វេទិកាដែនអង្គការមិនមែនរដ្ឋាភិបាល ស្តីពីកម្ពុជា
The NGO Forum on Cambodia

ROSA LUXEMBURG STIFTUNG
SOUTHEAST ASIA – HANOI OFFICE

Research Study on People Migration Link to Climate Change: Case Studies from Tonle Sap Plat Plain and Mekong River in Cambodia

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Disclaimer

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ABREVIATIONS

CBO	Community-Based Organizations
CSO	Civil Society Organizations
EDSR	Early Dry Season Rice
EEPSA	Economic and Environmental Programme for Southeast Asia
ELC	Economic Land Concession
EWSR	Early Wet Season Rice
FGD	Focus Group Discussion
FWUC	Farmer Water User Community
GDP	Gross Domestic Products
GHG	Green House Gases
GSSD	General Secretariat for Sustainable Development
ILO	International Labour Organization
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
KII	Key Informant Interview
MEF	Ministry of Economy and Finance
MFI	Micro Finance Institute
MLVT	Ministry of Labour and Vocational Training
MoE	Ministry of Environment
MoH	Ministry of Health
MoP	Ministry of Planning
MOWRAM	Ministry of Water Resource and Meteorology
MRC	Mekong River Committee
NCSD	National Council for Sustainable Development
NGO	Non-Governmental Organizations
NIS	National Institute of Statistics
NTFP	Non-Timber Forest Products
PDAFF	Provincial Department of Agriculture Forestry and Fisheries
PDE	Provincial Department of Environment
PDRD	Provincial Department of Rural Development
PDWA	Provincial Department of Women Affaire
PDWRAM	Provincial Department of Water Resource and Meteorology
RGC	Royal Government of Cambodia
TVET	Technical and Vocational Education and Training
UN CC	United Nations Climate Change Learning Partnership
UNDP	United Nations Development Programme
UNDRR	United Nations Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United State Agency for International Development

EXECUTIVE SUMMARY

Cambodia agriculture sector remains an important source of income, employment (37% of the country's labour force in 2017) and food security for rural farmers and local communities, for example, in 2019, agriculture contributed 21% to Cambodia's gross domestic product (GDP)[1]. Climate change is the biggest threat to Cambodia's people and country economy. Also, Cambodia is one among the most vulnerable countries to climate change in Southeast Asia due to its low adaptive capacity. In addition, water, fisheries and agriculture sector have been significantly affected by those extreme weather. During the last decades Cambodia faced with more severe and frequent climate change impacts and extreme weather such as drought, flash flood, and heavy rain with strong winds/storms. For instance, the 2011 flood affected approximately 237,375 families, damage to the economy approximately 4.3% of GDP and the estimate cost of the lost was over $520 million[2]. The recent 2020 flood affected 19 provinces of more than 2 million people, killed 42 people and directly affected 800,000 people[3]. Farmers often challenge with dilemma either water shortage during early stage of plantation or drought or too much water even flash flood during ripe stage. Ministry of Environment (MoE) revealed that people migration is one among remarkable impacts caused by climate change, especially severe flood, drought and storms[4].

Besides there are various factors associated with people migration, including: lack of budget to pay bank loan or interest is reported as a major linked to local people migration, limited capacity and awareness to adapt and mitigate the impacts of climate change, following by lack of awareness to diversify income, and deficient farmland for cropping. In line with this, insufficient irrigation system, declining fisheries, forest and soil fertility resource, and so on, are also regarded as the main causes[5]. Also, because of low yield and market prices of agriculture products, farmers are applying more chemical fertilizers than they did in the past. It is noted that, on top of climate change impact, debt is seen as major factor. It is happening due to the need for expanding their business (investment or buying four wheels or two wheels tractor, trucks, water pumping machines, etc.), farmers (nearly 90 % of households in the study sites) get loan from their neighbors or private money lenders or microfinance institutions or bank. Unfortunately, many households face with unsatisfied income (crops lost due to flood or prolong drought, major water sources dried out, low soil fertility, low price of agriculture products, imbalance of expense and income, etc.) and unable to solve bank loan, in turn, pushing them to diversify cropping, business or migrate to urban areas, Phnom Penh and abroad so as they can get more opportunities, skill and income to support families and solve the debt.

To address the constraints while improving living standard and maintaining the surrounding natural resources and ecosystem, farmers need the institutional support to: restore the condition of rivers, canals, lakes and ponds in the village; create ecotourism areas in their areas or nearby their communities to attract and get income from visitors; provide them good rice seeds (good price, short time, high yield and weather resistance) and fish species; and protect and conserve

[1] A Third Study on Understanding Public Perceptions of Climate Change in Cambodia: Knowledge, Attitudes, and Practices. National Council for Sustainable Development / Ministry of Environment (NCSD/MoE), Phnom Penh, Cambodia.
[2] Cambodia's Intended Nationally Determined Contribution. Available on line (accessed 12 June 2017). Royal Government of Cambodia. Phnom Penh, Cambodia.
[3] Cambodia Floods Response Plan. Available on line (accessed 13 Feb 2021). United Nations Office for the Coordination of Humanitarian Affairs.
[4] The Conference on "Climate change and its impact on Cambodia", hold in Phnom Penh on 12 Aug 2020, Available online (accessed 3 Sept 2021). Press OCM. Office of the Concil Ministers. Phnom Penh. Cambodia.
[5] Based on data collected from meeting and interview with key informant and relevant stakeholders conducted during report preparation in July 2021.

flooded forest. Besides, villagers also need to improve their awareness on creating community market; farming/cropping techniques (including application of agricultural inputs fertilizer, soil/land and water management, seed selection of both long and short-life seeds, and grain storage, etc.); and feeding animals, fish and eel (aquaculture). These institution supports would also help them to be able to cope with resource scarcities and climate stressors[6].

Migration is an important trend in Cambodia and across Southeast Asia. Many Cambodian rural migrant workers returned home with improved skill and income. Furthermore, safe migration, which ensures the living and working condition of migrant worker while they are staying abroad and returning home, helps contribute to country socioeconomic development as well. Regrettably, due to COVID-19 outbreak, migrant people (in country and abroad) have returned home and restart their farming activities. They actually need the support from concerning agencies to build their capacity for improving livings condition as well as to be able to adapt to climate change impacts.

The Royal Government of Cambodia (RGC) has issued laws and policies such as National Water Resource Policy, Law on Fisheries, Agriculture Strategic Development Plan 2019-23, etc., to manage and develop water, fisheries and agriculture sectors. RGC has continuously coordinated with development partner, private sector and Civil Society Organizations (CSOs) to build the capacity, awareness, skills and technical and vocational education and training (TVET) of the people and rural migrants to generate better income and to adapt to climate change. It is obviously that these helpful supports are highly required by local people and shall be timely implemented.

In line with this, relevant government institutions (from agriculture, environment, water, fisheries, forestry, rural development, women affair, climate change and natural disaster reduction and management sectors, etc.) have actively support rural people to improve the farming, living and socioeconomic condition according to their strategic and action plans. Various programmes, plans, policies and activities are undertaking for improving people awareness, skills, migration and livelihoods, as well as reducing and mitigating the impacts and risks of climate change and natural hazards. Consequently, the below recommendation is developed to effectively support the implementation of the above activities.

RECOMMENDATION

To further strengthen people awareness and livelihoods while minimizing the vulnerability of climate change and natural resources scarcity, and to enhance local community adaptation capacity to cope with the impacts of climate change and weather stressors, the following activities and measures should be undertaken as following:

Short Term activities and measures:

- Strengthen awareness on climate change adaptation and resilience of local communities who are the most vulnerable so that they are able to overcome climate change impacts;
- As part of viable ecosystem functions as protection of climate change effects, local people should be trained as well on safety and sustainable use of chemical input (pesticide, herbicides, fertilizers, etc.) so that they are aware of its benefit and adverse effects in the future to human and environment.

[6] Ibid.

- In order to increase resilience of local communities, they should be trained on how to produce and apply natural inputs to improve soil fertility, water quality, surrounding ecosystem and agriculture productivity.
- Organise suitable community training and exchange field study tours so that local communities can get better awareness, share knowledge and best practices and learn from each other. This would improve the management and development of water, fisheries, forestry and land resources since majority of local communities rely on them for their livelihoods;
- Continue to protect and conserve natural resources such as forestry, fisheries, land and water resources;
- Engage local communities in natural resources protection and conservation through patrolling and monitoring activities;
- Build local people capacity and engage them to participate in forest management and reforestation, fisheries management and conservation, aquaculture, and water and agriculture management and development;
- Train and encourage local people to implement the Ecosystem-based Adaptation (EbA) to ensure water security by using ecosystem functions and enhancing ecosystem services for flood and drought management;
- Provide local people on time weather forecasting and early warning information to that they can prepare themselves to cope with climatic and weather stressors;
- Identify and prioritize actual people's needs to cope with or fight against climate change impacts and support them on time and at the right places;
- Engage, empower and identify appropriate opportunities and ways for local people and ethnic minority communities to participate, assess and monitor the development of irrigation infrastructures (canal, weir, dams, embracement, spillways, water reservoir, etc.) to avoid and minimize as much as possible impacts or risks arising from such development, and to ensure accountability, transparency, equity, legality and maximum benefit to them.
- Raise awareness of people on prevention and protection measures to combat COVID-19 pandemic, and continuously take administrative, legal and health safety measures to fight against COVID-19 pandemic in all provinces and capital.
- Provide particular protection, supports and services (health care, basic skills, vocational training; etc.) to rural women, youth and ethnic minority groups so that they can live and work safely during they are working as migrant worker since they have limited capacity and education.
- Identify mechanism for protection and empowerment of rural migrant workers so that they can work effectively to improve their livelihood as well as the social and economic development of the country.
- Regularly conduct Safe Migration Campaigns at sub national and local level to inform people before they migrate to find jobs internally, regionally or internationally. These activities would particularly protect rural young and inexperienced women migrants from any forms of risks while ensuring that migration will provide positive benefit to the people and to the country.

Long Term activities and measures:

- Continue to construct, restore and improve irrigation system and reservoirs to ensure water availability (both upstream and downstream) for agriculture activities, sanitation and domestic consumption as well as to protect local communities from the risks caused by severe flood or droughts;
- Strengthen cooperation and coordination mechanisms among national and sub-national institutions, development partners, civil society and private sector to respond to climate change;
- Identify best practices on people migration and climate change and mainstream them in the relevant climate change adaptation and mitigation since this would also safeguard people migration and healthy environment;
- Improve the coordination among relevant public institutions, development partners, civil society and private sector to seek suitable solution to minimize unplanned people migration and to facilitate climate migrants;
- Create and expand international and regional cooperation (in particular Mekong Region) to mitigate climate change impacts especially floods, drought, salinity intrusion, etc., while ensuring water security (quantity and quality) for people livelihood, socioeconomic activities (irrigated agriculture, sustainable hydropower, safe navigation, biodiversity, fisheries) and ecosystem in the Lower Mekong Basin;
- Develop policies or legal frameworks on migration and climate change concerns through sectoral stakeholder coordination to reduce climate change vulnerabilities and natural hazards as well as to ensure the safety of climate migrant.
- Promote and strengthen technical and vocational education and training (TVET) in order to improve and increase the education, skills, effectiveness income and safety of migrant workers, and continuously organize national campaign on TVET at provincial, community and local level to raise awareness of local women, men, youth and indigenous people.
- Incorporate or mainstream migration education (general and climate induced migration) into national, sub-national and local campaigns relating to: vocational education and training, environment and climate change, health and sanitation, employment, socioeconomic development, natural resources governance, agriculture and rural development, village and commune safety, etc. so that people get better idea on safe migration.

1. INTRODUCTION

Cambodia is one of the countries significantly affected and threatened by climate change (MEF & GSSD 2019). During the last decades Cambodia and other countries in the Mekong region face more severe and frequent climate change impacts such as extreme weather e.g. drought and flash flood combined with heavy rain occurred with strong winds/storms (MRC 2020). Climate Change Vulnerability Mapping for Southeast Asia conducted by the Economy and Environment Programme for Southeast Asia (EEPSA), revealed that Cambodia is one among other most vulnerable countries to climate change in Southeast Asia due to its low adaptive capacity (Arief Anshory & Herminia 2009, World Risk Report 2018; Heng 2020[7]).

Climate change is the biggest threat to Cambodia's people and country economy. Natural disasters (such as drought, storm and flood) and rising temperatures, can pose a bigger hazard when it comes to the economic impact of climate change in Cambodia (UNDP 2018). In 2018, World Risk Report and Global Climate Risk Index indicated that Cambodia is ones of the most at risk countries by extreme weather events in Asia (World Risk Report 2018; Germanwatch 2018). The climate challenge for Cambodia is dealing with persistent poverty, social and economic marginalization, and gender inequalities that exacerbate climate change impacts – often resulting in further food insecurity, environmental degradation, and limiting of options for the poor to adapt to climate change. In addition, the United Nations Framework Conference on Climate Change (UNFCCC) reveals that climate change has a greater impact on population who relies on natural resources for their livelihoods, and significantly, women, girls and vulnerable groups who have also limited their voices and chances for participating effectively in all levels of consultation, making decisions, and contributing to climate-related planning, policy development and implementation (UNFCCC 2021).

Cambodia has encountered more frequent and heavy climate change risks and natural hazards (MoE 2018a) triggering challenges for economic and social of the population, natural resources and environment, particularly the livelihoods of people living country low land area such as Tonle Sap plat plain of Tonle Sap Great Lake, and areas along the major rivers and lakes such as upper and lower Mekong River, Tonle Sap and Bassac Rivers. For example, flood in 2000 caused the total physical damage about US$150 million, affected 750,618 families (representing 3,448,624 people) and killed 347 people (80% children) (RGC 2008). The flash floods in 2013, impacted more than half a million people and over half of Cambodia's provinces. The damage and loss was estimated about 356 million US$5, of which 153 million US$ was the physical assets (damage) in the affected areas, and 203 million US$ the losses in production and economic flows (RGC 2015).
The worst drought in the country, took place in 2002, had affected 2,047,340 people or 442,419 families and the damage cost was estimated to be more than US$21.50 million (RGC 2008).

In 2018, World Bank reported that climate change could force 143 million people in three regions of the world including Sub-Saharan Africa, South Asia and Latin America to move within their countries by 2050, 40.5 million of those in South Asia (Kumari *et al.* 2018). It is likely that urban areas will become hotspots of in-migration and rural-to-urban migration will grow. Migration is an important trend not only in Cambodia but also across Southeast Asia. There is also an increasing

[7] Dr. Heng Chan Thoeun, Deputy of Climate Change Department, addressed during seminar workshop on Ecosystem based Adaptation (EbA), hold in Kep Province in 2020.

number of women are seeking employment and education opportunities in Phnom Penh, other urban and rural areas, or internationally (MOP 2013a). Consequently, in 2014, the government has created the policy on Cambodia labour migration to ensure that Cambodia migrant workers are productively employed and their skills are developed to work in emerging sectors locally and externally (MLVT 2014),

MoE, in 2020, reported that climate change impacts including severe flood, drought and storms caused people to migrate for living alternatives (Press OCM 2020 and NCSD & MoE 2020a). Besides, aiming at ensuring the protection and conservation of biodiversity and natural resources that most Cambodian people rely on, and reducing greenhouse gas (GHG) effect that leads to the global warming through the protection and maintenance of forest cover, MoE and its provincial environmental department are actively working on protected areas patrolling by coordinating with local communities and authorities.

Yet, there is deficient evidence about what and how the issue of climate change links to migration, especially impacts caused by climate change on people migration in Tonle Sap plat plain and Mekong River. This report is to use as evident-based documents and anecdotal discussions with local inhabitants to understand whether climate change impacts forced them to migrate, and based on the finding, to enhance existing policies and on-going activities to combat climate change impacts, and to support people's migration.

2. OBJECTIVE

The overall objective of the assignment is to document the impacts of climate change and the interlinkages among climate impacts and people migration, especially women and youth in Tonle Sap and Mekong River, then, propose some possible solutions for different stakeholders.

In addition, the specific objectives of the study are two folds:

1) Identify and document significant impacts of climate change such as drought and flood which lead to the people migration include concerning issues of women and youths from Tonle Sap Lake and Mekong River; and
2) Define appropriate supports and needs to improve policies and enforce the practical implementation.

3. METHODOLOGY

For this report a desk review, selection and mapping of study areas, data collection and stakeholder/key informant interviews, data processing and analysis were conducted.

Desk review of relevant and up-to date information/documents and discussion is made to obtain knowledge of gaps and to prepare appropriate questions. In depth review of relevant regulations, documents, reports, available literature and publications are also undertaken. Maps of climate related hazards of the Tonle Sap and Mekong River are also reviewed and gathered to use for spot checks, ground observations and discussions with relevant stakeholders at national, sub-national and community levels. Besides desk review, questionnaire development and field work for data collection and semi-structure interview and focus group discussion with key informant and local stakeholders/communities are essential for this report preparation. The questionnaire is carefully developed in accordance to the research objectives as well as the local context. This questionnaire was reviewed and agreed by the panel composed of staff from NGO Forum and Rosa Luxemburg Stiftung before conducting data collection.

Targeted areas were selected for the research study, one in Kompong Thom province which represents of Tonle Sap plat plain, and another in Kratie province which represents of Mekong River area. These sites were selected because they represent two types of Cambodia agro-ecological zones.

Furthermore, the selected study sites are classified into main study sites[8] (Kompong Kou commune, Kompong Svay district, Kompong Thom province and Sambok commune, Chetr Borei district, Kratie province, and complementary sites[9] (Tnaot Chum and O'Kanthor Tborng commune, and Stung Saen Town of Kompong Thom province; and O'Krieng commune and Kratie Town of Kratie province).

Figure 1: Map of the study areas

Note: ◯ Study Areas

Geographically, main study site in **Kompong Thom** province covers a vast agricultural land and fishing areas that is considered as a main source of livelihoods and income generation. Tonle Sap zone and Plateau/Mountainous zone provides important information on situation occurring due to climate change and natural hazards as well as human induced changes on human livelihood and natural resources that people rely on.

Meanwhile, main study site in **Kratie province** is addressed on agriculture, fisheries and ecotourism development area in which most local inhabitants depend on ecotourism opportunities for their incomes and livelihood alternatives. The remained sites are the complementary sites selected for data verification in order to get precise data and information

[8] Main study site for data collection and cast study.
[9] Additional study sites for data and information collection to verify and validate data and information collected from main study sites. This helps ensuring that the collected data/information are consistent, accurate and reliable.

used for evidence-based reflections in relation to climate change and migration. Figure 1 shows map[10] of the study areas of both provinces.

Table 1: Number of male and female involved in in-depth interview in Study Sites

No	Provinces	District	Commune	Village	Targeted Groups	Male	Female
1	Kompong Thom	Kompong Svay	Kompong Kor	- Kaoh Krob Bay - Kompong Kor Krom	- Elderly people, women and youth groups - Water User Community - Fisheries Community	16	21
2	Kompong Thom	Baray	Tnaot Chum	Tnaot Chum Ti Mouy and Tnaot Chum Ti Pir	- Villagers of elderly people, women and youth groups - Water User Community	3	1
3	Kompong Thom	Stung Saen	O'Kanthor Tborng	O'Kanthor Tborng	- Community Fish Refuges (CFR) - Water User Group	4	1
4	Kompong Thom	Stung Saen	Stung Saen provincial town		- Relevant Provincial Departments and local NGO/CBO	6	1
5	Kratie	Sambou	O'Krieng	O'Kok	- Forestry Community - Fisheries Community - Indigenous community	8	2
6	Kratie	Chetr Borei	Sombok	Kampi	- Villagers of elderly people, women and youth groups - Fisheries Community	17	29
7	Kratie	Chetr Borei	Kratie provincial town		- Relevant Provincial Departments and local NGO/CBO	4	1
					Total:	58	56

About 53 respondents from Kompong Thom and 61 respondents from Kratie province were invited for meeting and in-depth interview. Those respondents were composed of local villagers, community chief, community members, local authorities (village leader or commune councils), women and youths, vulnerable and ethnic minority groups, provincial department officers as well as relevant local non-governmental organizations (NGOs) and community-based organizations (CBOs). In addition, two local experts at national level (one male and one female) were also part of the discussion. Then, the number of respondents increased to 116 in total including 56 women (49%).

Particular consultation with Cambodia climate change experts[11] who currently working on climate change mitigation and adaptation, agriculture, water, and natural disaster risks reduction and management, and expert from Fisheries Administration, were conducted to gather their point of views as well as to validate data and information collected from field and desk review. This cross checking is also undertaken to examine related issues and further aspects to incorporate in the report. Also, aiming at better understanding, women and youth opinion and difficulty within the context of climate change, migration and agriculture linked to current situation of COVID-19 pandemics were also examined.

[10] Map of Cambodia, available online, accessed 5 Aug 2021.
[11] Including Mr. Mao Vanchann, Climate Change and Environment Expert, and Mrs. Chhun Sony, Depart of Fisheries Community, Fisheries Officer, FiA

4. LITERATURE REVIEW

4.1 Unpredictable Climate Change and Natural Disasters

Climate change is the world's greatest environmental challenge which can be caused by natural internal processes or external forces, or long-term changes in the composition of the atmosphere, or by land use due to human activities that is directly or indirectly that further alter the composition of the global climate (UNFCCC 1992; UNFCCC 2011).

Previous studies, for example the previous and recent studies conducted by the Intergovernmental Panel on Climate Change (IPCC) in 2014 and 2021, have shown that climate change such as unprecedented weather, extreme temperatures and increased frequency of flood and droughts and forest fires will have greater potential for serious risks and impacts on ecological systems, human health, human systems (e.g., infrastructure damage or agricultural productivity) and people livelihood in particular the poor, indigenous people and vulnerable communities whose living mainly rely on already depleted natural resources or ecosystem services (IPCC 2014 & IPCC 2021). Any change or increase in the average temperature or rainfall amount/frequency on earth will impact on land and water resources, forestry, fisheries, agriculture and human wellbeing (MEF & GSSD 2019).

Climate change and natural disasters such as flash flood, prolonged drought, water scarcity, heat stress, storms, high temperature, etc. will not only intensify existing risks for people and communities who are lacking essential infrastructures and services or those who are living in exposed areas, but will also generate new risks that will affect people and their livelihood support assets (IPCC 2014).

Cambodia has been increasingly exposed to climate change, such as rising temperatures, changes in rainfall, frequency of floods, droughts and storms over the past few decades.

Table 2: Composition of Disasters in Cambodia from 1996 - 2020

Event	Deaths	Injured	House destroyed	House damaged	Directly affected	Evacuated	Education centers	Hospitals	Crops damaged (ha)	Lost Cattle	Roads damaged (m)
Drought					2,818,433		11		1,033,462	1,154	1,110
Flood	1,243	1,115	2,401	31,810	13,457,143	764,838	947	1,839	2,057,517	24,683	8,218,237
Lightning	1,191	661	39	185	2,252	337	1	1	502	458	
Storm	126	676	13,723	42,521	113,417	3,111	75	39	5,458	74	210
Total:	**2,560**	**2,452**	**16,163**	**74,516**	**16,391,245**	**768,286**	**1,034**	**1,879**	**3,096,939**	**26,369**	**8,219,557**

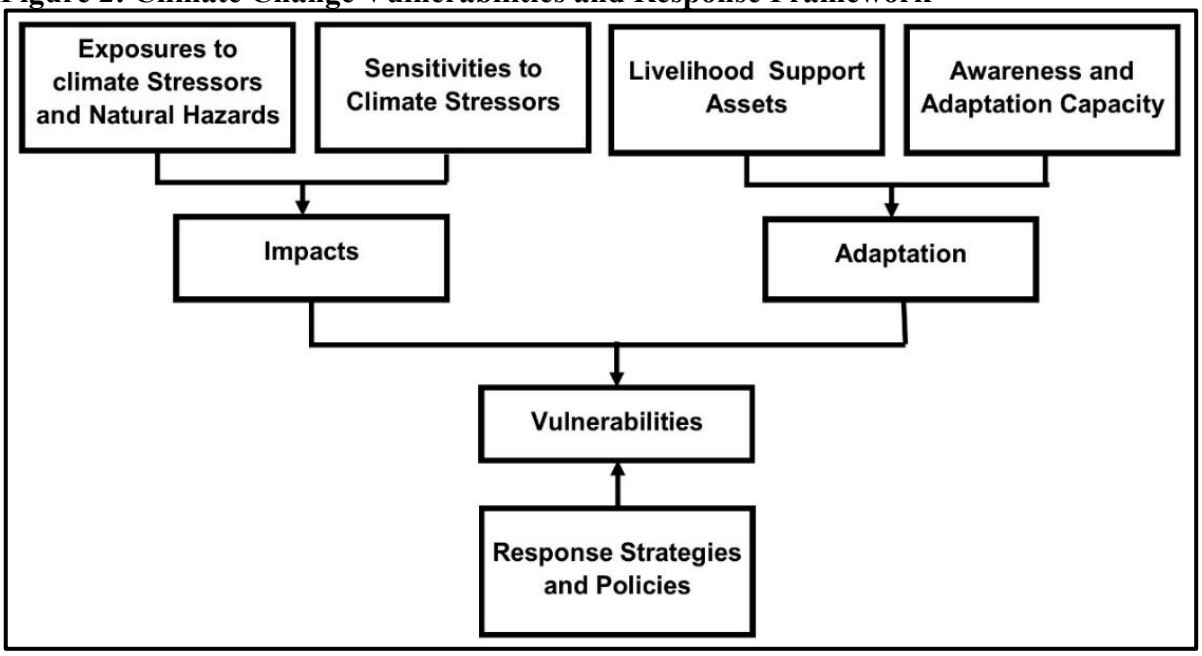
(UNDRR 2021a)

The above Table 2 reflects that, between 1996 and 2020, flood has severely affected about 13,457,143 peoples, killed 1,243 people and damaged 31,810 homes, 947 education centers, 1,839 hospitals, 2,057,517 ha of crops and about 8,218,237 m of roads. Notably, drought has also caused damages about 1,033,462 ha of crops, while storms combined with heavy rain and

lightning killed 1,317 people, injured other 1,337 peoples more and further damaged about 42,706 homes (UNDRR 2021a).

Impact of climate change increases pressure on environment, depletes community's livelihood support resources and makes community's living in troubles. Countries with the lowest socio-economic development are facing deficient adaptive capacity to cope with climate change and other environmental challenges (UNFCCC 2011).

Figure 2: Climate Change Vulnerabilities and Response Framework



Source: adapted from (Benjamin *et al.* 2012)

People on the world have experienced with variable impacts of climate change and natural hazards
at differing levels of severity and vulnerability (ILO 2014). Moreover, climate change will increase the frequency and intensity of extreme weather events including droughts, storms and severe floods, (Gunilla 2009). Although, climate scenarios are developed to estimate, understand and get rid of negative impacts of climate change, the prediction of climate change (or climate projection) is currently remained uncertainty at some extent. For example, IPCC (2000) revealed that climate change predictions vary because they are based on a variety of development scenarios which have been widely used in the analysis of possible climate change, its impacts, and options to mitigate climate change. Scenarios are alternative images of how the future might unfold. Each scenario also includes various assumptions about population growth, technological development, economic growth, and energy sources. Any variability of scenarios would create error margin in predictions (IPCC 2000).

Notably, the clear policy and strategy to response to climate change vulnerabilities shall be in place, and local communities should be well understood about the impacts of climate change and natural hazards and the level exposures and sensitivities of their community so that they can increase their adaptation capacity to cope those impacts. On the other hand, coordinated planned migration might be an adaptation option/ strategy as well. For example, as shown in Figure 2, the local communities can involve in the activities for building resilience to response to the identified climate vulnerabilities, and in turn a function of climate impacts will be intervened by their adaptive capacity (Benjamin *et al.* 2012).

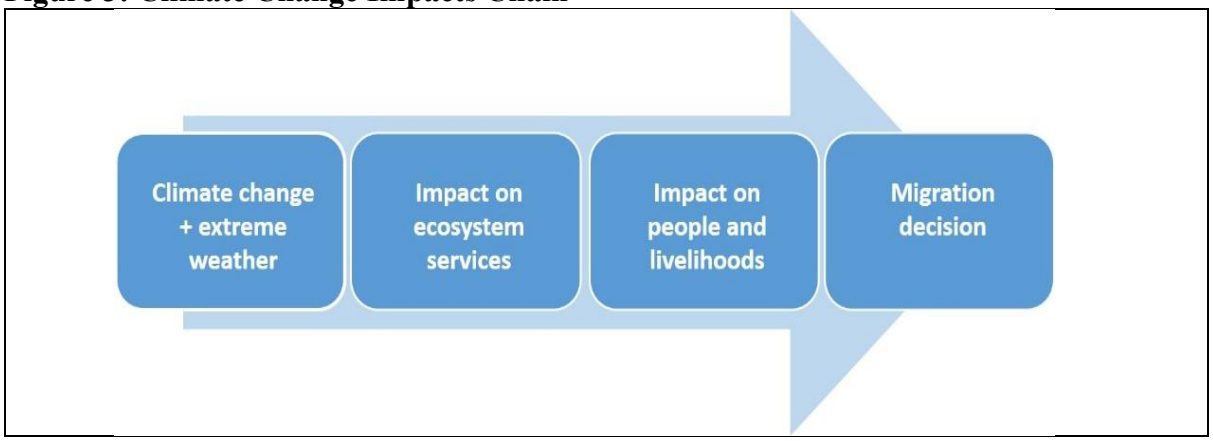
4.2 Climate Migrant

The International Convention on the Protection of the rights of all migrant workers and members of their families, article 2, defines a migrant worker as "a person who is to be engaged, is engaged or has been engaged in a remunerated activity in a State of which he or she is not a national" (UNWOMEN & UNOHCHR 2011). According to The International Organization for Migration (IOM), "Migration" is referred as the movement of persons away from their place of usual residence, either across an international border or within a State (IOM 2019b). There some kinds of migration currently existed such as: "Labour migrants" which are referred as people who mobilize for the purpose of employment, and "Economic migrants" which referred to people who enter a state to perform economic activities, such as investors or business travelers (Ibid). Furthermore, it is expected that natural climate change and human induced changes that lead to environmental degradations will likely to persuade/force migration in certain geographic locations that are prone to droughts, floods and storms (ILO 2014; EACH-FOR 2015; GEA 2020). In line with this, United Nations University defines "Climate Migrants" as *"People who leave their homes because of climate stressors such as changing rainfall, heavy flooding, and sea level rise, put pressure on people to leave their homes and livelihoods behind"* (UNU-EHS 2015); while "Environmental Migrants" is referred by IOM as *"Persons or groups of persons who, predominantly for reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their homes or choose to do so, either temporarily or permanently, and who move either within their country or abroad*" (IOM 2012).

Various literatures have examined the linkages between climate change and migration either internal or international scale in responding to slow-onset or rapid-onset events, and reported that migration serves several purposes including: i) to seek for reducing individual or household exposure to climate hazards, e.g. droughts or floods hampering agricultural yields, sea level rise and coastal flooding; ii) to diversify livelihood and income as well as to cope with climate stressors; iii) to increase household assets and resilience to climate change; iv) to bring new skills and technologies back to the communities they left, increasing their wealth and resilience to climate hazards (Alex de & Sherbinin 2020). In addition, migration with dignity can improve hope and prosperity for individuals and communities, and contribute to the development of the people, community and country (IOM 2019a; MLVT 2014).

In the study on the extent that climatic stressors and their impacts on ecosystems, livelihoods and habitability drive people migration, Kees *et.al* (2000) also found that: i) due to climate change, the impact of environmental change on migration will be occurred and stronger in the future than at present; ii) commonly environment induced migration would be internal or cross border; iii) migration could be due to lack of capacity to adapt to environmental changes, and could be also household strategies to diversify livelihoods and reduce climate risks; and iv) climate change will not only force people to migrate, but also confine them in vulnerabilities if they lack the abilities to migrate (Kees *et al.* 2020).

Figure 3: Climate Change Impacts Chain



(Kees *et al.* 2020)

In parallel to this study, some literatures (Linn *et al.* 2010; Nang *et al.* 2010; Kees *et al.* 2020; MoP 2013b; MoE & UNDP 2011; IOM 2019a; Lauren & Maxine 2020) also revealed that migration is associated with climate change and natural disaster or extreme weather, and the change of surrounding environment and ecosystem health that impacted on ecosystem services and livelihoods deponent resources. According to these literatures, people start to think whether they should stay or migrate when their living are under the pressures caused by these changes. For instance, climate change causes impacts on environment leading to declination of natural resources or common pool resources people relied on and due to this local people decide to mobilize to nearby and long distance areas that the natural resources (fish, non-timber forest product, irrigated land, etc.). Low economic opportunities (agriculture, construction, tourism, industry, garments and services sectors) and capacity (or education) for climate change impacts adaptation and mitigation, income generation, livelihood diversification, and employment opportunities in the living areas; forced people to migrate to seek jobs as well. On the other hand, people would choose to stay (or not to migrate) in the affected areas when there is no room for them to leave[12] or mobilize including lack of education/skill, lack of supported budget to travel long distance to seek jobs or hire farmland, or they have elderly or children to take care. In Cambodia, people migrate (locally or abroad) for jobs and income are observed across the country and the number of migration workers have been shifted from year to another. Migration abroad can be seen as an opportunity to improve skill and income as well. In 2018, Ministry of Labour and Vocational Training (MLVT) revealed that more than one million people have migrated abroad including: Thailand: 1,146,685, Republic of Korea: 49,095, Japan: 9,195, Malaysia: 30,113, Singapore: 831, Hong Kong: 45 and Saudi Arabia: 16 (NIS 2019).

It is noteworthy that it is not an easy task to make predictions on the ways that communities will adapt to climate change, including migration as an option. However, it is crucial to acknowledge that climate change will have gender specific impacts, because migration that is linked directly or indirectly to human-induced environmental degradation and natural climate change are a daily reality, and they will impact differently on vulnerable groups such as women, children, elderly, disabled and indigenous people, who are unable to move in the face of calamities and they could be trapped in desolate environments (IOM 2008; GEA 2020; IOM 2019a; Liège 2020). Then, specific consideration shall be made and ready for support them on time.

[12] No empty area for new settlement, no money for travelling or buying food and no farmland for cropping in new area. Etc.

Migration in the context of climate change, environmental degradation and disasters is true, and although, it is hard to foresee the impacts of climate change, future climate migration could face more challenges than in current situation, thus, appropriated and well managed migration could be a coping mechanism (IPCC 2000; Alex de & Sherbinin 2020; IOM 2019a; McSweeney *et al.* 2008).

In Southeast Asia, labour migration is seen as a key driver of economic growth and development. Beside climate change factor, both regular (with legal work permit) and irregular (without legal work permit) labour migration links also to socioeconomic factors (IOM 2020). Notable income discrepancy is a main factor influencing people to migrate from lower-income countries to higher-income countries. Consequently, most of migrant workers send their earnings back home for improving the living condition. However, many irregular migrants face low paid, workload, insecurity and exploitation due to their irregular status (Ibid), Safe migration has been considered and applied by countries in the region to solve such issue.

Ministry of Labor and Vocational Training (MLVT) has developed the Labour Migration Policy for Cambodia 2015-2018 to ensure the protection and empowerment of migrant workers at all stages of the migration process (MLVT 2014). Safe migration supports the healthy living and working condition of migrant workers and helps to ensure that migration will provide positive benefit to migrant people and to the country. MLVT also indicated that many international migration workers help increase the value and income of the local/internal labour forces (ThmeyThmey 2017). Meanwhile, they have absorbed the professional skills from developed countries and they will return home with income and better idea on modern production chain to develop themselves, their families, villages and communes as well as Cambodia country (Ibid). For example, a couple of migrant worker[13] who used to work for long time (20 years) in a construction site in Thailand revealed that now he and his wife also work in construction site in Cambodia. He and his wife have more and improved skill in this sector so his family get better salary and can save about US$ 500 to US$ 600 a month which is a bit higher than the amount that they can do when living in Thailand, because they had to spend much money for food, appliances, communication back home, travelling to visit home/family, and so on. Now his living is better that before, he has money for kids to go to school and for build new home. Another businessman who used to be a migrant worker in South Korea reports that after returning home he star a business on solar chicken grill, called C.Grill[14], an attractive and new energy saving technique using solar panel, and never ever existed chicken grill business in Cambodia allowing him to get profit twice time. Before he has only one branch, but now his business is success, and within a year he increased up to 15 branches in Phnom Penh. Notably, according to MLVT, Cambodian migrants sent home US$354 million in remittances[15] in 2011 (MLTV 2014), and this amount was remarkably increased few years later (ThmeyThmey 2017). These reflect the positive benefit and contribution of safe migration to people living, employment and to country economic development in Cambodia.

[13] Fresh News 2019, Cambodia's construction sector helps Mr. Chanthy improve his life and stop migrating to Thailand. Available online, accessed 23 Aug 2021.
[14] Business Cambodia 2021. Khmer Solar Chicken Grill can expand to 15 branches in just one year. Available online, accessed 24 Oct 2021.
[15] It did not include the remittances sent through non-official channels.

5. FINDINGS

5.1 Climate Drivers

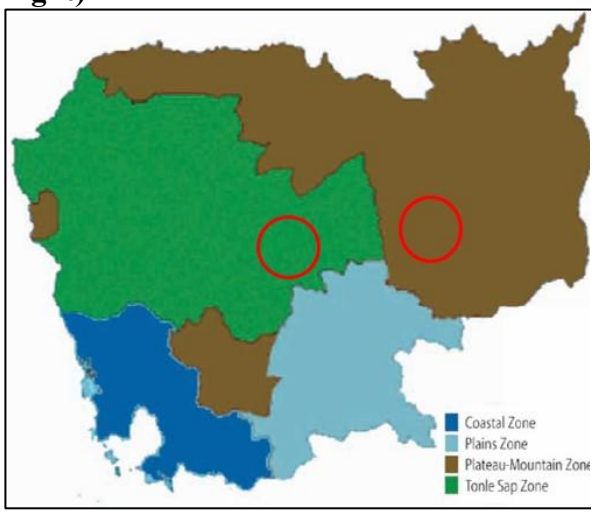
5.1.1 Climate Processes

Located in the tropical-monsoon climate (Southwest Monsoon from mid-May to October, and Northeast Monsoon from October to April), Cambodia has two seasons: the wet or rainy season started from mid-May to early October, and the dry season started from the end of October to the end of April. The country average annual temperature in the rainy season is from 27 °C to 35 °C and the dry season from 17 °C to 27 °C. The hottest month in Cambodia is from March to May (29 °C to 38 °C), while the lowest average temperature (17 °C) is January (Khun 2002; Chann 2002). Rain water is one of the most important sources of water in Cambodia. The average annual rainfall in the Central Plains is 1,400 mm, and in some coastal areas and in the Highlands the average annual rainfall is 4,000 mm (Heng 2015).

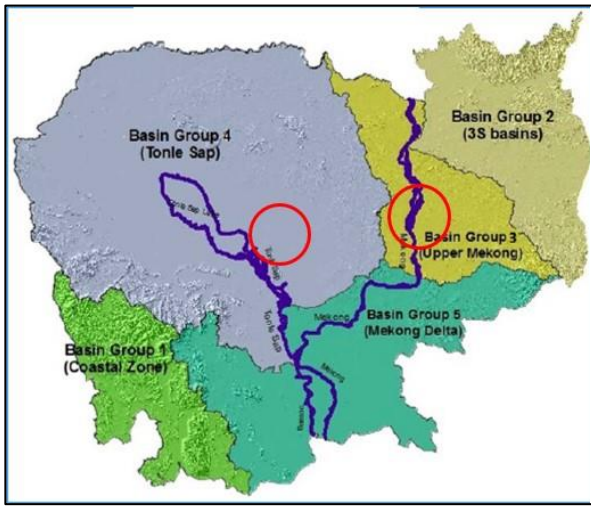
Cambodia is a country with fertile low land in the central part. This is called Tonle Sap plat plain a part of Tonle Sap Great Lake, which is surrounded by highland and mountainous area with numbers of watersheds, rivers (including Upper and Lower Mekong River, Bassac River, Tonle Sap River) streams and tributaries. Water has been used in many sectors including agriculture, energy, industry, domestic use, navigation, tourism, fisheries and ecosystem sustainability.

The country is divided into four major agro-ecological zones that represent heterogeneous agricultural activities, populations and livelihood systems such as Tonle Sap plain, Mekong plain, Mountains/Plateau, and Coastal area (MoE & UNDP 2011). In view of hydrology, Cambodia has five water regions namely: Tonle Sap, 3S Basin, Upper Mekong, Mekong Delta and Coastal Zone (MOWRAM & JICA 2017).

Figure 4: Cambodia Major Agro-ecological Zones (Left) and River Basin Groups (Right)



(MoE & UNDP 2011)



(MOWRAM & JICA 2017)

Note: ⬭ Study Areas

The study of McSweeney *et al.* (2008) shows that the temperatures during 1960-2100 in Cambodia will increase by 0.8°C, at a rate of approximately 0.18°C over a decade. The growth rate has increased rapidly 0.20-0.23°C over the past decade during the dry season. The rate decreased during the rainy season by about 0.20-0.23°C over a decade (McSweeney *et al.*

2008). In addition, by using the scenario models SRESA2 and SRESB2 in his study, Heng (2015) estimated that the maximum temperature of Cambodia between 2008 and 2099 is in the range of 32.7ºC -37.1ºC (Heng 2015). By forecasting the weather model, temperatures will rise in the future in addition to severe and frequent floods.

In 2020, MoE revealed that the variability of rainfall has noticeable changed the water regime of Mekong River and Tonle Sap, as revealed by MoE that *"…the impact of climate change has altered rainfall regime and water level in Tonle Sap and Mekong River Basin..."* (Press OCM 2020 and NCSD & MoE 2020a). Changes in rainfall patterns, temperature rise and the emergence of prolongation or shorten of the rainy season, and so on, will in turn alter the hydrological of water (quantity, quality, flow regime), humidity, soil fertility and composition, sedimentation, ecosystem services, etc. that pose a growing pressures on natural resources, including water, soil, fisheries and forest, and a significant risk rural farmers' livelihoods (including farmers in the study areas), human health and agricultural practices (MoE 2018a; MEF & GSSD 2019) (KII 2021). For example, people in the Kompong Kor village, Kompong Thom reported that "*We observed that the temperature is getting higher (hotter) than in the past*" (KII 2021). In 2016, hot temperature, storm, water dry out (shallow water), muddy water and lack of oxygen in the water, caused number of fish (about 70 tons) death in Kompong Thom's protected Tonle Chhmar Lake. It was also reported that during April-May, when there was no rain, the weather conditions were extremely hot, then the water was dried out, shallower and muddy. Then, the water was getting hotter, combining with storm, and thus decreasing the amount of dissolved oxygen in the water (Khmer Times 2016). In 2014 and 2015, about 89 tons and 176 tons of fish were also killed by storms (Ibid). Similarly, in 2018, in Phsar Chhnang commune of Kompong Chhnang province, part of Tonle Sap area (nearby Kompong Thom province), and more than 12 tons of fish died due to the hot weather (Khmer Times 2018).

"The amount of rainfall in some areas seem remaining the same but it is noticeable that the duration of rainfall is somehow shorter (or longer) than before. Notably, people living is more difficult in dry season than in raining season (e.g. water dried out, hot weather, animal died, crops lost, etc.)", said a Cambodian climate change and environment expert[16].

For women it is more difficult than men in the dry season as they need to work more to support their daily basic needs and small-scale business and saving. In addition, women have the burden to take care of their kids and housework, some women have to spend more time to travel far from home to collect daily food (wild vegetable, fish, crab, snail, etc.). Some diseases affecting to livestock and human, in particular children (fever, dengue fever), mainly happened in dry season. In such difficult situation like COVID-19 pandemics, women even work harder than men and they get smaller benefits from various works. Additionally women do often work, that men do not want to do, i.e. cleaning, washing clothes, carry water, or any works that they are requested/hired in exchange of some little money. Women even try to save food by consuming lesser meal than before (Ibid).

5.1.2 Climate Events

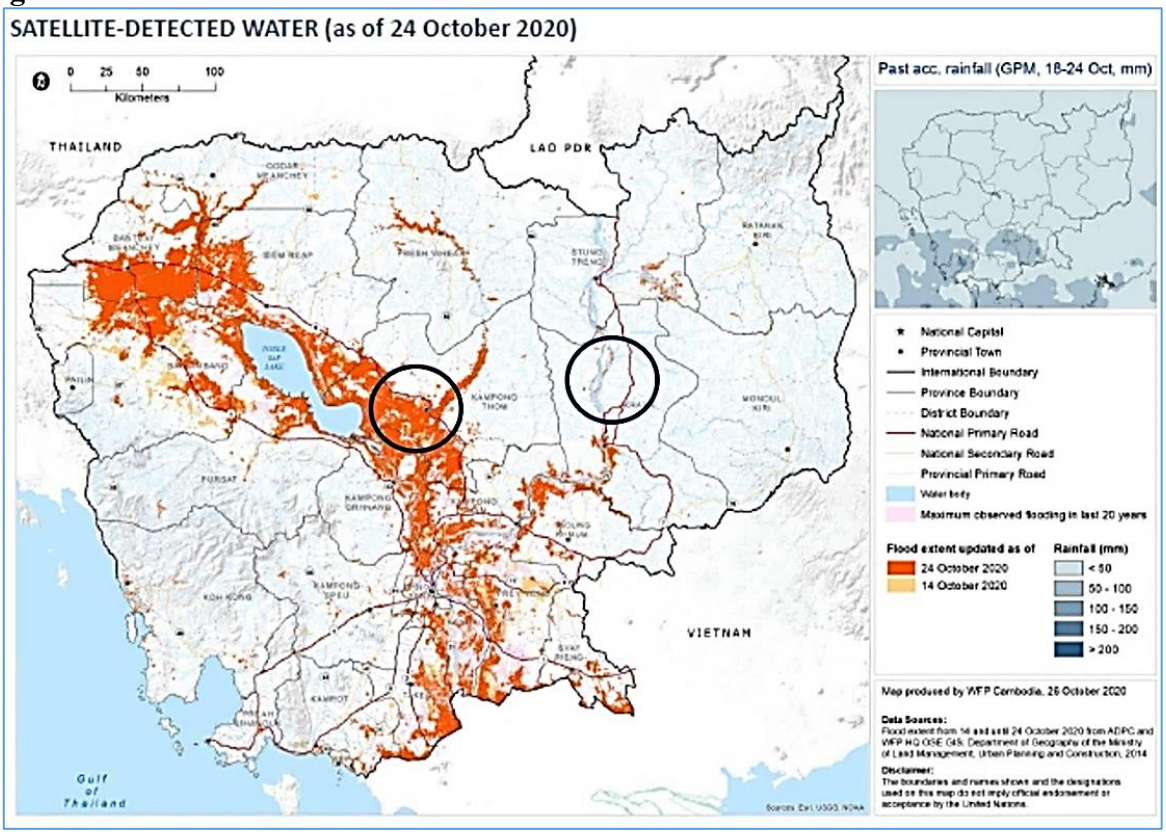
Due to its geography setting and weather condition, most of Cambodia people rely much on natural resources such as forest, fisheries, land and water resource for livestock, crop production and other agriculture activities (USAID 2021). Agriculture sector remains an important source of income, employment (37% of the country's labour force in 2017) and food

[16] Based on the interview with Mr. Mao Vanchann, Climate Change and Environment Expert, in July 2021.

security for rural farmers and local communities, for example, in 2019, agriculture contributed 21% to Cambodia's gross domestic product (GDP) (NCSD & MoE 2020b).

Cambodia, like many other countries in the world, is notably affected by climate change while most of the country rice farming system is extremely reliant on weather conditions (Heng 2015; MoE 2018b; MDPI 2021; Khmer Times 2021). Over the decades, the Cambodia, has been increasingly exposed to the effects of climate change, such as rising temperatures, changes in rainfall, and the frequency of floods, droughts and storms (MoE 2018a). Remarkably, the flood in 2011, is seen as the biggest floods occurred in Cambodia affecting approximately 237,375 families, damage to the economy approximately 4.3% of GDP and the estimate cost of the lost was over $520 million (RGC 2015). Recently, in 2020, as a result of multiple tropical storms that have crossed into Cambodia after making landfall in Viet Nam, Cambodia has been experiencing heavy rainfall that has led to widespread flooding affected 19 provinces of more than 2 million people, killed 42 people and directly affected 800,000 people. Such storm damaged more than 161,500 houses causing 14,300 households evacuated to safe areas (OCHA 2020).

Figure 5: Severe flood in 2020 in Cambodia



(HRF 2020)

Note: ⬭ Study Areas

Drought occurred in most of the provinces of Cambodia. In 2016, drought has severely impacted about 260,000 families, and approximately 18 among the country 25 provinces faced water scarcity (MOE 2018b). Drought that were occurred in 1997, 1998, 2000, 2001, and other droughts that happened between 2011-2016, caused serious impacts to people livelihoods, livestock and irrigated crops (MOE 2018). Storms that associated with heavy rain created

localized floods. Mekong River flooding experienced with heavy Tropical storms that spread into the Mekong basin from the South China Sea to the east and southeast across Viet Nam and the southern China (RGC 2008). In 2000, a series of monsoon storms hit five provinces and destroyed many homes of people living in rural areas.

At provincial level, from 2000 to 2019, Kompong Thom and Kratie provinces have been affected by a series of climate change related risks and natural hazards, such as droughts, floods, lightning and storms resulted in significant loss of life (human and animals) and considerable economic loss.

Table 3: Composition of Disasters in Kompong Thom from 2000-2019

Event	Deaths	Injured	Houses Destroyed	Houses damaged	Directly affected	Evacuated	Education centers	Hospitals	Crops damaged (ha)	Lost Cattle	Roads damaged (m)
Drought									42,497		
Flood	85	1	53	1,771	576,863	21,261	43	2	82,879	90	766,548
Lightning	48	63	1	14	62					29	
Storm	20	78	272	1,265	1,201		5			25	
Total:	**153**	**142**	**326**	**3,050**	**578,126**	**21,261**	**48**	**2**	**125,376**	**144**	**766,548**

(UNDRR 2021b)

As having shown in the above Table 3, between 2000 and 2019, flood has severely impacted about 576,863 peoples, killed 85 people and damaged 1,771 homes, 43 education centers, 2 hospitals, 82,879 ha of crops and 766,548 m of roads. While drought caused damages about 42,497 ha of crops, storms combined with heavy rain and lightning killed 68 people, injured other 141 people more and further damaged about 1,265 homes (UNDRR 2021b).

Farmers in Kompong Kor and O'Kanthor Tborng communes, Kompong Thom province, acknowledged floods and droughts as one of the main drivers of crop lost and poverty. In 2009, several houses, roads and infrastructures including irrigation infrastructures in the communes were inundated with flood after a prolonged rain combining with strong wind of Ketsana storm. People reported that *"There was so much rain, which suddenly causes floods damaging rice seedlings and animals"* (FGD 2021).

Local people reported that while most of the population in the province relies on those resources, negative effect of climate change make them particularly vulnerable. As mentioned by Farmer Water User Community (FWUC) leader that *"Approximately 200 m of embankment of irrigation scheme in O'Kanthor Tborng commune of Kompong Thom province, was destroyed by the past 2009 Ketsana storm making farmers more difficult to manage the water in the scheme until embankment was repaired and a new spillway was built few years later*"(KII 2021). People in Kompong Kor commune, FWUC and people in O'Kanthor Tborng commune, faced unsought experiences with the flood and storm in 2000, 2001, 2009, 2011, 2013 and 2020 which severely damaged agricultural crops, infrastructures including irrigation infrastructures, human settlements, surrounding environment, and animal lives (Ibid). Local farmers who have lived in the area for more than five decades informed that *"The increased frequency of floods, the amount and duration, amount, and frequency of rain had changed remarkably"(*Ibid).

The prolonged drought occurred more often while the storms further recurrent and were stronger (KII 2021). Drought is a major problem in the last few years for people doing dry season rice, known as early wet season rice (EWSR), in Kompong Thom, including the study area. The leader of FWUC, O'Kanthor Tborng commune, informed that "*For many farmers who apply EWSR, Stung Saen River is a main source of water for their crops, especially rice*

farming in the study area" (Ibid). However, while irrigated land is increasing, farmers also noted that the water in Stung Saen River has been gradually decreased, and some time, it was dried out in dry season (between March and April) leaving much troubles for local farmers, crops and livestock. Sometimes, water use conflicts occurred between upstream and downstream water user groups (Ibid).

Figure 6: Segment of Stung Saen River (study site) was severely dried out in 2021

(Source FWUC, O'Kanthor Tborng, 2021)

In Kratie, between 1996 and 2019, flood had severely killed 96 people, affected approximately 673,514 peoples and damaged 3,853 homes, 125 education centers, 13 hospitals, 91,019 ha of crops and 674,595 m of roads. About 42,497 ha of crops was damaged by drought. In addition, storm and lightning killed 28 peoples, injured 65 peoples and damaged 852 houses (UNDRR 2021b).

Table 4: Composition of Disasters in Kratie from 1996-2019

Event	Deaths	Injured	Houses Destroyed	Houses damaged	Directly affected	Evac-uated	Educat-ion centers	Hospitals	Crops damaged (ha)	Lost Cattle	Roads damaged (m)
Drought					3,284				15,999		
Flood	96	1	46	3,853	673,514	49,799	125	13	91,019	15,910	674,595
Lightning	23	27		2	5					9	
Storm	5	29	209	850	1,265		1		106	8	
Total:	**124**	**57**	**255**	**4,705**	**678,068**	**49,799**	**126**	**13**	**107,124**	**15,927**	**674,595**

(UNDRR 2021b)

Some parts of national and provincial roads and some bridges in Kratie province are often under flood due to inundation of the Mekong River and flash floods, for example in 2019, many roads located in Chetr Borei, Prek Prasop, Sambo and Chhlong districts were flooded. Apart from this, the river banks collapse are also a major concern (KII 2021). This issue created challenges not for government to repair/rebuild the roads/bridges, but for the local people to transport their products to market as well as for businessmen to come to buy local agricultural products, and resulting in dropping down the price of agricultural products.

Farmers reported that they have experienced with the present increased temperature that is hotter than in the past. Meanwhile, the time that used to have plenty of rain water or heavy rainfall now becoming sporadic or little rainfall. The leader of Fishery Community in Kampi village, Sambok commune, Chetr Borei district, Kratie province, mentioned that he observed that the water level of the Mekong River got high in different month/season, and the water

colour of the river sometimes became translucent. Fishermen reported that "*Daily fish catch is least as fisheries resource declination. Sometimes, we cannot catch fish. Also, rainfall often comes with strong wind or sometimes with storm and lightning. Just in the past two months (June 2021), one person was killed by lightning during the early rainfall of the year*" (KII 2021). Insufficient amount of rainfall, makes farmers unable to grow rice and other crops because water is shortage. This year (as of August 2021), the level of water in Mekong River is still low. The canals and irrigation system lack of water. Farmers who are involving in agriculture activities said that they are facing water scarcity, which is major challenges. Only people living near Community Lake (The lake is determined as Community Fish Refuge), have enough water for growing rice. The villagers in Kampi village told that *"Our village was inundated every year at this time (August) of the year, but it is changed now, i.e. the village is not inundated yet, and perhaps, it may occur next month" (Ibid).* Irregular and unexpected changing of weather condition (rainfall, flood, drought, and high temperature) caused them facing with challenges and risks for their agriculture practices and living condition. Besides, farmers reported that because of low yield and market prices of agriculture products, farmers are applying more chemical fertilizers than they did in the past (3 to 4 bags[17] of fertilizer per hectare) to get better yield. Some farmers who never apply fertilizer for their crops previously, now start applying too (Ibid).

5.2 Non-climate Drivers for Migration

5.2.1 Household Socioeconomic Trend

In 2019[18], Cambodian population is 15,288,489 persons (male: 7,418,577 persons and female: 7,869,912 persons) of which 7,477,444 persons (48.9%) are living in central plain, 4,801.260 persons (31.4%) in Tonle Sap area, 1,948,637 persons (12.7%) in highland and mountainous area, and 1,061,148 persons (6.9%) in coastal and sea area (NIS 2019). The population was 677,260 and 372,825 persons respectively in Kompong Thom and Kratie province, in 2019.

Table 5: Population in study provinces in 2019

Province	Household	Male	Female	Total
Kompong Thom	154,458	327,013	350,247	677,260
Kratie	86,137	185,429	187,396	372,825

(NIS 2019)

The central plain area covers the provinces of: Kompong Cham, Tborng Khmum, Kandal, Phnom Penh, Prey Veng, Svay Rieng and Takeo. The Tonle Sap area includes: Banteay Meanchey, Battambang, Kompong Chhnang, Kompong Thom, Pursat, Siem Reap, Oddor Meanchey, and Pailin provinces. Coastal area covers: Kampot, Kep, Preah Sihanouk and Koh Kong provinces. The remaining provinces: Kratie, Kompong Speu, Mondulkiri, Ratanakiri, Stung Treng and Preah Vihear are in the highland and mountainous area. The annual population growth rate for Cambodia is 1.2% with the highest 2.2% in highland and mountainous area in northeastern part of the country, in the central plain the rate is 1.2% and only 0.9 for Tonle Sap and coastal and sea areas (Ibid).

The population growth rate seems to be increased in the areas where new settlement, farmland, economic activities and employment opportunities are highly available. For example, in Phnom Penh, Preah Sihanouk, Preah Vihear, Mondulkiri, Stung Treng, Oddor Meanchey, Ratanakiri,

[17] A bag is about 25 kg.

[18] These figures exclude migrants working abroad. According to MLVT, 2018, the destination countries were: Thailand: 1,146,685, Republic of Korea: 49,095, Japan: 9,195, Malaysia: 30,113, Singapore: 831, Hong Kong: 45 and Saudi Arabia: 16.

etc. where the employment opportunities in economic, infrastructure, agriculture and other services are available such as garment industry, construction, hotel and resort, tourism, eco-tourism, agro-industry crops (cassava, sweet potatoes, sugarcane, rubber, pepper, edible fruit trees, etc.).

Table 6: Population growth rate in study provinces during 2008-2019

Municipality/province	Total population		Annual growth rate	
	2008	2019	1998-2008	2008-2019
Kompong Thom	631,409	677,260	1.0	0.6
Kratie	319,217	372,825	1.9	1.4

(NIS 2019)

The above Table 6 shows that the annual growth rate had declined comparing to the period between 1998 and 2018, i.e. from 1.0% to 0.6% in Kompong Thom, and from 1.9% to 1.4% in Kratie province. On the other hand, the population was increased in 2019 in all study provinces.

More people require more food, protein, energy, farmland, settlement and other daily consumption stuffs. The declining of annual growth rate in the above Table would reflect that household members have to travel long distance or far from home to work and live temporary there. A farmer in Kompong Kor commune, Kompong Thom province mentioned that in the past time, local people, including his parents, could feed 7-8 family members with the rice field of about 1-2 ha. However, at the present time, they cannot afford so because, in each household, the demand for living is much higher than before. That's why each family member (2-3 people per household and mostly elderly men or women and person from 18-30 years old) in his village have to migrate elsewhere (Phnom Penh, Thailand, Korea, Japan, etc.) to work as migrant labourers. People left home, rice fields and their children to be with elderly (more than 50 years old). Commonly, men (or husband) look for jobs at construction sites or garment, while women (or wife) work mainly in garment sector. During the outbreak of COVID-19, only those who work in Korea or Japan can send money to support families at home (KII 2021). Meanwhile, in the meeting with communities in Kompong Kor and Thnaot Chum communes, Kompong Thom province, and in Sambou commune in Kratie province, local people reported that some household members migrated to other areas (within or nearby provinces like Siem Reap, Preah Vihear, Mondulkiri, Ratanakiri, Stung Treng, Phnom Penh, Thailand, Korea, etc.) to seek for jobs to generate incomes to support their families living at home (FGD and KII 2021).

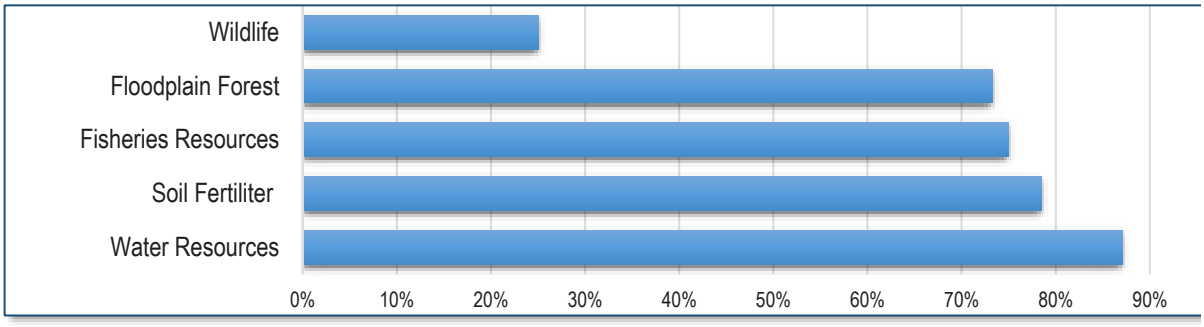
Normally, economic development projects in rural area (construction of hydropower dam, hotel and resort, infrastructure, agro-industrial cropping like rubber or sugarcane plantation, etc.) can attract a large labour force or in-migration which often happens with families. The increase in population in an area (rural-rural or rural urban migration) can gradually result in adverse impacts on surrounding environment while leading to resources scarcity. Furthermore, direct environmental impacts could also change living style resulting in noteworthy environmental impacts. Proper support including basic social services, with strict regulation is required at the correct time and place to ensure that the natural resources are utilized in a sustainable manner and the environment is well protected (MEF & GSSD 2019). For example, local community reported that the previously increasing number of fishing households in fishing community in Kompong Kor commune, caused steadily decline of fish catch. Farmers exploited available natural resources in the surrounding areas in an unsustainable way by reducing fish habitats (flooded forest), waterfowls, fish populations and fish species (KII 2021). In addition, local people also informed that even clearing or cutting of flooded forest is firmly prohibited, still, some flooded forest area were converted to rice fields. According to MoE data, about 6,214 ha of the flooded forest was declined between 2016 and 2018 (MoE 2020). Currently, due to decreasing of fish catch, some fishing households have moved further down to closer the mouth

of the Tonle Sap Great Lake (with the whole family members) from a place (fishing area) to another where they can catch more fish (KII and FGD in Kompong Kor commune, 2021).

5.2.2 Livelihood Dependent Resources Scarcity

According to farmers perception in the study sites in both Kompong Thom and Kratie provinces, water is the main vulnerable natural resources, following by soil fertility, fisheries and flooded forest.

Figure 7: Local's perception on vulnerable natural resources



(KII 2021)

An official from Provincial Department of Water Resource and Meteorology (PDWRAM), Kompong Thom, mentioned that water is available during wet season (mid-May to early October) of the year. Farmers require much water for rice cultivation. Vast rice fields are covered with water during wet season. Sometimes, during EDSR cultivation (Oct/Nov-Jan/Feb), water shortage is the most constraints for FWUC to cope with (KII 2021). In the study site in Kratie, water is available in the Mekong River, but it is hard for farmers to pump it up for rice farming and other agricultural crops.

Deficient irrigation system seems to be main constraint leading to water scarcity during cropping or cultivating season. Meanwhile, good irrigation scheme depends on reliable water source. Variability of rainfall makes farmers difficult to prepare cropping calendar while most crops traditionally rely on rain water.

Figure 8: Water Pumping Station on Stung Saen River

(By Author 2021)

Stung Saen's seasonal high water level is marked on the wall of the pumping station in O'Kanthor Tborng commune, Kompong Thom province. The level of water in Stung Saen River is full in the rainy season and dried out to the bottom in the dry season (FWUC 2021 &

KII 2021). Farmers reported that, recently, Stung Saen River becomes frequently dry out during dry season, especially between March and April.

There are different options and opportunities for local inhabitants and communities livelihoods. For example, in the main study site in Kompong Thom province, rice farming is considered as major source of incomes and livelihood alternatives while in the key study site in Kratie province, main income source is referred to ecotourism development which supports local livelihoods. Besides, ecotourism site in Kratie, locally known as Dolphin sightseeing, Waterfall watching and Dolphin Conservation Area have attracted many visitors including foreign visitors before COVID-19 pandemics.

Due to geographical features of the study site in Kompong Thom province, local inhabitants are involved mainly in rice farming as main occupation. Respondents have plots of different sizes for their cultivation. The commune councilor and FWUC's vice chief revealed that households have plots from 1 ha up to 5 ha, and few farmers hold farmland up to 50-100 ha. It is noted that the majority of flooded forest area had been previously converted into agricultural land and rice farming. Commonly, recession rice or early dry season rice (EDSR) faces water shortage.

Most respondents in the main study site and the complementary sites in Kompong Thom province mentioned that they grow crops twice a year after a number of irrigation schemes have been rehabilitated in the last several 7-8 years. Approximately ten years ago farmers grew only crops once a year. Meanwhile, rice cultivation had been traditionally dependent on rainwater with low production. Currently, irrigated area has been already expanded in full-scale cultivated area, and with double crops, rice yield has been improved. Irrigation schemes have provided sufficient water under operation and maintenance of water user communities, formally known as farmer water user community (FWUC) who are also responsible for water allocation and water service fee collection and management. Those irrigation schemes get water source from main rivers, such as Stung Saen and Stung Chinit Rivers. However, increasing cultivation of double crops has been resulted in water shortage, especially in dry season of second plantation of early wet season rice (EWSR) stating between April/May and July/August. FWUC members of Rolous irrigation scheme emphasized that the month of April or early May are considered as the end of dry season. Some water source (such as few segments of Stung Sean River and Stung Chinit) are nearly dried out in dry season. Further irrigation construction and expansion is definitely required to address the changes causing by water shortage. In Kratie province, farmers/villagers (including indigenous people) traditionally depended on wet season rice. Rain water is additionally used to address water shortage because there is insufficient irrigation system. Consequently, improving water resources management and governance to enhance agriculture development, while securing equitable water allocation for upstream and downstream farmers and ecosystem health, is highly required by many farmers.

Rice yield (EDSR in Kampong Kor commune) ranges from 4 tons/ha up to 6 tons/ha for last several years, and sometimes, it jumps to 10 tons/ha (due to rice field soaks during long fallow time). However, the yield of EWSR drops down 4-5 tons/ha, and the price of farmer's rice product is usually volatile and low. Farmers always faced with cheaper price of rice product, in particular their last harvesting of early wet season rice.

Figure 9: Rice field in study site in Kompong Thom (Post-EWSR)

(By Author 2021)

Figure 9 shows that rice fields are kept fallow and awaiting wet season water inundation or water intrusion of Tonle Sap Greater Lake after harvesting of early wet season rice (EWSR) in between April/May-July/August that happened on 3rd August 2021, few days before fieldwork in Kompong Kor commune, Kompong Thom province.

During the COVID-19 outbreak, agricultural inputs such as gasoline, fertilizers, pesticide and other inputs as well as labour fee are costly, but the price of unprocessed rice products are cheaper (comparing to August 2020), and after harvesting, some farmers are unable even to recover the inputs cost. Most of respondents in both provinces expressed their ongoing concerns on livelihood challenges due consequently to COVID-19 pandemics. In Kratie province, respondents said that *"Currently, there is no any tourists come to visit the ecotourism attraction areas, and this makes us hard subsistence and income generation"* (KII 2021). Farmlands are located behind their settlement. Rice plantation in Kratie province is only one crop of wet season rice which almost depends on rainwater. Commonly, each household has small plot of land. Rice farming is just for food of their living.

Regarding to natural resources, no any NTFPs are collected in the study sites in Kompong Thom province. In other words, there is no any vicinity area for NTFPs collection. Unlike in Kompong Thom province, in the study site in Kratie, people are still accessible to NTFPs collection in the forest areas. However, the size of the areas for NTFPs collection is less and less as majority of nearby areas have been converted into economic land concession (ELC). There is a huge area of the foreign-owned sugarcane farm located behind the villages in the study site of O'Krieng commune, Sambou district, Kratie province. Close to ELC area, the Forestry Community is established and managed by indigenous community. Indigenous community respondents mentioned that big trees for resin had been gone and NTFPs collection is just subsistence rather than for sale as in the past.

Figure 10: Sugarcane Farm in study site in Kratie

(By Author 2021)

Majority of respondents said that not much people regard fishing as one among their main occupations. In the study site in Kompong Thom province, respondents revealed that people who are fisherfolks, do not have land for rice plantation. Those people have only small plot of land for garden crop. Fisherfolks informed that fish catch has gradually declined. They need to go further down to Tonle Sap Greater Lake to catch fish. Because the water in the rivers become shallow and some river's segments are dried out in dry season, fisherfolks can hardly catch fish. In the past decades, flooded forest, which is considered as fish habitat, had been encroached and converted into agricultural land resulting the declining of fisheries resource. In addition, previous unsustainable fishing practice has also caused such declination of fisheries resource. Fisherfolks who have no option for their living, have to move deeper into some areas in Tonle Sap Greater Lake to catch fish for their subsistence and small saving.

In Kratie, fishing area is determined as Fish Refuge (known as Community Fish Refuge) and Dolphin Conservation Area which locate along Mekong River with limited access for Dolphin holes and its habitat. However, illegal fishing that even kills Dolphin occasionally occurred once or twice for several 4-5 years intervals. Most respondents said fish catch and fisheries resource have degraded due to illegal fishing in the past decades. Besides, number of fishing are becoming smaller comparing to other main occupation (farming/cropping). Former fisherfolks have changed their occupation to agricultural crop farmers or other jobs that can earn more money or incomes for their living.

5.2.3 Agriculture Productivity

Most of the respondents expressed their concerns on increasing agricultural inputs price such as fertilizer, pesticide, seeds, gasoline and so on. Chemical fertilizers have been increasingly applied including pesticides and herbicides as some farmers are not aware of its effects the future. As results, majority of farmers noted that soil fertility become poor and low in productivity. Then, awareness raising and capacity building are needed. Farmers expressed their concerns on the loss of soil fertility resulting from unappropriated use of agriculture inputs as well. In addition, water shortage is considered as important constraint for most respondents in Kompong Thom province because it can drop down or damage agriculture products at large scale. Aforesaid, Stung Saen River is main water source and it has recently been dried out in some segments that lead to water shortage for EWSR (April/May-July/August). Farmers applied more chemical fertilizers in order to increase rice productivity this means that they have invested more funds on agricultural inputs, labour, gasoline, irrigation water and others. However, farmers get a low price while their expenses are high. Many farmers said there is an

imbalance between their investment cost and income they received after selling agricultural products.

In Kompong Thom rice product price is usually volatile. Rice farming is important for farmer's livelihoods and income generation. In Kratie, rice farming is heavily dependent on rainwater and it is hard as current rainwater change. Indigenous respondents noted that rainfall in wrong place (i.e. often there is little amount of rainfall in the farmlands, but too much rainfall in village or forest areas that are far from their cropping areas) for their agricultural land and they have not sufficient water to be supplementary for their crops. In addition, soil fertility is becoming poor and they need to apply chemical fertilizer to improve agricultural productivity. Farmers grow rice is just for daily food instead of buying rice from others, and this helps them to save some amount of money to use in agriculture activities.

5.2.4 Credit, Employment Opportunity and Migration

Traditionally, rural parents share money, property or land to sons or daughters after they married or have their own families. In particular, agriculture or farm land is divided and given to children. While family members increase from year to year (more new born and children), some families who have limited farmland may face difficulties full filling this tradition while their agricultural land was gradually decreased to the extent that is under the threshold of agricultural productivity. To support family routine demand for food and other appliances, many people, including young couples, migrate to other provinces, Phnom Penh or abroad to find jobs (MOP 2012) (KII 2021).

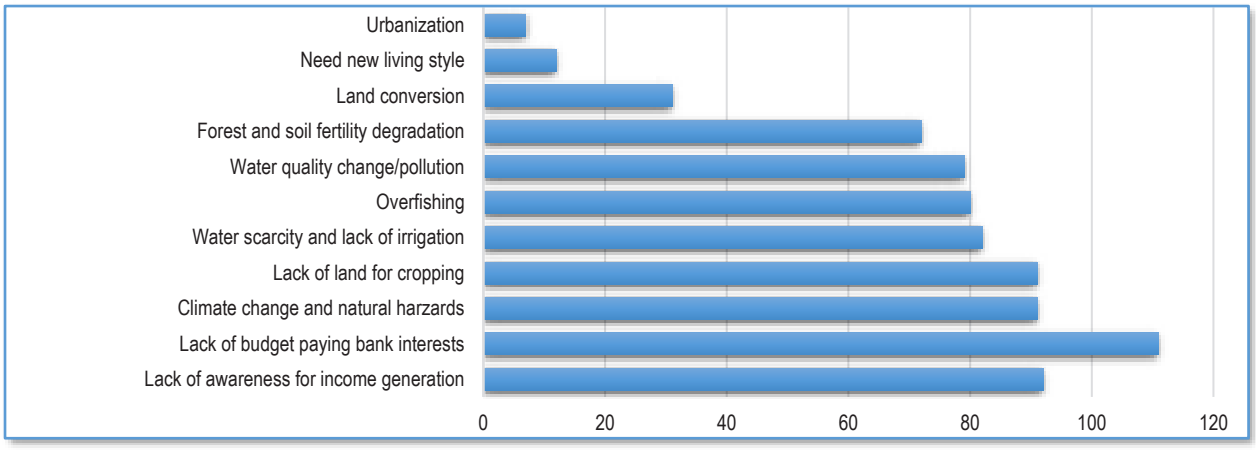
On the other hand, demand for more credit (money) or job to generate income to support daily food appliances also come along with the increasing number of new emerging family or among household members who start their new living with his/her family. Some families hire the farmland of other farmers in the village and they expand or diversify their agriculture activities (farming, fishing, aquaculture, raising livestock like pigs, cow, chicken, ducks, etc.). Some households involve in trading of agricultural products (buying and selling rice, vegetable, animal, fish, etc.) and the other are doing with rice field plowing, rice harvesting, pumping water for rice cultivation, etc. Some work as hired worker in their villages (rice planting, harvesting, aquaculture, vegetation, animal feeding, and they do anything to get income for daily basic needs when they are hired etc.) (KII 2021).

It is reported that, in order to secure and expand their business (such as investment for four wheels or two wheels tractor, trucks, water pumping machines, etc.) local farmers/households borrowing money from their neighbors (local loan) or private business owner[19] while some other get loan from the Microfinance Institution (MFI) (locally called Angkar[20]) (Ibid).

Notably, nearly 90 % of households in the study sites of both provinces have debt or loan from the MFI or private moneylenders. Except, indigenous communities in Kratie province who live in remote areas, have least loan or debt because they think they will not be able to earn sufficient income to pay back the loan or interest (Ibid).

[19] Money Lenders or local name
[20] A short and most popular word that referred to bank, private money lender or MFI.

Figure 11: People's perception on causes of people migration



(KII 2021)

Many respondents informed that a lack of budget to pay off loan or interest is a major cause for local people migration, following by the lack of awareness to diversify income, climate change (flood. drought, storm) and deficient farmland for cropping. Insufficient irrigation system, declining fisheries, forest and soil fertility resource are also the main drivers.

Generally, many households are confronted with unsatisfied income and therefore they are unable to pay back the bank loan. As a result of this some households had unfortunately fallen in debt (or heavy debt[21]) which push them to work harder or increase the cropping shift (for example some farmers increase rice plantation from double crops to even triple crops a year) or diversified their cropping so that they can get more income to solve the debt. Some farmers go to river/lake like Mekong River or Tonle Sap for fishing, some move to forest areas to find non-timber forest products (NTFPs) like in Prey Land where it is parts of Kompong Thom and Kratie provinces. Other farmers work in economic land concession areas (such as sugarcane farmland in Kratie province). Some farmers travel to urban including Phnom Penh and foreign country which are the most attractive destinations for rural migrants both men and women, to find jobs such as constructions, domestic workers, garment, hotel and resort, and other services (MOP 2013a & KII 2021).

Respondents reported that, number of local farmers/villagers migrate to Thailand, Malaysia or Korea to work as migrant workers to save money and remittance to pay the bank loan and to support their families at home (KII 2021). Women sent money back home more than men. In a village of the study area in Kompong Thom province, the commune council reported that some amount of migrant workers are able to send some amount of money back home, the remaining migrants can afford some remittance, and reasonable support for their families at home. Observably, they are more skilled when they come back home (Ibid).

Most migrant workers need support from their relatives, friends, and neighbors when they live for the first time away from home (nearby villages, commune, district/province, urban/city and cross border). In general, they follow each other without informing the village chief or commune leader when they migrate to find jobs (rural-rural, rural-urban, across the country) (meeting with commune council in Thnaot Chum commune, Kompong Thom province, KII 2021).

[21] Commonly, to get loan/credit farmers have to deposit with the bank or private businessmen their houses or farmland registration card or land property deed. Farmland or houses could be seized if farmers are unable to pay the debt.

Figure 12: Women prepare pre-working dinner at garment factory in Phnom Penh

(By Author 2021)

Migration to Phnom Penh (the most attractive place for job seekers across the country) to work as small business owners, domestic and construction workers, garment workers, hotel/resort and other industry worker remain popular among rural migrants across the country. It is also reported that rural people living in central and eastern part of the country like to travel to find jobs in Phnom Penh or in nearby provinces, while those who are living in western and northern part of the country (or along Cambodia-Thailand border) mostly like to go the find jobs in nearby provinces in Thailand or to Bangkok where economic activities and employment opportunities area available for them (KII 2021). Unskilled labour with low paid jobs find short-terms or long-term employment in the areas where the economic opportunities are available (Ibid).

Many ethnic minority people in O' Kork village, O'Krieng commune, Sambou district, Kratie province, reported that, so far, they used to do cropping with traditional method, i.e. slash and burn farming, from one area to another in the forest near their community, but now, this practice is not allowed any more. They have to do their cropping in the permanent lands/farmlands. Some other activities like collecting NTFPs in the forest areas are also prohibited because those forest areas are now under economic land concession (ELC) development area. The area that they can collect NTFPs and other livelihood dependent resources becomes smaller than it was in the past, and so do their income generation. They need to adapt and change their living standards to cope with such situation such as increase agriculture activities, find other jobs or start other new businesses (buy and sale agriculture products), animal feeding, etc.

Case Story 1: Climate Change and People's Migration Linkages in Koah Krob Bay and Kompong Kor Krom Villages, Kompong Thom Province

Koah Krob Bay and Kompong Kor Krom villages locate in Kompong Kor commune, Kompong Svay district, Kompong Thom province. This area covers with flooded forest, wetlands and rice fields which are closed to Tonle Sap plat plain. Previously, farmers applied recession rice or early dry season rice (EDSR) for their living and income generation. Fishing is also important activity for their livelihood alternatives after rice farming. In the past, rice farming depended on water source available from natural lakes, small streams and Stung Saen River. A villager who identified himself as fisherman in Kompong Kou commune said that his family's livelihoods almost depends on fishing as main occupation and his family has no land for rice farming. He also told that, over past decades, some flooded forest areas that were considered as fish habitat, had been converted into agricultural land. Traditionally, rice farming and fishing are common occupation for the villagers to cope with their daily subsistence and income. However, number of fisherfolk have gradually dropped as they could not catch more

fish as they did before. Meanwhile, majority of villagers currently depend on rice farming as main occupation for income and buying appliances for their living.

During 2000 to 2010, farmers can grow only one crop of early dry season rice. There was not enough water for cultivation and rice yield was low. Little by little, rice productivity has improved because farmers can get water through private water service provider (private water seller), but they have to pay to get water from private canal. In addition, farmers have to pump the water from private canal into their farmland individually. Furthermore, climatic constraints such as water shortage, droughts, floods and extreme hot, have severely damaged to their crops. An elderly man who is a commune council member noted that, droughts and hot temperatures go along with water shortage during dry season have often damaged rice production. Some farmers could not get any income or benefit after harvesting because they need to pay debt because they borrowed lot of money from the bank, microfinance institution or private money lenders for investing their farming. Consecutive damage due primarily to the consequence of ~~irregular~~ climate change that forced number of farmers to find other alternatives for their living and pay off debt. No opportunity is created to ease unemployment or diversify jobs, then, farmers (2-3 people per household and mostly ~~elderly~~ men or women and person from 18-30 years old) have to leave home or village to seek for job for their living and saving for paying off debt.

A key committee member of Farmer Water User Community (FWUC) mentioned that the Australian Government gave the financial support for rehabilitation of irrigation scheme in this area in 2010. This irrigation system was designed as gravity system with command area of approximately 1,000 ha that allowed farmers to grow double cropping. The construction of this system was completed in 2014. Practically, farmers grow double cropping annually of early dry season rice (EDSR) and early wet season rice (EWSR) that yield from 4 tons/ha up 6 tons/ha, and sometime it can jump to 10 tons/ha. Number of farmers who apply rice cultivation has been increased since 2014 after completion of irrigation scheme. In addition, many fisherfolks turn to do rice farming because fishing activities alone is no more enough to survive their living. However, another FWUC committee member expressed the concern that, the cultivated area is becoming bigger and bigger than the irrigated area, and this leads to deficient water allocation managed/operated by farmer water user community (FWUC). Water shortage is considered as the most critical constraint for farmers.

Both Commune council and FWUC committee members addresses that Stung Saen River is a main water source for rice farming. However, it recently becomes dry out and this happens few consecutive years while farmers do EWSR (or locally called second rice cultivation). This EWSR stage, farmers often challenge with dilemma either water shortage during early stage of plantation or drought or too much water even flash flood during ripe stage. It is noted that EWSR is usually prepared to grow in March/April till July/August. The month of August often has flash flood that damage rice yield or even worst then that when water level comes from Tonle Sap Greater Lake and meets the flash flood from the Stung Saen's upstream. In such circumstance, some household who have only dry season rice field, face much trouble because all of those rice field are inundated.
(See Annex for additional data table of study site in Kompong Thom province).

Case Story 2: Climate Change and People's Migration Linkages in of Kampi Village, Kratie Province

Kampi village locates along the Mekong River in Sambok commune, Chetr Borei district, Kratie province. The geographical features of Kampi village consists of natural freshwater lakes, wetlands and small tributaries of the Mekong River. One of key community committee

members mentioned that, this freshwater lake is designated as Community Fish Refuge (CFR). It is recognized by the Provincial Fisheries Administration. On the other hand, the segment of Mekong River in this area is designated as a Dolphin Conservation Area, then, most of the fishing areas there are prohibited. There is also community forestry managed by indigenous communities. Generally, this area is very attractive for the development of ecotourism, which provides many opportunities for local people to earn a living and generate income (before the outbreak of COVID-19).

A community committee member of community forestry said, in the past, the livelihood of the people in this area was mostly dependent on natural resources such as fertile farmland, rivers, lakes, fisheries, forest products and non-timber forest products. Due to the economic development in the past decades, the forest land has been turned into various plantation areas such as sugarcane plantations, which makes it narrow forest area for local people to find non-timber forest products or natural resources for their livelihood. In addition, elderly woman who is also community forestry member noted that, currently, slush and burn cultivation (clearing of forest land, burning and planting crops from one place to another) is replaced by the permanent plantations. Declining of forest land for non-timber forest products collection, scarcity of arable land and some other natural resources needed to sustain livelihoods, poses some difficulties for local people, especially indigenous communities, as most of them depend on those natural resources.

Like other migrants in low land areas, some of the ethnic minorities in O' Kork village of O'Krieng commune have to travel far from home or they work in the economic land concession areas nearby the communities, for instance the foreign-owned sugarcane farm behind their villages. They reported that they cannot travel to urban areas such as cities to seek jobs like other migrants living in lowland areas because their education is limited and they have no skills. They mostly rely on their physical strength to work in exchange for low paid money to buy food appliances. Then, working in the farmland like agro-industry plantation in various large-scale plantation farmlands or economic land concession areas in their provinces or the areas nearby, are their suitable and preferable migration destination (KII 2021).

Remarkably, indigenous communities had addressed that migrants who work elsewhere, either in the country or abroad, can afford to live there and have tiny remittance. They also get their labour fee in a shorter period of time. Respondents from the indigenous community who are working as labour force for sugarcane farm, said that they are hard to get labour fee as they are paid once 30-day-fee when they worked 60 days or more (KII, FGD, Kratie 2021). This means that they are facing difficulties to earn income for their daily subsistence while they rely on their daily labour fee.

Traditional farming practices are largely dependent on rainfall which is becoming more erratic. Certain villagers said that, frequent floods combined with prolonged droughts are main challenges and directly leading to food shortages, because most of villagers use agriculture product, especially rice, for daily food as subsistence Most villagers settle the concerns based on the ability of their living, although their adaptation capacity is limited, for example, to deal with natural resource scarcity, climate change, droughts, floods and lightning, storms, heat waves and hot temperatures, they try to find opportunities to address those challenges by developing ecotourism that can generate jobs and income for their livelihoods while protecting them from climatic hazards. Individual villager, from one house to another, in the village noted their concerns that, lack of access to improve soil fertility, lack of water for agriculture, deficient livelihood supported resources such as various kinds of plants, bamboo, rattan, shrub, herbs, wild fruits and vegetables, bees for honey collection, fish, crab, shrimp, frog, shellfish,

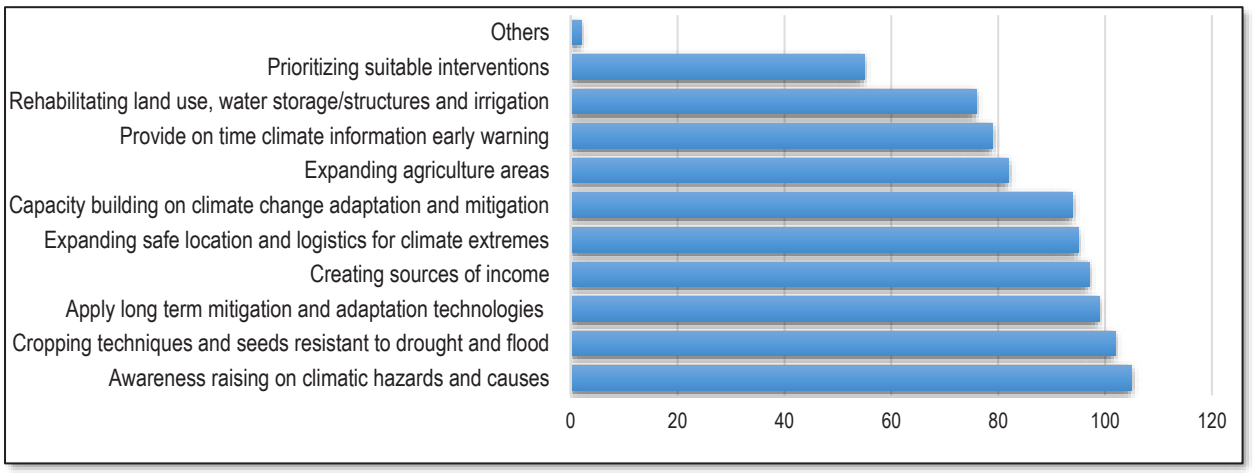
etc., and climate constraints remain a chronic concern, hindering efforts to increase agricultural productivity or businesses, and these challenges have become even heavier burden as most villagers are unable to pay off their debts (using for investing in agriculture or other businesses) of local bank, moneylenders or microfinance institutions. Recently, most villagers said that the outbreak of COVID-19 is the biggest obstacle to the existing problems and makes them more difficult to solve. Another elderly villager mentioned that, this has prompted some villagers to migrate to find work in economic land concessions (such as sugarcane plantations and agro-industrial plantations) in major cities / towns in Phnom Penh or abroad, i.e. nearly all villagers, family member or relative leaves the village / hometown to find jobs in Phnom Penh or other provinces in the country and outside of Cambodia. A key committee member of Fisheries Community reported that, due to the lack of ability and knowledge related to adaptation and climate change, some villagers have requested the relevant departments to strengthen their capacity and provide technical assistance to improve their skills in this area, for example, the application of smart agriculture, diversification of agriculture, crops and other businesses, as well as education and vocational training so that they can have the opportunity to grab a better-paying job than migrating to find work in other provinces, across the country or abroad, because some villagers have old parents or young children to take care of and cannot go far away. On the other hand, some villagers who have adequate farmland also do not want to relocate or work elsewhere as migrants if they can meet the necessities of daily life or they can afford to earn reasonable revenues, and prices of agricultural products on the market are even better. At the same time, some villagers said that they want to receive education and vocational training so that they can have more knowledge, skills and opportunities to work better both inside and outside their communities, as well as when they migrate for jobs inside or outside of the country. (See Annex for additional data table of study site in Kratie province).

6. PEOPLE'S NEED TO COPE WITH CLIMATE CHANGE IMPACTS

6.1 The Need for Climate Change Adaptation and Mitigation

Field observations and stakeholder consultation reflect that local people, communities and authorities are now living at the forefront of combating against climate change. Local communities inform, that they need the support from relevant agencies to improve their awareness on: climatic hazards and causes; cropping techniques and selecting seeds resistant to drought and flood; applying short and long term mitigation and adaptation technologies; creating more sources of income, expanding safe location and logistics for climate extremes. They also require: the technical support for properly expanding agriculture areas (with the amount of available water) in line with rehabilitation land use, water storage/structures and irrigation; and on time climate information early warning so that they can manage their crops and their living efficiently. Figure 13 shows people needs to reduce vulnerabilities[22] in the targeted study provinces.

Figure 13: People need to reduce climate change vulnerabilities



(KII 2021)

The above figure echoes that awareness on climatic hazards and causes, and cropping techniques and selecting seeds resistant to drought and flood are the major requirement for them. Meanwhile, further suitable interventions shall be in place and prioritized by concerning agencies to ensure that the needs of local people and communities are provided on time at the right location, village, and commune of various geographical landscapes.

It is observed that, to improve living standard as well as to rehabilitate and maintain the surrounding natural resources and ecosystem, farmers/villagers who are currently living close to the rivers (e.g. Tonle Sap, Stung Saen, Stung Chinit and Mekong River) need the institutional support to: restore the condition of canals, lakes and ponds in the village; create ecotourism area in their areas or nearby their communities; provide them good rice seeds and fish species; and protection and reforestation of flooded forest. Besides, villagers also need to increase their skills to create community markets; farming/cropping techniques (including application of agricultural inputs fertilizer, soil/land and water management, seed selection of both long and short-life seeds, and grain storage, etc.); and feeding animals, fish and eel (aquaculture). This institution supports would also help them to be able to cope with resource scarcities and climate stressors (KII 2021).

[22] Collected from interview and direct communication/consultation with local people, communities and authorities, relevant agencies and climate experts (August 2021).

Some local people in the communities are not able to separate their needs to cope with climate and non-climate driven impacts, and to precisely inform their most important demand (fund, techniques or physical infrastructure assistances) for adaption or mitigation services to be provided by relevant agencies. In addition, it is hard for them to change their traditional practice in agriculture (business as usual) to the newly applied agriculture techniques that would help building their resilience, for example selecting good crop varieties that need little water, takes shorter time and gives acceptable yield and price, and with improved irrigation system, apply new techniques (including machinery and four wheels or two wheels tractor) in growing/planting and harvesting crops, that can save time and labour cost, etc. Then, in line with physical infrastructures support, enhancing community awareness through capacity building programs aiming at promoting local people adaptation and resilience, are important to help them to cope with present and future climate related risks and hazards. In addition, the close and continuous coordination and collaboration among government, private businesses, local authorities, International Organizations, Non-governmental Organizations and development partners is significant to help local communities to cope with the challenges caused by climate change impacts.

6.2 Institutional Support

In responding to the needs of the local community to adapt to and mitigate climate change, Cambodian government has been working actively with the concerned public and private agencies, development partners and local NGOs to address the impacts of climate change on the lives of people, especially the rural poor, while ensuring that they have suitable capacity for managing agriculture, water, forestry, fisheries and other important natural resources as well their routine business they rely on for generating income to support their daily livelihoods.

At provincial level, while water and agriculture sector are vital important for local communities, various provincial departments like Provincial Department of Environment (PDE), Provincial Department of Water Resource and Meteorology (PDWRAM), Provincial Department of Agriculture, Forestry and Fisheries (PDAFF), Provincial Department of Rural Development (PDRD), and Provincial Department of Women Affaire (PDWA), etc. and local authorities play an important role in working with local communities including men, women, youth and ethnic minority people to cope with climatic risks. They help develop appropriate solutions to cope with climatic risks and hazards, help local community to understand the causes and the ways that people are affected by impacts of climate change, and improve the ability of household's capacity to find out suitable solutions and practices to adapt and respond to climate impacts. They also create mechanisms (e.g. they create saving group and rice bank to help poor villagers whom are hard to access to get loan from bank and/or private moneylender. At same time, relevant Provincial Departments and CSOs like community based organizations, local non-governmental organization to provide technical support in their targeted location, at large) to provide financial and technical assistance to reduce people vulnerabilities and enhance local people capacity for disaster risks reduction management. Shelter for emergency was set up (Figure 14) in order to get information and other emergency supports in the study site in Kompong Kor commune, Kompong Thom province.

Figure 14: Shelter for emergency support in the study site

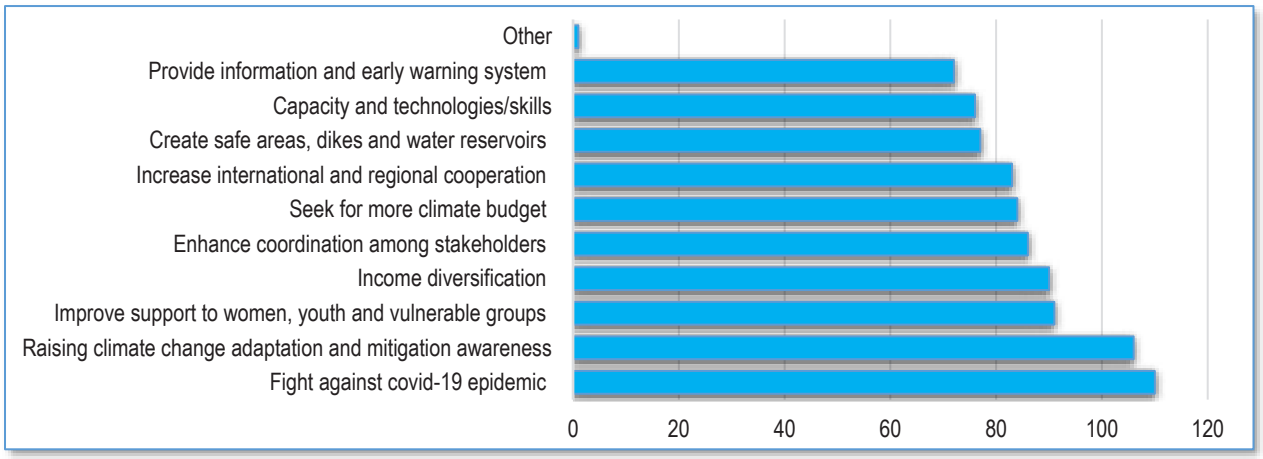
(By Author 2021)

Local communities and authorities reported that, aiming at fighting against climate change impacts, the concerning agencies have been working progressively on: building and raising awareness of local communities on climate change adaptation and mitigation[23]; increasing and improving the support to women, youth and vulnerable groups[24] since they are the most vulnerable to the climatic impacts and natural hazards such as flood, drought and storms; seeking better measures to diversify the income of the local people through the collaborating and coordination among stakeholders; seeking for more climate budget and climate interventions from relevant government agencies, private sector, NGOs and development partners as well as supporting from international and regional cooperation on climate change; expand and create more safe areas (in particular to prevent against major and flash floods), dikes, embankment and water reservoirs to ensure water demand for cropping and domestic use. Besides, building local capacity and skills on water and agriculture management and development and provision of weather information and early warning system, have also been taken into account.

The outbreak of COVID-19 seems to be a major concern for local communities. The communication and consultation with local stakeholders, revealed that COVID-19 epidemic has top up another hard burden after the severe impacts of climate change on their livelihoods. For example, some migrant people lost their jobs and come back home with only little money with them. Some local people have reduced their travelling or businesses activities from one area to another. Many farmers are facing with their agriculture products get low price, or sometimes, the products cannot sell (no middlemen/businessmen come to buy), while they have invested a lot of money (oil, seeds, fertilizer, pesticide, transportation, hire land/work force, water fee, etc.), labour and time. Figure 15 shows intervention to cope with the main challenges[25] in the targeted study provinces.

[23] Provincial departments and CSOs provided certain capacity building in their targeted implementation.
[24] Provincial departments and CSOs support them both materials and awareness to get access for information
[25] Collected from interview and direct communication/consultation with local people, communities and authorities, relevant agencies and climate experts (August 2021).

Figure 15: Intervention to cope with the climate change impacts



(KII 2021)

Presently, in the study site in Kratie, PDWA helps farmers (in particular women) to make small businesses, and provide seeds and train[26] them how to grow vegetation in the home garden to reduce or cut off expenses on buying vegetable from the market, in turn, they can sell it on the market to generate income. This will help women to save money and daily expenses as well. PDAFF also provides rice seeds and train number of farmers to apply for suitable seasonal agriculture. Meanwhile, aiming at ensuring the protection and conservation of biodiversity and natural resources that most people in Kratie province rely on, and reducing greenhouse gas (GHG) effect that leads to the global warming through the protection and maintenance of forest cover, PDE is actively working on protected areas patrolling by coordinating with local communities and authorities, raising awareness for local communities on Protected Area regulations and laws controlling resident people inside protected areas. PDWRAM provides weather forecasting and early warning information (by phone call to commune and village leader, announcement in MOWRAM Facebook and website, and private and public TV, and Youtube channels) to help farmers prepare their farmland and cropping activities properly and to avoid of any climate related risks in advance. Fishery Administration (FiA) is actively in providing supports to fishery communities to diversify the agriculture activities including aquaculture to generate more income for them including building their capacities in feeding animals (pig, chicken, fish etc.). Farmers reported that further assistance from involving agencies in agriculture activities is much required including agricultural extension and veterinary. In Kompong Thom, PDWRAM has collaborated with public agencies, local NGOs and the private sector to provide technical assistance to adapt to climate change and raise funds to buy seeds, agricultural equipment and oil/diesel for water pumping machines and to develop irrigation projects for helping people affected by climate change impacts and natural disasters.

Acknowledging that fighting against COVID-19 pandemics is an urgent need of the population country wide, the government had issued the Law on Measures to Prevent the Spread of COVID-19 and other Serious, Dangerous and Contagious Diseases, which sets out health and administrative measures to be taken to combat and prevent the spread of COVID-19 and other deadly communicable diseases to protect the people's life, public health and public order (RGC 2021b). As of 9 September 2021, the increased rate of COVID-19 vaccination in Cambodia was 96.85% compared to the target population of 10 million and on children - adolescents aged 12 to under 18 years old is 86.46% with a target population of 1,966,931 (MOH 2021).

[26] According to PDWA, this activity is undertaken by PDAFF.

7. DISCUSSION

It is noteworthy that Cambodia country is significantly affected by climate change especially, water, fisheries and agricultural sector, and it has also caused people to migrate to find jobs outside their communities. The effects of climate change combining with urbanization and industrialization growth will put an additional burden on country's natural resources and ecosystems (RGC 2019). Consequently, agricultural livelihoods have also been undermined by deteriorating land and water conditions resulting from climate change impacts, which dropped down agricultural yield, caused jobless people living in rural areas, and pushed them to migrate to other places like urban areas or other neighboring countries where employment opportunity in the domestic, garment, construction, tourism, transportation and services are in place (MOP 2012). In addition, urban areas located around Tonle Sap Lake, Mekong River and Phnom Penh will continue to expand as there is increasing rural to urban migration due to better social-economic opportunities (MOWRAM 2020).

Rural People recognized that climate change has led to drastic weather changes such as irregular rainfall (irregular and less frequent), rising temperatures, droughts, floods, hurricanes, lightning, etc. This led to low-yield and costs of agricultural products, and in turn made famers to get accumulate more debts and resulted in a higher migration rate. The variability of rainfall and rapid fluctuations of Tonle Sap and Mekong rivers are becoming challenges for farmers. Floods is frequently increased year after year and affected agriculture and the economy as well as people lives and assets. Heat or rising temperatures is also increasing and changing gradually and even rapidly, especially in recent years.

Field consultation and observation in study sites show that despite there are irrigation systems in place, the water supply is still insufficient for the people to use in farmlands, especially in the rainy season (prolong drought). In addition, the number of farmers who are involving in agriculture activities are increasing, they need more water. However, the amount of water available is not fitted to the amount of their crops (imbalance of water demand and supply) during dry season or prolong droughts, particularly. For example, in many cases, during early wet season rice (EWSR)-in between April/May to July/August, farmers need water from various water source, like Stung Saen and Stung Chinit rivers for their farmland. On the other hand, major water supply sources such as Stung Saen and Stung Chinit in Kompong Thom province, are recently dried out in the dry season as well at the time that dry season rice growing farmer needed.

For ethnic minority people (for example those who are living in O'Krieng commune, Kratie province), remote location, low education, illiterate and human induced changes that leading to natural resources scarcities are seen as further burden adding to the impacts of climate change. The opportunities for them to get better jobs with high benefits (salary/paid) seems so narrow, accept heavy jobs that utilize force or strength in the remote areas (large scale agro-industrial crops/farms) are available for them.

Farmers in study areas remain apply traditional methods for their agriculture activities. Awareness on modern agriculture techniques (especially the management of soil and water, new crop varieties/seeds and fertilizer applications, etc.) that can provide better products and resilience to climate stressors, remain moderately limited and practiced. Improperly utilize agriculture inputs such as fertilizer may create negative affects to both environment and people health as well, for example, farmers reported that the changing of rice planting to rice spraying or broadcasting practice pushed farmers to apply more pesticide and fertilizer (approximately 3-4 bags in Kompong Thom, and this figure is a little bit higher than this, 3-5 bags, in Kratie

province), and in turn, there is very little or no more (small or big) fishes or crabs in the rice filed or nearby small canals and ponds for them to catch for daily food.

Most of local people reported that when their cropping activities cannot support the daily livelihood (low yield and cost due to climate stressors), the expenditures for agricultural inputs such as seeds, fertilizer and pesticide are higher than the income they get after selling their products and when they have little works to do (farming/cropping, fishing, harvesting, transporting, etc.), they are also unable to pay bank interest or debt as well. Pay back bank loan, interest and debt is the major concern for local people, in particular, the poor families. They have no other alternatives, except, travelling far from home or migrating to seek jobs somewhere across the country or to other countries. This practice is commonly recognized and applied by local people (men and women). Many local communities reported that people migration are linked with the impacts of climate change and scarcity of livelihood dependent resources or the drop down of agriculture products. Sometimes people migrate elsewhere after growing or harvesting their crops because some rural farmers apply dry season rice, other do only wet season rice, while another group of farmers apply both wet and dry season rice. They will return home at cropping or harvesting season.

People reported that there are two types of migration abroad (to other countries likely Thailand, Malaysia, Korea, Japan, etc.) are observed. Legal migration applied through public or private agencies with official work permit allowing migrant workers have better and regular jobs and income, low risk, and sent handsome remittances back home to support families. In many cases, migrant workers return home with improved skills and better life. Illegal migration applied through individual or private agencies/mediators without official work permit, and as result those migrants to work irregularly with uncertain income, low paid, high risk, lack safety/security and sometimes are unable to get income/money to send back home or even unable to return home.

On the other hand, some rural migrant workers living in the study areas have limited education (some are illiterate or have completed primary school) and may eventually face with improper labour exploitation and workload (more work but less/low paid, no safety/hygiene at work/living, lack of health care and other public services, etc.) from employers, landlords or mediators, in particular youth, young women and indigenous people.

Notably, there are currently some programmes or best practices conducted by public and private sector in collaboration with development partners, local and international NGOs on safe migration to inform or teach them before migrating to find jobs or to work internally or internationally. These activities would also help to support and protect rural young and inexperienced women migrants from any forms of risks.

Due to COVID-19 outbreak, migrant people (in country and abroad) have notably returned home. Rural people start farming, fishing and doing other businesses for their families. The government has paid particular efforts and attention to increase awareness of people and rural communities on prevention and protection measures to prevent and combat COVID-19 pandemic. In line with this, relevant institution (from agriculture, environment, water, fisheries, forestry, rural development, women affair, climate change and natural disaster reduction and management sectors, etc.) have actively support rural people to improve the farming, living and socioeconomic condition according to their strategic and action plan.

In the future, if there will be enough irrigation system, water availability and improved agriculture techniques, agriculture product will get high yields, and the price of agriculture products on the market will be also good, then, people will be able to improve their living

standard and pay back bank loans and debts, and the number of rural migration would be decreased (especially illegal migration). If not, the number of people migrating will most likely increase inevitably.

Further facilitation and on time supports (soft and hard such as capacity building, fund, equipment or physical infrastructures) from relevant agencies (both state and private sectors, NGOs and development partners) on technical and vocational training, climate change adaptation, water, and agriculture management and development are much required by rural people and communities. For example, restoring, building or maintaining irrigation systems, dikes, embankment and flood protection dams; providing technical support to farmers, FWUCs as well as commune councils, building capacity of FWUC committee and water operators; and awareness raising on climate change adaptation and mitigation, agriculture, livelihood and income diversification for of local people other social groups (women, youth and ethnic minority). These supports are vitally important for both male and female farmers to adapt to climate change, build resilience, improve agricultural production and get better living.

8. CONCLUSIONS

Cambodia is gradually and increasingly affected by climate change impacts due to global weather status, country geographical location, and most of the people farming system is particularly reliant on weather conditions. The changes in rainfall patterns, the rise of temperature and the emergence of prolongation or shorten of the rainy season, will consequently effect water hydrology (quantity, quality, flow regime), humidity, soil fertility and composition, and pose heavy pressures on water, soil, fisheries and forestry; and severe risks on rural farmers' livelihoods and wellbeing. The impacts of climate change and weather extremes (heat, flood, drought and storm) in Cambodia, is definitely seen as one among major factors forcing people migration, both urban and rural people, men, women and youth.

Besides improving income and skills, migration is also a best practice local people used for dealing or coping with natural hazards. For example, Typhoon Ketsana which happened in Kompong Thom province in 2009, had forced numbers of people to migrate in search of jobs to generate income to support the families because their crops were destroyed. Some went to upstream to collect non-timber forest products to sell, some migrated to provincial town or urban areas for jobs, the others went down to the Tonle Sap Great Lake for fishing.

The farming system of the local communities are particularly relied on water and agriculture sector, the variability of weather conditions will definitely affect their agriculture practices and living standard. This report observes that majority of local migration is closely linked with the negative impacts of climate change and the declining of livelihood dependent resources (land/soil, forestry, fishery and water). Economically, bank or private loan are very important for local people and communities to expand their businesses or agriculture activities. However, climate risks and natural disaster such as flash flood, heavy droughts and the outbreak of COVID-19 have reduced income, opportunity and ability of local people and communities to pay back the bank loan or interest, and in turn, put further huge burden on them. This effect is seen as another cause of rural migration that have been taken place not only in the study areas, but also in other provinces and cities across the country. In addition, the living standard and skills of many rural migrant households have been improved and better after returning home. Meanwhile, particular attention from concerning agencies is very important to support rural migrant workers (especially youth, young women and indigenous people) who have limited education/skills and may eventually face with improper labour exploitation from employers, landlords or mediators.

The Royal Government of Cambodia (RGC) has been focusing on the enhancement and development of water and agricultural sector and employment opportunities, livelihood and dignity of the people, and developed relevant laws, policies, strategies and plans to protect and manage natural resources to cope with climate change, and to meet the people's demands and livelihood growth in the sustainable way. For example, comparing to the past, rural people and communities have more and better accesses to safe drinking water, roads, energy, public services, and better employment opportunities. The government has also increased its attention to promote and strengthen technical and vocational education and training (TVET) of the people through various activities and awareness raising campaign, e.g. the National Campaign on "TVET improves skills and high income" (RGC 2021), in order to improve and increase the education, skills, effectiveness income and safety of migrant workers. At the same time, government has created the policy on Cambodia labour migration to ensure that Cambodia migrant workers are productively employed and their skills are developed to work in emerging sectors locally and externally.

9. RECOMMENDATION

To further improve people awareness/skill, migration and livelihoods while minimizing the vulnerability of climate change and natural resources scarcity as well as to strengthen local community adaptation capacity to cope with the impacts of climate change and weather stressors, the following activities and measures should be undertaken as following:

Short Term activities and measures:

- Strengthen awareness on climate change adaptation and resilience of local communities who are the most vulnerable so that they are able to overcome climate change impacts;
- As part of viable ecosystem functions as protection of climate change effects, local people should be trained as well on safety and sustainable use of chemical input (pesticide, herbicides, fertilizers, etc.) so that they are aware of its benefit and adverse effects in the future to human and environment.
- In order to increase resilience of local communities, they should be trained on how to produce and apply natural inputs to improve soil fertility, water quality, surrounding ecosystem and agriculture productivity.
- Organise suitable community training and exchange field study tours so that local communities can get better awareness, share knowledge and best practices and learn from each other. This would improve the management and development of water, fisheries, forestry and land resources since majority of local communities rely on them for their livelihoods;
- Continue to protect and conserve natural resources such as forestry, fisheries, land and water resources;
- Engage local communities in natural resources protection and conservation through patrolling and monitoring activities;
- Build local people capacity and engage them to participate in forest management and reforestation, fisheries management and conservation, aquaculture, and water and agriculture management and development;
- Train and encourage local people to implement the Ecosystem-based Adaptation (EbA) to ensure water security by using ecosystem functions and enhancing ecosystem services for flood and drought management; and climate-smart farming systems to safeguard the agriculture products in the context of climate change;
- Provide local people on time weather forecasting and early warning information to that they can prepare themselves to cope with climatic and weather stressors;

- Identify and prioritize actual people's needs to cope with or fight against climate change impacts and support them on time and at the right places;
- Engage, empower and identify appropriate opportunities and ways for local people and ethnic minority communities to participate, assess and monitor the development of irrigation infrastructures (canal, weir, dams, embracement, spillways, water reservoir, etc.) to avoid and minimize as much as possible impacts or risks arising from such development, and to ensure accountability, transparency, equity, legality and maximum benefit to them.
- Raise awareness of people on prevention and protection measures to combat COVID-19 pandemic, and continuously take administrative, legal and health safety measures to fight against COVID-19 pandemic in all provinces and capital.
- Provide particular protection, supports and services (health care, basic skills, vocational training; etc.) to rural women, youth and ethnic minority groups so that they can live and work safely during they are working as migrant worker since they have limited capacity and education.
- Identify mechanism for protection and empowerment of rural migrant workers so that they can work effectively to improve their livelihood as well as the social and economic development of the country.
- Regularly conduct Safe Migration Campaigns at sub national and local level to inform people before they migrate to find jobs internally, regionally or internationally. These activities would particularly protect rural young and inexperienced women migrants from any forms of risks while ensuring that migration will provide positive benefit to the people and to the country.

Long Term activities and measures:

- Continue to construct, restore and improve irrigation system and reservoirs to ensure water availability (both upstream and downstream) for agriculture activities, sanitation and domestic consumption as well as to protect local communities from the risks caused by severe flood or droughts;
- Strengthen cooperation and coordination mechanisms among national and sub-national institutions, development partners, civil society and private sector to respond to climate change;
- Identify best practices on people migration and climate change and mainstream them in the relevant climate change adaptation and mitigation since this would also safeguard people migration and healthy environment;
- Improve the coordination among relevant public institutions, development partners, civil society and private sector to seek suitable solution to minimize unplanned people migration and to facilitate climate migrants;
- Create and expand international and regional cooperation (in particular Mekong Region) to mitigate climate change impacts especially floods, drought, salinity intrusion, etc., while ensuring water security (quantity and quality) for people livelihood, socioeconomic activities (irrigated agriculture, sustainable hydropower, safe navigation, biodiversity, fisheries) and ecosystem in the Lower Mekong Basin;
- Develop policies or legal frameworks on migration and climate change concerns through sectoral stakeholder coordination to reduce climate change vulnerabilities and natural hazards as well as to ensure the safety of climate migrant.
- Promote and strengthen technical and vocational education and training (TVET) in order to improve and increase the education, skills, effectiveness income and safety of migrant workers, and continuously organize national campaign on TVET at provincial,

community and local level to raise awareness of local women, men, youth and indigenous people.

- Incorporate or mainstream migration education (general and climate induced migration) into national, sub-national and local campaigns relating to: vocational education and training, environment and climate change, health and sanitation, employment, socioeconomic development, natural resources governance, agriculture and rural development, village and commune safety, etc. so that people get better idea on safe migration.

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ANNEXES

1. Data table of study site in Kompong Thom province

No	Interviewer's code	Respondent's code	Sex	Occupation	Location	Remarks
1	Leng Sothea003	Chum Chan Putheavy	Female	Executive Director of COW	Kompong Thom	Targeted area
2	Phuol Cheang17	Kanin Borimey	Female	Farmer	Kompong Thom	Villager
3	Phuol Cheang19	Lach Thay	Female	Farmer	Kompong Thom	Villager
4	Phuol Cheang20	Phat Phea	Female	Farmer	Kompong Thom	Villager
5	Phuol Cheang22	Lam Sila	Female	Retailer	Kompong Thom	Villager
6	Phuol Cheang34	Phat Srey	Female	Farmer	Kompong Thom	Villager
7	Suong Makara38	Ty Srey Pich	Female	Farmer	Kompong Thom	Villager
8	Suong Makara39	Huy Sath	Female	Farmer	Kompong Thom	Villager
9	Suong Makara40	Vuth Srey Theang	Female	Farmer	Kompong Thom	Villager
10	Suong Makara42	Huy Sim	Female	Farmer	Kompong Thom	Villager
11	Suong Makara46	Ty Syneth	Female	Farmer	Kompong Thom	Villager
12	Chuon Chan47	Khong Sokhean	Female	Farmer	Kompong Thom	Villager
13	Suong Makara52	Von Pha	Female	Farmer	Kompong Thom	Villager
14	Chuon Chan60	Pek Norm	Female	Farmer	Kompong Thom	Villager
15	Chuon Chan61	Yoeurn Chhay	Female	GarmentWorker	Kompong Thom	Villager
16	Chuon Chan62	Khorn Chheng Kin	Female	Farmer	Kompong Thom	Villager
17	Chuon Chan63	Von Komsoth	Female	Farmer	Kompong Thom	Villager
18	Phuol Cheang75	Ry Srey Sros	Female	Village's Chief	Kompong Thom	Villager
19	Eng Sokha92	Eur Kim Yeur	Female	Housewife	Kompong Thom	Villager
20	Eng Sokha94	Cheav Pov	Female	Retailer	Kompong Thom	Villager
21	Eng Sokha97	Thuong Sokhem	Female	Housewife	Kompong Thom	Villager
22	Eng Sokha99	Earn Soth	Female	Housewife	Kompong Thom	Villager
23	Leng Sothea001	Blang Vannak	Male	Village Chief	Kompong Thom	Villager
24	Leng Sothea002	Yim Buntheng	Male	Executive Director of COFAP	Kompong Thom	Targeted area
25	Leng Sothea004	BY Kimoeurn	Male	Executive Director of DKK	Kompong Thom	Targeted area
26	Leng Sothea005	Pao Menghong	Male	FiA Officer_Fishery Administration	Kompong Thom	Targeted area
27	Phuol Cheang15	Chhum Ny	Male	Farmer	Kompong Thom	Villager
28	Phuol Cheang16	Chin Vuth	Male	Farmer	Kompong Thom	Villager
29	Chuon Chan23	Ek Oeurn	Male	Community's Assistant	Kompong Thom	Villager
30	Chuon Chan27	Ry Nga	Male	Farmer	Kompong Thom	Villager
31	Chuon Chan28	Yin Chan Deourn	Male	Farmer	Kompong Thom	Villager
32	Suong Makara36	Him Hourt	Male	Community's Chief	Kompong Thom	Villager
33	Suong Makara37	Kha Hok Khy	Male	Community's ViceChief	Kompong Thom	Villager
34	Phuol Cheang41	Buong Te	Male	Farmer	Kompong Thom	Villager
35	Suong Makara43	Ry Saram	Male	Farmer	Kompong Thom	Villager
36	Suong Makara44	Ry Saroeurn	Male	Farmer	Kompong Thom	Villager
37	Chuon Chan59	Sear Chiev	Male	Commune Council	Kompong Thom	Commune coun
38	Eng Sokha93	Sorn Tol	Male	Community Cashier	Kompong Thom	Villager
39	Eng Sokha95	Nga Puth	Male	Farmer	Kompong Thom	Villager
40	Eng Sokha96	Tim Phat	Male	Farmer	Kompong Thom	Villager
41	Eng Sokha98	Heang Tuon	Male	Community member	Kompong Thom	Villager

Figure 16: Livelihood alternatives of study site, Kampong Thom

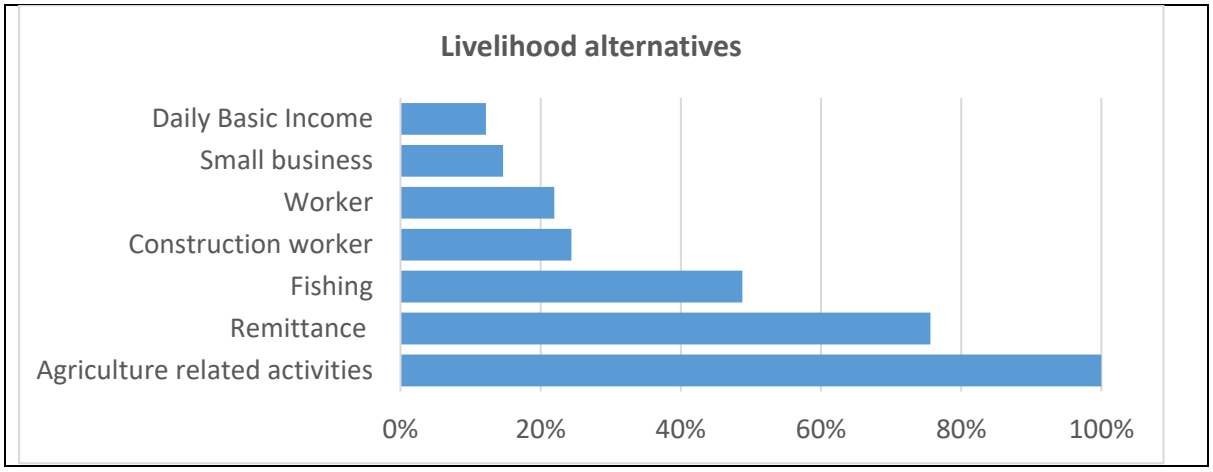


Figure 17: Challenges to reduce vulnerabilities of study site

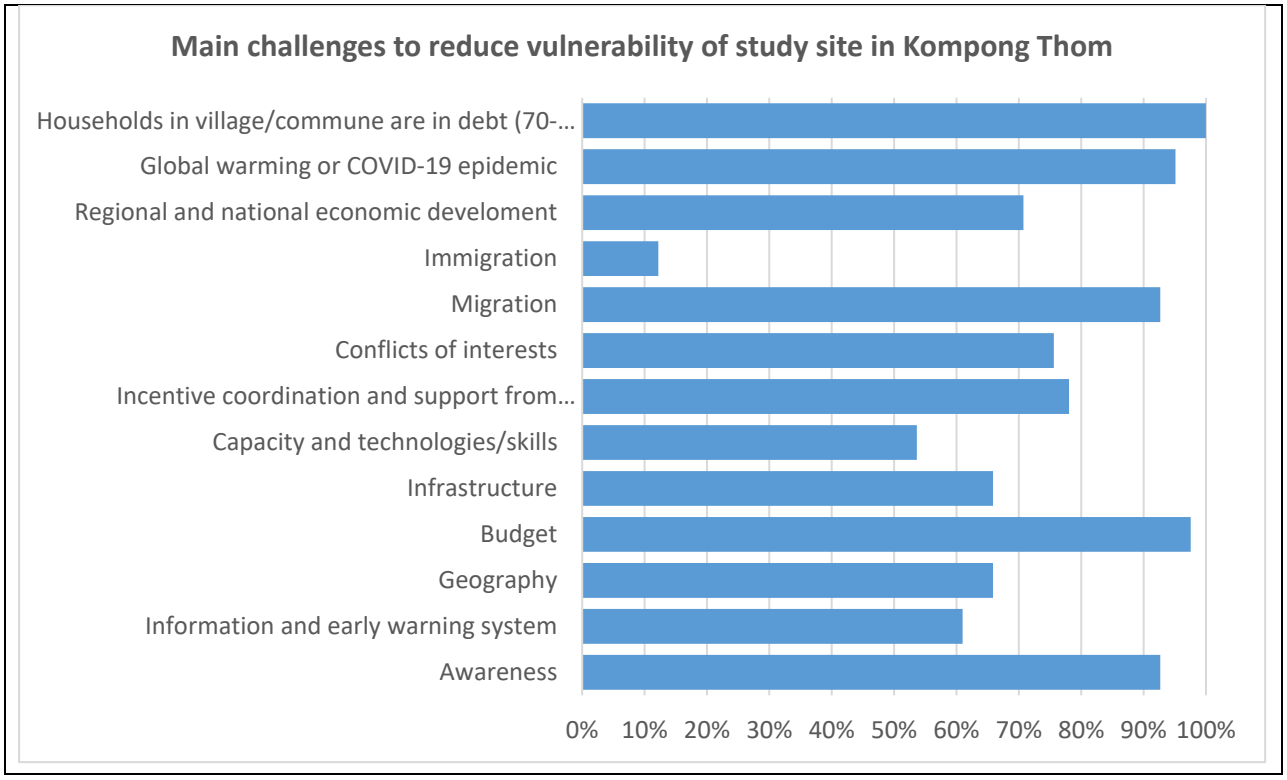


Figure 18: People migration of study site

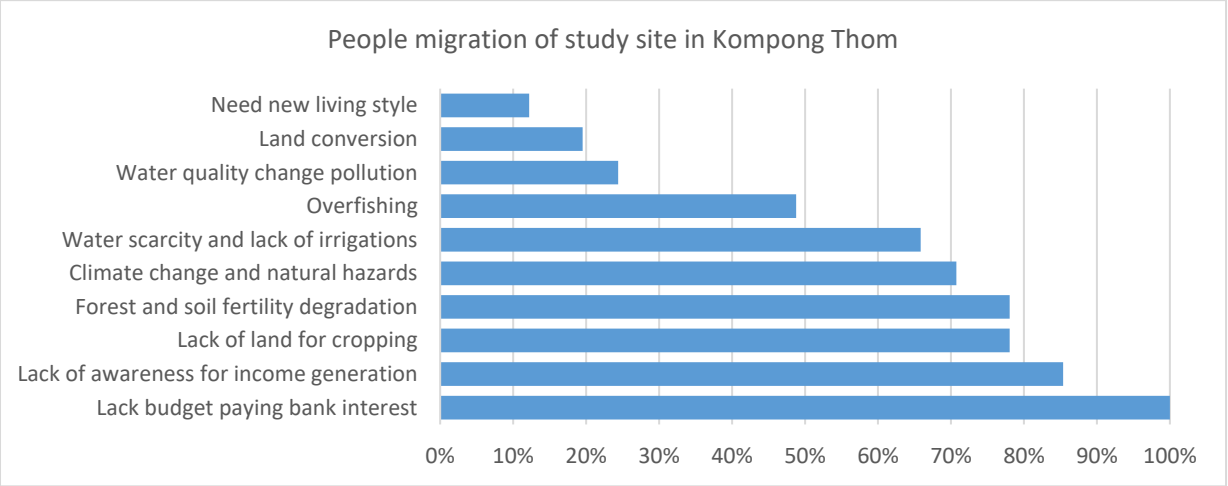


Figure 19: Main climate stressors

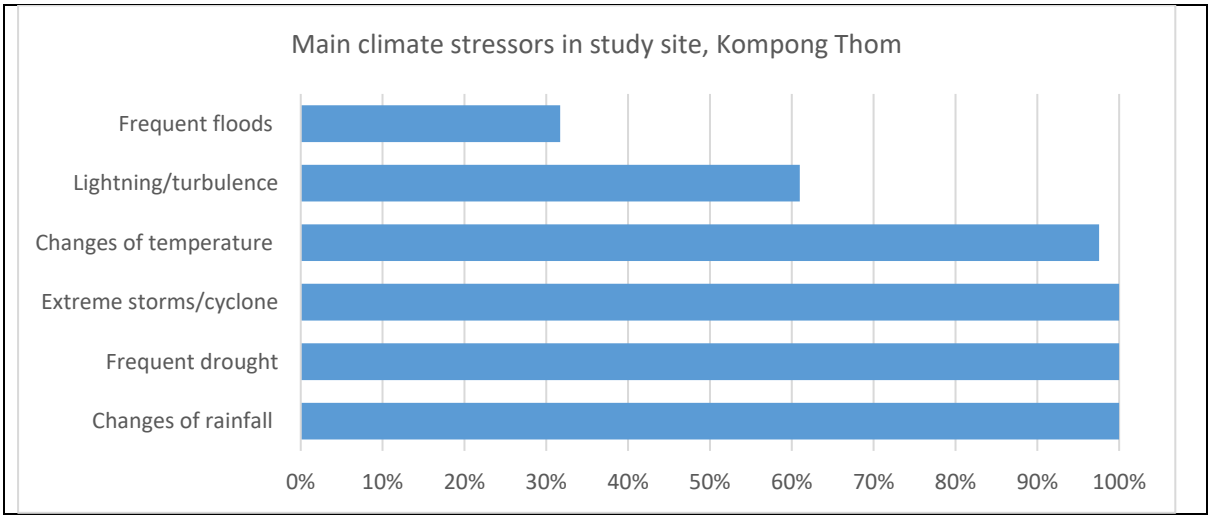


Figure 20: Vulnerable natural resource to climate change

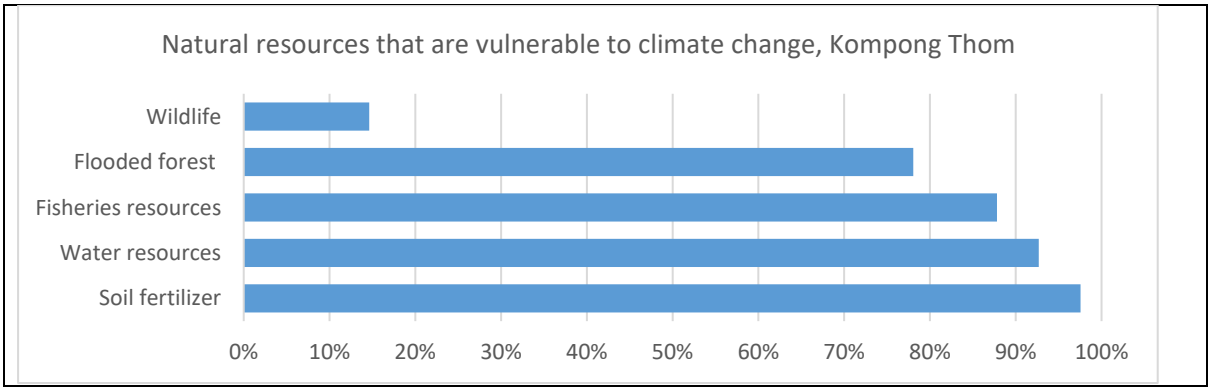


Figure 21: Vulnerable resources and communities

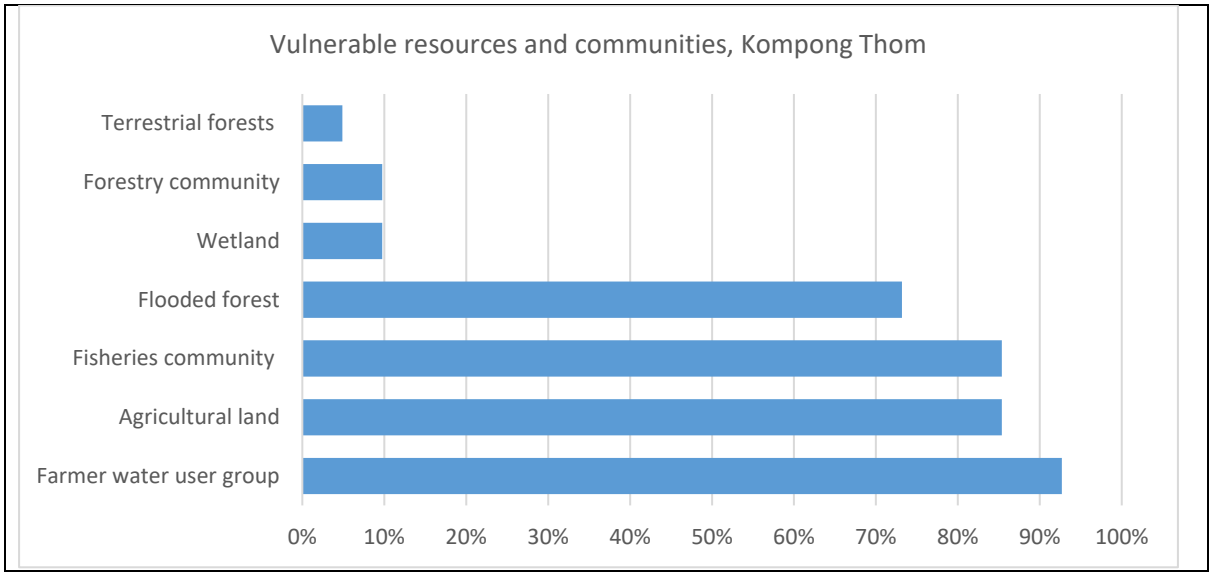


Figure 22: People perception on climate change and vulnerabilities

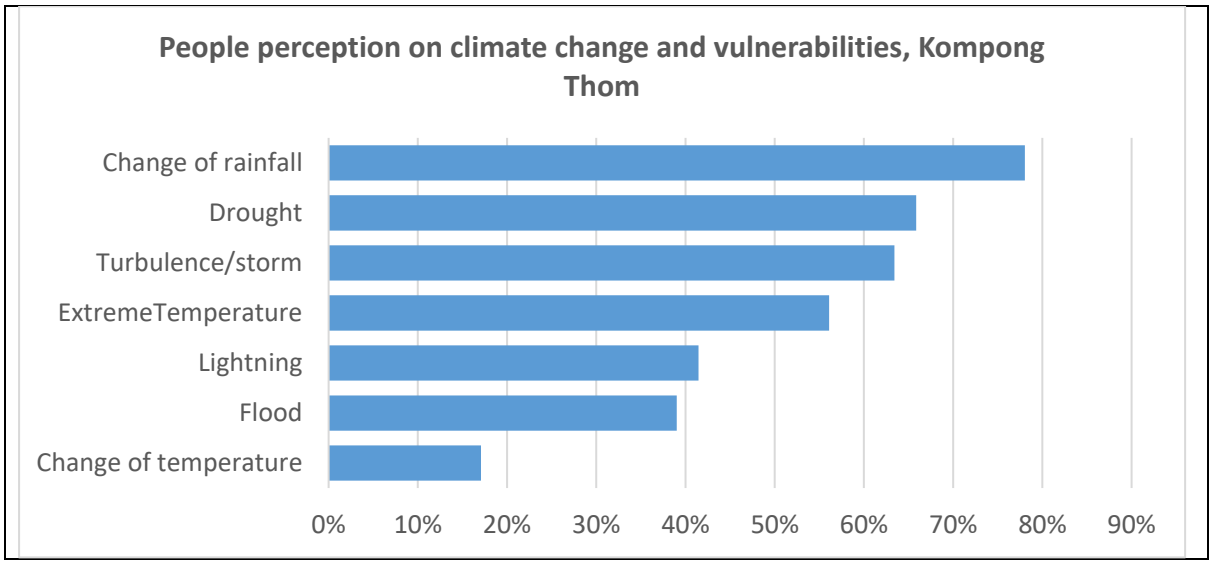


Figure 23: Responses to climate change-vulnerabilities

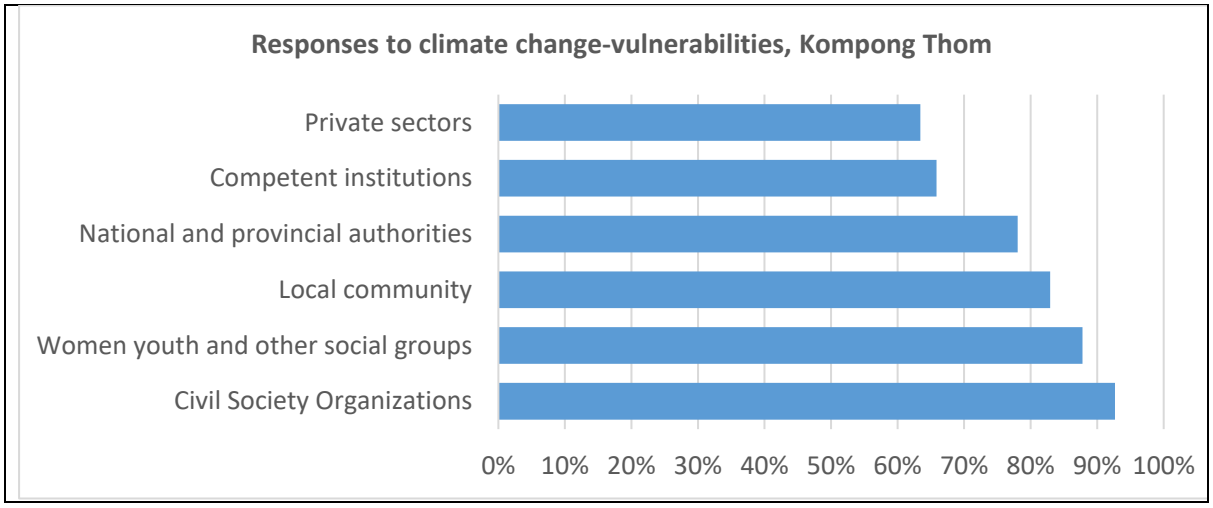
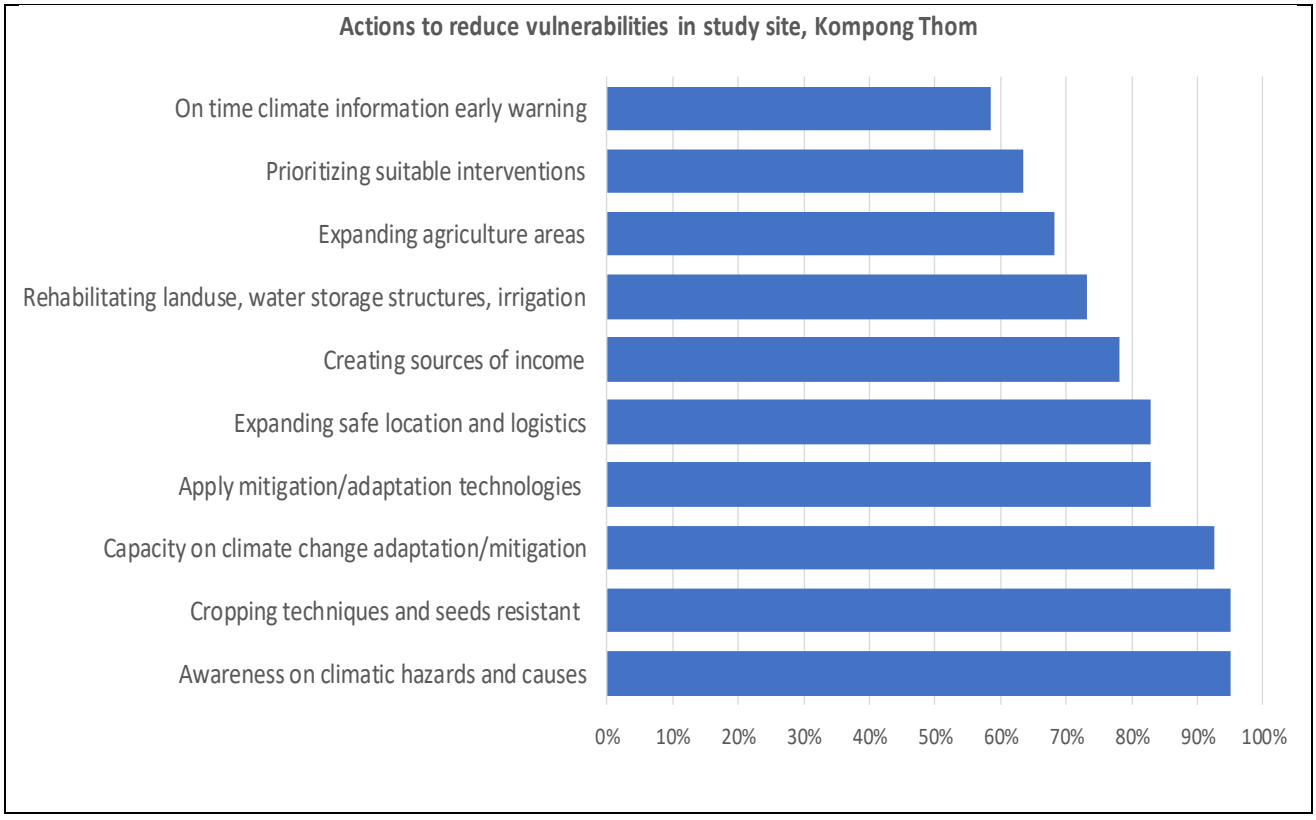


Figure 24: Actions to reduce vulnerabilities



3. Data table from Kratie province

No	Interviewer's code	Respondent's code	Sex	Occupation	Location	Remarks
1	Chuon Chan88	Koah Rorn	Female	Community Assistant	Kratie	Villager
2	Suong Makara09	Meas Sopha	Female	Farmer	Kratie	Villager
3	Suong Makara11	Dern Chhun Leng	Female	Farmer	Kratie	Villager
4	Suong Makara13	Chuon Seth	Female	Farmer	Kratie	Villager
5	Suong Makara14	Chuon Dem	Female	Farmer	Kratie	Villager
6	Chuon Chan24	Meas Neath	Female	Farmer	Kratie	Villager
7	Phuol Cheang30	Na Thy	Female	Farmer	Kratie	Villager
8	Phuol Cheang31	Kosal	Female	Farmer	Kratie	Villager
9	Phuol Cheang48	Hok Lymon	Female	Farmer	Kratie	Villager
10	Suong Makara64	Tep Bunny	Female	Farmer	Kratie	Villager
11	Chuon Chan76	Lorn Sophea	Female	Farmer	Kratie	Villager
12	Phuol Cheang80	Nhem Srery March	Female	Farmer	Kratie	Villager
13	Chuon Chan81	Muong Lika	Female	Farmer	Kratie	Villager
14	Chuon Chan82	Chan Navy	Female	Farmer	Kratie	Villager
15	Chuon Chan83	Deur Soknea	Female	Farmer	Kratie	Villager
16	Chuon Chan84	Huy Srey Chhoeurn	Female	Farmer	Kratie	Villager
17	Eng Sokha53	Lorng Channy	Female	Fisherfolk	Kratie	Villager
18	Eng Sokha54	Pov Phea	Female	Fisherfolk	Kratie	Villager
19	Eng Sokha55	Som Meydo	Female	Fisherfolk	Kratie	Villager
20	Eng Sokha65	Lok Oun	Female	Fisherfolk	Kratie	Villager
21	Eng Sokha68	Smark Pheap	Female	Fisherfolk	Kratie	Villager
22	Eng Sokha69	Lok Seth	Female	Fisherfolk	Kratie	Villager
23	Suong Makara12	Phorn Chanry	Female	Student	Kratie	Villager
24	Phuol Cheang26	Boeurn Lyhouy	Female	Student	Kratie	Villager
25	Phuol Cheang56	Im Ly Eur	Female	Student	Kratie	Villager
26	Eng Sokha70	Lab Sok Heak	Female	Student	Kratie	Villager
27	Eng Sokha72	Un Vuth	Female	Student	Kratie	Villager
28	Eng Sokha74	Pov Phanna	Female	Student	Kratie	Villager
29	Chuon Chan90	Ke Theay	Female	Village's Vice Chief	Kratie	Villager
30	Leng Sothea008	Chae Sokha	Female	Women Affair Officer_PDAF	Kratie	Targeted area
31	Eng Sokha100	Koah Su	Male	Community member	Kratie	Villager
32	Eng Sokha102	Muos Sok	Male	Community's Chief	Kratie	Villager
33	Suong Makara51	Ke Phary	Male	Community's ViceChief	Kratie	Villager
34	Eng Sokha101	Kreav Chhoeurn	Male	Community's ViceChief	Kratie	Villager
35	Eng Sokha73	Pov Thy	Male	Community's ViceChief	Kratie	Villager
36	Phuol Cheang57	Thok Ly	Male	Farmer	Kratie	Villager
37	Phuol Cheang58	Thuon Sokkong	Male	Farmer	Kratie	Villager
38	Eng Sokha04	Suon Sok Meng	Male	Farmer	Kratie	Villager
39	Suong Makara08	Meas Sophal	Male	Farmer	Kratie	Villager
40	Phuol Cheang25	Buth Han	Male	Farmer	Kratie	Villager
41	Phuol Cheang32	Buth Va	Male	Farmer	Kratie	Villager
42	Phuol Cheang33	Hor Vuth	Male	Farmer	Kratie	Villager
43	Phuol Cheang49	Tob Yean	Male	Farmer	Kratie	Villager
44	Phuol Cheang77	Pich An	Male	Farmer	Kratie	Villager
45	Phuol Cheang78	Kim Chheng	Male	Farmer	Kratie	Villager
46	Phuol Cheang79	Tho Rim	Male	Farmer	Kratie	Villager
47	Chuon Chan85	Muong Keo Khsay	Male	Farmer	Kratie	Villager
48	Chuon Chan86	Deur Synenh	Male	Farmer	Kratie	Villager
49	Suong Makara50	Antoert Kor	Male	FC Chief	Kratie	Villager
50	Chuon Chan89	Muos Sarath	Male	FiC Member	Kratie	Villager
51	Suong Makara07	Phon Pharong	Male	FiC Chief	Kratie	Villager
52	Eng Sokha66	Ton Sarin	Male	Fisherfolk	Kratie	Villager
53	Eng Sokha67	Deam Ngoy	Male	Fisherfolk	Kratie	Villager
54	Eng Sokha71	Sek Si In	Male	Fisherfolk	Kratie	Villager
55	Eng Sokha05	Thuon SokNear	Male	Fisherman	Kratie	Villager
56	Leng Sothea009	Nhean Sopho	Male	Program Manager_FLO	Kratie	Targeted area
57	Leng Sothea011	Phen Chhunhak	Male	Program Manager_GIZ	Kratie	Targeted area
58	Leng Sothea010	Bin Dim	Male	Program Manager_WWF	Kratie	Targeted area
59	Leng Sothea012	Chaem Chot	Male	Project Officer_SCW	Kratie	Targeted area
60	Chuon Chan91	Muong Leurn	Male	River Guard	Kratie	Villager
61	Suong Makara10	Mean Tola	Male	Teacher	Kratie	Villager

Figure 25: Main challenges to reduce vulnerabilities

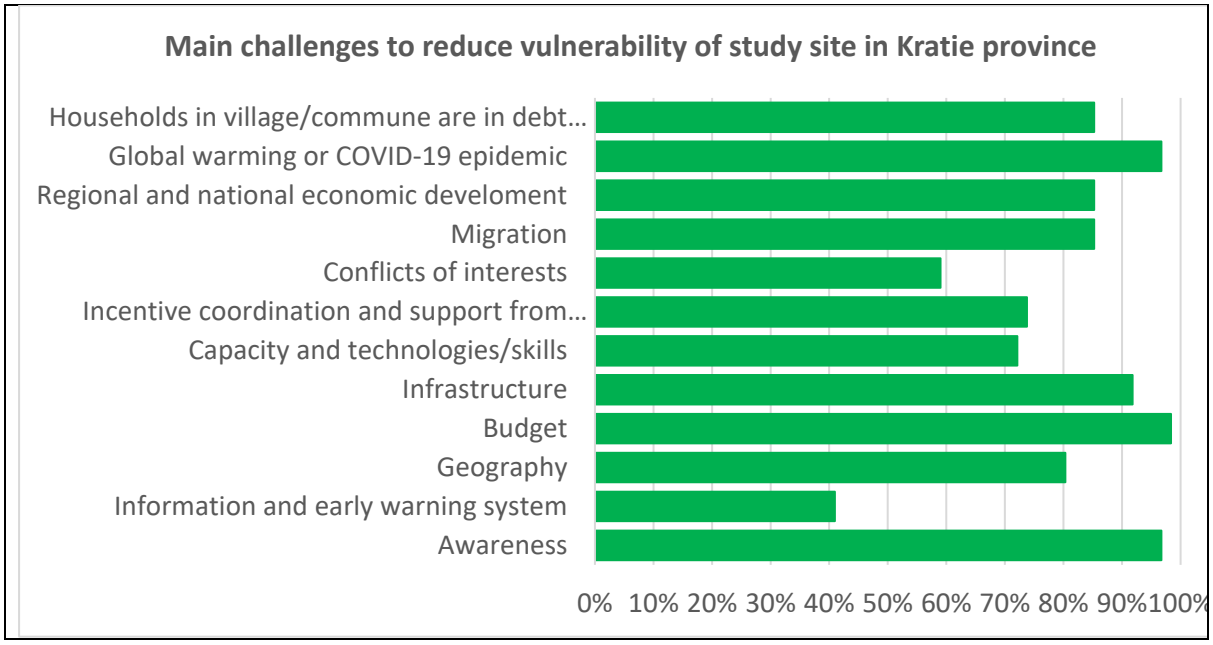


Figure 26: People migration of study site

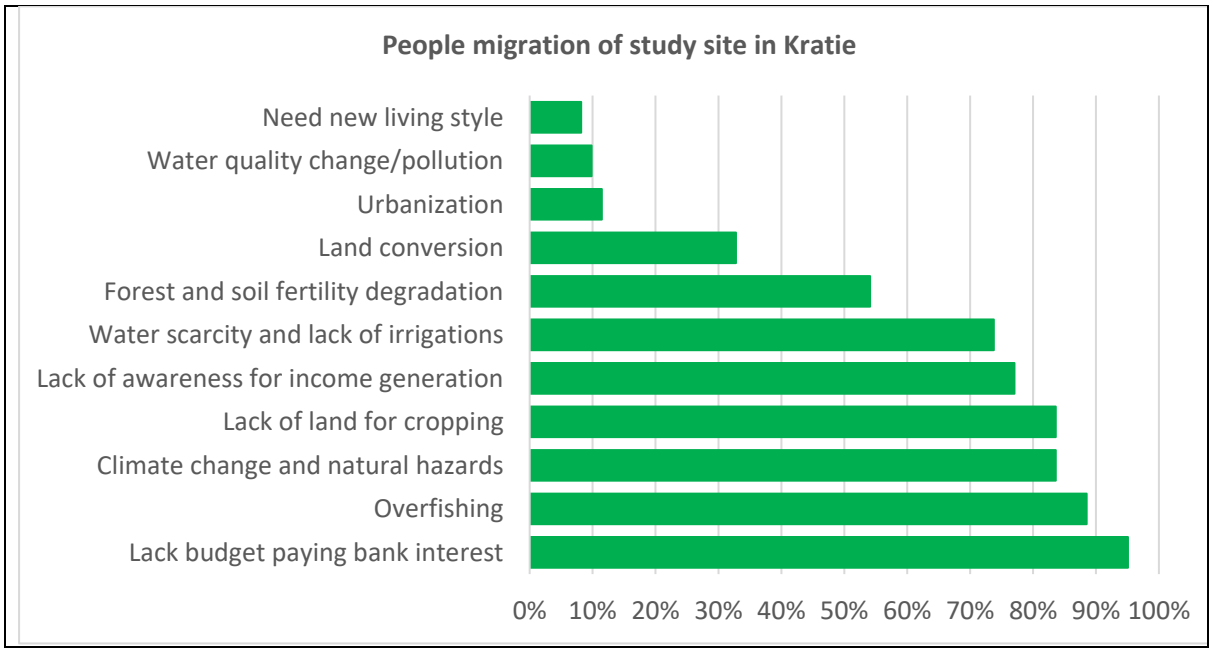


Figure 27: Vulnerable resources and communities

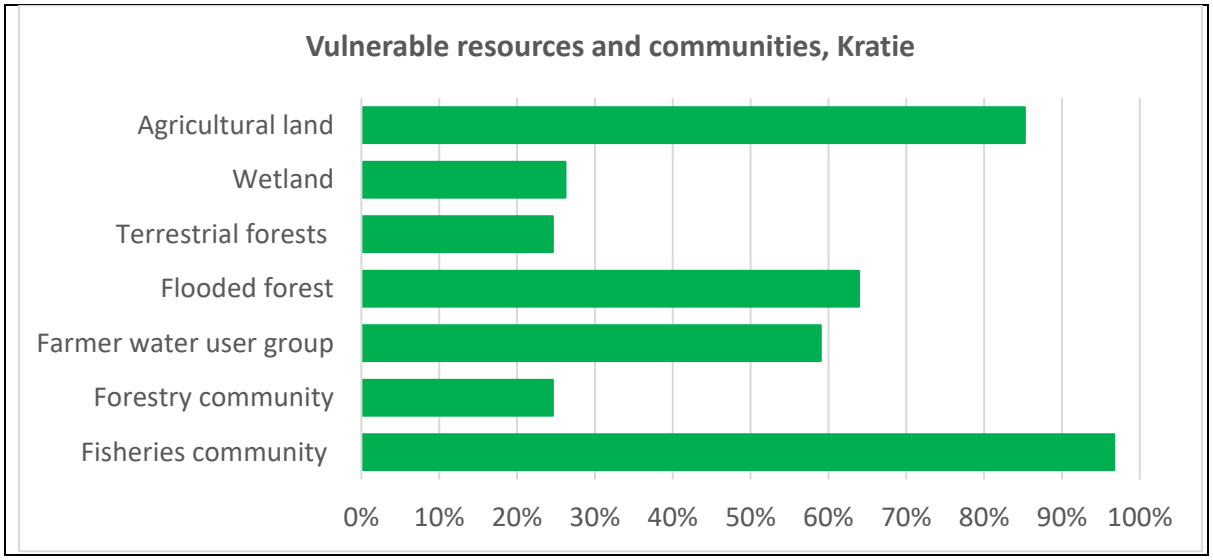


Figure 28: Main climate stressors

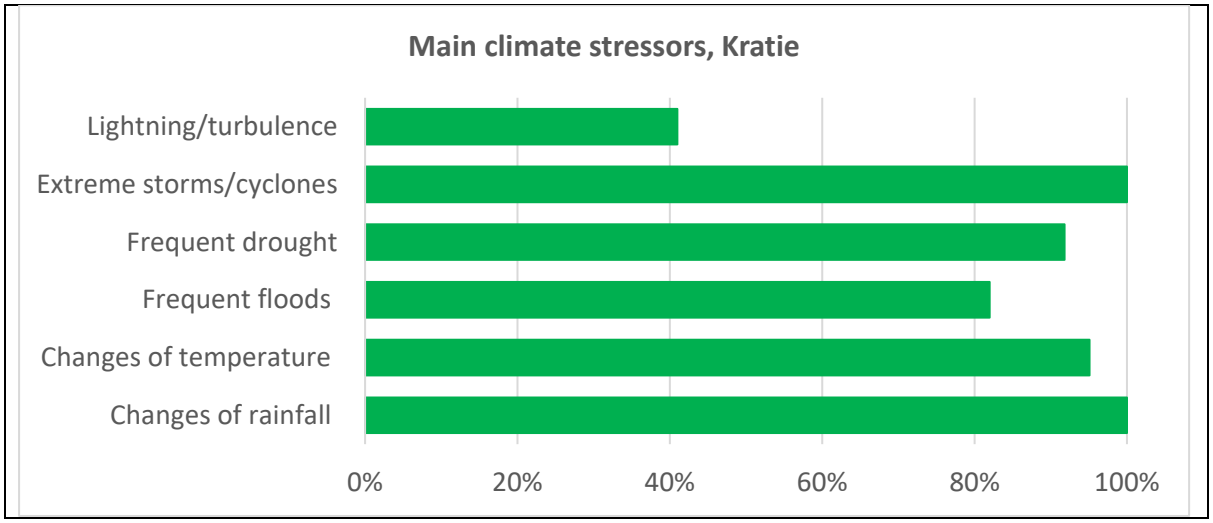


Figure 29: Vulnerable natural resources to climate change

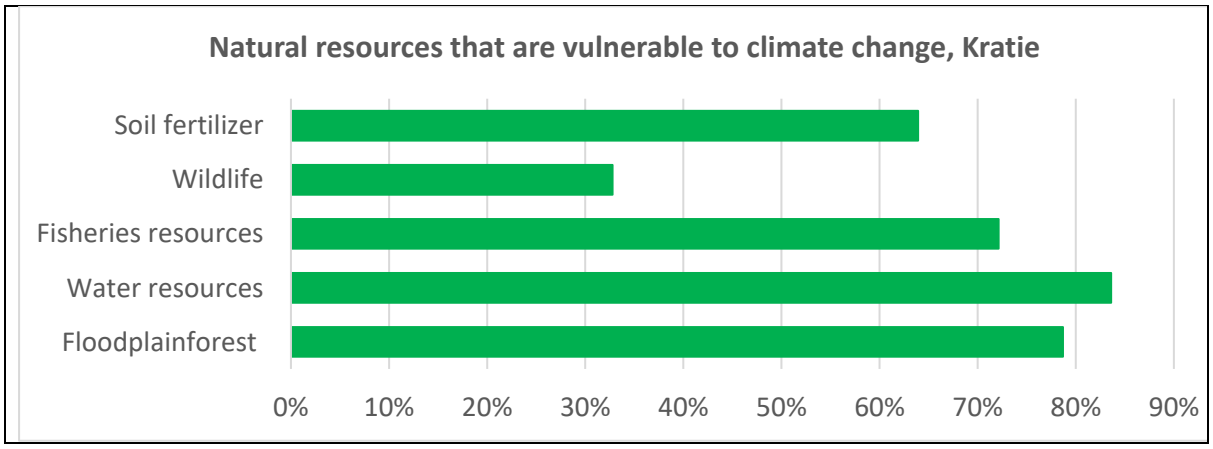


Figure 30: People perception on climate change and vulnerabilities

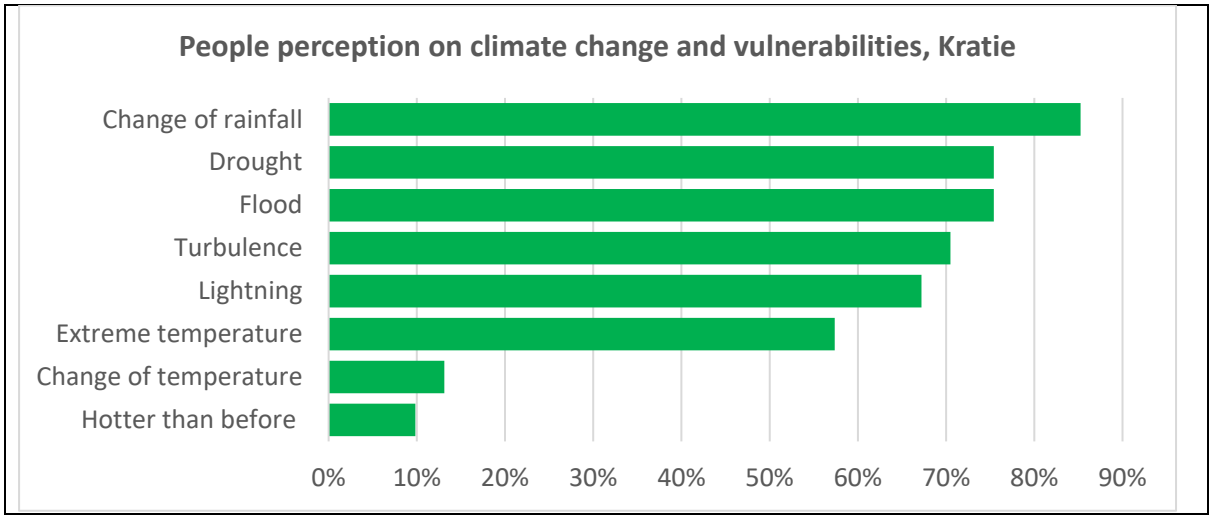


Figure 31: Responses to climate change-vulnerabilities

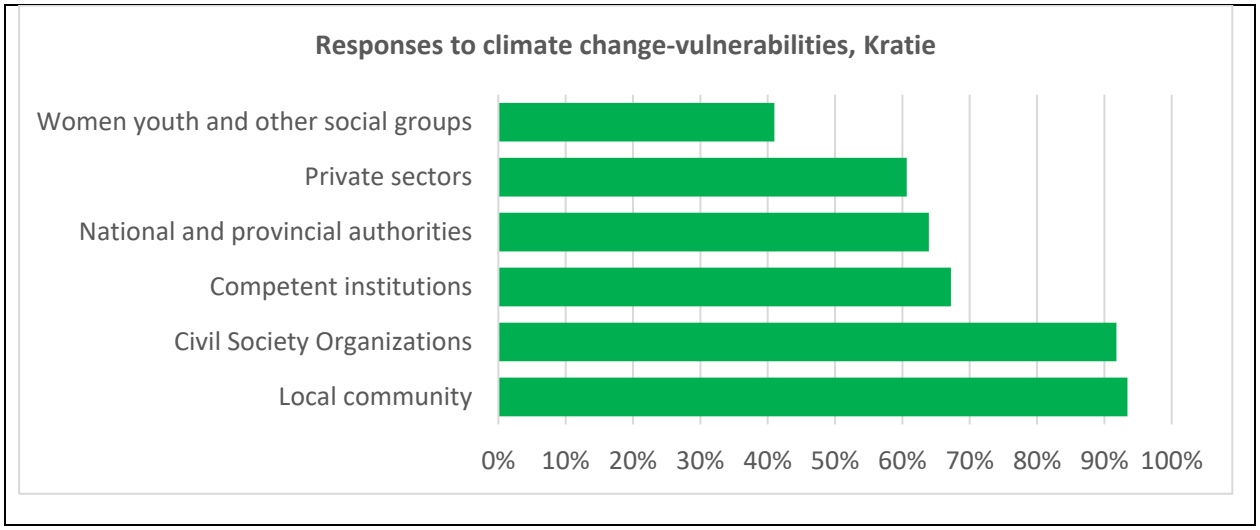
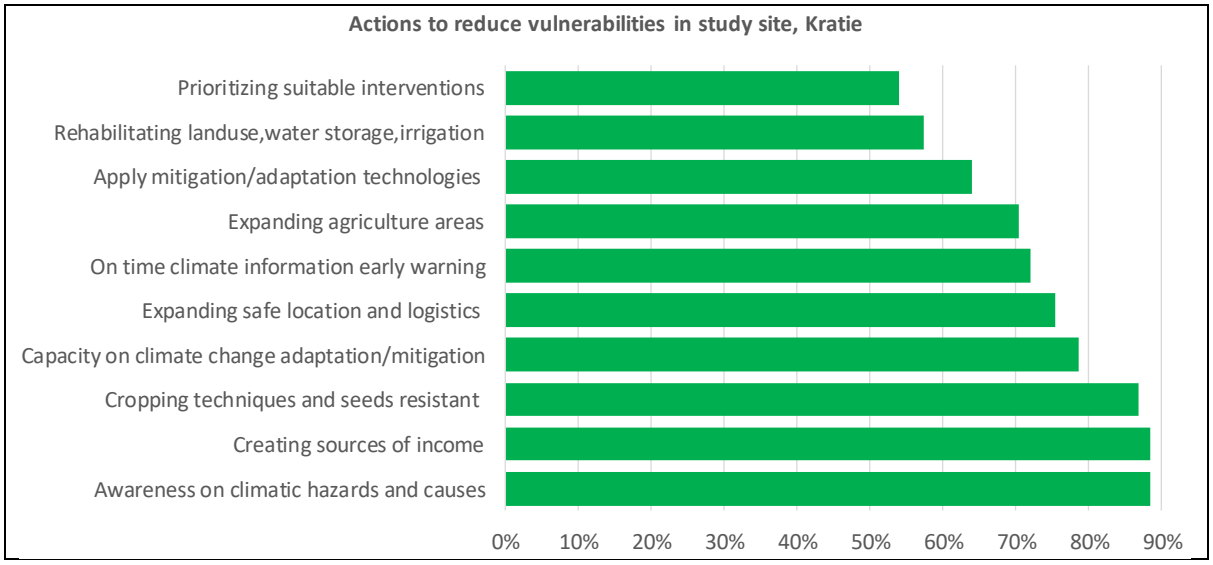


Figure 32: Actions to reduce vulnerabilities in study site



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