



Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

NATIONAL ADAPTATION PROGRAMME OF ACTION TO CLIMATE CHANGE

April 2009



Message of His Excellency Asang Laoly, Deputy Prime Minister of the Lao PDR, Chair of National Environment Committee

Climate change is a key issue in the international arena. It is a real threat, concern and challenge for all countries of the world. The phenomenon arises from the significant increase of greenhouse gases in the atmosphere. The Government of the Lao PDR has clearly recognized the issue. As a least developed country, Lao PDR is one of many countries vulnerable to the impacts of climate change. In recent years, we have witnessed more frequent and severe floods and droughts which are alternately occurring each year. Temperature is continuously increasing and the rainfall is erratic, resulting in a number of adverse impacts to the economic system, environment and the livelihoods of people of all ethnic groups. Thus, climate change poses a great challenge for the Lao PDR to tackle and we must adapt to climate conditions and control the emission of these greenhouse gases. Lao PDR lacks data, adaptation strategies, funds, human resources, experience, an appropriate approach and the mechanisms to develop immediate and long term solutions.

In addition, we also recognize the more severe issue at the international level, which includes the melting of the icebergs in the Arctic and Antarctic which will result in an increase in sea levels. It is thought that in the foreseeable future, some island countries will be inundated. Climate change will also have negative impacts on economies, societies and environments as well as global ecology, expediting the poverty of vulnerable people and communities in every corner of the world.

In this connection, the Government of the Lao PDR endeavours to find practical solutions to the challenges posed by climate change at a national level by formulating policies, approving proper rules and regulations and making solid decisions to participate with the international community by ratifying the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and the Kyoto Protocol in 2003. Thus, Lao PDR is fully committed to its obligations involving the management and protection of the environment. The country is making significant strides to reduce slash and burnt activities, pay close attention to the management and sustainable use of our forests, support the renewable use of energy, develop biogas, increase climate change awareness, and at the same time, manage and control pollution issues, and minimize waste from social and economic development activities. All in all, these activities directly contribute to developing carbon sinks, facilitating adaptation to climate change and mitigating greenhouse gas emissions to the atmosphere.

The main goal of the National Adaptation Programme of Action to Climate Change (NAPA) is to formulate urgently needed action plans for adaptation to climate change in the Lao PDR. A focus has been placed on, four sectors, namely, agriculture, forestry, water resources and public health. In this regard, 45 priority projects have been identified to implement urgent plans to adapt to climate change.

This NAPA is in line with the objectives of the Socio-Economic Development Strategy, National Growth and Poverty Eradication Strategy, National Environment Strategy, Agriculture Strategy, Policies on Irrigation Extension, Draft Strategy for Water

Resources Management, and Natural Disaster Prevention. In addition, the NAPA contributes to the achievement of the Millennium Development Goals. Lao PDR cooperates with other nation states throughout the World to meet its commitments towards the UNFCCC and Kyoto Protocol.

However, even though our efforts in the past have achieved considerable success on many fronts, the challenges continuously increase. In order to deal with these, there is a growing need to improve strategies that counteract the disasters caused by climate change and strengthen the capacities of the National Disaster Management Committee to deal with the adverse impacts which are likely to occur in the future. It is necessary to strengthen the recently established Climate Change Office, install an early warning system, realize in-depth studies of the impacts of climate change especially concerning droughts and floods in Lao PDR, formulate a strategy on climate change, mobilize reforestation, and other necessary activities.

Consequently, our future mission is one of cooperation, formulation of cooperation mechanisms, fund mobilization, technical assistance, coordination and monitoring amongst relevant sectors to implement the NAPA. In addition, this document must be widely disseminated to attract the participation and involvement of every sector in the society, including the public sector and the donor organizations which are of primary importance to the implementation of the NAPA.

On behalf of the people of the Lao PDR, I would like to take this opportunity to express our sincere gratitude to all stakeholders for their support and cooperation to the Government of the Lao PDR in preparing this NAPA. Specifically, I would like to thank the donor countries to the Global Environment Facility and the United Nations Development Programme for their support and cooperation in preparing this document. The Government of the Lao PDR looks forward to cooperating with all stakeholders to ensure successful implementation of the Lao NAPA.



Deputy Prime Minister
Chair of National Environment Committee

Foreword from Mme. Sonam Yangchen Rana, Resident Representative, United Nations Development Programme

The global climate is changing. We all witness changes in average temperatures, shifts in seasons and an increasing intensity of extreme weather events. In Lao PDR, the effects of climate change are already visible and will become more evident in the future. Climate change will have a more immediate effect on many of the poorest people, including those least able to recover from climate-related stresses such as droughts, flooding, and changing conditions for crop and livestock production.

With over 70% of Lao people depending on natural resources for their livelihoods and a heavy reliance of the national economy on the country's natural resource base, the people of Lao PDR are highly susceptible to the impacts of climate change. Predicted increases in the intensity and frequency of extreme climatic events will affect agricultural production, water supply, household food security, and the dynamics of water- and vector-borne diseases. Consequences will be severe, particularly in rural areas where the effects of climate stresses are magnified and the ability of natural and livelihood systems to recuperate from extreme events are already low.

The potentially far-reaching impacts of climate change for the people of the Lao PDR has led the Government of the Lao PDR to sign the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and the Kyoto Protocol in 2003. With funding from the Least Developed Countries Fund (LDCF) of the UNFCCC, the United Nations Development Programme (UNDP) has supported the Government of the Lao PDR to develop their National Adaptation Programme of Action (NAPA). This NAPA identifies and communicates urgent and immediate adaptation needs of Lao PDR to the effects of climate change.

Lao PDR's NAPA report presents a comprehensive summary of an intensive consultative process that has involved a range of inclusive stakeholder discussions and analyses to identify priority adaptation needs and priority projects to address them. The NAPA is the first step on a long road to reduce climate change-induced vulnerabilities in Lao PDR, and UNDP in partnership with other development partners, including the United Nations Environment Programme (UNEP) will continue to support the government in accessing financing for dedicated follow-up projects.

It has been widely recognized that climate change is no longer just an environmental issue, but deeply rooted in all sectors of development. As UN Secretary-General Ban Ki-moon (2008) notes, "Climate change threatens all our goals for development and social progress" and there is a "clear moral imperative for bold, decisive and urgent action. We have a duty to the vulnerable who contribute least to the problem but experience its impacts most severely, and we have a responsibility to succeeding generations." With this statement in mind, UNDP hopes that this document will be useful to the people of Lao PDR and to all development partners who work to reduce poverty and strengthen sustainable human and economic development in Lao PDR.



Resident Representative
United Nations, Lao PDR

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ADB	Asian Development Bank
ADPC	Asia Disaster Preparedness Centre
CCAM	Conformal Cubic Atmosphere Model
CFSVA	Comprehensive Food Security and Vulnerability Analysis
CPI	Committee for Planning and Investment
DMH	Department of Meteorology and Hydrology
DOC	Department of Communication
DOI	Department of Irrigation
DOP	Department of Planning
DLF	Department of Livestock and Fisheries
DSSAT	Decision Support System for Agro Technology Transfers
GDP	Gross Domestic Product
HDI	Human Development Index
IUCN	World Conservation Union
IPCC	Intergovernmental Panel on Climate Change
JMA AGCM	Japan Meteorological Agency Atmospheric General Circulation Model
LDC	Least Developed Country
LRIAD	Land Resources Inventory for Agriculture Development
MAF	Ministry of Agriculture and Forestry
MPWT	Ministry of Public Works and Transport
MEAs	Multi-lateral Environment Agreements
MLSW	Ministry of Labour and Social Welfare
MoH	Ministry of Health
MRB	Mekong River Basin
MRCS	Mekong River Commission Secretariat
NAFES	National Agriculture and Forestry Extension Service
NAP	National Action Plan
NAPA	National Adaptation Programme of Action
NBCA	National Biodiversity Conservation Areas
NBSAP	National Biodiversity Strategy and Action Plan
NDMC	National Disaster Management Committee
NDMO	National Disaster Management Office
NEAP	National Environmental Action Plan
NES	National Environment Strategy
NEW	National Environment Health and Water Programme
NGO	Non-Governmental Organizations
NGPES	National Growth and Poverty Eradication Strategy
NPA	National Protected Areas
NSEDP	National Socio Economic Development Plan
NTFPs	Non-Timber Forested Products
PAFO	Provincial Agriculture and Forestry Office
SEA	South East Asia
STEA	Science Technology and Environment Agency
START	SysTEM for Analysis, Research and Training
TAR	Third Assessment Report
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VIC	Variable Infiltration Capacity
WFP	World Food Programme
WREA	Water Resources and Environment Administration

EXECUTIVE SUMMARY

Lao PDR is ranked as one of the poorest countries or least developed countries (LDCs) in Southeast Asia and in the World. According to the UNDP Global Human Development Index (HDI), in 2008 Lao PDR was ranked at 133 out of 179 countries. Impact assessments of the country's economic base, education and social development in terms of adaptation to climate change have concluded with a high level of confidence that recent regional changes in temperature have had discernible impacts on physical and biological ecosystems. In particular, there is emerging evidence that human and natural systems are being affected by increased occurrence and severity of floods and droughts.

According to the IPCC Working Group on Asia and an analysis of extreme weather events in Asia, there is evidence of increasing intensity or frequency of such events on a regional scale throughout the 20th century (Cruz et al, 2007). An average increase of 0.1 to 0.3°C per decade between 1951 to 2000 has been reported, with a decreasing trend in total rainfall between 1961 and 1998, whilst the number of rainy days has declined throughout S-E Asia as a whole (Manton et al, 2001).

The Third Assessment Report (TAR) predicted that the area-averaged annual mean warming would be about 3°C in the decade of the 2050s and about 5°C in the decade of the 2080s over the land regions of Asia as a result of future increases in atmospheric concentration of greenhouse gases (Lal et al, 2001a). It is accepted worldwide that greenhouse gasses, primarily carbon dioxide (CO₂) and methane are increasing and will continue to do so for the foreseeable future. Differences in predictions of how the climate will change are generally based on assumptions of how current concentrations of atmospheric carbon dioxide of 350ppm will increase. This increase is dependent on how we develop our natural resources and which greenhouse gas producing activities increase or decrease in the future. For example, more clearing of forests and draining of wetlands, more carbon hungry industrial development and more methane producing intensive livestock production will accelerate the increase in greenhouse gasses in the atmosphere. In this respect, models of climate change use different greenhouse gas concentrations, based on different development scenarios, to simulate how the climate may change. Changes in the climate effect biological and physical systems in potentially

negative ways, which in turn may impact humans and human activities reliant on those systems.

Currently accurate predictions of the potential changes in climatic conditions and resulting adverse impacts of such changes have not been developed nationally by the Lao PDR but some indication can be taken from preliminary regional level predictions. For example the Asian Development Bank (ADB) predicts that increasing temperatures and rainfall variability throughout Southeast Asia will cause a 2.5–10 percent decrease in crop yields by 2020 and a 5–30 percent decrease in crop yields by 2050 (Asian Development Bank, 2007). In this connection, Lao PDR is susceptible to the impacts of climate change especially from floods and droughts. These have severe adverse impacts on livelihoods and in particular, the livelihoods of the poorest and most vulnerable groups with the lowest adaptive capacity.

The IPCC has argued for the strengthening of adaptive capacity to climate variability and extremes, especially for the least developed countries which have fewer resources and lower capacity to adapt to such changing conditions, making them the most vulnerable. The main objective of the NAPA is to develop a country-driven program to address immediate and urgent needs related to current and projected adverse effects of climate change in key sectors. The key sectors identified by Lao PDR are agriculture, forestry, water and water resources, and human health. The NAPA is cross-cutting, with issues embedded in national development policies and strategies that cut across multiple sectors, particularly the most recent policies and strategies that include the National Environment Strategy/National Environmental Action Plan (NES/NEAP), the National Biodiversity Strategy to 2020 and Action Plan to 2010 (NBSAP), National Growth Poverty Eradication Strategy (NGPES), National Forestry Strategy and Integrated Agriculture Development Strategy, as well as the Sixth National Socio-Economic Development Plan (NSED) from 2006-2010.

The NAPA preparation process for the Lao PDR, with involvement of concerned stakeholders, has been conducted based on the NAPA Guidelines of Least Developed Countries Expert Group and is consistent with the sustainable development goals and aims of the Government of the Lao PDR (GoL), recognizing the need to address and protect the

environment and realize sustainable natural resource use and management. The participation of different sectors concerned and mass organizations from local to central levels resulted in the establishment of an inter ministerial technical working group. This group was provided relevant information/data from members of respective expert organizations. A series of consultation workshops were organized from the central to the provincial levels, with the participation of sectors concerned, including technical experts and policy-makers who are engaged with the impacts of climate change. These workshops had the objective of assessing capacity and identifying adaptation measures.

The NAPA preparation is a significant contribution in terms of the results generated and the priority measures identified for adapting to climate change in Lao PDR.

It is apparent that floods and droughts that occur almost every year have had significant adverse effects on Lao PDR's socio-economic development, especially agriculture, forestry, water and water resources, public health, energy and people's livelihoods (income, employment, food security and nutrition). In this respect the agriculture sector, which is a primary contributor to the country's economy, has been most affected by the increasing severity of floods and drought.

In past decades, climate change appears to have exacerbated problems caused by natural and man-made environmental changes in areas of the country. These changes result from both unintentional and intentional human activities, including but not limited to environmental degradation by conversion of forest and wetlands for cultivation and construction, inappropriate exploitation of timber, illegal logging, shifting cultivation, and uncontrolled chemical use. In combination, these activities have contributed to natural disasters that are increasingly affecting the population.

In 2003, the Disaster Management Strategy and Plan to 2020 and Action Plan to 2010, number 1139/LSW.03 was endorsed by GoL. This strategy aims to mitigate negative impacts generated by natural disasters. At the same time, the Sustainable Development Mechanism was also adopted. The NAPA has been developed based on the urgent need for adapting to climate change and identifying measures that minimize the adverse impacts of climate change

(flood and drought), based on past lessons learnt, the experiences of different sectors of Lao PDR, and an analysis of available technical information. A number of activities have been implemented that are closely related to climate change adaptation namely, cooperation projects between the Lao National Mekong Committee, French NGOs and the National Disaster Management Office to prepare for flooding by providing communication equipment, computers and setting up water level measurement gauges at the community level in Champasack District of Champasack Province. Projects to minimize risks associated with drought have also been supported by Concern Worldwide and are operating in Khammouane and Savannakhet Provinces; whereas Australian Oxfam is working in Saravane. In addition the GoL has drawn some lessons from different countries at the regional and international levels which possess similar conditions to Lao PDR.

According to the most recent assessment of the IPCC (2007), it is found that in the future, climate change will result in increased extremes and frequencies of floods and droughts. Therefore, even though our efforts in the past to mitigate the impacts of such events could bear considerable success, on many fronts new challenges continue to arise. In order to deal with these issues, there is a strong and urgent need to improve strategies that address the challenges and counteract the disasters that result from climate change. The GoL must continue to: strengthen the capacity of the National Disaster Management Committee to deal with the likely future adverse impacts; strengthen the Climate Change Office; install an early warning system; initiate in-depth studies of the impacts of climate change, especially concerning droughts and floods; formulate a strategy on climate change; mobilize increased reforestation; and other necessary activities as identified in this NAPA.

I. INTRODUCTION



1.1 TOPOGRAPHY

Lao PDR is located in the Indochina Peninsular (Mekong Region), bordered by China to the North, Vietnam to the East, Cambodia to the South, and Thailand and Myanmar (Burma) to the West and Northwest respectively. Lao PDR has a total land area of approximately 236,800 km², 80 percent of which is mountainous. Mountains are found in the Northern region, the Annamite Chain (forming most of the eastern border of the country), and in the South, posing a significant natural buffer to storms that occur in the region. However, the remaining 20 percent of the country comprises mostly flat floodplains along the Mekong River. The lowest altitude of Lao PDR is 200 meters and highest is 2,880 meters.

1.2 CLIMATE

Lao PDR has a tropical climate, which is influenced by the southeast monsoon which causes significant rainfall and high humidity. The climate is divided into two distinct seasons: rainy season, or monsoon, from May to mid-October, followed by a dry season from mid-October to April. The average annual rainfall is about 1,300 – 3,000 mm. Average temperatures in the northern and eastern mountainous areas and the plateaus are 20°C, and in the plains 25-27°C. For the year 2006, the average temperature for the country was 26.5°C (National Statistic Center 2006). On the

basis of its altitude, Lao PDR is divided into three different climatic zones, as follows:

- (1) The northern mountainous areas above 1,000m have a montane temperate and hilly sub-tropical climate. There are relatively dry, with an average rainfall between 1,500 to 2,000mm. Temperature ranges are lower than the rest of the country.
- (2) The central mountainous areas in the Annamite Chain range in altitude from 500-1,000 m (with some mountain peaks >2,000 m). They have a tropical monsoonal climate with a higher temperature and higher average rainfall than elsewhere which ranges from 2,500 to 3,500 mm.
- (3) The tropical lowland plain and floodplains along the Mekong River and its main tributaries include the plains of Vientiane, Borikhamxay, Khammouan, Savannakhet, Champasack, Saravane, and Attapeu Provinces. More than 50 percent of the population of Lao PDR lives in these areas. They have an average rainfall of 1,500 to 2,000 mm.

1.3 SOCIAL CONDITIONS

The 2005 census (2006 Statistics) indicates that Lao PDR has a population of 5.8 million people and an average population density of about 24/km², which is the lowest density in Southeast Asia. The population growth rate was about 2.4 percent per annum, crude birth rate 33.7 per 1,000 people, and total fertility rate between 4.3 per woman to 6 per woman in rural areas. Infant mortality rates ranged from 5-12.5 depending on the Province and adult life expectancy (males and females) ranged from >50 – 60 depending on Province (Hook et al, 2003). Over 73 percent of Lao population live in the rural areas. The remaining 20 percent of the urban population has an average growth rate of 5.5 percent per year.

The results of official surveys in Lao PDR indicated that in 1992-1993, approximately 38.6 percent of poor households were living below the poverty line, and in 2002/3 it was estimated that that 28.7 percent of households in the country are poor (NGPES, 2004; Resolution of the VIII Party Congress, 2006; and MPI Background Document for the Round Table Implementation Meeting, 2008). This success reflects the Government and Party's utmost efforts to reduce poverty. Poverty reduction is a key policy directive of the Resolution of the VIII Party Congress. It is reflected in the National Growth and Poverty

Eradication Strategy (NGPES) where it forms the basis for the formulation and implementation of Government policies that will lift the country from LDC status by 2020. To date, poverty in mountainous and remote areas has been addressed gradually, in particular in the northern provinces and in the provinces along the Lao and Vietnamese borders, in which a large number of ethnic minorities rely mainly on shifting cultivation activities for their livelihoods.

In general, education development plans at different levels have been a relative success. This is a significant trend for future development, as both quantitatively and qualitatively reflected in the following aggregate figures: primary enrolment rates increased from 79 percent in 2001 to 84.2 percent in 2005 and an estimated 89 percent in 2007-08, lower school enrolment from 46.6 percent to 54.8 percent, and upper secondary school from 22.6 percent to 34.4 percent. Vocational education and university, both public and private,

TABLE 1. Key environmental and socio-economic data for Lao PDR

Social indicators	Year	Total numbers / %
Human Development Index	2008	133
Estimated population	2007	5.9 million
Population Growth Rate	2005	2.4%
Crude Birth Rate per 1000 people	2006	33.7%
Life expectancy (year) – male / female / total average	2006	59 / 61 / 60
Maternal mortality ratio per 100,000 live births (estimated)	2005	405
Infant mortality rate	2006	5.72%
Under 5 mortality rate	2006	9.3%
Adult literacy rate (estimate)	2007	77%
Access to water supply (percentage of the total population, estimate)	2007	55%
Number of people with access to latrine	2005-06	45%
Environmental indicators	Year	Total numbers / %
Agricultural land (percentage of total land area in Laos)	2003	8%
Forest cover	2004	41.5%
Forest destruction ratio (ha/year)	2004	53,000
Ratio of NPA for the protection of biodiversity to total land area	2006	14%
Access to safe and clean drinking water (percentage of the population: rural, urban and total respectively)	2004	60.06 / 75 / 64
Access to safe and clean drinking water (percentage of the population: rural, urban and total respectively)	2004	35.66 / 70 / 44.25
Waste produced in the urban areas (Kilo/person/day)	2004	0.75
Effective household storage of waste in 5 major districts	2003	45 %
Dry- irrigated land areas (ha)	2003	214,832 ha
Lao PDR supply of water to the Mekong River Basin	2005-06	35% = 170,000 million cubic meters
Economic indicators	Year	Total numbers / %
GDP 2008 (US dollar, nominal GDP)	2007-08	4,980 million
Contribution of agriculture sector to GDP, 2007	2007	40.3%
Contribution of industrial sector to GDP, 2007	2007	34.1%
Contribution of service sector to GDP, 2007	2007	25.6%

Source: National Statistics Centre, 2006; Resolution of VIII Party Congress; Lao PDR Economic Monitor 2008; and MPI Background Document for the Round Table Implementation Meeting, 2008.

are also increasing. Adult literacy rates have also increased to 73 percent in 2005 (NGPES, 2004) and an estimated 77 percent in 2007 (MPI Background Document for the Round Table Implementation Meeting, 2008). Because of successes such as these, Lao PDR now ranks 133rd out of 179 countries worldwide in the Human Development Index of the United Nations, compared to the 1993 when it ranked 141st out of 173 countries.

Over the last five years, the Government has paid close attention to expanding health care networks at both central and local levels. The health care network has increased significantly at the grassroots level, with villages and village clusters providing the centre point for health care services and curative centres for the people. At the same time, private health care networks have also been promoted and strongly enhanced, greatly contributing to health care services. The supply of medication domestically produced could meet 48 percent of domestic demand and about 96 percent of the villages in the country have now been equipped with village drug kits. In 2006, average life expectancy of the people increased to 61 years (National Statistics Centre, 2006). However, estimates suggest that despite considerable efforts, 37 percent of children younger than age 5 are underweight. Chronic malnutrition, or stunting, also remains a major issue, affecting 40 percent of children under age 5, and requires urgent attention (MPI Background Document for the Round Table Implementation Meeting, 2008).

1.4 ENVIRONMENTAL STATUS

Lao PDR has an abundance of environmental resources, including forest resources, water resources, biodiversity, land and others. The Government of the Lao PDR always pays close attention to managing the environment, as well as its natural resources. This is illustrated in the Party's policies and resolution, socio-economic development strategy, priority programmes, as well as the poverty reduction projects of the GoL. Meanwhile, the GoL has also strengthened the organizations responsible for environmental tasks at a grassroots level. Significant efforts have been taken to develop and enforce laws and regulations on environmental protection in parallel with socio-economic development, and to achieve sustainable development goals that will lift the country out of LDC status by 2020. The GoL has adopted the National Environmental Strategy Management to 2020 and National and Provincial Environmental

Action Plan 2006 – 2010, Environmental Education and Awareness Strategy to 2020, and Environmental Education and Awareness Action Plan 2006-2010, National Biodiversity Strategy to 2020, and Action Plans for the to National Forestry Strategy, Water Resources Management Strategy, Land Resources and others. These provide a strong foundation for immediate and long term environmental activities in the Lao PDR.

To achieve the objectives of the above-mentioned policies and strategies, ensuring the sustainable use and management of natural resources is a key task. There must be a logical analysis so that optimum benefits can be generated that actively contribute to poverty reduction of all ethnic groups, ensuring equitable and sustained growth for socio-economic development. At the same time, it is also necessary to manage and address urban environmental issues namely, pollution, waste, sewage, persistent organic pollutants (POPs), and greenhouse gas emissions.

Even though activities have been successfully implemented on many fronts, findings documented in the Lao PDR Environmental Monitor 2005 and 2007 (LEM) indicate that environmental degradation is occurring, as evidenced in the reduction of forestry cover, biodiversity loss, land degradation, water pollution, land erosion and urban environmental issues. These dynamics of degradation have the potential to increase dramatically due to waste, sewage, pollution, hazardous clinical waste from hospitals, and others.

To date there has been limited assessment, analysis or prediction of the potential impacts of climate change on the natural and manmade environment of Lao PDR. It is generally perceived that the dry season is becoming longer, that droughts are becoming more frequent and severe, and that the incidence of unusual and extreme flood events is increasing. However, very little national data exists to substantiate these perceptions and even less information is available (at a national level) on how future climatic conditions may impact the environment of Lao PDR. What is clear, is that additional pressures on the natural resource base of Lao PDR will have serious consequences for the 73 percent of the Lao population that live in rural areas. These people are primarily farmers and fishermen who rely on natural resources including agricultural land, aquatic resources, forests and wetlands for their livelihoods.

1.5 ECONOMIC CONDITIONS

Since the Government of the Lao PDR endorsed reform at the end of the 1980s, the country has opened investment, converted to a market-oriented economy and launched a decentralization policy. This policy defines the province as a strategic unit, the district as a financial and planning unit, and the village as an implementing unit. This policy is a basis for the construction of the national economy and for establishing a concrete foundation for gradual industrialization and modernization. The policy has also stabilized macro-economic conditions and ensured a steady, sustained growth and macro-equilibrium. The average gross domestic product (GDP) growth per head was about 7.9 percent in 2007 (World Bank, 2008), which is higher than the 5-year average growth from 1996-2000. Average income was about USD 511 per person per year in 2005-6 (National Statistics Center, 2006). In this regard, due to changes in the economic structure that have taken place over the last 5 years, the ratio of agriculture in the GDP has decreased from 51.9 percent in 2000 to 45.4 percent in 2005 and an estimated 40.3 percent in 2007, whereas the ratio of industry has increased from 22.4 percent in 2000 to 28.2 percent in 2005 and an estimated 34.1 percent in 2007, and the service sector also increased from 25.7 percent in 2000 to 26.4 percent in 2005 and 25.6 percent in 2007. These figures illustrate positive changes in the economic structure of the Lao PDR.

II. FRAMEWORK FOR THE NAPA PROGRAMME

2.1 OBSERVATION OF CLIMATE CHANGE AND ITS ADVERSE IMPACTS IN LAO PDR AND IN THE MEKONG RIVER BASIN

According to national statistics on disasters that have occurred over the last three decades, it has been observed that both the severity and frequency of floods and droughts have increased. Floods and droughts have significant impacts on agriculture, forestry, water resources, health and economic growth, and therefore on the livelihoods of the Lao people. The participants in the NAPA Technical Working Groups came from different sectors and levels, and included individuals who have responsibilities for, or have implemented activities related to, climate change issues. These national experts provided central and provincial consultation workshops with information

on the negative impacts associated with the increased uncertainty and unpredictability of rainfall and temperature. Climate change is a critically important issue with many implications for socio-economic development and local livelihoods, and particular attention was given to discussing impacts on agricultural production, water supply (energy, irrigation, piped water, drinking water and water for daily use), health, and macro socio-economic conditions.

This section presents data compiled by the NAPA Working Groups along with climatic data and climate change predictions produced regionally and relevant to Lao PDR.

2.1.1 Observed Extremes and Changes in the Climate of Lao PDR and in the Mekong River Basin

According to data and statistics from the Department of Meteorology and Hydrology (DMH), from 1995 – 2005 drought conditions were characterized by higher and irregular increases in temperature. In particular, the high temperatures experienced in 1996 triggered the occurrence of drought in specific areas of the country. In 1998, a drought was experienced and during the dry season the temperature was abnormally high. In 2003, a severe drought occurred which could not be attributed to El Niño, but rather was thought to be attributed to the impacts of climate change in the region as well as the world. Consequently, rivers, streams, lakes and ponds dried up at a faster rate than normal. In addition to the severe droughts that occurred on these three occasions, large floods were also experienced that covered vast areas of the central and southern parts of the country. There were also flash floods in the northern mountainous areas and eastern region in 1995, 1996, 2000, 2002 and 2005. Table 2 presents data from the Mekong River Commission that illustrates the incidence of drought years throughout the Mekong Basin since 1980.



TABLE 2. Mean annual rainfall and drought years in the Mekong River Basin from 1980-2003, where drought years are defined as having a rainfall of at least 20 percent below the average

Region						
	Northern (Thailand)	Khorat (Thailand)	Central (Laos)	Central Highlands (Vietnam)	Cambodia	Mekong Delta (Vietnam)
Station	Chiang Rai	Khon Ken	Pakse	Pleiku	Phanom Penh	Chau doc
Mean annual rainfall (mm)	1900	1250	2000	2200	1300	1300
Drought years	1987	1985 1992 1993 1997 1998	1980 1992 1993 1997 1998	1980 1992 1993 1997 1998	1997	1990 1992 1994 2002 2003

Source: Drought Management Program Strategy, MRC, 2006.

Table 3 lists severe drought years in terms of average annual discharge (flow) of the Mekong and the return period in years for an equivalent low flow level. The gauging stations listed are all on the Mekong mainstream, either in Lao PDR or where the river forms the international boundary with Thailand, with

the exception of Stung Treng which is close to the southern border between Lao PDR and Cambodia. It was noted that severe hydrological droughts occur approximately once every 10 years: 1957, 1967, 1977, 1987, 1998 (with exception of 1992).

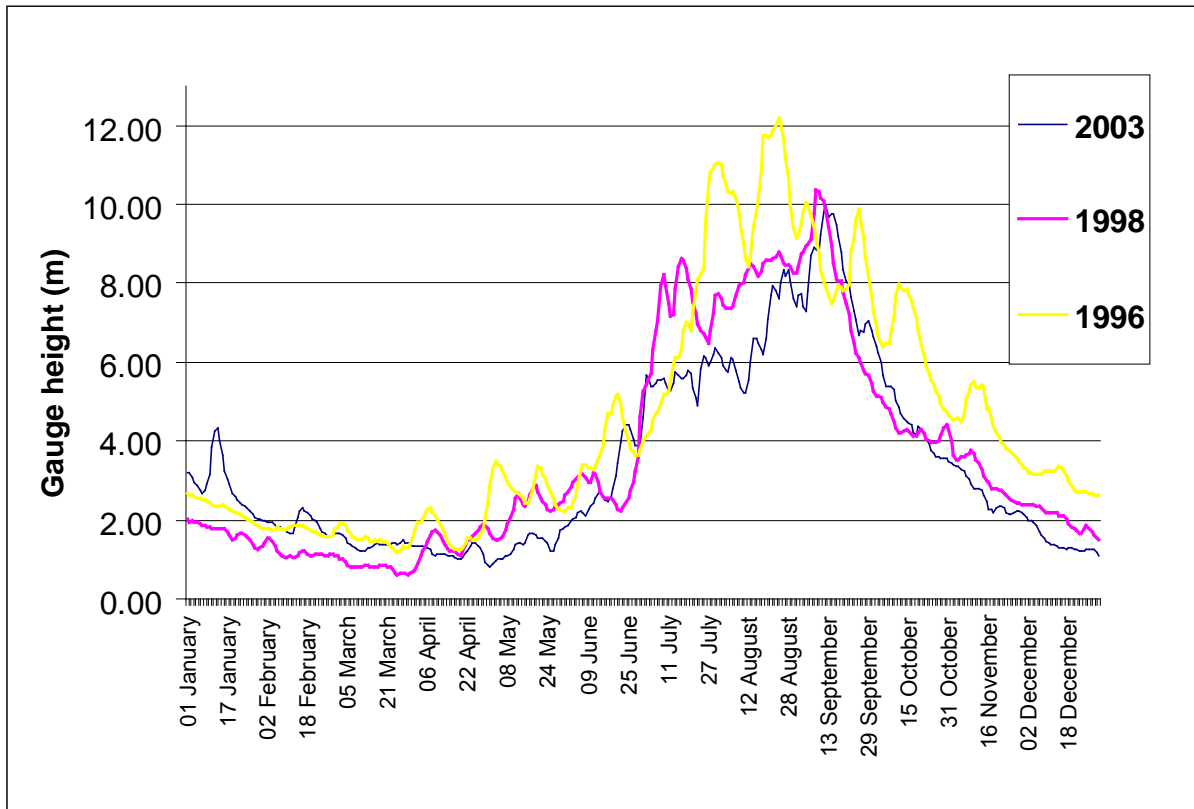


TABLE 3. Severe hydrological drought events along the Mekong River mainstream

No	Stations	Year	Average discharge (m ³ /s)	Return period (year)
1	Luang Prabang	1957	2286	200
		1992	2422	90
		1958	2842	15
		1987	3040	10
		1956	3163	8
		1967	3424	4
2	Vientiane	1957	2677	250
		1992	2850	100
		1931	3211	30
		1958	3332	20
		1967	3975	5
		1977	4111	4
3	Nong Khai (Thailand)	1992	2791	120
		1987	3552	12
		1988	3665	9
		1989	3716	8
		1972	3811	7
		1979	3876	6
		1977	4052	1
		1998	4026	4
4	Nakhon Phanom (Thailand)	1992	4378	250
		1987	5040	48
		1988	5291	28
		1977	5403	23
		1967	5841	11
		1957	6157	7
5	Mukdahan (Thailand)	1992	5256	100
		1977	5407	73
		1998	5787	33
		1987	6008	22
		1967	6828	7
6	Pakse	1998	6835	80
		1992	7128	50
		1977	7336	35
		1988	7389	33
		1987	7742	20
		1968	8159	12
7	StungTreng (Cambodia)	1998	9403	120
		1988	9689	90
		1977	10360	40
		1987	10676	25
		1959	11255	14
		1968	11326	12

Source: MRC, Flood and Drought Report of the Mekong Basin, Flood Forum 2003.

FIGURE 1. Hydrograph of the Mekong River at Vientiane (Km 4) in severe drought years: 1996, 1998 and 2003

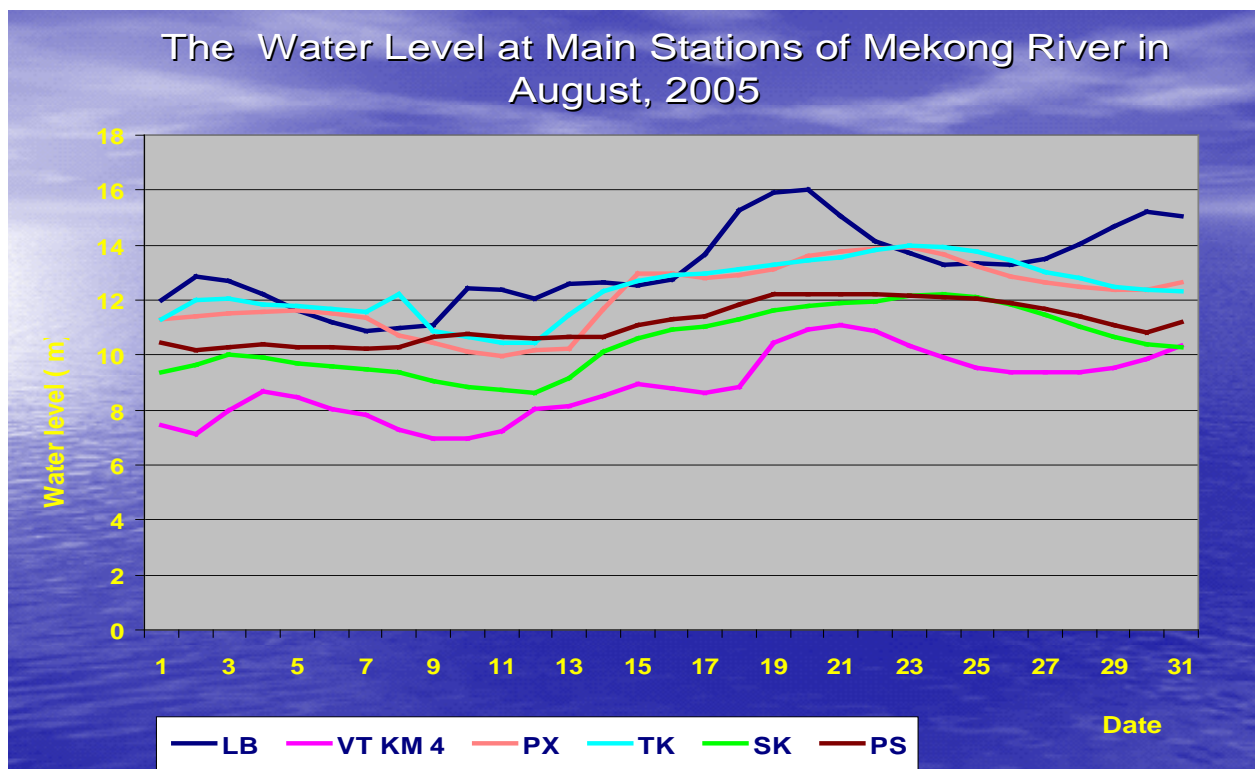


Source: Waterway Administration Division, MCTPC, 2006.

According to the above hydrograph (figure1), the highest level of the Mekong in Vientiane during severe drought years was 12.2m in August, 1996. The flood alarm level is 11.5m and when water reaches this level flooding occurs in the plain areas of Vientiane province (along the Num Ngum river). The lowest

water level observed during severe drought years was 0.61m (March, 1998) in Vientiane. In 1996 and 2003, the lowest level was 1.19m and 1.2m respectively, in the months of March/April, representing severe drought years.

FIGURE 2. Flood levels in the Mekong River from Luang Prabang to Pakse illustrated by the hydrographs for August 2005



Source: Waterway Administration Division, MCTPC, 2006.

Figure 2 illustrates that in 2005 the water level in the Mekong River at Vientiane station at Kilometer 4 (VT KM4) was slightly above the alarm level. At Pakxane, Thakhek, Savannakhet, and Pakse, the water level was above the critical level. The highest water level measured at Vientiane KM4 on 22 August 2005 was 11.52m, slightly exceeding the alarm level of 11.5m. At Pakxane, Savannakhet, and Pakse, the highest water levels were 15.18m, 14.08m, and 13.02m, respectively. As a result, vast areas in the Central and Southern parts of Lao PDR were flooded.

Some statistics on the highest water level for floods in certain years measured at Vientiane (Km 4) are as follows:

- In 1966, the highest water level was 12.86m, exceeding the critical level by 36cm (as a result, Vientiane was flooded);
- In 1996, the highest water level was 11.6m, exceeding the alarm level by 10cm (alarm level was 11.50m);
- In 2000, the highest water level was 11.53m, exceeding the alarm level by 3cm;
- In 2002, the highest water level was 12.6m, exceeding the critical level by 10cm (critical level was 12.50m); and
- In 2005, the highest water level was 11.52m, exceeding the alarm level by 2cm.



Since the initial drafting of this report, more severe floods have been experienced in the Mekong Basin. During the second week of August 2008, flood water levels in the Mekong Basin reached extreme levels, particularly at Luang Prabang, Vientiane and Nong Khai. The flood resulted from tropical storm Kammuri that tracked westwards across northern Lao PDR and southern Yunnan from the 8-10 August. This storm system produced 100-150 mm of rainfall, with locally recorded figures as high as 250 mm. Catchments were already saturated as a result of strong monsoonal conditions during May, June, and July, with the consequence that flood runoff was maximized. Large areas of Chiang Saen (North East Thailand) and Luang Prabang were inundated, and it was only the effective action by authorities and citizens that the city centres of Vientiane and Nong Khai were generally protected from flooding mostly by the rapid deployment of sandbags. Although water levels at Vientiane (km 4) were 1m higher than in the highest previously recorded flood of 1966, when the

city centre was flooded, the peak discharges were of the same order. These higher water levels for similar discharge conditions are explained by the raising of flood protection levees on both banks of the Mekong river after the 1966 event, and the resulting containment of the flood flow within the channel (Mekong River Commission, 2008).

The year 2008, has been a strong La Niña year, during which there is the probability of a more intense SW Monsoon over SE Asia. The above-average regional rainfall thus far in 2008 tends to confirm this link. La Niña conditions are also associated with a higher frequency of tropical storm formation in the Western Pacific.

The water level reached in Vientiane on the 15 August 2008 was the highest recorded since records began in 1913. At 13.7 m above the gauge datum, it was 1 m more than the maximum levels achieved in 1966, 1971 and 2002 (Table 4).

TABLE 4. Comparative maximum historical flood water levels at Chiang Saen, Vientiane and Mukdahan

Year	Maximum water level achieved above gauge datum (m)		
	Chiang Saen	Vientiane ¹	Mukdahan
1924	No data	12.7	No data
1929	..	12.4	..
1942	..	12.2	..
1966	13.8	12.7	13.6
1970	9.8	12.2	13.2
1971	11.0	12.5	12.5
2002	10.4	12.6	12.3
2008	10.6	13.7	12.7

Source: MRC, 2008.

¹Levels recorded at the river gauge at Kilometre 4.

Upstream at Chiang Saen and downstream at Mukdahan, the August 2008 maximum water levels were lower than those experienced in 1966, being over 3 m lower at Chiang Saen. This reveals that the situation in 1966 was somewhat different to that in 2008. In September 1966 tropical storm Phyllis tracked further north than did Kammuri in 2008. So while most of the floodwater in 1966 originated in Yunnan, in 2008, the origin of the floodwater was more or less evenly split between China below Jinghong and the large left-bank tributaries in northern Lao PDR. It is worth noting that the rapid water level rise at Luang Prabang occurred one day before water levels rose at Man An tributary station in China. This also strongly suggests that the flood event was primarily caused by heavy rainfall in the basins of the Mekong tributaries in the north of the Lao PDR. At Mukdahan, the 2008 water levels were lower than in 1966 and 1970, indicating a modest contribution from the central Lao

tributaries and some attenuation of the August peak downstream of Vientiane (MRC, 2008).

According to Jeggle (1996), change could be observed in 1977, 1983, 1988, 1998 and 2003 (DOP, MAF 2005), revealing that the medium average temperature in the eight northern provinces was 23.2°C, five central provinces was 26.6°C and four southern provinces was 27.3°C.

As observed, temperatures in the three most severe drought years (1996, 1998 and 2003), especially its medium average temperature in the eight northern provinces was 23.2°C, five central provinces was 26.6°C and four southern provinces was 27.3°C. However, the highest average temperatures in the most severe drought years of 1996, 1998 and 2003 are illustrated in Tables 5, 6, and 7.

TABLE 5. The highest average temperature (°C) in each region of Lao PDR

Region/year	1996 (°C)	1998 (°C)	2003 (°C)
North	27.9	29.9	28.8
Central	30.9	32.5	32
South	30.9	32.5	32

TABLE 6. The average low humidity (%) in each region of Lao PDR

Region/year	1996 (%)	1998 (%)	2003 (%)
North	59	54	55
Central	58	56	54
South	55	53	54

TABLE 7. The average rainfall (mm) in each region of Lao PDR

Region/year	1996 (mm)	1998 (mm)	2003 (mm)
North	1,667.2	444.5	11,237.1
Central	2,283.7	790.2	11,736.4
South	2,455.1	1,481.1	1,838.9

Source: Department of Meteorology and Hydrology, 2005.

According to historical data available, the normal average temperature for the North is 23°C, the highest average temperature is 23.2°C, with a variable rate of +0.2°C; the normal average temperature for the centre is 26.3°C, the highest average temperature is 26.6°C, with a variable rate of +0.3°C; and the normal average temperature for the South is 26.9°C, the highest average temperature is 27.3°C, with a variable rate of +0.4°C. If we look at the variable rate of the temperature in each region, it increases from the North to the South.

2.1.2 Prediction of potential future changes in the climate of Lao PDR and its neighbours

Due to a general lack of capacity and resources, the GoL and its institutions have not yet been able to conduct their own research or studies using climate change models to forecast future climate scenarios. At present in Lao PDR, only short term climatic conditions can be forecasted using available resources such as statistical data, actual occurrences, monthly weather monitoring and measurements (temperature, amount of rainfall, regularity and disaster severity) as well as environmental change conditions. Fortunately, there are also meteorological data which can be collected by GTS (Global Telecommunication System) linked from Bangkok in order to fulfil all the tasks of weather forecast and warning on hydro-meteorological severe events (flood and drought). In addition, regional institutions including the Mekong River Commission and the Asia Development Bank, international organisations such as World Food Programme, research groups like the South East Asia START Regional Centre (SEA START RC) and research partnerships such as the JMA AGCM climate experiments under the 'Research Revolution 2002' frameworks, funded by the Japanese government (Kiem et al, 2008), have produced significant research at both a national and regional level that is relevant to Lao PDR.

Much of the climate change modelling which has been produced for Lao PDR and the Mekong Region so far is in its initial phases and therefore should not be referred to as certain. However, it provides a useful start point especially in terms of policy development. Recent climate change models provide initial indications of future climate changes under different global conditions such as increased CO₂ levels. It is important for the GoL to be aware of such factors

for although Lao is not a net exporter of greenhouse gasses, currently having no CO₂ producing industries and no significant methane exporting livestock production, Lao will most certainly be impacted by the activities of its neighbours and changing global conditions. Therefore in this section we will review briefly some of the predictions produced so far for Lao and the Mekong Region.

The data and predictions presented in this section are largely extracted from the most recent technical reports (12, 13 and 15) of the Southeast Asia START Regional Centre, based in Bangkok, Thailand. The Southeast Asia START Regional Center (<http://www.start.or.th/>) is the regional research node of the Southeast Asia Regional Committee for START (<http://www.sarcs.org/>). In this respect, Southeast Asia is one of the eight existing regions of the Global Change SysTem for Analysis, Research and Training (<http://www.start.org/>) network, jointly initiated by the International Geosphere-Biosphere Programme (<http://www.igbp.kva.se/>), International Human Dimension Programme (<http://www.ihdp.unu.edu/>), and World Climate Research Programme (<http://wcrp.wmo.int/wcrp-index.html>). START is a global network that supports multidisciplinary research on the interactions between humans and the environment. Other START regional networks represent Pan-Africa, South Asia, Temperate East Asia, Mediterranean, and Oceania.

SEA START has been studying climate change in the Mekong river basin with case study sites in Thailand, Lao PDR and Viet Nam. Their studies address not only climate change simulation but vulnerability to changing water resources and extreme events, and the consequences for rainfed agriculture. The 'timeframe' for climate change as simulated in their research is presented in terms of future climatic conditions under increased CO₂ concentration rather than in terms of years from the present time. The climate change model used by the SEA START team is a Conformal Cubic Atmospheric Model (CCAM), which is the second-generation regional climate model developed specifically for the Australasian region by the CSIRO Division of Atmospheric Research in Australia. The CCAM has been evaluated as most suitable for the Asian region in several international model inter-comparison exercises (McGregor et al, 1998). Additional models have been used to study the impact of climate change on hydrological regimes (e.g. infiltration model) and on rainfed agriculture (e.g. crop models) (Snidvongs, 2006). The outputs of

these simulations will be discussed in the next section (2.1.3).

The CCAM simulations have been produced using the atmospheric CO₂ concentration of 360ppm as the baseline for the analysis representing present day levels. These have then been increased to 540ppm and 720ppm for future scenarios. The predicted climate scenarios indicate that the region tends to get slightly cooler under the increased CO₂ concentration of 540ppm but will be warmer under the CO₂ concentration of 720ppm. The change in temperature under this set of climatic scenarios will be within the range of 1-2 °C (Figure 3), but the change in number of annual hot and cool days will be prominent. Hot

days, defined as the number of days with a maximum temperature over 33°C, will increase by 2-3 weeks and the cool days, which are defined as days with a minimum temperature under 15°C, will be reduced by 2-3 weeks throughout the region (Figures 4 & 5). In other words, the summer time or dry season in the Mekong Region will be significantly longer in the future. The simulation results also reveal a trend of increasing precipitation from 10-30 percent throughout the region under future climate condition at CO₂ concentration of 540ppm and 720ppm, especially in the eastern and southern part of Lao PDR (Figure 6) (all figures reproduced from SEA START technical report no. 15, Snidvongs, 2006).

FIGURE 3. Average temperature in the lower Mekong River basin (baseline simulation) and comparison analysis to show future change under increasing CO₂ concentration

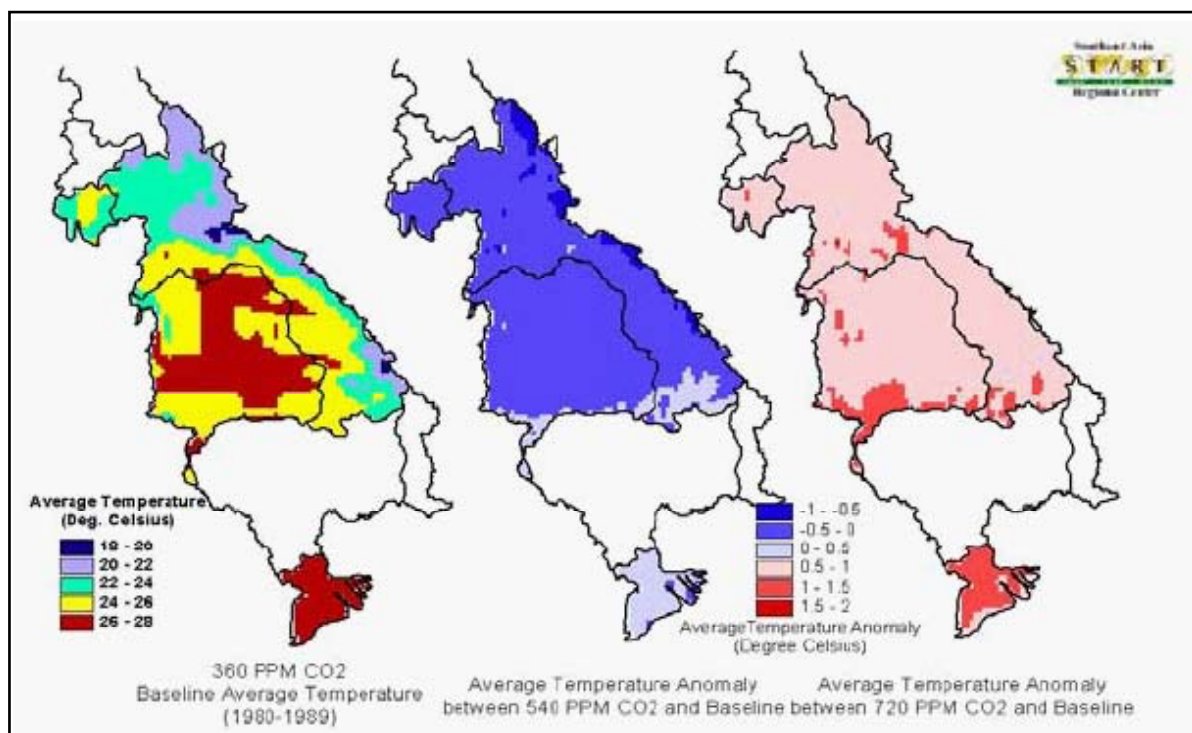


FIGURE 4. Number of annual ‘hot days’ in the lower Mekong River basin (baseline simulation) and comparison analysis to show future change under increasing CO₂ concentration

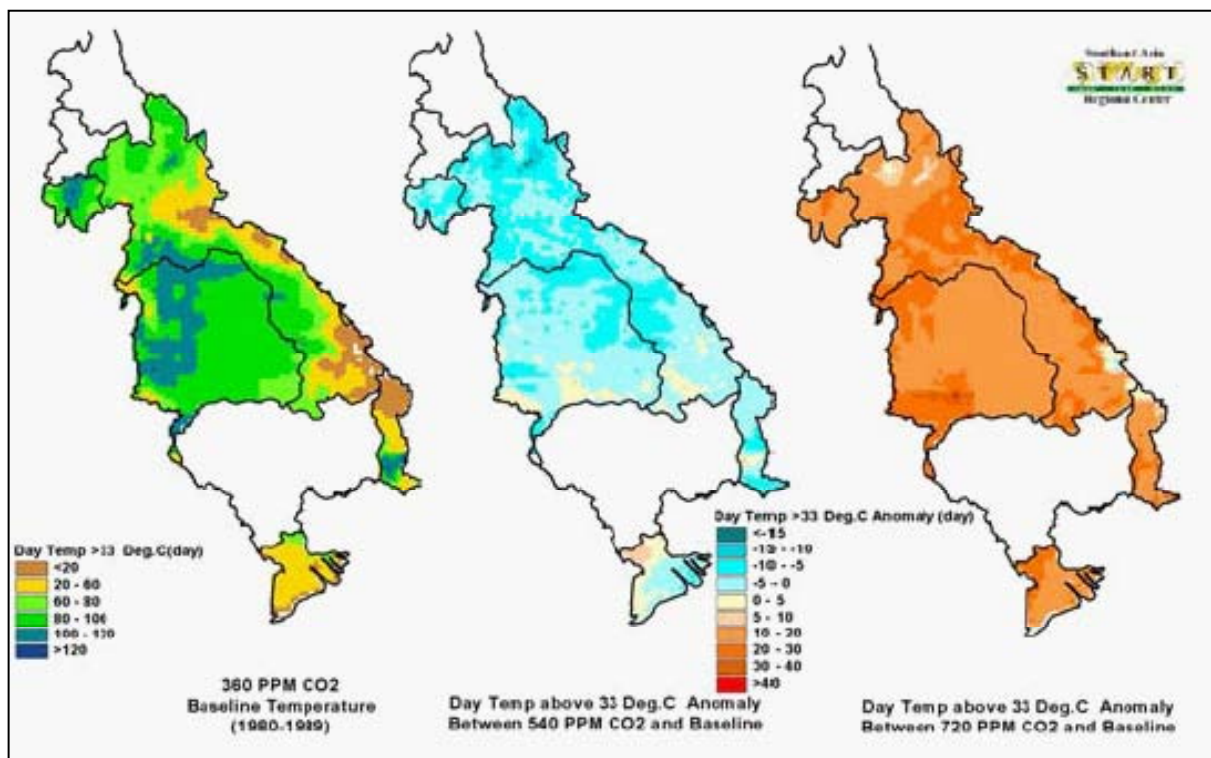


FIGURE 5. Number of annual ‘cool days’ in the lower Mekong River basin (baseline simulation) and comparison analysis to show future change under increasing CO₂ concentration

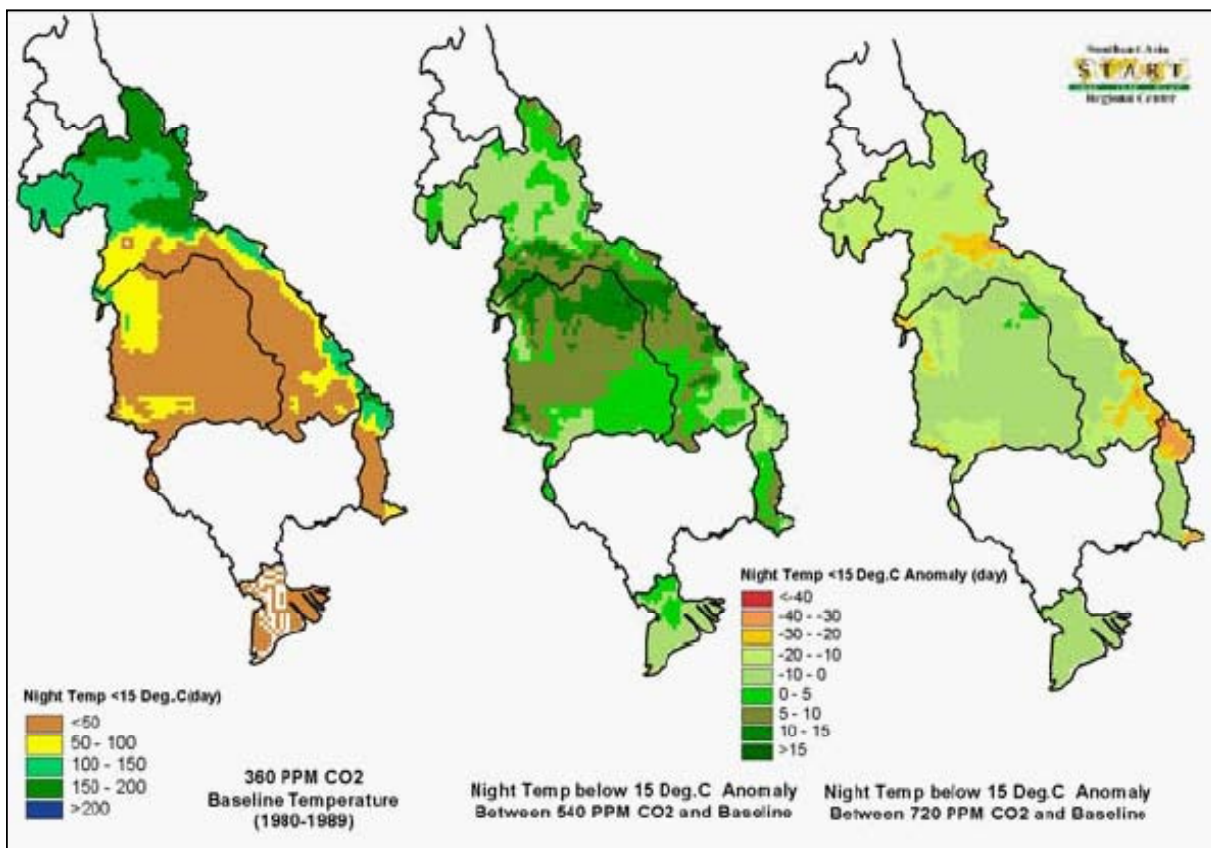
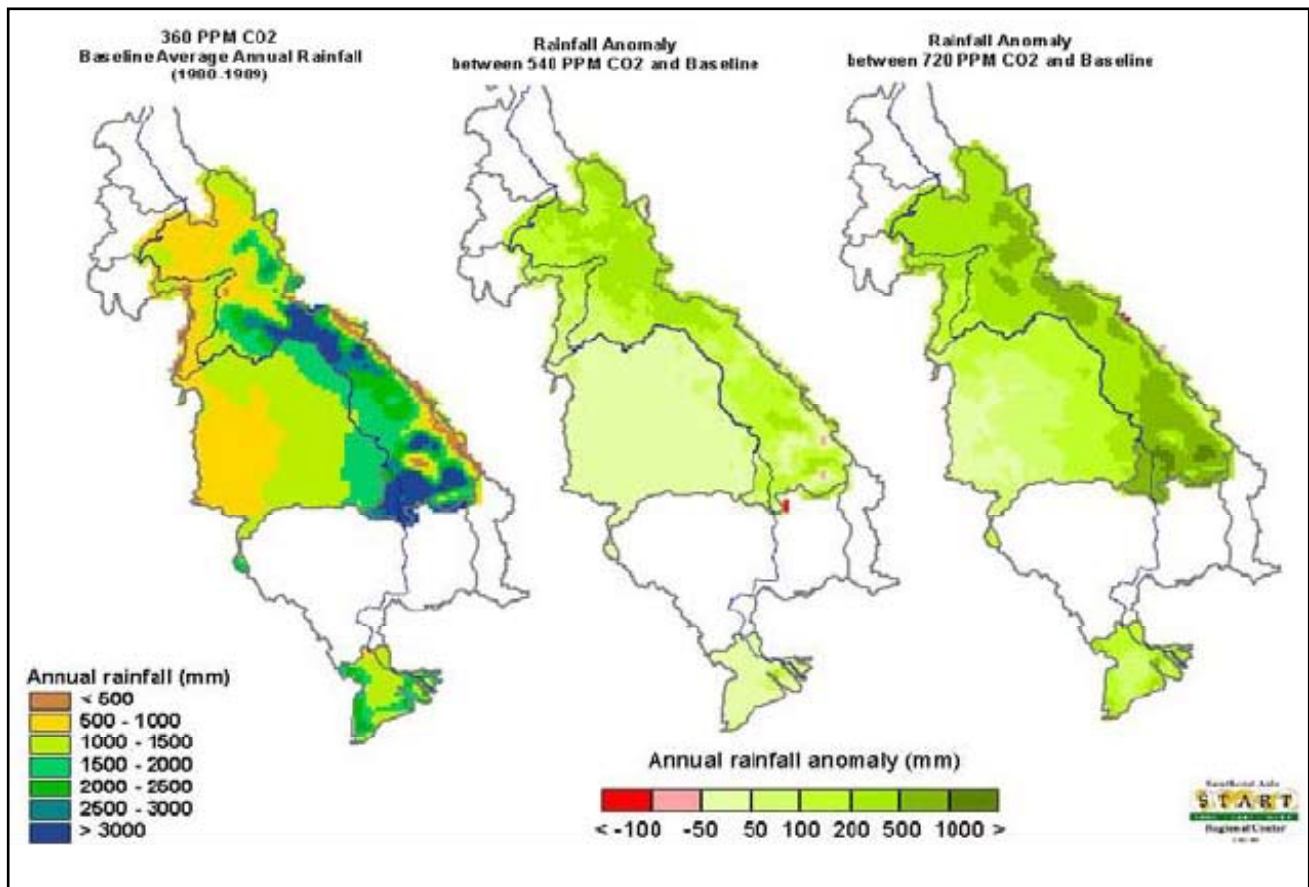


FIGURE 6. Average rainfall in the lower Mekong River basin (baseline simulation) and comparison analysis to show future change under increasing CO₂ concentration



The research partnership which utilized the Japan Meteorological Agency atmospheric general circulation model (JMA AGCM) produced several climate scenarios for the Mekong River basin (Kiem et al, 2008). The outcomes of this research were very similar to the findings of the SEAR START model outputs with the indication that the annual mean precipitation will increase in the 21st century (2080–2099) by 4.2 percent averaged across the basin, with the majority of this increase occurring over the northern MRB (i.e. China). Annual mean temperatures are also projected to increase by approximately 2.6°C (averaged across the MRB), leading to significant changes in the hydrology of the Mekong River basin. According to the findings of Kiem et al (2008) all Mekong River basin sub-basins will experience an increase in the number of wet days in the ‘future’. The group also predict that the magnitude and frequency of what are now considered extreme events are also expected to increase resulting in increased risk of flooding, but a reduction in the likelihood of droughts/low-flow periods, but critically this assumes that water extraction is kept at a sustainable level.

For generations, the Lao people especially those living in remote areas with no access to information have also used ancestral traditional knowledge to forecast and adapt to natural phenomena or natural disasters that may happen. The use of the traditional knowledge-based forecasting is one example. For instance, if villagers observed that cicadas call for several consecutive days, this indicates that a long drought is approaching. In contrast, if they observe that ants start moving to higher places, this is an indicator that flood will soon occur. Based on such indications, people start storing their food and keeping their livestock in safe places. In addition, if the drought is prolonged, villagers may hold a ceremony to parade a female cat, perform traditional dancing and singing around the village, and pray for rain with the king of all the goddesses. The use of traditional knowledge for forecasting climate change related events such as flooding and drought has not yet been documented in any detail.

2.1.3 Observed Adverse Impacts of Extreme Climatic Events on Physical Systems

Lao PDR has already experienced the impacts of climate change, especially from floods and droughts. From 1966 to 2005, floods and droughts caused great economic losses, costing millions of USD. As shown in tables 8, 9, 10, 11, and 12, floods and droughts have resulted in great losses to the national economy and the livelihoods of the people. Impacts are particularly severe in Lao PDR, given that about 80 percent of the Lao population rely on subsistence agriculture for their livelihoods. According to existing statistical data, from 1996 to 2005 (1998 and 2003 were drought years), floods significantly affected a large proportion of the rain-fed rice fields in the country. The population of Mekong riparian provinces in the central and southern parts of Lao

PDR were affected severely by the 1995 flood. Just in the areas of the Vientiane plain and the Ngum river valley alone, losses amounted to more than 10 million US\$ (FAO, Assessment of the Impacts of the Floods on Agricultural Sector, October 1995). The areas of rain-fed rice fields destroyed by flooding were 65,937 ha in 1995, 67,500 ha in 1996, 42,900 ha in 2000, 42,223 ha in 2001, and 57,300 ha in 2005 (DOP, MAF 2006). In addition, in 2005 and 2006, irrigation system damage by floods caused more than 50 billion Kip or about 5 million USD of damage. A summary of estimated losses caused by floods and droughts from 1966 to 1995/ 2005 is illustrated in Tables 8 and 9 below.

TABLE 8. Impacts of floods and drought in Lao PDR from 1966 to 1995

Year	Details of Floods and Droughts	Cost of Impacts (US\$)
1966	Large floods (Vientiane, central and southern)	Inaccurate data
1967	Drought (Central and southern)	5,200,000
1968	Flood (Southern)	2,830,000
1969	Flood (Central)	1,020,000
1970	Flood (Central)	30,000
1971	Large flood	3,573,000
1972	Flood and drought	40,000
1973	Flood (Central)	3,700,000
1974	Flood (Southern)	80,000
1975	Drought	Data not available
1976	Flash flood	9,000,000
1977	Severe drought	15,000,000
1978	Large flood (Central and Southern)	5,700,000
1979	Flood and drought	3,600,000
1980	Flood	3,000,000
1981	Flood	682,000
1983	Drought	<50% of total production
1987	Drought	5,000,000
1988	Drought and crop pest pandemic	4,000,000
1989	Drought	20,000,000
1991	Flood and drought	70,000 ha
1994	Flood	36,382 ha
1995	Flood	63,820 ha

Source: DoP, Ministry of Agriculture and Forestry/National Disaster Management Office, 1996.

TABLE 9. Rain-fed rice fields damaged by flood (1996 – 2005) in hectares (ha). Severe drought occurred in 1998 and 2003.

Province		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
No	Northern	1,215	255	-	161	20	240	1,810	207	357	620
1	Phongsaly	184				20		962			
2	Luang Namtha							157			
3	Oudomxay		15					110			70
4	Borkeo	136						377			60
5	Luang Prabang	178	40		3		10	64		25	245
6	Huaphanh	668	180		32			140	5	100	160
7	Xayabury	49	20		126		230		202	232	85
	Central	42,350	26,370	-	4,792	29,420	30,193	24,151	607	13,078	44,120
8	Vientiane Capital	210	2,800		390	11,290	5,080	5,493	90	1,488	1,385
9	Xieng Khuang						50	57	102		90
10	Vientiane	131	3,400		430	350	1,100	761	34	1,140	1,165
11	Borikhamxay	3,436	5,070		202	250	8,370	5,644		1,150	2,445
12	Khammuane	17,430	6,900			4,000	4,440	7,040		6,200	22,990
13	Savannakhet	21,038	8,200		3,770	12,460	11,153	5,156	350	3,100	16,045
14	Xaysomboon	105				1,070			31		
	Southern	23,981	6,750	-	3,549	13,460	11,790	8,103	-	960	9,900
15	Saravane	2,110	800		1,883	1,400		222		550	3,340
16	Xekong	350	50			12,060					90
17	Champasack	19,194	5,700		466		11,790	7,432		410	6,470
18	Attapeu	2,327	200		1,200			449			
	Grand Total	67,546	33,375		8,502	42,900	42,223	34,064	814	14,395	54,640

Note: 2003 is the least impacted year (almost no impacts).

1996 is the most impacted year.

Source: Department of Planning, Ministry of Agriculture and Forestry, 2005.

The impacts of flash floods and prolonged floods resulting from the Xangsan Storm in 2006 caused damages to the agricultural sector of some 17 billion kip (1.7m USD), to irrigation infrastructure of 18 billion kip (1.8m USD), and to the power house of Namtha 3 hydro power project and Namlung hydropower (Nalae district, Luang Namtha province) of approximately 6.5 billion kip (0.65m USD). In 2007, flooding from Lekima Storm affected six provinces in the North, Central and Southern regions, causing approximately 19.8 billion kip (1.98m USD) of damage to irrigation infrastructure. The total rain-fed rice production areas affected by this natural disaster were 35,433 ha, of which 34,751 ha were flooded, causing damage to rice crops amounting to a loss of 70 billion kip (7.1m USD), and loss of livestock (aquatic and inland animals) worth of 103.5 billion kip (10.5m USD).

In 1966, there were great losses due to several consecutive weeks of flooding. At that time there were no embankments along the riverbank in Vientiane. In 2005, the areas affected by flooding were larger than those affected in 2002, particularly in central and southern Lao. 2005 flash floods in Oudomxay province (northern Lao) also caused damage to the agricultural sector and rural infrastructure, as quantified in Table 10.



TABLE 10. Losses caused by floods in Central and Southern parts and by flash floods as a result of tropical storm Washi Tahiti in Oudomxay Province in 2005

No	Description	Losses
1	Provinces	8
2	Districts / Villages	84 / 2,510
3	Families / affected people	85,533 households / 450,910 people
4	Areas of rice field flooded	Flooded 87,725 ha (the total areas of rice fields already cultivated in 2005: 684,555 ha)
5	Areas of rice field damaged	54,775 ha
6	Number of livestock lost	14,941 (water buffalos, cows, pigs and poultry)
7	Fish ponds	4,289 ponds = 609 ha
8	Irrigation system projects Irrigation channels	1,421 projects (117 were damaged) 15,124 m blocked by sediment
9	Schools	102 schools were damaged
10	Roads	225,726 km

Source: Ministry of Agriculture and Forestry/ Natural Disaster Management Office, October 2005.

Severe drought events have affected Lao PDR in the years 1998 (Table 11) and 2003 (Table 12) with 29,202ha and 23,770ha of rice field being destroyed, respectively. On a more regular basis, localized

droughts affect both rice production and household food security severely, as associated agrobiodiversity which includes fish, insects, frogs, wild plants, etc., are lost.

TABLE 11. Rice fields affected by droughts from 1995 - 2005

ຕາຕະລາງ: ເນື້ອທີ່ນາ ເສຍຫາຍຈາກ ແຫ້ງແລ້ງ (Destroyed Area by Drought)												
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
ພາກເໜືອ	Northern	2,605	1,416	5,650	11,478	749	0	10	0		50	1085
2 ຜົງສາລີ	Phongsaly	120			374		-	-	-			5
3 ຫຼວງນ້ຳທາ	Luangnamtha	180			4		-	10	-			-
4 ອູດົມໄຊ	Oudomxay	150		4,810	3,529		-	-	-			990
5 ບໍ່ແກ້ວ	Bokeo		71				-	-	-			45
6 ຫຼວງພະບາງ	Luangprabang	1,255	179	200			-	-	-			0
7 ຫົວພັນ	Huaphanh	900	35	640	3,851	549	-	-	-			0
8 ໄຊຍະບູລີ	Xayabury		1,131		3,720	200	-	-	-			0
ພາກກາງ	Central	4,160	20,333	110	11,926	960	-	25	-	15,847	342	-
1 ກ.ພ ວຽງຈັນ	Vientiane.C	60	189	60	352		-	-	-			142
9 ຊຽງຂວາງ	Xiengkhuang				902	80	-	25	-			-
10 ວຽງຈັນ	Vientiane	200	686	30	421	470	-	-	-			200
11 ບໍລິຄຳໄຊ	Borikhamxay	3,200	9		200	40	-	-	-			-
12 ຄຳມ່ວນ	Khammuane	100	4,962		160		-	-	-			-
13 ສະຫວັນນະເຂດ	Savannakhet		14,468	20	9,891	370	-	-	-			-
18 ເຂດພິເສດ ໄຊສົມບູນ	Xaysomboon	600	19				-	-	-			-
ພາກໃຕ້	Southern	300	263	50	5,798	-	-	-	-	7,923	8,168	-
14 ສາລະວັນ	Saravan				4,549		-	-	-			550
15 ເຊກອງ	Sekong				802		-	-	-			1640
16 ຈຳປາສັກ	Champasack		78	50	154		-	-	-			3878
17 ອັດຕະປື	Attapeu	300	185		293		-	-	-			2100
ທັງປະເທດ	Grand Total	7,065	22,012	5,810	29,202	1,709	-	35	-	23,770	8,560	1,085

TABLE 12. Losses caused by serious drought in 2003

The 2003 severe drought caused damages to 23,770 ha of rain-fed rice fields on the plain area and 11,670 ha of upland rice fields			
The degree of damage to rain-fed and upland rice fields in percentages			
No.	Damage	No. of districts	Names of districts and provinces
1	< 50%	3	Kwa (Phongsalay); Xaysetha (Attapeu); and Mounlapamok (Champasack)
2	30 – 49 %	4	Sing and Nalae (Luang Namtha); Sanamxay (Attapeu); and Phu Koud (Xiengkhuang)
3	20 – 29 %	6	Vieng Phukha (Luang Namtha); Namor (Oudomxay); Pak Ou, Nam Bark and Chomphet (Luan Prabang) and Kong (Champasack)
4	10 – 19 %	12	Xay, Rah, Nga, Baeng, Hoon, Ngoy (Oudomxay); Paksaeng, Phonxay (Luang Prabang); Xiengkhone (HuaPhanh); NongBok, Bualapha (Khammuane); and Phu Vong (Attapeu)
5	5 – 9 %	15	Samphanh (Phongsaly); Namtha, Long (Luang Namtha); Luang Prabang, Xieng Ngeun (Luan Prabang); Viengthong, Samtai, Ad (Huaphanh); Phaxay (Xiengkhuang); Thakak, Hin Boune, Nakai, Xebangfai (Khammoune); Samakeyxay and Sanarm (Attapeu)
6	3 – 4 %	6	Phongsaly, Mai (Phongsaly); Pakbaeng (Oudomxay); Mahaxay, Yommalath (Khammuane); and Pathumphone (Champasack)
Around 97,665 tons of rice grain output were lost and 274,000 persons were impacted			
46 districts needed 58,600 tons of rice to consume within the year			

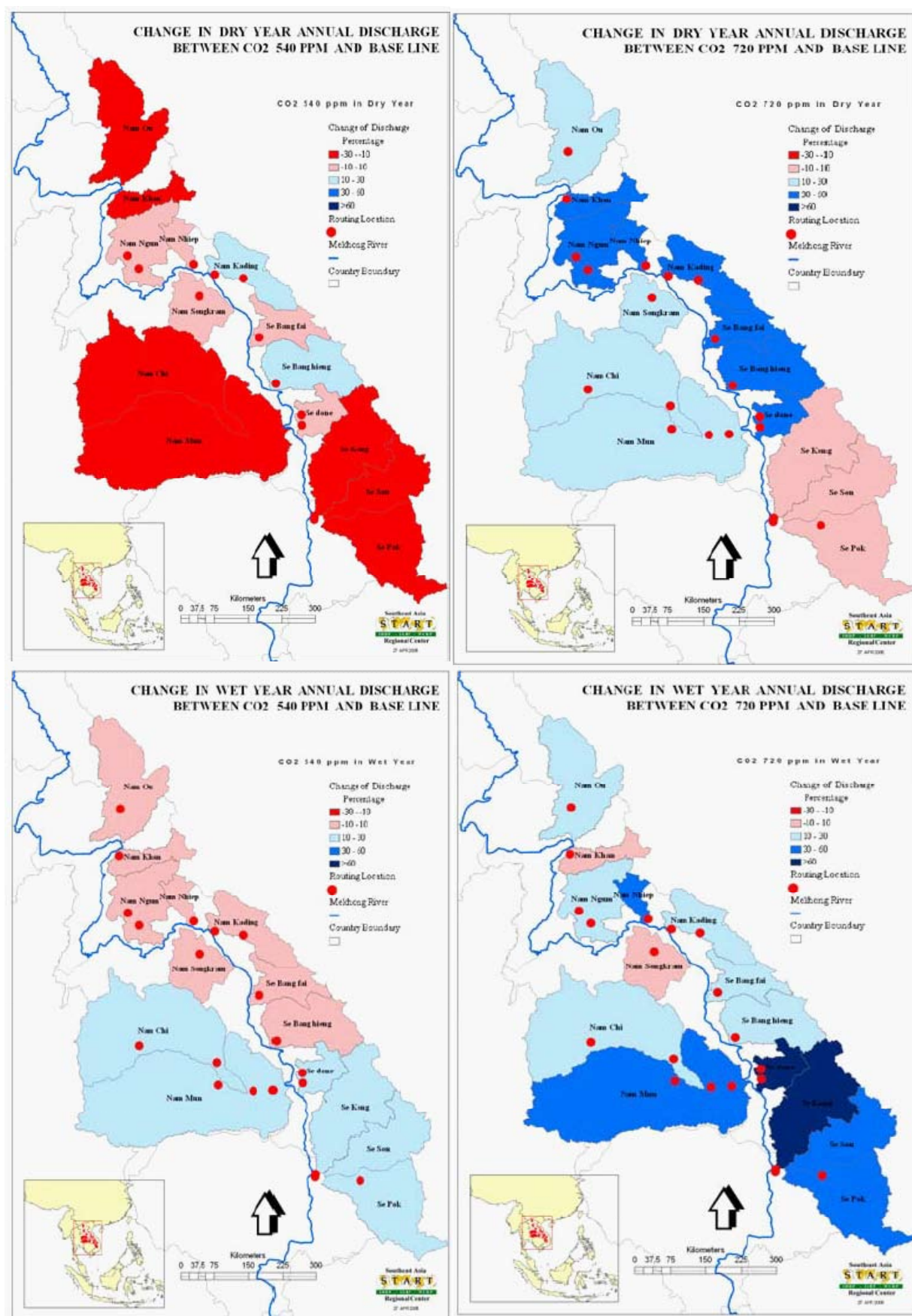
Source: Ministry of Agriculture and Forestry, 2003.

2.1.4 Predicted Adverse Impacts of Climate Change on Physical Systems

The SEA START modelling team produced not only climate change simulations but also assessed the implications of these simulations for water resources in terms of extreme events, the consequences for rainfed agriculture and vulnerability associated with potential changing conditions (Snidvongs, 2006). To do this they utilized both the CCAM climate change model to generate a snap shot of one decade of climatic conditions under different CO₂ concentrations, and the Variable Infiltration Capacity (VIC) hydrological model. The VIC is a macro-scale hydrologic model that solves full water and energy balances, and that was originally developed by Xu Liang at the University of Washington (Liang et al, 1994). Data on wettest year and driest year

of the decade were used for hydrological regime simulation, in order to analyze a plausible range of hydrological change under future climatic conditions. The simulation result from VIC hydrological model, which focused on major Mekong River tributaries in Lao PDR and Thailand, shows that most of the sub-basins tend to have higher discharge under the impact of climate change (Figure 6) due to largely increased precipitation. In the modeled wet years, almost every watershed has higher discharge under the climatic condition of CO₂ concentration increased to 540 ppm, increasing further at 720 ppm CO₂. In the dry year scenarios, many sub-basins have slightly less water under a CO₂ concentration of 540 ppm, while discharge increases at a CO₂ concentration of 720 ppm. Table 13 illustrates the predicted changes to discharge in individual tributaries.

FIGURE 7. Predicted change in discharge of the Mekong River tributaries in Lao PDR and Thailand under different climate scenarios (dry year: baseline, 540 & 720 ppm CO₂; wet year: baseline, 540 & 720 ppm CO₂)



Source: SEA START technical (Snidvongs, 2006).

TABLE 13. Predicted impact of climate change on discharge in the Mekong River tributaries in Lao PDR, Northeast Cambodia and Thailand

Mekong River tributaries	Wet Year Scenario: Tributary catchment's discharge under climate condition at different CO2 concentration			Dry Year Scenario: Tributary catchment's discharge under climate condition at CO2 different concentration		
	Baseline: 360 ppm (million m ³)	540 ppm (% change from baseline)	720 ppm (% change from baseline)	Baseline: 360 ppm (million m ³)	540 ppm (% change from baseline)	720 ppm (% change from baseline)
Lao PDR						
Nam Ou	11,458	+7.23%	+16.78%	9,035	-15.56%	+24.38%
Nam Khan	1,293	+6.65%	+6.93%	946	-11.17%	+44.80%
Upper Nam Ngum (before dam)	3,820	+14.77%	+8.44%	2,891	-12.30%	+51.49%
Nam Ngum	14,837	+6.83%	+11.79%	11,837	+4.70%	+46.63%
Nam Nhiep	4,796	+4.70%	+46.63%	3,902	-4.00%	+33.28%
Nam Theun	39,427	-5.86%	+18.75%	31,483	+11.03%	+30.47%
Se Bang Fai	8,330	-4.54%	+14.92%	6,412	+1.40%	+32.69%
Se Bang Hieng	10,057	+0.04%	+27.95%	6,784	+10.60%	+51.21%
Se Done	2,574	+13.30%	+100.05%	1,829	+2.91%	+53.43%
Se Kong	37,506	+20.20%	+63.21%	35,138	-13.64%	+5.57%
Cambodia						
Sre San	14,279	+24.74%	+51.75%	13,303	-11.60%	+1.84%
Sre Pok	13,050	+22.39%	+51.26%	12,382	-15.29%	-3.53%
Thailand						
Nam Song-kram	12,270	+6.34%	+7.41%	11,750	+7.18	+24.98
Nam Chi	6,423	+12.73%	+21.27%	7,788	-10.24	+14.43
Nam Mun	18,645	+10.02%	+34.06%	21,232	-15.01	+15.39

Source: SEA START technical report no. 15 (Snidvongs, 2006).

The SEA START team also utilised a crop model to simulate future potential rice productivity in the region under different climatic conditions, using the different scenarios simulated by the climate model. The model used to predict future rice yields was a Decision Support System for Agro Technology Transfers (DSSAT version 4.0) crop modeling software (Hoogenboom et al, 1998) with daily climate data from climate scenarios generated by CCAM climate model. The outputs from the CCAM model used as inputs to the DSSAT model included for example, maximum and minimum temperature, precipitation, and solar radiation. These were then coupled with a crop management scheme and soil properties to calculate the rice crop yield. By using daily climate data for the simulation process, the

study was able to capture the predicted impact of climate change on rain-fed rice production not only in terms of the change in degree of intensity of each climate parameter, e.g. increase or decrease in rainfall or temperature, but also change in temporal aspect, e.g. shifting the onset, or changing the length, of rainy season; or changing in the pattern of the mid-season dry spell period. The crop management scheme used in the simulation process was based on assumed homogeneous practices at each site to simplify the calculation process. Crop management variables comprised of crop cultivars, planting field, initial condition of the field before planting, planting detail (method and plant density), water management, and both organic and inorganic fertilizer application (Snidvongs, 2006).

Rice production in Lao PDR and the North East of Thailand (Esan) are single crop cycle per year due to the length of the rainy season. The climate change from the CCAM climate model shows slight negative impact on the rain-fed rice productivity in Lao PDR. The simulated yield of rice productivity in Savannakhet Province would reduce by 10 percent under the simulated CO₂ concentration of 540 ppm

on rice cultivation in the Mekong region. However the study also points out that the results from the simulation still differs somewhat from the actual yield according to survey data from field interviews. This may be due to the assumptions made for crop management and the accuracy of other datasets used in the simulation, particularly soil properties. Despite this, the figures may be used as an indicator

TABLE 14. Simulated rice yield showing changes in productivity sites under changing climatic conditions (increasing CO₂) at two study sites in the Lower Mekong Basin

Location	Rice productivity yield shown in kg/ha			% Change compared to baseline	
	Atmospheric CO ₂ concentration			540ppm	720ppm
	360 ppm	540 ppm	720 ppm		
Lao PDR - Savannakhet Province					
Songkhone District	2,534.90	2,303.20	2,470.10	-9.14	-2.56
Thailand - Ubonratchathani Province					
Zone 1	1,154.39	1,235.14	1,330.85	7.00	15.29
Zone 2	1,919.61	2,002.15	2,072.04	4.30	7.94
Zone 3	2,363.70	2,407.62	2,438.92	1.86	3.18
Zone 4	2,542.32	2,575.03	2,591.89	1.29	1.95
Zone 5	3,024.18	3,051.44	3,068.82	0.90	1.48

Source: SEA START technical (Snidvongs, 2006).

but would increase back to almost baseline under a CO₂ concentration of 720 ppm. This can be contrasted to the simulation of rice productivity at the study site in Ubonratchathani Province, Thailand (adjacent to Savannakhet on the West bank of the Mekong), where the simulation results for indicate a trend of increasing yield for rice productivity under modeled future climatic conditions (Snidvongs, 2006).

What this modeling study shows clearly is that climate change may have both a positive and negative effect

of potential future trends in the light of climate change impacts on rice productivity in the Southeast Asia region. Another significant climate impact on rice production in the study areas is from extreme climatic events, such as floods and droughts, which previous studies mentioned in this report have shown will increase. Based on farmer interviews carried out by the SEA START team in both Thailand and Lao PDR, extreme climatic events may cause a loss of rice productivity, for example, ranging 30-50 percent during a moderate flood year.

2.1.5 Risk, Vulnerability and Climate Change

The potential loss of crops or crop productivity leads us to consider the impact of climate change on the livelihoods of the rural population. This encompasses not only the loss of crops, but includes all of the factors that increase the risks and vulnerability experiences of the poorer groups of society, largely the rural poor. According to the World Food Program (WFP 2007):

Risk = Hazards x Vulnerability.

Risk analysis helps identify populations that are likely to experience food insecurity in the future, due to the effects of a particular hazard or shock. This includes extreme climatic events. Risk analysis can therefore be used to identify geographic areas and populations at risk. This enables decision-makers to plan appropriate interventions, highlight factors contributing to increased vulnerability among households, and estimate the effects of these factors on households. Risk analysis has three main stages:

1. Study the occurrence of various hazards, their geographical and temporal extent and historical impact;
2. Explore households' vulnerability to a particular type of shock;
3. Based on the first two steps, estimate the number households who are at risk of becoming food insecure because of a specific hazard (WFP, 2007).

The definitions as outlined by WFP are (WFP, 2007):

- Hazard (hazard risk): probability of occurrence of a potentially damaging phenomenon within a given time period and area.
- Vulnerability: increased susceptibility of households to the impact of specific hazards.
- Risk: probability of harmful consequences, or expected losses (specifically with regard to food security) resulting from interactions between hazards and vulnerable conditions.

Vulnerability to becoming food insecure because of a particular shock, such as climate change, depends on the exposure of a household to that shock and on its capacity to cope with the effects of the shock. Exposure depends mainly on how extensively households depend on livelihood activities that will be negatively affected by a particular shock. For example, farmers are more exposed to droughts than traders. For this reason, households reduce

their exposure by diversification and try to depend on various livelihood activities that are exposed differently to hazards. For example if a household relies on both rice and capture fisheries, it may fall back on fish during a flood. The coping capacity of a household depends on the strategies it deploys to obtain sufficient food, in spite of the effects of the shock. Coping capacity is strongly associated with the wealth and assets of the household; and social networks and access to forest resources are also important. Households that are currently food secure and have high coping capacities are less likely to become food insecure because of a shock, whilst households with high levels of exposure to a shock and weak coping capacity (low wealth, borderline food consumption) are more vulnerable to that shock. Further, if the probability of a severe shock occurring is high, the risk of food insecurity for these households is also high (WFP, 2007).

WFP Lao (WFP, 2007) has carried out countrywide risk and vulnerability assessment, including climate risks. This study was not focused specifically on climate change but it made a clear assessment of households in Lao which were vulnerable to risk factors likely to arise from / be augmented by climate change. WFP make it clear that their analysis remains indicative and that moreover, some thresholds are based on subjective choices. The numbers presented therefore should not be interpreted as absolute, but rather as relative in order to compare risk between regions and population groups.

Climate risks are not new to Lao farmers. For example, midseason dry spells that damage young plants and late-season floods just before harvest and cause severe crop loss are recurrent threats to local livelihoods. Table 15 illustrates reported natural disasters in Lao PDR from 1966-2002 and the proportion of the Lao population who were affected by these disasters (WFP, 2007).



TABLE 15. Summary of natural disasters in Lao PDR from 1966 to 2002

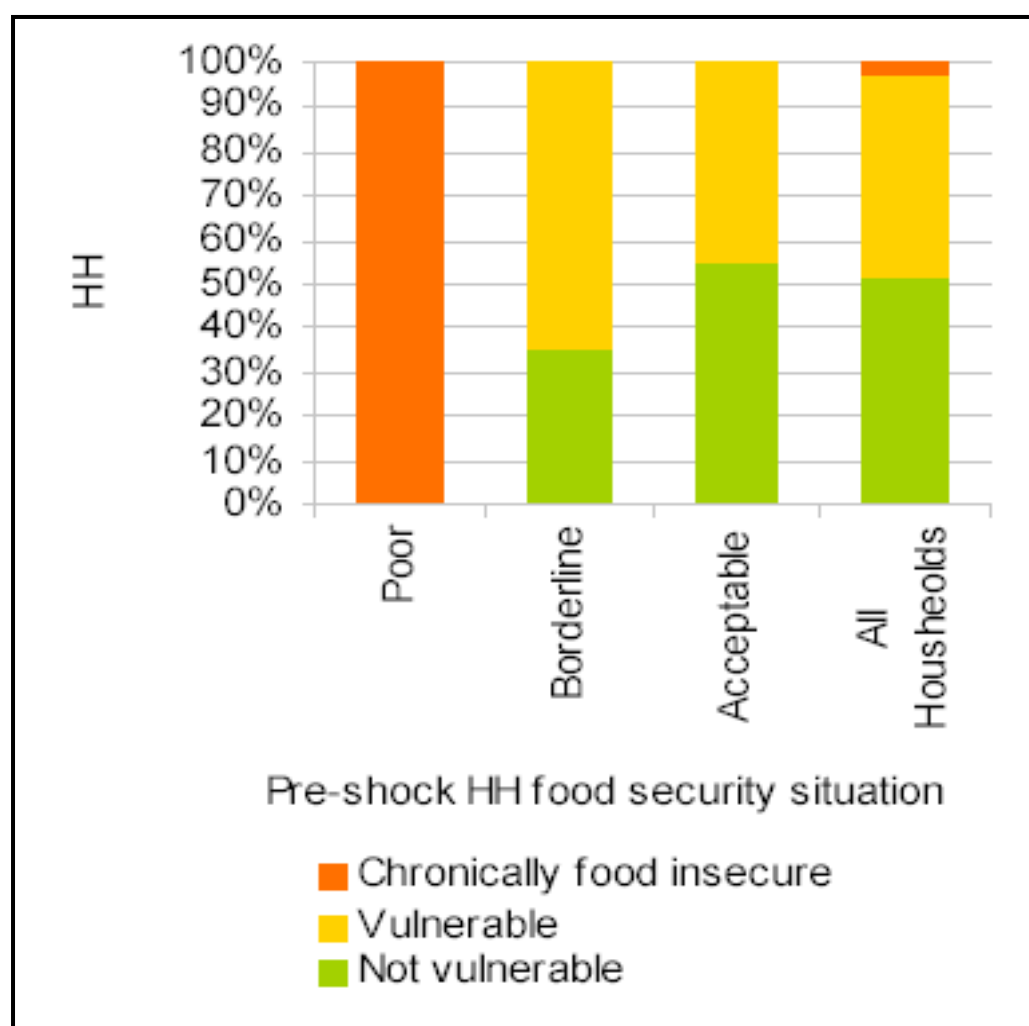
Type of event	Report number of events	Total number of people effected
Flood	16	3,244,150
Epidemic	7	19,929
Drought	5	4,250,000
Wind Storm	4	1,307,312

Source: OFDA/CRED International Disaster Database (EM-DAT) in WFP, 2007.

Households’ vulnerability to drought is proportional to their livelihoods’ exposure (non irrigated agriculture, farm labour) to drought, and to the resilience of the household. According to WFP estimates, 46 percent of the rural population in Lao PDR are vulnerable to drought, most of whom are located in the lowlands, especially in the Southern regions and in the provinces of Xayabury and Luang

Prabang. This is in addition to the 2 percent that are already chronically food insecure. Most households vulnerable to drought are farmers or (agricultural) unskilled labourers. 12 percent of agropastoralists are also considered vulnerable to drought. Figure 8 illustrates the vulnerability of households (HH) to becoming food insecure from drought in relation to pre-shock food security according to wealth group.

FIGURE 8. Vulnerability to becoming food insecure from drought in relation to pre-shock food security



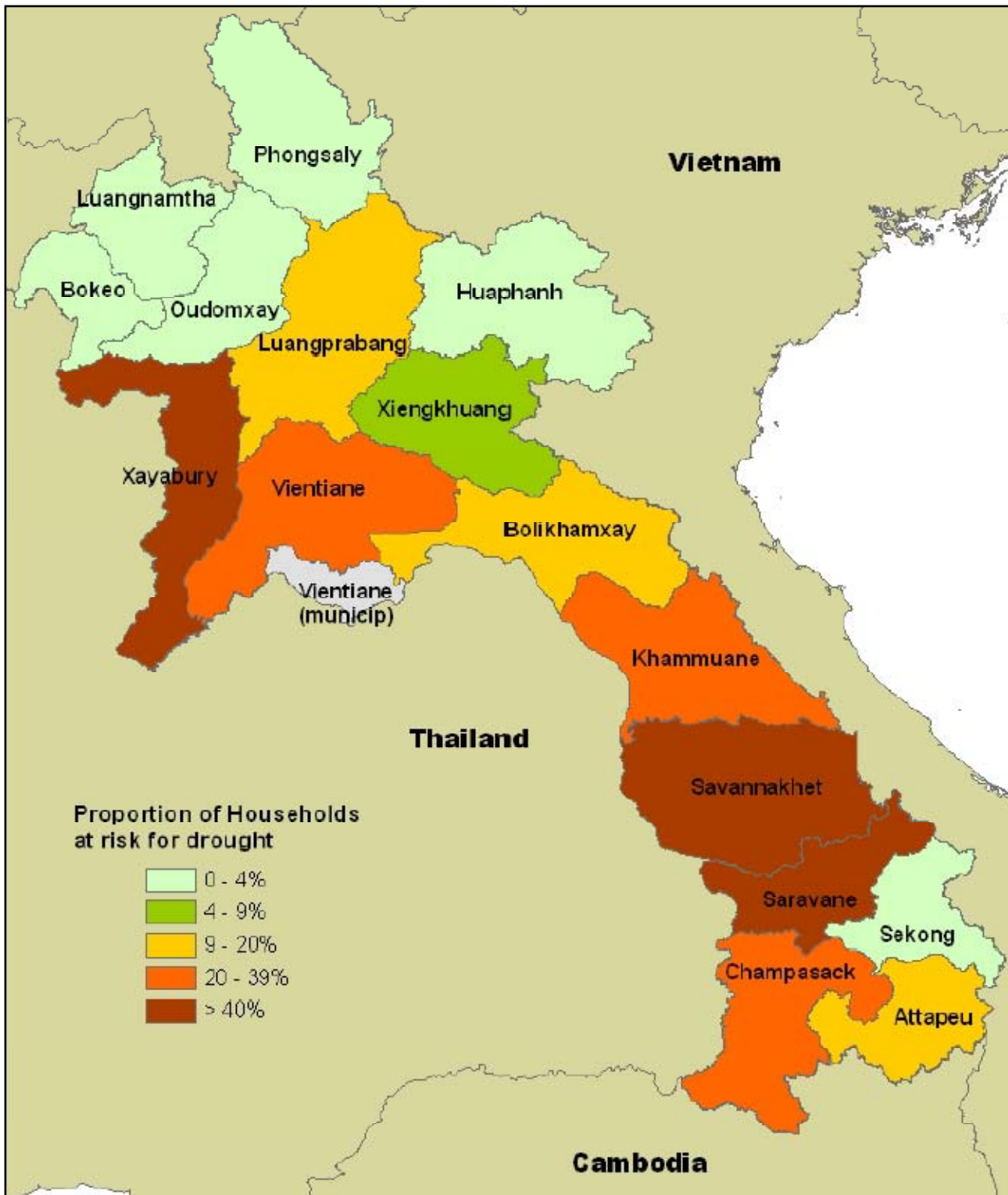
Source: WFP Lao PDR, CFSVA Community Survey, 2006, in WFP, 2007.

It is estimated that around 188,000 households in Lao PDR are at risk of food insecurity caused by drought. These vulnerable households are mostly located in Khammuane, Savannakhet, Saravane, Champasack, Xayabury and Vientiane provinces. Figure 9 illustrates the distribution of households in Lao PDR at risk of becoming food insecure because

of droughts (excluding chronically food insecure).

Further analysis of the WFP household data shows that the households at most risk from drought are mainly those farmers, farmers/gatherers and farmers/fishers/hunters that depend on rain-fed agriculture (WFP, 2007).

FIGURE 9. Households in Lao PDR at risk of becoming food insecure because of droughts (excluding chronically food insecure)



Source: WFP Lao PDR, CFSVA Community Survey, 2006, in WFP, 2007.

According to the Joint Study Team including MAF, WREA, IUCN, ADPC and PAFO, climate change is likely to enhance the severity and frequency of flood and drought in the future. Floods will increase during the rainy season and drought will increase during the dry season (Report of the Joint Study Team including MAF, STEA, IUCN, ADPC, PAFO of Attapeu, January 2005). Floods and droughts are the most common hazards that climate change poses to Lao PDR. Due to the fact that the

majority of the population still relies on agriculture for their livelihoods, the occurrence of either floods or droughts severely affects the agricultural sector (crop, livestock and fisheries). The areas of Lao PDR most vulnerable to flooding are the plain areas along the Mekong River in the central and southern parts. Areas in the north, especially very northern and most north-western parts of the country are more prone to drought or rice insufficiently, as illustrated in Figures 10 and 11.

FIGURE 10. Areas affected by the disaster in 1995

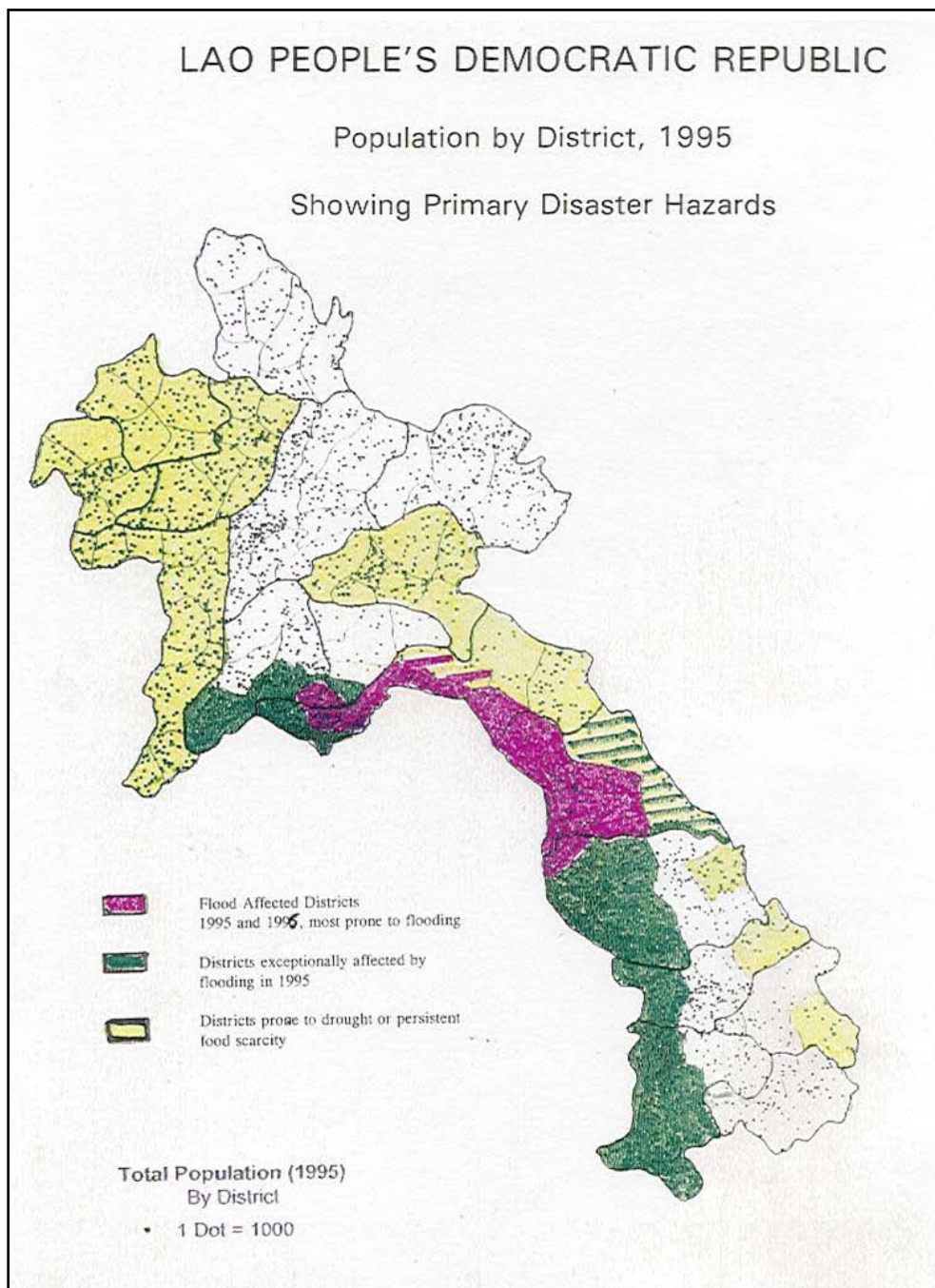
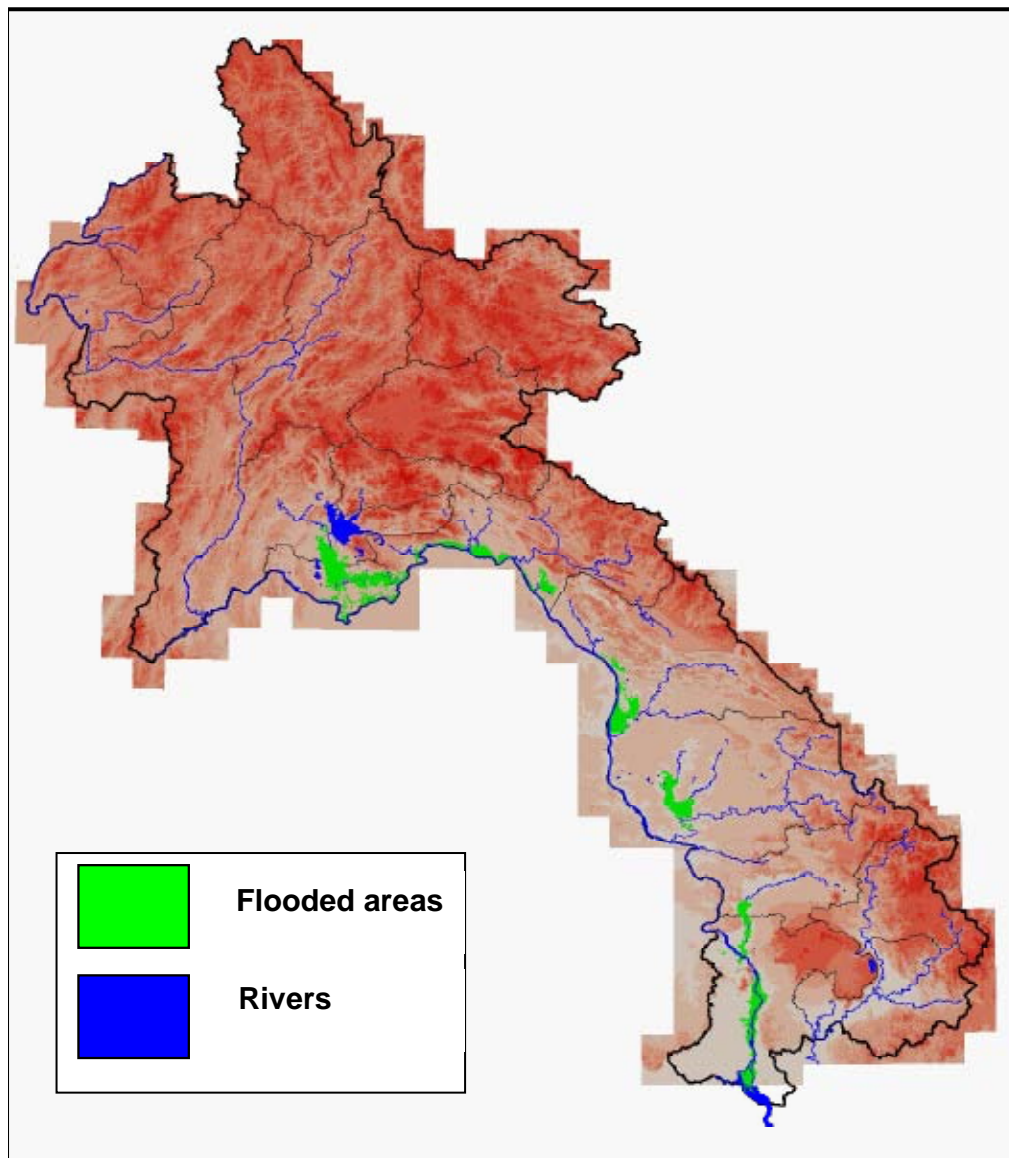


FIGURE 11. Flooding in the central and southern regions in 1995

Source: DOI, MAF, LRIAD Project, July 1999.

As we have already discussed the frequency and impacts of flooding on different sectors, we will not discuss the occurrence of floods in Lao PDR further at this stage. However the following excerpt from the WFP (2007) report, provides a household perspective on flooding and its impacts. The last sentence is particularly important to flooding in the Lao context:

The annual floods along the Mekong river are looked upon as part of the natural landscape, and communities have lived with yearly floods for generations. Villagers recognize the benefits of flooding, such as the increased availability of fish and other aquatic animals in wetlands. Even though they might lose the rice crop during a flood, the next year's rice production is likely to improve. Many factors contribute to an individual's resilience following a flood, such as health, age, and sex, but the question of livelihoods

is ultimately played out at the household level. Family members rely strongly on each other to share income and labour. Their combined assets before and after an event determine their vulnerability to floods.

Floods in this region do not often lead to deaths. However, large floods do cause housing damage, loss of equipment, and other asset damage that can impact on households' wellbeing. The number of people affected in each major flood [between 1966 – 2002] ranged from 2,000 to more than 590,000. Although rice losses and paddy field damage is a common and immediate impact on the households, most villagers reported that losing livestock was hardest for livelihood and family security.

In Lao PDR, as in many other developing countries, the family's buffaloes and cows are used as a saving mechanism. When a disaster strikes or there is a

medical emergency, families rely on selling livestock. They act as a safety net and are often the most valuable asset in the household. Across all wealth categories, the average family lost half of its cows and/or buffaloes in the 1996 flood. Buffaloes are very valuable, so this is a serious setback for many households. Cows and buffaloes also play a key role in livelihood as draught animals in the paddy fields.

Following a flood, sanitation is a major concern in the village. Gastrointestinal diseases may persist for weeks after a flood. In addition to human health impacts, diseases may also affect many of the animals surviving a flood.

All households in a flooded area will be affected, regardless of their wealth status and livelihood strategies. However, households will be worse off if they depend on agricultural crop production, livestock production, labour and other activities inside the flooded area. In view of the above, all households living in flood prone areas are considered to be “at risk”.

As this exert also points out, rural households use many natural resources in addition to agricultural land to supplement their livelihood. These other livelihood strategies include fishing, collection of non-fish animals and plants from wetland areas (including rivers, ponds, lakes and swamps), and the collection of both timber and non-timber forest products. These resources may also be used directly by the household or sold for cash income, so that access to a range of ‘common’ natural resources represents a safety net or ‘insurance policy’ for rural households. It follows then that any loss of these resources or loss of access to them represents a significant threat to household security and forces families into a vulnerable situation.

One of the main challenges faced today by the GoL concerns how to manage the impacts associated with a loss of forest and wetland biodiversity. The high dependency on natural resources for food security and income generation makes rapid environmental degradation an issue of particular concern and urgency. Whilst both national and international environmental regulations exist to protect these natural resources, limited resources and lack of capacity at the national

and local levels make enforcement very weak. This situation is only likely to be exacerbated by climate change, as there will be higher pressure on dwindling common natural resources. When rice crops fail, villagers all turn to the forests and wetlands to provide basic foods. If the forest has been cleared for to make way for a rubber plantation and the wetland has been drained for agriculture or flooded for hydropower, where will vulnerable households find food?

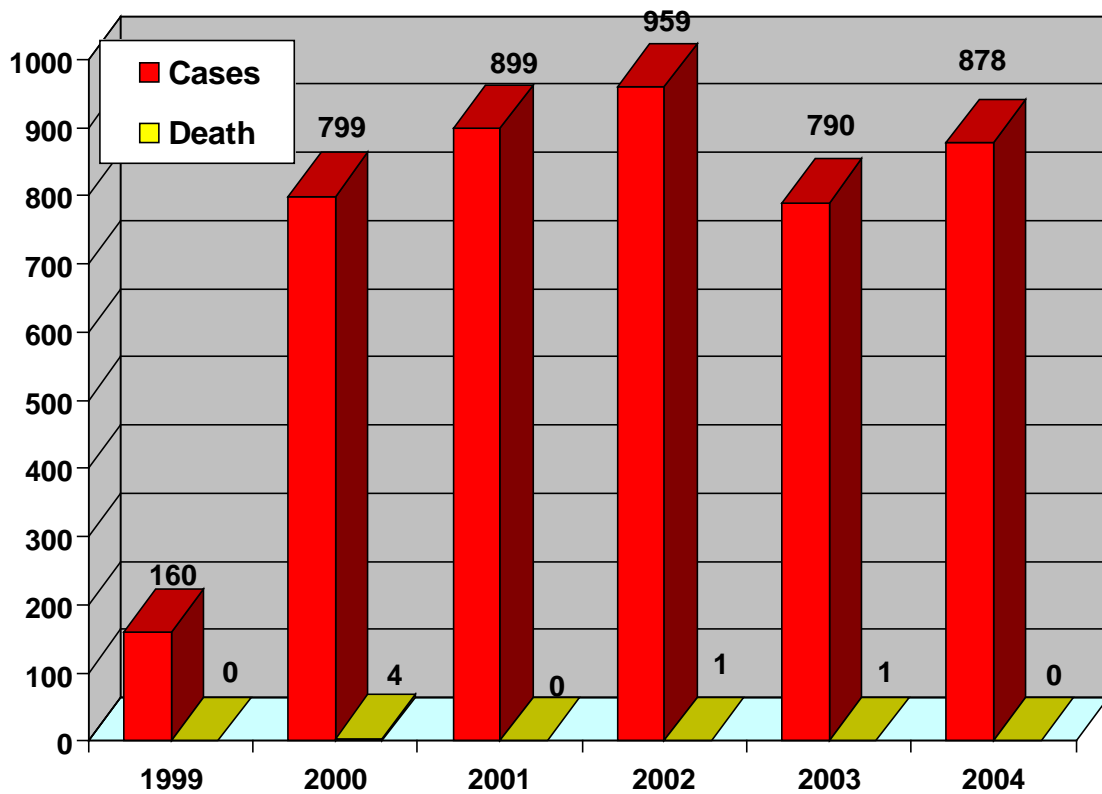
According to the Comprehensive Food Security and Vulnerability Analysis (CFSVA) of the WFP (2007):

Households affected by continuous degradation of forest resources, or by reduced access to natural resources, would have less access to wild vegetables, fruits, fish, other aquatic resources and wild meat. A limited number of households would also lose cash income from selling forest products. Overall, it is estimated that around 157,000 ($\pm 20,000$) households, or 24 percent of the people in rural Lao PDR, would become food insecure if fishing, hunting and gathering were less productive or reduced. In this risk analysis, other factors such as threats due to trade, unsustainable harvest, and environmental degradation following the development of hydropower and mining schemes, rapid and uncontrolled land use planning and management (e.g. large-scale concessions for rubber plantations) are not factored in.

2.1.6 Adverse Impacts of Climate Change on Human Health

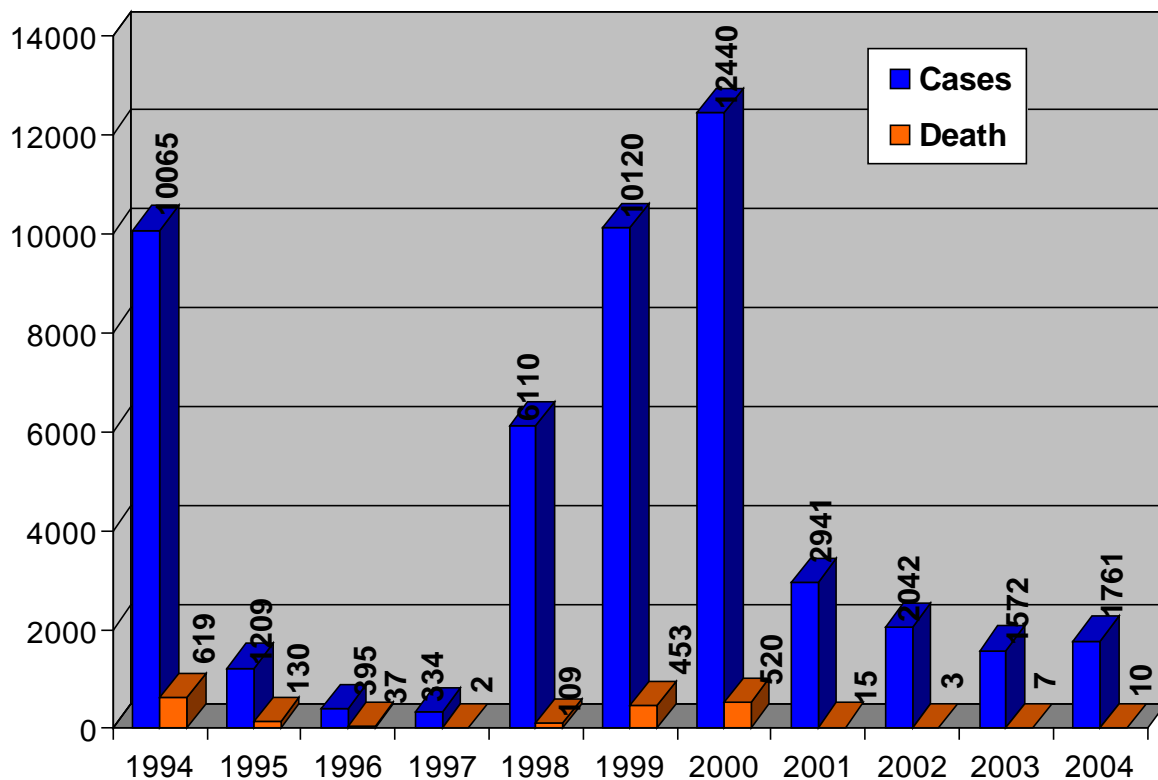
Floods and droughts not only cause great losses to the national economy, they also affect the livelihoods of the people by creating a public health hazard, increasing the likelihood of disease outbreaks such as smallpox, malaria, diarrhoea, dysentery, dengue fever and pneumonia. In 2005 alone, more than 10,000 cases were recorded (Department of Sanitary and Disease Prevention, Ministry of Public Health, 2005). The increase and spread of such diseases over the last 10 years, in parallel with floods and droughts, is shown by Figures 12 to 15.

FIGURE 12. Comparison of different cases and deaths resulting from unidentified dysentery from 1999-2004



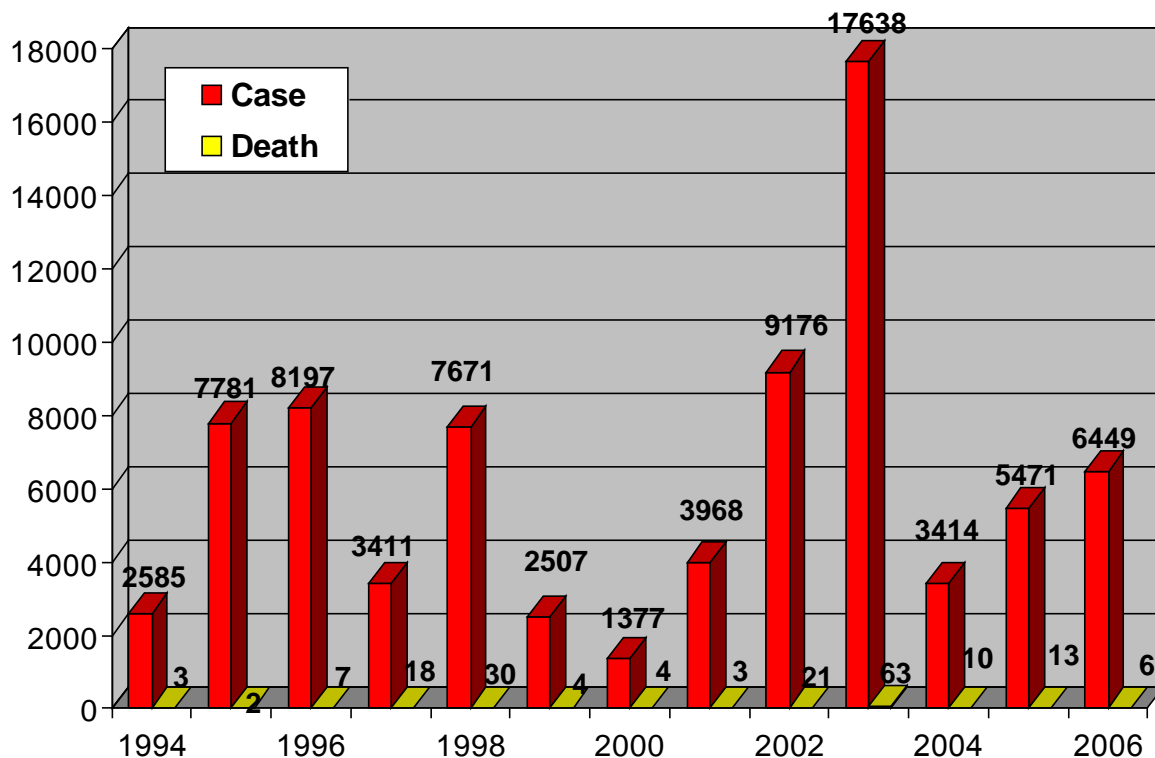
Source: Division of Disease Pandemic, Pandemic and Diagnostic Centre, Ministry of Public Health.

FIGURE 13. Comparison of different cases and deaths resulting from diarrhoea, from 1994-2004



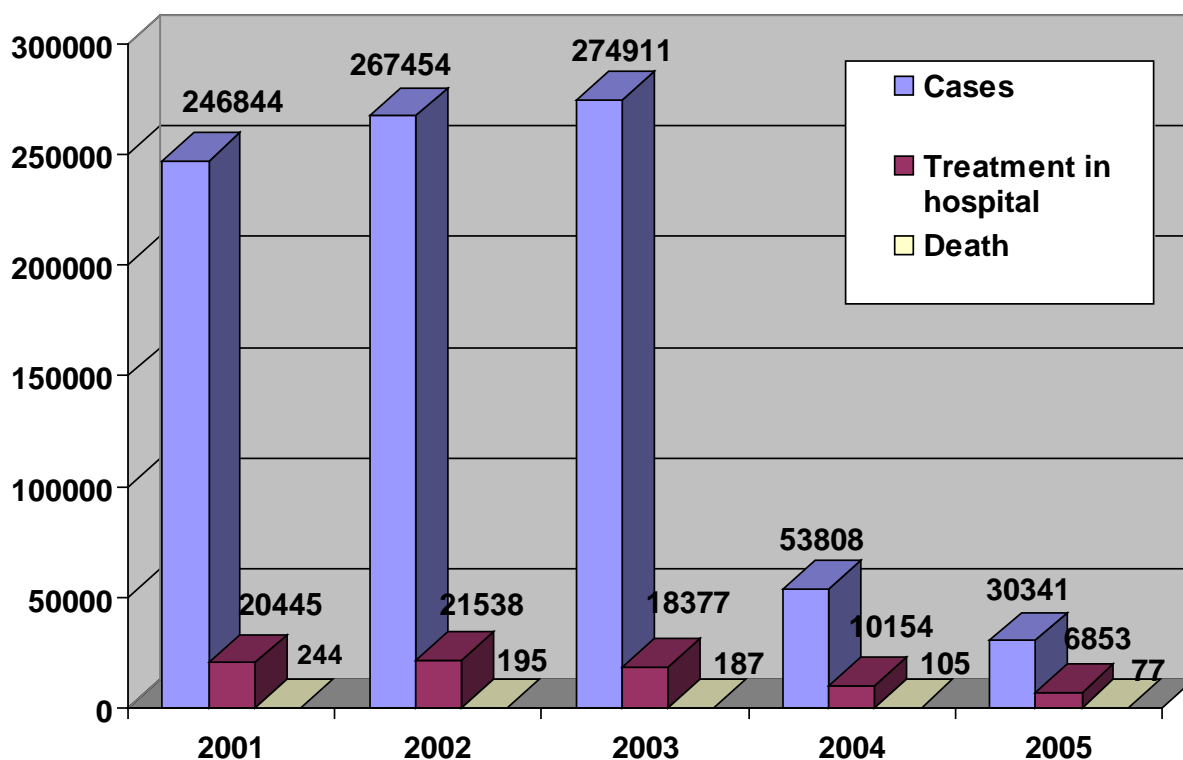
Source: Division of Disease Pandemic, Pandemic and Diagnostic Centre, Ministry of Public Health

FIGURE 14. Comparison of different cases and deaths resulting from dengue fever (DF, DHF and DSS), from 1991 - 2006

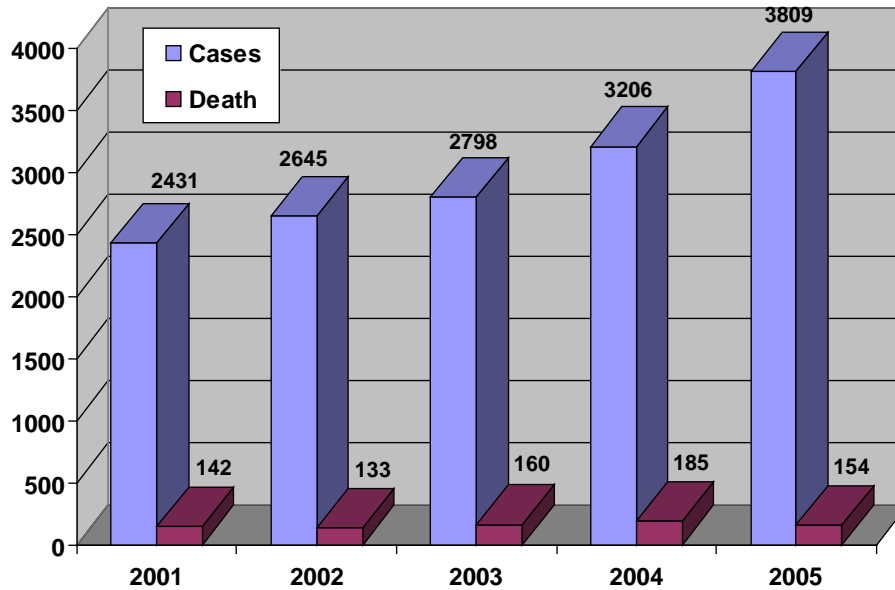


Source: Statistics Centre 1991-1997, Division of Disease Pandemic, Pandemic and Diagnostic Centre, Ministry of Public Health.

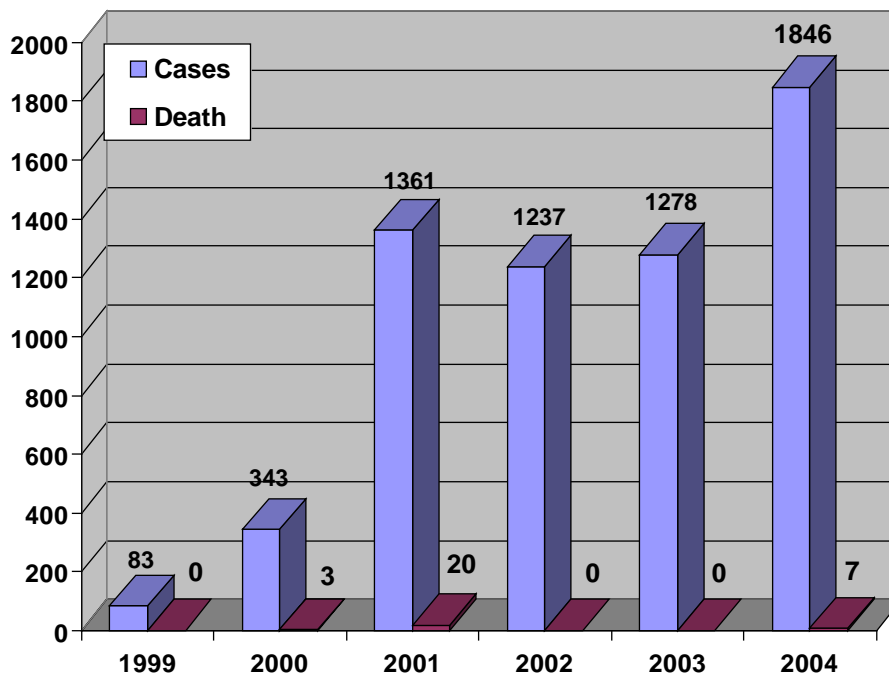
FIGURE 15. Comparison of different cases and death resulting from malaria



Source: Malaria Prevention Centre.

FIGURE 16. Comparison of different cases and deaths resulting from pneumonia

Source: Pneumonia Prevention Centre.

FIGURE 17. Comparison of different cases and death resulting from smallpox

Source: Disease Pandemic Diagnostic Centre, Ministry of Public Health.

Clearly while some water related diseases such as malaria seem to be on the decrease in Lao PDR, others including dengue and dysentery appear to be increasing, while extremely contagious diseases such as smallpox are increasing in occurrence even though mortality rates remain relatively low.

Whilst all of these diseases are preventable with simple measures including basic hygiene, the

provision of sanitary latrines, removal of stagnant water and the use of bed nets, all such precautions become ineffective during widespread flooding. Therefore, if serious flooding events increase due to climate change, Lao is likely to experience an increase in both occurrence and deaths due to mainly stagnant water related, mosquito borne diseases.

2.2 NAPA FRAMEWORK AND RELATIONSHIP TO NATIONAL DEVELOPMENT PLANS AND MULTI-LATERAL ENVIRONMENTAL AGREEMENTS (MEAS)

2.2.1 NAPA Framework



The NAPA focuses on reviewing various strategies and measures for managing disasters in the past, present and future, as well as strengthening capacity and assessing alternatives for adaptation to the potential impacts of climate change. In addition, the NAPA identifies urgent needs associated with effectively mitigating and adapting to climate change, with a particular focus on the key sectors that are likely to be negatively affected, namely agriculture, forestry, water and water resources and public health. Within this NAPA document 45 priority project proposals are identified which address the needs of climate change adaptation in these key sectors in Lao PDR.

2.2.2 Relationship to National Development Plans and MEAs

As mentioned above, NAPA is one of the many environmental management projects which is directly linked with all national development strategies and policies, including the National Action Plan (NAP) to Combat Drought and Desertification, and Eight National Priority Programmes, National Growth and Poverty Eradication Strategy (2004), and the 5th National Socio-Economic Development Plan (NSEDP) 2006-2010. NAPA identifies strategies that focus primarily on improving the livelihoods of communities that have low adaptive capacity and are vulnerable to any kinds of climate change hazards, gradually minimizing the impacts of climate change by improving food security, ensuring the sustainable use and management of natural resources, and building the capacity of relevant staff.

The development of the NAPA is not only in line with sustainable development goals, priority environmental problems and sound natural resource management, but it also contributes to the commitments of the Lao PDR under the conventions and MEAs to which Lao PDR is signatory. These include the United Nations

Framework Convention on Climate Change, United Nations Convention on Biological Diversity, United Nations Convention to Combat Desertification, Cartagena Protocol on Biotechnology Safety, Vienna Convention on the Protection of Ozone Layer, Stockholm Convention on POP, Convention on Cultural and Natural Heritage, ASEAN Agreement on the Preservation of Nature and Natural Resources, ASEAN Agreement on the use of Genetic Resources, Agreement on the Sustainable Use of Mekong Basin, and the Cooperation with GMS Countries on economic and environmental sectors. Furthermore, NAPA is also in line with the United Nations Development Assistance Framework (UNDAF): Goal 3: Sustainable Use of Natural Resources, and Protection of Cultural Heritage Adaptation activities, such as those identified in this NAPA are also important to the achievement of the Millennium Development Goals (MDGs).

2.3 BARRIERS FOR THE IMPLEMENTATION OF NAPA

One of the major constraints to the implementation of the NAPA relates to coordination and cooperation among the sectors concerned. Lao has limited access to accurate information/data and in-depth studies, and has historically had no specific agency responsible for dealing with climate change, early warning and surveillance. This is in addition to a general lack of capacity and poor cooperation between the people involved, weak ownership, low levels of awareness and unsystematic monitoring.

The second set of constraints relate to a weak institutional set-up. This can be attributed to the limited quantity and quality of personnel and a lack of appropriate tools and equipment (e.g. manuals, guidelines, posters) on how to adapt to, and cope with, the impacts of climate change.

The third set of constraints relate to low levels of public awareness on climate change issues. This includes awareness of general information, causes and impacts, and mechanisms for mitigating and adapting to climate change. Decision and policy makers, technical staff, teachers and professors of academic institutes, communities in risk prone areas, and the general public have not fully understood the above mentioned issues. General understanding of climate change issues and global warming in Lao PDR is still low. In fact, nearly everybody has been affected by the climate change, but the degree to which people have been impacted relates directly to their economic status (poor or rich) and their living location (urban or rural).

The final constraint relates to the limited budget available for the implementation of the priority adaptation activities identified in this NAPA.

III. IDENTIFICATION OF IMMEDIATE AND URGENT NEEDS TO CLIMATE CHANGE ADAPTATION

3.1 MEASURES FOR CLIMATE CHANGE ADAPTATION IN THE PAST, AT PRESENT AND IN THE FUTURE

For many decades, Lao PDR has experienced the effects of climate change to varying degrees nearly every year. Extreme climatic events have caused great damage to the country and its people's livelihoods and assets. The GoL considers this problem as an urgent and important issue in need of appropriate solution. The GoL has therefore employed its utmost efforts, and collaborated with domestic, regional and international organizations, to develop activities that prevent damage from, and strengthen adaptation to, climate change.

Since the establishment of the Lao PDR in 1975, the policies of the GoL have included social welfare issues, resettlement of war victims, and provision of emergency relief (food, basic needs and safe living places) to people affected by disasters and extreme climatic events. These activities have fallen under the responsibility of the Ministry of Agriculture and Forestry (MAF). Since 1995, GoL has assigned the Ministry of Labour and Social Welfare (MLSW) to assume responsibility for these issues. In 1999, in order to ensure the effective implementation of such activities, the National Disaster Management Committee (NDMC) was created to take lead role. The Committee consists of various stakeholders from the concerned sectors. In this connection, the National Disaster Management Office (NDMO) was set up to act as its secretariat to assist the committee in carrying out its duties.

In the past, in order to adapt to climate change, the GoL has realized a number of activities, including building embankments for flood protection of nearly 30 km in length in Vientiane Capital and in Pakse, Champasack province. The GoL has also completed the construction of Hongxaeng water drainage channel, approximately 9km long, capable of preventing floods in some parts of Vientiane Capital. In addition, many water gates have been built along



the Mekong River and its major tributaries, e.g. in Vientiane Capital, along Nam Ngum River, and along Xebangphai River. Furthermore, the GoL has invested in more than 7,000 sets of water pumps. In addition, many irrigation systems have been constructed and have the capacity to supply water to 310,000 ha during the rainy season and 215,000 ha during the dry season. Comprehensive public irrigation systems have also been developed in six northern provinces to combat drought and provide permanent livelihoods for the local people. This programme has worked satisfactorily. These activities all facilitate adaptation to climate change. At the same time, flood and drought prevention/response projects have been undertaken in cooperation with international organizations and non-governmental organizations such as the World Food Programme, Care International, Concern Worldwide (Anti-Disaster Preparation Project) and Oxfam Australia (Disaster Risk Reduction Project).

In the near future it is expected that the GoL will continue to expand irrigation systems to prevent floods and droughts, and establish an irrigation development plan to 2020. In 2003, the GoL also formulated the Disaster Management Strategic Plan, No. 1139/03, as follows.

Objectives to 2010:

1. Successfully establish District Disaster Management Committees in all districts;
2. Set up and appoint coordination points for disaster management within the main units of the public and private sectors, including factories;
3. Establish and improve information dissemination and early warning systems up to 100 percent in 142 districts nationwide;
4. Establish information reception networks for villages which are vulnerable to natural disasters;
5. Establish warehouses for storing emergency goods in every province and in some districts vulnerable to disasters;
6. Continue conducting regular warning and community-based education campaigns against disasters;
7. Organize trainings on disaster management for various sectors and at all levels;
8. Carry out demonstrations and practices with the participation of rescue units, various key sectors and the public; and
9. Improve collaboration with other countries in ASEAN, regionally and internationally to facilitate the exchange of lessons learned and relevant information; and to collaborate in implementing rescue demonstration and disaster relief projects.

Objectives to 2020:

1. Improve the safety of Lao society by mitigating the negative impacts of disasters on the lives, economies and properties of the people and Government;
2. Ensure that all disaster-affected people get adequate help and support on time, and that their livelihoods recover as fast as possible;
3. Ensure that Lao PDR has sufficient regulations and laws to mitigate the impacts of disasters on an individuals, communities, society and the economy of the country; and
4. Ensure that knowledge about disaster management and environmental protection is in line with, and integrated into, all development issues and that general public awareness is raised.

The MAF has interpreted the VIII Resolution of the Party and formulated the Agriculture and Forestry Strategy which has been integrated into the 6th Five Year National Socio-Economic Development Plan (2006-2010). It defines four goals and 13 measures namely:

Goal 1: Food Production Program;

Goal 2: Commodity Production;

Goal 3: Complete Eradication of Slash and Burn Cultivation; and

Goal 4: Sustainable Forest Management.

Measures:

1. General improvement of agriculture and forestry sector;
2. Survey and allocation of agricultural and forestry land;
3. Provide improved seeds and breeds;
4. Promote technical services and human resource development;
5. Establish village development groups;
6. Organize production and establish economic structures from local/grassroots level (bottom-up approach);
7. Develop irrigation and prevent impacts of droughts and floods;
8. Increase productivity (fertilizer, compost, seeds, techniques);
9. Quality control (Standard Production System or SPS) and disease prevention;
10. Mobilize funds and utilize aid as well as domestic and foreign investments;
11. Achieve economic success (production cost);

12. Implement, monitor and evaluate the strategy; and
13. Decentralization (management hierarchy) and cooperation among Government-people and economic sector.

3.2 URGENT NEEDS FOR CLIMATE CHANGE ADAPTATION

The elaboration of this NAPA was based on an analysis of rapid assessments and baseline data on the impacts of climate change; extreme climatic events such as floods and droughts; strategies, mechanisms and lessons learnt from the past of Lao PDR; regional and international cases; and results of consultation workshops held at the central and local levels. This revealed that in Lao PDR there are four main sectors which are directly and severely affected by climate change: agriculture, forestry, water and water resources, and public health. In this regard, the GoL NAPA Working Group identified needs and priority activities for climate change adaptation in four main sectors. These needs are prioritised in the following sections and have been divided into priority one, most urgent and priority two, less urgent groups.

3.2.1 Agriculture**Priority One:**

1. Strengthen the capacity of the National Disaster Management Committees.
2. Promote secondary professions in order to improve the livelihoods of farmers affected by natural disasters induced by climate change.

Priority Two:

3. Land use planning in hazard prone and affected areas.
4. Promotion of short-duration paddy and other cash crops in natural hazard prone areas.
5. Technical capacities of local agricultural officers in natural hazard prone areas strengthened.
6. Improve and develop crop varieties and animal species that are better adapted to natural hazard prone areas.
7. Improve and construct crop and animal disease laboratories at central and local levels and build related capacity of technical staff.
8. Train farmers on the processing and storing of human and animal food stuffs.
9. Establishment and strengthening of farmers

groups in natural hazard prone areas.

10. Promote soil improvement using locally available organic fertilizer and existing agricultural waste.
11. Develop appropriate bank erosion protection systems for agricultural land in flood prone areas.
12. Promote integrated pest management (IPM) and use of herbal medicines in pest management and livestock treatment.
13. Develop the capacity of technical staff in organic fertilizer research.

3.2.2 Forestry

Priority One:

1. Continue the slash and burn eradication programme and permanent job creation program.
2. Strengthen capacity of village forestry volunteers in forest planting, caring and management techniques as well as the use of village forests.

Priority Two:

3. Carry out surveys and identify and develop forest areas suitable for supporting seed production.
4. Promote and establish tree nurseries to provide saplings to areas at high risk from flooding or drought.
5. Raise public awareness on wildlife conservation and forest-fire prevention.
6. Set up and further strengthen the technical capacity of the forest fire management teams at provincial, district and village levels.
7. Public awareness campaign to disseminate information on forest and wildlife regulations and laws, and strengthen the implementation of these regulations.
8. Develop agro-forestry systems for watershed protection and erosion reduction in steep areas.
9. Development of small reservoirs in upland areas in order to provide water for wildlife/aquatic animals and plants during the dry season.
10. Public awareness campaign on pest and disease outbreaks in wildlife caused by natural disasters, and associated preventive measures.
11. Extension campaign on integrated forest plantation management for crop pest and disease control.
12. Conduct research and select seeds of plant species suitable for flood and drought prone areas.
13. Construct bush fire barriers / forest-fire protection buffer zones in forest conservation areas.
14. Build research capacity on wildlife pests / diseases and outbreaks of animal diseases.

3.2.3 Water

Priority One:

1. Awareness raising on water and water resource management.
2. Mapping of flood-prone areas.
3. Establish an early warning system for flood-prone areas, and improve and expand meteorology and hydrology networks and weather monitoring systems.
4. Strengthen institutional and human resource capacities related to water and water resource management.
5. Survey underground water sources in drought prone areas.
6. Study, design and build multi-use reservoirs in drought prone areas.

Priority Two:

7. Conservation and development of major watersheds.
8. Build and improve flood protection barriers to protect existing irrigation systems.
9. Improve and protect navigation channels and navigation signs.
10. Repair/rehabilitate infrastructure and utilities damaged by floods in agricultural areas.

3.2.4 Public Health

Priority One:

1. Improve systems for the sustainable use of drinking water and sanitation with community participation in flood and drought prone areas.
2. Improve knowledge and skills of engineers who design and build water and sanitation systems.

Priority Two:

3. Raise public awareness on sanitation in flood prone areas.
4. Improve and standardise the quality of drinking water.
5. Expand epidemic disease diagnostic laboratories at regional and provincial levels to provide disease epidemic information in a timely fashion to flood and drought affected areas.
6. Prevention and treatment of water borne diseases.
7. Develop a timely and accurate reporting system for epidemic diseases.
8. Improve the capacity of the epidemic disease surveillance system.

IV. PRIORITY CLIMATE CHANGE ADAPTATION ACTIVITIES AND SELECTION CRITERIA

4.1 CRITERIA FOR SELECTING PRIORITY CLIMATE CHANGE ADAPTATION ACTIVITIES

On the basis of advice received from the NAPA Least Developed Countries Expert Group, the NAPA must address natural disasters resulting from climate change and outline adaptation activities that will complement the GoL's existing strategic plans. In this respect the NAPA should be linked to key sector plans that address economic and social development and poverty eradication. An analysis of development plans, together with the Biodiversity Action Plan, National Action Plan to Combat Desertification, and Chapter 4, clause 15 of the NAPA guidelines (Sustainable and Cost Effective Development), facilitated the identification of four criteria for selecting climate change adaptation activities:

1. Activities must deal with a variety of degrees of severity of impacts from climate change;
2. Contribute to poverty reduction;
3. Linkages with other Multilateral Environmental Agreements;
4. High value for economy and society.

On the basis of the four criteria mentioned above, and based on the Guidelines detailed in chapters 15 and 16, the Lao PDR NAPA team has selected a set of criteria for the selection of priority adaptation activities which are in line with the National Growth and Poverty Eradication Strategy (NGPES, June 2004) and comply with the Lao situation (MDG, 2000).

Criteria for the selection of priority activities in the sectors of Agriculture, Forestry, Water and Water Resources listed according to importance (1 is most important):

1. Loss of lives and livelihood security
2. Human health
3. Food security and agriculture
4. Availability of potable water for using and drinking (both volume and quality)

5. Infrastructure development
6. Cultural, historical and natural heritage
7. Sustainable use and conservation of biodiversity
8. Land use and forest protection (reduce and eradicate shifting cultivation by 2010)
9. Other environmental amenities
10. Administrative and personnel capacity building

Criteria for the selection of priority activities in the Public Health Sector:

1. Lives and livelihood security;
2. Human health;
3. Food security and agriculture;
4. Availability of potable water for using and drinking (both volume and quality);
5. Infrastructure development; and
6. Administrative and personnel capacity building.

4.2 PROJECT PROPOSALS OF PRIORITY CLIMATE CHANGE ADAPTATION ACTIVITIES

In the preparation of NAPA, 45 priority project proposals were identified to implement adaptation activities in four main sectors: agriculture, forestry, water and water resources, and public health. These proposals were identified, screened and prioritized by the multi-sector TWG on climate change. According to the priorities stated above, 12 priority one project proposals were selected and these are outlined below. The remaining 33 priority two project proposals are attached to this document in Appendix I.

4.2.1 Priority One Project Proposals for the Agriculture Sector

PROJECT 1: STRENGTHEN THE CAPACITY OF THE NATIONAL DISASTER MANAGEMENT COMMITTEES

PROJECT RATIONALE

In the past and at present, the performance and response of the National Disaster Management Committees (NDMCs) to floods and droughts has been weak, especially in terms of coordination and the translation of policies into action and successful results. As a result, activities aimed at improving welfare of those people affected by floods and drought frequently have not reached target groups in a timely manner. Thus, it is necessary to build the Committee's knowledge of related policies and their ability to interpret these into actions that span from central to local levels in a timely fashion.

DESCRIPTION

Objectives

- Improve and strengthen the capacity and knowledge of NDMCs in the prevention and mitigation of the impacts of climate change (with a particular emphasis on extreme climatic events floods and droughts).

Activities

- Review and improve policies, and strengthen institutions involved in both adaptation to, and mitigation of, climate change impacts (USD 0.2 million).
- Train NDMC members on the mitigation of the impacts of floods and droughts, from the local to the national levels (USD 0.3 million).
- Exchange lessons and information through various mechanisms that include study tours, both in Lao PDR and abroad (USD 0.5 million).

Short-term outputs

- Knowledge and capacity of NDMC members improved.
- Related institutional structure and policies strengthened.
- NDMC has the capacity to deal with problems in a timely and effective manner, through the translation of relevant policies into practice.
- Data/information and coordination networks both in Lao PDR and abroad established.

Potential long-term outcomes

- Human resources at the central and local levels strengthened to effectively facilitate adaptation to, and mitigation of, climate change impacts.
- Organizations at the central and local levels strengthened.

IMPLEMENTATION

Implementing agency

National Disaster Management Office supported by relevant organizations.

Project location

Central and local levels.

Time frame

3 years

Budget

US\$1 million

Risks and barriers

- Irregular involvement of NDMC members in project activities.
- Coordination issues amongst the members of the Committee.
- Members of the Committee have too many tasks.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: policies and institutional structure improved; number of staff trained and capacity strengthened; number of network offices at both central and local levels; and number of national- international linkages developed.

PROJECT 2: PROMOTE SECONDARY PROFESSIONS IN ORDER TO IMPROVE THE LIVELIHOODS OF FARMERS AFFECTED BY NATURAL DISASTERS INDUCED BY CLIMATE CHANGE

PROJECT RATIONALE

Farmers in natural disaster affected areas rely primarily on agriculture and agriculture related income for their livelihoods. However, agricultural activities are particularly susceptible to the impacts of extreme weather events, i.e. floods and drought. Thus, promotion of secondary occupations and livelihood diversification is important to decrease the vulnerability of those living in natural disaster affected areas.

DESCRIPTION

Objectives

- To decrease the vulnerability of farmers living in drought and flood prone areas through livelihood diversification and the development of secondary occupations.

Activities

- Survey and collect data on livelihood diversification possibilities and improved marketing in natural disaster affected areas (USD 0.15 million).
- Study and analyze survey data to prioritize activities which diversify livelihoods and promote secondary occupations (USD 0.05 million).
- Implement the prioritized activity plan and provide associated training and capacity building (USD 0.35 million).
- Project monitoring and evaluation (USD 0.12 million).
- Dissemination of results to other geographical areas (USD 0.15 million).

Short-term outputs

- Opportunities for livelihoods diversification and secondary occupations are identified and introduced to farmers in drought and flood prone areas.
- Livelihood vulnerabilities of farmers in flood and drought prone areas are decreased, and incomes are increased.

Potential long-term outcomes

- Farmers exposure to risks associated with natural disasters is reduced.
- Incomes of farmers living in natural disaster affected areas are increasingly secure.
- Adaptive capacity of farmers to the impacts of extreme weather events associated with climate change are improved.

IMPLEMENTATION

Implementing agency

Ministry of Agriculture and Forestry (National Agriculture and Forestry Extension Service) supported by relevant agencies.

Project location

Three pilot sites located in the most drought and flood prone areas of the country.

Time frame

3 years

Budget

US\$ 0.82 million

Risk and barriers

- Farmer may not be interested in participating.
- Knowledge and skills of farmers related to the development of secondary occupations may be low.
- Potential for secondary livelihoods in natural disaster prone areas may be limited.
- Market uncertainty.

Monitoring and evaluation

Potential monitoring evaluation indicators include: changes in number of farmers with secondary livelihoods; and levels of diversification of the income sources of farm households.

4.2.2 Priority Two Project Proposals for the Forestry Sector

PROJECT 1: CONTINUE THE SLASH AND BURN ERADICATION PROGRAM AND PERMANENT JOB CREATION PROGRAM

PROJECT RATIONALE

Slash and burn agricultural practices are a main cause of watershed degradation. One of the development strategies of Lao PDR is to replace slash and burn with permanent land use systems that support rural livelihoods. Unless slash and burn cultivation is controlled, deterioration of watershed ecosystems will continue and the impacts of climatic variability will increase in severity. To date, the implementation of the 'end slash and burn' plan has been slow due to technical and financial limitations. Implementation must be urgently accelerated.

DESCRIPTION

Objectives

- Replace the slash and burn agriculture with permanent livelihoods.

Activities

- Intensive technical training for relevant project implementation personnel in project management and administration (USD 0.3 million).
- Improve management systems (software and hardware) (USD 2 million).
- Replace slash and burn agriculture with appropriate agricultural land use systems (USD 10 million).
- Monitor and evaluate implementation (USD 0.3 million).

Short-term outputs

- Capacities of project personnel in project management and administration increased.
- Management systems improved.
- Shifting cultivation reduced.
- Appropriate agricultural land use systems replace slash and burn.

Potential long-term outcomes

- Restoration of watershed ecosystems.
- Sustainable livelihoods of upland farmers improved.
- Adaptive capacity of upland farmers increased.

IMPLEMENTATION

Implementing agency

Ministry of Forestry and Agriculture, Forest Resources Conservation Department and Forest Inventory and Planning Center, with support of related agencies.

Location

Watersheds with slash and burn practices and susceptible to extreme climatic events in Bokeo, Luang Namtha, Oudomxay, Luang Prabang and Huaphanh Provinces.

Time frame

5 years

Budget

USD 12.6 million

Risk and barriers

Low levels of acceptance of farmers; cultural and spiritual factors; and low levels of education of the people living in target areas.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; sound project management and administration as evidenced in regular reports and successful audits; total number of people who convert from of shifting agriculture to more permanent land use systems; sustainability of introduced land use systems; and key indicators of improved livelihoods.

PROJECT 2: STRENGTHEN CAPACITY OF VILLAGE FORESTRY VOLUNTEERS IN FOREST PLANTING, CARING AND MANAGEMENT TECHNIQUES AS WELL AS THE USE OF VILLAGE FORESTS.

PROJECT RATIONALE

Community forests are important sources of timber and non-timber forest products for rural communities. With appropriate management, community forests can be used in a manner that maintains a healthy ecological balance within the watershed ecosystem. With increasing demand for forest products in rural communities, enhancing the management capacity of relevant parties is critical for sustained use of forest resources and watershed protection, particularly in areas prone to natural hazards, such as those affected by floods and drought.

DESCRIPTION

Objectives

To increase technical the capacity of forest volunteers in community forest management.

Activities

- Provide technical training to forest volunteers in areas prone to natural hazards. (USD 0.7 million).
- Evaluate the post-training performance of forest volunteers to improve the training activities (USD 0.2 million).

Short-term outputs

- At least 600 forest volunteers trained in planting, caring for, and managing community forests.
- Management of community forests improved.

Potential long-term outcomes

- Sustainable use of forest products from community forests is ensured.
- The degree of protection provided to the watershed from community forests is increased.

IMPLEMENTATION

Implementing agency

Ministry of Agriculture and Forestry, Department of Forestry, District Agriculture and Forestry Extension Office.

Location

Luang Prabang, Vientiane, Khammouane, Saravane and Attapeu Provinces.

Time frame

2 years

Budget

US\$ 900,000

Risk and barriers

Availability of forest volunteers to participate in the training courses.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of forest volunteers trained; number and area (ha) of community forests with improved management systems; and changes in efficiency of forest resource utilization.

4.2.3 Priority One Project Proposals for the Water and Water Resources Sector

PROJECT 1: AWARENESS RAISING ON WATER AND WATER RESOURCE MANAGEMENT

PROJECT RATIONALE

Water resources in Lao PDR are abundant, but are not equally distributed. Availability of water resources and accessibility to water supply varies greatly between and within regions. Moreover, variations in water supply, particularly in drought or flood prone areas poses serious problems for domestic and agricultural uses. Raising public awareness about the scarcity of water resources and promoting efficient water utilization can contribute substantially to its effective use. To date, no activities to raise public awareness about water scarcity have been carried out in Lao PDR.

DESCRIPTION

Objectives

Conduct public awareness raising campaign in management of water and water resources.

Activities

- Provide training for responsible personnel in the realization of public campaigns on efficient water and water resource management (USD 0.015 million).
- Prepare publication materials and manuscripts that promote proper management of water and water resources for broadcasting to the general public (USD 0.03 million).
- Realize public awareness raising campaign on management of water and water resources (USD 0.025 million).
- Disseminate publications to general public in urban and rural areas (USD 0.03 million).

Short-term outputs

- Materials on efficient management of water and water resources are published.
- Public aware of issues related to water scarcity, proper utilization of water and conservation of water resources.

Potential long-term outcomes

- Increased public participation in water and water resource management.
- Efficiency of water use and water resource allocation increased.
- Adaptive capacity of those farmers exposed to floods and drought increased.

IMPLEMENTATION

Implementing agency

WRCC Secretariat Office with support of relevant line agencies

Location

Nation-wide

Time frame

2 years

Budget

USD 0.1 million

Risk and barriers

Continuity of public awareness raising after the completion of this project; and limited communication means to reach rural areas.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of booklets and materials that are produced; frequency of radio/television broadcasting; and number of documents disseminated to the public.

PROJECT 2: MAPPING OF FLOOD-PRONE AREAS

PROJECT RATIONALE

The process of realizing the NAPA has indicated that maps and databases of information on natural hazard prone areas are either limited or non-existent. Information on flood-prone areas is not sufficient for the GoL to efficiently pursue its medium and long-term plans to enhance the adaptive capacity of communities to climatic variability and extreme climatic events. With modern information technology and associated facilities it is possible to collect detailed information on flood and drought-prone areas, and this information can be integrated into a national information network that supports national sustainable development planning processes.

DESCRIPTION

Objectives

Conduct mapping of flood-prone areas in Lao PDR.

Activities

- Review and select appropriate mapping tools, taking into consideration compatibility with national information system (-).
- Training of personnel in mapping (USD 0.05 million).
- Purchase of software and hardware needed for mapping (USD 0.1 million).
- Conduct mapping of flood-prone areas, linking maps and associated databases into a national information system (USD 0.5 million).

Short-term outputs

- National capacities related to the use of mapping technologies enhanced.
- Software and hardware for mapping purchased and being utilized.
- Information system for flood-prone areas developed.
- National information system for planning processes improved.

Potential long-term outcomes

- National development planning processes actively consider and plan for climatic variability and floods.

IMPLEMENTATION

Implementing agency

Department of Meteorology and Hydrology and Irrigation Department, with support from relevant line agencies.

Location

Vientiane Capital, Vientiane, Borikhamxay, Khammouane, Savannakhet, Saravane, Attapeu and Champasack Provinces.

Time frame

2 years

Budget

USD 0.65 million

Risk and barriers

Lack of specialists in mapping technologies and high cost of software and hardware.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; number of mapping facilities improved; and database of maps developed.

PROJECT 3: ESTABLISH AN EARLY WARNING SYSTEM FOR FLOOD PRONE AREAS, AND IMPROVE AND EXPAND METEOROLOGY AND HYDROLOGICAL NETWORKS AND WEATHER MONITORING SYSTEMS.

PROJECT RATIONALE

Improving capacities to adapt to climate change variability involves enhancing efforts that prevent or reduce potential damage to rural communities and their properties and lives. The tragedies caused by flooding in Oudomxay province both justify and emphasize the importance of such an approach. Early warning systems are an important tool that can be used to alert the public of potential flooding in those areas at risk. To be effective, warning systems must be based on accurate meteorological and hydrological networks which are currently lacking in Lao PDR.

DESCRIPTION

Objectives

Establish an effective early warning system for priority flood prone areas.

Activities

- Identify and select three prioritized flood prone areas (USD 0.1 million).
- Review the existing warning, meteorological and hydrological network in the prioritized areas (USD 0.1 million).
- Review and develop an early-warning system for the prioritized areas (-).
- Establish meteorological, hydrological and early-warning systems for prioritized areas (USD 2 million).

Short-term outputs

- Early-warning system for floods established for three critical areas.
- Meteorological and hydrological network in three critical areas enhanced.

Potential long-term outcomes

- Damages to properties and lives are reduced through the effective use of early warning systems.
- Enhancement of meteorological and hydrological network.
- Vulnerability of communities to floods in three priority areas reduced, while adaptive capacity is increased.
- Early warning systems serve as a model that can be expanded to include all flood prone areas in Lao PDR.
- Early warning system integrated with related regional and global systems and networks.

IMPLEMENTATION

Implementing agency

Meteorological and Hydrological Departments, in close collaboration with the NDMO and relevant line agencies.

Location

Three flood prone areas located in Luang Namtha, Khammouane, Savannakhet and Attapeu Provinces.

Time frame

2 years

Budget

USD 2.2 million

Risk and barriers

Lack of human resources and high costs associated with system maintenance.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: quality of the system developed; and effectiveness of the use of the system.

PROJECT 4: STRENGTHEN INSTITUTIONAL AND HUMAN RESOURCE CAPACITIES RELATED TO WATER AND WATER RESOURCE MANAGEMENT

PROJECT RATIONALE

Despite the importance of water resources to socio-economic development, the existing institutional framework for water and water resource management in Lao PDR is relatively weak. This results in an ineffective management system that is unable to cope with a situation characterized by a growing demand and a limited supply. Institutional and human resource strengthening activities are vital for the effective management of water and water resources. This, in turn, will enable Lao PDR to better adapt to climate change.

DESCRIPTION

Objectives

- To improve the national institutional framework for water and water resource management.
- To strengthen human resource capacity for water and water resource management.

Activities

- Review and analyze the existing institutional structures related to water and water resource management (USD 0.1 million).
- Restructure relevant institutions to improve water and water resource management systems (USD 0.06 million).
- Conduct an analysis of human resource systems and design a plan of action to strengthen human resources to support the improved institutional structure (USD 0.04 million).
- Implement the human resource development program to support the new institutional structure (not included within the scope of this proposal).

Short-term outputs

- A proposed revised institutional framework for water and water resource management.
- A human resource development program that supports water and water resource management.

Potential long-term outcomes

- More efficient institutional framework for water and water resource management.
- Increased human resource capacity related to water and water resource management.
- Increased sustainability of water use and water resource conservation.

IMPLEMENTATION

Implementing agency

WREA, WRCC Secretariat Office, Irrigation Department/MAF and relevant line agencies.

Location

Vientiane Capital

Time frame

1.5 years

Budget

USD 0.2 million

Risk and barriers

Low levels of capacity to conduct institutional analysis and the political implications of institutional restructuring may affect the implementation of the recommendations developed.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: revised institutional framework; and human resource development program.

PROJECT 5: SURVEY UNDERGROUND WATER SOURCES IN DROUGHT PRONE AREAS.

PROJECT RATIONALE

Water is vital for production and consumption in rural and urban areas. In a large proportion of drought-affected areas in Lao PDR, surface water is not readily available and people use groundwater. Unfortunately, groundwater availability in drought prone areas is highly uncertain, scattered and ultimately limited in quantity. Groundwater should therefore be extracted at a rate that does not exceed the associated carrying capacity. The identification of appropriate locations to access groundwater and develop groundwater systems in drought prone areas requires an accurate database of groundwater tables and information about replenishment rates. This information is seriously lacking in Lao PDR and as a result the adaptive capacities of households located in drought-prone areas is questionable over the long run.

DESCRIPTION

Objectives

To develop a groundwater table information system for drought prone areas of Lao PDR.

Activities

- Map the existing capacity of groundwater tables (-).
- Assess the existing groundwater table database for drought prone areas (-).
- Enhance human resource capacity in groundwater table mapping and database development (USD 0.2 million).
- Purchase and install state-of-the-art software and hardware for groundwater mapping and database development (USD 0.3 million).
- Conduct groundwater mapping in drought prone areas (USD 1.5 million).
- Develop a groundwater table information system (USD 0.1 million).

Short-term outputs

- Human resource capacities in the areas of groundwater mapping and the development of groundwater information system strengthened.
- Software and hardware for groundwater information system purchased and being used.
- Database and groundwater information system for Lao PDR developed.

Potential long-term outcomes

- Groundwater being used in an efficient and sustainable manner in drought prone areas.
- Improved adaptive capacity of communities to drought.

IMPLEMENTATION

Implementing agency

MAF, Department of Irrigation, and National Center of Water and Sanitation (Nam Saat), with support from the National Statistic Center and other relevant line agencies.

Location

Drought prone areas located in the provinces of Luang Prabang, Savannakhet and Champasack.

Time frame

3 years

Budget

USD 2.1 million

Risk and barriers

Limited and basic data concerning groundwater tables.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; quantity and quality of software and hardware installed; and number of areas with groundwater table information.

PROJECT 6: STUDY, DESIGN AND BUILD MULTI-USE RESERVOIRS IN DROUGHT PRONE AREAS

PROJECT RATIONALE

The quality and quantity of water resources in natural hazard prone areas are relatively fragile and water supply often fluctuates highly. Wise and sustainable management of water resources in these areas is essential, particularly drought prone areas. Stabilized water supply can significantly reduce vulnerability and enhance adaptation to drought caused by climate change and climate variation of rural households. Small multipurpose reservoirs could support domestic water needs of farmers and reduce crop damage due to drought.

DESCRIPTION

Objectives

To construct small multi-purpose reservoirs in three critical drought prone areas.

Activities

- Survey water resource conditions in drought prone areas (USD 0.1 million).
- Select three critical drought prone areas with potential for developing small multipurpose water reservoirs (-).
- Conduct feasibility studies and design the reservoirs (USD 0.2 million).
- Construct multipurpose reservoirs as per design (USD 2 million).
- Establish management systems (-).
- Monitor and evaluate the effectiveness of the reservoirs (USD 0.05 million).

Short-term outputs

- Three small multi-purpose reservoirs constructed in critical drought areas.
- Improved water supply and water resource conservation in priority target areas.

Potential long-term outcomes

- Reduction of vulnerability to drought in priority target areas.
- Improved adaptive capacity of rural households in priority target areas.
- Improved water resource conservation.

IMPLEMENTATION

Implementing agency

WRCC with support from relevant line agencies.

Location

Three selected critical drought areas located along the road No. 9 corridor of Savannakhet Province.

Time frame

3 years

Budget

USD 2.35 million

Risk and barriers

Lack of cooperation and coordination among relevant agencies; and water rights issues amongst stakeholders.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number and capacity of reservoirs constructed; size of areas with reduced vulnerability and improved adaptive capacity; and impacts on social and economic conditions of the households located in target areas.

4.2.4 Priority One Project Proposals for the Health Sector

PROJECT 1: IMPROVE SYSTEMS FOR THE SUSTAINABLE USE OF DRINKING WATER AND SANITATION WITH COMMUNITY PARTICIPATION IN FLOOD AND DROUGHT PRONE AREAS.

PROJECT RATIONALE

In Lao PDR, water supply and sanitation systems are limited while demand for such systems is growing rapidly. Water shortage together with the use of unclean water are key determining factors in the incidence of communicable diseases, and seriously affect the health of people living in flood and drought prone areas. Thus, the improvement of existing, and construction of new, safe and sustainable water and sanitation systems is important and necessary, and should be undertaken with the widespread participation of those people who live in flood and drought prone areas.

DESCRIPTION

Objective

To ensure that people living in flood and drought prone areas have access to sufficient, clean drinking water, with reduced incidence of water borne diseases.

Activities

- Research, review and assess different possible management systems, their implications for people's health, and the associated public participation processes in flood and drought prone areas of Lao PDR (USD 0.3 million).
- Develop and implement sanitary, healthy and sustainable water use systems in a number of pilot sites (USD 0.1 million).
- Revise and improve mechanisms for public participation in water utilization and sanitation management systems (USD 0.3 million).
- Construct and maintain water supply and sanitation systems for people living in the flood and drought prone pilot sites (USD 0.3 million).
- Integrate sustainable water use and sanitation management systems into national development planning(-).

Short-term outputs

- Water supply and sanitation systems are sustainably managed.
- Water supply and sanitation systems have been constructed in a number of pilot sites.

Potential long-term outcomes

- People in the pilot flood and drought prone areas are healthier.
- People in the pilot flood and drought prone areas have reduced incidence of illness and death due to water-borne diseases.

IMPLEMENTATION

Implementing agency

MoH, Department of Hygiene and Disease Prevention, Environmental Health and Sanitation Center.

Location

In pilot sites throughout the country, especially in the flood and drought prone areas.

Time frame

2 years

Budget

USD 0.44 million

Risk and barriers

- Lack of cooperation and coordination among related agencies and stakeholders as well as amongst the communities living in the flood and drought prone areas.
- Severity of natural hazards such as drought and flood is higher than expected.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of sanitary, water use and management systems that have been developed according to specifications; number of water user groups systematically developed; and reduced incidence of water-borne diseases amongst the people living in flood and drought prone areas.

PROJECT 2: IMPROVE KNOWLEDGE AND SKILLS OF ENGINEERS WHO DESIGN AND BUILD WATER AND SANITATION SYSTEMS.

PROJECT RATIONALE

In a least developed country, development of public utilities, especially water supply and sanitation facilities is frequent slow, of low standard and generally insufficient. Lack of clean water supply and sanitation facilities (and required materials and technical knowledge) affects people's health and quality of life, particularly in those areas experiencing severe drought and flooding events. In this regard, it is necessary to improve and enhance the capacity of the technicians designing, researching and constructing water supply and sanitation facilities.

DESCRIPTION**Objectives**

To ensure sustainable, sufficient and standardized water supply and sanitation facilities for the people.

Activities

- Assess the technical capacities of existing human resources in the health sector responsible for water supply and sanitation facilities at multiple levels (USD 0.02 million).
- Formulate plans and technical training modules for technical staff in the health sector responsible for water supply and sanitation facilities (USD 0.08 million).
- Conduct training for trainers of health sector personnel responsible for water supply and sanitation in Vientiane (USD 0.05 million).
- Conduct training activities in other regions (USD 0.15 million).

Short-term outputs

- Database on capacity needs of relevant health sector staff developed.
- Training module planned and elaborated.
- Relevant staff trained.

Potential long-term outcomes

- Services provided by the Government to local communities in the area of water supply and sanitation facilities is improved.
- Improved livelihoods for the people.

IMPLEMENTATION**Implementing agency**

Central level: Hygiene and Disease Prevention Department, Environmental health and Water Supply Center of the Ministry of Health.

Provincial level: Environmental Health and Water Supply Center of the Provincial Health Office.

Location

Central and Provincial levels

Time frame

2 years

Budget

USD 0.3 million

Risk and barriers

Lack of coordination and cooperation among stakeholders and relevant agencies.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: scope and accuracy of database; number of relevant personnel trained; and number of improved water supply and sanitary facilities.

V. NAPA PREPARATION PROCESS

The process of preparing this NAPA was based on the Guidelines for Least Developed Countries Expert Group dated July 2002, and adapted to the actual situation of Lao PDR. The preparation of NAPA was based on the following eight steps:

- Step 1:** NAPA Committee and NAPA Working Group established; capacity of the Committee and Working Group strengthened.
- Step 2:** All available data on current capacity limitations in the area of climate change adaptation synthesized.
- Step 3:** Assessment of capacity limitations and climate change adaptation methods for the past, present and future in the four key sectors (agriculture, forestry, public health, and water and water resources) conducted.
- Step 4:** All possible adaptation activities that contribute towards addressing capacity limitations in the past, at present and in the future classified and summarized for the four prioritized sectors.
- Step 5:** Climate change adaptation activities analyzed.
- Step 6:** Prioritized climate change adaptation activities selected and described.
- Step 7:** Initial identification of activities that will enable Lao PDR to adapt to climate change realized.
- Step 8:** NAPA prepared, consulted, and finalized.

WREA was the key responsible agency for the preparation of this NAPA, with wide cooperation from all concerned sectors at the central and local levels.

At an early stage of the preparation process, STEA (now WREA) designated key government officials from the Department of Environment to lead the process. The primary responsible point person was the National Focal Point for the United Nations Framework Convention on Climate Change (UNFCCC). The direct roles and responsibilities of the National Focal Point included planning, supervising, delegating and organizing assessments of the immediate and urgent needs for climate change adaptation, as well as carrying out stakeholder consultations at the central and local levels. At the

same time, the NAPA Steering Committee was also established, and included different members of the concerned sectors at the central level. The Committee was primarily responsible for ensuring that the preparation of this NAPA was carried out in accordance with its set objectives and timeframe. In addition, a NAPA Technical Working Group (TWG) consisting of many key representatives from different relevant ministries at the central level was established and shared responsibilities to develop the NAPA with the NAPA Core Team. Furthermore, local and international experts were recruited to provide technical assistance to the Committee and Working Group when necessary.

The Core NAPA unit and Technical Working Group were trained by international experts on planning, assessment processes/steps, and prioritization of needs regarding adaptation to climate change. Priority sectors were selected for assessment. Presentations and open discussions with sector participants aimed at raising awareness and understanding on the background information, objectives and importance of the NAPA. These discussions and presentations facilitated broader participation of the concerned sectors in the assessment process.

Before conducting the assessment, the core responsible unit collected all available information from various resources and organized stakeholder consultation meetings with relevant sectors at central, provincial and district levels. Additional data was collected focusing on types of natural hazards which occur frequently in Lao PDR, their impacts, and their intensity. In addition, information on actual strategies, measures and adaptation activities developed in the past and present was also collected.

After obtaining this background information, the NAPA unit together with the some key members of the NAPA TWG organized and led an assessment of capacity limitations and climate change adaptation methods used both in the past and at present. A number of key representatives of various concerned sectors at central and local levels, as well as all members of the NAPA TWG and policy-makers, were all invited to participate in the assessment process. Furthermore, as part of the assessment process, three national consultation workshops were organized, which were attended by many participants amongst which were technical and administrative staff from the grassroots level. The assessment focused on four priority sectors: agriculture, forestry, water and water resources and public health. These sectors were identified as being the most affected by climate change.

After completing the assessment, the NAPA unit collaborated with key TWG members, analyzed individual adaptation options for climate change obtained from the above mentioned workshops, considered the suitability and viability of each option, and assessed whether they addressed the immediate and urgent needs of the Government and the Lao people. A national workshop was then organized and attended by representatives of central and local levels from concerned sectors to realize a detailed analysis of the activities and options listed, and then select those considered as the most immediate and urgent for implementation in the future and near future. Finally, priority activities were then determined.

The selection of priorities was carried out according to selection criteria defined by each sector. After prioritizing, an initial concept note for each of the adaptation activities identified was drafted to include in the NAPA. The concept notes were then discussed during consultation workshops by representatives from the sectors concerned at both central and local levels.

This NAPA has been consulted with all concerned sectors and parties at both central and local levels and then proposed to the Government for consideration and approval.

VI. NAPA IMPLEMENTATION MEASURES

1. Following the approval of NAPA, WREA will take the lead in collaborating with the four main sectors, agriculture, forestry, water and water resources and public health, to widely disseminate the plan throughout the country and to mobilize funds from domestic, regional and international levels to implement the 45 priority projects identified within the NAPA.
2. The sectors at each level will be assigned responsibilities for implementation, monitoring and evaluation, reporting, assessing and drawing lessons for the implementation of priority projects at regular time intervals.

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**Priority Two Project Proposals
for Adapting to Climate Change
in Lao PDR**

Priority One Agriculture Projects Contained in Section IV:

PROJECT 1: STRENGTHEN THE CAPACITY OF THE NATIONAL DISASTER MANAGEMENT COMMITTEES.

PROJECT 2: PROMOTE SECONDARY PROFESSIONS IN ORDER TO IMPROVE THE LIVELIHOODS OF FARMERS AFFECTED BY NATURAL DISASTERS INDUCED BY CLIMATE CHANGE.



Priority Two Projects:

PROJECT 3: LAND USE PLANNING IN NATURAL HAZARD PRONE AND AFFECTED AREAS.

PROJECT RATIONALE

Land uses in natural disaster prone areas need to be surveyed, and improved land uses must be designed and effectively promoted. At present, land use planning that specifically addresses vulnerability to natural hazards has not been fully integrated into overall national land use policies. This issue is of great importance for farmers living in natural disaster prone areas.

DESCRIPTION

Objective

To identify the appropriateness of land areas for agricultural production and promote improved land uses that increase the capacities of farmers to adapt to changes in climate and associated natural hazards.

Activities

- Survey and collect soil samples in natural disaster prone areas (USD 0.2 million).
- Analyze existing land uses and potential improved land use systems (USD 0.1 million).
- Develop land use databases in natural disaster prone areas (USD 0.2 million).
- Plan to integrate key land use issues into the National Agricultural Policy and Action Plan (USD 0.05 million).
- Disseminate information and organize trainings on improved land use and land management (USD 0.01 million).

Short-term outputs

- Land use database created for natural disaster prone areas.
- Increased knowledge and information on improved and beneficial land use and land management systems for natural disaster prone areas.

Potential long-term outcomes

- Rules and regulations that guide improved land uses in natural disaster affected areas have been developed and are being implemented.
- Adaptive capacity of farmers living in natural disaster prone areas is improved.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Research Institute of the Ministry of Agriculture and Forestry, with support and participation of relevant agencies.

Project location

Natural disaster prone areas around the country.

Time frame

2.5 years

Budget

USD 0.65 million

Risk and barriers

Limited capacity of technical staff; lack of technical equipment; and limited existing data/information.

Project monitoring and evaluation

Potential monitoring and evaluation indicators include: scope and accuracy of databases on natural disaster prone areas; land use plans; and number of farmer households in natural disaster prone areas that are appropriately informed about the land use plan.

PROJECT 4: PROMOTION OF SHORT-DURATION PADDY AND OTHER CASH CROPS IN NATURAL HAZARD PRONE AREAS.

PROJECT RATIONALE

Mitigating the impacts of natural hazards is an extremely important activity that can improve the livelihoods of poor farmers living in drought and flood prone areas. Delayed rainfall and floods cause damage to crops. In this regard, providing support to farmers is urgently needed. The provision of food for consumption during times of extreme conditions can be improved by promoting short cycle crops, drought and flood resistant crop varieties, and cropping techniques that mitigate against the impacts of drought and flooding.

DESCRIPTION

Objectives

To improve the adaptive capacity of rural farmers to cope with hazardous circumstances by providing opportunities, and building the capacity of farmers affected by natural hazards to practice rotation of crops and grow short-cycle crops. This strategy will minimize crop losses and increase the diversity of crops available for consumption and income.

Activities

- Strengthen and improve capacities of both local level technicians and farmers on short-cycle cropping systems and development of rotational crops systems (USD 0.2 million).
- Build demonstration plots for growing short-term rice and other crops with farmers in the affected areas in different regions (USD 0.2 million).
- Monitor, promote and evaluate demonstration plots with local farmers (USD 0.1 million).
- Disseminate techniques for short-cycle cropping systems and for growing short-lifecycle crops to other areas affected by floods and droughts (USD 0.2 million).

Short-terms outputs

- Capacities of technical staff and farmers in the production of short-cycle cropping systems is increased.

Potential long-term outcomes

- Farmers gain experience in growing short-cycle crops.
- Living conditions of the people in affected areas are improved.
- The adaptive capacities of farmers to the conditions of areas affected by natural disasters are improved.
- Resilience of rural livelihoods improved.

IMPLEMENTATION

Institutional Arrangement

National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry, with support and participation of relevant agencies.

Project location

Areas affected by natural disasters (three sites).

Time frame

3 years

Budget

USD 0.7 million

Risk and barrier

Market dynamics: demand for produce may decrease.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of technicians and farmers trained; size of areas under short-cycle cropping systems; extent of adoption of rotational systems; and levels of farmers income.

PROJECT 5: TECHNICAL CAPACITIES OF LOCAL AGRICULTURAL OFFICERS IN NATURAL HAZARD PRONE AREAS STRENGTHENED.

PROJECT RATIONALE

Agricultural development is important, especially to countries like Lao PDR that rely heavily on their natural resource base and agricultural output. Hence, the technical capacity of local agricultural officers needs to be continuously strengthened. This is particularly so in natural hazard-prone areas where agricultural problems are often multi-dimensional and extremely complex. At present, there is limited quantity and quality of technical staff in the field of agriculture. Thus, it is important to build human capacities in this field to reduce risks and improve the adaptive capacity of farmers to natural disasters in hazard prone areas.

DESCRIPTION

Objectives

To strengthen the technical capacity of agricultural extension officers at the local level.

Activities:

- Collect baseline data (USD 0.05 million).
- Develop a capacity building plan and identify training modules (USD 0.05 million).
- Organize trainings (USD 0.2 million).
- Realization of study tours and exchange of lessons learned both within Lao PDR and abroad (USD 0.2 million).

Short-term outputs

- Training modules in place.
- Technical capacity of agricultural officers at the local level improved.

Potential long-term outcomes

- Technical officers have improved implementation capacities and are better able to effectively transfer technical knowledge to farmers.
- Adaptive capacity of farmers improved.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry, with support and cooperation of line agencies.

Project location

Central

Time frame

2 years

Budget

USD 0.5 million

Risk and barriers

Limited knowledge and capacities of technical staff; and low levels of participation by local agricultural officers.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of technicians trained; number of study tours realized; and before and after training assessment percentages.

PROJECT 6: IMPROVE AND DEVELOP CROP VARIETIES AND ANIMAL SPECIES THAT ARE BETTER ADAPTED TO NATURAL HAZARD PRONE AREAS.

PROJECT RATIONALE

Lao PDR has a very rich diversity of crop and animal species. To increase long-term adaptive capacities with respect to climate change, it is necessary to develop local crop varieties and animal species that are adapted to natural conditions in natural hazard prone areas. At present, NAFRI lacks modern tools and equipment to promote the utilization of locally available biodiversity, such as local crop varieties and animal species.

DESCRIPTION

Objectives

To research and promote a diversity of crop varieties and animal species that are adapted to the stressful environmental conditions that characterize natural hazard prone areas.

Activities

- Technical training on developing and improving crop varieties and livestock breeds (USD 1.2 million).
- Build and improve laboratory and crop and animal experimental stations (USD 3 million).
- Develop and improve crop varieties and animal species which are resistant to drought and flood conditions (USD 2.5 million).
- Experiment crop varieties and animal species and use new technologies with farmers in drought and flood prone areas (USD 1 million).

Short-term outputs

- Research and development infrastructure improved.
- Technicians have increased capacity in the development and improvement of crop varieties and animal species.
- Crop varieties and animal species collected.

Potential long-term outcomes

- New crop varieties and animal species that have higher levels of resistance to natural hazards are developed and bred, and in natural hazard prone areas.
- Agricultural system is increasingly adapted to local conditions and suited to natural hazard prone areas.
- Adaptive capacity of farmers living in natural hazard prone areas is improved.

IMPLEMENTATION

Implementing agency

Ministry of Agriculture and Forestry (NAFRI, Department of Agriculture, Department of Livestock and Fishery) with support and cooperation of concerned agencies.

Project location

Central level (laboratory), and Crop Variety and Animal Species Research Station.

Time frame

10 years.

Budget

USD 7.7 million

Risk and barriers

Limited knowledge and capacity of technical staff; sustainability of the facilities due to high cost and the need for experts to support the project.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of technical staff trained; number of new crop and animal varieties developed and bred; and extent of improvement / construction of other facilities.

PROJECT 7: IMPROVE AND CONSTRUCT CROP AND ANIMAL DISEASE LABORATORIES AT CENTRAL AND LOCAL LEVELS AND BUILD RELATED CAPACITY OF TECHNICAL STAFF.

PROJECT RATIONALE

Agricultural production in Lao PDR is susceptible to different pests and diseases in different parts of the country. Because of environmental and natural balances and imbalances, different measures can be used to protect crops against insects, pests and diseases. Environmental friendly technologies and biological mechanisms that can be used to inspect and fight pests and diseases are important. They are not only important contributors to high levels of agricultural production and therefore to the economy, but have minimal adverse environmental impacts and contribute towards sustainable agricultural development. At present, Lao PDR is lacking technical capacities and facilities to successfully diagnose crop and animal diseases.

DESCRIPTION

Objectives

To strengthen technical capacities in the diagnosis of crop and animal diseases and improve associated laboratory facilities.

Activities

- Train central and local technicians on plant and animal diseases (USD 1 million).
- Improve and construct laboratories on plant and animal diseases at central and local levels (USD 3 million).
- Develop a comprehensive database on plant and animal diseases (USD 0.05 million).
- Disseminate information on plant and animal diseases to farmers (USD 0.5 million).

Short-term outputs

- Increase technical capacities to diagnose plant and animal diseases.
- Laboratory facilities for research and development related to plant and animal diseases constructed and equipped.
- Database of plant and animal diseases developed.
- Farmers are informed and able to prevent plant and animal diseases.

Potential long-term outcome

- Sustainability of agricultural development improved.
- Agricultural eco-system improved.
- Increase the adaptive capacity of farmers to natural hazards, particularly those related to plant and animal diseases.

IMPLEMENTATION

Implementing agency

Department of Agriculture and Department of Livestock and Fishery as well as Provincial Agriculture and Forestry Offices of the Ministry of Agriculture and Forestry, with support and cooperation of concerned agencies.

Project location

At central and local levels.

Time frame

5 years.

Budget

USD 4.5 million

Risk and barriers

Limited knowledge and capacity of technical staff; sustainability of the facilities due to high cost and the need for experts to support research and development activities; new kinds of plant and animal diseases; and importation of plant and animals species without inspection.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of technicians trained at national and local levels; number of laboratories rehabilitated and established; and depth and scope of data collected on plant and animal diseases.

PROJECT 8: TRAIN FARMERS ON THE PROCESSING AND STORING OF HUMAN AND ANIMAL FOOD STUFFS.

PROJECT RATIONALE

Farmers and animals in flood and drought prone areas often experience food shortage. This issue can be at least partially addressed by improving food processing and storage. In this respect, it is necessary and important to organize training and advocacy for farmers on processing techniques, storing of human and animal foodstuffs, and promotion of local knowledge related to processing and storing.

DESCRIPTION

Objectives

Build capacities of farmers to process and store human and animal foodstuffs in flood and drought prone areas.

Activities

- Survey and collect the data on existing techniques (USD 0.2 million)
- Plan and organize training courses (USD 0.1 million).
- Disseminate technical information/data (USD 0.2 million).
- Monitor and evaluate the promotion of these techniques for further improvement (USD 0.05 million).

Short-term outputs

- Database on existing techniques developed.
- Farmers are informed and understand food processing techniques and issues related to the storage of human and animal foodstuffs.
- Processing and storing techniques for human and animal foods are improved.

Potential long-term outcomes

- Farmers livelihoods are increasingly secure.
- Adaptive capacities of farmers in drought and flood prone areas are enhanced.

IMPLEMENTATION

Institutional arrangement

National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry, with support and cooperation of line agencies.

Location

Local level.

Time

2 years.

Budget

USD 0.55 million

Risk and barriers

Lack of farmers' interest and low levels of involvement; lack of sources of raw material.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of farmers trained and using improved techniques; and curriculum on the processing and storing of human and animal food developed.

PROJECT 9: ESTABLISHMENT AND STRENGTHENING OF FARMERS GROUPS IN NATURAL HAZARD PRONE AREAS.

PROJECT RATIONALE

Farmers living in natural hazard prone areas collectively experience the negative impacts of natural hazards. Cooperation and coordination amongst affected parties could improve their capacities to cope with such hazards, as well as contribute to the collective prevention and the development of self-help activities. The existing farmers groups have not been very efficient, particularly in terms of collective action in the face of natural disasters, whilst in certain areas such groups do not exist. Formulation and strengthening of farmers groups in natural hazard prone areas will enhance the response and therefore the adaptive capacity of the local people to some of the impacts of climate change.

DESCRIPTION

Objectives

To establish effective farmers groups in natural hazard prone areas and improve their capacities to adapt to natural hazards.

Activities

- Public campaign to promote the formation of farmers groups in natural hazard prone areas (USD 0.2 million).
- Provide training in management of farmers groups and raise awareness on the importance of farmers groups (USD 0.3 million).
- Facilitate the networking among farmers groups, thereby promoting the exchange of information and lessons learned (USD 0.1 million).

Short-term outputs

- Public awareness raising activities increase levels of understanding of the importance of farmers groups.
- Farmers groups are formulated and enhanced (institutional and regulatory systems).
- Adaptive capacities of people living in natural hazard prone areas to the natural hazards are improved.

Potential long-term outcomes

- The effective functioning of farmers groups in natural hazard prone areas improves the security of farmers livelihoods.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry, with support and cooperation from line agencies.

Project location

Provincial Agriculture and Forestry Offices.

Time frame

3 years.

Budget

USD 0.6 million

Risk and barriers

Limited farmer involvement in the groups and market uncertainty.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of farmers groups formulated and rehabilitated; number of participating members in farmer groups; and outcomes of the farmer groups.

PROJECT 10: PROMOTE SOIL IMPROVEMENT USING LOCALLY AVAILABLE ORGANIC FERTILIZER AND AGRICULTURAL WASTE.

PROJECT RATIONALE

Soil conditions in hazard prone areas, especially in drought prone areas, are normally of poor quality and degrade rapidly. Thus, it is necessary to support farmers to improve the quality of their soils through the use of locally available organic fertilizer and agricultural waste, thereby enhancing the adaptive capacities of the farmers living in these areas.

DESCRIPTION

Objectives

To increase the use of organic fertilizers in agricultural production, thereby generating improvements in soil quality in natural hazard prone areas.

Activities:

- Survey and collect baseline data (USD 0.1 million).
- Organize training for farmers on the preparation, production and use of organic fertilizers using locally available materials (USD 0.2 million).
- Produce and distribute materials on the production and use of organic fertilizers (USD 0.1 million).
- Monitor, support and evaluate the use of organic fertilizers with local farmers (USD 0.1 million).

Short-term outputs

- Baseline data on soil quality available in national database.
- Farmers have the necessary knowledge and capacity to produce and use organic fertilizers.
- Organic fertilizers are widely used in agricultural production in natural hazard prone areas (particularly those affected by drought).

Potential long-term outcomes

- Land used for agricultural production in natural hazard prone areas is improved in quality.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry, with support and cooperation from line agencies.

Project location

Provincial Agriculture and Forestry Offices.

Time

2 years

Budget

USD 0.5 million

Risk and barriers

Farmers may lack a long-term vision of soil conservation and instead overemphasize short-term economic benefits generated by chemical fertilizers and give insufficient attention to the use of organic materials.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of farmers trained; number of farmers who use organic fertilizer to improve their soils; and production costs.

PROJECT 11: DEVELOP APPROPRIATE BANK EROSION PROTECTION SYSTEMS FOR AGRICULTURAL LAND IN FLOOD PRONE AREAS

PROJECT RATIONALE

Agricultural land in steep areas and along the banks of rivers is often affected by flash floods and more widespread flooding. To reduce the risks of losing agricultural production areas to riverbank erosion it is necessary to build embankment systems. This method provides a long term solution to river bank erosion and therefore secures agricultural land used by local people to sustain their livelihoods.

DESCRIPTION

Objectives

To protect agricultural land in areas affected by flooding.

Activities:

- Survey and collect data on the affected areas (USD 0.3 million).
- Select, design and construct embankment systems in areas that are commonly affected by flash flooding and more widespread flooding (USD 0.1 million).
- Construct embankment systems in key erosion prone sites (USD 2 million).
- Monitoring and evaluation (USD 0.05 million).

Short-term outputs

- Data/information generated that can be used to support the sound planning and construction of embankment and land protection systems.
- Embankment systems have been constructed in a number of key areas affected by flash floods and more widespread flooding.
- Exposure of agricultural production land to flash floods and common flooding is reduced in those areas where embankment systems have been constructed.

Potential long-term outcomes

- The vulnerability of the livelihoods of farmers living in areas prone to flooding is reduced.
- Agricultural production areas secured.

IMPLEMENTATION

Implementing agency

Department of Irrigation of the Ministry of Agriculture and Forestry, with the support and cooperation from line agencies.

Location

Three pilot sites that are regularly affected by flash flooding and more widespread flooding.

Time frame

3 years

Budget

USD 2.45 million

Risk and barriers

Lack of resources for the operation and maintenance of the bank erosion protection systems; severity of natural hazards.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: scope and accuracy of the database developed; number of embankment systems constructed; and size of agricultural production areas protected from flooding.

PROJECT 12: PROMOTE INTEGRATED PEST MANAGEMENT (IPM) AND USE OF HERBAL MEDICINES IN PEST MANAGEMENT AND LIVESTOCK TREATMENT.

PROJECT RATIONALE

Modern agricultural development most frequently involves an increased use of chemicals, with associated negative effects on the agricultural ecosystem and the health of both farmers and consumers. At the same time, chemical inputs also increase agricultural production costs. Promotion of integrated pest management and use of herbal medicines (as natural herbicides and pesticides) are effective alternatives to chemicals in the management and treatment of plant and animal diseases. This project will promote the use of integrated pest management (IPM) and herbal medicines in the prevention and treatment of plant and animal diseases.

DESCRIPTION

Objectives

To increase the sustainability of agricultural ecosystem management through promoting the use of an integrated approach to pest management in agricultural activities.

Activities:

- Survey and collect data on integrated pest management, herbs and their application (USD 0.1 million).
- Provide practical training to farmers on the IPM approach and the application of herbs to agricultural crops (USD 0.2 million).
- Monitor, promote and evaluate the use of IMP and herbal medicines by farmers in selected agricultural production areas (USD 0.1 million).
- Disseminate information on IPM and use of herbal medicines for the prevention and treatment of plant and animal diseases to reduce the use of chemical substances (USD 0.2 million).

Short-term outputs

- Farmers' knowledge and capacities in IPM and the use of herbal medicines for the prevention and treatment of plant and animal diseases are enhanced.
- Production costs associated with external inputs are reduced.

Potential long-term outcomes

- Healthier surrounding environment and more sustainable agricultural production systems.
- Farmers and consumers are safe from the negative effects of chemical substances.

IMPLEMENTATION

Implementing agency

Department of Agriculture and Department of Livestock of the Ministry of Agriculture and Forestry, with support and cooperation from line agencies.

Project location

Local level (three sites).

Time frame

2 years

Budget

USD 0.6 million

Risk and barriers

Lack of raw materials (herbal medicines); and low levels of farmer involvement.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of farmers trained and practically using IPM methods; increase in agricultural productivity; and decrease in the use of external inputs.

PROJECT 13: DEVELOP THE CAPACITY OF TECHNICAL STAFF IN ORGANIC FERTILIZER RESEARCH.

PROJECT RATIONAL

Biological fertilizers are important for soil improvement and agricultural production, especially in natural hazard prone areas. Development of research into biological fertilizers in Lao PDR is limited, due to lack of capacity amongst technicians as well as lack of facilities. Thus, it is necessary to strengthen the capacity of technical staff to effectively research and develop organic fertilizers.

DESCRIPTION

Objectives

To enhance technical capacities related to research and development of standardized and high quality biological fertilizers.

Activities:

- Upgrade the capacity of technical staff abroad (USD 1 million).
- Provide specific training of trainers in biological fertilizer research and development for selected agricultural technicians (USD 0.8 million).
- Establish software, hardware and infrastructure for research and development into biological fertilizers (USD 1.5 million).
- Conduct research and development activities (USD 0.05 million).

Short-term outputs

- Research and development capacities of agricultural officers at central level related to organic fertilizers are enhanced.
- Facilities and infrastructure for research and development into biological fertilizers improved.
- Standardized and improved quality of biological fertilizer.

Potential long-term outcomes

- Healthier environment through the use of standardized, high quality biological fertilizer.
- Increased use of biological fertilizer over wider geographical areas.

IMPLEMENTATION

Implementing agency

NAFRI and Department of Agriculture of the Ministry of Agriculture and Forestry, with support and cooperation from relevant agencies.

Project location

Central level

Time frame

5 years

Budget

USD 3.35 million

Risk and barriers

Limited participation by key stakeholders; and lack of sustainability of the equipment due to associated high costs.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of technicians at central level trained; number of technicians at local level trained; infrastructure developed; and the rates of use of organic fertilizers by farmers.



Priority One Forestry Projects Contained in Section IV:

PROJECT 1: CONTINUE THE SLASH AND BURN ERADICATION AND PERMANENT JOB CREATION PROGRAMME.

PROJECT 2: STRENGTHEN CAPACITY OF VILLAGE FORESTRY VOLUNTEERS IN FOREST PLANTING, CARING AND MANAGEMENT TECHNIQUES AS WELL AS THE USE OF VILLAGE FORESTS.

Priority Two Projects:

PROJECT 3: CARRY OUT SURVEYS AND IDENTIFY AND DEVELOP FOREST AREAS SUITABLE FOR SUPPORTING SEED PRODUCTION.

PROJECT RATIONALE

One of the most important characteristics of natural forest resource ecosystems in Lao PDR is its rich biodiversity. Reforestation in Lao PDR emphasizes the use of indigenous species that have high levels of resistance to droughts and floods that may be caused by climate change and climatic variability. In order to maintain this diversity as well as the quality of the trees, it is of utmost importance that reforestation is performed with high quality seeds and seedlings. Selection of high-quality seeds from natural forests is a key prerequisite for the development of good reforestation or rehabilitation programmes for forest resources. Despite the wide availability of forest resources, Lao PDR has yet to develop a high-quality seed production system for reforestation/rehabilitation.

DESCRIPTION

Objectives

To survey and select appropriate forest areas for the development of seed production programmes, and to collect good quality seeds for utilization in reforestation and rehabilitation activities.

Activities

- Develop criteria for the selection of forest areas (-).
- Survey prospective forest areas according to the criteria selected (USD 0.7 million).
- Develop conservation systems for the selected areas (USD 0.1 million).
- Conduct seed quality tests to select good seeds (USD 0.2 million).
- Coordinate/cooperate with relevant seed production units for appropriate utilization (-).

Short-term outputs

- Appropriate forest areas are selected and used for seed production from indigenous species.

Potential long-term outcomes

- Biological diversity of forest resources is maintained.

IMPLEMENTATION

Implementing agency

Forestry Research Centre, Provincial Agriculture and Forestry Offices (Vientiane, Borikhamxay and Savannakhet Provinces).

Location

Luang Namtha, Oudomxay, Vientiane, Savannakhet and Champasack Provinces.

Time frame

3 years

Budget

USD 1 million

Risk and barriers

Low recognition of the importance of conserving a rich variety of indigenous species; and lack of availability of forest seeds.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: size of areas reserved for forest seed production; and total stock utilized for seed production per year.

PROJECT 4: PROMOTE AND ESTABLISH TREE NURSERIES TO PROVIDE SAPLINGS TO AREAS AT HIGH RISK FROM FLOODING OR DROUGHT.

PROJECT RATIONALE

In areas vulnerable to flood and drought, forest resources may be affected by natural disasters and high rates of damage may occur. In such cases, restoration or reforestation of the site may be required. Unfortunately, a lack of seedlings or poor seed quality hinders the success of reforestation or restoration efforts, resulting in an overall deterioration of forest resources. Development of forest nursery stations, together with the development of a programme of support to forest seed production (project 3) will facilitate rapid and effective reforestation and restoration of degraded areas.

DESCRIPTION

Objectives

To develop forest nursery stations in strategic areas that support reforestation and restoration of forest resources in flood/drought prone areas.

Activities:

- Development of criteria for the selection of strategic locations (-).
- Select strategic locations suitable for the development of nursery stations (USD 0.1 million).
- Establish forest nursery stations (USD 0.6 million).

Short-term outputs

- Six forest nursery stations established and fully functioning.

Potential long-term outcomes

- Rapid support to restore forested areas that have been damaged by drought/flood.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Research Institute, National Agriculture and Forestry Extension Service of the Ministry of Agriculture and Forestry.

Location

Vientiane, Khammouane, Saravane and Champasack Provinces.

Time frame

2 years

Budget

USD 0.7 million

Risk and barriers

The transportation of saplings and forest seeds to drought and flood prone areas is difficult.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of nursery stations developed; quantity of seeds produced per year; and distribution and utilization of the seeds.

PROJECT 5: RAISING PUBLIC AWARENESS ON WILDLIFE CONSERVATION AND FOREST-FIRE PREVENTION

PROJECT RATIONALE

The successful implementation of public policy requires public awareness and acceptance of these policies, as well as their active participation in associated implementation processes. Public policies related to forest and wildlife conservation are one of the most important sets of public policies in Lao PDR. The promotion of public acceptance and awareness of, and participation in, these policies is prerequisite for their successful implementation. Wildlife degradation and forest fires due to severe droughts that are likely to be intensified by climate change are two phenomena that need particular attention. At present, public awareness on these issues and their negative implications has not yet been sufficiently raised.

DESCRIPTION

Objectives

To raise public awareness on the importance of wildlife conservation and prevention of forest-fires.

Activities

- Prepare and publish awareness raising materials on wildlife conservation and forest-fire prevention suitable for the general public and disseminate nation-wide (USD 0.5 million).
- Prepare appropriate radio and television programmes for a nation wide public campaign (USD 0.5 million).
- Provide forest-fire fighting training programs for forest volunteers (USD 0.6 million).
- Organize activities that raise public awareness on wildlife conservation and forest fires at the grass-roots level (such as using mobile conservation units that realize conservation promotion activities) (USD 1 million).
- Establish a wildlife conservation and forest-fire fighting network that facilitates the exchange of information and experience amongst forest volunteers (USD 0.1 million).

Short-term outputs

- Awareness raising materials on wildlife conservation and forest-fire prevention aimed at the general public are produced.
- Levels of public awareness on wildlife conservation and forest-fire prevention raised.
- Forest volunteers are trained in forest-fire fighting.
- A network is established amongst those who are interested in wildlife conservation and fighting forest fires.

Potential long-term outcomes

- Public awareness of, and public participation in, wildlife conservation and forest-fire prevention is enhanced.

IMPLEMENTATION

Implementing agency

Department of Forestry, in close collaboration with public relations agencies.

Location

Luang Prabang, Xayabouri, Oudomxay and Houaphanh Provinces

Time frame

2 years

Budget

USD 2.7 million

Risk and barriers

Lack of interest and cooperation of rural households whose livelihoods heavily rely on forest resources.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: quantity and quality of published materials distributed; frequency of public campaign by types of media; number of forest volunteers trained; extent to which the number of forest-fires decrease in areas within which the campaign has been run.

PROJECT 6: SET UP AND FURTHER STRENGTHEN THE TECHNICAL CAPACITY OF THE FOREST FIRE MANAGEMENT TEAMS AT PROVINCIAL, DISTRICT AND VILLAGE LEVELS.

PROJECT RATIONALE

Forest resources are highly important to the economy and environment of Lao PDR. Forest fires are one of the main factors that cause not only the deterioration of forest resources, but also the release of carbon dioxide into the atmosphere thus contributing to global warming. Forest fire prevention is also one of the main forest policies of the Government of Lao PDR. However, at the same time, over the past few years there have been numerous forest fires, damaging thousands of hectares of forest resources. While every effort has been taken to both prevent and cope with the fires, the capacity of relevant parties, particularly the government personnel is not sufficient and needs to be strengthened.

DESCRIPTION

Objectives

To strengthen the technical capacity of forest fire prevention units at provincial, district and village levels; and to review and improve forest fire operation systems at provincial, district and village levels.

Activities

- Prepare integrated training programs that ensure cooperation and consistency in forest fire prevention among provincial, district and village levels (USD 0.1 million).
- Provide technical training for trainer programs for forest fire prevention units at provincial level (USD 0.5 million).
- Establish training programs for districts and villages, mobilizing trainees at provincial level (USD 0.4 million).
- Review and enhance the forest fire operation systems in consistency with the integrated training program (USD 0.1 million).
- Rehabilitate/improve facilities needed to support the operating of forest fire prevention and fire fighting teams (USD 2 million).

Short-term outputs

- Forest fire prevention operation system is improved.
- Capacity to prevent forest fires improved at provincial, district and village levels.
- Facilities to support forest fire prevention and fire-fighting are improved.

Potential long-term outcomes

- Human resources related to forests are strengthened.
- Conservation of forests and biological diversity is improved.

IMPLEMENTATION

Implementing agency

Department of Forestry of the Ministry of Agriculture and Forestry.

Location

Nation-wide with emphasis on fire-prone areas.

Time frame

3 years

Budget

USD 3.1 million

Risk and barriers

Traditional livelihoods of the people (slash and burn); difficulty accessing some areas that are highly exposed to forest fires.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; facilities developed; and effectiveness of forest-fire prevention and forest fire fighting systems.

PROJECT 7: PUBLIC AWARENESS RAISING CAMPAIGN TO DISSEMINATE INFORMATION ON FOREST AND WILDLIFE REGULATIONS AND LAWS; AND STRENGTHEN THE IMPLEMENTATION OF THESE REGULATIONS

PROJECT RATIONALE

Slash and burn for agricultural farming contributes to climate change and climate variability, and also destroys wildlife habitat and associated biodiversity. In order to maintain a healthy environment and wildlife habitat, several regulations and laws on forests and wildlife have been promulgated. Nevertheless, a lack of knowledge and understanding of these laws and regulations by the public inhibits their effectiveness. Limited public information dissemination systems further constrains efforts to educate the public on these laws and regulations. Increased levels of public understanding will support the enforcement of forest and wildlife laws and regulations.

DESCRIPTION

Objective

To raise levels of knowledge and understanding of forest and wildlife laws and regulations among rural households located in natural hazard prone areas.

Activities

- Prepare and publish awareness raising materials on forest and wildlife laws and regulations aimed at the general public, and disseminate nation-wide (USD 0.8 million).
- Prepare appropriate radio and television programmes for a nation-wide public campaign (USD 0.8 million).
- Establish mobile units that realize intensive campaigns on forest and wildlife laws and regulations in natural hazard prone areas (USD 1 million).

Short-term outputs

- Awareness raising materials on forest and wildlife laws and regulations are produced for the general public.
- Public awareness raising campaigns using different media are conducted.
- Mobile units aimed at improving public awareness of forest and wildlife laws and regulations are established.

Potential long-term outcomes

- Levels of public understanding and knowledge of forest and wildlife laws and regulations improved.
- Public awareness of, and participation in, forest conservation is enhanced.
- Adaptive capacity of farm households increased.

IMPLEMENTATION

Implementing agency

Department of Forestry, Provincial Agriculture and Forestry Offices, Provincial Water Resources and Environment Office, in close collaboration with Public Relation Departments, Provincial Legislative Departments, with the support of relevant agencies.

Location

Vientiane Capital, Vientiane, Borikhamxay, Khammouane, Savannakhet, Champasack and Attapeu Provinces, with emphasis on natural hazard prone areas.

Time frame

2 years

Budget

USD 2.6 million

Risk and barriers

Rural households are not interested in public relations; and lack of access to public communication systems, e.g. radio, in remote areas.

Monitoring and evaluation

Assessing the impacts of public awareness raising projects is difficult. Potential monitoring and evaluation indicators include: quantity and quality of publication materials produced and distributed; frequency of broadcasting of campaign messages by types of media; and number of households in target areas that receive information.

PROJECT 8: DEVELOP AGRO-FORESTRY SYSTEMS FOR WATERSHED PROTECTION AND EROSION REDUCTION IN STEEP AREAS.

PROJECT RATIONALE

Traditional slash and burn activities contribute to climate change and climatic variability, which in turn influences the frequency and intensity of natural hazards such as flash floods. At the same time, large numbers of farm households practice agriculture on steeply sloped land located in upper watershed catchments. Their agricultural practices are highly sensitive to soil erosion. In many countries of the region, agro-forestry systems have been used successfully to protect watersheds and allow farmers to maintain their livelihoods. Such systems are known but not yet widely practiced by farmers living in upper watersheds in much of Lao PDR. The promotion and development of these systems has the potential to help rural communities to develop sustainable livelihoods that are not adversely affected by soil erosion and decreasing land productivity on steep slopes.

DESCRIPTION

Objective

To develop agro-forestry systems that integrate soil protection and income generation on steeply sloped lands located in natural hazard prone areas.

Activities

- Provide training in agro-forestry systems to villagers / community leaders (USD 0.5 million).
- Establish programs to develop agro-forestry system for trainees to introduce/practice associated techniques in their areas (USD 0.3 million).
- Provide necessary (minimum) support required by the programs (USD 1 million).
- Evaluate the programs for further improvement (USD 0.1 million).

Short-term outputs

- Not less than 300 village/community leaders are trained in agro-forestry.
- Agro-forestry systems in pilot areas developed.

Potential long-term outcomes

- Agro-forestry systems appropriate for steep sloped land are developed.
- Soil conservation in steeply sloped areas are enhanced.
- Sustainability of livelihoods in steeply sloped areas is improved.
- Adaptive capacity of farmers to natural hazards is improved.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Extension Service, Forestry Department, Agriculture Faculty, Forestry Faculty, and Provincial Agriculture and Forestry Offices.

Location

Luang Namtha, Oudomxay, Houaphanh, Vientiane and Xekong Provinces.

Time frame

3 years

Budget

USD 1.9 million

Risk and barriers

Low levels of awareness concerning the importance of long-term soil conservation needs; and overemphasis placed on short-term economics and income generation by farmers.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of village/community leaders trained; adoption of agro-forestry systems; improvement in farmers livelihoods in target areas; and degree of technology diffusion within pilot areas.

PROJECT 9: DEVELOPMENT OF SMALL WATER RESERVOIRS IN UPLAND AREAS FOR WILDLIFE/AQUATIC ANIMALS AND PLANTS DURING THE DRY SEASON.

PROJECT RATIONALE

Water availability in the highland areas is scarce during the driest years, and this is likely to be further exacerbated by climate change. The situation is more extreme in drought prone areas. Lack of water forces wildlife to migrate to downstream areas and hence increases their susceptibility to hunting. The development of appropriate small reservoirs would provide water for wildlife during the dry season.

DESCRIPTION

Objective

To develop small water reservoirs for wildlife in highland/upstream areas of natural hazard prone areas.

Activities

- Survey of water-shortage spots in highland/upstream areas where wildlife are concentrated (USD 1 million).
- Design and develop water reservoirs appropriate for wildlife in the identified spots (USD 3 million).
- Evaluate the effectiveness of the water reservoirs on a regular basis (USD 0.2 million).

Short-term outputs

- Small water reservoirs in highland/upstream areas are constructed.
- Access to water by wild animals during the dry season is improved.

Potential long-term outcomes

- Wildlife protection improved.
- Overall natural ecological systems in good health.

IMPLEMENTATION

Implementing agency

Department of Forestry and Provincial Agriculture and Forestry Office of the Ministry of Agriculture and Forestry, with the support of relevant agencies.

Location

Highland/upstream areas in drought prone areas located in Bokeo, Luang Namtha and Savannakhet Provinces.

Time frame

3 years

Budget

USD 4.2 million

Risk and barriers

Reservoirs may have negative effects on the natural movements of wildlife; and water availability for forest encroachers will be improved.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of reservoirs developed; amount and period of water availability during dry season; and number and type of animals that use the water sources constructed.

PROJECT 10: PUBLIC AWARENESS CAMPAIGN ON PEST AND DISEASE OUTBREAKS IN WILDLIFE CAUSED BY NATURAL DISASTERS, AND ASSOCIATED PREVENTIVE MEASURES.

PROJECT RATIONALE

During periods of natural catastrophe such as heavy flooding, pests and diseases that are transmitted by / come from natural forests and wildlife may be rapidly transmitted to humans, causing increased incidence of illness and death. Raising public awareness on such pests and diseases as well as associated preventive measures can contribute greatly to improving human health, particularly amongst rural households located in natural hazard prone areas. Such public awareness raising activities have not yet been realized in Lao PDR.

DESCRIPTION

Objective

To increase levels of public awareness of pests and diseases from forests and wildlife and associated preventive measures in natural hazard prone areas through a public awareness raising campaign.

Activities

- Prepare publication materials aimed at the general public on pests and diseases from forests and wildlife and preventive measures and disseminate nation-wide (USD 0.4 million).
- Prepare appropriate radio and television programmes for a nation-wide campaign (USD 1 million).
- Provide training in prevention/basic hospitalization methods to forest volunteers in natural hazard prone areas (USD 0.3 million).
- Establish programs for forest volunteers to disseminate knowledge to community members (USD 0.2 million).

Short-term outputs

- Awareness raising materials on pests and diseases from forest and wildlife and preventive measures for general public are produced.
- Public awareness on pests and diseases from forests and wildlife and preventive measures is raised.
- Forest volunteers trained.

Potential long-term outcomes

- Reduced incidence of human illness from pests and diseases from forests and wildlife.
- Adaptive capacity of rural households to natural hazards is increased.

IMPLEMENTATION

Implementing agency

Department of Forestry and National Agriculture and Forestry Research Institute, in close collaboration with public relation agencies.

Location

Nation-wide with emphasis on natural hazard prone areas located in Luang Namtha, Khammouane and Champasack Provinces.

Time frame

2 years

Budget

USD 1.9 million

Risk and barriers

Low levels of experience in raising public awareness about preventing diseases associated with forests and wildlife.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: quantity of published materials distributed; frequency of public campaigns by type of media; number of forest volunteers trained; and change in the frequency and dynamics of illnesses caused by pests and diseases from forests and wildlife in target areas.

PROJECT 11: EXTENSION CAMPAIGN ON INTEGRATED FOREST PLANTATION MANAGEMENT FOR CROP PEST AND DISEASE CONTROL.

PROJECT RATIONALE

Incidence and severity of pests and diseases in forest plantations will be affected by climate change and climate variability and may lead to lower levels of agricultural production. Increasing already high levels of agricultural inputs, particularly pesticides, will further reduce farmers returns. Reduction or avoidance of chemical inputs is not only cost-saving, but also good for farmers health and the ecological system. With a heavy reliance of rural households on primary resources, particularly forests and agriculture, maximizing biological control of pest and diseases in the community would contribute to improved economic, social and environmental gains. Integrated forest plantation management represents a practical approach to forest plantations that provides multiple benefits. This approach has not yet been extensively introduced in Lao PDR.

DESCRIPTION

Objective

To enhance the technical capacity of farmers to realize integrated forest plantation management for pest and disease control.

Activities

- Provide training in integrated forest plantation management to key farmers (USD 0.3 million).
- Establish a pilot program for integrated forest plantation management, mobilizing the trainees (USD 0.5 million).
- Evaluate the pilot program for future improvement (USD 0.1 million).

Short-term outputs

- Knowledge of key farmers in priority areas in integrated forest plantation increased.
- Areas under integrated forest plantation management expanded.
- Effect of pests and diseases on forest plantations is reduced.

Potential long-term outcomes

- Health of ecological systems in target watersheds is improved.
- Increase in forested areas under integrated forest plantation management.
- Levels of pollution from chemical pesticides is reduced.

IMPLEMENTATION

Implementing agency

Department of Forestry, with support from relevant agencies.

Location

Nation-wide, with an emphasis on natural hazard prone areas located in Vientiane, Borikhamxay, Savannakhet, Champasack and Attapeu Provinces.

Time frame

3 years

Budget

USD 0.9 million

Risk and barriers

Low levels of knowledge and low capacity of the people to realize integrated forest management, and weak coordination amongst stakeholders.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of key farmers trained; number of pilot sites established; performance of pilot sites; and diffusion of technology into surrounding areas.

PROJECT 12: CONDUCT RESEARCH AND SELECT SEEDS OF PLANT SPECIES SUITABLE FOR FLOOD AND DROUGHT PRONE AREAS.

PROJECT RATIONALE

Tropical forests are rich in biodiversity. Various indigenous species can be sustained under particular circumstances and in specific natural conditions, while others cannot. Forest plantations or reforestation in flood or drought prone areas must involve the selection of species that are appropriate to the specific situation and that preferably are useful to local people. Identification and development of plant species that are suited to specific climatic conditions is a long process. As floods and drought are two of the most important effects of climate change in Lao PDR, identification and selection of plant species that are resistance to floods and drought is a priority to enhance adaptive the capacity in the affected areas.

DESCRIPTION

Objectives

To identify and develop plant and tree species that are suited to flood and drought prone areas.

Activities

- Review and analyze the climatic and ecological conditions of major flood and drought prone areas (USD 0.3 million).
- Identify environmentally and economically important plant and tree species potentially suited to the drought and flood prone areas (-).
- Select forest areas that contain populations of plant and tree species that have good prospects to resist flood and drought conditions (USD 0.2 million).
- Conduct research into suitable species for flood and drought conditions (USD 0.5 million).
- Coordinate with seed production centers for production of seeds (-).

Short-term outputs

- Research into the most appropriate species for areas affected by climatic extremes is undertaken.
- More appropriate plant and tree species for extreme conditions are identified and developed.

Potential long-term outcomes

- Forests in flood and drought prone areas are increasingly adapted to changing climatic conditions.
- Adaptive capacity of farmers in flood and drought prone areas is improved.

IMPLEMENTATION

Implementing agency

National Agriculture and Forestry Research Institute, Forestry Faculty of the National University

Location

Vientiane, Borikhamxay, Khammouane, Savannakhet and Champasack Provinces.

Time frame

2 years

Budget

USD 1 million

Risk and barriers

Lack of availability of forest areas with high stock levels of the required species; and low levels of long-term sustainability of species selected.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: size of the selected forest; number of species identified and collected; and number of plant and tree species selected for seed production.

PROJECT 13: CONSTRUCT BUSH FIRE BARRIERS / FOREST-FIRE PROTECTION BUFFER ZONES IN FOREST CONSERVATION AREAS.

PROJECT RATIONALE

Drought prone areas are not only vulnerable to the social and economic activities of farm households, but are also vulnerable to natural hazards that affect these ecological systems. Drought increases the potential for forest fires and subsequently hinders the adaptive capacity of farm households located in these areas. Prevention of forest fires will reduce the severity of the impacts of drought and will support the adaptive capacity of farm households in Lao PDR. To date, activities aimed at protecting these areas from forest fires have not been developed.

DESCRIPTION

Objective

To construct forest-fire protection buffers in forest reserves located in drought prone areas.

Activities

- Identify priority areas where it is recommended that forest-fire protection buffers be constructed (USD 0.2 million).
- Rehabilitate/acquire necessary equipment (USD 2 million).
- Construct forest-fire protection buffer in priority areas (USD 2 million).

Short-term outputs

- Forest-fire protection buffers established in prioritized areas.
- Equipment for operation is available.
- Forest fire prevention measures are improved.

Potential long-term outcomes

- Damage from forest fires in drought prone areas is reduced.
- Susceptibility of forest resources to fires in drought prone areas is reduced.

IMPLEMENTATION

Implementing agency

Department of Forestry, Ministry of Agriculture and Forestry.

Location

Prioritized drought prone areas located in Luang Namtha, Oudomxay, Luang Prabang and Savannakhet Provinces.

Time frame

3 years

Budget

USD 4.2 million

Risk and barriers

Lack of public awareness and weak cooperation and coordination of stakeholders in protecting forests from fires; difficulties associated with ensuring the continuity of activities.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: size of the forest fire buffers constructed; area of forest protected from forest fires by the forest fire buffers; and inventory of equipment improved.

PROJECT 14: BUILD RESEARCH CAPACITY ON WILDLIFE PESTS / DISEASES AND OUTBREAKS OF ANIMAL DISEASES.

PROJECT RATIONALE

Forest and wildlife resources have natural pests and diseases. These pests and diseases can cause serious damage to forest and wildlife populations during flooding and drought. In addition, rural households living alongside these resources are highly susceptible to diseases that are transmitted by wildlife and pests. Research aimed at increasing understanding of pests and diseases that are related to forest and wildlife resources in Lao PDR has not been sufficiently developed. However, such research is vital to the sustainability of forest and wildlife resources, as well as to contributing towards improved human health over the long run.

DESCRIPTION

Objective

To enhance research capacity into forest and wildlife pests and diseases.

Activities

- Provide advanced training to entomologists and pathologists in the specific area of pests and diseases that are related to forest and wildlife resources (USD 1 million).
- Provide technical training to relevant personnel to improve their capacities in entomology and pathology as related to forest and wildlife resources (USD 0.3 million).
- Rehabilitate/establish laboratories/research stations needed for entomology and pathology related to forest and wildlife resource research (USD 1 million).

Short-term outputs

- Laotian entomologists and pathologists are trained.
- Related technical personnel are trained.
- Laboratories/research stations are improved.

Potential long-term outcomes

- Research capacities in the area of pest and disease related research in Lao PDR is enhanced.
- Adaptive capacities of forest resources and rural households are improved.

IMPLEMENTATION

Implementing agency

Agriculture and Forestry Faculty of National University, National Agriculture and Forestry Research Institute, in collaboration with national and international academic institutes.

Location

Vientiane Capital and Savannakhet Province.

Time frame

5 years

Budget

USD 2.3 million

Risk and barriers

Limited researchers; and limited technical knowledge.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of scientists that receive advanced training; number of technical personnel that receive training; number and type of equipment/facilities that are rehabilitated/established; and number of laboratories/research stations that are improved.

Priority One Water Resources Projects Contained in Section IV:

PROJECT 1: AWARENESS RAISING ON WATER AND WATER RESOURCE MANAGEMENT.

PROJECT 2: MAPPING OF FLOOD-PRONE AREAS.

PROJECT 3: ESTABLISH AN EARLY WARNING SYSTEM FOR FLOOD PRONE AREAS, AND IMPROVE AND EXPAND METEOROLOGY AND HYDROLOGICAL NETWORKS AND WEATHER MONITORING SYSTEMS.

PROJECT 4: STRENGTHEN INSTITUTIONAL AND HUMAN RESOURCE CAPACITIES RELATED TO WATER AND WATER RESOURCE MANAGEMENT.

PROJECT 5: SURVEY UNDERGROUND WATER SOURCES IN DROUGHT PRONE AREAS.

PROJECT 6: STUDY, DESIGN AND BUILD MULTI-USE RESERVOIRS IN DROUGHT PRONE AREAS.



Priority Two Projects:

PROJECT 7: CONSERVATION AND DEVELOPMENT OF MAJOR WATERSHEDS.

PROJECT RATIONALE

With an appropriate management system, water, a renewable resource, can be utilized indefinitely. Likewise, an inappropriate management system characterized by the misuse or wasteful use of water resources, will result in unsustainable use. This has negative implications for the people who rely on these water resources and, importantly, the unsustainable use of water resources is often irreversible. Hence, decisions concerning water utilization must be made wisely. As a land-locked country, primary resources, particularly water and forest resources, are vital to the current and future development of the country. Synergies between natural resources and human development, which can be pursued through integrated management approaches are necessary to ensure the long-term, sustainable socio-economic development of the country.

DESCRIPTION

Objectives

To develop an integrated management system for water resources in two major watersheds of Lao PDR.

Activities

- Identify major watersheds of Lao PDR (USD 0.02 million).
- Analyze the synergies between water and forests in the major watersheds (USD 0.2 million).
- Develop integrated management systems for sustainable use of water resources in two main target watersheds (-).
- Implement integrated management systems in two selected pilot watersheds (USD 0.4 million).
- Refine the integrated management system and integrate into the national socio-economic development plan (USD 0.02 million).

Short-term outputs

- Database of water and forest resources in major watersheds established.
- Integrated management system for major watersheds developed.
- Two pilot sites test the integrated management system.

Potential long-term outcomes

- Renewable resource management system for Lao PDR improved and integrated into the national socio-economic development plan.
- Sustainable use of water and forest resources of Lao PDR enhanced.

IMPLEMENTATION

Implementing agency

Water Resources Coordination Committee, MAF, Department of Hydropower and Lao National Mekong Committee, with support of related line agencies.

Location

Major Mekong River Tributaries: Nam Ngum, Nam Xane, Nam Kading, Xebang Fai, Xebang Hieng and Xedone Watersheds.

Time frame

5 years

Budget

USD 0.64 million

Risk and barriers

Lack of coordination and cooperation among relevant agencies and stakeholders

Monitoring and evaluation

Potential monitoring and evaluation indicators include: extent and accuracy of database developed; efficiency of integrated management system; and changes in the efficiency of water and forest resource utilization in the pilot areas.

PROJECT 8: BUILD AND IMPROVE FLOOD PROTECTION BARRIERS TO PROTECT EXISTING IRRIGATION SYSTEMS.

PROJECT RATIONALE

In those areas frequently affected by floods or droughts, efficient irrigation systems are vital for agricultural production and the livelihoods of rural farmers. The development of irrigation systems in Lao PDR was not based on a comprehensive land-use plan. As a result, irrigation systems are frequently flooded. Tropical rainstorms and associated frequent flash flooding causes extensive damage to flood protection dikes and irrigation systems. Damage to irrigation systems hinders the adaptive capacity of farmers to climate change and climatic variability. It is necessary to develop and maintain the efficiency and effectiveness of irrigation systems in order to enhance the adaptive capacity of farmers.

DESCRIPTION

Objective

To improve flood protection dikes for irrigation systems in flood prone areas.

Activities

- Assess the condition of irrigation systems in flood prone areas (USD 0.1 million)
- Select three irrigation systems that urgently need rehabilitation/construction of flood protection dikes (-)
- Rehabilitate/construct flood protection dikes (USD 2 million)
- Evaluate the performance of rehabilitated/constructed dikes (0.1 million)

Short-term outputs

- Condition of the irrigation systems in flood prone areas is assessed
- Three priority flood protection dikes rehabilitated/constructed
- Damage to crops in irrigated areas reduced

Potential long-term outcomes

- Risks posed by floods to irrigation systems and agricultural production reduced in three flood prone areas
- Adaptive capacity of farmers to floods is improved

IMPLEMENTATION

Implementing agency

Irrigation Department, with support from relevant line agencies

Location

Vientiane, Borikhamxay, Khammouane, Savannakhet and Champasack Provinces

Time frame

3 years

Budget

USD 2.2 million

Risk and barriers

Durability of flood protection dikes maybe lower than anticipated.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: reports from the assessment of flood protection dykes; quantity and quality of rehabilitated/constructed flood protection dikes; and number of hectares of agricultural land protected by rehabilitated/constructed protection dikes.

PROJECT 9: IMPROVE AND PROTECT NAVIGATION CHANNELS AND NAVIGATION SIGNS.

PROJECT RATIONALE

Rivers and canals are common and cost-effective means of transportation, particularly in the rural areas of Lao PDR. Extreme events associated with climate change, particularly floods and drought can cause extensive damage to river and canal banks, navigation routes and navigation signs. Without proper routes and signs, navigation in these rivers and canals is dangerous and risky. Rehabilitation and maintenance of navigation routes and signs in areas that have been affected by severe floods is presently lacking and urgently needed.

DESCRIPTION

Objectives

To rehabilitate and maintain navigation routes and signs in natural hazard prone areas.

Activities

- Review and prioritize the rivers/canals that require rehabilitation and maintenance of navigation routes and signs (USD 0.1 million).
- Select three prioritized rivers/canals for rehabilitation and maintenance (-).
- Establish navigation rehabilitation and maintenance system (-).
- Rehabilitate the selected rivers/canals (USD 1 million).
- Develop maintenance program (-).

Short-term outputs

- Navigation system in rivers/canals in natural hazard prone areas is reviewed and rehabilitation needs are prioritized.
- Navigation routes and signs along three prioritized rivers/canals are rehabilitated.
- Maintenance program and taskforce are established for each of the three sites.

Potential long-term outcomes

Improved navigation system in natural hazard prone areas.

IMPLEMENTATION

Implementing agency

Waterway Administration Division, Department of Communication/MCTPC with collaboration of WRCC and Lao National Mekong Committee, and support from relevant line agencies.

Location

Natural hazard prone areas located in Bokeo, Vientiane and Champasack Provinces.

Time frame

2 years

Budget

USD 1.1 million

Risk and barriers

Durability of rehabilitated routes and signs may be low.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of rehabilitated irrigation systems; and length of improved navigation routes.

PROJECT 10: REPAIR/REHABILITATE INFRASTRUCTURE AND UTILITIES DAMAGED BY FLOODS IN AGRICULTURAL AREAS.

Although this project is of slightly less relevance to NAPA, and lies within the Government programme of regular maintenance of public infrastructure and utilities, the repair / rehabilitation of infrastructure and utilities in agricultural areas could be a NAPA project only when there has been extensive damage by floods and where there is a need for special assistance.

PROJECT RATIONALE

Being located in a tropical region, flooding is common to Lao PDR. The intensity of floods and the extent of the associated damage varies from year to year. Flooding causes damage to infrastructure and utilities, including roads, irrigation systems, reservoirs and water supply facilities. Timely and efficient repair or rehabilitation would substantially relieve those affected and assist them to return to their normal lives. The existing system does not prioritize agricultural areas and hence they are frequently neglected by rehabilitation programmes.

DESCRIPTION

Objective

To repair/rehabilitate infrastructure and utilities damaged by floods in agricultural areas.

Activities

- Establish a system for reporting on flood damage and repair and rehabilitation needs in agricultural areas (USD 0.05 million).
- Develop and run a training programme for personnel of the program (USD 0.3 million).
- Conduct needs assessments of losses and rehabilitation requirements in critical agricultural areas (USD 0.2 million).
- Prioritize areas/infrastructure/utilities for repair/rehabilitation (-).
- Perform repair/rehabilitation of prioritized items (USD 5 million).
- Integrate the reporting system into national sustainable development planning processes (-).

Short-term outputs

- Program to repair/rehabilitate infrastructure/utilities in agricultural areas established.
- Capacity of a number of personnel increased.
- Database on losses and rehabilitation needs developed.
- Key priority infrastructure/utilities rehabilitated / repaired.

Potential long-term outcomes

- Vulnerability of farm households reduced and adaptive capacity increased in target areas.
- National sustainable development planning enhanced.

IMPLEMENTATION

Implementing agency

MCTPC and MAF.

Location

Critical agricultural areas located in Vientiane Capital, Khammouane and Savannakhet Provinces.

Time frame

4 years

Budget

USD 6 million

Risk and barriers

Weak cooperation and coordination between related agencies.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: establishment of a reporting system; number of personnel trained; performance of trained personnel; quantity and quality of infrastructures/utilities rehabilitated; and evidence of integration into national plans.

Priority One Public Health Projects Contained in Section IV:

PROJECT 1: IMPROVE SYSTEMS FOR THE SUSTAINABLE USE OF DRINKING WATER AND SANITATION WITH COMMUNITY PARTICIPATION IN FLOOD AND DROUGHT PRONE AREAS

PROJECT 2: IMPROVE KNOWLEDGE AND SKILLS OF ENGINEERS WHO DESIGN AND BUILD WATER AND SANITATION SYSTEMS.



Priority Two Projects:

PROJECT 3: RAISE PUBLIC AWARENESS ON SANITATION IN FLOOD PRONE AREAS.

PROJECT RATIONALE

Understanding of hygiene and involvement in the prevention of diseases is often limited, especially amongst people living in flood and drought prone areas. In the past, a number of public health awareness raising activities have been realized, but they were not widespread and did not receive in-depth coverage. More extensive and intensive public health awareness raising activities on water and sanitation are very important and must be urgently implemented.

DESCRIPTION

Objectives

To increase levels of understanding, involvement in the implementation of hygiene and disease prevention activities, particularly during times of flood and drought.

Activities

- Design, develop and disseminate publication materials on health and sanitation awareness appropriate for natural hazard prone areas (USD 0.15 million).
- Conduct public campaigns on health and sanitation in natural hazard prone areas through appropriate tools and media (USD 0.2 million).
- Encourage people to transfer their knowledge by means of peer education (USD 0.1 million).

Short-term outputs

- Public awareness raising tools developed and disseminated.
- Levels of understanding and awareness on the importance of good hygiene and sanitation is increased.

Potential long-term outcomes

- Public actively participating in and contributing to the promotion of good hygiene and sanitation practices.

IMPLEMENTATION

Implementing agency

MoH, Ministry of Education, and mass organizations from central to local levels.

Location

Areas affected by natural hazards throughout the country.

Time frame

3 years.

Budget

USD 0.45 million.

Risk and barriers

Differences in levels of basic knowledge on health, economic, cultural, social and environmental issues.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of public campaign materials developed and disseminated; number of areas within which public awareness raising campaigns are conducted; and number of participants and categories of public involved (target groups), listening to, and contributing to the implementation of the activities.

PROJECT 4: IMPROVE AND STANDARDISE THE QUALITY OF DRINKING WATER.

PROJECT RATIONALE

Supplies of clean water for drinking are provided by different sectors including public, private and international organizations. There is a high level of variability both in quality and quantity of the water produced. As a result, water related health problems such as diarrhoea and dysentery can be commonly observed. Thus, it is important to analyze and improve the standard and quality of both drinking water and water for consumption.

DESCRIPTION

Objective

To reduce the impact of unclean water on people's health in flood and drought prone areas.

Activities

- Review and analyze the existing water quality and supply of drinking water and water for consumption in flood and drought prone areas (USD 0.02 million).
- Develop a water supply system which is able to timely and sufficiently respond to people's needs in flood and drought affected areas (USD 0.02 million).
- Provide necessary training to relevant personnel in the promotion of water quality measures (USD 0.3 million).
- Conduct research and formulate water quality improvement measures in flood and drought prone areas throughout the country (USD 0.2 million).
- Assess water quality following the implementation of activities that aim at improving quality (USD 0.15 million).

Short-term outputs

- Quality of water supply in flood and drought prone areas is analyzed according to technical specifications.
- Measures to improve water quality are promoted, ensuring that water supply demands are met in a timely manner in natural hazard prone areas.

Potential long-term outcomes

- The health and livelihoods of people living in flood and drought prone areas are improved.

IMPLEMENTATION

Implementing agencies

- Central level: MoH, Department of Hygiene and Disease Prevention, Environmental Health and Water Supply Center.
- Provincial level: Provincial Health Office, Environmental Health and Water Supply Unit.
- District level: District Health Office, Environmental Health and Water Supply Unit.

Location

Areas affected by natural hazards throughout the country.

Time frame

3 years

Budget

USD 0.75 million.

Risk and barriers

Chemical contamination of ground water, e.g. caused by use of arsenic, in the affected areas; and weak cooperation and coordination amongst stakeholders and relevant agencies.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: water quality measures; and number of households with improved access to a quality water supply.

PROJECT 5: EXPAND EPIDEMIC DISEASE DIAGNOSTIC LABORATORIES AT REGIONAL AND PROVINCIAL LEVELS TO PROVIDE DISEASE EPIDEMIC INFORMATION IN A TIMELY FASHION TO FLOOD AND DROUGHT AFFECTED AREAS.

PROJECT RATIONALE

In the past, public health networks used in the surveillance of epidemic diseases have been established from the central to local levels (village), with daily, weekly, monthly and quarterly reporting. However, diagnosis of epidemic diseases is mostly based on the symptoms of the patient rather than on laboratory analysis. Sending samples to the central level for analysis takes time and is costly, resulting in a situation of hesitation or reluctance to counter epidemic diseases. Thus, it is important to have laboratories located at the sub-national level, in close proximity to natural hazard prone areas.

DESCRIPTION

Objective

To diagnose epidemic diseases in affected areas accurately and to counteract and control the outbreak of these diseases in an effective and timely manner.

Activities

- Assess and identify critical flood and drought prone areas that have lower levels of access to existing laboratory services for diagnosis of epidemic diseases (USD 0.05 million).
- Select, construct and equip laboratory facilities in two prioritized areas of the country (USD 0.15 million).
- Provide training to relevant personnel involved in disease diagnosis (USD 0.05 million).

Short-term outputs

- Number of personnel who have received training on the diagnosis of epidemic diseases increased.
- Epidemic disease research facilities improved.
- Epidemic disease prevention systems improved.

Potential long-term outcomes

- Skills in epidemic diseases diagnosis are improved.
- Prevention of epidemic diseases is improved, thereby eventually eradicating the outbreak of such diseases.

IMPLEMENTATION

Implementing agencies

- Central level: Ministry of Public Health, Hygiene and Disease Prevention Department and Epidemic Centre.
- Provincial level: Provincial Health Office, Epidemic Division.
- District level: District Health Office, Promotion and Prevention Unit 'Epidemic Unit'.

Location

At two sub-national sites (Northern and Southern 'Champasack province').

Time frame

4 years.

Budget

USD 1.6 million.

Risk and barriers

New diseases occur at a rate that is greater than the capacity of personnel to cope with; low levels of technical capacity of those who will attend training on disease diagnosis; and trained technicians may not use and apply their new knowledge.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; number of laboratories established and equipped with necessary equipment; and accuracy and timeliness of disease diagnosis.

PROJECT 6: PREVENTION AND TREATMENT OF WATER BORNE DISEASES.

PROJECT RATIONALE

Illnesses and death from water-borne diseases such as diarrhoea and dysentery are public health concerns. The Government has prioritized disease prevention and treatment as a core and highly important activity. Prevention and treatment of water-borne diseases is required to improve the health of people living in flood and drought prone areas.

DESCRIPTION

Objectives

To increase the capacity of communities living in flood and drought prone areas in the prevention of disease outbreaks and ensure they can access basic health treatment in a timely manner; and to reduce the incidence of illness and death from water-borne diseases.

Activities

- Design and produce awareness raising and educational materials to disseminate that advocate for health and sanitation and disease prevention (USD 0.05 million).
- Prepare manuals that detail the treatment of common infectious diseases and disseminate in natural hazard prone areas (USD 0.05 million).
- Train village health volunteers on hygiene and disease prevention, surveillance, countering disease outbreaks, primary treatment, and use of basic medicines and chemical substances for sterilization during times of flooding (USD 0.05 million).
- Provide village health kits and chemical substances that are able to kill water-borne diseases in situations of emergency and extreme hazards (USD 0.1 million).
- Conduct public campaigns using a variety of media on disease prevention and treatment in natural hazard prone areas (USD 0.1 million).

Short-term outputs

- Educational materials on disease prevention are developed and disseminated.
- Primary treatment manuals on common disease outbreaks are developed.
- Village health volunteers nominated, trained and working.
- Village health kits and some chemical substances that are able to kill water-borne diseases in situations of emergency and extreme hazard are provided.
- Communities living in natural hazard prone areas have an increased level of understanding of disease prevention and treatment.

Potential long-term outcomes

- Levels of health care improved for communities living in natural hazard prone areas.
- Reduced incidence of illnesses and deaths caused by water-borne diseases.

IMPLEMENTATION

Implementing agencies

- Central level: MoH, Department of Hygiene and Disease Prevention, Environmental Health and Water Supply Center.
- Provincial level: Provincial Health Office, Environmental Health and Water Supply Unit.
- District level: District Health Office (Environmental Health and Water Supply Unit)

Location

Natural hazard prone areas throughout the country.

Time frame

2 years

Budget

USD 0.35 million

Risk and barriers

Basic knowledge on health, economy, culture, social and environmental issues may be limited.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of educational materials produced and distributed; number of communities included within public awareness raising campaign; number of village health volunteers trained and working; appropriateness of use of village health kits and chemical substances to kill water-borne diseases in emergency cases; and number and types of public (target groups) participating in the prevention and treatment of water-borne diseases.

PROJECT 7: DEVELOP A TIMELY AND ACCURATE REPORTING SYSTEM FOR EPIDEMIC DISEASES.

PROJECT RATIONALE

At present, the public health system in Lao PDR has, from central to local levels, greatly improved. However, surveying, recording and reporting on epidemic diseases is not yet systematic, and needs to be improved to be more accurate and timely.

DESCRIPTION

Objectives

To develop effective systems of surveillance and prevention of epidemic diseases; and to develop sufficient human and resource capacities to ensure the timely control of epidemic diseases and reduce the severity of any outbreaks.

Activities

- Review and assess existing information gathering and reporting systems at central and local levels (USD 0.03 million).
- Design and construct an appropriate information system specifically on epidemic diseases that is both timely and accurate (USD 0.01 million).
- Provide and install necessary equipment in three pilot areas (USD 0.1 million).
- Install the reporting systems in three pilot natural hazard affected areas, providing the necessary capacity building for those responsible for its use and operation (USD 0.2 million).

Short-term outputs

- Information system for the surveillance of epidemic diseases in three pilot areas is developed, installed and functioning in a timely manner.
- Human resources are improved in quantity, quality and capacity.

Potential long-term outcomes

- National surveillance system and counter-measures associated with epidemic disease outbreaks are improved.

IMPLEMENTATION

Implementing agencies

- Ministry of Public Health, Department of Hygiene and Disease Prevention and Epidemic Center.
- Provincial level: Provincial Health Office, Epidemic Division
- District level: District Health Office, Promotion and Prevention Unit 'Epidemic Unit'
- Village and Health Center Levels: head of the health center and team, village head and village health volunteers.

Location

Central level and three selected pilot sites.

Time frame

2.5 years

Budget

USD 0.39 million

Risk and barriers

Outbreaks of new diseases; difficulties associated with the installation of reporting systems in remote areas; and coordination and cooperation amongst relevant sectors.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: number of personnel trained; quantity and quality of software and hardware installed; effectiveness of the information system as evident in number of cases reported; and number of counter-measures taken.

PROJECT 8: IMPROVE THE CAPACITY OF THE EPIDEMIC DISEASE SURVEILLANCE SYSTEM.

PROJECT RATIONALE

As a least developed country, Lao PDR has no systematic social relief mechanism that can timely and adequately assist households that have been affected by epidemic diseases. As a result, natural hazard affected households have been left to cope by themselves. In order to assist households in natural hazard prone areas to adapt to potential climate variability and extreme events, the development of a good social relief system is extremely important.

DESCRIPTION

Objective

To develop a social relief system for natural hazard prone areas.

Activities

- Review existing institutional structure related to social relief systems (USD 0.1 million).
- Identify areas which require improvements in the system (USD 0.02 million).
- Develop a program that establishes a functioning social relief system (USD 0.02 million).
- Test the system in three selected natural hazard prone areas (USD 0.1 million).
- Refine and integrate the system into national development planning processes (USD 0.05 million).

Short-term outputs

- Reliable social relief system model developed.
- Three natural hazard prone areas implement social relief system.

Potential long-term outcomes

- Development of national social relief system.
- Enhancement of adaptive capacity of households in natural hazard prone areas.

IMPLEMENTATION

Implementing agencies

- Central level: Ministry of Public Health, Department of Hygiene and Disease Prevention and Epidemic Centre.
- Provincial level: Provincial Health Office, Epidemic Division.
- District level: District Health Office, Promotion and Prevention Unit 'Epidemic Unit'.
- Village and Health Centre Levels: head of the health centre and team, village head and village health volunteers.

Location

Central level: Ministry of Public Health, Hygiene and Disease Prevention Department and Epidemic Centre.

Local level: In pilot areas throughout the country.

Time frame

2.5 years

Budget

USD 1.05 million

Risk and barriers

low levels of technical capacity of those who will attend training on disease diagnosis; trained technicians may not use and apply their new knowledge; and lack of coordination and cooperation amongst relevant agencies.

Monitoring and evaluation

Potential monitoring and evaluation indicators include: surveillance system for epidemic diseases improved; and number of personnel trained.

