CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

UNEP-DHI PARTNERSHIP
Centre on Water and Environment

Mission report, visit to Lao PDR August 1st – 6th 2016.

Consultation in Vientiane on August 1st 2016

Contents

1 Description of workshop approach

The visit in Laos was organised as a series of workshops with representatives from the 6 cities involved in the study and in addition there was also time allocated for meeting with relevant authorities. . The workshops provided general presentation of the project purpose along with technical presentations of climate and ecosystem related topics. A part of the workshops was devoted discussion of the available data, and it was the intention to obtain a first feedback on the actual availability of the different data types relevant to the study.

In addition, the workshops aimed at facilitating discussions among the participants in relation to flooding and ecosystem damages. An effective facilitation method was adopted:

The participants discussed the topic flood-related problems and damages, in a group. The main flood damages that the participants could think of were all written down as individual headlines on a number of single ‘post-it’ notes. Once all inputs had been given, the participants ranked the various damages in terms of importance. The post-it notes were then stuck to a large piece of paper pre-printed with a ‘high’ and a ’low’ priority mark according to their ranking. Damages that had the same ranking/importance were lined up horisontallyon the same line/level on the paper.

After the assessment of flooding damage the participants were asked to use the same approach to identify damages to ecosystem services and “Post-it” notes were again ranked and stuck to a flip-over with high and low priorities.

The above processwas a very effective way to have all participants to provide opinions, and to obtain consolidated prioritised input during a short time.

The results from the above-described discussions are all included in an annex to this report. Conclusions of the individual discussions as well as an across-city analysis of the results is presented in this report.

In addition to the above, the workshops contained possibilities for one-to-one discussion between the CTCN team and the participants.

1.1 Summary of the across-city results

The cities came up with many of the same type of flooding and ecosystem service damages, which was also expected. Cross-city tables for flooding and ecosystem services are presented in Annex 2. For flooding, the type of damages could be grouped in 5 sections, where some of the statements were more related to the ecosystem services damage:

- Agriculture, forest and aquaculture (20 inputs)
- Economy and tourism (8 inputs)
- Geology (5 inputs)
- Infrastructure damages (24 inputs)
- People, property and health (33 inputs)

For the ecosystem service damages the number of input was slightly lower and the inputs could also be grouped in 5 sections:

- Biology/habitats (11 inputs)
- Crops, wild and cultivated (26 inputs)
- Geology/soil (7 inputs)
- Protection and impacts (4 inputs)
- Water-related damages (10 inputs)

Looking across all inputs there is no doubt that damages to infrastructure are the most common denominators for the 6 cities and damages to roads was mentioned most often, followed by power cuts and damages to private and public properties. For the ecosystem services the impacts highest on the agenda were related to the water supply, whether from public supply systems or from contamination of private shallow wells, followed by loss of crops.

While flood-related problems were certainly recognised, problems related to droughts were also mentioned, see annex 2.

2 Visiting Agenda

The mission was executed from the July 31st to August 6th. The team arrived in Vientiane on 31 July and prepared for the workshops and meetings in the week to follow. The daily activities are presented below.

2.1 Sunday July 31st

Arrival in Vientiane. Introduction meeting with Phaivanh Phiapalath (National ecosystem expert) to discuss plan of the week.

2.2 Monday August 1st

Morning:

Meeting with participants from the National Designated Entity (NDE), i.e the Ministry of Natural Resources and Environment, Department of Disaster Management and Climate Change. Participants: New appointed Director, Mr. Sangkane Thainthammavong, Deputy Director, Mr. Syamphone

Sengchandala and coordinator Ms. Xaysomphone Souvannahvong. Introduction and discussion of the CTCN project and plan for the week. Discussion of payments.

Afternoon:

Consultation with Lao Ministry representatives, Vientiane City and Bolikhamxay/Paksan City. Welcoming remarks by Deputy Director NDE, Mr. Syamphone Sengchandala, followed by presentations by the DHI delegation. Breakout sessions with Ministries in one group and Cities in another group. Discussion and brainstorming on 1) Flood problems and impacts and 2) Ecosystem services damages. Notes taken by Lao staff and affixed to premade posters. Good activity and active participants.

Some observations during discussions:

Vientiane city has a separate drainage system with storm and sewers separated. A protection wall/dyke has been build towards the Mekong to protect the city from river flooding. In order for the wall to be fully effective, a pumping system as well as a sluice gate needs to be put in operation in order to drain water from local flooding. Until this is in place, significant flooding in Vientiane city can still occur.

Flooding occurs both from local rainfall and from tributaries.

Flooding of paddy fields and fish ponds takes place during extreme events. Sometimes wastewater is mixed with storm water and poses a threat to both paddy fields and ponds.

Seasonal cropping along flood prone area of the Mekong River affected during high floods. Local farmers can grow vegetables etc. within one month. However, some years, not much can be produced if floods are high or frequent.

Description of main outcome of 'Flooding impacts' discussion
In Vientiane and Paksan city flooding causes inconvenience in public and private transportation, failure of electrical power supply and damaged sanitation systems. In addition flooding causes poor water quality in wells and results in dirty residential areas. Flooding is further cause of landslides and rice production is periodically inhibited.
Description of main outcome of 'Ecosystem services damages' discussion
In Vientiane and Bolikhamxay provinces the ecosystem services damages are main related to rubber tree plantations, and to the food supply chain which is generally affected. In addition, biodiversity is reduced and changes in river/stream water flows have occurred.

2.3 Tuesday August 2nd

Morning:

Meeting with

- **Department of Housing and Planning, Ministry of Public Works & Transport**
    - Khamtavy THAIPHACHANG, Director General
    - Bountouy KEOHANAM, Director of Division
    - Sengdara DOUANGMYXAY (douangmyxay@gmail.com), Director

- Viraghith DOUANGCHANH, specialist (st037053@yahoo.com), appointed as coordinator

General discussion of project and its purpose as well as request for data. The department possesses a fair amount of the data described in the data matrix provided to the NDE, see Annex 3.

Many data have been developed through donor financed projects and initiatives, such as city masterplan studies. Some data are in digital format while others are not. Photos were taken of the title page of the most important reports/studies. One of the recent publications (in Lao language) is a guideline for urban planning using climate change principles. This publication was handed over to the team (now with Mr. Phaivanh).

While recognising the value of the studies, the department expressed concerns that they have no budget for implementing the plans/recommendations in the reports.

The department seemed quite willing to corporate for the CTCN project.

The department has appointed Mr. Viraghith as coordinator for the data facilitation for the CTCN project. It is the consultant Team's judgment that once the project is started, detailed specifications of and agreements for data / information exchange can be undertaken within one day.

- **Department of Land Development and Planning, Ministry of Natural Resources and Environment**

  - Touy THAMMAVONGSA, Acting Director

The department is concerned with planning on a more overall level as compared with the Department of Urban Planning. It appears that the department can provide a significant part of the data requested for the study, see Annex. Landuse maps, satellite images, maps of deforested areas, maps of flooded areas (perennial flooding) etc., can be provided in digital and/or hardcopy.

The data are readily available, and it will only be a matter of spending a day with the department to define and retrieve the requested data.

The department is willing to support the CTCN project, and someone from the department will be assigned as a coordination point for the project.

- **Department of Meteorology and Hydrology**

Mr. Nikhom, Director of Climate Division

The department is responsible for the collection of data and maintenance of hydro-meteorological stations throughout Lao PDR. A short presentation of project purpose and data requests was held. The department is further responsible for water level and flow monitoring of rivers throughout Laos.

The department gave information on the availability of data as follows:

Hydromet stations (1 main station measuring all hydrometeorological data such as rainfall, evaporation, temperature, wind, etc., and remaining stations measuring rainfall and temperature):

Luang Prabang: 1 station (main)

Vientiane: 3 stations (1 main plus 2 others)

Bolikhamxai: 2 stations (1 main plus 1 other)

Khammouan: 2 stations (1 main plus 1 other)

Savannakhet: 3 stations (1 main plus 2 others)

Pakse: 3 stations (1 main plus 2 others)

Hydraulic stations (water levels and flows) are available along the main stream Mekong as well as on major tributaries. The actual locations were not discussed, but according to the consultants experience these can be obtained from the Mekong River Commission (MRC) homepage.

The available record for the data varies with station and type of data, but for most stations (except on the tributaries) data are available for at least 20-30 years.

The department has set a fee for acquisition of the data:

Discharge on the rivers: 40000 KIP/station/year

Other data: 20000 KIP/station/year

The procedure for acquisition is such that first the consultant will select data type, period and location and communicate this to the department. Hereafter the data can be retrieved in digital form in approximately a week's time.

Afternoon:

Despite plans for visiting Department of Forestry Management and Department of Water Resource these meetings could not be confirmed. It is judged however, that the amount of data that these departments could deliver to the project are minor compared to the other departments. It will be possible to visit the departments by our national expert, or in the beginning of the study.

The afternoon was spend wrapping up the findings from the meetings.

Travel to Luang Prabang by the end of the day.

2.4 Wednesday August 3rd

Morning:

Consultation meeting with City of Luang Prabang, see attendance list in Annex 5. Opening speech by Deputy Director of PONRE. Introduction to the CTCN project purpose and its process by DHI Team. Presentations on climate change vulnerability assessment and ecosystem services assessment by DHI.

Group discussion on Flooding and – Impacts as well as on Ecosystem Services Damages. The number of attendances made it possible to conduct the discussion in one single group only. Although various different departments were participating, the discussion was lively and most participants were active. The outcome of the discussions is presented in Annex 2.

Description of main outcome of 'Flooding impacts' discussion
In Luang Prabang the flooding causes traffic problems as well as damages to roads, houses and peoples properties and assets. There are cuts in electrical power supply as a result of flooding, and water supply systems are affected. In addition flooding causes spreading of water borne diseases and causes in general inconveniences for the city residents.
Description of main outcome of 'Ecosystem services damages' discussion
Ecosystem services are both affected by floods and droughts. Flooding causes increased landslides as riparian trees are lost for protection. The water quality for aquatic fauna decreases due to both floods and droughts. Droughts are the cause of decreased stock of wild plants and animals, decreased food sources for animal fodder. In addition droughts cause forest fires, die-out of trees and gives general inconveniences for the city populations due to high temperatures.

Discussion of data availability and filling out of data request sheet on site.

Wrap up of data availability discussion, and closing of workshop.

Lunch together with PONRE.

Afternoon:

Summarising results of the workshop.

Travel to Vientiane.

2.5 Thursday August 4th

Travel to Savannahkhet by car.

2.6 Friday August 5th

Morning:

Consultation workshop with representatives from Savannahkhet, Champasak and Khammouan provinces. The names and affiliation of the participants are shown in Annex 5.

Opening statement by Chairman (Director of PONRE, Kaysone Phomvihane city). Presentation of CTCN project purpose by DHI. Presentation of approaches for city climate change vulnerability assessment and ecosystem services definitions. Presentation and discussion of data matrix sheet.

Group discussion on Flooding and – Impacts as well as Ecosystem Services Damage. The result of the discussions is seen in Annex 2.

The three groups (one for each city) were quite active in the discussion and came up with prioritised headlines for identified flood and ecosystem issues and damages. The data availability matrix sheet was filled by the groups on location and handed over to the team, see Annex 3.

Description of main outcome of 'Flooding impacts' discussion
Kaysone Phomvihane (Savannakhet) experience damages due to floods on their drainage system and –canals. Roads and houses/properties are likewise affected and damaged by floods. It is common that the city has odour problems after flooding has occurred. Some rivers and streams have become shallower and sedimentation occurs, most likely as a result of changes to the dry season period (perhaps also due to upstream dam operation). In Pakse people and their properties are increasingly affected by floods. Roads are being damaged and general traffic problems occur during floods. During floods, the water quality decreases and there is a risk of spreading of water borne deceases. In Thakhet roads are being damaged by floods, there are disruption of the electrical power supply and water infrastructure such as water supply systems, drainage systems and dikes are being affected by floods. There are odour problems both during and after floods, and water borne diseases spread during floods.
Description of main outcome of 'Ecosystem services damages' discussion
In Savannakhet the drinking water resource is affected due to floods. There are impacts on the agricultural land and non-forest products such as mushrooms, bamboo and insects are being damaged. It has got increasingly more difficult to find firewood. In Pakse the more shallow rivers has led to increased bank collapse. The fertility of the soils have declined and there are effects on some plants and wildlife. In Thakhet groundwater levels are affected and there is a general change in the urban landscape (?). Further, there is a loss in crops, trees and livestock due to floods. Ecotourism is affected as well.

Separate discussion with hydrologist from Pakse: effects of this year's prolonged drought in Thailand has caused significant impact on groundwater levels. Consequently, many geotechnical failures have been observed affecting hours and other constructions. The hydrologist is suggesting that similar effects may be seen in Pakse area. Furthermore, the hydrologist mentioned that the planned hydropower dam on the Mekong downstream of Pakse is expected to have a large effect on the city as water levels will be maintained at an artificial high level, possibly inundating land around Pakse and backing up river tributaries.

Closing workshop remarks by the Chairman.

Joint lunch with the workshop participants.

Afternoon:

Wrap up with the NDE. The following activities were agreed upon:

1. NDE to translate the attendance sheets from the three workshops and send to DHI in the first half of coming week.
2. The local expert Phaivanh Phiapalath will finalize the data matrix translation and send to DHI. Early next week.
3. Phaivanh to translate the workshop Power Point presentations. Early next week.
4. DHI to update the mission report and send to the NDE.

5. DHI to update the discussion notes and share with the NDE.

Work at the hotel summarizing the outcome of the week and to start actions.

2.7 Saturday August 6th

Travel to Denmark.

Annex 1 Mission schedule

Date	Day	Place/Venue	Description	No. of People	Remark
July 31st	Sunday	Vientiane	Danish delegation arrives in Laos	2	
Aug 1st	Monday	Vientiane	Visit to NDE. Afternoon workshop with national stakeholders and Municipal Authorities from Vientiane and Bolikhamxay.	40	Invite 5-8 Officers from Bolikhamxay to Join Meeting in Vientiane.
Aug 2nd	Tuesday, Morning	Vientiane	– Visit to national stakeholders: Dept. Housing and Urban Planning, Dept. Land Planning and Development, Dept. of Water, Dept. of M&H, Dept. Forest Management. (Morning or extend to afternoon if require) – Travel to Luang Prabang. (Evening, 05:00PM)	5	Meeting with each dept. individually Trip to LP by plane
Aug 3rd	Wednesday, Morning	Luang Prabang.	– Workshop with Municipal Authorities from Luang Prabang Province. – Travel back to Vientiane (Evening, 06:45 PM)	16	Invite 5-8 Officers from Luang Prabang to Join Meeting.
Aug 4th	Thursday	Vientiane-Savannakhet	Travel from Vientiane to Savannakhet	10	by Plane and car via Pakse (expected)
Aug 5th	Friday	Savannakhet.	– Workshop with local stakeholders from Khammouan, Savannakhet and Champasak Provinces. (Morning Session) – Wrap-up and Working Session with CTCN Team. (Afternoon) – Travel back to Vientiane (Evening, 06:00 PM)	30	7 officers from Khammouan and 7 Officers from Champasack will be invited to join meeting in Savannakhet.
Aug 6th	Saturday	Vientiane	CTCN travels back to BKK.		Vientiane to BKK CTCN travel to BKK

Annex 2 Results from discussions during workshops

Workshop outcome
Venue: Vientiane, Don Chan
Date: 1. August 2016

Input from yellow-sticker exercise: Listed with highest priority on top of each list

Flooding damages,

State institutions and ministries:

Impact on infrastructure:

- Roads,
- Electricity,
- Health,
- Agriculture and
- farm land

Vientiane (VTE) and Paksan (PKS) cities (in prioritized order):

- Inconvenience in public and private transportation (VTE)
- Electricity polls falling over, cutting the supply (VTE)
- Dirty residential areas (VTE)
- Damaged sanitation /toilets (VTE)
- Rice production inhibited periodically
- Poor water quality in wells (VTE)
- Landslides
- Loss of school time (no access to school during flooding)
- Affecting drainage systems (VTE)
- Damaged irrigation systems
- Damaged roads (VTE)
- Difficult livelihood
- Water-borne diseases (dengue fever)
- Poor quality of food
- Loss of crop yield (PKS)
- Affect house hold income
- Affecting state budget for repairing damages
- Poor quality of water
- Affect mental health
- Traffic congestion
- Shortage of state budget to rehabilitate ecoystems
- Impacts to livestock activities
- Damaged forest
- Affect habitats
- Affect culture

Damage to ecosystem services:

State institutions and ministries:

- Damage to residential areas (?? Not an EC-damage!! JDA)
- Affecting wildlife and aquatic animals

- Water quality degradation
- Degradation of soil
- Damaged drinking water facilities (sedimentation)
- Soil erosion
- Damaged forests
- Damaged public parts
- Damaged crops
- Damages to shallow wells
- Damaged habitats

Vientiane (VTE) and Paksan (PKS) cities:

- Impacts on rubber tree plantations
- Food supply chain affected
- Changes in water flow
- Reduced biodiversity
- Change of water channel corridor (change in the physical place of the river channel)
- Damage to non-timber forest products
- Erosion
- Affecting the agriculture: Impacts on seeds, livestock, Products, Crops, vegetables,
- Affect insect habitats
- Lack of budget to prevent bank erosion
- Ruining habitats (??)
- Damage to vegetables and herbs
- Damage to aquatic animals
- Damaged fish cages
- Flooded fish farms
- Damage to natural mushroom
- River bank erosion
- Affected water plants (Green plants or water facilities ??)
- Affected green areas
- Damaged wells and drinking water facilities

Workshop outcome
Venue: Luang Prabang
Date: 3. August 2016

Input from yellow-sticker exercise: Listed with highest priority on top of each list

Flooding damages,

Luang Prabang:

- Traffic problems
- Damage to roads, houses and other properties
- Electricity supply cuts
- Damage to people's assets
- Problems with water supply
- Water borne diseases
- Inconveniences for residents
- Loss of state budget for repair
- Crops destroyed
- Soil erosion
- Teaching material damaged
- Children cannot go to school
- Some effects on tourism
- Impact on livestock
- Bridge Damage (1 case)

Damage to ecosystem services:

The LPB authorities stated that there are also impacts during droughts and these are included below:

Provincial institutions and ministries:

- Riparian trees lost for landslide protection
- Lower water quality for aquatic animals
- Decrease in wild plants and animals (droughts)Restrictions for grassland for livestock grazing
- Fewer food sources for animal fodder (drought)
- Aquatic plants disappear
- Forest fires (droughts)
- Trees die due to higher temperatures (Droughts)
- Higher temperatures give health problems for the people (drought)
- Shallow pools in the river is removed by the floods and remove fish as well.

Workshop outcome
Venue: Savannakhet with participation from Pakse and Thaketh
Date: 5. August 2016

Input from yellow-sticker exercise: Listed with highest priority on top of each list

Flooding damages,

Savannakhet:

- Drainage damage
- Effects on agricultural crops (ES!)
- Drainage channels damaged
- Effects on houses and property
- Smelling problems after flooding
- Road damages
- Shallower, sedimentation
- Damages to water supply
- Damages to electricity supply (power cuts)
- Blocking of drainage channels during and after flooding
- Water-borne diseases
- Bank erosion
- Damages to fish culture

Pakse:

- Effects on peoples life and houses for 2 months
- Damage to crops (paddy fields) (ES)
- Damage to poultry and pigs (ES??)
- Road damages
- Traffic problems
- Pollution of urban areas
- Water-borne diseases and sickness
- Effects to local livelihood, difficult to live
- Loss of state budget for repair

Thaketh

- Damage to roads
- Effects on local livelihood
- Electricity cuts
- Effects water supply run-off ???(Check sticker)
- Effects to drainage systems and dikes
- Smelling problems under and after flooding
- Water-borne diseases
- Impacts on property (private and public)
- ????? (Check yellow sticker)
- Crop losses (ES)
- Impacts on education and teaching (schools damaged and closed)
- Temples damaged
-

Damage to ecosystem services:

Savannakhet

- Effects on drinking water resources
- Changes in land fertilizer, sulled land??? (Check yellow sticker)
- Impacts on agricultural land
- Difficult to find firewood
- Effects on non-forest-products like Mushroom, Bamboo, Insects
- Effects on wildlife and some plants
- Salt water from salt factory changes water quality (Effects on drinking water???)

Pakse

- Shallow river gives more bank erosion (collapsing banks) (FD)
- Soil fertility declines
- Crops infested with insects (Not directly flooding-linked!!)
- Effects on some plants and wildlife

Thaketh

- Groundwater level disqualified ??? (Check yellow sticker)
- Changes in the urban landscape /scenic ??
- Loss of crops
- Loss of trees
- Decline in food production
- Loss of livestock
- Impacts on ecotourism (stops during flooding)

Cross-cutting results from the flood damage discussion: Highest priority on top to the extent possible

Flooding damages	VTE	PKS	LPB	SVK	PAK	THK
Inconvenience in public and private transportation	x				x	
Electricity polls falling over, cutting the supply	x		x	x		x
Dirty residential areas (smell, dirt)	x			x	x	x
Damaged sanitation /toilets	x					
Rice production inhibited periodically	x	x				
Damage to houses and public property			x	x	x	x
Poor water quality in wells	x					
Water supply problems (sedimentation)			x	x		
Water supply system cannot operate during flooding						x
Landslides	x	x				
Soil erosion			x			
Bank erosion				x		
Loss of school time (no access to school during flooding)	x	x	x			x
Teaching material damaged			x			x
Affecting drainage systems	x			x		x
Damaged irrigation systems	x	x				
Damaged roads	x			x	x	x
Damage to bridges			x			
Difficult livelihood	x	x			x	x
Water-borne diseases (dengue fever)	x	x	x	x	x	x
Poor quality of food	x	x				
Loss of crop yield		x	x	x	x	x
Loss of poultry and pigs					x	x
Affect house hold income	x	x	x			
Inconveniences for residents			x			
Affecting state budget for repairing damages	x	x			x	
Poor quality of water	x	x				
Affect mental health	x	x				
General health problems			xD			
Traffic congestion	x	x	x			
Shortage of state budget to rehabilitate ecosystems	x	x	x			
Impacts on tourism and temples			x			x
Impacts to livestock activities	x	x	x			x
Impacts on aquaculture				x		
Damaged forest	x	x				
Affect habitats	x	x				
Affect culture	x	x				
Salt from salt factory impacts drinking water during flooding				x		

Cross-cutting results from damage to ecosystem services discussion: Highest priority on top to the extent possible

Eco system damages	VTE	PKS	LPB	SVK	PAK	THK
Impacts on rubber tree plantations	x	x				
Loss of trees for landslide protection			x			
Food supply chain affected	x	x				
Changes in water flow	x	x				
Changes in water quality			x			x
Reduced biodiversity	x	x				
Less firewood				x		
Change of water channel corridor (change in the physical place of the river channel)	x	x			x	
Damage to non-timber forest products	x	x		x		
Erosion	x	x			x	
Affecting the agriculture: Impacts on seeds, livestock, Products, Crops, vegetables	x	x		x		
Decrease in wild plants and wildlife			xD[1]	x		
Affect insect habitats	x	x		x		
Lack of budget to prevent bank erosion	x	x				
Ruining habitats (??)	x	x				
Fewer food sources for livestock			xD			
Damage to vegetables and herbs	x	x				
Damage to aquatic animals	x	x				
Damage to aquatic plants			x			
Damaged fish cages	x	x				
Flooded fish farms	x	x				
Damage to natural mushroom	x	x				
River bank erosion	x	x				
Soil fertility goes down				x	x	
Affected water plants (Green plants or water facilities??)	x	x				
Affected green areas	x	x				
Damaged wells and drinking water facilities	x	x		x		
Forest fires			xD			
Trees die due to higher temperatures			xD			
Shallow fish-filled pools disappear during flooding			x			

[1] D = drought

Overview of **Flooding damages,** grouped in 5 sections and based on similarity between cities, and ranked on no. cities with the same problems.

Priority	Flooding damages	VTE	PKS	LPB	SVK	PAK	THK
	Agriculture, forest and aqaculture						
21	Loss of crop yield		x	x	x	x	x
32	Impacts to livestock activities	x	x	x			x
5	Rice production inhibited periodically	x	x				
20	Poor quality of food	x	x				
22	Loss of poultry and pigs					x	x
34	Damaged forest	x	X				
35	Affect habitats	x	x				
33	Impacts on aquaculture				x		
	Economy and tourism						
25	Affecting state budget for repairing damages	x	x			x	
30	Shortage of state budget to rehabilitate ecosystems	x	x	x			
31	Impacts on tourism and temples			x			x
	Geology						
9	Landslides	x	x				
10	Soil erosion			x			
11	Bank erosion				x		
	Infrastructure damages						
16	Damaged roads ands bridges	x		x	x	x	x
2	Electricity polls falling over, cutting the supply	x		x	x		x
3	Dirty residential areas (smell, dirt)	x			x	x	x
29	Traffic congestion	x	x	x		x	
14	Affecting drainage systems	x			x		x
15	Damaged irrigation systems	x	x				
4	Damaged sanitation /toilets	x					
37	Salt from salt factory impacts drinking water during flooding				x		
	People, property and health						
19	Water-borne diseases (dengue fever)	x	x	x	x	x	x
6	Damage to houses and public property			x	x	x	x
12	Loss of school time (no access to school during flooding)	x	x	x			x
18	Difficult livelihood	x	x			x	x
8	Water supply problems (sedimentation)			x	x		x
23	Affect house hold income	x	x	x			
27	General health problems	x	x	xD			
7	Poor water quality in supply and shallow wells	x	x				
13	Teaching material damaged			x			x
36	Affect culture	x	x				

Overview of **Ecosystem services damages**, grouped in 5 sections and based on similarity between cities, and ranked on no. cities with the same problems.

Priority	Eco system damages	VTE	PKS	LPB	SVK	PAK	THK
	Biology/Habitats						
13	Affect insect habitats	x	x		x		
6	Reduced biodiversity	x	x				
15	Ruining habitats (??)	x	x				
18	Damage to aquatic animals	x	x				
19	Damage to aquatic plants			x			
29	Trees die due to higher temperatures			xD			
	Crops, wild and cultivated						
9	Damage to non-timber forest products	x	x		x		
11	Affecting the agriculture: Impacts on seeds, livestock, Products, Crops, vegetables	x	x		x		
1	Impacts on rubber tree plantations	x	x				
3	Food supply chain affected	x	x				
12	Decrease in wild plants and wildlife				x		
14	Lack of budget to prevent bank erosion	x	x				
17	Damage to vegetables and herbs	x	x				
20	Damaged fish cages	x	x				
21	Flooded fish farms	x	x				
22	Damage to natural mushroom	x	x				
25	Affected water plants (Green plants or water facilities ??)	x	x				
7	Less firewood				x		
16	Fewer food sources for livestock			xD			
30	Shallow fish-filled pools disappear during flooding			x			
	Geology, soil						
10	Erosion	x	x			x	
23	River bank erosion	x	x				
24	Soil fertility goes down				X	x	
	Protection, impacts,						
26	Affected green areas	x	x				
2	Los of trees for landslide protection			x			
28	Forest fires			xD			
	Water related damages						
8	Change of water channel corridor (change in the physical place of the river channel)	x	x			x	
27	Damaged wells and drinking water facilities	x	x		x		
4	Changes in water flow	x	x				
5	Changes in water quality			x			x

Annex 3 Data request sheet

Data Access Matrix: Updated 2 August 2016
A: Readily available, F: Free data access (no costs), P: Payment necessary, N: Not available, Dx: Data available after x months

Data	Importance E: essential S: supporting	Vientiane	Luang Prabang	Bolikhamxay, Paksan	Khammouan, Thakhek	Savannakhet	Champasak, Pakse	Responsible authority	Other information
Topographic information									
Topographical data for cities[2]	E	x	x	x	x	x	x	Monre Land Planning	Topo maps used as background maps for land planning
Topographical data for water shed	E	x	x	x	x	x	x	Monre Land planning	Grid size not available
Hydro-meteorological data:									
Precipitation/evaporation	E	3	1	2	2	3	3	Meteorological Dept, Climate	One main station per city plus xx substations
Temperature	S	x	x	x	x	x	x	Meteorological Dept, Climate	Data available at a price.
Wind	S	x	x	x	x	x	x	Meteorological Dept, Climate	Flow: 40K KIP/year/station
Water level and flow in Mekong River[3]	E	x	x	x	x	x	x	Meteorological Dept, Climate	All other data: 20K KIP/year/station
Water level and flow in other rivers affecting the cities	E							Meteorological Dept, Climate	Main trib. In the cities
Maps of previous flooding events caused by Mekong[4]	S							MONRE Land planning	General flooding maps for typical/annual events

[2] Digital terrain models, DTM
[3] 2-3 decades at the least
[4] Extent of flooding events shown on maps

Data	Importance E: essential S: supporting	Vientiane	Luang Prabang	Bolikhamxay, Paksan	Khammouan, Thakhek	Savannakhet	Champasak, Pakse	Responsible authority	Other information
Maps of previous flooding events caused by heavy rain in the cities/rural areas[5]	S								
Data on flooding impacts on religious sites or sites important to tourism[6]	S								
Urban planning									
Plans and activities related to urban planning and climate change[7]	E	(x)	(x)	(x)	(x)	(x)	(x)	Min. Public works, Dept Housing & Urban planning	Mainly data from master plans for the cities. Most data in hardcopy. To check with local authorities.
Vulnerability maps (cities)	S						x	Min. Public works, Dept Housing & Urban planning	Check UN-Habitat study on Pakse
Vulnerability maps rural	S							?	
Records of damages in previous flooding events	S						x	Min. Public works, Dept Housing & Urban planning	Check UN-Habitat study on Pakse
Land use maps									
Forests, agriculture, soil classification, crop types	S	x	x	x	x	x	x	MONRE Land planning Dept	Available in digital format. Request from Monre to dept. for data.
Spatial information									
Satellite images	E	x	x	x	x	x	x	MONRE Land planning Dept	
Remote sensing data (additional), cities/catchment	S	x	x	x	x	x	x	MONRE Land planning Dept	
Population distribution									

[5] Damages (extend and costs) on e.g. housing, transportation, agriculture, tourism, fishing, access to forest areas etc.
[6] E.g. temples, museums, old part of cities. Flood marks, flood extent, flood duration etc.
[7] Descriptions and reports

Data	Importance E: essential S: supporting	Vientiane	Luang Prabang	Bolikhamxay, Paksan	Khammouan, Thakhek	Savannakhet	Champasak, Pakse	Responsible authority	Other information
Urban classification (Housing/industry/parks/ other)	E							Local city authorties	May be part of masterplans.
Rural classification (Housing, industry, national parks, other)	S							(Monre Land planning ??)	To be assessed
Infrastructure									
Map of water supply utilities, incl. distribution area	E							Min Public Works, Dept. Water Supply plus local authorities	Dept. Not visited.
Map of wastewater utilities, incl. serviced area	E							Min Public Works, Dept. Water Supply, plus local authorities	Dept. not visited
Other structures: Retention basins, controlled flooding areas etc.	E		x					Min Public Works, Dept. Water Supply plus local authorities	Dept. not visited. LPB has a drainage plan. Authority to be asked

Annex 4 Photos

Banner from consultation in Vientiane August 1st 2016.

Consultation participants in Vientiane August 1st 2016

Consultation participants in Luang Prabang, August 3rd 2016.

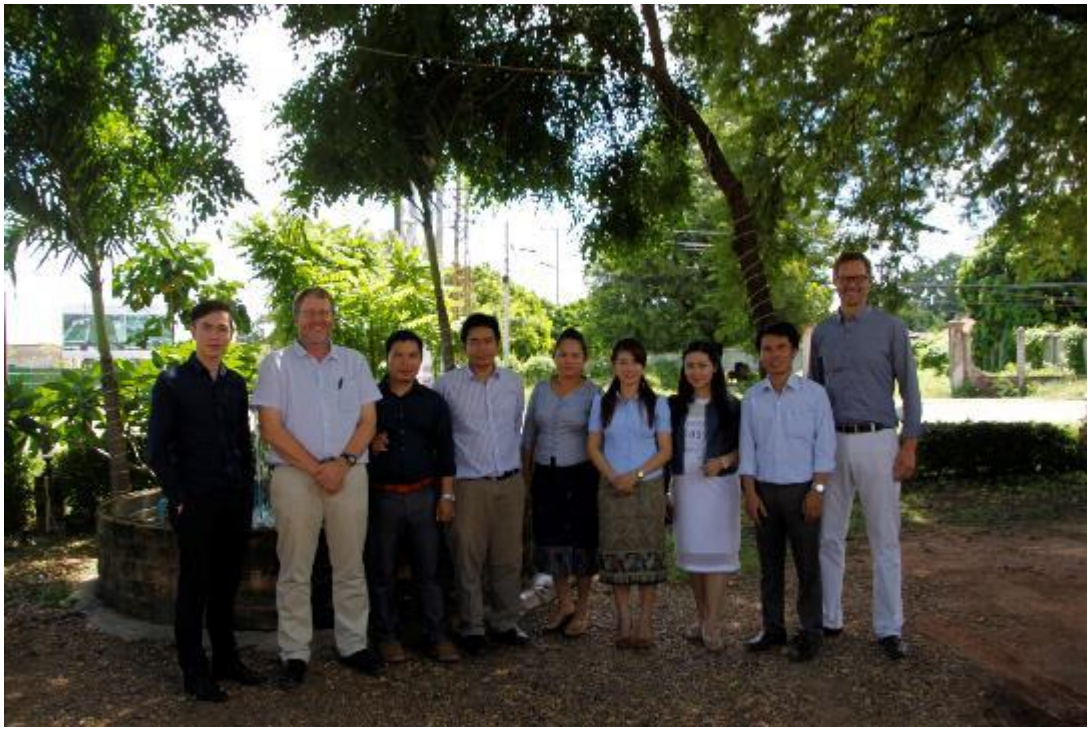
Consultation participants in Kaysone Phomvihane (Savannahkhet)





Various photos from the workshop in Luang Prabang

Various photos from the workshop in Kaysone Phomvihane



The NDE and the CTCN team

Annex 5 Attendance sheets, consultations

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National Consultation on City Climate Vulnerability Assessment and Identification of Ecosystem-based Adaptation Intervention, 05 August 2016, Luangprabang Province.

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25					

National Consultation on City Climate Vulnerability Assessment and Identification of Ecosystem-based Adaptation Intervention, 05 August 2016, Savannakhet Province.

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