

# RESEARCH & DEVELOPMENT IN CLIMATE CHANGE AND RELATED AREAS WITHIN HIGHER EDUCATION IN CAMBODIA, LAOS AND VIETNAM: CURRENT STATUS AND TRENDS



REACT



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## ABBREVIATIONS

<b>ALU</b>	Albert-Ludwig Universität of Freiburg
<b>CC</b>	Climate Change
<b>EU</b>	European Union
<b>HCM USSH</b>	Ho Chi Minh University of Social Sciences & Humanities
<b>HEIs</b>	Higher Educational Institutions
<b>NIER</b>	National Institute of Economic Research
<b>NUOL</b>	National University of Laos
<b>PCs</b>	Partner Countries
<b>R&amp;D</b>	Research & Development
<b>RUA</b>	Royal University of Agriculture
<b>UA</b>	University of Alicante
<b>UHST</b>	University of Heng Samrin Thbongkhmum
<b>HUAF</b>	Hue University of Agriculture and Forestry



## FOREWORD

Cambodia, Laos and Vietnam are some of the most vulnerable countries in the world to the effects of Climate Change as a majority of their population lives in rural areas and is highly dependent on local habitats and have limited capacity to cope with Climate Change related risks (Mekong River Commission, 2011). Extreme weather events, habitat & infrastructure destruction, rising sea levels, depleted stocks etc., all pose significant risks to regional development and need innovative targeted adaptation and mitigation solutions to face these threats.

Higher Education Institutions (HEIs) can lead the way to reaching these solutions through the development of innovative Climate Change research and technology, and train the next generation who will carry on the torch. For this, cooperation among experts from different disciplines, institutions and countries, is key.

REACT is an Erasmus+ Capacity Building in Higher Education project that is being developed in Cambodia, Laos and Vietnam between October 2016 and October 2019. REACT's overall objective is to support HEIs in Cambodia, Laos and Vietnam in strengthening their capacities and regional cooperation by promoting effective Research & Innovation in Climate Change. Specifically REACT aims to:

1. **Build up the human capacities** of partner institutions to initiate, develop, manage, assess and exploit R,D&I in Climate Change, as well as to modernize relevant curricula with the integration of R,D&I in Climate Change towards more competence-based study programs; and

**2. Strengthen institutional capacities** by setting up a solid, regional and competitive multi-disciplinary REACT Network of Research & Academic Units in Climate Change.

The present document is the result of an in-depth empirical study and analysis on research and development (R&D) and academic offering focused on Climate Change, conducted in the three South-east Asian countries through means of surveys and semi-structured focus group sessions with HEI academics, students, and external stakeholders.

## EXECUTIVE SUMMARY

This report represents the closing document of WP2 “In-depth Empirical Study and Analysis on R&D in Climate Change and Competence Based Learning at PCs”, in the framework of the REACT Project, with a focus on the current status and needs of Cambodia, Laos and Vietnam in terms of R&D (from management to methodology, implementation, assessment and transfer of research results) in Climate Change, as well as the current offer and needs of Climate Change related topics in the curricula of Higher Education Institutions (HEIs) in the above-mentioned Partner Countries. The aim of this study was to identify potential fields of improvement where the REACT Research & Academic Units in Climate Change can effectively intervene or where further capacity development is needed. The data were collected through a survey consisting of two questionnaires sent to HEIs in the PCs and semi-structured focus group interviews conducted with the different stakeholders by the South East Asian (SEA) REACT partners in a shared effort. A total of 29 institutions and 98 researchers were reached with the survey and a total of 53 representatives from authorities and private sector, 71 academics and 77 students from 7 universities in Cambodia, Laos and Vietnam took part in the interviews and focus group sessions.

From the assessment, it emerged that the offer of programs entirely dedicated to Climate Change (CC) is very limited, while the distribution of related teaching materials is more common, in fact, more than half of the 29 institutions that took part to the investigations offer specific lectures and courses correlated to this field. Only 8 among the institutions that answered the questionnaires offer PhD positions in CC, and 7 of them complement the curricula with courses dedicated to the improvement of the research skills of the

post-graduates. Research on the impact of CC on different sectors of the national economies of Cambodia, Laos and Vietnam is broad and an interdisciplinary approach is used by one third of the researchers to investigate such topics. The majority of the research is financed by international donors and foundations while the private sector remains as marginal in the contribution to the R&D related to CC.

From the interviews with the representatives of authorities and private sector it emerged that the impact of CC is perceived as a real problem and the consequences have already affected agriculture, tourism and forestry sector with serious effects on the livelihood of small farmers living off subsistence agriculture. Severe floods, prolonged droughts and salt water intrusions in the coastal zones are the main threats for clean water resources and the cultivation of crops, important for the agricultural production which represents at least 60 % of the national economy in Cambodia, Laos and Vietnam. Collaboration between governments and research institutions in the formulation of effective adaptation and mitigation strategies is weak and the national budget dedicated to research on CC limited. The formation of interdisciplinary research groups and data sharing is mostly based on personal contacts since there is lack of a solid network between HEIs.

An important aspect that emerged from the interviews of the focus groups “academia” and “students” is the fact that even when courses on CC are offered, the teaching material is considered as superficial and the teaching methods and contents inadequate to prepare the graduates to have an active role in the field of research or entering the labour market. Regarding the accessibility to courses and degrees related to CC it emerged that there are no scholarships opportunities specific to this topic.

This study serves as a milestone for a better understanding of the status and needs in order to increase capacity in R&D on CC in Cambodia, Laos and Vietnam. Given the outcomes of the investigation, there are three main aspects on which the REACT units will have to concentrate their efforts:

- Facilitate and encourage the collaboration between HEIs and governmental offices and agencies dedicated to the research and formulation of CC adaptation and mitigation strategies.
- Coordination and standardization of the data sharing process in order to improve the network between HEIs and the establishment of database in each research institution.
- Promotion of internships and real-life case studies to support partnerships between private sector and universities in order to improve the professional skills of the students and increase the interest of the private sector in the research.

## **INTRODUCTION**

### **AIM OF THE REPORT**

This report presents an in-depth analysis of the current status and needs of Cambodia, Laos and Vietnam in terms of R&D in Climate Change (CC), as well as the current offer and needs of CC related topics in Higher Educational Institutions' (HEIs) curricula. In the Erasmus+ REACT project, CC is considered as a multidisciplinary field with impact on several sectors such as Agriculture, Forestry, Tourism and Socio-Economy. Moreover, it identifies potential fields of improvement where the REACT unit can effectively intervene or where further capacity development is needed. This report represents the closing document of REACT WP2 "In-depth Empirical Study and Analysis on R&D in Climate Change and Competence based Learning at PCs", which will serve as baseline for the next steps of the project by identifying relevant topics for Trainings and the formation international REACT Network, able to coordinate the exchange of information within the country and with the other SEA partners, and guide HEIs in fundraising research financing.

### **CONTENTS AND STRUCTURE OF THE REPORT**

The data collected are presented as follows: in the first section, informative data at national level describing the overall status of research in CC in HEIs in Cambodia, Laos and Vietnam are presented; the second section is an analysis of qualitative data collected through focus-group interviews with two internal groups: "academics and students" and two external groups "private sector and authorities", subdivided by country in alphabetic order, hence: Cambodia, Laos and Vietnam. Ultimately recommendations and strategies for building and strengthening capacity in R&D through the REACT

units are given in the last section together with conclusive remarks about the overall status of R&D on CC and the main obstacles to its advancement and increasing impact on national policies.

The data collection was performed by the SEA partners of the project under the supervision of the team of the Albert-Ludwig Universität of Freiburg (Germany). The previous “*Report on study visit at EU HEIs*” (D2.1.1) constituted the baselines for the drafting of the questions for the semi-structured focus group interviews and the two questionnaires with short open answers. The first questionnaire aimed to collect data about the status of CC topics included in the curricula of HEIs, while the second questionnaire collected data about currently being conducted or completed research in the field of CC from public and private research institutions in the three countries.



Photo 1: Participants in Focus Group “Authorities and Private Sector” at Hue University of Agriculture and Forestry (Vietnam)

While the questionnaires aimed to assess what are the main focuses of research on CC using a quantitative approach, the focus group interviews intended to investigate more in depth the practical and social aspect of the research together with their impact on national policies and private sector, hence on the societal and economic development of the nation. Therefore, for the external groups, they comprise three parts: one concerning perception and awareness of CC impact on different sectors relevant for the national economy, one on the current capacity of the research institutions in terms of human resources and their preparation to fulfil the demand of the private sector and one last part is dedicated to identify the implementation mechanism of dedicated policies and the main sources of financing for R&D in general and specifically in the field of CC. A different set of questions was developed for the internal focus-group “Student” and “Academics”, in order to assess the teaching methods, accessibility of dedicated courses, curricula and their applicability to prospective careers. The list of institutions that participated in the different focus groups, and area of knowledge for students and academics, can be found in Tables 5-7 in the ANNEX.

Detailed instructions were provided to the partners through the report: “*Data collection guidelines*” (D2.2.1), including the survey and interviews definition and analysis methodology. The document is available to consult upon request, in order to have a deeper understanding of the present investigation and the data collection process.



## ANALYSIS OF QUESTIONNAIRE RESULTS

### RESULTS FROM THE QUESTIONNAIRE "CLIMATE CHANGE IN ACADEMIC INSTITUTIONS"

With the effort of our Asian partners we have reached in total 29 institutions from Vietnam, Cambodia and Laos with this survey. Data collection from different non-partner institutions were challenging.

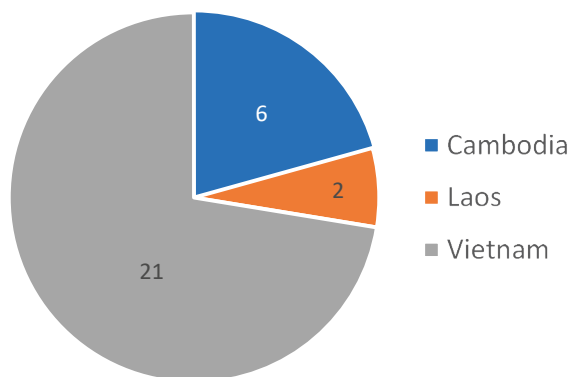


Figure 1: Number of institutions joined the survey

They answered six different questions. In the section below, the answers for the questions are discussed in detail.

### a. Institutions offering degrees or courses on Climate Change

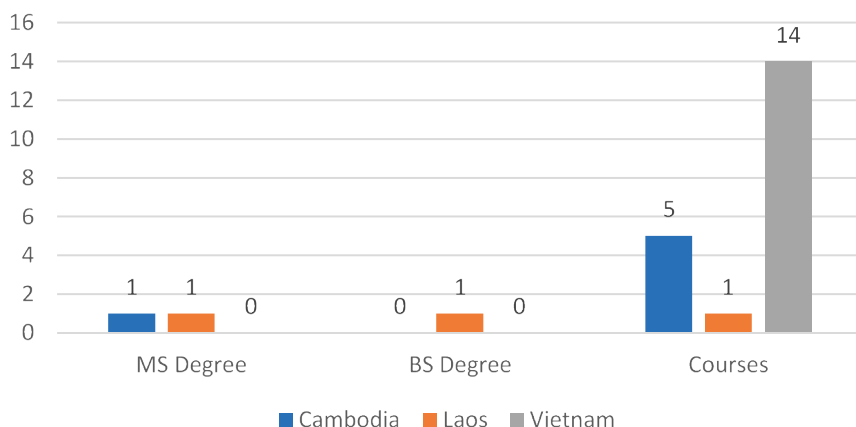


Figure 2: Number of institutions having MS Degrees, BS Degrees or courses on Climate Change

The question is asked in order to understand the involvement of “Climate Change” in the curricula. According to the data gathered, institutions are more likely to have CC related courses within different degrees. From 29 institutions who joined the survey, 20 of them offers courses about CC. There are only 2 institutions from Cambodia and Laos that offer master programs on CC. In the National University of Laos, there is more than one master program on CC offered to the students, namely the MSc in Forest Management for Climate Change Adaptation and Mitigation and the Master of Climate Change for Rural Development. Moreover, the Royal University of Phnom Penh in Cambodia has started to offer a new master degree in 2017 called “Master of Science in Climate Change”.

When we only consider the degrees specifically on CC, none of the institutes are offering any Bachelor’s degrees on CC apart from the Faculty of Agriculture and Forest Resources in Souphanouvong University (SU). However, the name of the program is not provided in

the survey. Nevertheless, there are BS degrees noted by the institutions from Vietnam and Laos such as “Environmental Economics”, “Environmental Science”, “Environment and Natural Resource Management” as CC related degrees.

The courses within different masters and bachelor degrees can be listed as below. Some of the courses are offered by more than one institution.

**Table 1: Courses offered by the participant institutions on Climate Change**

Cambodia	Laos	Vietnam
Introduction to Climate Change	Climate Change and Biodiversity	Climate Change
Climate Change adaptation and Mitigation	Carbon Measurement and Monitoring and Forest Governance	Valuation of impacts and adaptation of Climate Change under Environmental Geography, BA
Environmental Impact Assessment in fisheries and forestry programs	Courses related to Climate Change in environmental economics	Climate change and adaptation
		Natural resources management depending on community
		Environment Law and Policy
		Major Resources and Environment Management

		Environmental and social impact assessment in forestry
		Sustainable forest management
		Urban Sociology, Rural Sociology, Agricultural Tourism, Village Tourism
		Disaster management, mitigation and adaptation of Climate Change
		Land Management
		Sustainable Development
		Natural Resource Management

**b. Institutions that have teaching materials or information related to Climate Change**

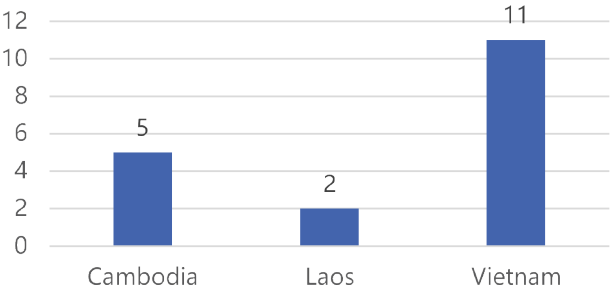


Figure 3: Institutions that have teaching materials or information related to Climate Change

In total, at least half of the institutions who participated in the survey offer teaching materials or information regarding CC to their stu-

dents. The materials provided by the institutions in Vietnam are mostly teaching materials and books for the courses on CC. In NUOL, they provide a training manual on REDD+ for technical staff and for local people in Laos, duplicate maps or document of CC additional to the reference books for the courses. In Cambodia, Power Point handouts and videos related to the subjects are provided. Moreover, in some institutions laboratories and computer labs are used during the courses. Specifically, in University of Battambang in Cambodia, in a specific study on heat effect on fishes, recirculating tank systems, spirometry tank, chase tank, etc. have been utilized.

### **c. Institutions offering PhD positions on Climate Change topics**

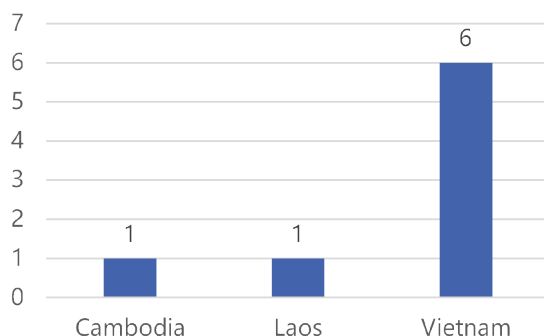


Figure 4: Institutions offering PhD positions on Climate Change

The institutions which have PhD positions in CC are rather low. Only 8 institutions from 29 offer PhD positions in CC related topics. The mentioned topics are: Land and water environment, Green economic development at mountainous areas, CO<sub>2</sub> absorption capacity of rubber forest grown in Tan Hung rubber plantation, Ben Cat District, Binh Duong Province, Water use for coffee cultivation at Dak Nong, Environmental change and people migration at An Giang, non-renewable and renewable energy in forest management.

**d. Qualification programs to improve research skills parallel or prior to the master or PhD programs**

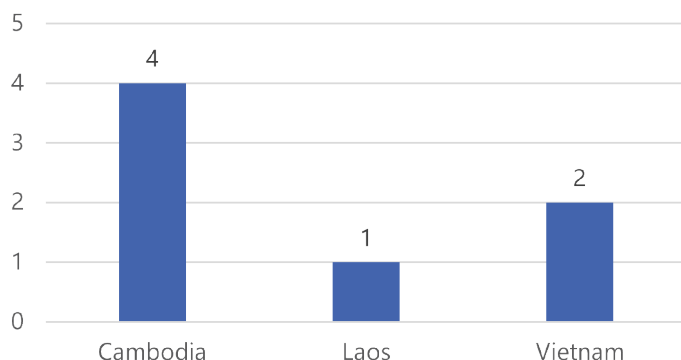


Figure 5: Number of institutions offering qualification programs

From 29 institutions only 7 of them provide research skill programs. These programs are given as; courses regarding skills for writing international projects, project management during MS programs, training in building capacities in human resource development in the country, training for data analysis, research proposal development, research methods in social sciences, academic writing. Also, in some institutions research skills are included in the master degrees on CC. In Cambodia, one institution offers a summer course on scientific English for agriculture, while another institution offers trainings in Leadership for Sustainable Development and Decision Support System (DSS) additional to project management and research skills.

**e. Institutions involved in an interdisciplinary or transdisciplinary research body on a topic related to Climate Change**

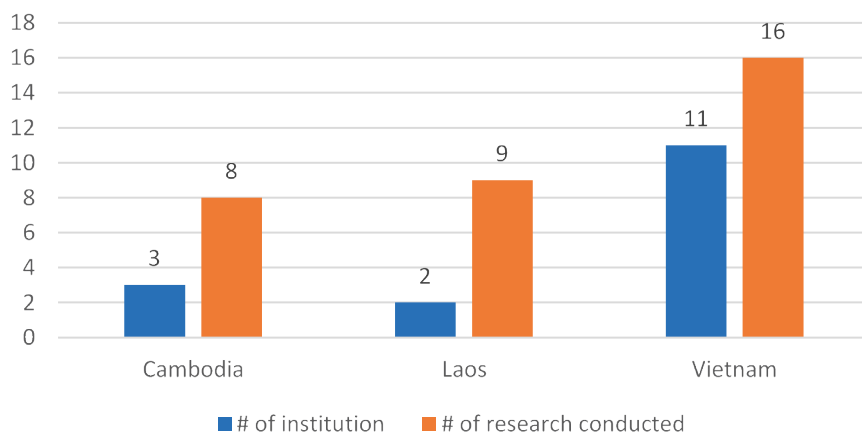


Figure 6: Number of institutions involved in an interdisciplinary or transdisciplinary research body & number of research conducted

From the institutions who joined the survey, 16 of them are involved in one or more interdisciplinary or transdisciplinary research projects. Within those 16 institutions, 33 different research initiatives were conducted or are still being conducted. The project topics, project partners and received grants can be found in the APPENDIX (Table 1);

**RESULTS FROM THE QUESTIONNAIRE "RESEARCH IN CLIMATE CHANGE"**

The REACT partners in Cambodia, Vietnam and Laos were able to collect answers to the "Research in Climate Change" questionnaire from 98 different researchers conducting research in 24 different institutions.

## R&D IN CLIMATE CHANGE AND RELATED AREAS WITHIN HIGHER EDUCATION IN CAMBODIA, LAOS AND VIETNAM: CURRENT STATUS AND TRENDS

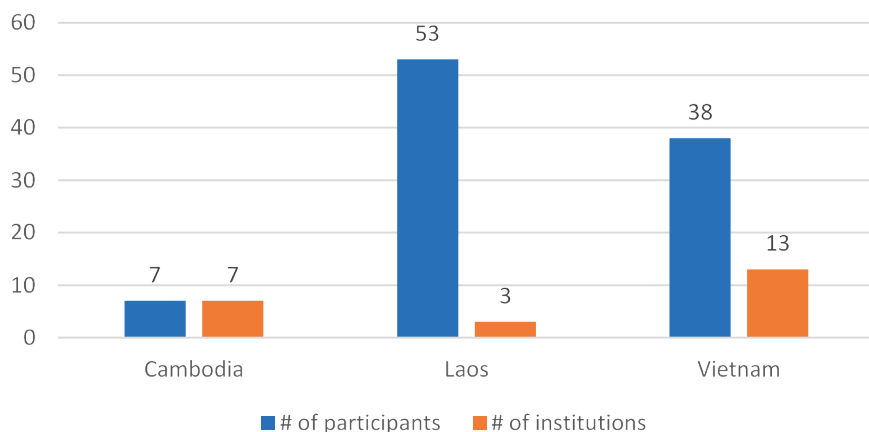


Figure 7: Number of participant institutions and researchers

### a. Participants conducting research in Climate Change

From the participants, more than the half of the researchers have been conducting research in the area of CC.

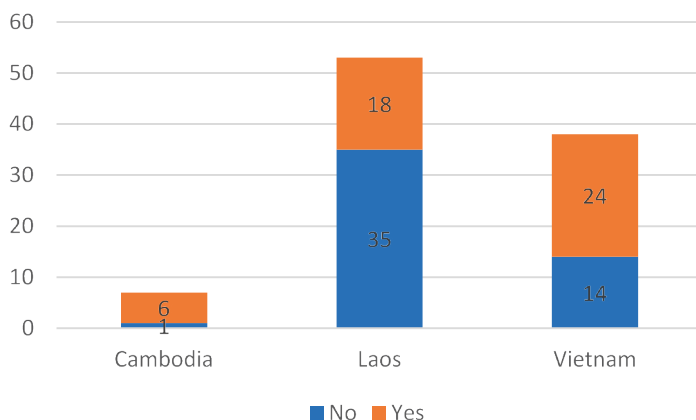


Figure 8: Number of researchers conducting and not conducting research in Climate Change



The main research field of nearly 35% of researchers who conducted research in the area of CC is specifically on CC. The number distributes equally among the countries. The focus point of the research however differs. For instance, a researcher from Can Tho City University in Vietnam is focusing on the effects of CC in the Mekong delta, while another researcher from the same university focuses on impacts of CC on tourism. Researchers from REACT partners from Laos, NIER and NUOL, focus more on the economic related issues such as green growth or economic development and environment. One of the main research fields of a freelance researcher from Cambodia is also the Mekong River, while another researcher from the Ministry of Agriculture, Forestry and Fisheries is working on developing climate adaptation options for farming communities not only in Cambodia, but also in Lao PDR, India and Bangladesh.

Many of the participants who are working on a topic related to CC have more than one publication in the field.

In all three countries, many CC related areas are covered by research. From “GIS – Remote sensing and modeling calculations to map the flood risk due to sea level rise” to “participation of people in the protection of natural resources”, many natural and social science topics related to CC are under research in all countries. The research institutions, main field of the researcher and the conducted research topics can be found in Table 2 in the APPENDIX.

### **b. Participants collaborating with international partners or private institutions**

According to the answers of the participant researchers; in general research, collaboration with private institutions is not very common, while the collaboration with international institutions seems to be more common.

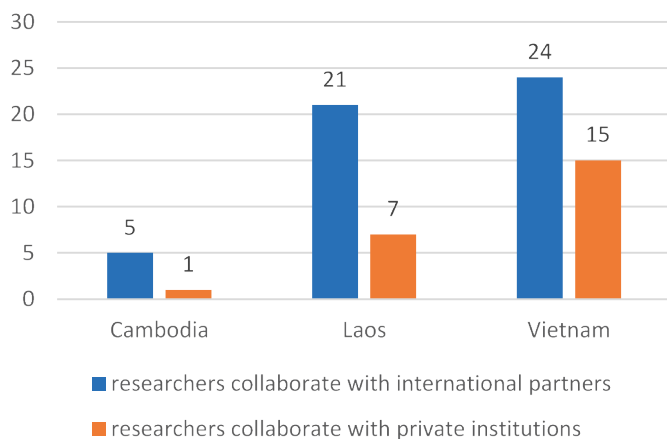


Figure 9: Researchers collaborate with international partners or private institutions

In all three countries, the researchers who are conducting CC related research seem to be collaborating more with international institutions compared to the colleagues who are not in the field of CC (Figure 10). For all countries, more than 80% of the scientists who have conducted research in CC have been working with international institutions. On the contrary, this is only the case for less than 37% of the scientists who are not working on CC collaborate with international organizations. Moreover, in Cambodia and Vietnam, the researchers conducting CC research seem to have collaborated more with private institutions which is not the case in Laos.

## R&D IN CLIMATE CHANGE AND RELATED AREAS WITHIN HIGHER EDUCATION IN CAMBODIA, LAOS AND VIETNAM: CURRENT STATUS AND TRENDS

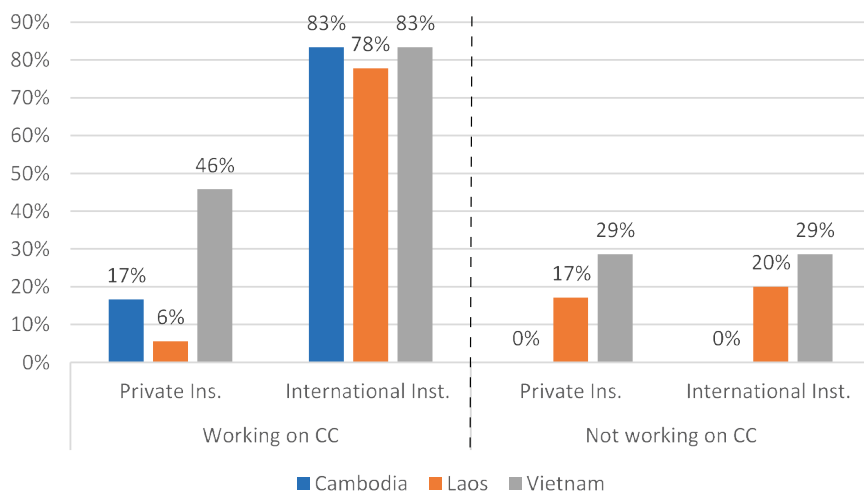


Figure 10: Comparison of researchers within CC field and outside of CC field in collaboration with private and international organizations

The private and international institutions whom the researchers are collaborating with can be found in Table 3 in the APPENDIX.

### c. Fields where more research is needed

We finally asked the participants their opinion about the fields which need more research. Researchers from all three countries answered the question in detail and specified many topics which they think are important to focus on. Most of them mentioned the effects of CC on different fields such as agriculture, livelihood, fisheries, land use, forests etc. Adaptation to CC as well as mitigation strategies are common areas the participants have mentioned. Social topics such as social effect of CC, gender and CC, public perception, awareness, attitude towards CC are also mentioned.

Energy situation in their countries and research on renewable energy are within the topics expressed by the participants as well as the economics of CC. Drought and floods, reasons, effects and mitigation strategies are mentioned by the participants from all three countries. Land use planning, resilient infrastructure in urban and rural areas or on specific regions are also topics of interest.

The above-mentioned topics are a small summary of the areas mentioned by the participants where more research is needed. The full list of topics is represented in Table 4 in the APPENDIX.

## ANALYSIS OF FOCUS-GROUP INTERVIEWS

### CAMBODIA: AUTHORITIES AND PRIVATE SECTOR

A total of 12 representatives from the Department of Climate Change and the Ministry of Environment, and 14 representatives from the NGO forum of Cambodia took part in the semi-structured group interviews. The interviews are divided into three sections; therefore the presentation of the data will also follow this order and structure.

#### Perception and awareness

According to the representatives of the focus groups “Authorities” and “Private sector” in Cambodia, CC is understood as a real phenomenon considering the perceived consequences including increased temperature, changes in seasonal rainfall patterns, sea level rise and salinity increase at the coastal zones, more frequent and severe weather events such as floods, droughts and storms. The impact of CC affects vital sectors of the national economy and especially the most vulnerable classes of society, causing a delay in the reaching of economic equality in the country and competitiveness at international level. The most impacted sector is agriculture together with degradation of water resources.

In the agricultural sector, several impacts have already been observed:

- Change in crops growing seasons
- Frequent and severe floods, droughts and storms
- Change in climate variability such as temperature, precipitation, rainfall patterns with consequence on infiltrations and underground water resources as well as on air humidity.
- Decreased crops yield with consequent diminishing in overseas exports.

- Damaged rice plantations due to severe floods during rainy season.
- Increased pest and insect outbreaks, with loss of most vulnerable crops species
- Rising of sea level with a consequent impact on the agricultural production along the coastal zones
- Increased water-reservoir consumption due to the prolonged drought which in some cases results in crop failure
- It is also predicted that wet season rice yield (rain-fed) would continuously decrease until 2080, and could fall by up to 70% of current yield levels. The dry season rice (irrigated rice), yields for crops planted normally in November and December could decrease by 40%.
- Losses of production have been mainly due to flooding (about 62%) and drought (about 36%)

The tourism sector is vulnerable to external shocks, including rising oil prices, epidemics and recurring natural disasters, natural environment degradation, damages to cultural heritage, changes in water availability, biodiversity losses, reduced landscape aesthetic, altered agricultural production and coastal erosion. The loss of biodiversity, one of the most important touristic attractions, is the most relevant consequence of CC. The destruction of local flora and fauna would result in the substantial decrease in the number of tourists visiting the country. CC is also believed to degrade historical heritage sites due to the possible severe droughts and floods as well as the increased number of hot days.

Forestry is also an important sector in Cambodia as a great proportion of people living in rural areas depend substantially upon the non-timber forestry products for their daily household consumptions and incomes. The impacts of CC on forestry are associated with forestry fires and loss of biodiversity, unhealthy growth and reduced

forest productivity due to prolonged droughts. The predicted specific impacts are listed below:

- Threatening of some vital native species by enabling a conducive environment for undesirable alien and invasive species, affecting the balance of the natural forest ecosystems.
- Under emission scenarios B1 and A2, most of the lowland forest will be exposed to longer dry periods until 2050, particularly forest areas located in the northeast and southwest of the country.
- More than 4 million ha of lowland forest, which currently has a water deficit period of between four and six months, would be exposed to a water deficit period of between six and eight months or more.

CC is also perceived to affect other sectors as listed below:

**Fishery Sector:** By prolonged, drier dry season and delayed rainy season, affecting the hatching period of fish, fish habitats, fish migration and survivorship rate until adulthood, as well as increasing the presence of invasive species along the riverine or floodplain areas. Prolonged drought and higher evaporation rate due to the increased temperature could also dry up some lakes, leading to the loss or degradation of fish stock. For example, hundreds of tonnes of fish in the Tonle Sap Lake were killed during the unprecedented hot period of the dry season in 2015.

**Education:** Increasing frequency of extreme weather events affects the educational services, human resources development and infrastructure. Floods, droughts and storms lead to increase the number of days which students (esp. children) and teachers cannot attend school. For instance, more than 500 schools were delayed due to the high flood in 2013. Also, in 2015 virtually all primary schools in Cambodia were closed for at least one month during the peak hot

season within the regular semester, to avoid high risks of children getting sick when going to schools during that period.

**Gender:** CC has impacts on men and women in a different way due to the contribution of labour in households, communities and societies. Pregnant women might be more affected by changes in weather and climate than men.

**Public health:** Extreme weather phenomena can cause direct and indirect impacts on human death, injuries, morbidity and mental problems. An increased prevalence of dengue fever and other water-borne diseases has been registered and the most affected groups are children and the poorest classes of society characterized by an unbalanced nutrition, hence a more vulnerable health condition

**Infrastructure:** Flood and drought; flood causes dis-connectivity along the rural roads and national roads in the rural area as well as urban areas, creating obstacles for a homogenous social-economic growth of the country.

**Water resources:** Prolonged drought cause limited water supply for household consumption and agricultural production processes. Runoff and groundwater recharge and surface water quality are affected by flood and flash flood also due to the poor condition of watersheds, catchment and floodplain management

**Coastal zone:** Sea level rising causes salinity intrusion with direct consequences on water sanitation, coastal biodiversity and hygiene.

All of the impacts listed above have direct and indirect influence on the socio-economic development of the nation. Most of the Cambodian population relies on agriculture as the main source of income, which is the most sensitive sector to the impact of CC. This phenomenon is closely related to the degradation of water resources in terms of quality and availability of the water. Infrastructural damages due to droughts and storms threaten the communications, national and international exchange of goods and continuity of services such



as electricity and water supply in both rural and urban areas. The intrusion of salty water on the coastal zone threatens the yields of aquaculture and hence the economic activities of the population of these areas. The increased incidence of dengue fever and other water-borne diseases overload the public health services causing higher investments from the state budget and affect the national production and the wellness of the population.

The data collected during the interviews testifies that the representatives of Authorities and Private Sector are well aware of present and potential impacts of CC in their nation. However, it is not clear yet to what extent they will affect population and economics of the country. According to the participants, the awareness of the interested actors is relatively widespread, however, the responses are limited and less effective. This fact is due to a lack of knowledge and expertise in the field of CC, it is desirable for it to be integrated into education at all levels: from primary school to the higher educational institution in order to form professional figures able to address impact of CC in different sectors.

At the institutional level, the National Climate Change Committee (NCCC) has a prominent role in the coordination of actions dedicated to CC responses, strengthening and facilitating partnerships among stakeholders and monitoring the implementation of the strategic plan for CC adaptation and mitigation.

At line-ministry level, CC focal points and working groups have already been established. According to the participants, the responsibilities of these working groups are not defined yet, in particular, their relationship with other line ministry departments, to ensure that the planning of sectoral policies, programmes and investments fully takes into account CC risks and opportunities.

Over the past 17 years, the Climate Change Department of the Ministry of Environment has played a key role in coordination and support of the R&D national policies through implementing the related CC action plan, strategic plan, and dedicated policies. As such, CC plays an important role in the R&D national policies of up to 14 sectors. However, the national budget dedicated to the R&D is usually not very high and varies from one ministry to another. Research in key sectors including agriculture, education, health and infrastructure receive the biggest share of the national budget.

As a final remark, a need to continue and increase partnership with key universities emerged from the investigation. Research institutions can help private sector and dedicated governmental entities to establish a strategic dialogue in order to identify priorities and drafting effective agenda to fully understand the phenomenon and the best actions to address it.

From the focus-group interviews it has emerged that twelve different Ministries and one national committee have interest and take part in the assessment of the impact of CC:

- Ministry of Agriculture, Forestry and Fishery
- National Committee for Disaster Management
- Ministry of Education, Youth and Sport
- Ministry of Women Affair
- Ministry of Public Health
- Ministry of Rural Development Ministry of Water Resource and Meteorology
- Ministry of Land Management Urban Planning and Construction
- Ministry of Tourism
- Ministry of Industry and handicraft
- Ministry of Public Work and Transport
- Ministry of information

- Ministry of Environment (MoE)
- Ministry of Mines and Energy

### **R&D National Capacity and Role of the Private Sector**

The data used by institutions and interested actors to measure the magnitude of impacts and variations in the normal seasonal course are meteorological (rainfall, temperature, wind), land coverage variation (e.g. Decrease of forest surface, lowering or increasing in sea level), soil quality, hydrological data. It is not clear which are the sources of such information and how the validity and quality of the data are guaranteed.

Mainly donors and international development partners promote research, monitoring and evaluation in the field of CC. These interventions are also coordinated by the Department of Climate Change of the Ministry of Environment. Two Japanese institutions which have a role in CC impact assessment and are founded by government and private companies are hereby given.

*Overseas Environmental Cooperation Center (OECC):* Joint research on energy efficiency on testing water quality of shallow well in luxurious hotels in Phnom Penh and Siem Reap, Cambodia in 2015. The OECC's mission is to collect yearly environmental information in the developing countries in cooperation with Japan. Members of the mission are composed of corporations engaged in environmental consultancy or environmental monitoring/analysis, corporations engaged in the manufacturing or construction of environmental protection facilities, in production or sale of environmental monitoring equipment, or in other related business entities, local governments and other non-profit organizations engaged in activities for the conservation of the environment. Targeted fields of survey are flora, atmosphere, water, biodiversity, waste management, and environmental and social con-

siderations. Members proceed with their survey through preliminary studies, visiting and hearing from officers of environment-related ministries/international donors/NGOs, and environmental treatment facilities as well. After the data collections, a one-day seminar on environmental management is held in the capital city with a presentation of solutions for environmental challenges of the targeted country.

*The Institute for Global Environmental Strategies (IGES):* Conducts standardized baseline on rice miller in Cambodia to develop emission factor in term of CDM project in collaboration with Department of Climate Change of the Ministry of Environment. The institute was established to achieve a new paradigm for civilization and conduct innovative policy development and strategic research for environmental measures, reflecting the results of research into political decisions for realising sustainable development both in the Asia-Pacific region and globally. The IGES collects environmental data that are sold to interested actors in order to finance the research.

In Cambodia, the Private sector seems not to contribute to the research of CC, if the biggest company and international corporations do study impacts of their interest, it is unlikely that the results would be published. The main constraint for the local NGOs to actively contribute to the national research on CC is the lack of funding to be dedicated to field surveys, independently from specific project frameworks. Another important factor is the limited human resources specialized in the field of CC impact assessment. The demand for such professional figures is, nevertheless, increasing. The Department of Climate Change, for instance, is currently looking for experts in CC adaptation and mitigation strategies as well as CC impact assessment and GHG inventory

## **Financing and resources for R&D in Climate Change**

From the interviews it emerged that several action plans and strategies to cope with CC have been formulated by the Royal Government of Cambodia. A list of the mentioned programmes follows:

- Cambodia Climate Change Strategic Plan 2014-2023 (CCCSP) with a focus on 3 phases:
  - In the immediate term (2013 – 2014)
  - In the medium term (2014 – 2018)
  - In the long term (2019 – 2023)
- National Strategy for Green Growth and Sectorial Development plans
- National Strategic Development Plan (NSDP)
- Rectangular Strategy
- Climate Change Action Plan (CCAP)
- Sectorial Climate Change Strategic Plan (SCCSP)
- Climate Change Financing Framework.

The CCCSP, together with the related action plans, provides a strategic framework for the programs of CC interventions in Cambodia. National Climate Change financing mechanisms support this strategic approach through the application of the following principles:

- Alignment with national priorities areas
- Pooling resources
- Use of national systems and procedures
- Subsidiarity

In 2014, the following actions were taken to put into place a credible, attractive and effective CC financing framework for Cambodia:

- An analysis of resource mobilization opportunities (domestic and external), both at the national level and in prioritized sectors;

- An evaluation of the costs for the CCCSP and SCCSPs, with prioritization of high relevance projects;
- An evaluation of the socio-economic impacts of non-action and net benefits of various response scenarios in order to provide a basis for prioritization of expenditures per sector and sub-sectors;
- An analysis of best national practices and relevant international practices in the management of pooled funding arrangements, and recommendations on proposed arrangements for national and sub-national climate financing mechanisms;
- An analysis of capacity gaps and recommendations for developing national and sub-national capacities to manage the proposed CC finance mechanisms. This also included recommendations for further work on possibilities to mobilize private finance for adaptation and mitigation activities.

Financial support is allocated from the international donors to Department of Climate Change (DCC) through CCCA-Trust Fund. CCCA-Trust Fund allocates the budget to 11 institutions according to the proposal submitted. The first priority is agriculture, hence, DCC has been developing university partnership with 4 agricultural academic institutions such as the Royal University of Agriculture, Royal University of Phnom Penh, Prek Leap National School of Agriculture, and Mean Chey University, to promote capacity building on CC related topics.

The grants were provided to non-government and private sectors; governmental institutions were excluded because of their limited capacity in the field.

In general, most of the funding coming from international donors is dedicated to projects implementation and human resources development. Civil society, educational institutions and relevant ministries are the principal receivers and managers of such funds.

The DCC is currently coordinating 3 main programmes.

- *Cambodia Climate Change Alliance (CCCA)*, funded by EU, UNDP, SIDA and DANIDA with a budget of US\$ 11 million in Phase 1 (2010-14) to strengthen the national system and capacity to support the coordination and implementation of Cambodia's climate change responses. Phase 2 is resuming its objective, 2014-19, with the amount of US\$ 12.4 million funded by EU, UNDP and SIDA.
- *Strategic Program for Climate Resilience (SPCR)*, has been implemented in two phases. Phase I supported the country to assess and develop an SPCR. Phase II (Sep 2013 – Aug 2018) implements SPCR's 7 investment projects focusing on 3 priority areas i.e. agriculture, water resources and infrastructure. The program has been implemented in collaboration with the Ministry of Economy and Finance as well as several line ministries.
- *South East Asia Network on Climate Change (SEAN-CC)* is funded by (UNEP) to increase awareness of the local government officials on CC and develop guidelines to mainstream CC at the sub-national level.

## CAMBODIA: ACADEMICS

A group of 14 representatives of the Academia from the Royal University of Agriculture and 15 from the University of Heng Samrin Thbongkhmum and Svay Rieng University were involved in the investigation. From the interview, it emerged that research on CC and different aspects of its impacts on different sectors have been already widely researched:

- Water and food security
- Building capacity of government institutions to help farmers adapt to CC
- Climate-smart agriculture

- Farm conservation and sustainable use of cereals diversity
- Economics of adaptation in the Agriculture sector
- Historical climate change, climate vulnerability and climate change projection in Cambodia
- Water governance and climate change adaptation
- Rehabilitation of native species in Cambodia
- Climate resilience and disaster risk reduction
- Develop allometric equation to calculate carbon stock in forests
- Identification of natural hazards
- Impact of CC on Agriculture sector
- Impact of drought on rural livelihoods
- Study of CH<sub>4</sub> emission from enteric fermentation using INVITRO SYSTEM
- Producing CH<sub>4</sub> gases using waste from vegetables, fruits and with animal fertilizer
- Module for GHG emission from animal raising
- Improving community livelihood through CC adaptation and mitigation

Currently, the following topics are being researched:

- Scaling-up Sustainable Land Management (SLM) practices
- Climate Change adaptation using direct seeding
- Effects of forest restoration on water availability for smart agriculture
- Strengthening CC research and innovation capacities
- Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia
- Enhancing Climate Change Resilience of Rural Communities Living in Protected Area in Cambodia

The research programme and funding schemes are allocated by national and international donors to higher educational institutions for CC-related research and short training courses, research projects, capacity building, and supporting scholarship for master's



programme. A list of projects and programmes that have been implemented is hereby given:

#### Past

- Short training course supported by APN (Indonesia, the Philippines, and Cambodia)
- Building Capacity of Institutions to Help Farmers Better Adaptation to Climate Change in Cambodia funded by UNDP Cambodia
- Farm Conservation and Sustainable Use of Cereals Diversity Through Participatory Plant Breeding and Securing Local Seed Systems in Climate Vulnerable Provinces of Cambodia funded by NGO Forum Cambodia
- Integrated CC into Curriculum Development for Agriculture Institutions in Cambodia funded by HEQCIP-World Bank
- Supporting National Forest Inventory: “Develop Allometric Equation and Emission factors” funded by FAO
- UNDP Assisting Least Developed Countries (LCDs) with country-driven processes to advance National Adaptation Plans (NAPs) funded by UNDP
- UNDP-USAID Capacity Building Program on the Economics of Adaptation Asian Climate Adaptation Study on the Economics of Adaptation in the Agriculture Sector funded by UNDP
- Historical Climate Change, Climate Vulnerability and Climate Change Projection for Cambodia funded by Indian Green Fund
- Water Governance and Climate Change Adaptation in Cambodia funded by CDRI
- Supporting Scholarship Master’s program in the field of Natural Resources Management funded by USAID-Post Harvest/MoE/Winrock International
- Regional Climate Change curriculum Development funded by USAID Leaf Program

- Rehabilitation of native species in Cambodia: participation of Participatory research of forest ecosystem with community forestry funded by IGES Japan
- Updating tertiary educational curriculum on climate resilience and DRR funded by ADB
- Support to develop emission and removal factors for REDD+ related activities and test monitoring of demonstration activities” funded by FAO
- Building Capacity of Government Institutions on Climate Change for Training of Trainers funded by MRC

#### Current

- Scaling-up Sustainable Land Management (SLM) practices by smallholder farmers: Working with agricultural extension services to identify, assess and disseminate SLM practices funded by IFAD
- Effects of forest restoration on water availability for smart agriculture: a case study of Cambodia (FRAWSA) funded by Swedish Government
- Strengthening Climate Change Research And innovation Capacities in Cambodia, Laos and Vietnam (REACT) funded by Erasmus+ Program
- Building Adaptive Capacity through the Scaling-up of Renewable Energy Technologies in Rural Cambodia (S-RET) funded by IFAD
- Enhancing Climate Change Resilience of Rural Communities Living in Protected Area in Cambodia funded by MoE/UNEP

From the interviews, it emerged that the main drivers for the research topics and agenda are the implementation of national dedicated policy and the fulfilment of their objectives. For instance the Royal University of Agriculture (RUA) provided data and insights for policymaking at all levels. In addition, RUA's objective is to transfer

the knowledge and technologies to students, academic staff, young researchers, and at community levels, having an important role in dissemination. Through building R&D in the field of CC, HEIs become more competent and able to get funding support from international and national donors. So far there is not a central body that coordinates the network of research institutions. HEIs and even single departments of same universities still work individually without having a complete picture of the status of research and resources available in the country. Hence communications still rely on personal relationships between researchers, coordinators, administrative personnel and higher officers of the faculty. There are no standards for the composition of research groups that are built according to the expertise needed and the topics. For shared projects between institutions a multilateral agreement between the parties (Memorandum of Understanding) needs to be notified and a letter of agreement with terms and condition of the contract need to be signed by the responsible of the project. When the parts are internal to the institution, there are no official agreements and the staff is involved in the activities under the conditions of their regular contracts. Nevertheless, these mechanisms are well established, the role of the university in R&D for national capacity building is still limited, however joint projects with different faculties and grants for young promising researchers and lectures are planned to be allocated specifically for research in CC-related topics. A national platform for sharing information among HEIs is present, however, according to the participants, the information is not standardized and not all of them are accessible open source.

R&D on CC is negatively affected by a lack of specific knowledge and experience, limited dedicated budget, the absence of local reliable data and aged or insufficient equipment for experimental laboratories and measuring tools for field monitoring. All these obstacles,

leads also to common feelings of frustration and demotivation for researchers, undermining the creative and observatory potential of local analyst and slowing down the discovery of most suitable solutions for local interventions.

In the perception of lecturers, students are generally involved in projects in terms of data collection, field work, research funding and thesis writing, however they do not play a central role in the research itself given their lack of specific skills necessary for scientific research on CC, as for example methods and modelling for extreme climatic phenomena or impact analysis and monitoring, vulnerability assessment, remote sensing and knowledge of useful software such as GIS.

Ultimately the suggestions for training topics range from CC basic knowledge to more specific research skills in relation to different sectors:

- Basics of Climate Change
- CC adaptation and mitigation
- Climate Change Strategies
- Waste management and air pollution
- Climate Change modelling
- Climate Change research methodology
- Climate Change and food safety
- Biodiversity conservation
- Pest control and management
- Proposal writing for fundraising
- Scientific writing

## **CAMBODIA: STUDENTS**

Three groups of students from three different national universities took part in the interviews, specifically 14 students from Royal

University of Agriculture (RUA), 7 from University of Heng Samrin Thbongkhmum (UHST) and 14 from Svay Rieng University (SRU) for a total of 35 participants.

From the interviews, it emerged that courses on CC in the MSc programmes like Sustainable Agriculture, Natural Resource Management, are provided by the universities. However, programmes completely dedicated to CC are absent. Seminars dedicated to CC topics are also available from time to time in RUA, UHST and SRU. Lack of learning materials and related articles in the local language are mentioned as barriers to the learning process and increasing awareness.

In the students' perception, the interest in CC-related topics is limited considering the low demand from the Cambodian labour market, however an increasing demand has been noticed. Another obstacle that was mentioned and could be considered as applicable also for other disciplines is the high tuition fee and the fact that all the universities are located in big cities, hence youth living in rural areas do not have the same opportunities as students living in the cities given the lack of scholarships and facilities that would enable access to HEIs for lower-income population.

Regarding the effectiveness of the program in preparing the student for a successful future career in the field of CC, the perception is that the topics are still too general and theoretical. More specific skills and tools are demanded by the young academics in order to successfully prepare them for the labour market. REDD+, CDM, EIA, Environmental Service, Policy analysis, climate modelling to analyse CC and carbon stock, models for the evaluation of payment for environmental services, land use and land management planning, wetland conservation were the subjects mentioned by the participants.

A revision of teaching methods and translations of teaching material in the local language is also highly demanded. Lack of equipment and laboratories impedes a hands-on approach to the acquisition of technical skills, which are rather thought in theoretical lectures with the supports of power-points presentations and books.

The number of research institutions and dedicated local and international NGOs is slightly growing in the nation, creating more job opportunities for young graduates, also the international attention and mainstream CC are having an impact in raising awareness about the problems connected with CC and the need of immediate solutions. Therefore, the students do see promising opportunities coming for potential careers in this sector. The network between universities and private sector is enabled by internships programmes which are still seen as insufficient to create a solid basis entering the labour market. Again when the programs have a positive impact in opening successful collaboration with external companies and organizations, students find themselves incompetent in the working place.

Even though scholarship programs and grants are still considered insufficient to cover the demand, a list of scholarship opportunities are offered by the public bodies as well as by international organizations:

#### Public Sector

- Ministry of Environment (MoE)
- Ministry of Education, Youth and Sport (MoEYS)
- Royal University of Agriculture (RUA)
- Ministry of Agriculture, Forestry and Fisheries (MAFF)

#### Private Sector

- PhD: Nagoya University (Japan), Jonh Alwrigh (Australia)
- Winrock International

- USAID
- WCS
- CSEAS
- World fish
- ACIAR
- Kyoto University (Japan)
- WCS
- ITTO

## **LAOS: AUTHORITIES AND PRIVATE SECTOR**

A group of 12 representatives from authorities and private sector, specifically international donors, took part in the study. Since it was not possible to gather the participants for group interviews, the researchers of the National Institute for Economic Research (NIER) conducted single in-depth interviews or in small groups whenever possible.

### **Perception and Awareness**

The majority of Laos population (70%) is employed in the agricultural sector (rice production) or practice subsistence agriculture. This sector is highly impacted and vulnerable to CC with severe consequences on the national socio-economic stability and development. Several extreme weather conditions and disasters have already been registered in the past years which damaged the national agricultural production and livelihood of rural communities.

- Floods caused damage to yet to be harvested crops, livestock, rice stock, irrigation systems, and contribute to an increase in pests, plant and animal diseases.
- Droughts devastated crops, caused delays in crop planting because of lack of water, and contributed to an increase in insect pests (e.g., locusts), plant and animal diseases. In the

driest regions and periods the grass for breeding animals happened to be insufficient, resulting in farmers and breeders having to give additional fodder, adding costs on the yearly expenses that were not needed in the past.

- Storms' heavy rains and violent winds caused serious floods and landslides which destroyed farmland and livestock.

The main touristic attractions in the country are temples and historical sites, tropical landscape, waterfalls and caves. From the interviews it emerges that the consequences of CC have not affected the local and international tourism sector severely yet. However, floods, landslides and droughts do have adverse effects on tourism activities by damaging road networks which could impede the visit to sites of cultural interest. On the other hand, droughts resulted in low water levels in some waterfalls which constitute a major attraction for the tourists visiting Laos. Moreover, the combination of long dry periods and slash-and-burn agriculture is contributing to an increase in forest fires with consequent damages to the natural attractions and to the forestry sector. Waterborne diseases and pests spread when there is the alternation of drought and floods having a negative impact on forest growth and productivity. Moreover, the loss of biodiversity has consequences on the local ecosystem's delicate balance.

The extreme weather conditions and natural disasters induced by CC have impacted public infrastructures such as damages to roads and communication networks, power transmission lines, households' assets such as domestic irrigation systems and private buildings as well as public education and health services, water supply and sanitation plans. Furthermore, considering the high dependency for national power supply on hydropower, the variations of the hydrological cycle caused by the occurrence of extreme weather conditions is a great challenge for the energy sector as well.



As a direct consequence of the mentioned damages, a big share of the state budget goes into reparations and rebuilding which limit the amount of financing available for other primary goals of the nation such as poverty reduction. Farmers are, in fact, the most impacted category and constitute 70% of the population, and the agricultural sector constitutes the major share of the national production. Economic activities and goods transportation within the country have been affected by the interruption of roads and the destruction of power lines. Epidemics after disasters such as floods and droughts increase national expenditure on health and in some cases, lead to the loss of lives.

Based on the present investigation, it can be seen that among Authorities and Private sector awareness on CC is widespread and the understanding of its consequences is precise and deep. However, degrees of severity, exact time and location of extreme weather conditions are still difficult to predict, hence prevent.

Although Lao farmers do not have scientific knowledge about CC, they have been well aware that climate is changing unfavourably and that it is negatively affecting their livelihoods. Temperature is rising; rainfall patterns have changed; floods, droughts, storms and landslides, epidemic outbreaks are occurring more often than before. They recognize that they need to adapt to such changes, however so far their responses have not been effective given their limited knowledge of adaptation strategies.

The government of Laos has been increasingly aware that the country is very vulnerable to CC. In 2008, the National Steering Committee on Climate Change Strategy chaired by the Deputy Prime Minister was established to formulate CC strategies, programs and projects for the Lao People's Democratic Republic. Under the National Steering Committee, eight technical working groups staffed with

representatives of the concerned line ministries and stakeholders were created. In 2009, CC was included as a duty and responsibility of the National Environment Committee which is chaired by the Deputy Prime Minister. In the same year, the first National Adaption Programme of Action to CC (NAPA) was formulated. In this NAPA document, four sectors (agriculture, forest, water resources and public health) were identified as the areas that need urgent adaptation. Specifically for the forestry sector, the government introduced policies to limit deforestation and regulate slash and burn farming practices. In addition, the importance of addressing challenges created by CC has been included and discussed in Laos' 7th Five-Year National Socio-Economic Development Plans since 2011.

Regarding the R&D National priorities, it emerged that all ministries have their own research institutes which are specialized in the field of interest related to the ministerial duties. Therefore, it is difficult to decide which areas are the main focus of R&D national policies. Nonetheless, broadly speaking the government of Laos' actions are mainly focused on graduation from the least developed country status by addressing poverty reduction, human resource development and economic vulnerability. Regarding CC, most of the efforts are focused on monitoring and prevent risks for local ecosystems and regulating the building of big new infrastructures when not necessary in order to preserve the environment in its variety and lushness.

### **R&D National Capacity and Role of Private Sector**

As CC affects many sectors of the local economy, assessing its impact requires the involvement of many government agencies and relevant stakeholders. Each Ministry evaluates the CC impact for its own area of responsibility and then submits its assessment report to the Ministry of Natural Resources and Environment (MoNRE hosts

the Climate Change Office that acts as the Designated National Authority or national point of reference for the UNFCCC), which is responsible for compiling and producing the national communications on CC. The list of ministries involved in the CC impact assessment is as follows:

- Ministry of Agriculture and Forestry
- Ministry of Energy and Mines
- Ministry of Public Works
- Ministry of Industry and Commerce
- Ministry of Public Health
- Ministry of Education and Sports
- Ministry of Science and Technology
- Ministry of Social welfare and Labour (the National Disaster Management Office)

Regarding the sharing and availability of data collected, to date there are no digital public platforms that facilitate consultations and exchange of information. To a large extent, each of the relevant ministries collects, processes, stores and maintains CC-related information in the area of its own responsibility. Nonetheless, the Department of Disaster Management and Climate Change (DDMC) in the Ministry of Natural Resources and Environment, receives regularly updated information on CC from the different ministries. Therefore, most information available on CC can be obtained from DDMC. Other sources that are commonly used are dedicated websites from international organizations and environmental and research institutions.

The involvement of the private sector in national R&D activities in the field of CC (adaptation and mitigation) is still limited. Activities of private local and international firms have been mostly concentrated on the energy sector through building partnerships to develop hydro-

power projects, a climate-friendly and renewable energy source. Hydropower developers are often keen to contribute to protecting watershed because of the need of water to feed their hydropower plants. Another type of renewable energy that a Lao firm called Sun-labob is harnessing is solar energy (solar PV, solar heating systems).

In the tourism sector, an adventure and eco-tourism company called Green Discover Laos has adopted a participatory approach for its business. It employs local people in the areas where tours are offered. These new income sources have incentivized the local people to participate in forest protection and reforestation and to reduce their hunting activities for wild animals.

The main constraints that still limit the participation of the private sector in the R&D for CC are financial, followed by human resource capacity and limited available technologies to cope with the impact of CC in the agriculture and forestry sector. The lack of professional experts in CC assessment also affects the public sector where most staff have acquired knowledge of CC only through working on projects and in short-term training programs (seminars and workshops) which are mostly offered by international donors or partners that manage the projects. Additionally, the preparation of local officers is mainly theoretical rather than practical, leading to the need of an external consultant to manage research projects related to CC. Training local experts with practical research and writing skills emerged to be a priority according to the participants of the interviews in order to create a solid ground to boost R&D on CC in the nation.

### **Financing and Resources**

Since the year 2000, a number of policies, action plans and programmes have been issued by the government and dedicated agencies:

- The First National Communication on Climate Change to the UNFCCC- Lao PDR (2000);
- The Second National Communication on Climate Change to the UNFCCC-Lao PDR (2013);
- The National Adaptation Programme of Action to Climate Change (2009);
- The National Strategy on Climate Change of Lao PDR (2010);
- Climate Change Action Plan of Lao PDR 2013-2020 (2013);
- 8th Five-Year Socio-Economic Development Plan 2016-2020 (2016).

To a large extent, the national strategy on CC has been integrated into the 8th Five-Year National Socio-Economic Development Plan (NSED) 2016-2020, which cover all sectors of the economy. Based upon NSED, the different Ministries formulate their annual implementation and work plan and they are required to submit their executive report at the end of the implementation period. The effectiveness of implementation of NSED is largely influenced by the availability of funds. As the Lao government's main goal is to graduate from the least developed country status by 2025, its current priorities are to grow the economy, develop human resources and improve public health in order to meet the graduation criteria. This results in few public funds being available for addressing CC issues. Consequently, Laos has to continue depending on international donors and development partners for funding CC adaptation and mitigation research and activities. The financial support is given in form of funds, capacity building and concession loans for climate-resilient infrastructure development.

Financial assistance has been distributed among the key sectors, particularly: agriculture, forestry and land use, water resource management, energy, and transport and urban development.

Major international donors and development partners who have funded climate-related activities in Laos are as follows:

- World Bank
- Nordic Development Fund
- European Union
- ADB
- UNDP
- JICA
- The German Federal Ministry for Economic Cooperation and Development through GIZ/KfW

Since 2013, the government of Laos has allocated 1% of its total public investment for general research and development. However, this amount is insufficient to meet the demand. Therefore, external finance assistance remains the main source of funding for R&D in Laos. A few private companies do offer some funds for research in their field of interest, their activities normally include: logging, export of agricultural products, preservation of indigenous flora and fauna. In these case the government acts as a mediator for the allocation of the funding through the responsible Ministry.

## **LAOS: ACADEMICS**

A Group of 24 academics from different faculties of the National University of Laos (NUOL) and Souphanouvong University (SU) took part in the study. The spectrum of the participants ranges from the faculty of environmental science to the faculty of politics and law.

The research related to CC and its impact on local environment has been focused on:

- Biodiversity
- Agricultural production and related irrigation problems

- Forest management and protection
- Willingness to pay for environmental services

The research is mainly financed by international donors and state budgets, specifically among the international organizations, World Bank Organization, The Toyota Foundation, Agency Intergovernmental de la Francophonie (AIF), IDRC, REDD+ were named. At State-level a share of the Government Budget is dedicated to research and it is distributed between the Ministry of Science and Technology, Ministry of Education and Ministry of Natural Resources and Environment. The funds are usually assigned after a formal application of a research proposal from an individual or a group of researchers. The research at university level is in most cases developed in the framework of one specific discipline, while at international level a multidisciplinary approach is more common. There is still unbalance between the number of female and male researchers, given by social structures for which, women are still encouraged to have children rather than continue their academic studies. In general, the head of the research group is a titled or an associated professor who also designs the overall study. Post graduates and graduates normally have assisting roles for data collection. The groups and roles are usually defined on personal relationship basis or on the genuine interest of researchers to take part in the study, there are no formal introductions to the group or official procedures that legitimize and bond the group, therefore it is likely that the group working on one project could change during the course of the study, and the participants work mostly for tasks assigned by the manager of the research, rather than autonomously and independently. When a component of the group wants to implement some further steps, he or she always has to receive the approval of the head of the group. This applies to any research group. From the study it emerged that research groups focused on CC related issues are not created yet. In fact, to

date professors are more involved in giving lectures on these topics rather than doing research. Regarding the data, they are available on the dedicated ministries webpages, however, they are difficult to access since the platforms are not user-friendly and the amount of information is still insufficient to support research works.

A list of potential topics that still need to be investigated was given by the participants of the interviews:

- The impact of dams' creation.
- The impact of banana plantations in Laos funded by Chinese investors.
- The impact of rubber tree plantations in Laos.
- The impact of mining activity in Laos.
- The cost and benefit of forest plantation in Laos.
- The impact of floods
- CC impact on local micro and macro ecosystems.

The factors that mainly limit the R&D sector on CC are financial, there is a limited state budget which is normally used for national projects in the interests of the line ministries in charge of it and it is more difficult to obtain financial support for research at the university level. The academic dimension still suffers from insufficient capacity in terms of superficial knowledge of the topics and language skills, necessary for the scientific investigations, potential publications and exchange of data. The sharing of data itself appears to be difficult since no strong networking has been built between different HEIs and exchanging of information mostly relies on personal contacts and previous collaboration in other projects. Scarcity of official reliable data also afflicts the development of studies, since the gathering of primary data is usually an expensive process that in general requires the participants to work unpaid because the available budget is limited. What emerged to be new in



the investigation was the fact that multi-intra and transdisciplinary approaches are mostly not in use and rather subject-specific methods are normally used with minor considerations about the links to other disciplines.

The role of students in research is still limited to data gathering, they do not contribute actively to the research design because of their superficial knowledge of the topics investigated and methods that could be used. Young academics need to improve their language skills and scientific writing and exposition as well as practice and study research method which are most suitable for CC-related issues. These actions could be enabled by increasing their networking and collaboration with international research institutions and projects.

Ultimately the participants in the focus-group interviews suggested the following topics for training:

- Fundraising and proposal writing for research grant applications.
- Research methods applicable to CC impact assessment
- Statistical software training e.g. R programme.

## **LAOS: STUDENTS**

5 participants for the National University of Laos (NUOL) and 16 from Souphanouvong University (SU) took part in the study, to contribute to the assessment of the status of R&D national sector dedicate to CC in Laos.

From the interview it emerged that there are some youth programs like the “SEED project” which promote the preservation of the environment as a main factor for a good society with teachings on environment, cleaning of public areas. Some courses are offered in

the faculty of Environmental Science such as land use planning, environment and development, and environmental policy in NUOL. In SU the faculty of Economy and Tourism offers managerial courses that take in consideration the protection of environment in the planning of touristic activities and in the faculty of Architecture, the impact of buildings on the pre-existent habitat is part of the curricula. However, the offer is still limited and the focus is towards the environment and not specific to CC. When there are seminars or special courses on the topic of CC students get information through the Universities' websites which are not always updated.

There are no collaborations between faculties and the private sector in the field of CC so far, and most of the postgraduate students find occupations in governmental agencies or ministry offices that are in charge of CC impact assessment and formulation of mitigation and adaptation strategies. In the perception of the students, there is no demand for professionals specialized in CC from private companies.

Programs and educational training are seen as still superficial and fragmented, with inadequate teaching methods and learning material. The overall university infrastructure offers limited services to the students in terms of available spaces and equipment, as an example, it is not possible for the students to use the university Wi-Fi network.

To the knowledge of the participants in the interview, there are no scholarships available dedicated to CC related programs.

## **VIETNAM: AUTHORITIES AND PRIVATE SECTOR**

A total of 15 representatives of the Department of Agriculture, Natural resources and Environment, Hydrology, Meteorology and Climate Change, district committees and international donors took part in the interviews. The interview guidelines were divided into three main

sections, therefore also the presentation of the data will follow this order and structure.

### **Perception and awareness**

Several impacts of CC have been observed and already studied in the Socialist Republic of Vietnam. The main impacted sectors are water resources and agriculture. Specifically:

- Saltwater intrusion has affected the agricultural production of plant and available water resources for breeding.
- Landslides have damaged the drainage systems in Mekong Delta.
- Extreme weather conditions: unexpected long-term rain, drought and irregular typhoons have destroyed crops especially in the Sunken Area near the sea. More serious consequences have been observed since 2014.
- Due to droughts, there have been phenomena of salinization of the field's soil which reduced the production land area for agriculture and forestry plantation
- Increasing temperature as well as longer cold season has changed crop calendar and crop structure, decreasing crops yields. Hence it is more difficult to predict and plan the appropriate planting period during the year without having damages for the final harvest.
- The alteration of the regular hydrological cycle has made certain areas become dry, stopping the local production
- The salty water intrusion threatens the normal operations of industrial activities located coastal areas and hospitals since it corrodes pipes and cooling systems

Besides the agricultural and water sector, CC has had a severe impact on other sectors that are vital for the economy of the country. For example, in the tourism sector, a decrease in yearly visits

has been observed in certain regions because of saltwater intrusion, storms and biodiversity losses. The damages are not limited to the attractions, roads and main conjunction arteries are also affected by irregular major storms and landslides. The fear of extreme weather conditions also affects international tourism, reducing the visitors to the local ones. All of these elements create conspicuous economic losses and higher investment in the reparation and strengthening of the tourism infrastructure.

Forests constitute a natural patrimony for the country in terms of touristic attraction, biodiversity conservation and materials. Extreme weather phenomena have destroyed entire plantation forests through intense storms and fires due to hot dry weather. At the same time prolonged drought has affected the afforestation and growth of seedlings after planting.

Water salinization causes big consequences on the local ecosystems and infrastructure. It reduces the diversity of fisheries resources due to the necessary dam system which prevents flows from upstream to the lagoon. Salty water erodes constructions, commodities and geological formations, causing major investments from the national budget, for example 1km of landslides caused damages for 7 billion of Vietnamese Dongs (250 000 € ca) to rebuild gabion boxes and repair a damaged dyke. The health care system is put under pressure after major floods or big storms due to the increase in skin diseases, dengue fever and other waterborne infections. Given the magnitude of extreme weather events, material assets of the local citizens are damaged partly or irreversibly affecting people's livelihood and businesses. All of these socioeconomic consequences require major investments from the national budget that could be, instead, dedicated to the economic development and social welfare.

From the interviews it emerged that all the actors involved in the agriculture, forestry, tourism, and other sectors are aware of the present and potential impact of CC. However, there are uncertainties about effective adaptation and mitigations actions to be taken since it is not clear yet what will be the severity of the issues in the long term.

The Mekong Delta Provinces are directly affected by CC. In the Ben Tre Province, the national government implemented the project named “Northern Ben Tre Irrigation” in order to build dyke systems for its five districts. If that project didn’t exist, agricultural production of Ben Tre would be limited and undeveloped. However, although such projects are implemented to avoid the direct immediate impacts, there is a need to implement comprehensive long-term policies in order to effectively cope with the consequences of CC. Public awareness is still limited to the populations that are directly affected by the changes, while those who are not affected still lack knowledge about the issues connected with CC. Big companies and producers seem to have specific plans and have already designed coping actions to face the issues and limit economic losses.

At policy level, the national government has planned programs and interventions to cope with different CC scenarios for the whole country and more specific interventions for most impacted areas, as in the case of the Delta provinces. The national bodies play a primary role in coordinating the necessary action to deal with CC through monitoring (forecasting systems and identification of vulnerable sectors) and integration of CC issues in the policies interventions in every sector. The main focuses of R&D in CC are therefore:

- Assessing impacts and magnitude of CC
- Strengthening capacity to cope with CC impacts
- Renewable energy technology development and promotion

- Building scenarios on CC and extreme weather conditions
- Weather forecast, warning system
- Develop adaptation models for local agriculture
- Including CC in the curricula of students at all level of education
- Vocational training to improve human resources for dedicated R&D institutions
- Update the training programs to meet the demand of organizations, companies and private and public institutions related to the field

### **R&D National Capacity and Role of Private Sector**

At institutional level, several governmental bodies are involved in the assessment of adaptation and mitigation of the CC impact on the local and global scale. A list of institutions and their role in the field is listed below:

- Ministry of Natural Resources and Environment: Impact assessment and forecasting.
- Ministry of Agriculture and Rural Development: Planning and developing coping strategies in agricultural production.
- Ministry of Planning and Investment: Management and distribution of funding for implementation and support for programs and projects related to CC.
- Ministry of Science and Technology: Building and prioritizing the selection of research related to CC and developing technology programs.
- The National Hydro-Meteorological Forecast Centre takes charge of the impact assessment of environmental monitoring including providing the hydro-meteorological and marine forecasts; monitoring climate variations and climate trend assessment; outlining the development strategy on research and forecasting of meteorology, hydrology, marine, and climate

monitoring and assessment; enhancing the community awareness of weather and climate information.

The Ministry of Natural Resources and Environment and the Hydro-Meteorological Forecast Centre are the main source of data and information for public and private sector. They can provide:

- General information on the weather in the past.
- Climate Change scenarios and forecasts of its effects.
- Meteorological data for specific regions.
- Warnings about extreme weather phenomena.
- Models to respond to CC.

Generally, the private sector doesn't greatly contribute specifically in the field of R&D in CC. However, there are several big private companies working with national organizations, such as Loc Troi, Phuong Hoang companies that dedicate part of their budget to jobs creations and upgrading infrastructure in response to CC. The states and management agencies have built a network with the private sector to coordinate and implement action plans for adaptation to CC. However, profit remains the main drive of private stakeholders' decision-making process, hence a limited share of their budget goes into research and planning to address the long term impact of CC. In this regard, a limited knowledge of the potential economic consequences also plays a fundamental role, therefore it is important to involve and inform more the private companies about the impact that CC will have on their future profits.

On the other hand, when the effects are clear, the lack of trained human resources and applicable alternative technologies impedes the implementation of coping actions. In general, there is a lack of human resources and professionals specialized in CC. This phenomenon can also be observed in the dedicated offices of the Ministry of Natural Resources and Environment.

In the province, training courses on the impact of CC are held every year. The targets are key staff of the municipality, environmental cadastral officers, and citizens, especially in areas already affected by CC. However, these courses usually last one session or a day and therefore the content is basic and theoretical rather than practical. Another factor is that because of a limited budget, especially in local administration, a public representative is often in charge of several departments which makes it difficult to effectively follow the issues and promote adequate solutions. Sometimes these officers are not competent on the subject and their duties consist in implementing actions and mechanisms coming from the central government.

### **Financing and resources for R&D in Climate Change**

Several policies and action plans have been issued by the government in the past years regarding CC adaptation and mitigation strategies and sustainable development. The planned interventions interest different classes of the society and multiple economic sectors. Additionally, a CC scenario has been theorized which foresees the changes until the end of the 21st Century. The list of policies and interventions follows:

- Resolution 24 / NQ / TW (2013) on CC response of the Central Committee of the party.
- National Strategy on Climate Change 2011.
- National Action Plan on Climate Change 2012-2020.
- Green Growth Strategy (2012)
- Green Growth Plan (2014)

There are many laws relating to CC adaptation (Law on Environmental Protection in 2014, Law on the prevention and prevention of natural disasters in 2013, Law on water resources in 2012, Law on biodiversity in 2008, Law on land 2001, Law on minerals 1996), as



well as the National Target Programme to respond to CC (2008), in place.

After signing The Paris Agreement in 2016, regulations and policies to reduce CO<sub>2</sub> emission, and increase the use of renewable energy sources were implemented, also priorities for CC adaptation's solutions have also been set for each province in order to establish a carbon trading market for business activities following the model applied in Europe.

The Government provides resources and mobilizes domestic and international financial support for the implementation of the different strategies. The state budget is distributed following the criteria of severity and urgency for interventions and the priorities set for economic growth. To date the share of budget dedicated to CC research is limited and is mostly directed to the provinces in the form of theoretical training on CC and its impact.

The dedicated budget from the private sector is still limited and the majority of the financial resources come from international donors. On the other hand, if the small business and companies want to have support for CC related research, they can contact the Department of Agriculture and Rural Development, Climate Change Steering Board which is the one which distributes financial resources.

International donors contribute to the R&D in CC in different forms such as sponsoring capitals, holding training, implementing pilot projects, facilitating job creations, constructing infrastructure and improving the living standards of the local community. Capitals and subsidies are directed to the share of populations mostly affected by the consequences of CC.

Two example of funding projects are hereby listed.

- **JICA (The Japan International Cooperation Agency)** supports building irrigation systems in Ben Tre Province to prevent saltwater invading into rivers. The government borrows international capital of JICA with low-interest loans. Then JICA is in charge of planning and constructing the infrastructure in the time period 2018 to 2023.
- **AMD (Adaptation in the Mekong Delta) Project** is funded by the International Fund for Agricultural Development (IFAD). AMD aims to train and consult locals about breeding, cropping and building infrastructure to adapt to CC. AMD Project is being implemented in municipalities in the Ben Tre province since 2014 until 2020, benefitting poor and near-poor households. Its main objective is to develop sustainable livelihoods for the farmers affected by the change in seasons with a consequent decrease in production of crops.

## VIETNAM: ACADEMICS

A group of 18 Academics took part in the focus-group interviews with representatives from Ho Chi Minh, University of Social Science and Humanities (HCM-USSH) and Hue University of Agriculture and Forestry (HUAF) and other national universities and research institutions as listed in the APPENDIX. From the study, it emerged that several topics of research in CC have been already investigated and solutions have been searched.

- Irrigations solutions for CC adaptation of the agricultural production.
- Temperature and rainfall rise and frequency of flooding in urban areas. Impact assessment, prevention and mitigation actions to limit the damages
- Level of livelihood under new climate conditions: what are the costs?

- Assessing livelihood vulnerability to CC impacts and analysis of adaptation capacity, especially in the forestry sector.
- Use of Geographical Information System for CC monitoring and forecasting.
- Social losses under impacts of natural disasters.
- Forest management and protection.
- Research on erosion mechanism, drought, salinization, land-slides and forecasting.
- Study on the selection and hybridization of plants adapted to specific sites and conditions (sand, salinization, drought ...).
- Research on how to integrate CC into curricula at university level
- Research on renewable energy sources and energy efficient technologies implementation.

The main financiers for research in this field are:

- International-level: World Bank Organization, The Sumitomo Foundation, The Toyota Foundation, World Vision, Agence Inter-gouvernementale de la Francophonie (AIF), Nuffic.
- State-level: Government Budget; Ministry of Labour, invalids and social affairs; Ministry of Science and Technology; Ministry of Education; Ministry of Natural Resources and Environment.
- Province-level: Departments of Natural Resources and Environment.
- Internal institutions, for example, Vietnam National University, Ho Chi Minh University of Agriculture and Forestry, Can Tho University, Ho Chi Minh City Institute for Development Studies.
- LUCCI Project: Research on agro-forestry related to CC.
  - ACCCU Project: Supporting the integration in Agricultural Curricula of Climate Change concerns at Universities of Agriculture: Hong Duc University, Hue University of Agriculture & Forestry and Vietnam National University of Agriculture (Hanoi).

- JICA project coordinated between Kyoto University and Hue University of Agriculture and Forestry in capacity building, livelihoods to cope with natural disasters for upland, lowland and lagoon communities in Thua Thien Hue province.

The research groups are normally composed by experts from different fields and have a multidisciplinary approach depending on the topic identified as a research gap in the field.

The main factors that influence the formation of the research group are: available budget, previous experience of the researches and knowledge of appropriate research method as well as good writing skills. HEIs finance their studies from their annual budget, while for example the Department of Science and Technology's research receives funding from the state budget. Alternatively, in order to receive funding, a research tender needs to be implemented and the research topic needs to be selected. Even when certain projects receive state financial support equipment and materials are often limited. The database on CC is seen as inadequate in most cases and information can differ according to different providers, hence their reliability is questionable when the methodology used is not transparent.

Since research related to CC affects several sectors at different level, a multi-disciplinary approach is fundamental. A research group normally includes researchers from different backgrounds, such as agriculture, economic, social studies, geography, biology, chemistry, environmental science.

For example:

- At Ho Chi Minh City Institute for Development Studies, a multi-disciplinary project has academics in financial aspect, urban development, green buildings, and green development.

- Another research project supported by AIF funding, include some researchers with major in infrastructural techniques but also social scientists supporting on data statistics and sociological qualitative investigation.

Within a research group, the first author leads the group and divides it into smaller groups by research areas. Co-authors communicate with each other in person or contact by emails while conducting research. It is usual that the researchers are contacted by the group leader through personal relationships.

Although collaboration among research institutions is not strong, the cooperation between faculties within each institution is quite tight

Furthermore, international organizations and donors have solid cooperation with national institutions; especially in the field of CC.

Regarding data availability, the Ministry of Natural Resources and Environment is the main provider followed by the Department of Science and Technology, and Ho Chi Minh City Institute for Development Studies where more area specific information can be found. However, a platform for data sharing is not established yet, and personal communication between individual research and sometimes between research institutions is the most common way for exchanging data.

Regarding the dissemination of the results, absence of a common platform results in the data collected during the study remaining unavailable if not published in scientific papers or limited to researchers that know about that particular project and personally ask for them. Furthermore, in this case the sharing of data is not always guaranteed.

The topics that need to be investigated for further research are:

- Qualitative investigation on the social issues related to CC with studies on perception and awareness and solutions to cope with this aspect.
- Repetition of studies on broader and less affected areas that haven't been investigated yet especially in the Mekong delta.
- Research on social problems associated with health, food supply and economic development in the most vulnerable communities.

The main constraint of the research is fundraising, especially in the academic contest. The available materials, equipment and human resources are limited due to lack of funding. Research is supported at national level through tenders which however have limited budget and are very time-consuming and bureaucratic. Therefore, HEIs often look for funding from international donors.

A major barrier for the capacity building of human resources is the language barrier and writing skills. In fact, most of the students and some academics themselves do not have a complete understanding of the language and have no experience with scientific writing until the completion of their studies therefore their work suffers from poor exposition and vocabulary.

From the interviews, it emerges that personal relationships and acquaintances are the main driving factors for data sharing and collaboration in research, this testifies that networking is still weak at institutional level and needs to be enhanced.

Students are mostly involved in research groups as assistants and data collectors. Their thesis and internships are the major occasions to practice writing skills and critical analysis and observation. Given the superficial knowledge of the subject, graduates are unable to find research gaps and formulate valid research proposals. The current curricula need to be integrated with:

- Specific material about risk assessment, disaster management, and adaptation of new production chains.
- Scientific research methods and analysis models in different fields.
- Forecasting skills.
- Soft skills: scientific writing, English proficiency, communication, logic thinking.
- Use of software for planning interventions and monitoring variations in the landscape and knowledge of coding languages for statistical analysis such as “R” or “Python”

Therefore, the topics suggested for Trainings are the following:

- Models and methods utilized in the field of impact of CC and forecasting.
- Scientific writing and report drafting (structure, vocabulary and elaboration)
- Fundraising application procedures (what are the requirements to successfully win a tender or financing for a project.
- Formulation of specific modules to be integrated in the curricula of existing courses with specific practical skills mainly required from the private sector and academia.

## **VIETNAM: STUDENTS**

A total of 21 Student from HUAF and HCM-USSH took part in the study.

From the interview, it emerges that there are courses related to CC available in different faculties and programmes:

- Faculty of Geography:  
Subject: Climate change (1 credit), included in Course: Air pollution

- Faculty of Sociology:  
Subjects: Environment and Development, and Environmental Sociology
- Faculty of Urban Studies:  
Subjects: Urban Environment, and Assessment of environmental impacts.
- “Kick-off to future” Program belongs to JCI (Junior Chamber International), which set 17 goals sustainable development. The program concluded 12 soft-skills courses and supported participants in implementing projects. The projects had to be related to one of the 17 goals listed. An example related to environmental issues was: “Say no to dirty tissues”.
- Sustainable Urban Development Program (SUDP) belongs to International Association for Cold Storage Construction (IACSC) network. The program is annually hold by Department of Urban Studies (HCM-USSH), University of Sains Malaysia (USM) and Yokohama City University (YCU). During the program, professors from the different universities present research and studies related to CC topics. Specifically, the impacts of CC and how to develop urban area sustainably as well as adaptation to CC are presented.
- TF SCALE Program, an exchange program about water environment protection between Institute of Republic Polytechnic (Singapore) and our institution.
- There are several community activities for volunteer students. However, CC is a minor topic through those activities. For example, “Green summer”, “Earth Hour”, or “Sea Turtles Conservation”.

Although there are numerous courses available specific to CC related topics, they are limited and theoretical rather than practical. More specific and comprehensive programs like “Kick-off to future” or “Sea Turtles conservation” are very selective since the number of participants is limited. Moreover, they are usually held in Ho Chi



Minh City and Hanoi which makes it difficult for certain candidates to participate. Another factor is that they are usually not announced on a university's official website, as a consequence students tend to get the information from social networks and acquaintances.

Regarding the effectiveness of the courses in meeting the demands of private sector and the labour market in general, the students' opinion is that the curricula lack practical knowledge and problem-solving activities. In order to improve the quality of the program, the students suggest enriching the traditional lesson with interactive and alternative ways of teaching such as playacting, videos or holding competitions related to the lessons. The practice of research and case studies are also seen as stimulant challenges to better understand the topics and the scientific research process. Another suggestion is to establish collaborations with the private sector to make the program contents compatible with current or predictable situations. Moreover, when students are involved in real-life projects, the results can be a contribution to the research development and the economy of the nation. Furthermore, each faculty should build a network of alumni who have worked for companies involved with environmental issues in general or CC in specific. Thanks to the connection between alumni and students, alumni could easily share their working and research experience, enable an effective network between academia and the private sector and provide useful insight to strengthen the curricula.

Most undergraduate students haven't been exposed to CC yet, as a result they are passive in approaching and exploring. Regarding the postgraduates who have been directly involved in research and professional activities, it was observed that they are more aware of the importance of understanding CC for a sustainable development and the future of the country.

Hue University of Agriculture and Forestry has a solid network with businesses in recruiting and introducing job opportunities for students. The collaboration with the association of companies enables students to practice and study abroad (Japan, Israel, Finland ...).

Among the students, the potential of future demand for CC related careers appears to be well understood. On the other hand, students from HCM-HSSU indicate a disadvantage in the selection of CC related positions for which, economic and technical majors are preferred.

Even though scholarship programs and grants are still considered insufficient to cover the demand, financing opportunities are offered by the public universities in collaboration with foreign universities:

- Master of Urban and Regional Planning, University of Amsterdam (Holland) for Department of Urban Studies (HCM-USSH).
- Japanese Government Scholarship Program and Kyoto University (Graduate School of Global Environment Study -GEGES) for short courses, master's and doctoral degrees in the environment and CC.
- Joint training program between Hue University and Okayama University for master's degree and doctorate related to the environment.
- The joint-program of doctoral and research training between Hue University of Agriculture and Forestry and Sweden on livestock and CC.

## CONCLUSION AND RECOMMENDATIONS

The main outcomes of this investigation are hereby summarized:

- From the focus group “Authority” and “Private sector” interrogated in each of the three countries it emerged that, although the effects of CC have been widely observed and studied, the main uncertainties are constituted by the severity and occurrence of extreme weather events and prolonged variation in the typical seasonal cycle. In the case of Vietnam different potential scenarios have been built in order to protect and better plan agricultural plantations. Methods and tools that have been utilized in this process could be shared with the other SEA partners through the REACT Network in order to facilitate the elaboration of future scenarios also in Cambodia and Laos.
- Cambodia, Laos and Vietnam’s economies rely on the agricultural sector, particularly in terms of export. Moreover, subsistence agriculture practices still involve more than 50% of the population. CC has shown to be a main threat for agriculture with severe socio-economic consequences, especially towards small farmers who are also the least informed of available coping strategies. In the perception of the interview participants, a tighter collaboration between HEIs and governmental agencies and ministries would enable the formulation of effective solutions to be transferred to the most affected groups.
- From the results of both the focus-group interviews and the questionnaire it can be observed that research on CC impact assessment, adaptation and mitigation strategies is broad and deep both at HEIs and at ministries level. In terms of data sharing and availability, Vietnam and Laos have a governmental office in charge of collecting and storing information coming from HEIs and different line-ministries’ offices that conduct research such fields. On the other hand, Cambodia appears to

be lacking a central coordinating body. However, when existing, shared platforms and databases lack regulations which guarantee transparency, consistency and accessible sources of the data uploaded. The main channels for data exchange remain personal contacts and acquaintances in all of the 3 focus nations. Since the data sharing network remains weak and difficult to coordinate at national level with a main central agency, the authors would suggest to initiate a process of decentralization. A complete database is recommended to be established in each of the REACT partner institutions following a set of standards that could be provided by the REACT Unit. This practice should also be encouraged in other research institutions in the country in order to build more accessible open source platforms and establish networks and data exchange between institutions.

- According to the information collected through the questionnaires and the focus-group interviews, the main source of financing for research related to CC are international donors, while the private sector tends to be profit driven and less involved in this field. The state budget dedicated to such research is limited and the bureaucratic nature of the application for research funding is considered as a deterrent for potential interested individuals or research groups. HEIs could become the connecting element between research and private sector by working together on case-studies and real life projects in order to share resources for the common scope of finding solutions to cope with impact of CC.
- Despite the presence of dedicated courses and modules at higher educational level, both the representatives of “Students” and the “Academia” point out a superficial knowledge and understanding of issues related to CC. Theoretical materials and lack of practical experiences given by a weak collaboration between the private sector and university are seen as the main causes of the inadequate preparation of students in order to

have an active role in the research. New equipment for laboratories, updated materials and methods and case studies to work on, are the main requests from the student side in order to improve their skills and be more prepared for the labour market.

## APPENDIX

**Table 1: Institutions involved in an interdisciplinary or transdisciplinary research body, project, partners and grants received**

Country	Institution	Project	Partners and number of scholars	Grant
Cambodia	Royal University of Phnom Penh (RUPP)	Climate change impact and transboundary water resource management	<ul style="list-style-type: none"> <li>- UNESCO-IHE Western Washington University</li> <li>- AIT</li> <li>- Asian Disaster Preparedness Center, and</li> <li>- Partner universities under the CIDA funded Urban Climate Resilience in Southeast Asia Partnership (UCRSEA)</li> </ul>	<ul style="list-style-type: none"> <li>- UNESCO-IHE about \$ 25,000 (2014-2016)</li> <li>- Adaptation Fund project of Ministry of Environment, \$ 30,000 (2015-2018), as scholarship support</li> <li>- MacArthur Foundation as part of water bird conservation, about \$ 5,000 (2017-2018)</li> </ul>
		Vulnerability assessment		
		Urban climate resilience		
		Deforestation drivers		
	Meanchey University	Climate change adaptation	University of Battambang	\$ 8,000 funded by Royal University of Agriculture
	Kampong Cham National School of Agriculture	Some varieties of crops adapted to drought, resistance and efficient water use for irrigation	Some organizations and companies about 5 staff involving research program	Less than \$ 10,000 funded by Sapmess company (SKY. life.co, Ltd) and government financial support
	University of Battambang	Maintaining productivity and income in Tonle Sap Fisheries in the face of Climate Change	N/A	€194,000 funded by Agence National de la Recherche (France), BELMONT Forum, National Science Foundation (USA), Natural Sciences and Engineering Research Council of Canada

# R&D IN CLIMATE CHANGE AND RELATED AREAS WITHIN HIGHER EDUCATION IN CAMBODIA, LAOS AND VIETNAM: CURRENT STATUS AND TRENDS

Laos	National University of Laos, Faculty of Economics and Business Administration	The impact of Climate Change on Laos farmers and their adaptation	EPSEA and IDRC	\$ 10,000
	National University of Laos, Faculty of Forestry	Adaption of Asia-Pacific forests to Climate Change	Faculty of Forestry, UBC, Canada	APFNET
		Research project on impacts of REDD+ on resource governances and livelihood	CIFOR, CDE	Unknown
		Carbon Accounting Assessment	IGES	\$ 50,000
		The participant of forest resource management in forest protected area of Laos	Assoc. Prof. Sithong Thomanivong	Unknown
		IREDD Project	Copenhagen, Denmark	Unknown
		Alleviating poverty and enhancing environmental integrity through restoring ecosystem service, REDD, REDD+	ICRAF from Finland	Unknown
		How different biomass in NPA and national protected forest	N/A	\$ 200,000

## R&D IN CLIMATE CHANGE AND RELATED AREAS WITHIN HIGHER EDUCATION IN CAMBODIA, LAOS AND VIETNAM: CURRENT STATUS AND TRENDS

Vietnam	Ho Chi Minh University of Natural Resources and Environment	Application of discriminant analysis method in salinity invasion zone: Case study in Tan Thanh Ward, Ba Ria - Vung Tau Province.	University of Can Tho; HCM Institute for Environment and Resources 3 scientists	Unknown
	Southern Institute of Social Sciences	Media model of Climate Change adaptation for Mekong community (Case study at Tra Vinh and Ca Mau Province)	4 scientists	430 Million VND from Vietnam Academy of Social Sciences
	Ho Chi Minh City Institute for Development Studies	Study on urban management model in HCMC in the context of Climate Change	N/A	Ho Chi Minh City Budget Source
	Ho Chi Minh University of Social Sciences & Humanities	Challenges for sustainable development in Mekong Delta	Center for Sea and Island Research, Faculty of Anthropology, Faculty of Geography, Faculty of History, HCM University of Sciences, HCM University of Technology, An Giang University, More than 60 scientific researchers participated	30 Million VND for conferences
	DRAGON Institute - Mekong - Can Tho University	Climate Change impacts on agricultural production at Mekong Delta.	10 scientists	From different organizations; funding: around \$100,000.
	Research Center for Rural Development - An Giang University	Research on floods, drought and saltwater instruction that affect people's livelihoods and farmers.	Province-level departments, NGOs and scientists from other institutions.	\$10,000 - \$20,000.
	Da Nang University	Community adapts to Climate Change.	Rockefeller Foundation	Unknown



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	Ho Chi Minh University of Agriculture and Forestry	Improving the capacity of forest resource management.	JICA, ICRAF, Faculty of Forestry - HCM University of Forestry	Unknown
		Evaluation of combined Agroforestry systems.		
	Faculty of Geography, HCM USSH	Diseases related to temperature increase and flooding.	Internal and external universities	Unknown
		Raising awareness of Climate Change in the community.		
		Farmers' adaptation to the impacts of Climate Change.		
		Water and climate change research		
	Thai Nguyen University	Adaptation to Climate change of North Mountainous farmers	Care International	Unknown
	Hue University of Agriculture and Forestry	The integration of Climate Change into training program and research related agriculture, forestry and fisheries	Agricultural Universities in Vietnam	€ 2,198,000, Nuffic, Netherlands
		Land use change-Climate Change Adaptation	HUAF, Hue College of Economics, Academic on Water Resources, Da Nang University of Technology, IMHENB in Ha Noi	€ 5 Million, Federal Ministry of Education and Research, Germany

**Table 2: Research field and research topics of researchers who  
conduct Climate Change related research**

Country	Institution	Main field of research	Research topic
Cambodia	DanChurchAid (DCA)	1. Drought Resistant Agricultural Techniques 2. Water Management and Governance 3. Drought Monitoring Information Hub 4. Technical Assessment of Agro-meteorological System 5. Climate Change Adaptation and Disaster Risk Reduction	
	Freelance	Water Governance, Climate Change, DRR, Environmental Impact Assessment, Mekong River, Gender	
	Department of Climate Change, Ministry of Environment	Climate Change Impact, Vulnerability Assessment, GHG Inventory, and Mitigation analysis	
	Ministry of Agriculture, Forestry and Fisheries	Developing Climate adaptation options for farming communities in Svay Rieng Proving, Cambodia.	
	United Nations Development Programme	Climate change and private sector, Solar Business	
	Food and Agriculture Organization of the United Nations	National Forest Inventory (assessment the forest resources through the field mensuration for complement the remote sensing data).	

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Laos	NIER	Environmental and resource economics; public policy	National sustainable development of Lao PDR, funded by the Lao government
	NIER	Social and environmental field	<ul style="list-style-type: none"> <li>- Climate change and water scarcity impact assessment in Lao PDR: case study in Champhone district, Savannakhet Province (draft report), supported by SIDA via SUMERNET;</li> <li>- Climate change impacts on small-scale farmers in Lao PDR: case study in Oudomxay and Vientiane provinces (2014), supported by Mekong River Commission;</li> <li>- Basin-wide Climate Change impact and vulnerability assessment for wetland of lower Mekong basin for adaptation planning: case study in Xe Chanphone and Siphandone wetland (2011), supported by MRC.</li> </ul>
	NIER	Agricultural, natural resources and environmental economics	Improving the Resilience of the Agriculture Section to Climate Change Impacts (IRAS) from 2012 to 2015, funded by UNDP and GIF.
	NIER	Environmental related issues; green growth; green SMEs financing; Climate Change impact	A study on Climate Change impacts to small-scale farmers in Lao PDR (yet to be published; source of funding: Mekong River Commission and Lao National Mekong Secretariat)
	NUOL, Department of Environmental Engineering, Faculty of Engineering	Environmental impact assessment; environmental protection control; Climate Change adaptation and mitigation	<ul style="list-style-type: none"> <li>- Greenhouse gases emissions from the Faculty of Engineering, NUOL (undergraduate student's thesis);</li> <li>- Assessment of water availability and impact on Climate Change on streamflow in Namsane river basin, Lao PDR (International conference proceeding);</li> <li>- Climate Change Vulnerability Study in Xechamphone District, Savannakhet Province (master course student's thesis)</li> </ul>

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	NUOL, Research Division, Faculty of Environmental Sciences	Economic development and environment; environmental impacts of investment; Climate Change	<ul style="list-style-type: none"> <li>- Contents of training courses on Climate Change mitigation and adaptation;</li> <li>- Contents of training courses on Climate Change economics</li> </ul>
	NUOL, Research Division, Faculty of Environmental Sciences	Climate change (modelling, adaptation and mitigation)	<ul style="list-style-type: none"> <li>- Crisis prevention and disaster risk reduction from flood in urban area in Vientiane Capital, Lao PDR, Paper presented at the International Expert Workshop towards Urban Water Security in Southeast Asia: Managing Risk of Extreme Events It was organized by Asian Institute of Technology in 2015;</li> <li>- COP21 actions from Lao PDR published in a Newsletter of the International Research Network for Low Carbon Societies (LCS-RNet)</li> </ul>
	NUOL	Environmental Economics and Economic Development	The impact of Climate Change on Laos farmer
	NUOL, Faculty of Economy and Business Administration, Ass Prof. Thongphet Chanthavong	Environment Tax	The impact of Climate Change on Laos farmer
	NUOL, Faculty of Forest Sciences	Forest cover and land use change	
	NUOL, Faculty of Forest Sciences, Thounthone Vongvisouk, PhD.	Land use, resource governance, Livelihood	The context of REDD+ in Laos, how Laos is moving with the REDD+ schemes and REDD+ on hold
	NUOL, Faculty of Forest Sciences, Doungta Bouaphavong	Appropriate techniques and wood technology for improving teak log plantation in Laos	Community base carbon accounting in Sangthong district, Vientiane capital, Laos

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	NUOL, Faculty of Forest Sciences, Saykham Bouthavong	Forest Environmental Science	Participatory REDD+ Readiness, Community Carbon Accounting, Forest Biomass Monitoring
	NUOL, Faculty of Forest Sciences, Viengsy Paathor	Ecotourism Development	
	NUOL, Faculty of Social Sciences	Assessment of CC impact and adaptation national resource management	Vulnerability and adaptation of rain fed-rice farmer to impact of Climate Change variability in Savannhakheth Province
	NUOL, Faculty of Social Sciences	Social economic	NAFRI, IRAS project
	Lao National Mekong Committee Secretariat	Persistent organic pollutants (PCB, dioxins/furans); Climate Change adaptation policy; water resources management and use.	Policy analysis report of Lao PDR submitted to Mekong River Commission for the project Policy Analysis on Climate Change and Adaptation in the Lower Mekong Basin and Formulation of the Mekong Adaptation Strategy and Action Plan under Climate Change and Adaptation Initiative Programme.
Vietnam	Can Tho University, Faculty of Social Sciences	Gender, Migration, Social Learning	Migration, Climate Change and environment - proofs to make policy
	Can Tho University	Impacts of Climate Change in tourism	Evaluation of Climate Change impacts on tourism of Mekong Delta; PhD Candidate Huynh Van Da, 2018.
	Can Tho University, Faculty of Sociology, Department of Social Sciences & Humanities	Gender, Environment and Family	Assessment of gender vulnerability in Ca Mau Province in context of Climate Change, 2014, GTZ Organization
	Can Tho City, Department of Climate Change	Environment and Climate Change at Mekong Delta	Action plan - Climate Change adaptation at Can Tho in 2016-2030; have been conducted from 2015; Source: Rockefeller Funding - ACCCRN

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	Can Tho City, Department of Climate change	Remote Sensing and GIS in agriculture and forestry management	Impacts of reduction on nutrition and amount of alluvial to agricultural production and livelihoods in An Giang Research group: Pham Van Quang & Faculty of Rural Development and Natural Resources Management
	Thai Nguyen University, College of Economics and Business Administration	Agricultural economics	Green economics development for Northern mountainous regions in Vietnam.
	Center for Water Management and Climate change	Water Source management, Climate Change adaptation	
	An Giang University, Department of Agriculture - Natural Resources	Livelihoods, natural resources management, indigenous knowledge, rural tourism, floods, and Climate Change.	People experience to adapt to Climate Change at Mekong Delta (Case study in An Giang Province)
	An Giang University, Research Center for Rural Development	Water governance, Ecological agriculture, Climate Change	Adapting to Climate Change through the conservation and development of local rice farming systems at Mekong delta; total budget: over \$100,000 USD from SEARCA, Sumernet, Lower Mekong public policy, Mitsui.
	HCM USSH, Faculty of Geography	Environmental Informatics	Research on GIS - Remote sensing and modeling calculations, surface temperature increase forecast at HCMC - Department of Science and Technology of Ho Chi Minh City.

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	HCM USSH, Faculty of Geography	Public health, Environmental education, Demography	<ul style="list-style-type: none"> <li>- Research and recommendations for raising community awareness on Climate Change in Ho Chi Minh City, 2012, Ho Chi Minh Waste Recycling Fund (REFU)</li> <li>- Waterlogging, temperature rise and related diseases in Ho Chi Minh City for 2001-2011, 2014, Ho Chi Minh Waste Fund</li> <li>- Research on adaptability of rice farmers in An Giang under the context of Climate Change and hydropower dams in upper Mekong river, 2016, conducted jointly with Center for Water management and Climate Change Vietnam National University - Ho Chi Minh</li> </ul>
	HCM USSH, Faculty of Science Management,	GIS	GIS application in the establishment of flood risk map due to sea level rise.
	Thu Dau Mot University	Agriculture, Environmental Science	Participation of people in the protection and use of natural resources.
	Hue University of Agriculture and Forestry	Land Policy, Property market	Effects of drought on agricultural land use in context of Climate Change in Quang Nam province
	Hue University of Agriculture and Forestry	Rural development, community development	Mangrove forest plantation in Lap An-Lang Co lagoon, Combination model of mangrove forest and aquaculture adaptive to Climate Change in Lang Co
	Hue University of Agriculture and Forestry	Land and Water governance	Role of gender and benefits of payment for environment service program in Quang Nam province
	Hue University of Agriculture and Forestry	Land Assessment, Land Use Planning	Effects of droughts on rice production in Quang Nam province
	Hue University of Agriculture and Forestry	Plant Protection, Adaptation and mitigation of Climate Change to crop production	LUCCI, MIRSA, IRRI

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	Hue University of Agriculture and Forestry	Climate Change, land management	Application of TRMM-GIS technology into study on effects of droughts to agricultural production in Central Vietnam
	Hue University of Agriculture and Forestry	Variety selection, sivilculture	Study on Mangrove forest, Use of biotechnology in Acacia breeding and selection in sandy soil of Central Vietnam, Study on Huong river watershed protective forest
	Hue University of Agriculture and Forestry	Land management	Effects of salinity on rice cultivation land use in Huong Phong commune, Huong Tra district, TT Hue province
	Hue University of Agriculture and Forestry	soil fertility, environmental and natural resources management	Coping with typhoon and flood in Tam Giang lagoon area and Central Vietnam
	Hue University of Agriculture and Forestry	Aquaculture	Study on aquaculture models adaptation to Climate Change In Tam Giang lagoon, Thua Thien Hue
	Thai Nguyen University	Soil environment	Soil environment change



**Table 3: Private and international institutions collaborating in  
research**

Country	Institution	International Institution	Private Institutions
Cambodia	Freelance	DCA/CA, PIN, Plan international, World Vision, WB, UNDP, HRF, Care international, German Watch, Southern Voice, etc.	
	Ministry of Agriculture, Forestry and Fisheries	This research was funded by the Australia Government through its Australia Centre for International Agricultural Research (ACIAR); (Dr. Christian.Roth CSIRO Australia)	
	United Nations Development Program	Co-financed with EU and SIDA to carry out the study research in the above topics	
	Food and Agriculture Organization of the United Nations	National Forest Inventory (GDANCP-MoE, FA-MAFF, FiA-MAFF, EU, UNREDD, FCPF, and RUA	
	DanChurchAid (DCA)		DCA and ECHO
Laos	National Institute of Economic Research (NIER)	IDEC, Hiroshima University. Impacts of urbanization on energy use and CO2 emissions	
	NIER	MRC and SIDA via SUMERNET	
	NIER	World Bank. (1) green growth strategy formulation; (2) establishment of green growth promotion center of Laos.	
	National University of Laos (NUOL), Department of Environmental Engineering, Faculty of Engineering	Srinakharinwirot University, Thailand, Vietnam Institute of Meteorology, Hydrology and Environment, National University of Laos. Project name: Integrated analysis of climate, land-use and water for resilient urban megacities: A case study of Thailand, Lao PDR and Vietnam.	

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	NUOL, Research Division, Faculty of Environmental Sciences	Climate Change International Technical and Training Center (CITC) [Thailand Green House Gas Management Organization (GTO)]	
	NUOL, Research Division, Faculty of Environmental Sciences	Green House Gas Inventory and Research Center (GIR), Korea; International Environmental Research Center (IERC), Korea; University Technology Malaysia (UTM)	
	Lao National Mekong Committee Secretariat	Mekong River Commission (MRC)	
	NUOL, Environmental Engineering Department, Faculty of Engineering	Finland Future Research Centre, Turku, Finland	
	NUOL	EEPSEA	
	NUOL, Faculty of Economics and Business Administration	ADB, World Bank	
	NUOL, Faculty of Economics and Business Administration	EU, World Bank	
	NUOL, Faculty of Forest Sciences	Faculty of Forest, University of British Columbia, Canada	
	NUOL, Faculty of Forest Sciences	Copenhagen University, I-REDD+ Project	
	NUOL, Faculty of Forest Sciences	IGES	IGES, UNDP
	NUOL, Faculty of Forest Sciences	Climate Change Project that funded by World Bank	JICA and GIZ
	NUOL, Faculty of Forest Sciences	University of British Columbia, Canada	
	NUOL, Faculty of Forest Sciences	IGES, UNDP	

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	NUOL, Social Sciences	Improving the resilience the agriculture sector in Laos to CC impact (IRAS project, NAPA is the follow up project)	
	NUOL, Social Sciences	Partner development of agriculture land management, MAE, EU, AFD project, eco-friendly intensification and climate resilient agriculture system (EFICAS)	
	NUOL, Social Sciences		Environment management project.
Vietnam	Can Tho University, Faculty of Social Sciences,	Wageningen University - Holland; Melbourne Law University	IOM, WWF, GTZ, VRN (Rivers of Vietnam), IUCN, LMPPI (Fulbright)
	Can Tho City, Department of Climate Change	ISET, Pan Nature, Care	
	Can Tho City, Department of Climate Change	IRRI	Oxfam; WWF
	Can Tho University, Faculty of Sociology, Department of Social Sciences & Humanities	MECLEP Organization	MECLEP Organization, GTZ Organization, IUCN Organization.
	Can Tho University	Assessing the Learning Effects of Games on Attitude of Stakeholders towards Sustainable Shrimp Farming (ALEGAMES) worked with WOTRO (The Netherlands) and IUCN (Asia)	
	Center for Water Management and Climate Change	IHE - Delft Institute of Water Education, Wageningen University	International Union for Conservation of Nature (IUCN) - Vietnam
	An Giang University, Department of Agriculture - Natural Resources	A research on the impacts of sediment reduction and nutrient loads on the agricultural production and livelihoods in the Mekong regions of Vietnam (OXFAM).	

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	An Giang University, Research Center for Rural Development	Australian National University, Yangon University (Myanmar), Chulalongkorn University (Thailand), College of Agriculture and Forestry (Laos), Royal University of Agriculture (Cambodia).	Pan ap, Searca, Summernet, LMPPI, Cooking Studio Company
	HCM USSH, Faculty of Geography	Research project «Living with flood in Mekong Delta - Viet Nam» - East Anglia University - Norwich - UK.	
	Hue University of Agriculture and Forestry	Japanese Universities	
	Hue University of Agriculture and Forestry	IUCN, GEF, MFF, FAO	
	Hue University of Agriculture and Forestry	LUCCI , Land use change Climate Change adaptation in Quang Nam province, Cologne University, Germany	
	Hue University of Agriculture and Forestry	NUFFIC, Netherlands, DAAD, Germany, Gottingen University	
	Hue University of Agriculture and Forestry	IRRI, NARD, Cologne University, CIAT	PAPACH company, Lac Hong company
	Hue University of Agriculture and Forestry	Komazawa University, Japan. Effects of Climate Change to coastal lagoon landslide in Central Vietnam	Institute of Meteorology- Hydrology Science and Climate Change
	Hue University of Agriculture and Forestry	LUCCI and Colonge University, Germany	
	Hue University of Agriculture and Forestry	NUFFIC, Netherlands, Gottingen University	
	Hue University of Agriculture and Forestry	JICA	
	Hue University of Agriculture and Forestry	OXFARM	Rural Development Centre

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	Hue University of Agriculture and Forestry	Netherlands, Australia: Tropenpos, IRRI, NUTI SEA	Tropenpos, Climate Change Centre
	Thai Nguyen University	Crop cultivation adaptation to Climate Change in North mountainous area	Care International
	University of Social Sciences and Humanities		An Giang Province
	Centre for Tropical Forestry Study, Vietnam		Vietnam Forestry Science Institute

**Table 4: Areas where more research is needed**

Country	Areas where more research is needed
Cambodia	Land use change and planning in CC context,
	Potential renewable energy and energy efficiency for Cambodia to replace coal and mega hydro dam which negatively affects environment and ecosystem including fish population & livelihood of small farmers.
	Practical drought and flood monitoring and response mechanism at local level.
	Climate financial management/ mechanism in an accountable and transparent manner that includes CSOs.
	Identify climate funds for Cambodia.
	Looking into a practical mechanism for Public and Private Partnership (PPP) in addressing both mitigation and adaptation.
	Forestry, waste, agriculture, construction, transportation, biodiversity, Green Technologies and Capacity Building by sectors
	Resilient infrastructure in urban and rural area
	Irrigation and water resource availability in Cambodia to support agricultural sector
	Land use change and deforestation
	Clean water for livelihood supply
	Vulnerability assessment
	GHG mitigation analysis
	Socio-economic research to understand the livelihood strategies of farming households and to assess their capacity to adapt to a changing climate.
	Effective early warning system and decision making to adapt to CC risks
	Forest rehabilitation (included: restoration, rehabilitation, reclamation) in different forest types
	Incentive mechanism for CC adaptation financing at local development
	Emphasised link between CC and socio-economic development
	Economics of CC– cost benefit analysis
	Linkages between ecosystem and CC
	Forest monitoring system
	Allometric equations
	Agriculture practices (management) in sloping areas
	Land use planning (landscape level as well as village level)

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Laos	Improving GHGs inventory at aggregated and disaggregated levels; collecting and assessing information about disasters and impacts related to CC; assessing public perception, awareness, attitude and action towards CC; formulating policies, strategies and measures for adaptation and mitigation.
	Climate Change, but looking more specific at impacts on specific sectors, resources, physical and social infrastructure, etc.
	Assessment of impacts of CC initiatives on macro-economic indicators and the private sector; if CC commitment is seriously integrated into Lao's socio-economic development plan, what kind of adaptation policies are required to keep a balance among economic, social and environmental aspects?
	Climate Change adaptation in local community, Climate Change risk management, CC impacts on food security, water resources and others.
	Impacts of CC on agricultural production; CC and urbanization
	Climate modelling to project future scenarios; CC vulnerable assessment and adaptation based on issues (agriculture, social and livelihood, gender, migration, health); promote renewable energy; develop CC curriculum and short course training (including disaster response, risk assessment, adaptation, SDGs,... etc)
	Adaptation policy within CC vulnerable sectors (agriculture, urban environment, transportation, health and hydro sector); impact of CC on future urban planning and urban environment protection measures
	Develop comprehensive adaptation measures in both urban and rural areas; build adaptive capacity for the public sectors in key agencies of central and local governments and local community; disseminate and update the society on CC impacts, financial and technical support.
	As there are many mining activities in Laos and those activities can have negative impacts on underground environment. Therefore, more research is needed for environmental geology and groundwater contaminant problems.
	Adaptation to CC for rice farmers, Flood and enough mitigation, Economic of water and forest
	Climate Change on international trade
	Environment Tax
	How to mitigate GHGs emission from forestry and agriculture sectors
	How much benefit sharing from REDD+ will be reached local community. Is capacity of public organisations in Laos adequate for REDD+ implementation? 4. what are key lessons learnt that Laos has from readiness phase of REDD+?
	How Laos emission reduction program (ER-PD) aligns with national social economic development plans (NEDP) and other sectoral strategies?
	Flooding in southern part of Laos

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	How to develop HINNAMNOR national protected area in Laos
	Forest protected area at Sangthong district, Vientiane capital, Laos
	Modelling Forest in Sangthong protected area
	The Impact of CC on Biodiversity Vegetation and Wildlife
	Climate Change and Land use system, Climate change and forest restoration, Natural Resource Governances
	Ecotourism in the protected area
	Gender and CC
	Social development, CC and sustainable development
	Sustainable livelihood, ecosystem service, geospatial science and modelling population and community ecology
	Long term climate vulnerability (trend or scenarios) and adaptation measures/ strategies by province/ district (the question is, what do we want to change farmer practices that are resilient to CC impact for better income?)
Vietnam	Environmental Pollution
	Assessment of vulnerability of CC and adaptation solutions
	Landslide and sea level rise in Mekong Delta
	Climate change impacts on agricultural productions and community livelihoods
	Water pollution, water waste treatment and rubbish processing
	Resilience of environment and Socio-ecology
	Green Idea and VRN ( Vietnam River Network)
	Water and air pollution, and floods.
	Environment, and science technology.
	Social impacts of CC.
	Economic development accompanied by environment protection.
	Effect of CC on public health
	Adaptation to CC , food security and water source security.
	How do people (farmers) improve their capacity to adapt to CC in daily life and production?
	People's livelihoods
	Effects of CC on Farming, Fisheries, livelihoods in some places stricken by CC and global warming
	International studies, CC , International Development Studies
	Effects of CC on agricultural production, on land use, effects of natural disasters (drought, flood) on food security in context of CC
	Variety selection and breeding adaptive to CC , farming system adaptive to CC, crop season change adaptive to CC.



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	Salinity, Tourism, Droughts, Flood, Sea level rise, livelihood adaptive to CC
	Urbanization, role of forest cover and CC
	Water and fertilizer management; crop structure
	Water resources governance, green energy use
	Impact of CC to Central Vietnam, Social solutions, technique solution, warming system
	Study on land use planning with the integration of CC
	Sustainable land resources use under the impacts of CC
	Study on grass varieties in drought and waterlogged tolerance to meet the demands of green rough feed for ruminant
	Solutions of CC adaptation and mitigation on aquaculture to improve local people's livelihoods living in coastal lagoon

**Table 5: Institutions participating in the Focus Groups “Authorities”  
& “Private Sector”**

Country	Name of Institution	Number of Participants
Cambodia	Department of Climate Change (DCC)	4
	Cambodia Climate Change Alliance (CCCCA)	2
	NGO Forum (NGOF)	5
	Youth Resource Development Program (YRDP)	1
	PLAN (International NGO)	1
Laos	Department of Climate Change	1
	REDD+ Office	1
	DEQP, Ministry of Natural Resources and Environment	1
	IREP, Ministry of Energy and Mines	1
	Climate Change Centre, NAFRI	1
	UNDP	1
	EU attaché	1
	Asia Development Bank	1
	GIZ	1
	Green Discovery Laos	1
	Lao Agro Processing Association	1
	Dao-Heuang Group	1
	Luang Prabang Legend Hotel	1
	Tiger Trail Travel	2
	Green Adventure	2
	Pakhouaymixay Restaraunt	1
	Department of Science and Technology	2
	Department of Natural Resources and Environment	1
	Department of Energy and mining	1
	Department of Agriculture and Forestry	3

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Vietnam	AMD Project at Chau Thanh District, Ben Tre Province	1
	Department of Agriculture and Rural Development, Chau Thanh District, Ben Tre Province	1
	District People's Committee, District 8, HCMC	1
	People's Council of Ward 15, District 8, HCMC	1
	Department of Natural Resources and Environment, Ben Tre Province	2
	Division of Water Resources, Department of Natural Resources and Environment, Chau Thanh District, Ben Tre Province	1
	Department of Meteorology, Hydrology and Climate Change, Ca Mau Province	1
	Quang Binh Province Department of Agriculture and Rural Development	2
	Quang Binh Province Branch of Fisheries	2
	Quang Binh Province Branch of Veterinary	1
	Quang Binh Province Branch of Rural Development	1
	Quang Binh Province Branch of Crop and Plant Protection	1

**Table 6: Participants in the Focus Groups “Academics”**

Country	Name of Institution	Faculty/Institute	Number of Participants
Cambodia	Royal University of Agriculture	Faculty of Fisheries	1
		Faculty of Agricultural Engineering	1
		Centre for Agricultural and Environmental Studies	6
		Faculty of Agro-Industry	1
		Graduate School	2
		Faculty of Forestry	1
		Division of Research and Extension	1
	University Heng Samrin Thbongkhmum	Technical Education Institute	1
		Faculty of Agriculture	5
		Research and Community Development Office	1
		Faculty of Literature and Humanities	2
		Planning and Finance Office	3
		Foreign Language Institute	1
		Foundation Office	1
		Quality Assurance Office	1
	Svay Rieng University	Academics from unspecified faculties	7
Laos	National University of Laos	Faculty of Education	1
		Faculty of Law and Political Science	1
		Faculty of Environmental Science	1
		Faculty of Economics and Business Administration	1
		Not specified	2
	Souphanouvong University	Faculty of Engineering	4
		Faculty of Economics and Tourism	4

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		Faculty of Architecture	4
		Faculty of Agriculture and Forest Resource	4
Vietnam	Ho Chi Minh University of Social Sciences and Humanities / National University of Vietnam	Researcher (area not specified)	2
		Urban Studies	1
		Urban Research & Management	1
	Viet Duc University	Researcher (area not specified)	1
	University of Economics: Binh Duong University	Lecturer (area not specified)	1
	Northeast Asia Research Institute	Researcher (area not specified)	1
	Nong Lam University, HCMC	Researcher (area not specified)	1
	Hue University of Agriculture and Forestry	Faculty of Land Resources and Environment	4
		Faculty of Extension and Rural Development	1
		Faculty of Animal Sciences and Veterinary	1
		Faculty of Agronomy	1
		Faculty of Forestry	1

**Table 7: Participants in the Focus Groups “Students”**

Country	Name of Institution	Programme	Number of Participants
Cambodia	Royal University of Agriculture	Master in Natural Resource Management	12
	Svay Rieng University	Master of Sustainable Agriculture	7
	University of Heng Samrin Thbongkhmum	Bachelors in Agronomy	6
Laos	National University of Laos	Bachelors in Planning and Development	5
	Souphanouvong University	Faculty of Engineering	4
		Faculty of Economics and Tourism	4
		Faculty of Architecture	4
		Faculty of Agriculture and Forest Resource	4
Vietnam	Ho Chi Minh University of Social Sciences and Humanities / National University of Vietnam	Bachelors in Geography	2
		Bachelors in Sociology	3
		Bachelors in Urban Studies	2
	Hue University of Agriculture and Forestry	Unspecified	14



This report represents the closing document of WP2 “In-depth Empirical Study and Analysis on R&D in Climate Change and Competence Based Learning at Partners Countries”. This work sheds light on the current status and needs the national Climate Change(CC) R&D sector of Cambodia, Laos and Vietnam, with special focus on the educational offer and capacity of Higher Education Institutions (HEIs). From the assessment it has emerged that, while the impact of climate change is perceived as a real issue and its consequences are already visible in several sectors of national economies, the R&D national sector to mitigate such effects is still in its initial phase.



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