

Terms of reference

Nam Phak River watershed study to inform participatory integrated water management

In August 2022, heavy rains fell in the Oudomxay Province of Northern Lao PDR following tropical storm Ma-On. Several areas, including along the Nam Phak River in La District, have been impacted by major flooding, causing agricultural land and housing damage¹, environmental health hazards, and damage to an already precarious infrastructure². The floods resulted in crop losses and incurred heavy costs to restore arable land and protect it from further flooding. Upland farmers are even more heavily dependent on upper watershed forest resources since their lower elevation fields were flooded. To cope with income loss and destruction, farmers reportedly increased their upland acreage, accentuating land pressure and deforestation, and in turn the risk of flooding. Moreover, droughts are also a serious threat to livelihoods. During the first six months of 2019, the rainfall in Nam Ou basin, of which Nam Phak is a sub-watershed, decreased by 41 percent compared to the same period in 2018³. The irrigation was compromised and rice planting impacted⁴. The Nam Phak watershed study will fill an important knowledge gap by addressing the hydrological dynamics related to the floods and droughts, and by replacing them in spatial and historical context. This knowledge aims at feeding concertation at an inter-community level, to better manage the watershed through nature-based solutions.

I. Context

The Comité de Coopération avec le Laos (CCL) in Lao PDR

For almost forty years, the Comité de Coopération avec le Laos (CCL) has been implementing rural development programs in Lao PDR. Since 2011, together with its partner, the Oudomxay Provincial Agriculture and Forestry Office (PAFO), CCL has been carrying out projects aimed at enhancing environmental and socioeconomic outcomes in the uplands of Oudomxay Province. The ongoing project (*Project on Integrated rural development in Beng, La and Xay districts, Oudomxay province*) (2025-2027) embraces an integrated and participatory approach to sustainable rural development. The project has the following three objectives: (i) The villagers and communities activate levers to reduce the economic and environmental vulnerability of their agroecosystems; (ii) the local governance on environment and economic development issues is strengthened to support local stakeholders in collectively addressing socioeconomic and environmental challenges; (iii) the local knowledge on development and

¹ Vongphachanh M., Flooding Wrecks 90% of the Agricultural Land in Oudomxay, *The Laotian Times*, September 1, 2022. <https://laotiantimes.com/2022/09/01/flooding-destroys-90percent-agricultural-land-in-oudomxay/>

Lipes J., Weeks after tropical storm Ma-On batters northern Laos, residents struggle to recover, *Radio Free Asia*, September 10, 2022. <https://www.rfa.org/english/news/laos/storm-09102022171537.html>

² Vongphachanh M., Oudomxay Estimates Over LAK 60 billion to Repair Roads, *The Laotian Times*, September 7, 2022. <https://laotiantimes.com/2022/09/07/oudomxay-estimate-over-lak-60-billion-to-repair-roads/>

³ Climate change, global warming cause drought in Laos: experts, *Xinhuanet*, December 16, 2019. http://www.xinhuanet.com/english/2019-12/16/c_138634910.htm?utm_source=chatgpt.com

⁴ Gerin R., Severe Drought in Mekong Region Reduces Rice Planting in Laos, *Radio Free Asia*, July 26, 2019

environmental issues are acknowledged, strengthened and shared at the scale of the Oudomxay province and beyond.

The Nam Phak watershed study falls within the Result 1 of the Objective 2: “The neighboring communities organize themselves to answer to climate change adaptation and water conservation issues”. It is the first activity of this result 2.1, whose 4 activities are listed below:

- (i) Study on the Nam Phak River watershed.
- (ii) Inter-community concertation meeting on water management in the Nam Phak River Basin.
- (iii) Formalisation of an action plan to reduce the risks of floods & droughts by the communities of the Nam Phak River Basin (based on the results of the intercommunity concertation).
- (iv) Implementation of nature-based solutions in the Nam Phak River Basin to reduce the vulnerability to floods & droughts (through input delivery and monitoring).

The Nam Phak Watershed Area

Located in Northern Laos, the Nam Phak River is the most important tributary to the Nam Ou (a tributary of the Mekong) and drains a territory of 3 342 km². Its springs is located upstream in Namor district (Oudomxay province). It then crosses La district (Oudomxay province) and Khoa district (Phongsali province), where it meets the Nam Ou. From its spring to the confluence, it stretches over about 160 km.

In the frame of the inter-community concertation for water management, only a selected area within the Nam Phak basin will be targeted. It will likely include a dozen of communities, some of them along the Nam Ma (a tributary of the Nam Phak), from near the border with Xay district up to Muang La, and some of them along the Nam Phak, from Muang La up to near the border with Khoa district (Phongsali province). We may also consider villages not directly located on river banks but whose territories border the Nam Phak or are included in its watershed, upstream of Muang La. Note that the exact geographical scope and involved communities may still be subject to modifications, to make it as consistent as possible with both the scientific scope of the study and communities’ needs.

Here is a tentative list of the communities and associated lands to be investigated:

Villages along Nam Ma, upstream of Muang La	Villages along Nam Phak, downstream of Muang La	Hill villages included in Nam Phak watershed, upstream of Muang La (<i>selection to be confirmed</i>)
Houaithong	Pakkor	Phusatee
Tangneuy	Hataen	Pangsabath
Mai	Hatnnick	Phonsawath
Phavi	Huaypae	Langling
	Huaychay	Phuthen
	Huakeang	Pangsom

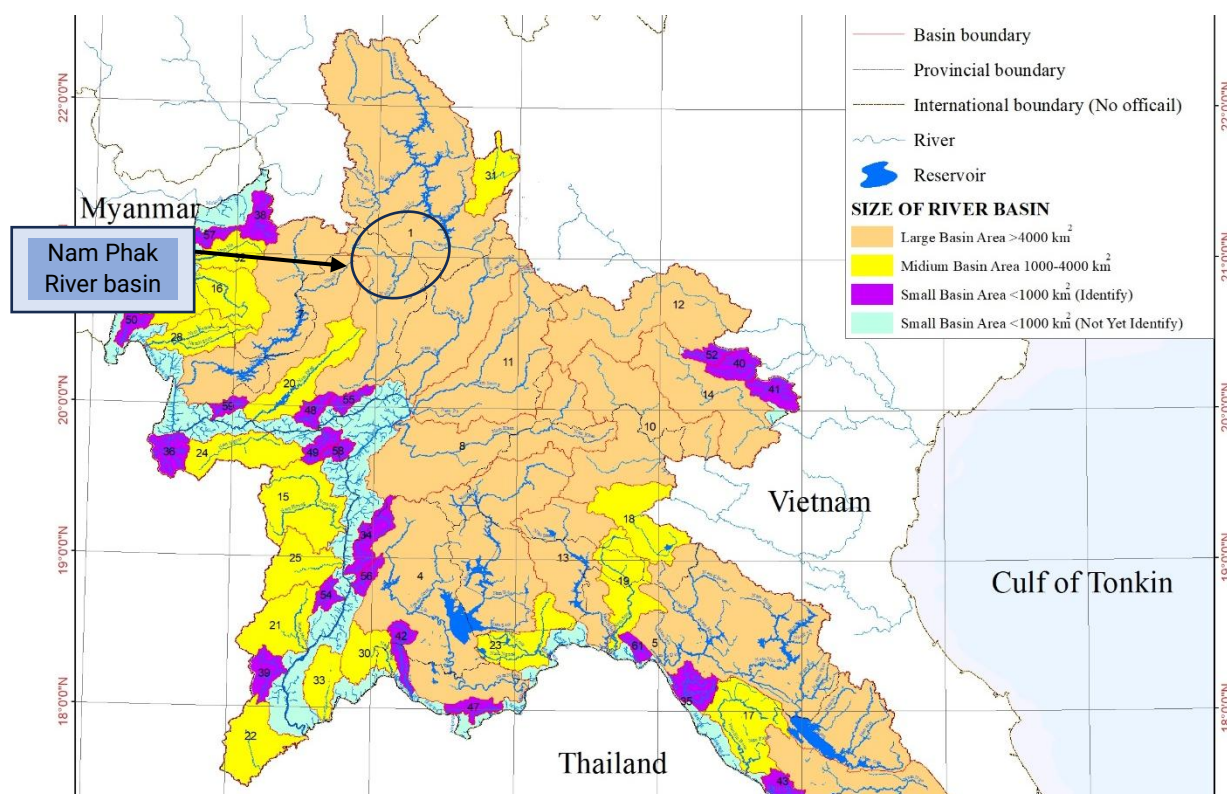


Figure 1: Location of the Nam Phak River basin (from MONRE-DWR, 2018, map of river basins in Lao PDR)

The Nam Phak watershed has a mountainous landscape, a humid tropical climate influenced by the monsoon, and a mainly rural population. It encompasses the district capital of Namor, which constitutes the main urban area across the district. Structural poverty limits the ability of local communities to steer their socio-economic trajectories and is an overall hindrance to sustainable development. In rural areas, the local population is predominantly agricultural and from ethnic minorities. Farming systems are traditionally based on slash-and-burn agriculture, with rotations between periods of rain-fed rice cultivation and fallow to allow forest recovery. Rotational farming is combined with secondary activities, such as irrigated rice-growing, livestock rearing, off-season crop cultivation, handicrafts, and trade. Forests are at the core of agrarian systems, providing the communities with food and income, notably through the collection and processing of Non-Timber Forest Products (NTFP: hunting, fishing, and gathering).

As illustrated by recent floods and droughts, forest agroecosystems are central to community resilience and provide a range of critical ecosystem services. They are, however, increasingly under pressure, with the development of export-oriented cash crops (sugar cane, bananas, rubber), demographic growth, and land concessions (mines, plantations), which altogether lead to increased deforestation, land fragmentation and reduced fallow times⁵. This dynamic creates new vulnerabilities for the rural population: pressure from weeds, crop pests and animal epidemics, droughts and floods, rarefaction or even disappearance of certain NTFPs. The climatic trends observed in the Nam Phak area (rising average temperatures, increased rainfall variability, etc.) are expected to worsen over the coming decades, thereby reducing forest and community resilience. Within this economically and ecologically volatile setting, newly emerging opportunities (e.g., cattle exports to China, contract farming, etc.) represent a

⁵ Bauernschuster, S., M. Pichler, V. Nanthavong, R. Bernhard, M. Epprecht, and S. Gingrich. 2022. Carbon emissions from land acquisitions in Laos. *Ecology and Society* 27(3):45. <https://doi.org/10.5751/ES-13395-270345>

potential for rural income generation and diversification. Yet they can lead to a vulnerable and dependent state due to limited capital access, poor market access and unstable agricultural prices.

Climate change impacts, combined with preexisting social and economic challenges makes local communities more vulnerable. In its 6th assessment report, the Intergovernmental Panel on Climate Change (IPCC) stresses the central importance of water security to climate change and resilience, stating that most sustainable development goals are unattainable without adequate access to water. At the scale of Oudomxay Province, water issues have been identified as critical, both in terms of access and conservation of the resource. Inappropriate land management, such as deforestation in catchment areas, continues to pose a significant risk of water scarcity. In addition, deforestation of slopes and riverbanks, combined with an increase in the frequency and severity of meteorological events, accentuates the risk of floods. These dynamics induce, on the one hand, shortages of water for both domestic and agricultural use and, on the other hand, crop, and infrastructure destruction.

In August 2022, the province of Oudomxay was hit by massive flooding which weakened already fragile livelihoods. In response to loss of income, farmers have reportedly increased their upland acreage (swidden/shifting agriculture). These dynamics, which have yet to be explored, could exacerbate watershed degradation (e.g., soil and nutrient loss). In an increasingly fragmented landscape, further deforestation could in turn increase the risk of flooding, and thereby undermine the resilience of local populations. Land Use/Cover changes (LULC) related to forest removal typically produce a broad array of hydrological responses⁶. In 2019, the CCL conducted a study on hydro-sedimentary processes in Oudomxay Province, focusing on hydrologic connectivity between landscapes and streams⁷. Based on landscape analysis, farmer interviews, and GIS analysis, the study highlighted the importance of plot rotation, slope gradient, slope shape, and the presence/composition of buffer areas as key factors driving run-off and hydrologic connectivity in the area.

However, within the Nam Phak, the range of hydrological responses associated with land fragmentation and landscape features (e.g., upland forest, riparian forest) remains undocumented.

Upland forests play a crucial role in rainfall interception, increasing infiltration and reducing runoff. They reduce waterflow downstream and thus reduce water flood volumes. Riparian vegetation has for instance a crucial function in stabilizing riverbanks and constitutes a buffer to disruptions brought by floods and fires in upland areas⁸. In the ADAEBio2 project, CCL supports the protection of forests, including upland and riparian vegetation. They are considered as nature-based solutions reducing communities' vulnerability to floods and droughts.

The objective of CCL is to develop a participatory process enabling concerted action at watershed level, including for the setting up of nature-based solutions. The scarcity of

⁶ Bosch J.M. and J.D. Hewlett. 1982. [A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration](#). *Journal of Hydrology* 5: 3– 23.

Bruijnzeel L.A. 2004. [Hydrological functions of tropical forests: not seeing the soil for the trees?](#) *Agriculture, Ecosystems & Environment* 104(1): 185-228.

Ziegler A.D., Giambelluca T.W., Tran L.T., Vana T.T., Nullet M.A., Fox J., Tran Duc Vien, Pinthon J., Maxwell J.F., and S. Evett. 2004. [Hydrological consequences of landscape fragmentation in mountainous northern Vietnam: evidence of accelerated overland flow generation](#). *Journal of Hydrology* 287: 124–146.

⁷ Sandevor, L. 2019. Pesticide flows in Northern Laos: A geographic approach to vulnerabilities. CCL & Université Paris est-Créteil & Université de Caen

⁸ Vu T.Q.A. 2006. *Floristic Composition and Growth Dynamics of Riparian Forests in North-East Vietnam*. Cuvillier Verlag. 180 p.

scientific data specific to the Nam Phak is an obstacle. Moreover, understanding the way communities perceive the climate risks and the potential adaptation or prevention strategies is a crucial step for facilitating such an inter-community process.

In this context, CCL seeks to generate knowledge on hydrological processes and current water issues (drought & flood risks, management gaps) at the scale of the Nam Phak basin.

This study will thereby focus on the description of the Nam Phak River basin and provide advice that will help CCL in the facilitation of the inter-community facilitation process aiming at better managing the watershed.

II. Objective and Scope

The intent of this study is to contribute to more informed participatory watershed management.

The study will include the following five components:

- **C.1: GIS- and RS- based hydrogeomorphic analysis**
The sustainable management of watersheds requires reliable knowledge of the mechanisms that control the basins and their sub-basins. Activities under Component 1 will document and analyze the hydrological and morphometric parameters of Nam Phak River watershed based on geospatial analysis and mapping. This will include, but not limited to, a topography analysis, a description and analysis of the drainage network, an analysis of geomorphic aspects (linear, areal, relief) and dynamics.
- **C.2: Flood hydrological response analysis and geospatial risk mapping**
In connection with the study of hydrological and morphometric parameters, Component 2 will document the hydrogeomorphic response of the Nam Phak River and its Nam Ma tributary to the previous floods (in particular the 2022 flash flood), and drought episodes (in particular the 2019 drought) together with geospatial mapping of flood and drought hazards⁹. This will entail identifying and delineating the functional morphological units corresponding to the past floods (annual, frequent, and exceptional) within the watershed. The study will rely on both scientific data and communities' perceptions of the risks they face, their causes and consequences. The analysis will, as far as reasonably practicable, allow to: (i) delineate the flood and drought hazard areas; (ii) determine the main critical areas, where communities are the most vulnerable to floods and droughts and how it impacts their livelihoods; (iii) identify the water levels for annual, frequent, and exceptional floods VS droughts.
- **C.3: GIS- and RS- based Land Use/Cover (LULC) change analysis**
Land Use Land Cover (LULC) is crucial to investigate land use patterns and help forecast future sustainable watershed management. The aim of Component 3 is to analyze spatial and temporal dynamics of LULC from 1995 to 2025 and to examine the relations between changes in LULC and floods in the study zone and more generally the Nam Phak watershed. Complementing this diachronic dimension, the LULC analysis for the years 2023-2024 will assess the social response to the 2022 flash floods.
- **C.4: Upland forest and riparian vegetation geospatial and landscape analysis and localization of key deforested/degraded areas**

⁹ For a recent example of morphometric analysis integration in flood zoning studies, see e.g., Alam, A., Ahmed, B., and P. Sammonds. 2021. [Flash flood susceptibility assessment using the parameters of drainage basin morphometry in SE Bangladesh](#). *Quaternary International* 575-576 : 295–30.

As for the Component 3, this Component will document the relations among upland forest/riparian vegetation, process, and landforms in the study zone through a diachronic analysis and mapping of the evolution of the forest spatial patterns over three decades. It will include a diagnosis of the main critical areas 1) affected by forest loss 2) particularly subject to runoff and erosion 3) where the forest/vegetation loss has a direct impact on communities' livelihoods.

- **C.5: Recommendations for technical intervention**

Based on hydrological, LULC, as well as catchment characteristics, the Component 5 will aim at drafting guidelines for interventions towards sustainable watershed management and, in particular, flood and drought management. This will include, but not limited to, (i) a list of critical areas to consider for nature-based solutions; (ii) a list of the most suitable nature-based solutions, linked to each critical area.

III. Methodology

An appropriate methodological approach will have to be defined by the selected consultant and validated by his/her supervisor and the CCL. The methodology guidelines suggested in section II of this ToR are indicative and may be reassessed based on technical feasibility. It is expected that the consultant will mainly rely on **Geospatial analysis** (which can be carried out remotely) through GIS and remote sensing explorations. Based on a diachronic approach, the geospatial analysis aims at working on the historical images available, comparing them with the latest images available. The choice and number of years for the analysis will be defined jointly by the consultant, the supervisor and CCL depending notably on the availability and quality of existing geospatial data. This remote work will constitute the main part of the consultancy. If wished by the consultant, a preparatory field work can be conducted beforehand, in order to get a better idea of the situation in the field.

IV. Deliverables and Timeline

- **C.1: Report on the characterization of the hydrological and morphometric parameters of Nam Phak River watershed**

This will include, but not limited to: a location map of the Nam Phak watershed and its sub-watersheds (including Nam Ma watershed) with their Digital Elevation Model (DEM) and major streams; a map of terrain profile of Nam Phak River watershed; a map of the drainage pattern of the Nam Phak River and streams. If possible, the whole watershed will be mapped with a special focus on the area including the target villages.

- **C.2: Report on the geospatial analysis of flood and drought hazards.**

This will include a mapping of the areas impacted by the past main flood and drought episodes. Moreover, based on the analysis of past events as well as spatial vulnerability of communities to such events, it will include a map of current flood and drought risks. It will also include a list and analysis of the main drivers of floods and droughts, especially the drivers linked to landscape management.

- **C.3: Report on the Land Use/Cover (LULC) change analysis.**

This will include: LULC maps for selected historical years¹⁰ and, if relevant, an analysis of the effects of spatiotemporal LULC dynamics on flood/drought occurrence and

¹⁰ The number and selection of years to be analyzed will be decided conjointly with the consultant.

hazard levels. A map illustrating the social response to the 2022 flash flood, in terms of land uses, will also be developed.

- **C.4: Report on the upland forest and riparian vegetation analysis**

This will include a land cover mapping of the forest and riparian vegetation to assess spatio-temporal changes in the watershed. It will also include a mapping of the critical zones affected by forest loss, subject to degradation and having a direct negative impact on livelihoods.

- **C.5: Final summary and technical recommendation report.** This report will discuss the main results of the components C.1 to C.4, and on this basis gives technical recommendations for intervention. This may include the identification of key forest areas to be protected and/or reforested as well as other potential levers for slowing down run-off, including through the implementation of nature-based solutions on the slopes and within the thalwegs.

- **Scientific publication**

In case of a mutual interest, the study could be included in a publication on the inter-community management of the watershed.

The study is expected to span over November and December 2025.

The working language for the purposes of this consultancy is English, thus the final deliverables must be submitted in English. Final reports must be submitted as PDFs.

All maps, photographs and tables used for the purpose of this study will be submitted as separate image files with high resolution. Geographic Information System (GIS) data (layers, maps) and sources used for the analysis will be submitted as separate files. The consultant shall ensure, as far as is reasonably practicable, the operability of all GIS layers and maps associated with the study with QGIS open-source software.

V. Profile of the consultant

The consultant will be selected based on proven experience and meeting the following criteria:

- Master in one of the following fields: Integrated Water Resources Management, Hydrology in Water Resource Management (research-based).
- Proven experience (previous consultancy, university project) in hydrology and geomorphology, geospatial data collection/integration/analysis (GIS, remote sensing), including hydrological mapping, morphometric analysis, GIS- and RS-based Land Use/Cover (LULC) change analysis, flood hazard mapping.
- Proven experience (previous consultancy, university project) of field work with rural communities, especially on data collection and participatory approaches.
- Knowledge in upland forest, riparian vegetation and nature-based solutions.
- Fluent in spoken and written English.

VI. Selection and application process

The candidates (national or international) must submit an expression of interest including the following items:

- A Curriculum Vitae of the consultant(s) involved.
- A technical proposal which includes the description of the method followed to complete each step of the consultancy.

- A financial proposal which details the consultancy fees (related to the number of working days required and every expense expected to be made to reach the objectives of the consultancy).

For any question about this call of interest, please contact Mr. Dorian Dejae: dorian.dejae@ccl-laos.org

Offers are due by the 3 of November 2025 and must be submitted per email to: the CCL Director, Mrs. Manivone Vorachak, manirachak@gmail.com, the Project Advisor, Mr. Dorian Dejae dorian.dejae@ccl-laos.org.

After reviewing the application, the consultant will be invited to an interview.