection and conservation of mangroves and forest and law enforcement can benefit climate change response as well. There is a lack of specific strategies related to adaptation and GHG mitigation under the land use sector, though land registration and titling can help reduce forest encroachment. SLR is not mentioned as it may not be an immediate threat for some sectors within this development time frame, but appropriate building code must be adopted based on potential SLR for

some major infrastructure such as road, buildings and residents intended for public use longer than 20-30 years or so.

V. Proposals for amendment of existing Provincial Plans and Budget for climate change mainstreaming in land use planning and implementation in Sihanouk Ville

For climate change governance to be improved, appropriate policy measures and actions should be taken at both national and sub-national levels, since the sub-national plans should meet the local needs and at the same time reflect the national development goals and targets. Below is a set of recommendations to fill the gap identified at the national level and in Preah Sihanouk.

5.1 Proposed Action and Policy Measures for Improved Climate Change Governance at the National Level

5.1.1 Institutional Building and Coordination

Built on previous policy gap analysis (MOE 2013), a set of policy recommendations are proposed below:

1. **Improved Institutional Structure of MOE:** MOE is now undertaking the institutional review with possible restructuring of its institution at the national level, but it should take further step to consider appropriate structure at the sub-national levels in conjunction with the financial reform, D&D reform and in consultation with NCDD and provincial councils.
2. **Improved Institutional Participation and Coordination:** the Ministry of Land Management, Urban Planning and Construction is a member of NCCC, but for various reason it was not actively involved in the development of CCCSP and SCCSP during the NSDP 2009-13 and should be more engaged during the NSDP 2014-18.
3. **Incorporation of Sector Climate Change in NSDP:** all sectors must have a policy statement or action to guide climate change planning and response, including its annual workplan and budget.
4. **Capacity building of relevant departments of MLMUPC at the National Level:** several departments of MLMUPC responsible for land management and urban planning should be the prime target for capacity building. These technical officers can transfer their knowledge to the officers at sub-national levels. Topics of training can vary according to the need of target groups (policy, technical, and field level) and may include global warming and GHG emission; international treaties and agreements; Cambodia Climate Change Policy and Commitment; climate change and land use; data collection and analysis; stakeholder consultation; tools for vulnerability assessment, modeling of climate change projections and impacts, zoning and mapping of flood prone, saline prone and disaster risk areas, methods for calculation of GHG emission from various land use practices, and assessment and evaluation of adaptation and mitigation options (MOE, 2013).
5. **Information and Knowledge Dissemination on Climate Change and Land Use Planning:** Land use planning is also cross-sectoral by nature, therefore it cannot be effectively achieved without information and data provided by other ministries. A formal agreement maybe set up to share information, have a joint survey and studies, and to setup clearing house mechanism for information management and analysis.

5.1.2 Improved Legal Framework and Planning Process

Climate change analysis and assessment is missing in legal and institutional framework for preparation of land use plans and master plans. According to the gap analysis (MOE 2013) land use guidelines, regulations and sub-decrees do not have clear climate related clauses or provisions, therefore they can be amended to add specific provisions to address both adaptation and mitigation in land use planning. Below is a list of sub-decrees or regulations subject to additional review and amendment:

- Sub-Decree on the Procedures for Making Commune/Sangkat Land Use Plan.
- Instruction on the Preparation of Commune/Sangkat Land Use Plan.
- Circular on Managing and Developing Coastal Areas of the Kingdom of Cambodia.
- A Draft Sub-Decree on Urban Planning for Municipalities, Towns, and Urban Centers.
- A Draft Law on Land Management and Urban Planning.

5.2 Policy Recommendations for sub-national land use planning process and climate change consideration in Preah Sihanouk

Based on the above analysis a number of policy recommendations for improved climate change governance for Preah Sihanouk are proposed as the following:

1. **Establishment of the Provincial Climate Change and Green Growth Sub-committee (PCCS) under the supervision of the Provincial Council:** this PCCS will play a coordination role in reviewing and endorsement of climate change related sector programs and projects, including master spatial and urban plans, and conducting monitoring and evaluation of climate change response at the provincial level. The PCCS composes of members representing various departments and will be assisted by a secretariat with specialists on information management and monitoring framework, awareness raising and knowledge dissemination, climate change adaptation and mitigation, and green growth. Experienced staff from the Technical Working Group for Climate Change (PTWG) can be selected to form this secretariat or a Climate Change Coordination Unit (CCCU).
2. **Development of guidelines for climate change planning and integration in provincial development plans, sub-national land use plans and other sector plans:** the guidelines must ensure that climate change situation analysis and assessment of climate change response should be properly carried out along with assessment of land use issues and socio-economic needs so that climate change can be an integral part of sustainable development in the province. It is important that gender assessment and stakeholder analysis is carried out to ensure broad participation of potential affected stakeholders at different stages of land use planning. Good representation of key stakeholders in the Provincial Committee of Spatial and Urban Planning should be properly reflected in the guidelines so that climate change inputs are taken during planning and adoption of land use plans and master plans.

4.3. Capacity building for all relevant departments and stakeholders in climate change planning and mainstreaming: training can target several key departments, namely Department of Land Management, Urban Planning and Construction, Department of Environment, Department of Water Resources and Meteorology, Department of Agriculture, Forestry and Fisheries, Department of Industry, Mines and Energy, Department of Public Works and Transport, Department of Women Affairs, provincial and district offices and the commune councils.

6.4. Awareness raising and knowledge dissemination on climate change and land use: PDE and PLMUPC need to discuss and agree on the means and approach for collection, management and dissemination of information and knowledge on climate change and land use to all stakeholders, civil society and private sector.

6. Private Sector Engagement: as far as land use is concerned private sector can play a critical role in efficient management of their land and resources to meet its business objectives and at the same time mitigate climate change implications and harvest its benefits. Guidelines and regulations can be developed for large economic land concessions and SEZ to guide land owners and businessmen to integrate climate change in their land use planning and climate resilient and green infrastructure development that can minimize climate risk and avoid property damage.

8.7. Promoting co-benefits between climate change response, sustainable resources management, and green growth: many study reports, including recent published AR5, see that for climate change response to be effective, planners must search for practical solutions that can produce win-win results, meaning any adaptation and mitigation option can help promote sustainable development and green growth or vice-versa. Green growth concept is based on resources efficiency, which means to use less resources while having productivity stable or higher. By doing so, it will help reduce GHG emissions and decouple¹¹ GHG from GDP growth. Sustainable forest utilization and conservation will have co-benefits in terms of minimizing climate change impacts, GHG mitigation, increased biodiversity, and improved livelihoods.

VI. Conclusion

Land use planning can play an important role in promoting sustainable development and addressing climate change challenges. For several years of efforts, a notable progress has been achieved on many aspects of climate change responses, especially improved institutional coordination, capacity building, climate change integration in higher national policies and strategies such as RS and NSDP, including sector plans, and implementation of several climate change adaptation projects. However, a number of constraints and gaps exist in certain areas and sectors for example, in land use planning. Climate change governance remains weak at the sub-national levels though there are initiatives undertaken in some provinces, especially in the coastal areas of Cambodia. Based on the review of existing literatures and interview with key senior officers at central level and in Preah Sihanouk, gaps in climate change governance are identified and corresponding recommendations are proposed to fill these gaps. In addition assessment of climate change impacts on some key sectors is conducted and some adaptation measures are proposed for mitigation of impacts. Policy measures and actions are proposed to improve climate change governance (institutional and legal framework) at the national and provincial level, using Preah Sihanouk as a case study, but it could be equally relevant to other Cambodian coastal provinces as well.

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