



LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MINISTRY OF PUBLIC WORKS AND TRANSPORT

DEPARTMENT OF ROADS

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The Southeast Asia Regional Economic Corridor and Connectivity Project (P176088)

**FEASIBILITY STUDY AND ENVIRONMENT
AND SOCIAL ASSESSMENT (ESA) STUDY FOR
IMPROVEMENT AND MAINTENANCE OF NATIONAL ROAD 2**

**National Road Climate Resilient Improvement and
Maintenance in NR2**

Biodiversity Management Plan (BMP)

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Acronyms and Abbreviations

Acronyms/Abbreviations	Definition
BMP	Biodiversity Management Plan
CITES	Convention on International Trade in the Endangered Species of Fauna and Flora
CR	Critically Endangered
DAFO	District of Agriculture and Forestry
PAFO	Provincial Office of Agriculture and Forestry
DoE	Department of Environment
DoI	Department of Inspection
DoR	Department of Roads
DoT	Department of Transport
DPC	Department of Planning and Cooperation
DPWT	Provincial Department of Public Works and Transport
DWR	Department of Water Resources
E&S	Environmental and Social
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EN	Endangered
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMMP	Environmental and Social Management and Mitigation Plan
ESMP	Environmental and Social Management Plan
FS	Feasibility Study
GOL	Government of Laos
GRM	Grievance Redress Mechanism
IBA	Important Bird Area
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature and Natural Resources
KBA	Key Biodiversity Areas
MAF	Ministry of Agriculture and Forestry
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and the Environment
MPAC	Master Plan for ASEAN Connectivity
MPWT	Ministry of Public Works and Transport
NGO	Non-governmental Organization
NPA	Nationally Protected Area
NR2E	National Road 2 East
NR2W	National Road 2 West
NRERI	Natural Resources and Environmental Research Institute
OHS	Occupational Health and Safety
OP	Operational Policy
OPWT	Office of Public Works and Transport
PDR	(Lao) Peoples Democratic Republic
PMU	Project Management Unit
PONRE	Provincial Department of Natural Resources and Environment
WB/WBG	World Bank/ World Bank Group

1. INTRODUCTION

1.1 Overview

This Biodiversity Management Plan (BMP) is part of the process of compliance with the World Bank Environmental and Social Framework (ESF) in relation to the Southeast Asia Regional Economic Corridor and Connectivity Project (SAERECC). The proposed SEARECC project will support the Government of Lao PDR (GoL) to improve regional and domestic trade and climate resilient transport connectivity along an East-West corridor in Southeast Asia, and to provide immediate and effective response in case of an Eligible Crisis or Emergency. It has five components:

- Component 1: Lao PDR and Regional connectivity enhancement;
- Component 2: Logistics services development and border-crossing management;
- Component 3: Strengthening institutional capacity and regulatory framework in agriculture, transport, and investments planning;
- Component 4: Project Management; and
- Component 5: Contingency Emergency Response.

This Project falls under Component 1. This subcomponent supports the improvement and maintenance of the climate resilience and safety of selected sections of NR2W¹ to meet the Asian Highway Class III standards. This includes widening of the road from 6 meters to 8 meters (6 meters of the carriageway and 2 meters of shoulders – 1 meter each side to accommodate pedestrian safety) and rest areas. The Output and Performance-Based Road Contracts (OPBRC), with three years for construction, for which the payments are based on completed road subsections, and seven years for operations and maintenance, for which the quarterly payments are made based on the fulfillment of the service level specified in the contract. The Department of Road (DOR), MPWT, will be the lead implementing agency for this subcomponent.

The Project Development Objectives (PDOs) are to improve regional and domestic trade and climate resilient transport connectivity along an east-west corridor in Southeast Asia, and to provide immediate and effective response in case of an Eligible Crisis or Emergency.

An Environmental and Social Impact Assessment (ESIA) study has been carried out to meet the environmental and social requirements of World Bank. Within the scope of ESIA studies, the Consultant has prepared an ESIA Package containing the following documents:

- Environmental and Social Impact Assessment (ESIA)
- Biodiversity Management Plan (BMP)
- Stakeholder Engagement Plan (SEP)
- Resettlement Action Plan (RAP)
- Labour Management Plan (LMP)
- Gender Action Plan (GEP)
- Environmental and Social Management Plan (ESMP)
- Ethnic Groups Engagement Plan (EGEP)

¹ The NR2E sections will be financed by EIB in parallel to this project.

Biodiversity Management Plan (BMP) is one of the documents submitted within the scope of the ESIA package, describes the measures and controls developed in line with the mitigation hierarchy for the management of the impacts identified during the ESIA process, determines the implementation schedule, roles and responsibilities, reporting and monitoring requirements. The primary aim of the BMP is to safeguard and promote viability of priority species and habitat associated with the Project. The key priority of the Project is to support for the conservation of biodiversity in the national conservation, protection forests and rivers in close proximity to the Project, including Phou Hippi National Protected Areas (NPA), Nam Beng National Protection Forest (NPF), Nam Phak, Nam Kor and Nam Beng rivers. This BMP provides a framework for the implementation of the Project's biodiversity mitigation and management measures during the planning/preconstruction, construction and operation phases of NR2 that will be followed by the Project's contractors and other concerned agencies (e.g., MPWT/PMU, WB, EIB). An outline of biodiversity monitoring and evaluation strategy has been included to evaluate the efficiency and success of biodiversity management measures and enable adjustments to be made if required. Implementation of this BMP will ensure the Project's alignment best practice, legislative requirements and the Project's commitments to biodiversity, including ESS 6 of the World Bank' ESF: Biodiversity Conservation and Sustainable Management of Living Natural Resources. This plan is dynamic document that will be adapted and updated as and when new information becomes available throughout the lifespan of the Project to ensure its relevancy.

1.2 Project Description

1.2.1 The Proposed Road Alignment

The Project is located in the northern part of Lao PDR, approximately 295 km in length, comprising NR2 West (NR2W, 145 km) and NR2 East (NR2E, 150 km), which entails improvement and maintenance of an existing road from Pakbeng, Houn, Beng and Xay districts, Oudoxay province (NR2W), and then from Xay, Lar districts, Oudomxay Province, to Khoua district, Phongsaly province (NR2E). The proposed footprint of road (NR2) alignment follows the existing road, which lies in the middle of the Nam Beng National Protection Forest (NR2W), and in close proximity to the national conservation forest designated as the Phou Hippi National Protected Area, which the road sites along the bank of the Nam Phak River on the left-hand side, whereas the boundary of NPA follows another side of the river's bank (see Figure 2).

1.2.2 Road Design

The proposed road will comprise two lanes and will vary in width from 6 meters to 8 meters (6 meters of the carriageway and 2 meters of shoulders – 1 meter each side to accommodate pedestrian safety). The road will also be fitted with safety barriers, retaining walls, protection walls and a drainage system. The road will be surfaced with asphalt and the maximum slope of the road will be 8% according to the predicted standards. More detail description of road design was provided in ESIA, which follow Standard of the Road Design Manual of Ministry of Public Works and Transport (Lao PDR) 2018.

1.2.3 Construction Approach

While there is much uncertainty regarding the detailed methods of construction at this stage in the project development, some key aspects of the approach have been identified. For example, some trees, bushes and topsoil will be cleared using graders/bulldozers on either side of road in some sections to expand. The exact area of land clearance beyond the road footprint is clearly determined in the road design, and also it has been assessed that there are 40 species of 260 big trees (≥ 30 cm DBH, diameter in breast height), of which 131 and 129 trees are in NR2E and NR2W, respectively, and bushes to be removed from the project corridor in sections where the road is expanded. Most of them are not listed in the globally threatened species and found common in other conservation forests in Laos. The excavated materials, e.g., topsoil and rocky substrate, will be stockpiled and reused for construction and landscape restoration. Technically, the stockpile areas will be located close to the proposed road alignment and will include a few temporary waste disposal sites for storing inert materials, which they will then be closed and rehabilitated after completion of the construction. Vegetation within the stockpile areas will be rehabilitated after the use. The exact locations of the stockpiling sites and borrow pits are unknown at this stage in the project development, but consideration will be given to the distances from headstreams or water surface, and distance from natural habitats. The waste materials will be disposed in accordance with the Environmental Health and Safety Guidelines (EHSg) and the national requirements, and the approach will be approved by local authorities. Water from waterbodies located in the project area, e.g., Nam Phak, Nam Kor, Nam Beng rivers and tributaries, will be used for construction activities and for consumption by the workforce. Personnel facilities such as a portable office and cabins for storage of personal items and equipment will also be installed within the project area but the exact location is unknown. The power supply to the office will be accessed through the existing network, and the temporary accommodation will be built in nearby the project area for use of workforce.

1.2.4 Timelines

It is anticipated that the proposed road will take 36 months for construction and 84 months for maintenance. Ministry of Public Work and Transportation (MPWT) will be responsible for the monitoring and maintenance work. The MPWT will retain a quality assurance role for monitoring the establishment of habitats and species relevant to the Project area.

1.3 The Project's Approach to Biodiversity and Natural Resources Management

A summary of the Project's approach and commitments to achieving best practice biodiversity management are listed as follows:

- Identification and characterization of biodiversity baseline condition for the Project based on primary and secondary data sources.
- Identification of important biodiversity features, i.e., priority species and natural habitat, of high conservation value and relevance to the Project based on critical habitat screening.

- Application of the mitigation hierarchy to avoid, minimize and rehabilitate the Project related impacts to these biodiversity features during Project construction and operation.
- Adherence to national regulatory requirements.

The proposed NR2 W & E road scheme forms part the regional and local roads connectivity, a main transport corridor that connects Lao PDR with Vietnam and Thailand (Fig 2). This project focuses on the role that improved roads can play in enabling connectivity-driven economic gain, particularly in the agricultural, logistic, and tourism sectors, which are key drivers of growth and employment in the northern part of the country. This infrastructure project complies with the existing laws, regulations and practices in Laos as well as with the Bank's Operational Policies on Environmental Assessment, Involuntary Resettlement and Bank's Environmental and Social Performance Requirements, and that project will not have a lasting adverse impact on the natural environment or properties of particular cultural value.

1.4 Purpose and Scope of Biodiversity Management Plan (BMP)

The purpose of this BMP is to outline the strategies to be employed for the management of biodiversity along the NR2. This BMP is a framework for managing Project risks and impacts on biodiversity and to identify and prioritize appropriate impact management actions. BMP is a requirement for EIB Environmental and Social Standards and ESS 6 of the World Bank' ESF compliance. This BMP:

- collates diverse biodiversity management measures in one place, despite various department responsibilities for their implementation.
- facilitates communication about sound project biodiversity risk management to external audiences.
- provides reassurance that risks and impacts are being managed, and ensure investment is prioritized towards actions that most cost-effectively tackle highest risks or impacts.
- brings potential risks and impact arisen from construction and operation of NR2 (W & E).
- should take actions and measures necessary for the effective management of biodiversity along the NR2 (W & E)
- provides a basis for planning and tracking progress.

This BMP fits within the impact assessment process and is a key component of the Project's Environmental and Social Management and Monitoring Plan. The scope of this BMP includes:

- management measures to mitigate adverse impacts during construction and operation phases.
- a description of the ecological monitoring and reporting commitments including location, frequency and key performance indicators for adaptive management.

- a description of roles and responsibilities
- a presentation of the proposed schedule of works.

1.4.1 Mitigation Hierarchy

The Project has applied the steps of the mitigation hierarchy so that potential adverse project-related impacts are avoided, minimized and restored or rehabilitated where possible. The mitigation hierarchy is a framework for managing biodiversity and ecosystem services risks as well as direct and indirect project-related impacts to biodiversity receptors and important ecosystem services (CSBI, 2015)². The Project's adherence to the steps of the mitigation hierarchy is a requirement of the World Bank' ESF/ESS 6: Biodiversity Conservation and Sustainable Management of Living Resources. The steps of mitigation hierarchy are defined in the World Bank' ESF as follows:

Step 1: Anticipation and Avoidance: Avoidance is the most preferred form of mitigation. As a first step, the environmental and social assessment will identify and evaluate technically and financially feasible alternatives (including location, technology, and or alignment options). When determining technical and financial feasibility of alternatives, both cost and benefits should be considered. The evaluation should impact on project design enabling the Borrower to choose alternatives that anticipate and avoid adverse environmental and social risks and impacts.

Step 2: Minimization: Where avoidance is not possible, the environmental and social assessment will identify specific actions to minimize or reduce adverse environmental and social risks and impacts that are likely to arise throughout the project life cycle. For example, this could include reducing the physical footprint of a project; reducing impacts on the climate by choosing alternatives with lower carbon emissions; or selecting infrastructure, equipment, and technology options that support efficient use of resources (including energy, water, and raw materials) and reduce generation of wastes throughout the project life cycle.

Step 3: Mitigation: To manage the residual risks and adverse impacts (after the avoidance and minimization steps), the environmental and social assessment will identify mitigation measures by establishing specific actions to ensure the project will meet the requirements of applicable ESSs 1-8 and comply with relevant national laws and regulations. In case of existing facilities, these actions will include measures to rectify the prevailing risks and adverse impacts identified in the environmental and social audits or due diligence reports. All these measures, including a suite of other thematic plans or mitigation measures required under other applicable ESSs (for example, Resettlement Plans, Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Community Plans, Biodiversity Management Plans, and so forth), normally form part of the environmental and social management plan (ESMP) for the project.

Step 4: Offset or Compensation³: Where avoidance, minimization, or mitigation is not adequate to manage significant adverse risks and impacts, it may be appropriate to design and

² A cross-sector guide for implementing the Mitigation Hierarchy

³ Notedly, it is noted that offset measures are not permitted according to the EIB's E&S standards.

implement measures that compensate/offset for residual risks and impacts. These measures do not necessarily eliminate the identified adverse risks and impacts, but they seek to offset them with comparable positive ones. Environmental offsets are a cost-effective way to ensure that even though damage will occur, there is compensation for that damage. Even within environmental offsets, there is a hierarchy that is followed. Restoration, creation, enhancement, and preservation comprise this hierarchy (the last two measures particularly concern habitats that are under severe threat of extinction/ degradation).

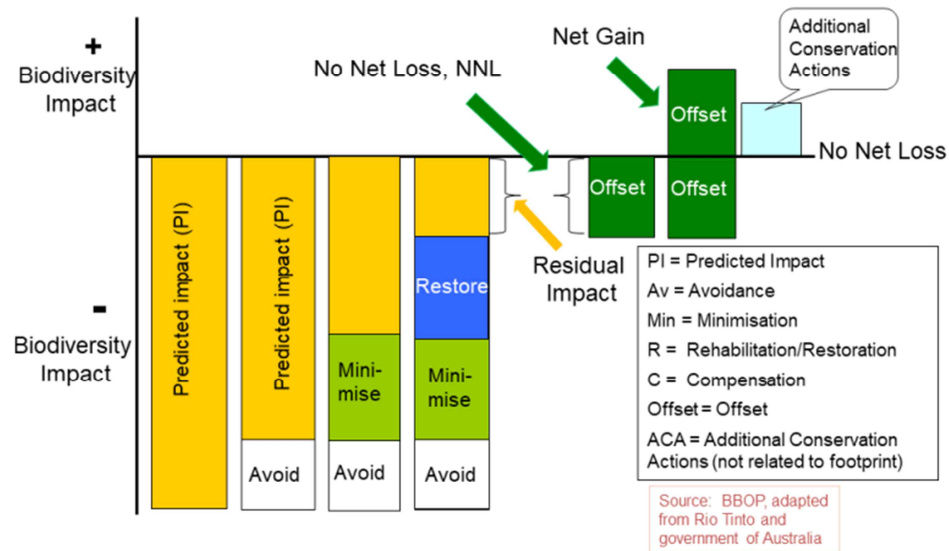


Figure 1. The Mitigation Hierarchy (BBOP, 2019)

1.4.2 Stakeholder Consultation and Engagement

In the context of this BMP, stakeholders are individuals, groups or organizations (government and non-government organizations (NGOs) that either affect, are affected by, or have an interest in biodiversity management. Stakeholder consultation and support is integral to the design and implementation of any BMP and it is important that stakeholders are engaged in this project's BMP process. This has been partly achieved through consultation with biodiversity related stakeholders, such as;

- Provincial and District Agriculture and Forestry Offices (P/DAFOs)
- Provincial and District Natural Resources and Environment Offices (P/DONRE)
- Provincial/district Division of Public Works and Transport
- Biodiversity experts
- Village headman/elders represented from communities whose access to or use of ecosystem services may be affected

The consultation involves a discussion of the current ecological understanding of national protected area and national protection forest as well as village forests, identification of key priority features for the project, the likely significant effects for each feature, and the

identification of key avoidance and mitigation measures. Feedback was collated and used it as part of mitigation measures in this BMP.

1.5 Policies and legal framework

This BMP is developed aligned with national laws and regulations as summarized below.

1.5.1 National Legislations

Table 1. Summary of relevant laws and regulations

National strategies/plan	Context
Forest Law, 2019 No. 64 /NA 13 June 2019	<p>The law seeks to secure effective protection and sustainable use of forest resources and forest land by enriching forests, increasing forest cover, making them as tourism resources, sustainable sources of living and use for the people, ensuring a sustainable condition and protection of soil, climate, water resources, biodiversity, environment in compliance with green and sustainable growth directions. For management purposes (Article 14), the forests in Lao PDR are classified into three categories: (i) Protection Forests; (ii) Conservation Forests; and (iii) Production Forests.</p> <ul style="list-style-type: none"> ❖ Protection forest (Article 15) is defined as: 'forest and forest land classified for the protection of watershed areas, river banks, road sides and the prevention of soil erosion. It also includes areas of forest land significant for national security, areas for protection against natural disaster and protection of the environment and other areas.' Protection Forests comprise national, provincial, district and village Protection Forests, as specified in a specific regulation. ❖ Conservation forest (Article 16) is defined as: 'forest and forest land classified for the purpose of protecting and conserving nature, faunal and flora, forest ecosystems and various other things which have historical, cultural, tourism, environmental, educational and scientific research value. ❖ Production Forest (Article 17) is defined as: “forests, both natural forests and planted forests, that are designated for use and production. These areas are designated as such to support the production of wood and forest products, and to satisfy the needs of national socio-economic development where necessary”.
Decree on Protected Area No. 134 (based on the last update version to be approved by the government soon).	<p>This decree addresses their effectiveness and sustainability with the objective of protecting the environment and biodiversity, preserving water sources, preventing soil erosion, maintaining land quality, conserving strategic lands for national defense and public security purposes, enhancing climate change resilience and mitigation, providing a space for tourism and recreation, and addressing global warming-related issues thus contributing to improved well-being and livelihood of Lao multi-ethnic peoples and fostering the nation’s socio-economic development.</p> <p>The Protected Areas are classified into 4 levels;</p> <ol style="list-style-type: none"> 1) National Protected Areas (>50,000 h); 2) Provincial and Capital City Protected Areas (b/w 5-50,000 h); 3) District and Municipality Protected Areas (100 – 5,000 h); 4) Village Protected Areas (~ 100 ha).

National strategies/plan	Context
Wildlife Law No.07/NA, 2007	<p>Article 10 Wildlife and Aquatic life regulations are divided into three categories:</p> <ol style="list-style-type: none"> 1) Prohibition category wildlife and aquatic; 2) Management category wildlife and aquatic; 3) Common or general category wildlife and aquatic <p>Article 24 defines species of wildlife and aquatic allowable for hunting in specified season and tools used for hunting. The catching and hunting animals for business purposes require the permission.</p>
Land Law No.70/NA, 2019	<p>The objectives of the Land Law are to determine the regime on the Management, protection and use of land in order to ensure efficiency and conformity with [land-use] objectives and with laws and regulations and to contribute to national socio-economic development as well as to the protection of the environment and national borders of the Lao People's Democratic Republic. For land use purposes (Article 19), each category of land shall be used for the following purposes;</p> <p>Conservation purposes include protection forest areas, protected forest areas, production forest areas, wetland areas and other categories of lands that are preserved by the State to protect the ecosystem and environment including the protection of border land areas;</p> <p>Development purposes are areas used for agricultural production for food security, and zones designated an area of construction, industry, energy, mining, Special Economic Zones, communication, culture, tourism, national defense and security, etc.</p>
The Law on Aquatic and Wildlife (2007)	<p>The law promotes the conservation, protection, development, and sustainable regeneration of wildlife and aquatic. The law aims at increasing the population of wildlife and aquatic in order to meet the need for social-economic development while considering the environment and livelihood improvement.</p>
Environmental protection law, 2012	<p>The Law defines principles, regulations and measures related to environmental management, monitoring of protection, control, preservation and rehabilitation, with quality, of mitigating impacts and pollution created by anthropogenic loads or by nature, aiming to provide balance between social and natural environment, to sustain and to protect natural resources and public health, and contribution into the national socio-economic development and reduction of global warming. Article 15 addresses that environmental prevention as to (i) prevent against impacts on people's lives, health, shelters and productions, and (ii) prevent against impacts on forests, water resources, animals and natural biodiversity and resources, including climate change.</p>
National Biodiversity Strategy and Action Plan 2016-2025	<p>The National Biodiversity Strategy and Action Plan (NBSAP) 2016–2025 seeks to protect the country's diverse and economically important ecosystems including the species and genetic diversity by achieving national goal of 70% forest cover as stipulated in the NBSAP-strategy 1, specifically, the Sub Strategy 1.1 Protection of Forest Ecosystems, and Sub Strategy 1.5 Protected Areas Management and Species Conservation.</p>
Forest Strategy 2030 (FS2030) - draft	<p>The drafted FS2035 set the target in that “By 2030, Lao PDR has abundant healthy forest resources as a national resource/asset, as a potential for socio-economic development, environmental protection and biodiversity and as a source of livelihood for the people. Ensure that forests and forest lands, which cover 70% of the country's land area, be managed, protected and developed in</p>

National strategies/plan	Context
	a green and sustainable manner with the participation of the people, and in accordance with the law.”
National Green Growth Strategy of the Lao PDR till 2030	The Strategy provides key guidance and instruments to strengthen the balance between economic expansion, environmental protection, and social development to ensure the maintenance of high, stable, sustained and durable economic growth, which focuses on: (1) encouraging and promoting the economic growth and poverty reduction in a comprehensive, inclusive and fair manner, (2) raising the efficiency and effectiveness of the utilization of limited natural resources of the country to ensure optimal benefits; (3) economic growth that is clean and environmentally-friendly and that decreases wastes and greenhouse gas emissions; and (4) increasing the economic resilience to climate change, natural disasters and of global economic uncertainties.

1.5.2 World Bank ESF

The Project will also ensure compliance with the requirements of the WB ESF and their Environmental and Social Standards, including:

ESS1: Assessment and Management of Environmental and Social Risks and Impacts sets out responsibilities to assess, manage and monitor environmental and social risks and impacts associated with each phase of the project, supported by the World Bank with Investment Project Financing (IPF).

ESS2: Labor and Working Conditions, describes the importance of creating employment and income for comprehensive financial development and poverty reduction.

ESS3: Resource Efficiency and Pollution Prevention and Management, refers to resource efficiency and pollution prevention and pollution management requirements with a holistic approach in project implementation.

ESS4: Community Health and Safety, emphasizes health, safety and security risks and their impact on communities due to project activities.

ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement requires avoiding compulsory resettlement, if not avoided, necessary measures should be taken to reduce negative effects on displaced people.

ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources requires conservation and preservation of natural resources living with biodiversity is essential in ensuring sustainable development.

ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities encourages the development process of these communities to respect the human rights, identity, culture and lifestyles based on natural resources.

ESS8: Cultural Heritage states that cultural heritage provides continuity in concrete and abstract forms between past, present and future. Necessary measures should be taken to protect cultural heritage in the implementation of the projects.

ESS10: Stakeholder Engagement and Information Disclosure emphasizes the importance of open and transparent participation between the client and stakeholders, and good international

practice is an essential element. It contributes to projects in terms of effective stakeholder engagement, improving environmental and social sustainability, increasing project acceptance and successful project design.

1.5.3 EIB Environmental and Social Standards

The EIB is a public entity that is guided by the European Union's policy goals and principles of sustainable development, public engagement, and accountability. It aims to promote sustainable and inclusive growth while safeguarding the natural and social environment in a comprehensive manner, ensuring that environmental and human well-being requirements are included in the definition, preparation, and implementation of all EIB-financed activities.

The EIB also recognizes the need for a proactive approach to guarantee that environmental and social factors are considered early in the strategic decision-making process by promoters to have a real impact on the development options available. To that end, the EIB encourages the use of the strategic environmental assessment as a tool for identifying and analyzing prospective plans and program impacts.

The EIB environmental and social elements that must be evaluated (version February 2022) include:

- Environmental and social impacts and risks
- Stakeholder engagement
- Resource efficiency and pollution prevention
- Biodiversity and ecosystems
- Climate change
- Involuntary resettlement
- Vulnerable groups, indigenous peoples, and gender
- Labor rights
- Health, safety, and security
- Cultural heritage

1.6 EIB Environmental and Social Standards and World Bank environmental and social standards (ESS) Applicable to the Project & Gap Analysis with National Regulations

This section sets out in tabular format the relevant WB ESS and any gaps between them and national regulations. As noted above, an IEE completed to national standards, as well as a lender compliant ESIA have been prepared to ensure that all relevant regulatory and lender requirements are included in the Project.

Table 2: Gap Analysis

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
<p>ESS1: Assessment And Management Of Environmental and Social Risks and Impacts</p> <p>Standard 1 – Environmental and Social Impacts and Risks</p>	<ul style="list-style-type: none"> • Conduct an environmental and social assessment of the proposed project, including stakeholder engagement. • Undertake stakeholder engagement and disclose appropriate information in accordance with ESS10 / Standard 2. • Develop an ESCP, and implement all measures and actions set out in the legal agreement including the ESCP. • Conduct monitoring and reporting on the environmental and social performance of the project against the ESSs / EIB Standards. • Preparation of an ESMP 	<ul style="list-style-type: none"> • A broad guidance for E&S assessment is articulated in the Environmental Protection Law (2012), Article 21 (for IEE), and Article 22 (for EIA). • Further guidance for the conduct of ESIA and ESMP is provided in the Decree on Environmental Impact Assessment (2019), and the Decision on EIA process (2013). • The Decision on the Endorsement and Promulgation on the List of Investment Projects and Activities (No.8056/MONRE, 2013) indicates that improvement or rehabilitation of 	<ul style="list-style-type: none"> • The Lao PDR’s regulation requires the conduct of IEE for national road improvement, not ESIA and less focus on social issues • No capacity of the project owner to implement and monitor the ESMP is required. • There is no provision for the “no project” option. • No reference to institutional capacity development and training measures. • No separate ESCP, SEP and/or EGEP is required by the Lao laws. 	<ul style="list-style-type: none"> • The ESIA in-hand ensures that all key differences are addressed, including no project option and capacity building and training measures. • Separate SEP & EGEP prepared. • Project includes requirements to follow ESOM where relevant. • ESMP in hand provides measures to ensure implementation of the ESMP.

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
		<p>existing national or provincial roads required only the conduct of IEE. However, the final clause of this Decision asserts that any projects that cause involuntary resettlement shall require the conduct of ESIA.</p> <ul style="list-style-type: none"> Environmental and Social Operations Manual for Road Sector (2009) also provides additional E&S requirements for road sector projects. 		
<p>ESS2: Labour and Working Conditions</p> <p>Standard 8: Labour Rights</p> <p>Standard 9: Health Safety</p>	<p>ESS2, Standard 8 and 9 establishes minimum requirements in the following areas to be observed:</p> <ul style="list-style-type: none"> Terms and Conditions of Employment 	<ul style="list-style-type: none"> The employee rights and working conditions are specified in the Labour Protection Law (2013) which has provisions that are consistent with the 	<ul style="list-style-type: none"> In Lao PDR, the Trade Union is managed under the government system which are not a collective association of workers. However, the WB's ESS2 outlines that the project will not restrict project workers from developing 	<ul style="list-style-type: none"> The national Labour Law is highly consistent with ESS2 and Standard 8. However, to address some of the gaps, the project's LMP includes:

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
and Security	<ul style="list-style-type: none"> • Non-Discrimination and Equal Opportunity • Rights to Organize. • Prevention / restriction of child Labour • Prevention of forced Labour • Grievance Mechanism for Labourers • Identification of potential hazards • Provision of preventive and protective measures • Training of workers and maintenance of training records • Documentation and reporting of occupational accidents, disease, and incidents. • Emergency Preparedness; and 	<p>Bank’s ESS2;</p> <ul style="list-style-type: none"> • In addition, the Prime Minister’s Notification on the Minimum Wage of Labour in Lao PDR (2018) also sets out a minimum wage of LAK 1.1 million/month. • The Law on Grievance Redress (2016) also outlines conflict resolution procedures. 	<p>alternative mechanisms to express their grievances and protect their legitimate rights regarding working conditions and terms of employment. The Borrower should not seek to influence or control discriminate to retaliate against project workers who participate, or seek to participate, in workers’ organization and collective bargaining or alternative mechanisms.</p> <ul style="list-style-type: none"> • There is no specific national guidelines for labour conflict resolution. 	<ul style="list-style-type: none"> • Procedure to Prevent Child Labour and Forced Labour (PPCLFL). • Project Workers’ Grievance Mechanism. • In addition, the LMP sets out requirements for additional measures to comply with ESS2 and Standard 8, which will include: <ul style="list-style-type: none"> ○ Direct Project Workers’ Occupational Health and Safety Strategy ○ Terms and Conditions of Employment for Direct Project Workers. ○ Environmental, Social, Health and Safety

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
	<ul style="list-style-type: none"> • Remedies for adverse impacts on workers safety, • including occupational health, and safety and SEA/SH. • Zero tolerance for the use of forced labour⁴ and child labour⁵; • Respecting the principles of freedom of association and collective bargaining; 			<p>Specification (ESHSS) for contracts.</p> <ul style="list-style-type: none"> ○ Community Labour Management Procedure. ○ Provisions in location and site - specific ESMP ○ Site-specific Occupational Health and Safety Plans (works) ○ The project will only allow employment of people 18 years old and above.
<p>ESS3: Resource Efficiency and Pollution Prevention and</p>	<p>Resource Efficiency and Pollution Prevention requires project to:</p> <ul style="list-style-type: none"> • Promote more sustainable use of resources including 	<ul style="list-style-type: none"> • Key legislation regarding resource efficiency and pollution prevention includes the Decree on Lao PDR National Environmental 	<ul style="list-style-type: none"> • There is a lack of national policy for enhancing the resource efficiency of infrastructure particularly the use of construction materials, e.g., sand, 	<ul style="list-style-type: none"> • ESS3 and Standard 3 will be implemented to apply a precautionary approach that complements the national regulation that

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
<p>Management Standard 3: Resource Efficiency and Pollution Prevention</p>	<p>energy and water and the reduction of project related GHG emissions; and</p> <ul style="list-style-type: none"> • Avoid or minimize pollution from project activities. • Ensuring consistency with the “Do Not Significant Harm” principle and thus contributing to the achievement of the “zero pollution” 	<p>Standards (2017); Ministerial Instructions on Hazardous Waste Management (2015); and the Law on Environmental Protection (2012); Decision on Pollution Control (2021), Decree on Energy Saving and Efficiency (2020), National</p> <ul style="list-style-type: none"> • Policy on Energy Efficiency (2016), Law on Water and Water Resources (2017). 	<p>gravel.</p>	<p>ensures the rational and sustainable resource uses, manage, and prevent the pollution.</p> <ul style="list-style-type: none"> • Standard Waste Management Plan will be required from the Contractor. • Measures to manage extraction activities are included in the ESMP and ESIA
<p>ESS4: Community Health and Safety Standard 9: Health Safety and Security</p>	<p>The Bank’s Standards requires for Community Health, Safety and Security and requires projects to:</p> <ul style="list-style-type: none"> • Avoid or minimize adverse impacts on the health and safety of project affected communities; and • Ensure safeguarding project 	<ul style="list-style-type: none"> • Key legislation for community health, safety, and security in Lao PDR include the Decree on Occupational Health and Safety (2019), Law on Road Traffic (2012), Lao PDR National UXO / Mine Action Standards (2012); and discharge / 	<ul style="list-style-type: none"> • Currently, there is no national law, regulation or guideline specific to community health and safety. 	<ul style="list-style-type: none"> • The ESIA and ESMP provide specific measures to manage CHS based on GIIP.

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
	<p>property and personnel is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to project affected communities.</p> <ul style="list-style-type: none"> Identify, assess and manage risks to the health and safety of project-affected people and communities, (including to project-related gender-based violence risks including sexual harassment, exploitation and abuse) during the life-cycle of the project. 	<p>hazardous waste legislation.</p>		
<p>ESS5: Land Acquisition, Restrictions on Land Use And Involuntary Resettlement</p> <p>Standard 6: Involuntary Resettlement</p>	<ul style="list-style-type: none"> Avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs and layouts; Mitigate adverse social and economic impacts from land by: (i) Providing compensation for loss of 	<ul style="list-style-type: none"> Key national legislation related to land acquisition and involuntary resettlement includes the Law on Land (2019); Forestry Law (2019), Law on Resettlement and Vocation (2018); and the Decree on 	<ul style="list-style-type: none"> According to the Land Law (2019), Article 130: Acquisition of Customary Land Use Rights, rights can only be assigned to individuals that can demonstrate continual use of the land for more than 20 years. 	<ul style="list-style-type: none"> A resettlement action Plan has been prepared to meet the requirements of ESS5 / Standard 6.

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
	<p>assets at replacement cost; and (ii) Ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected;</p> <ul style="list-style-type: none"> • Improve or at least restore the livelihoods and standards of living of displaced persons; and • Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites. 	<p>Compensation and Resettlement (2016).</p>	<ul style="list-style-type: none"> • However, the World Bank's ESS5 articulates that those who suffer negative social and economic impacts as a result of the acquisition of land for a project and / or restrictions on land use, may include those having legally recognized rights or claims to the land; those with customary claims to land; and those with no legally recognized claims. 	
<p>ESS6: Biodiversity Conservation and Sustainable Management of Living</p>	<ul style="list-style-type: none"> • The E&S assessment will consider direct, indirect and cumulative project-related impacts on habitats and the biodiversity they support. • The Borrower will avoid 	<ul style="list-style-type: none"> • EIA process provides for analysis of all potential alternatives. There is no explicit rule providing for use of land already converted and to avoid land 	<ul style="list-style-type: none"> • Lack of clear reference to siting project on lands already converted. • In the hypothesis that no feasible alternative exists as demonstrated by an 	<ul style="list-style-type: none"> • Project activities will be confined almost exclusively to the existing alignment and Right of Way and will not include construction on lands

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
<p>Natural Resources</p> <p>Standard 4 – Biodiversity and Ecosystems</p>	<p>adverse impacts on biodiversity and habitats.</p> <ul style="list-style-type: none"> Where the project occurs within or has the potential to adversely affect an area that is legally protected, designated for protection, the Borrower will ensure that any activities undertaken are consistent with the area’s legal protection status and management objectives. 	<p>located within protected area, water catchment and area containing high forest.</p> <ul style="list-style-type: none"> However, since 2016 with WB supports (through the Environment Protection Fund), MoNRE and MAF capacity as well as the PONREs and PAFOs of Oudomxay province to protect and manage Phou Hinphee NPA and protection forest area including enforcement of wildlife trade has been strengthened. 	<p>ESIA, there is no legal obligation to provide for compensation for conversion of non- critical habitats.</p> <ul style="list-style-type: none"> There is no mention of “critical natural habitats” or prohibition on investing in projects that would degrade or convert them. 	<p>already converted.</p> <ul style="list-style-type: none"> Measures and process to avoid and/or mitigate impacts on natural habitats has been included in the ESIA.
<p>ESS7: Indigenous People/Sub-Saharan African Historically Underserved</p>	<ul style="list-style-type: none"> Requires the Borrower to avoid adverse impacts on communities of indigenous peoples and to engage with affected communities to ensure they have given their Free Prior and Informed 	<ul style="list-style-type: none"> The Decree on Ethnicity (2020) confirms that the GOL has special policies for ethnic, vulnerable and disadvantaged groups. The National Social 	<ul style="list-style-type: none"> The Land Law does not specifically mention customary to land used by ethnic and vulnerable groups who are often found to be present and have collective attachment to the forestlands in rural area in 	<ul style="list-style-type: none"> An EGEP has been prepared as a stand-alone document to cover the existing gaps. The EGEP provides proactive and inclusive approach and measures to ensure the

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
Traditional Local Community Standard 7: Vulnerable Groups, Indigenous Peoples and Gender	Consent.	Protection Strategy (2020) states that ethnic groups, women, children, vulnerable people and those living in remote areas are specially promoted to access education, health care and equal economic activities.	Laos. There is no sub-law registration with implementable procedures in place for registering communal and non-communal (individual) customary rights. This may negatively impact ethnic groups and other vulnerable communities, since excluding such communities from the benefits of land registration and overruling or replacing their actual customary land (e.g. with smaller area or poorer quality of land) could increase inequality and their vulnerability. There are no specific	vulnerable and ethnic groups will not be negatively affected by the project activities.
ESS8: Cultural Heritage Standard 10: Cultural Heritage	<ul style="list-style-type: none"> Aims to protect cultural heritage through consultation procedures, community access and removal of replicable cultural heritage. Provides specific requirements for chance finds, consultation, 	<ul style="list-style-type: none"> Key applicable national legislation includes the Law on National Heritage (2013), Agreement of the National Assembly on Ethnicity (2008) and the Decree of the President 	<ul style="list-style-type: none"> No significant gap. Reference to “chance finds” is formally lacking in applicable laws and regulations. 	<ul style="list-style-type: none"> The ESIA and ESMP includes requirements for a chance find procedure.

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
	<p>community access, removal of replicable and non-replicable cultural heritage, as well as critical cultural heritage.</p>	<p>of Lao PDR on the Preservation of Cultural, Historical and Natural Heritage (1997).</p> <ul style="list-style-type: none"> • Mandatory reporting to authorities (Ministry of Culture and Information and MPWT). The project owner and contractor must interrupt all construction activities and measures must be adopted to preserve the vestiges uncovered by chance until the classification of those assets or until conclusion of the • Archaeological research shall be prescribed by the Ministry of Culture and Information. The area of archaeological patrimony accidentally revealed must be delimited, as suitable 		

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
		<p>and protected under the responsibility of the project owner and contractor.</p>		
<p>ESS10: Stakeholder Engagement and Information Disclosure</p> <p>Standard 2: Stakeholder Engagement</p>	<ul style="list-style-type: none"> • Requires effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them. • Provides specific requirements for Stakeholder Analysis and Engagement Planning, Disclosure of Information, Consultation and Indigenous Peoples. • Establishment of a Grievance mechanism 	<ul style="list-style-type: none"> • GOL’s requirements are covered by various legislations, especially those on consultation and grievance including the Constitution, the Law on Government (amended 2016), the Law on Handling Petitions (amended 2016), as well a subordinate decree such as the EIA Decree • (2019) and the Compensation and Resettlement Decree (2016), as well as the Public Involvement Guideline (2012) and the Ethnic Group Consultation Guideline (2013) 	<ul style="list-style-type: none"> • There is a lack of clarity about when engagement activities can be considered meaningful. Those affected by a project can file grievances using the existing system, not a project-based system. There are also unclear procedures on public disclosure of E&S documents, and on how to respond to concerns and grievances of project-affected parties • The ethnic group consultation guideline (2013) is the sole document requiring consultation with ethnic groups. The EIA decree only requires dissemination of 	<ul style="list-style-type: none"> • This ESIA summarizes the SEP in terms of consultations and disclosure. A SEP consistent with ESS10 and Standard 2 has been prepared for this project. • A SEP has been developed which details a GRM for the project covering all project aspects, including concerns about environmental and social impacts. • The GRM must be accessible to all stakeholders, in particular vulnerable, ethnic group people, and women and

ESS / Standard	ESS / Standard Requirements	Lao E&S Regulations	Key Difference	How Gap is Addressed
			information to them.	suitable receive and respond to SEA/SH.
Standard 5: Climate Change	<ul style="list-style-type: none"> Assessing GHG emissions at the project level. Assessing the project's resilience to physical climate risks 	<ul style="list-style-type: none"> The decree on climate change (2019) encourages relevant authorities to adapt to climate change adaptation practices. Adaptation to climate change is an adapting of people, animals, plants, ecosystems, infrastructure, urban planning, etc. to be tolerant of climate change and to have the least impact by applying appropriate measures in reducing fragility, risks and potential damages. 	<ul style="list-style-type: none"> No specific requirement for projects to report emissions. 	<ul style="list-style-type: none"> Climate Change Adaptation Report prepared for the project and summarized in the ESIA with mitigation measures presented in the ESIA. GHG emissions assessed as part of the ESIA.

2. PRIORITY HABITATS AND SPECIES

2.1 Identification of Priority Habitats and Species

The assessment characterizes the existing biodiversity features within and adjacent environment based on the following;

- ❖ Habitat mapping
- ❖ Site visit and rapid biodiversity survey
- ❖ Literature reviews

According to the WB's ESF/ESS 6 , habitat is divided into: (i) natural habitats – where land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions; (ii) modified habitats – where there has been apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas; and (iii) Critical Habitats (CH)– a subset of either modified or natural habitats supporting high biodiversity value, including:

- ❖ Habitat of significant importance to critically endangered/endangered species (IUCN Red List)
- ❖ Habitat of significant importance to endemic and/or restricted-range species
- ❖ Habitat supporting globally significant concentrations of migratory species or congregatory species
- ❖ Highly threatened and/or unique ecosystems
- ❖ Areas associated with key evolutionary processes.

Identification of critical habitats here take consideration of criteria above, taking account areas with high biodiversity value, i.e., habitat required for the survival of critically endangered or endangered species. Priority species of high conservation value are judged accordingly to IUCN Red list of globally threatened species (i.e., Critically endangered and endangered species of plants and mammals). This assessment was based on review of published literature and data, rapid village and field survey, consultations with Forests and NPA Officials, discussions with other Stakeholders and the local Communities and cursory look at the market places show that there are very few, if any, endangered, critical or vulnerable species in the forests and parks along NR2. Only species listed in the IUCN Red List as “vulnerable” are reported to present here but they have been found more abundant in most national protected areas across Laos (see Table 6). However, the actual occurrence of species in this NPA and nearby forests is uncertain due to the areas are highly disturbed by human activities, e.g., land clearing/burning, hunting and other harvesting activities (see existing threats below). The data on wildlife species listed here are considered as species possibly occur in the Phou Hippi NPA and in the NR2 landscape. Apparently, enforcement

of the current wildlife and natural habitat protection regulations by Local Authorities appears to be lax. The Authorities also seem to be unresponsive to clearance of forest lands for agriculture use. Given the above scenarios, and there is required on the part of the enforcement agencies, to enforce the existing regulations and promote much better understanding of the importance of flora and fauna to the local environment and economy (minimize flooding, minimize erosion and impact of climate change, enhance eco service products, promote fisheries, etc.).

2.2 Overview of The Biodiversity Characteristics Adjacent/relevant to the Project

Lao PDR is in one of the 10 most important global biodiversity ecoregions and home to some of the world's biologically richest and most endangered species. The country includes four ecologically diverse regions: (a) the Northern Highlands, (b) the Annamites Range; (c) the Indo-Chinese karst landscapes; and (d) the Mekong plain. These regions give Lao PDR high levels of biodiversity, and support diverse production systems for food, fiber and medicines, as well as tourism jobs. The NR2 Project is located in the northern highlands where its biodiversity representations occur in those northern national protected areas, e.g., Phou Hhiphi NPA.

2.2.1 Protected area

The NR2 is located in close proximity to the northern part of Phou Hhiphi NPA of approximately 21 km in distance. The NR2E sites along the bank of Nam Phak River on the west whereas the boundary of NPA is on the east bank of the river. The NPA was formally established on 11th September 2012 under PM Decree 396, covering an area approximately 87,846 ha. It is one of the most degraded protected areas in terms of natural vegetation, covered by the secondary forest (rotational fallow land) of about 60% (~ 52,231 ha)⁴. The natural habitat (of semi/evergreen and mixed deciduous forest types) was accounted for 35% (~31,268 ha), and other 5% (~4,347 ha) of NPA was paddy fields, agricultures, village settlement. Taking account its habitat condition, 65% of the area was a mosaic of human-modified habitats whereas 35% was of natural habitats⁵ in 2013. However, the natural habitat is now increasing to up to 46% based on the current forest cover analysis using planet scope image of March 2023 (Table 4). The National Protected Area is not considered to support high biodiversity values. There are only a few large mammal species are reported to exist in the area, including clouded leopard and Southern Serow. The bird fauna is quite diverse, although only a few species are of global conservation significance. The area is thought to be botanically unique and diverse, although no thorough surveys have been conducted. Wild tea (large) tree is found in this protected area. There are a wide variety of non-timber forest products, notably *Aquilaria* sp and the jewel orchid which can still be found in the area.

⁴ Vegetation cover and other land use data provided by the Protection Forest and Conservation Forest Inventory Service, Department of Forest Resource Management, 2013. Factsheet of Phouhiphi NPA.

⁵ Phou Hhiphi National Protected Area Profile, Forest cover analysis in 2013.

Another protected area at provincial level, namely Phou Tho, is also in close proximity to the NR2E on the west side, with an area of approximately 9,381.7 ha (see the Figure 2). It was established by Directive of Provincial governor of Oudomxay on 18 September 2019 with aims for sustaining the natural forests nearby the Xay capital of Oudomxay province for watershed protection, the natural beauty and tourism attraction. The area was once abundant in fauna and flora species and rich natural habitats, but the area has experienced the rapid degradation and loss of natural habitats and wildlife due to clearing for agriculture, logging and uncontrolled hunting.

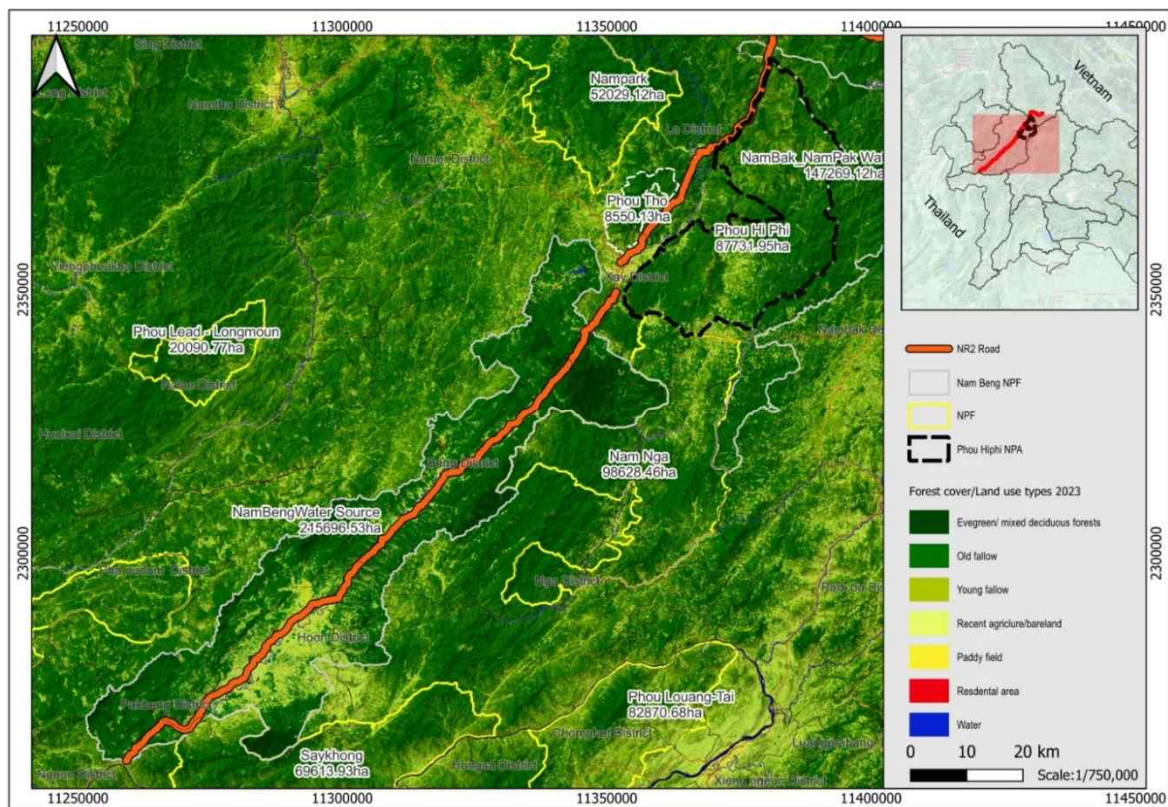


Figure 2. Distribution of National Protected Areas and other forest categories in proximity to the NR2 project.

2.2.2 Protection Forest

The NR2W passes through the middle of the Nam Beng National Protection Forest (NPF), established in accordance with the forestry law for the purpose of protection of watershed areas, river banks, road sides and the prevention of soil erosion. It covers an area of ca. 212,000 ha, of which about 38% was natural habitats of evergreen, mixed deciduous and dry dipterocarp forests and 62% was modified habitats (i.e., agriculture, human resettlement, etc.). The NPF has exposed to high human disturbances including agriculture, hunting, road, agriculture, hydropower, and others leading to heavy degradation of natural habitats in the NPF⁶. Now, the current forest analysis indicates only 15.32% is natural habitats and only 85% is modified habitat (see Table 3).

⁶ Factsheet of Nam Beng National Protection Forest

Table 3. Summary of conservation and protection forest in proximity to the NR2 Project

Conservation/protection forests	Area (ha)	Section	Notes
Phou Hippi National Protected Area (NPA)	87,846	NR2E	App. 21 km NR2E sites close to NPA boundary on east bank of Nam Phak, NR2E on the west side.
Phou Tho Provincial Protected Area (PPA)	9,382	NR20E	PPA on the west side of NR2E
Nam Beng National Protection Forest (NPF)	212,000	NR2W	NR2W pass through NPF
Nam Bak-Nam Phak National Protection Forest (NPF).	147,269	NR2E	Only small part of PPA is in proximity to NR2E to the east side of Nam Phak River.

2.2.3 Habitat

The NR2 lies in the human-dominated landscape. The road is largely surrounded by highly degraded habitats, which considered as modified habitats according WB' ESF/ESS 6, due to the clearing of land for agriculture, human settlements and other infrastructure development. The patches of evergreen/mixed deciduous forests considered as natural habitats, according to the WB' ESF/ESS 6, remain only in the national conservation and protection forests, which is far distant from the NR2 (see Figure 2). However, it was evident that only a few sections of NR2W, between KM 15 and KM 18, is surrounded by relatively good natural forests on both sides of the road. The proposed improvement of NR2 project will not encroach into that natural forest, only follow the existing national road alignment.

Table 4. Summary of forest cover/land use analysis

Forest cover/land use types	Phou Hippi NPA		Nam Beng NPF	
	Area (ha)	Percent (%)	Area (ha)	(%)
Evergreen/mixed deciduous forests	40,518	46.26	32,989	15.32
Old fallow	42,996	49.09	130,071	60.39
Young fallow	3,606	4.12	40,807	18.94
Paddy field	240	0.27	5,973	2.77
Recent agriculture / bare land	73	0.08	4,412	2.05
Residential area	85	0.10	356	0.17
Water	76	0.09	793	0.37
Grand Total	87,593	100.00	215,399	100.00

Note: Description of Land/forest classification in Annex 4.

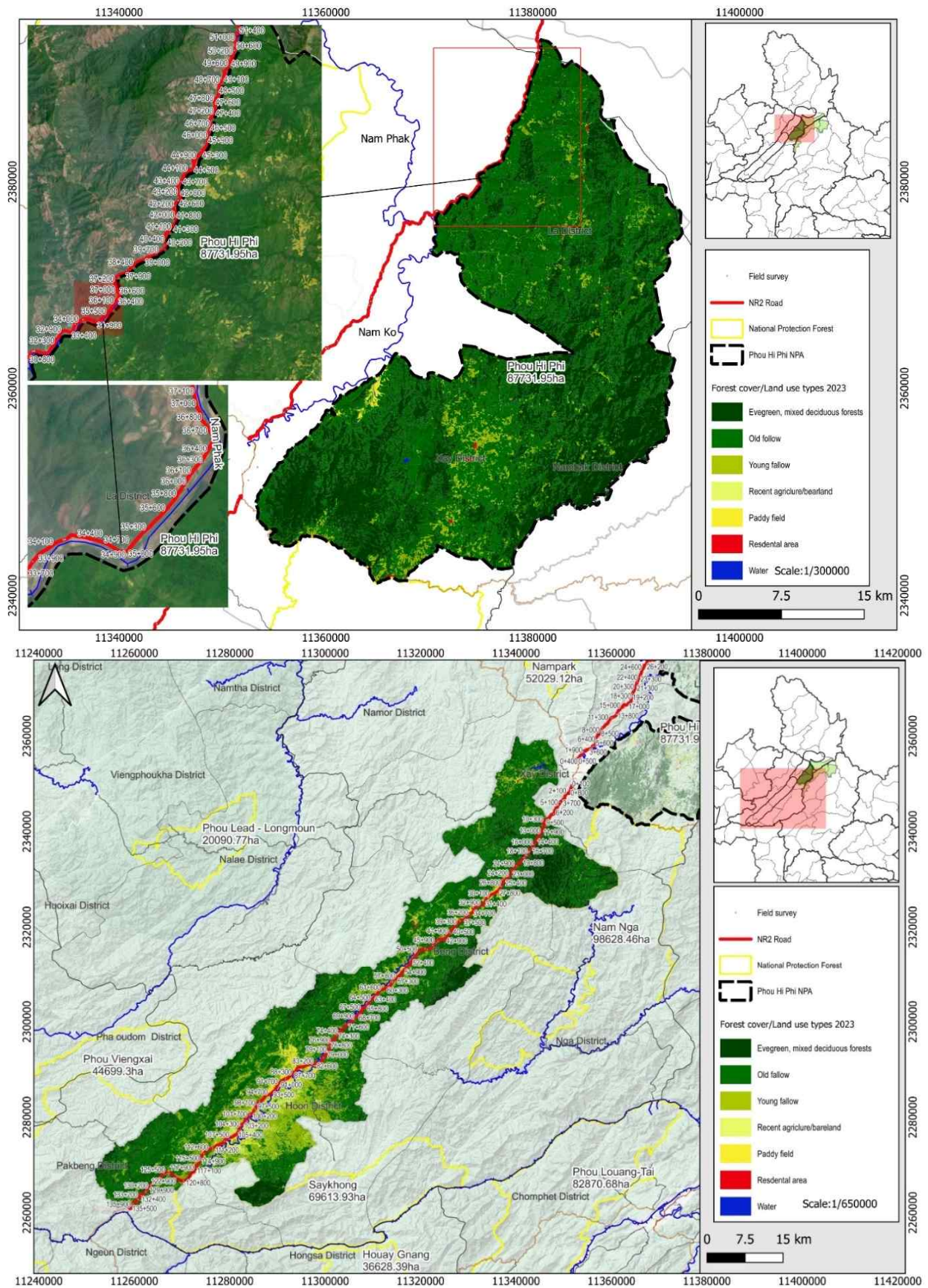
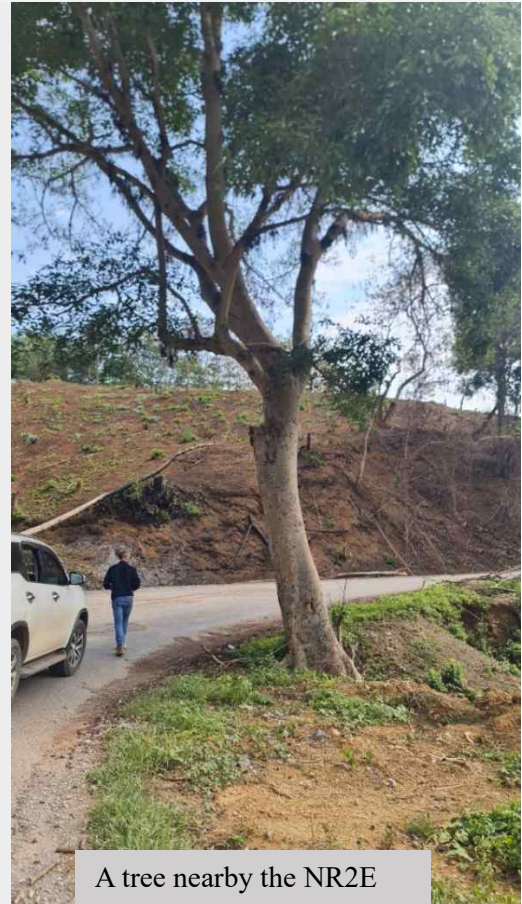


Figure 3. Forest cover/land use type of Phou Hippi National Protected area (above) and Nam Beng National Protection Forest (below) and major rivers in relevant to NR2 E&W



Habitat clearance on NR2E



A tree nearby the NR2E



Habitat clearance for agriculture along NR2W



NR2E sites along the bank of Nam Phak River to the west

Figure 4. NR2E sites

2.2.4 Flora

There have been very few studies of plants in Phou Hphi NPA, but the comprehensive list of plant species has not yet made available to the public. Little is known about plant species diversity in the NPA and other forests nearby/adjacent to the NR2 landscape. However, the list of key plant species presented here summarized from the results of rapid field assessment of botanical team, between 8th and 9th May 2023, who conducted field survey on identification of species and number of trees to be affected during the construction work and thus need to be removed along NR2. Two botanists and a driver drove a car slowly along the road and screened carefully to look for any trees greater than 20 cm in diameter within 2 meters from road side, and botanists also observed any other trees of interests while observing and recording the data. The team recorded 40 species of 260 trees in natural habitat, of which 129 trees in NR2W and 131 trees in NR2E sections (Table 5, Annex 6). Most species here found more abundant in other conservation areas in Laos. Other key plant species recorded during field mission are summarized in table 6 (Table 6).

Table 5. List of tree species to be removed along the NR2, which is located within 2m from the existing road

Ref. No	Local names	Scientific names	No. tree individuals	IUCN Red list	National Managed list
1	Ten	<i>Duabanga grandiflora</i>	39	LC	NA
2	Ngom	<i>Toona ciliata</i>	38	LC	II
3	Thong	<i>Erythrina sp.</i>	17	NA	NA
4	Thone	<i>Albizia chinensis</i>	14	NA	III
5	Ka dao chang	<i>Azadirachta indica</i>	11	LC	III
6	Ket ke	<i>Balakata baccata</i>	11	LC	NA
7	Ka bor	<i>Dalbergia assamica</i>	11	LC	NA
8	Sa Kham	<i>Garuga pinnata</i>	10	NA	III
9	Deua	<i>Ficus racemosa</i>	9	NA	III
10	Sa thone	<i>Albizia lebbeck</i>	8	LC	III
11	Len	<i>Albizia lucidior</i>	8	LC	NA
12	Sor	<i>Gmelina arborea</i>	8	NA	II
13	Peuay dok khao	<i>Lagerstroemia tomentosa</i>	8	LC	II
14	Kiou	<i>Colubrina sp.</i>	6	NA	NA
15	Sack ko	<i>Neolamarckia cadamba</i>	6	NA	III
16	Bong mi	<i>Litsea glutinosa</i>	5	LC	NA
17	Dou	<i>Pterocarpus macrocarpus</i>	5	EN	I
18	Kham phi	<i>Dalbergia oliveri Benth.</i>	4	CR	I
19	Sa lik dong	<i>Alangium barbatum</i>	4	LC	NA
20	Ngen	<i>Terminalia bellirica</i>	4	LC	II
21	Ben mon	<i>Terminalia phillyreifolia</i>	4	NA	NA
22	Hai	<i>Ficus sp.</i>	3	NA	III

Ref. No	Local names	Scientific names	No. tree individuals	IUCN Red list	National Managed list
23	Lam ngai pa	<i>Nephelium hypoleucum</i>	3	LC	NA
24	Dok ban	<i>Bauhinia variegata</i>	2	LC	NA
25	Kham phi Bai mon	<i>Dalbergia balansae</i>	2	VU	NA
26	Peuay	<i>Lagerstroemia sp.</i>	2	NA	II
27	Moung pa	<i>Mangifera sp.</i>	2	NA	III
28	Pip	<i>Mayodendron igneum</i>	2	NA	NA
29	Por	<i>Sterculia villosa</i>	2	LC	III
30	Meuad Pa siou	<i>Symplocos racemosa</i>	2	NA	NA
31	Tin peth	<i>Alstonia scholaris</i>	1	LC	NA
32	Som phad	<i>Bischofia javanica</i>	1	LC	NA
33	Kha pha	<i>Callicarpa arborea</i>	1	LC	NA
34	Hath	<i>Celtis tetrandra</i>	1	LC	NA
35	Ke hom	<i>Cinnmomum sp.</i>	1	NA	NA
36	Som moun	<i>Elaeocarpus sp.</i>	1	NA	III
37	Por hou chang	<i>Macaranga gigantea</i>	1	NA	NA
38	Kok	<i>Spondias pinnata</i>	1	NA	III
39	Sa phoung	<i>Tetrameles nudiflora</i>	1	LC	III
40	Por hou	<i>Trema orientale</i>	1	NA	NA
Total		40 species	260 trees		
Threatened Tree Species listed in IUCN red List					
1	Dou	<i>Pterocarpus macrocarpus</i>	5	EN	I
2	Kham phi	<i>Dalbergia oliveri</i>	4	CR	I
3	Kham phi Bai Mon	<i>Dalbergia balansae</i>	2	VU	NA

National Managed List (Forestry Law, Article 3)

- Tree list I refers to species that are rare, have medicinal properties, are at risk of extinction, grow or can be cultivated only in a particular area, have slow growth, have a unique wood texture, and produce a highly durable wood. This list also includes all species listed in the CITES Appendices, such as *Dalbergia cochinchinensis*, *Cunninghamia sinensis*, *Pterocarpus macrocarpus*.
- Tree list II refers to tree species that grow and can be cultivated in specific areas, have slow natural growth and produce wood of medium durability, such as *Dipterocarpus sp.*, *Vatica harmandiana*.
- Tree list III refers to tree species that grow and can be cultivated in most areas, that have a good natural growth rate and produce wood of low durability, such as *Alstonia rostrata*, *Mangifera sp.*, *Samanea saman*.
- NA – None Assessment

IUCN Red List

- CR – Critically Endangered;
- EN – Endangered;
- VU – Vulnerable;
- LE – Least Concern.

Table 6. Key Plant Species listed in IUCN Red List found in forest areas nearby the NR2

Local names	Scientific names	IUCN Red List	Note
Ketsana	<i>Aquilaria crassna</i> Pierre	CR	Widely planted species
Ketsana	<i>Aquilaria yunnanensis</i>	VU	found at Mounгла
Ka bor	<i>Dalbergia balansae</i>	VU	found at Pakbeng
Kha Gnoung	<i>Dalbergia cochinchinensis</i>	CR	found at Pakbeng
Kham Phi	<i>Dalbergia oliveri</i>	CR	found at Pakbeng
Dou	<i>Pterocarpus macrocarpus</i>	EN	Pakbeng, Houn and Xai

2.2.5 Fauna

❖ Mammals

The wildlife species, particularly mammals, that possibly occur in forest areas nearby the footprint of the NR2 project are summarized from the literature reviews in combination with results from rapid village interviews and market survey, and interviews of national experts who have been working in the region, i.e., the Oudomxay province. Overall, there has been little studies of wildlife using scientific sound methods in this region, rather most knowledge of wildlife, e.g., mammals, herpes, is largely known from provisional reports and local roadside markets observations. Therefore, the actual presence of wildlife species in natural habitats is still uncertain in the event of high human disturbances, e.g., hunting, logging, clearing of land. Only some of them listed in the IUCN Red List as “Vulnerable” were reported to exist in natural habitats, especially at national protected area (Phou Hippi), but those are found more abundant in other protected areas in Laos. Key species potentially occur in forest areas in proximity to NR2 footprint are summarized below⁷.

Table 7. Mammals and birds possibly occur in Phou Hippi NPA.

Common Name	Scientific Name	Global Threat Category	Lao Risk Status
Mammals			
Assamese Macaque	<i>Macaca assamensis</i>	VU	PARL
Black Giant Squirrel	<i>Ratufa bicolor</i>	NT	PARL
Back-striped Weasel	<i>Mustela strigidorsa</i>	VU	LKL
Small-clawed Otter	<i>Aonyx cinereus</i>	VU	ARL
Smooth-coated Otter	<i>Lutra perspicillata</i>	VU	ARL
Clouded Leopard	<i>Pardofelis nebulosa</i>	VU	PARL
Marbled Cat	<i>Pardofelis marmorata</i>	DD	LKL
Leopard Cat	<i>Prionailurus bengalensis</i>	LC	-
Southern Serow	<i>Capricornis milneedwardsii</i>	VU	PARL

⁷ Fact Sheet: Phou Hippi National Protected Area

Common Name	Scientific Name	Global Threat Category	Lao Risk Status
Sambar deer	<i>Rusa unicolor</i>	0	PARL
Birds			
Silver Pheasant	<i>Lophura nycthemera</i>	-	LKL
Grey-Peacock Pheasant	<i>Rheinardia ocellata</i>	-	LKL
Blyth's Kingfisher	<i>Alcedo Hercules</i>	VU	PARL
Grey-headed Lapwing	<i>Vanellus cinereus</i>	GNT	PARL
Pied Falconet	<i>Microhierax melanoleucos</i>	GNT	LKL
Green Cochoa	<i>Cochoa viridis</i>	GNT	0
Yellow-vented Warbler	<i>Phylloscopus cantator</i>	GNT	0
Rufous-throated Fulvetta	<i>Alcippe rufogularis</i>	GNT	0
Short-tailed Parrotbill	<i>Paradoxornis davidianus</i>	VU	0

Note: At Risk in Lao PDR (ARL); Potentially At Risk in Lao PDR (PARL), Little Known in Lao PDR (LKL).

- At Risk in Lao PDR (ARL): this category is roughly equivalent at a national level to the Globally Threatened categories of IUCN (1996). Minor amendments (see Thewlis et al. 1998) result in the exclusion of some species for which the only threat is long-term habitat loss and which might be considered 'Vulnerable' following the criteria of IUCN (1996).
- Potentially At Risk in Lao PDR (PARL): this category includes species (a) suspected to be At Risk in Lao PDR but where information about threats or species status is insufficient to make a firm categorization, and (b) species on or close to the borderline of At Risk in Lao PDR.
- Little Known in Lao PDR (LKL): this category provides for species where the conservation status is difficult to assess, i.e., those with detection or identification problems, or where fieldwork within their preferred range and habitats has been restricted, or where threats or species status are not clear for other reasons.

❖ Reptiles

Key species of reptiles here were summarized from wildlife survey report⁸, village interviews, NPA staff interviews and rapid field/market observations. Their presence is based on provincial reports and market observation, but exact locations and their population status across the NR2 landscape are uncertain.

⁸ CEPF|Rapid Strategic Environmental Assessment of the Lancang-Mekong Development Plan|ICEM

Table 8. Key reptile species possibly occur in natural habitats nearby the NR2 footprint based on literature reviews, village interviews and local road side market survey

Species	IUCN Red List	Lao Status	Source
Keeled Box Turtle (<i>Cuora mouhotii</i>)	Endangered	At risk in Laos	Report*
Big-headed Turtle (<i>Platysternon megacephalum</i>)	Endangered	At risk in Laos	Report, interviews
Impressed Tortoise (<i>Manouria impressa</i>)	Endangered	At risk in Laos	Report, interviews, market**.
Asiatic Softshell Turtle (<i>Amyda cartilaginea</i>)	Vulnerable	At risk in Laos	Report

Source: * CEPF|Rapid Strategic Environmental Assessment of the Lancang-Mekong Development Plan|ICEM. Baseline Assessment Report | December 2018. ** three living tortoises sold at road market KM14, Xay district.

❖ Fish

The NR2-W sites mostly along the bank of the Nam Beng River to the west (left-hand side). It was reported that 1.5 tons of fish were harvested from Mekong' tributaries, i.e., Nam Beng River⁹. Nam Beng is a tributary to the Mekong River, the results from fish survey in Mekong mainstream and sub-basins (including Nam Beng) between Xieng Kok and Xayaburi found 272 species, of which eleven (4%) are endemic, eight (2%) are introduced, and 250 (91%) are native species. However, due to the hydrological condition in the event of low level of water as a result of hydropower dam, especially in dry season, the actual occurrence of fish in Nam Beng is uncertain. At the time of our field mission, it was clearly evident that the water level is very low in the river (both upstream and downstream of the dam) and heavily fished by local communities, it is therefore assessed that the endangered Mekong' fish species may not persist in this river.

The NR2-E sites largely along the bank of Nam Phak River (at KM 27+800) to the end at Khoua district at Km 99+051, it is a tributary and flows into the Nam Ou River. Fish studies in Nam Ou basin including Nam Phak River¹⁰ found at least 139 fish species, of which one critically endangered, two endangered and 10 vulnerable fish species were recorded (see Table 9). It was assessed that the Nam Phak remains an important habitat that support the population of those key species. Therefore, assessment of potential risk and impacts on fish arising from road construction activities were assessed in the following section.

Table 9. Fish records in Nam Ou and its tributaries nearby the footprint of the NR2 project

No	Scientific name	Family	IUCN Red List
1	<i>Chitala blanci</i>	Notopteridae	NT
2	<i>Bangana behri</i>	Cyprinidae	VU
3	<i>Cirrhinus cirrhosus</i>	Cyprinidae	VU
4	<i>Cirrhinus molitorella</i>	Cyprinidae	NT

⁹ Oudomxay Provincial Economic and Social Development Plan of 2009-2010.

¹⁰ NAM OU RIVER BASIN PROFILE SUMMARY DOCUMENT. Environmental and Social Characteristics of a Key River Basin in Lao PDR

No	Scientific name	Family	IUCN Red List
5	<i>Cyprinus carpio</i>	Cyprinidae	VU
6	<i>Hypsibarbus lagleri</i>	Cyprinidae	VU
7	<i>Hypsibarbus malcolmi</i>	Cyprinidae	VU
8	<i>Luciocyprinus striolatus</i>	Cyprinidae	EN
9	<i>Mekongina erythrospila</i>	Cyprinidae	NT
10	<i>Mystacoleucus lepturus</i>	Cyprinidae	VU
11	<i>Onychostoma gerlachi</i>	Cyprinidae	NT
12	<i>Probarbus jullieni</i>	Cyprinidae	CR
13	<i>Probarbus labeamajor</i>	Cyprinidae	EN
14	<i>Pseudohemiculter dispar</i>	Cyprinidae	VU
15	<i>Scaphognathops theunensis</i>	Cyprinidae	CR
16	<i>Ompok bimaculatus</i>	Siluridae	NT
17	<i>Wallago attu</i>	Siluridae	VU
18	<i>Bagarius bagarius</i>	Sisoridae	VU
19	<i>Bagarius yarrelli</i>	Sisoridae	VU

2.2.6 Existing threats to biodiversity

The current threats to natural habitat quality and species diversity identified here are those threats occurring without improvement of the road condition (i.e., prior the NR2 project). These threats are predominantly linked to human habitation and anthropogenic activities in the region. Existing threats to biodiversity in the project area are summarized as follows:

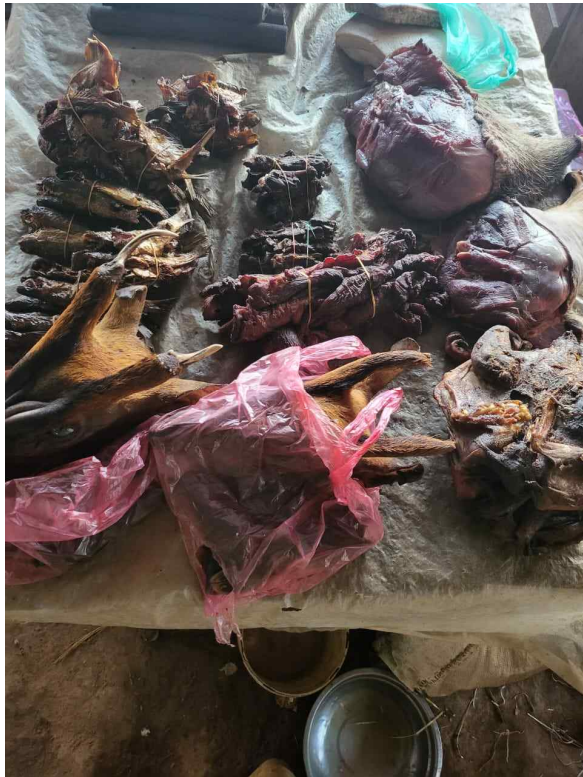
- ❖ **Habitat loss and degradation** – localized habitat clearance for agriculture was widely observed in close proximity to the proposed project footprint of NR2, either West or East sections. Of most significant, conversion of natural habitats to agricultural land by the concession projects, e.g., banana, rubbers and cassava, along NR2W appears to pose a serious threat to natural habitats and biodiversity in the region. Given its current trend, the future increasing human population and the upgrade of transport infrastructure (in combination with the lack of sustainable management of forest and conversion to agriculture) are considered to be a driver for the loss and degradation of natural habitats and subsequent loss of biodiversity in the region.
- ❖ **Unsustainable Hunting/poaching** – the wildlife law has listed the wildlife in three different categories, i.e., prohibited, managed and general, and determines number of species allowed to hunt for only family consumption, not for trade. Any trade in wildlife is therefore illegal everywhere and anytime in Lao PDR. However, during our field mission, wildlife was evidently sold at the road side markets along the NR2 (i.e., KM 14), of which are three endangered impressed tortoises in addition to mammals and birds (see photos below). This incidence truly indicates the ineffective

enforcement of law and regulations by local authorities in the project area. The risk of uncontrolled hunting and trading appear to pose significantly a threat to wildlife population, either terrestrial and aquatic species.

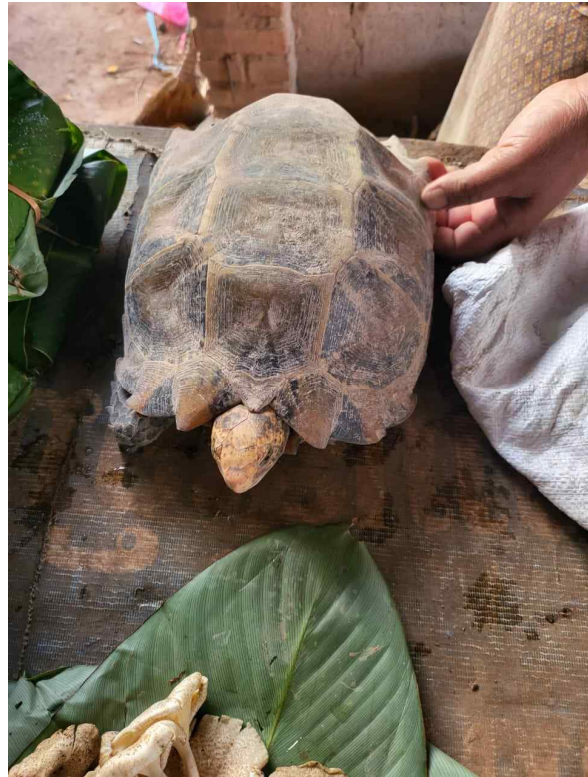
- ❖ ***Unsustainable Fishing*** – uncontrolled fishing is worldwide causing a decline in a number of fish species. It was reported that local people are heavily dependent on fishing for livelihoods in local streams and rivers (e.g., Nam Beng and Nam Phak), however, fish and also other aquatic animals seem to be sharply declined in recent years due to drainage of chemicals (i.e., pesticide, insecticide) and fertilizers from intensive agricultural methods (in addition to use of destructive fishing gears) according to village interviews.
- ❖ ***Alien invasive species encroachment*** – whilst alien invasive species were not observed in the study area during the field mission (based on direct observation and village interviews), but the potential risk of invasive species is likely to occur in the future if the road infrastructure is upgraded and subsequent increase of traffic volume from neighboring countries.
- ❖ ***Poor waste management*** – it was evidenced that local waste management infrastructure is limited. Litter was observed within the study area around the settlements during the field mission. Poor waste management may also attract pest species (i.e., vermin) which in turn may result in the displacement of natural wildlife and act as vectors of disease. Plastic waste can have detrimental effects on wildlife and aquatic animals, which result in the motility of individuals if ingested. Chlorinated plastic can release harmful chemicals into the surrounding soil, which can then seep into groundwater, causing potentially harmful effects to the aquatic environment and species dependent on it (UNEP 2018).



Figure 5. The Hydropower Dam in Nam Beng River. NR2W sites along the bank to the west



Red muntiac and wild pig meats



Endangered Impressed Tortoise



Lesser coucal and another bird sp.



Wildlife & other forest products sold at road side market KM 14- muntjac, tortoise, birds.

2.3 Designated Sites

❖ Aspects of the Project that have the potential to have impacts to Designated Sites

- Noise and air quality impacts on designated sites are discussed in ESIA below (.
- Other Project aspects that could impact upon designated sites include:
 - Workers presence close to designated sites.
 - Improvement of the road leading to improved access to designated sites by workers and the community.

❖ Sensitive Receptors

- The key sensitive receptor in this instance is the Phou Hippi NPA which runs parallel to NR2E for over 20km and within 1km of the bypass around Muang Xai and 2km of the far north NR2W. Another protected area at provincial level, the Phou Tho, is also in the region of NR2E on the west side (approximately 1 km apart). National Protection Forest, namely Nam Beng, also present in the Project area along NR2 W, and these are discussed under the topic of flora and fauna below. There are no internationally designated sites within the COI.

❖ Potential Impacts

Construction Phase

- The Project involves widening of the road by 1 – 2 m on either side of the road and improvement of bridges and drainage structures. None of these works are located within the Phou HiPhi NPA which is located on the opposite bank of NR2E for approximately 20km of the alignment. As such there will be no direct encroachment into the NPA which as noted previously is already heavily modified and degraded along much of the riverbank in the COI.
- No machinery will be required to enter the NPA and it might be possible for workers to easily cross the river to enter the park, but the good quality forest is far from the river bank where access is made possible only by foot. Agricultural lands are extensively found along the river bank opposite to the NR2. Works maybe undertaken within the river bank on the opposite side of the Nam Phak to the NPA, e.g., for embankment protection, and there is a very remote risk that construction machinery could move across the river in periods of very low flow. Only one vehicle crossing to the NPA has been identified close to NR2E, just beyond Muang La village. Here is it possible for construction workers and vehicles to directly access the NPA and this is probably the greatest risk to the NPA in terms of Project works. Other small pedestrian bridges also exist across the Nam Phak at various locations between NR2E and the NPA – here workers could also access the park directly.
- Road construction noise, such as that produced during earth works, pile driving and road surfacing, can be of high intensity but usually of limited duration. Road noise has a number of ecological impacts on wildlife living in nearby habitats. It may be stressful for animals, makes it harder for animals to hear each other, their predators and their prey, cause temporary or permanent hearing loss in animals, and high levels of road construction noise may injure animals, especially fish, in nearby habitats.

- Air pollution and its deposition onto vegetation, soil and water can damage vegetation directly or indirectly through the addition of nutrients or changes in acidity levels within a habitat. These can cause a shift in the competitive balance between species, changes in plant species composition or subtle changes in vegetation structure, which can affect the use of a habitat by an animal species.
- The key risk from workers is poaching. Workers may see an opportunity to poach wildlife in the NPA either to sell at local markets, or to eat. There is also a possibility that the Contractors workers could drive demand in the local economy for specific species in the NPA, mainly for food.
- Other potential impacts could occur, for example; (i) harvesting of firewood and other non-timber forest products such as bamboo shoots, mushroom, orchids, honey and traditional medicines for small camps. However, it is unlikely that workers would make their way across the river to harvest wood for small camp fires; (ii) risk of campfires spreading to the nearby forests, and siting of borrow pits in the NPA/forest.

Operational Phase

- In the longer-term traffic volumes are anticipated to increase along NR2E and W, and only slightly along the Bypass. It is however noted that existing traffic volumes are low along NR2E and NR2W, approximately 30 vehicles and hour, the majority of which are motorcycles. This is anticipated to increase to a maximum of 105 vehicles per hour in 17 years' time. The risk that road improvements could lead to increased access to the NPA and that may facilitate the increase in poaching, illegal harvesting and wildlife trade, but it is likely to be minimal given these low traffic volumes. Moreover, the increased traffic volume is also unlikely to pose significant risk on animal crossing along NR2E&W since the populations of most large mammals have disappeared from the area as a result of being hunted out for food and trade by local communities and habitat loss due to agricultural expansion over the past decade. Now, only some species of large mammals (muntjacs, wild pigs, bears, pangolins, civets and others) were reported to remain in the remote forests of NPA and protection forests. It was evident that the agricultural lands (mixed new fields, regenerating vegetation – i.e. young fallow <2-3 years, and old fallow < 5 years, and plantations) are now widespread along the NR2E&W, which may provide important habitats for small mammals (rats, squirrels, bats) and birds. The Project will not provide additional vehicle crossings to the NPA. The limited level of interventions through limited road widening or pavement improvements under this project would not lead to increased poaching or exploitation of an area which is already accessible to the public.
- WB reports (Lao Forest Report, 2020) do note that a road itself does not cause deforestation, however, the disturbance caused by roads and infrastructure was found to be the driver of around 5% of forest area disturbed compared with 64% caused by agriculture. Accordingly, what is needed is better management of the park to ensure that the current exploitation and degradation of the park from all sources, specifically agricultural expansion and tree plantation does not continue. This task however, is beyond the scope of the road improvement Project.

Cumulative Impacts

None anticipated in the area around the NPA and NR2E.

Transboundary Impacts - None.

Impact summary and assessment of significance

Table 10 provides an assessment of the significance of project impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 10. Potential Impacts to Designated Sites

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Requirements	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
<i>C</i>	<i>Encroachment</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>ST</i>	<i>SM A</i>	<i>ME D</i>	<i>UN</i>	<i>L</i>
<i>C</i>	<i>Poaching</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>ST</i>	<i>SM A</i>	<i>ME D</i>	<i>UN</i>	<i>L</i>
<i>O</i>	<i>Encroachment</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>LT</i>	<i>SM A</i>	<i>HI</i>	<i>UN</i>	<i>M</i>
<i>O</i>	<i>Poaching</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>LT</i>	<i>SM A</i>	<i>HI</i>	<i>UN</i>	<i>M</i>
<i>C/O</i>	<i>Noise and vibration</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>LT</i>	<i>SM A</i>	<i>HI</i>	<i>UN</i>	<i>M</i>
<i>C</i>	<i>Air pollution</i>	<i>Phou HiPhi</i>	<i>L</i>	<i>H</i>	<i>M</i>	<i>L</i>	<i>MA J</i>	<i>LT</i>	<i>SM A</i>	<i>HI</i>	<i>UN</i>	<i>M</i>

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Low Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely / SMA: Small / INT – Intermediate / EXT – Extensive / HI – High / + denotes positive impact

Mitigation and Management Measures

Preconstruction Phase

During this phase of the Project typical activities will include:

- Conduct pre-construction surveys to identify trees to be moved and prepare demarcation and mapping of land cleared areas and tree removals.
- Ensure a confirmatory pre-construction check of all suitable otter habitat a suitably qualified ecologist prior to any construction works commencing.
- Ensure all the Project' facilities, e.g., construction camps, are not located in the natural habitats and far from NPA.
- Recruit a suitably experienced and qualified ecologist to be on hand to supervise the habitat clearance works and provide advice to the workforce.

- The BMP, mitigation measures, as part of the ES requirements, will be included within the bid documents for project works. The bid documents will state that the Contractor will be responsible for the implementation of the requirements of BMP through his own CESMP.

Construction Phase

- ❖ To limit the impacts of noise and air pollutions the following measures will be applied:
 - The use of noisy machinery and vehicles will be avoided at dusk, dawn and at night to minimize disturbance to nocturnal and crepuscular fauna from increased noise and vibration.
 - Working hours during construction will be limited between 7am and 7pm to avoid disturbance to fauna at night.
 - Vehicles, equipment and machinery will be regularly checked and maintained to ensure that they are in good working order and within industry standards for noise and vibration emissions.
 - All vehicles will be fitted with effective exhaust silencers to minimize noise emissions.
 - Open-burning of general wastes and vegetation will be banned.
 - Regular watering during the dry season in areas of biodiversity sensitivity.
 - Use of geotextiles to cover exposed topsoil prior to the establishment of vegetation in areas of biodiversity sensitivity.
- ❖ To limit the impacts of encroachment and poaching the following measures shall be applied:
 - Regular worker training sessions and toolbox sessions for all workers on NR2E relating to Phou HiPhi NPA.
 - Routine inspections of work sites along Pho Hhiphi to ensure that machinery and workers are not on the other side of the river or dumping waste materials in this area.
 - Implementation of a strict code of conduct with regards to treatment of local fauna which will include a prohibition of poaching which will be a sackable offence. Workers are to be clearly informed the environmental rules of conduct, along with the penalties for non-compliance, to be prohibited from buying/selling, eating of wildlife, and burning of natural vegetation, anywhere in or near the project area.
 - Project staff and contractors will be banned from hunting, fishing, buying and collecting natural resources (e.g., wildlife, aquatic animals, fish) within the project area including rivers to minimize impacts to fauna and their habitats.
- ❖ Other measures to mitigate impacts to designated sites include:
 - No borrow pits, quarries or sources of construction materials to be located within Pho HiPhi or Phou Tho. Further, no haul routes will be allowed through these areas.
 - No camp, or ancillary facility to be located within 2km of Pho HiPhi or Phou Tho.
 - Project construction will not be undertaken at dusk, dawn and at night within 500m of the NPA to avoid disturbance to nocturnal and crepuscular fauna (i.e., bats, herpes) from increased noise and vibration.

- ❖ Other measures outlined below and elsewhere in this report and the Project BMP will limit the potential for impacts relating to pollution of designated sites, e.g., through leaks and spills of liquids.

Operational Phase

- Prohibit hunting and natural resource collecting by the road maintenance personnel and contractors when at work. To be communicated through induction and training to all personnel (employees and contractors).
- A program to strengthen the management of the park is required in the longer term and reduce a potential future degradation of the site. However, such a program is beyond the scope of this Project and should be part of a provincial government effort to provide better management of the NPA.

Residual Impacts

Table 11. Designated Sites Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Encroachment	Low	<i>Implementation of the proposed mitigation measures should ensure that there is no encroachment into the NPA and no poaching</i>	No residual impacts
C	Poaching	Low		No residual impacts
O	Encroachment	Medium	<i>Without better management of the NPA by the relevant authorities it is likely that the NPA will continue to be degraded particularly by agricultural expansion and tree plantations, however, as noted above, road projects are not the key threat to the NPA and as such a broader management plan needs to be adopted by the provincial government to protect the NPA from further impacts. So, monitoring data from this project collected during construction and operation phases will contribute significantly to the biodiversity conservation and management planning by concerned agencies in the region.</i>	Medium
O	Poaching	Medium		Medium

3. TARGETS AND ACTIONS FOR BIODIVERSITY MANAGEMENT TO BE FOLLOWED BY PROJECT CONTRACTORS

3.1 Overview of Project-related Impacts to Fauna and Flora

Key Aspects of the Project that have the potential to have impacts to Flora and Fauna

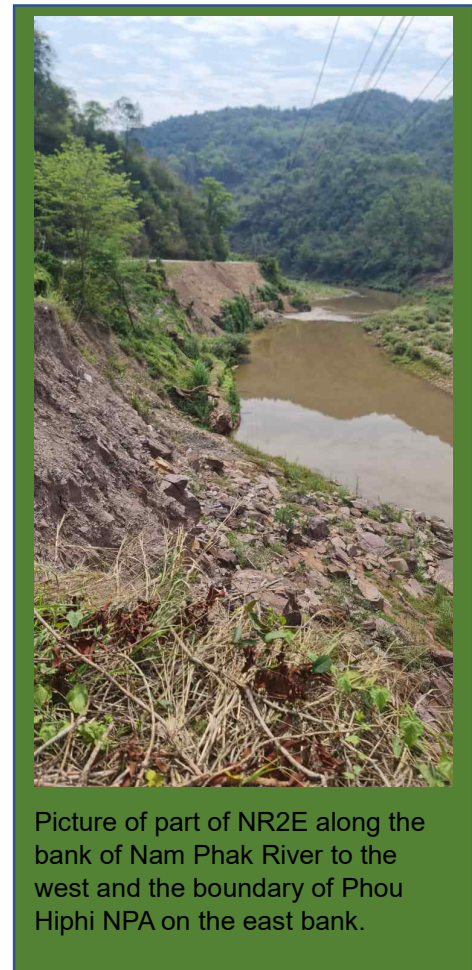
- Vegetation removal for increased pavement, new drainage structures and bridges.
- Siting and operation of construction camps and ancillary facilities.
- Opening and operating borrow pits and use of haul routes.
- Worker's presence close to sensitive areas.
- Increased access to sensitive areas during operational phase.

Sensitive Receptors

- Special status species in the broader project area, specifically aquatic species in the Nam Phak.
- General flora and fauna in the Project area.

Potential Impacts

1. The Project focuses on improvement of the existing NR2, it will not encroach into natural habitat, but some trees and bushes are to be removed where the road is expanded. It was expected to remove 260 trees of 40 species along the NR2. Most of them are not listed as threatened vascular plants in the IUCN' red list, only few of them are listed as threatened species, but they are found more abundant in other national protected areas in the country. It is therefore anticipated that the potential impact on loss of nationally or globally threatened plant species is minimal.
2. Of most concern, the NR2W and NR2E are in parallel to the main rivers, siting largely alongside of the rivers' banks. For example, NR2E is located along the bank of Nam Phak River, a tributary to Nam Ou River, and parts of the NR2E (ca. 20 km) are also in close proximity to the Phou Hippi NPA with its boundary on the other side of the river (i.e., east), whereas the NR2W is largely located on the bank of Nam Beng, a tributary to the Mekong River. It passes through the middle of the Nam Beng NPF.
3. Given its alignment in proximity to the rivers and natural habitats in national conservation forests, key potential project-related risks and



Picture of part of NR2E along the bank of Nam Phak River to the west and the boundary of Phou Hippi NPA on the east bank.

impacts to natural habitats and biodiversity during the construction and operation phases are mainly relevant to;

- i. Increase demand of fish, aquatic by camp workers/contractors** - In the Nam Ou basin, including Nam Phak River, at least one critical and two endangered fish species were reportedly present¹¹, and other aquatic species of high conservation values such as otters (*Aonyx/lutra* sp.) and soft-shelled turtles (*Amyda cartilaginea*) were reported in rivers (Villagers, verbal per. Com). Increase demand from construction workers may result in increasing harvest of fish from the rivers by local people, which can lead significantly to the rapid decline of fish as well as other aquatic animals in the rivers due to uncontrolled harvest of fish and other aquatic animals and plants. Mitigation measures will be implemented by the Project to avoid and minimize impacts to biodiversity to the extent practicable.
- ii. Increase demand of terrestrial wildlife species by camp workers** - The project-related impacts on wildlife facilitated access to the wildlife hunting are likely minimal due to the road alignment is in highly degraded habitats modified by human. Most primary natural forests and wildlife remain in the far distance to national conservation forests. However, it was clearly evident that wildlife was sold in the roadside markets (venders) without improvement of NR2. Illegal trade on wildlife is truly linked to the ineffective enforcement of national laws by local authorities. Therefore, the potential risks and impacts arising from this proposed project during the construction and operation phases are likely to involve in increase of wildlife trafficking as a result of the increasing demand of fish, wild meats and forest products by camp workers, which will result in widespread hunting of wildlife, harvesting of fish in the rivers and other forest products by local communities to sell to the workers. This eventually contribute to erosion of wildlife and fish species of high conservation values. Therefore, measures will be implemented by the Project to avoid and minimise impacts to biodiversity to the extent practicable.
- iii. Induced Access and Project-related In- migration** - Land clearance for agriculture, illegal logging and harvesting of forest products have been observed without the road improvements. Land concession projects for development of agriculture and infrastructures were found to contribute to erosion of natural habitat in close proximity to the proposed project footprint (e.g., NR2W). However, the risk of uncontrolled habitat clearance for the development of agro-pastoral activities and housing are likely to pose a threat to natural habitats and wildlife in the project area as consequences of the facilitated access and project related in-migration, especially in the section of NR2W. Mitigation measures need to be taken into action to avoid and minimize those potential threats.
- iv. Invasive Alien Species Introduction** - According to the IUCN definition, "Invasive species are alien species that threaten biological diversity"¹². Invasive species include pests, insects and diseases. People are the main source for the

¹¹ NAM OU RIVER BASIN PROFILE SUMMARY DOCUMENT, Environmental and Social Characteristics of a Key River Basin in Lao PDR, 2021.

¹² iucn.org/issues-brief- July 2018.

introduction of alien species either by accident, deliberate action and/or imports. These species often have a high dispersal ability and adaptability, which enables them to rapidly acclimatize quickly to new habitats. Due to these abilities, invasive plant species compete with native species for resources such as nutrients, soil moisture, sunlight and space, often resulting in the loss of naturally occurring species. Although invasive alien species was not yet identified as a threat to biodiversity in the project area at present time, the NR2 is improved to link to neighboring countries, that connects Thailand to the west and Vietnam to the East, and therefore, the introduction of invasive alien species may be of potential risks and impacts to biodiversity in the project area in the long-run. According to the Article 51 of forestry law 2019, the prevention and control of pests, diseases and other plant enemies is to prevent the outbreak and spread of tree pests, diseases weeds and other plant enemies, and control measures need to be implemented in a timely and effective manner. A key procedure of prevention and control of tree pests, diseases and other plant enemies is clearly defined in this article. In the context of NR2, a key priority for the Project is to ensure conservation and safeguard of the biodiversity in NR2 landscape with emphasis on designated areas of national forest conservation (i.e., Phou Hphi) and national protection forest (i.e., Nam Beng) and major rivers in close proximate to the NR2 project area. Mitigation measures designed for reducing direct and indirect impacts to biodiversity values of national conservation forests will also benefit other habitats and species adjacent to the project area. Therefore, avoidance, minimization and restoration measures will have a focus on the biodiversity values of conservation forest as well as other habitats and species adjacent to the proposed project footprint.

Impact summary and assessment of significance

Table 12 provides an assessment of the significance of land use impacts before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 12. Potential Impacts to Flora and Fauna

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
<i>C</i>	<i>Increase demand of fish</i>	<i>River biodiversity</i>	<i>M</i>	<i>H</i>	<i>H</i>	<i>MA J</i>	<i>ST</i>	<i>SM A</i>	<i>ME D</i>	<i>UN</i>	<i>L</i>
<i>C</i>	<i>Increase demand of terrestrial</i>	<i>Special status species</i>	<i>M</i>	<i>H</i>	<i>M</i>	<i>MA J</i>	<i>ST</i>	<i>SM A</i>	<i>ME D</i>	<i>UN</i>	<i>L</i>

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	<i>wildlife</i>										
<i>O</i>	<i>Induced Access and Project-related In-migration</i>	<i>General flora and fauna</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>MOD</i>	<i>LT</i>	<i>SMA</i>	<i>MED</i>	<i>POSS</i>	<i>M</i>
<i>C/O</i>	<i>Invasive Alien Species Introduction</i>	<i>General Habitat</i>	<i>M</i>	<i>H</i>	<i>M</i>	<i>MAJ</i>	<i>LT</i>	<i>SMA</i>	<i>MED</i>	<i>POSS</i>	<i>M</i>

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Low Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely / SMA: Small / INT – Intermediate / EXT – Extensive. + denotes positive impact

Residual Impacts

Table 13. Flora and Fauna Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
<i>C</i>	<i>Increase demand of fish</i>	Low	<i>The measures outline in this ESIA, along with the Project BMP should ensure that no significant project associated impacts to flora and fauna remain.</i>	Not significant
<i>C</i>	<i>Increase demand of terrestrial wildlife</i>	Low		Not significant
<i>O</i>	<i>Induced Access and Project-related In-migration</i>	Medium		Not significant
<i>C/O</i>	<i>Invasive Alien Species Introduction</i>	Medium		Not significant

3.2 Mitigation and Management Measures

3.2.1 Avoidance Measures

A number of measures have been developed to avoid impacts, as much as feasible, on key species and habitats, as described below.

Action A1: Avoid placing construction equipment, stockpiles, locating labour camps in the NPA and PPA as they are very closed to the NR2 E/W road alignment.

- Avoid placing construction equipment, stockpiles, locating labour camps and spoiled disposal sites in natural forests/habitats within Phou Hippi NPA and Nam Beng PPA.
- An ecologist will be on hand to supervise the selection of above facilities and provide advice to the workforce.

Action A2: Avoid clearance of natural habitats and threatened tree species adjacent to NR2

- An ecologist will be on hand to supervise the habitat (tree and bushes) clearance works and provide advice to the workforce.
- Vegetation located on the steep slopes of mountains within the project area will also be preserved where possible to minimize the risk of erosion.
- Storage areas will be located in areas away from natural forest, headstreams and drainage.
- Controls of forest/bushfire including a Project ban on open-burning of waste.

Action A3: Avoid disturbance to priority nocturnal fauna from project-related light, noise and vibration impacts.

- Project construction will not be undertaken at dusk, dawn and at night to avoid disturbance to nocturnal and crepuscular fauna (i.e., bats, herpes) from increased light, noise and vibration.

Action A4: Avoid adversely impacting flora and NPAs through the open-burning of wastes and forest fires.

- Avoid the open-burning of wastes and forest fires by the camp workers.

Action A5: Avoid adversely impacting fauna, flora and protected areas through spills of hazardous materials.

- Avoid spills of oil, asphalt, chemicals and other hazardous materials into the rivers.
- Stockpiles of materials and hazardous compounds (including asphalt, oil, diesel and chemicals) will not be located near any surface watercourses and standing water bodies (i.e., rivers, streams).
- Emergency response procedures will be prepared for the Project which will include a protocol for responding to accidental spills and leakages of diesel fuel, non-hazardous waste and hazardous compounds.

Action A5. Avoid adversely impacting threatened wildlife species through illegal hunting and trafficking from project-related employees or contractors.

- Project staff and contractors will be banned from hunting, fishing, buying and collecting natural resources (e.g., wildlife, aquatic animals, fish) within the project area including rivers to minimize impacts to fauna and their habitats.

Action A6. Avoid introduction of invasive species and pests

- A washdown procedure will be employed to prevent invasive weed spread and potential contamination of the project area from the receiving environment.
- Non-invasive local plant species will only be used for revegetation
- Best practice organic waste management procedures will be followed to avoid attracting pests.

3.2.2 Mitigation and Minimization Measures

Biodiversity management controls have been designed to mitigate high-risk potential impacts during the construction and operation phases, to priority biodiversity species and habitats. A summary of the proposed mitigation measures outlined (see Table 14). Implementation of these best-practice mitigation measures will reduce as much as feasible the residual impacts on priority biodiversity features. The following section details the principal actions that will be required to ensure no long-term impact on priority biodiversity features.

Action B1. Minimize loss of threatened vascular plant species and natural habitats.

- An ecologist will be on hand to supervise the habitat clearance works (e.g., removal of trees where the road is expanded) and provide advice to the workforce.
- Pre-clearance checks will be undertaken prior to the commencement of works to avoid cutting unnecessary trees along the road.
- Controls of forest/bushfire including a Project ban on open-burning of waste.

Action B2. Minimize the impact of an accidental spill of hazardous materials on priority aquatic species and habitats.

- Staff and contractors will receive training in spill events management.
- Staff and contractors will strictly adhere to a hazard control regulation.

Action B3. Minimize impacts to aquatic species and habitats from suspended sediments and polluted runoff from construction sites.

- Install sediment control systems (i.e., traps and dams) where necessary.
- Clearly communicate to all employees and contractors that any dumping or discharging of potentially contaminated water (e.g., oily water, raw sewage, untreated waste water, etc.) into the rivers is strictly prohibited: through employee training, mandatory induction, specific contract requirements, and procedures in place.
- Water discharge from facilities (i.e., wheel washes, vehicle washing points, equipment washing points, etc.) will be captured by a combination of drainage systems, settling tanks and oil interceptors. The waste will then be responsibly disposed.

Action B4. Minimize introduction of invasive species and pests

- Actively monitor and eradicate invasive vascular plant species along the right of way.

Action B5. Minimize impacts to habitats and threatened species from over-exploitation of natural resources and illegal hunting.

- Workers are to be clearly informed the environmental rules of conduct, along with the penalties for non-compliance, to be prohibited from buying/selling, eating of wildlife, and burning of natural vegetation, anywhere in or near the project area.

Action B6. Minimize the indirect impacts to natural habitats and species associated with exploitation of natural resources and illegal hunting from Project-related facilitated access and in-migration.

- Coordination with the local forest/PA authorities to put “No wildlife hunting and trafficking” signs along the NR2 alignment near the NPA/PPA.
- Provision of information on areas of high risk for landslide/soil erosion along NR2 to relevant government sectors (i.e., agricultural and environment) to limit the clearance of land for agriculture.
- Consultation with local authorities to minimise the impacts of in-migration on natural resource (including the collection of timber, non-timber products and hunting) during the operation phase.
- Collaboration with protected area managers to ensure indirect impacts to the Phou Hippi NPA and other forested area in the NE2 Landscape are adequately mitigated;
- Promote environmental preservation and conservation practices by local communities through establishing stakeholder engagement network.
- Prohibit hunting and natural resource collecting by the road maintenance personnel and contractors when at work. To be communicated through induction and training to all personnel (employees and contractors).

3.2.3 Rehabilitation / Restoration Measures

A key priority for the Project is to ensure conservation and safeguard of the biodiversity in NR2 landscape. The project will set targets/actions to successfully rehabilitate and restore habitats within the project area.

Action C1. Restore the physical landscapes that have been adversely impacted by Project activities.

- All rubbish and waste materials within the project area (including the project footprint, the working width, borrow pits, stockpiling areas and contractor facility area) will be cleared of all rubbish and waste material in accordance with the project’s waste management principles.
- The physical landscape of the project area (i.e., escarpments and embankments) will be restored by clearing the area of debris, filling holes with recycled material from the road works.
- The geocells (the upper layer of the geotextile) will be filled with suitable substrate for the establishment of vascular plant species (i.e., grasses and herbs).

Action C2. Establish and implement a planting scheme for the Project

- A planting scheme should be developed and implemented by the Project or the contractor in consultation with Project Management Unit (including Provincial/district Public Work and Transportation Division (PWT)).
- A number of trees and bushes will be planted along the sidewalks of the proposed road from the beginning to the end of the road alignment. The species of trees to be planted should be native tree species of local provenance including rare and threatened species.
- The geocells geotextile along the escarpments and embankments will be seeded with grasses and herbs using native species of local provenance including nationally rare and threatened species.
- All closure quarries and borrow pits will be rehabilitated to an acceptable manner as close to the original land by planting native trees or bushes, and that can provide natural habitats for wildlife.

Action C3. Undertake regular watering and monitoring to minimize the risk of poor species establishment following planting.

All planted trees, bushes, grasses, herbs, including rare and threatened species will be regularly watered by the contractors until successful establishment has been achieved. MPWT/PMU should monitor the establishment of all planted vascular plants on a regular basis following the completion of the construction works. Any dead vascular plants will also be replaced as 'like for like' during the agreed timeframe.

Table 14. Summary of the proposed avoidance, minimization and restoration/rehabilitation measures which are under responsibility of contractors.

Project-related impacts	Avoidance measures	Minimization	Rehabilitation
Preconstruction Phase			
Loss of habitat and threatened flora/fauna species	Avoid placement of the Project' infrastructures in natural habitat areas. Keep away from natural forests, headstreams and drainages.	<p>An ecologist will be on hand to supervise the habitat clearance works and provide advice to the workforce.</p> <p>Ensure a confirmatory check of all plants/trees to be removed by a suitably qualified ecologist prior to clearance commencing.</p> <p>Ensure a confirmatory pre-construction check of all suitable otter habitat by a suitably qualified ecologist prior to any construction works commencing.</p>	
Construction phase			
Loss of habitat and threatened flora species	Forest/bushfire controls including a Project ban on open-burning of waste	<p>An ecologist will be on hand to supervise the habitat clearance works and provide advice to the workforce.</p> <p>Routine checks will be undertaken by the Environmental Team to ensure compliance</p>	<p>Establish and implement a planting scheme for the Project by planting only native trees and bushes along the road side.</p> <p>All closure quarries and borrow pits will be rehabilitated to an acceptable manner as close to the original land by planting native trees or bushes, and that can provide natural habitats for wildlife.</p>
Noise and vibration	Avoidance of night working to avoid impacts to priority nocturnal, crepuscular fauna.	Vehicles, equipment and machinery will be regularly checked and maintained to ensure that they are in good working order and within industry standards for noise and vibration emissions.	

Biodiversity Management Plan (BMP) for National Road No.2

Project-related impacts	Avoidance measures	Minimization	Rehabilitation
Air pollution	Ban on open-burning of general wastes and vegetation	Regular watering during the dry season in areas of biodiversity sensitivity.	
Invasive species transfer and pest immigration	<ul style="list-style-type: none"> - Implementation of best practice organic waste management procedures to avoid attracting pests. - Non-invasive local plant species will only be used for revegetation. - A washdown procedure will be employed to prevent invasive weed spread and potential contamination of the project area from the receiving environment. 	Actively monitor and eradicate invasive vascular plant species along the right of way	
Adverse impact on fauna, flora and protected areas through spills of hazardous materials.	<ul style="list-style-type: none"> - Avoid spills of oil, asphalt, chemicals and other hazardous materials into the rivers through strictly adhere to a hazard prevention and control regulation. - Stockpiles of materials and hazardous compounds (including asphalt, oil, diesel and chemicals) will not be located near any surface watercourses and standing water bodies (i.e., rivers, streams). 	<ul style="list-style-type: none"> - Emergency response procedures will be prepared for the Project which will include a protocol for responding to accidental spills and leakages of diesel fuel, non-hazardous waste and hazardous compounds. - Staff and contractors will receive training in spill events management. - Staff and contractors will strictly adhere to regulation. 	All rubbish and waste materials within the project area (including the project footprint, the working width, borrow pits, stockpiling areas and contractor facility area) will be cleared of all rubbish and waste material in accordance with the project's waste management principles
Suspended sediments and polluted runoff from construction sites	-	<ul style="list-style-type: none"> - Install sediment control systems (i.e., traps and dams) where necessary. - Clearly communicate to all employees and contractors that any dumping or discharging of potentially contaminated water (e.g., oily water, raw sewage, untreated waste water, etc.) into the rivers is strictly prohibited: through employee training, mandatory induction, specific contract requirements, and procedures in place. 	

Biodiversity Management Plan (BMP) for National Road No.2

Project-related impacts	Avoidance measures	Minimization	Rehabilitation
		<ul style="list-style-type: none"> - Water discharge from facilities (i.e., wheel washes, vehicle washing points, equipment washing points etc.) will be captured by a combination of drainage systems, settling tanks and oil interceptors. The waste will then be responsibly disposed. 	
Adverse impacts on threatened fauna and flora species through wildlife trafficking and over-exploitation	Project staff and contractors to be banned from hunting, buying, fishing and collecting natural resources within the project area. This will be communicated to staff and contractors through staff inductions and training.	<ul style="list-style-type: none"> - Workers are to be clearly informed the environmental rules of conduct, along with the penalties for non-compliance, to be prohibited from buying/selling, eating of wildlife, and burning of natural vegetation, anywhere in or near the project area. - Workers' camps should be inspected regularly, but on random days and times, for such products 	
Over-exploitation of natural resources and illegal hunting from Project-related in-migration		<ul style="list-style-type: none"> - Collaboration with protected area managers to ensure indirect impacts to the Phou Hippi NPA and other forested area in the NE2 Landscape are adequately mitigated; - Consultation with local authorities to minimize the impacts of in-migration on natural resource exploitation (e.g., collection of timber, NTFPs and hunting). - Prohibit hunting and natural resource collecting by the road maintenance personnel and contractors when at work. To be communicated through induction and training to all personnel (employees and contractors) - Extend the biodiversity training to the local government officials, local market officials, boarder officials, NPA staff and others, aimed at enforcement of the regulations, importance of preserving the natural habitat to enhance preservation and encourage increase in wildlife. 	
<i>Operation & Maintenance Phase</i>			
Noise and vibration from		<ul style="list-style-type: none"> - Use of natural and artificial sound barriers near biodiversity sensitive habitats. 	

Biodiversity Management Plan (BMP) for National Road No.2

Project-related impacts	Avoidance measures	Minimization	Rehabilitation
traffic vehicles and human disturbance		<ul style="list-style-type: none"> - Speed restrictions within 	
Exploitation of natural resources and illegal hunting from Project-related in-migration		<ul style="list-style-type: none"> - Collaboration with protected area managers to ensure indirect impacts to threatened fauna & flora are adequately mitigated; - Consultation with local authorities to minimize the impacts of in-migration on natural resource exploitation (including the collection of timber, non-timber products and hunting). - Prohibit hunting and natural resource collecting by the road maintenance personnel and contractors when at work. To be communicated through induction and training to all personnel (employees and contractors) 	
Invasive species transfer and pest in-migration		<ul style="list-style-type: none"> - Actively monitor and eradicate invasive vascular plant species along the right of way 	

4. MONITORING, EVALUATION AND ADAPTIVE MANAGEMENT

4.1 Introduction

Aligned with the Project ESIA and Environmental and Social Management Plan (ESMP). This will incorporate a Biodiversity Monitoring and Evaluation Program to assess the efficacy of the avoidance and mitigation measures and to inform the requirement for adaptive management. This could potentially be a collaborative approach with protected area managers and other local government agencies. A draft set of monitoring actions has been developed based on the avoidance and mitigation measures designed for the Project. Where possible, thresholds will be established for each monitoring approach that will alert the Project that mitigation measures need to be adapted and revised.

4.1.1 Anecdotal Wildlife Observations

A reporting system will be established to monitor anecdotal observations of priority wildlife sightings and field signs recorded by staff, contractors and local residents during construction. The reporting system will be followed by the contractors and managed by a supervising engineer with support from an experienced ecologist when required. This information will be used to assess the requirement for adaptive management.

4.1.2 Wildlife trafficking monitoring

Monitoring of wildlife trade in local markets including roadside markets/vendors and district markets along the NR2 – Nam Beng, Houn, Beng, Xay, Lar and Khoua districts. In parallel, monitoring of wildlife consumption in the workers' camps to assess the correlation and efficacy of mitigation measure on wildlife trafficking and workers' consumption as a consequence of presence of numbers of construction workers and contractors. Consumption and cooking of wildlife, bush meat, protected / endangered / vulnerable fish and aquatic organisms should be banned from the camps under penalty of loss of job for anyone caught doing it. Indicator: Wildlife trafficking data at local markets and workers' camps.

4.1.3 Monitoring of pre-clearing/removal of trees and forest fire.

Monitoring of pre-clearing of trees and bushes within the NR2 project where the road is expanded to ensure that only trees surveyed and marked by ecologist to be removed. In addition, routine records of forest/bushfire in the contiguous forest alongside the road to assess the efficacy of minimization measure on control of forest/bushfire as consequence of the Project activities. Indicator: 260 trees will be removed.

4.1.4 Monitoring Habitat Restoration

The status of the planted trees, shrubs and endemic, rare and threatened species will be closely monitored until successful establishment has been achieved. The number of trees and quadrats of grass land will serve as an indicator of success for the wider restored habitats.

Regular walkover assessments will also be undertaken to assess establishment over time. In the event of dieback, areas of dead vascular plants will be replaced either through plug planting or seeding. This will be undertaken by contractors under supervision of supervising engineer in consultation with local government offices.

Indicators:

- Changes in indicators of plant health (i.e., leaf coloration, wilting, etc.)
- Changes in plant numbers
- Changes in coverage

4.1.5 Monitoring the Efficacy of mitigation measure on spoiled hazards discharged into the rivers.

- Routine records by the Project Environmental and Social Unit Manager/officer at the construction site.

Table 15. Summary of recommended monitoring approaches

Monitoring types	Indicators	Triggers for adapted management	Frequency	Responsibility
Anecdotal Wildlife Observations	N/A	N/A	Ongoing	ES Unit, Ecologist
Wildlife trafficking monitoring	Species and number of wildlife being sold at local markets and at workers' camps.	An increase in wildlife trafficking/sale and consumption following the establishment of a camp or presence of construction workers	Ongoing	ES Unit, Ecologist
Monitoring of pre-clearing/removal of trees and forest fire	260 trees of 40 species	Increase in tree numbers cut, and frequency of bush fire	Ongoing	ES Unit, Ecologist
Monitoring Habitat Restoration	Changes in indicators of plant health and in plant numbers	Plant dieback	Until establishment	ES Unit, Ecologist

5. IMPLEMENTATIONS

5.1 Responsibility

The roles, responsibilities and monitoring systems for the delivery of avoidance, mitigation and management measures are detailed in the Project's Environmental and Social Management Plan (ESMP), the Environmental Monitoring Plan (EMP); a summary which relates to biodiversity management is presented below. It is anticipated that this will be updated with more detailed descriptions as the Project progresses.

5.2 Staff and Contractors

Implementation of this BMP will require appropriate staff, financial resources, equipment and support systems. It is the responsibility of all relevant government staff and Project contractors to comply with the requirements set out in this BMP, ESMP, EMP and ESIA. The responsibility of Project contractors and suppliers will be defined through standard terms and conditions of contracts that are consistent with the commitments of the BMP, ESMP and EMP.

Ministry of Public Work and Transportation, i.e., the Project Management Unit is responsible for setting up a suitably experienced and qualified Environmental and Social Team to oversee implementation of the BMP by the Project. The team should comprise a Project environmental and biodiversity expert, an occupational health and safety and social expert, who will be recruited by PMU. The environmental and biodiversity expert will report directly to the Project Manager. Under the direction of the Environmental and Social Unit manager, the environment team will be responsible for the day-to-day implementation and continued improvement of the BMP, compliance monitoring, compliance with physical and biodiversity rehabilitation activities and reporting.

Table 16. Summary of staff roles and responsibilities related to biodiversity management

Role	Responsibility
Project Manager and the Environmental and Social Unit Manager	<ul style="list-style-type: none"> • overall responsibility for the implementation of this management plan • updating this management plan • make the plan available to all employees and contractors • provide leadership on biodiversity matters within the Project Environmental Team. • work effectively with relevant department managers to develop best practice standards to ensure compliance with biodiversity requirements • oversee the implementation of the biodiversity management actions in accordance with this plan • lead stakeholder consultation • disseminate data to biodiversity specialists to enable evaluation of the effectiveness of programmes in achieving biodiversity objectives • monitor and report on compliance with the Project's biodiversity actions, commitments and legal obligations • provide technical and strategic advice on biodiversity matters to the Project Manager

Role	Responsibility
	<ul style="list-style-type: none"> • prepare quarterly and annual biodiversity reports focusing on compliance, monitoring, evaluation and adaptive management with support from the wider environmental team, • prepare annual reports for WB and EIB
Environmental and biodiversity advisor	<ul style="list-style-type: none"> • provide training and guidance to staff and contractors on the requirements of this management plan • assist with the implementation of the biodiversity management actions in accordance with this management plan • enforce the biodiversity ‘permit to work’ systems • monitor and report on compliance in accordance with the national legislation and regulatory requirements, ESMP, ESAP and BMP • assist in the delivery of biodiversity monitoring, data analysis and reporting. • assist with stakeholder consultation • assist with training and capacity building of employees and contractors.
Ecological clerk of works	<ul style="list-style-type: none"> • as part of the contractor’s team, the ecological clerk of works will provide technical guidance on the implementation of the BMP • coordinate the pre-construction surveys, biodiversity checks and monitoring in accordance with the BMP, ESMP and ESIA • undertake supervisory tasks including the supervision of the habitat clearance works. • The provision of biodiversity inductions and presentation to all contractors and staff • management of the biodiversity ‘permit to work systems’ and compliance monitoring and enforcement.
General staff and contractors	<ul style="list-style-type: none"> • comply with requirements of the BMP, ESIA, ESAP and ESMP, relevant to their specific job requirements • uphold the Project’s biodiversity objectives as defined in the BMP and ESMP • use appropriate materials, equipment, machinery and vehicles to minimize EHS and Biodiversity risks • attend training and site inductions • reporting of accidents and incidents • comply the Albanian law requirements
Supervising engineer	<ul style="list-style-type: none"> • undertake daily monitoring of implementation of ESMP / EIA, OHS and Social requirements • input into monthly reporting • ensure the training of workers, use of appropriate equipment, machinery and vehicles and compliance with health and safety procedures and protective equipment • documentation and reporting of occupational accidents, diseases and incidents • compliance monitoring • the provision of quarterly reports on status of implementation of the criteria on ESMP, ESIA, ESMP, OHS and social and environmental mitigation measures.

5.3 Key stakeholders

Table 17. Key stakeholder engagement in BMP

Stakeholder	Role	Responsibility
Local communities and Local Government (Khua District, Phongsaly province; Xay, Houn, Beng and Pak Beng District, Oudomxay Province) Land owner, land user, inhabitants in local area.	The communities will participate in planning and implementation. The impacts and benefits on the people living and working in the area need to be well understood. Communities need to be able to maximize their benefits.	Communities are interested and are keen to discuss the income generating opportunities and work with Contractor, Consultants and Biodiversity specialist.
Contractor	Key party for BMP implementation activities during pre-construction, construction phase and post construction phase.	Implements required obligations and instruction stated in the BMP. It is important to hire biodiversity specialist to conduct implementation frameworks as required by project owner (MPWT, DOR, PMU, DPWT)
Ministry of Public Work and Transportation (MPWT), Department of Roads (DOR), Project Management Unit (PMU).	PMU represents MPWT and DR for all management and monitoring the project activities, reporting and documentation.	Committed to engaging with BMP and communities, to support the objectives the BMP.
Provincial/District Agriculture and Forestry Office (P/DAFO)	Under supervision of Ministry of Agriculture and Forestry (MAF). PAFO and DAFO will play a key role in sustainable management of agriculture and forests including the BMP for following up and implementing required approval of BMP activities.	Implements required obligations and instruction stated in the BMP. It is important to collaborate with biodiversity specialist to conduct implementation frameworks as required by project owner (MPWT, DOR, PMU, DPWT)
Provincial/District Office of Natural Resources and Environment (P/DONRE)	Under supervision of Ministry of Natural Resources and Environment. PONRE will lead the Natural Resources and Environment related issue including the BMP for following up and implementing required approval of BMP activities.	Implements required obligations and instruction stated in the BMP. It is important to collaborate with biodiversity specialist to conduct implementation frameworks as required by project owner (DPWT)

5.4 Capacity Building

MPWT/PMU (together with biodiversity expert) will provide specific environmental and social training that is relevant to the roles and responsibilities of all employees and contractors, inclusive of an initial induction for any on-site workers. The Environment Team will also receive specific training relevant to their job requirements. This may include species identification, survey techniques, the use of equipment and data analysis. During periodic site inspections, workers' knowledge of general environmental, health and safety issues will be evaluated to monitor enforcement and compliance with Project procedures and plans.

The construction operator and / or supervisor will be fully aware of the ESIA / ESMP and BMP provisions and trained regarding their implementation. The MPWT/DOR/PMU staff will provide training on ESMP / ESIA / BMP implementation and reporting, in line with WB/EIB's guidelines and the Environmental and Social Management Framework of the Project. The workers will be trained before commencement of works (and upon the employment, for newcomers) regarding safety issues and also by MPWT/DOF/PMU staff during site visits to the construction site. A Site Instruction Manual will be prepared and distributed to all employees (including contractors) summarizing environmental and social requirements, responsibilities, and work procedures. A

As part of the wider regional and local Roads Connectivity Project, capacity-building trainings will be provided to the provincial/district PMU staff to enhance their knowledge and understanding of the ways in which, the participation of both women and men in road maintenance can be enhanced and local ownership and sustainability of road maintenance activities promoted. This will include working with several contractors to explore opportunities to promote women's employment in high-skilled jobs in their respective workforce.

5.5 Monitoring and Maintenance Works

MPWT/PMU will be responsible for overseeing the delivery of the monitoring works throughout the construction phase and during the operation following completion of the construction phase. During the construction phase, the supervising engineer / contractor will report on the implementation of the ESMP, BMP, and EMP to MPWT/PMU on a monthly as well as on the implementation of works. The report will include a chapter or section on the environmental performance including performance measures relating to biodiversity. The content of the report will be agreed with MPWT/PMU and subject to review by WB and EIB. In case of accident or negative impact on the environment including biodiversity (not predicted by the EISA / ESMP) the supervising engineer will report to World Bank and EIB immediately.

5.6 Reporting Commitments

MPWT/PMU will provide an annual environmental and social report to WB/EIB which includes reporting on project progress, compliance, the provision of any material changes or updates to the BMP and ESMP in accordance with the loan agreement. During construction, there will be weekly and monthly management meetings, where required. Contractors will prepare a pre-construction report with analysis provided to WB/EIB prior to the commencement of works, and include biodiversity management plan implementation update to MPWT/PMU by monthly reporting.

5.7 Updating the BMP

This BMP will be updated, when necessary, to reflect any significant changes; such as the use of blasting during the construction phase and the associated mitigation measures. Any material changes to the BMP will be included in the change of process by the Environmental and biodiversity advisor with agreement with MPWT/PMU.

5.8 Performance Review and Auditing

Regular audits of the Project ESMP including the BMP implementation will be undertaken internally by MPWT/PMU. The audits will assess: Adequacy of the plans with respect to the scale and nature of anticipated impacts and current development stage of the Project;

- workforce awareness, competence and compliance with the ESMP, BMP and associated plans and procedures
- performance of managers and operators in implementing, maintaining and enforcing the BMP and associated plans
- suitability of allocated resources, equipment and budget for implementation of the ESMP and BMP.

All audit recommendations will be discussed with the contractors and also where appropriate ADF. Corrective actions will be followed up through the relevant ADF tracking database to ensure the process is documented and items closed.

5.9 Project Schedule

It is anticipated that the road will take 36 months to construct and the start date will be determined by the Investor according to the procurement process.

5.10 Budget for implementation of BMP

This BMP is considered as part of environmental, social, health and safety requirements. The costs for implementation of the BMP as per contractors' responsibility will be part of OPBRC contracts. The BMP implementation as per the MPWT/PMU including coordination with other relevant ministries/departments, data collection, training, monitoring, and reporting will be and put in the project budget.

References:

- C. Niyomdham, Pham Hoàng Hộ, P Dy Phon & J.E. Vidal, 1997. Flore du Cambodge, du Laos et du Vietnam, Vol 29: 1-60, Paris, France
- Chawalit Niyomdham, 2002. Thai Forest Bulletin (BOT) 30:124-166, Bangkok Thailand
- Dezhao Chen, Prof. Dianxiang Zhang & Kai Larsen, 2010. Flora of China Vol. 10: 121-130
- Department of Forestry, Ministry of Agriculture and Forestry, 2022a. The Survey and Assessment Agarwood (*Aquilaria* spp. and *Gyrinops* sp.) in Laos. Vientiane Capital, Lao PDR
- Department of Forestry, Ministry of Agriculture and Forestry, 2022b, Guideline Taxonomy Study on *Aquilaria* and *Gyrinops* (Thymelaeaceae) of Lao PDR. Vientiane Capital, Lao PDR
- Gagepain, 1916. Fl. Gen. l'Indo-Chine. T. II, fasc. 4, p. 469-500, Paris, France
- Hô, P.H. (2003). An Illustrated Flora of Vietnam, Vol. 2: 47. Hanoi, Vietnam.
- Hô, P. H. (1992). Le Flore du Cambodge, du Laos et du Vietnam. Vol. 26: 46-54.
- Hoang Van Sam et al., (2019). *Aquilaria yunnanensis* S.C. Huang (Thymelaeaceae), A New Record for the Flora of Vietnam. Forest and Society. Vol. 3(2): 202-208.
- J.E. Vidal, 1960, Noms vernaculaires de Plantes en usage au Laos, Paris, France
- Lecomte (1915). Flore Générale d'Indo-Chine. Vol. 5 (1): 176
- L.C. Kiet & Keßler. (2005). A New Species Of *Aquilaria* (Thymelaeaceae) From Vietnam in Blumea 50:135-141.
- NAFRI, 2022. Master List of Tree in Laos
- Newman, M., Ketphanh, S., Svengsuksa, B., Thomas, P., Sengdala, K., Lamxay, V. & Armstrong, K. (2007). A checklist of the vascular plants of Lao PDR: 1-394. Royal Botanic Gardens Edinburgh. UK.
- Peterson, B., (1997). Thymelaeaceae. In Flora of Thailand Vol. 6(3): 226–232.
- Pham Hoàng Hộ, 1999. An Illustrated Flora of Vietnam. Vol I, P. 878-889.
- W. John Kress, Robert A. DeFilipps, Ellen Farr and Daw Yin Yin Kyi, 2003, A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar. Vol. 45. 1-590. Washington, DC. USA
- Wang Yinzhen et al., (2007). Thymelaeaceae in Flora of China Vol. 13: 214-215.

Annex 1: Standard Operating Procedures for minimization of the potential project-related impacts

Action Number	Measures for habitat/ land clearance and stockpiling management	Project Phase	
		Construction	Operation
Minimization of Habitat Clearance Areas to The Extent Practicable			
	An ecologist will be on hand to supervise the habitat clearance works and provide advice to the workforce	X	
	Only list of tree species along the NR2 identified by an experienced botanist to be removed will be used by the Contractor.	X	
	Storage areas will be located in non-natural habitat areas away from natural forests, headstreams and drainages.	X	
	Routine checks will be undertaken to ensure vegetation (trees/bushes) clearance is confined to defined areas of disturbance.	X	
	Vegetation located on the steep slopes of mountains within the project area will also be preserved where possible to minimise the risk of erosion.	X	
Stockpile management			
	Stockpiles will be located within designated soil stockpile areas away from high condition natural habitat, local waterways and flood inundation areas to minimize the risk of erosion and sediment run-off.	X	
Alien Invasive Species Control			
	A washdown procedure will be employed to prevent invasive weed spread and potential contamination of the project area from the receiving environment	X	X
	Pre-clearance checks for alien invasive species of areas designated for clearance and the site access routes will be undertaken prior to the commencement of site preparation works	X	
	Non-native plant species are planted in natural habitats		
Measures for the Management of Water Quality and Pollution events			
	Pollution controls will be put in place during the construction process. These will be fully defined by the project prior to the construction	X	
	Stockpiles of materials and hazardous compounds (including asphalt, oil, diesel and chemicals) will not be located near any surface watercourses and standing water bodies (i.e., rivers, headstreams/tributaries)	X	

Action	Measures for habitat/ land clearance and	Project Phase	
	Water discharge from facilities (i.e., wheel washes, vehicle washing points, equipment washing points etc) will be captured by a combination of drainage systems, settling tanks and oil interceptors. The waste will then be responsibly disposed.	X	
	Clearly communicate to all employees and contractors that any dumping or discharging of potentially contaminated water (e.g., oily water, raw sewage, untreated waste water, etc.) into the surrounding environment, particular rivers, is strictly prohibited through employee training, mandatory induction, specific contract requirements, and procedures in place.	X	X
	Emergency response procedures will be prepared for the Project which will include a protocol for responding to accidental spills and leakages of diesel fuel, non-hazardous waste and hazardous compounds.	X	X
Minimization of hunting and trafficking of endangered wildlife and aquatic species from over-exploitation			
	Staff and contractors are clearly informed through staff inductions and training, and enforce strictly the regulation against violation.		
Minimization of habitat and threatened plants form forest/bush fire			
	Forest/bushfire controls including a Project ban on open-burning of waste	X	X
	Staff and contractors were provided induction and training and strictly punished against violation.	X	X

Annex 2: Wildlife Species reported to occur in Phou Hippi NPA

At Risk in Lao PDR (ARL); Potentially At Risk in Lao PDR (PARL), Little Known in Lao PDR (LKL)

Common Name	Scientific Name	Global Threat Category	Lao Risk Status	Sources
Mammals				
Assamese Macaque	<i>Macaca assamensis</i>	VU	PARL	R, I
Black Giant Squirrel	<i>Ratufa bicolor</i>	NT	PARL	R, I
Back-striped Weasel	<i>Mustela strigidorsa</i>	VU	LKL	R, I
Small-clawed Otter	<i>Aonyx cinereus</i>	VU	ARL	R, I
Smooth-coated Otter	<i>Lutra perspicillata</i>	VU	ARL	R, I
Clouded Leopard	<i>Pardofelis nebulosa</i>	VU		R, I
Marbled Cat	<i>Pardofelis marmorata</i>	DD	LKL	R
Leopard Cat	<i>Prionailurus bengalensis</i>	LC	-	R
Southern Serow	<i>Capricornis milneedwardsii</i>	VU	PARL	R, I
Sambar deer	<i>Rusa unicolor</i>	0	PARL	R, I
Binturong	<i>Arctictis binturong</i>	VU	ART	R, I
Pangolins	<i>Manis pentadactyla/javanica</i>	CR	ART	R, I, Re
Wild Pig	<i>Sus scrofa</i>	LC	-	I
Red Muntjac	<i>Muntiacus muntjac</i>	LC	-	I
Asiatic brush-tailed porcupine	<i>Atherurus macrourus</i>	LC	-	I
Squirrels	<i>Sciurus spp.</i>	LC	-	I
Birds				
Silver Pheasant	<i>Lophura nycthemera</i>	-	LKL	R
Grey-Peacock Pheasant	<i>Rheinardia ocellata</i>	-	LKL	R
Blyth's Kingfisher	<i>Alcedo Hercules</i>	VU	PARL	R
Grey-headed Lapwing	<i>Vanellus cinereus</i>	GNT	PARL	R
Pied Falconet	<i>Microhierax melanoleucos</i>	GNT	LKL	R
Green Cochoa	<i>Cochoa viridis</i>	GNT	0	R
Yellow-vented Warbler	<i>Phylloscopus cantator</i>	GNT	0	R
Rufous-throated Fulvetta	<i>Alcippe rufogularis</i>	GNT	0	R
Short-tailed Parrotbill	<i>Paradoxornis davidianus</i>	VU	0	R
Red Jungle fowl	<i>Gallus gallus</i>	LC		R
Reptiles				
Big head Turtle	<i>Platysternon megacephalum</i>	EN	ART	Re, I
Impressed Tortoise	<i>Manouria impressa</i>	EN	ART	Re, I
Yellow Tree Monitor	<i>Varanus reisingeri</i>	LC		Re, I

Note. R – Report; I – Interviews of local staff/villagers, Re – Release to the forest by officials.

Annex 3: Fish recorded in Nam Ou basin including Nam Phak Rirver

No	Scientific name	Family	IUCN Red List
1	<i>Notopterus notopterus</i>	Notopteridae	LC
2	<i>Chitala blanci</i>	Notopteridae	NT
3	<i>Chitala lopis</i>	Notopteridae	EX
4	<i>Chitala ornate</i>	Notopteridae	LC
5	<i>Clupeichthys aesamensis</i>	Clupeidae	LC
6	<i>Sundasalanx mekongensis</i>	Sundasalangidae	LC
7	<i>Acheilognathus deignani</i>	Cyprinidae	DD
8	<i>Bangana behri</i>	Cyprinidae	VU
9	<i>Bangana lippus</i>	Cyprinidae	DD
10	<i>Barbonymus gonionotus</i>	Cyprinidae	LC
11	<i>Barbonymus schwanefeldii</i>	Cyprinidae	LC
12	<i>Cirrhinus cirrhosis</i>	Cyprinidae	VU
13	<i>Cirrhinus molitorella</i>	Cyprinidae	NT
14	<i>Cosmochilus harmandi</i>	Cyprinidae	LC
15	<i>Crossocheilus reticulatus</i>	Cyprinidae	LC
16	<i>Cyclocheilichthys apogon</i>	Cyprinidae	LC
17	<i>Cyclocheilichthys armatus</i>	Cyprinidae	LC
18	<i>Cyclocheilichthys enoplos</i>	Cyprinidae	LC
19	<i>Cyclocheilichthys furcatus</i>	Cyprinidae	LC
20	<i>Cyclocheilichthys heteronema</i>	Cyprinidae	LC
21	<i>Cyclocheilichthys repasson</i>	Cyprinidae	LC
22	<i>Cyprinus carpio</i>	Cyprinidae	VU
23	<i>Cyprinus rubrofuscus</i>	Cyprinidae	LC
24	<i>Danio laoensis</i>	Cyprinidae	LC
25	<i>Danio roseus</i>	Cyprinidae	LC
26	<i>Esomus metallicus</i>	Cyprinidae	LC
27	<i>Garra cambodgiensis</i>	Cyprinidae	LC
28	<i>Garra cyclostomata</i>	Cyprinidae	Not Evaluated
29	<i>Hampala macrolepidota</i>	Cyprinidae	LC
30	<i>Hemibarbus maculatus</i>	Cyprinidae	LC
31	<i>Hypsibarbus lagleri</i>	Cyprinidae	VU
32	<i>Hypsibarbus malcolmi</i>	Cyprinidae	VU
33	<i>Hypsibarbus pierrei</i>	Cyprinidae	DD
34	<i>Hypsibarbus vernayi</i>	Cyprinidae	LC

No	Scientific name	Family	IUCN Red List
35	<i>Hypsibarbus wetmorei</i>	Cyprinidae	LC
36	<i>Labeo chrysophekadion</i>	Cyprinidae	LC
37	<i>Luciocyprinus striolatus</i>	Cyprinidae	EN
38	<i>Mekongina erythrospila</i>	Cyprinidae	NT
39	<i>Metzia bounthobi</i>	Cyprinidae	New sp. 2012
40	<i>Mystacoleucus atridorsalis</i>	Cyprinidae	LC
41	<i>Mystacoleucus marginatus</i>	Cyprinidae	LC
42	<i>Mystacoleucus ectypus</i>	Cyprinidae	LC
43	<i>Mystacoleucus greenwayi</i>	Cyprinidae	LC
44	<i>Mystacoleucus lepturus</i>	Cyprinidae	VU
45	<i>Onychostoma fusiforme</i>	Cyprinidae	LC
46	<i>Onychostoma gerlachi</i>	Cyprinidae	NT
47	<i>Onychostoma meridionale</i>	Cyprinidae	LC
48	<i>Opsarius koratensis</i>	Cyprinidae	LC
49	<i>Opsarius pulchellus</i>	Cyprinidae	LC
50	<i>Osteochilus lini</i>	Cyprinidae	LC
51	<i>Paralaubuca barroni</i>	Cyprinidae	LC
52	<i>Poropuntius angustus</i>	Cyprinidae	DD
53	<i>Poropuntius carinatus</i>	Cyprinidae	LC
54	<i>Poropuntius laoensis</i>	Cyprinidae	LC
55	<i>Poropuntius normani</i>	Cyprinidae	LC
56	<i>Probarbus jullieni</i>	Cyprinidae	CR
57	<i>Probarbus labeamajor</i>	Cyprinidae	EN
58	<i>Pseudohemiculter dispar</i>	Cyprinidae	VU
59	<i>Pseudorasbora parva</i>	Cyprinidae	LC
60	<i>Puntioplites falcifer</i>	Cyprinidae	LC
61	<i>Puntioplites proctozyston</i>	Cyprinidae	LC
62	<i>Puntioplites waandersi</i>	Cyprinidae	LC
63	<i>Puntius brevis</i>	Cyprinidae	LC
64	<i>Puntius Jacobusboehlkei</i>	Cyprinidae	LC
65	<i>Puntius semifasciolatus</i>	Cyprinidae	LC
66	<i>Puntius stoliczkanus</i>	Cyprinidae	LC
67	<i>Raiamas guttatus</i>	Cyprinidae	LC
68	<i>Rasbora atridorsalis</i>	Cyprinidae	LC
69	<i>Rhodeus ocellatus</i>	Cyprinidae	DD

No	Scientific name	Family	IUCN Red List
70	<i>Scaphiodonichthys acanthopterus</i>	Cyprinidae	LC
71	<i>Scaphognathops stejneri</i>	Cyprinidae	LC
72	<i>Scaphognathops theunensis</i>	Cyprinidae	CR
73	<i>Sikukia gudgeri</i>	Cyprinidae	DD
74	<i>Tor tambra</i>	Cyprinidae	DD
75	<i>Tor tambroides</i>	Cyprinidae	DD
76	<i>Acanthopsoides gracilentus</i>	Cobitidae	LC
77	<i>Acanthopsoides hapalias</i>	Cobitidae	LC
78	<i>Botia caudipunctata</i>	Cobitidae	LC
79	<i>Botia modesta</i>	Cobitidae	LC
80	<i>Lepidocephalichthys berdmorei</i>	Cobitidae	LC
81	<i>Annamia normani</i>	Balitoridae	LC
82	<i>Balitora cf. annamitica</i>	Balitoridae	LC
83	<i>Hemimyzon papilio</i>	Balitoridae	LC
84	<i>Hemimyzon pengi</i>	Balitoridae	DD
85	<i>Nemacheilus longistriatus</i>	Balitoridae	LC
86	<i>Nemacheilus pallidus</i>	Balitoridae	LC
87	<i>Nemacheilus Platiceps</i>	Balitoridae	DD
88	<i>Physoschistura meridionalis</i>	Balitoridae	DD
89	<i>Schistura athos</i>	Balitoridae	LC
90	<i>Schistura bucculenta</i>	Balitoridae	LC
91	<i>Schistura melarancia</i>	Balitoridae	LC
92	<i>Schistura poculi</i>	Balitoridae	LC
93	<i>Schistura porthos</i>	Balitoridae	LC
94	<i>Vanmanenia serrilineata</i>	Balitoridae	DD
95	<i>Hemibagrus filamentus</i>	Bagridae	DD
96	<i>Hemibagrus cf. nemurus</i>	Bagridae	LC
97	<i>Hemibagrus wyckioides</i>	Bagridae	LC
98	<i>Belodontichthys truncates</i>	Bagridae	LC
99	<i>Hemissilurus mekongensis</i>	Siluridae	LC
100	<i>Kryptopterus bicirrhis</i>	Siluridae	LC
101	<i>Micronema apogon</i>	Siluridae	LC
102	<i>Micronema bleekeri</i>	Siluridae	LC
103	<i>Micronema cheveyi</i>	Siluridae	DD
104	<i>Micronema micronemus</i>	Siluridae	LC

No	Scientific name	Family	IUCN Red List
105	<i>Ompok bimaculatus</i>	Siluridae	NT
106	<i>Wallago attu</i>	Siluridae	VU
107	<i>Wallago leeri</i>	Siluridae	LC
108	<i>Clupisoma sinensis</i>	Siluridae	LC
109	<i>Laides longibarbis</i>	Schilbeidae	LC
110	<i>Pangasius macronema</i>	Pangasiidae	LC
111	<i>Pseudolais pleurotaenia</i>	Pangasiidae	LC
112	<i>Bagarius bagarius</i>	Sisoridae	VU
113	<i>Bagarius yarrelli</i>	Sisoridae	VU
114	<i>Glyptothorax fuscus</i>	Sisoridae	LC
115	<i>Glyptothorax lampris</i>	Sisoridae	LC
116	<i>Glyptothorax laosensis</i>	Sisoridae	LC
117	<i>Glyptothorax macromaculatus</i>	Sisoridae	LC
118	<i>Pseudobagariussinermis</i>	Sisoridae	DD
119	<i>Clarias batrachus</i>	Clariidae	LC
120	<i>Xenentodon canciloides</i>	Belonidae	LC
121	<i>Monopterus albus</i>	Synbranchidae	LC
122	<i>Macroglyptothorax siamensis</i>	Mastacembelidae	LC
123	<i>Mastacembelus armatus</i>	Mastacembelidae	LC
124	<i>Parambassis siamensis</i>	Chandidae	LC
125	<i>Pristolepis fasciata</i>	Pristolepididae	LC
126	<i>Oreochromis niloticus</i>	Cichlidae	LC
127	<i>Oxyeleotris marmorata</i>	Gobiidae	LC
128	<i>Papuligobius ocellatus</i>	Gobiidae	LC
129	<i>Rhinogobius nammaensis</i>	Gobiidae	DD
130	<i>Rhinogobius sp. N. Nam Ou</i>	Gobiidae	
131	<i>Rhinogobius sp.</i>	Gobiidae	
132	<i>Macropodus opercularis</i>	Osphronemidae	LC
133	<i>Trichopodus trichopterus</i>	Osphronemidae	LC
134	<i>Channa gachua</i>	Channidae	LC
135	<i>Channa striata</i>	Channidae	LC
136	<i>Brachirus harmandi</i>	Soleidae	LC
137	<i>Pao cambodgiensis</i>	Tetraodontidae	LC
138	<i>Pao cochinchinensis</i>	Tetraodontidae	LC
139	<i>Pao turgidus</i>	Tetraodontidae	LC

Annex 4: Forest cover/land use types

(Dry) Evergreen Forest	The Evergreen Forest has a proportion of evergreen trees between 50%-80% and there are a considerable number of species of which 2 to 3 species tend to dominate. A typical characteristic of this forest type is climbers and lichens on the tree stems. Bamboo is usually not found except where the canopy has been opened. The complexity of this forest is indicated by the diversity of canopy tree species that may be present. The most important of associated canopy trees are <i>Lagerstroemia angustifolia</i> (Lythraceae), <i>Irvingia harmandiana</i> (Simaroubaceae), <i>Dialium cochinchinense</i> (Fabaceae), <i>Chaetarpus castanocarpus</i> (Euphorbiaceae) and <i>Walsura robusta</i> (Meliaceae).
Mixed Deciduous Forest (DF)	The MDF is characterized by tall and diverse canopy structure with a large dominance of deciduous species. The features that distinguish mixed deciduous forests from other habitats are: a) the presence of a closed forest canopy dominated by deciduous tree species; b) a relatively low diversity of lianas and understory species; and, c) a floristic dominance of members of the Fabaceae, Lythraceous and Rubiaceous, together with a relatively low occurrence or absence of Dipterocarpaceae. Dense local stands of bamboo are often present, particularly in areas with significant human impacts. The canopy of these forests reaches up to 30 m or more, and supports a mixed dominance of species. The phenology of canopy trees in these areas of northern Laos showed a complete dominance by a deciduous growth habit, with species almost equally split between those losing their leaves for less than one month and those with a longer leafless period (Rundel 1999).
Old Fallow	Land is left fallow for vegetation to recover over 5 years old (Old generation forest over 5 years).
Young Fallow	Regenerating vegetation – the land is left fallow for vegetation to recover less than 5 years.
Recent agriculture / bare land	Agricultural area is currently used for cultivation of upland rice, or cultivation of maize, or other crops.
Rice paddy (RP)	The rice fields, which people cultivate annually, situated in flat land and valley bottom
Urban (U)/Residential area	Urban Areas include all areas being used for permanent settlements such as villages, towns, public gardens etc. It also includes roads having a width of more than 5 m and areas under electric high-power lines. Any type of land under high power lines, except Rice Paddy, should be classified as Urban Areas
Water	The water body, including ponds, rivers, and streams.
http://dof.maf.gov.la/en/home	

Annex 5: Plant survey protocol on NR2 and results of rapid field survey

Based on high experience of botanical experts from Laos, the main objectives of the flora survey are as follows:

- Identify and assess the species and number of trees (>30 cm DBH) nearby the NR2
- Identify the potential presence of the important value in the pilot areas as along the road;
- Assess the likely conservation as global assessment (IUCN red list).
- List of threatened or endangered species and distribution maps along the road as list of species protected by IUCN Red List.

The main processes of Flora survey technique are:

1.1 Sites and time of field survey: The plant species survey was taken during 2 days from 8-9 May 2023 along the NR2 from Pak beng district, Oudomxay province to Koua district, Phongsaly province around 200 Km by car and walking (some where necessary) for species observing, field identifying, data recording and collecting.

1.2 Field data record:

- The trees that were found in target area and which are diameter at breast height (DBH) > 30 cm. were measured and record also its waypoints (GPS record) were noted of each individual particular concerned species.
- There are some tree species are very close in target clearing area (if present) in the line of road were record as the high disturb individual tree species.
- Sample observation as leaves, flower and fruit (if possible) are needed for plant identify and classify as a taxonomic study.
- The intensive survey was conducted along the road covered in all plant species as the encounter frequency for more common and specialist species as well as rare and endangered species were given hints to their occurrences and distributions.
- Field identification species was conducted based on high experience of Lao's botanical experts. however, field identification is only on family or genus levels but some common species to Laos were completely identified on field.

1.3 Plant Species Identification:

Some plant species may be required special laboratory work and identification. Those species were prepared for sample collection (also their pictures). Botanical experts have observed all part of plant species as its leave and flowers and fruits (if possible) then deeply observing, identifying and determining species at the herbarium, Vientiane.

Botanical expert team have determined plant species using standard references in this region such as Flora of Thailand, Flora of Vietnam, Flore du Cambodge, du Laos et du Vietnam and also Flore General de l' Indo-Chine and other botanical books, journals, bulletins and others and also, compare type specimens that digitized in the website of National d'Histoire Naturelle Herbarium Paris (P). Royal Botanical Garden Edinburgh UK (E) and other...

1.4 Report on survey activities: List of threatened or endangered species and its distribution maps along the road as list of species protected by IUCN Red List were provided and should also be assessed according to conservation status and IUCN assessment on global red list.

Key Plant species

Ref .#	Scientific names	IUCN Red List	Remark/	References
1	<i>Aquilaria crassna</i>	CR	Widely plantation	https://www.iucnredlist.org/species/32814/2824513 https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:830826-1 https://padme.rbge.org.uk/laos/checklist MOF/MOFA, 2022a and 2022b and other related references that presented below
2	<i>Aquilaria yunnanensis</i>	VU	Found at Mouang la	https://www.iucnredlist.org/species/191318/1975746 https://powo.science.kew.org/results?q=Aquilaria%20yunnanensis MOF/MOFA, 2022a and 2022b and other related references that presented below
3	<i>Dalbergia balansae</i> is synonyme of <i>D. assamica</i>	VU moved to LC	Found at Pak beng	https://www.iucnredlist.org/species/19892099/20054530 https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:490087-1 https://padme.rbge.org.uk/laos/checklist
4	<i>Dalbergia cochinchinensis</i>	CR	Found at Pak beng	NAFRI, 2023, Report on Updating the Occurrence and Maps of <i>D. cochinchinensis</i> and <i>D. oliveri</i> in Central to Southern Lao PDR. Vientiane, Laos. https://www.iucnredlist.org/species/215342548/2822125 https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:490142-1 https://padme.rbge.org.uk/laos/checklist and other related references that presented below
5	<i>Dalbergia oliveri</i>	CR	Found at Pak beng	NAFRI, 2023, Report on Updating the Occurrence and Maps of <i>D. cochinchinensis</i> and <i>D. oliveri</i> in Central to Southern Lao PDR. Vientiane, Laos. https://www.iucnredlist.org/species/215341339/2813403 https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:490372-1 https://padme.rbge.org.uk/laos/checklist and other related references that presented below
6	<i>Pterocarpus macrocarpus</i>	EN	Found at Pak beng, Houn and Xai district	https://www.iucnredlist.org/species/32308/2813424 https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:516502-1 https://padme.rbge.org.uk/laos/checklist and other related references that presented below

Annex 6: List of tree species ≥ 30 cm DBH (diameter in breast height) along NR2

Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	36	15	LC	NA	19.901784	101.14564	354	W
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	31	10	LC	NA	19.904111	101.147093	351	W
Ben mon	<i>Terminalia phillyreifolia</i>	Combretaceae	37	10	NA	NA	19.90778	101.151254	350	W
Ngom	<i>Toona ciliata</i>	Meliaceae	30	15	LC	II	19.912546	101.15735	375	W
Ka dao Chang	<i>Azadirachta indica</i>	Meliaceae	32	10	LC	III	19.913269	101.157711	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	30	10	LC	II	19.913269	101.157711	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	45	15	LC	II	19.913269	101.157711	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	47	15	LC	II	19.913269	101.157711	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	43	15	LC	II	19.913269	101.157711	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	30	10	LC	II	19.92018	101.164405	361	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	50	15	LC	NA	19.927629	101.172532	361	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	41	15	LC	NA	19.95198	101.197983	377	W
Ngom	<i>Toona ciliata</i>	Meliaceae	35	15	LC	II	19.954838	101.201592	376	W
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	31	15	LC	NA	19.958922	101.21457	397	W
Sa thone	<i>Albizia lebbeck</i>	Fabaceae	35	15	LC	III	19.958444	101.219843	426	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	63	15	LC	NA	19.957743	101.221251	424	W
Ben mon	<i>Terminalia phillyreifolia</i>	Combretaceae	42	15	NA	NA	19.957743	101.221251	424	W
Sa phoung	<i>Tetrameles nudiflora</i>	Tetramelaceae	41	15	LC	III	19.956554	101.22272	432	W
Sor	<i>Gmelina arborea</i>	Lamiaceae	34	12	NA	II	19.953679	101.226338	452	W
Ngom	<i>Toona ciliata</i>	Meliaceae	34	15	LC	II	19.951533	101.228014	442	W
Sor	<i>Gmelina arborea</i>	Lamiaceae	43	15	NA	II	19.951053	101.22845	441	W
Sor	<i>Gmelina arborea</i>	Lamiaceae	31	15	NA	II	19.950847	101.228715	440	W
Ngom	<i>Toona ciliata</i>	Meliaceae	37	15	LC	II	19.949769	101.231755	431	W
Sor	<i>Gmelina arborea</i>	Lamiaceae	30	15	NA	II	19.94955	101.23252	433	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	31	15	LC	NA	19.948825	101.233942	439	W
Ngom	<i>Toona ciliata</i>	Meliaceae	41	20	LC	II	19.948576	101.234311	442	W
Sa kham	<i>Garuga pinnata</i>	Burseraceae	34	20	NA	III	19.946438	101.240164	448	W

¹³ Forestry Law No. 64/NA (2019), Article 3.

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Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Sa kham	<i>Garuga pinnata</i>	Burseraceae	31	20	NA	III	19.946914	101.24459	452	W
Dou	<i>Pterocarpus macrocarpus</i>	Fabaceae	31	15	EN	I	19.94794	101.248853	455	W
Sa kham	<i>Garuga pinnata</i>	Burseraceae	35	15	NA	III	19.948088	101.250293	450	W
Sa kham	<i>Garuga pinnata</i>	Burseraceae	43	15	NA	III	19.949411	101.251487	457	W
Ngen	<i>Terminalia bellirica</i>	Combretaceae	37	15	LC	II	19.950103	101.251642	458	W
Len	<i>Albizia lucidior</i>	Fabaceae	30	13	LC	NA	20.165176	101.507953	510	W
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	37	15	LC	III	20.165176	101.507953	510	W
Sor	<i>Gmelina arborea</i>	Lamiaceae	35	15	NA	II	20.183948	101.519292	491	W
Ngen	<i>Terminalia bellirica</i>	Combretaceae	47	20	LC	II	20.2111	101.538999	511	W
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	31	10	LC	II	20.211239	101.539285	512	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	47	20	LC	NA	20.367936	101.718771	560	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	31	15	LC	NA	20.374671	101.727248	567	W
Kham phi Bai mon	<i>Dalbergia balansae</i>	Fabaceae	34	12	VU	NA	20.378224	101.73918	577	W
Kha pha	<i>Callicarpa arborea</i>	Verbenaceae	34	12	LC	NA	20.378711	101.739797	579	W
Ben mon	<i>Terminalia phillyreifolia</i>	Combretaceae	31	15	NA	NA	20.386092	101.744569	584	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	50	20	LC	NA	20.386761	101.745577	584	W
Sa kham	<i>Garuga pinnata</i>	Burseraceae	37	12	NA	III	20.396031	101.753422	593	W
Som moun	<i>Elaeocarpus sp.</i>	Elaeocarpaceae	43	15	NA	III	20.396251	101.753634	594	W
Hai	<i>Ficus sp.</i>	Moraceae	60	20	NA	III	20.396251	101.753634	594	W
Ngom	<i>Toona ciliate</i>	Meliaceae	41	15	LC	II	20.406212	101.763459	599	W
Bong mi	<i>Litsea glutinosa</i>	Lauraceae	37	15	LC	NA	20.406384	101.763746	599	W
Bong mi	<i>Litsea glutinosa</i>	Lauraceae	31	12	LC	NA	20.406306	101.76368	599	W
Bong mi	<i>Litsea glutinosa</i>	Lauraceae	34	15	LC	NA	20.406306	101.76368	599	W
Kham phi Bai mon	<i>Dalbergia balansae</i>	Fabaceae	35	15	VU	NA	20.40652	101.764071	600	W
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	50	20	LC	NA	20.41839	101.780455	629	W
Sa thone	<i>Albizia lebbeck</i>	Fabaceae	41	15	LC	III	20.418614	101.780867	626	W
Ngen	<i>Terminalia bellirica</i>	Combretaceae	50	15	LC	II	20.433161	101.795405	642	W
Sa thone	<i>Albizia lebbeck</i>	Fabaceae	30	10	LC	III	20.433989	101.800967	659	W
Sa thone	<i>Albizia lebbeck</i>	Fabaceae	50	20	LC	III	20.435294	101.804029	669	W

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Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	31	15	LC	III	20.455505	101.828461	685	W
Sa Kham	<i>Garuga pinnata</i>	Burseraceae	45	15	NA	III	20.476112	101.845772	689	W
Hath	<i>Celtis tetrandra</i>	Cannabaceae	35	15	LC	NA	20.483105	101.854243	696	W
Som phad	<i>Bischofia javanica</i>	Phyllanthaceae	60	15	LC	NA	20.512398	101.879307	782	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	43	15	LC	NA	20.516265	101.882286	804	W
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	40	8	LC	II	20.516727	101.882691	805	W
Thone	<i>Albizia chinensis</i>	Fabaceae	63	20	NA	III	20.517306	101.883257	809	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	31	15	LC	NA	20.517387	101.883332	809	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	34	20	LC	NA	20.517387	101.883332	809	W
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	45	20	LC	II	20.517952	101.8839	813	W
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	47	20	LC	II	20.518061	101.88397	814	W
Thong	<i>Erythrina sp.</i>	Fabaceae	73	20	NA	NA	20.518191	101.884186	816	W
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	93	25	NA	III	20.518321	101.88448	818	W
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	42	20	NA	NA	20.518445	101.88475	821	W
Thong	<i>Erythrina sp.</i>	Fabaceae	81	20	NA	NA	20.518622	101.885151	823	W
Dok ban	<i>Bauhinia variegata</i>	Fabaceae	41	15	NA	NA	20.518734	101.88526	823	W
Dok ban	<i>Bauhinia variegata</i>	Fabaceae	42	15	NA	NA	20.518734	101.88526	823	W
Thong	<i>Erythrina sp.</i>	Fabaceae	120	30	NA	NA	20.51908	101.88549	825	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	65	25	LC	NA	20.519697	101.88574	829	W
Thong	<i>Erythrina sp.</i>	Fabaceae	54	25	NA	NA	20.520052	101.885886	830	W
Por hou chang	<i>Macaranga gigantea</i>	Euphorbiaceae	47	20	NA	NA	20.520641	101.886086	835	W
Sa lik dong	<i>Alangium barbatum</i>	Cornaceae	51	20	LC	NA	20.521403	101.887087	840	W
Thong	<i>Erythrina sp.</i>	Fabaceae	81	25	NA	NA	20.521576	101.887424	843	W
Thong	<i>Erythrina sp.</i>	Fabaceae	72	25	NA	NA	20.521576	101.887424	843	W
Thong	<i>Erythrina sp.</i>	Fabaceae	54	25	NA	NA	20.521763	101.887789	846	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	63	25	LC	NA	20.521813	101.887936	847	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	58	25	LC	NA	20.521813	101.887936	847	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	57	25	LC	NA	20.521813	101.887936	847	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	83	25	LC	NA	20.52196	101.888487	849	W
Bong Mi	<i>Litsea glutinosa</i>	Lauraceae	81	25	LC	NA	20.522019	101.888719	850	W

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Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Ten	<i>Duabanga grandiflora</i>	Lythraceae	63	25	LC	NA	20.52231	101.889146	854	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	61	25	LC	NA	20.52231	101.889146	854	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	57	25	LC	NA	20.52231	101.889146	854	W
Thong	<i>Erythrina sp.</i>	Fabaceae	43	25	NA	NA	20.522707	101.889501	858	W
Ngen	<i>Terminalia bellirica</i>	Combretaceae	81	25	LC	II	20.52445	101.890821	872	W
Thong	<i>Erythrina sp.</i>	Fabaceae	63	25	NA	NA	20.524717	101.890808	873	W
Thong	<i>Erythrina sp.</i>	Fabaceae	67	25	NA	NA	20.525048	101.890952	875	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	97	25	LC	NA	20.525246	101.891076	876	W
Thong	<i>Erythrina sp.</i>	Fabaceae	43	15	NA	NA	20.526284	101.891886	885	W
Thong	<i>Erythrina sp.</i>	Fabaceae	51	20	NA	NA	20.526284	101.891886	885	W
Thong	<i>Erythrina sp.</i>	Fabaceae	67	25	NA	NA	20.526284	101.891886	885	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	91	25	LC	NA	20.526434	101.892039	886	W
Thong	<i>Erythrina sp.</i>	Fabaceae	93	25	NA	NA	20.527479	101.892895	897	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	64	10	LC	NA	20.527479	101.892895	897	W
Thong	<i>Erythrina sp.</i>	Fabaceae	97	25	NA	NA	20.527722	101.893166	900	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	87	25	LC	NA	20.527999	101.893434	904	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	85	25	LC	NA	20.527999	101.893434	904	W
Thong	<i>Erythrina sp.</i>	Fabaceae	63	20	NA	NA	20.529008	101.894002	911	W
Thong	<i>Erythrina sp.</i>	Fabaceae	57	20	NA	NA	20.529104	101.894048	912	W
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	34	15	LC	III	20.530027	101.894651	913	W
Kok	<i>Spondias pinnata</i>	Anacardiaceae	31	15	NA	III	20.530027	101.894651	913	W
Sa Kham	<i>Garuga pinnata</i>	Burseraceae	67	25	NA	III	20.590833	101.932861	802	W
Hai	<i>Ficus sp.</i>	Moraceae	150	30	NA	III	20.590615	101.932599	803	W
Sa lik dong	<i>Alangium barbatum</i>	Cornaceae	83	25	LC	NA	20.595527	101.9396	801	W
Thone	<i>Albizia chinensis</i>	Fabaceae	34	12	NA	III	20.597238	101.940902	805	W
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	63	20	NA	III	20.597238	101.940902	752	W
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	42	15	LC	NA	20.606798	101.946799	751	W
Sa kham	<i>Garuga pinnata</i>	Burseraceae	31	12	NA	III	20.611237	101.948484	743	W
Por	<i>Sterculia villosa</i>	Malvaceae	35	15	LC	III	20.611073	101.948284	741	W
Ngom	<i>Toona ciliate</i>	Meliaceae	43	15	LC	II	20.611338	101.948701	744	W

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Thone	<i>Albizia chinensis</i>	Fabaceae	31	12	NA	III	20.613836	101.951293	748	W
Sa lik dong	<i>Alangium barbatum</i>	Cornaceae	47	15	LC	NA	20.614101	101.951414	746	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	73	25	LC	NA	20.614705	101.951729	743	W
Pip	<i>Mayodendron igneum</i>	Bignoniaceae	40	15	NA	NA	20.615052	101.951871	740	W
Ben mon	<i>Terminalia phillyreifolia</i>	Combretaceae	37	12	NA	NA	20.6152	101.951948	739	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	63	20	LC	NA	20.617522	101.953718	748	W
Sa lik dong	<i>Alangium barbatum</i>	Cornaceae	47	20	LC	NA	20.619187	101.95679	715	W
Dou	<i>Pterocarpus macrocarpus</i>	Fabaceae	65	25	EN	I	20.619366	101.956928	714	W
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	31	10	LC	III	20.619447	101.956984	714	W
Ngom	<i>Toona ciliate</i>	Meliaceae	37	12	LC	II	20.624433	101.960994	705	W
Sa thone	<i>Albizia lebeck</i>	Fabaceae	34	12	LC	III	20.625852	101.961029	702	W
Dou	<i>Pterocarpus macrocarpus</i>	Fabaceae	61	20	EN	I	20.626813	101.961076	702	W
Ten	<i>Duabanga grandiflora</i>	Lythraceae	64	20	LC	NA	20.630575	101.963512	697	W
Deua	<i>Ficus racemose</i>	Moraceae	35	10	NA	III	21.101074	102.315718	412	E
Ngom	<i>Toona ciliate</i>	Meliaceae	32	10	LC	II	21.101074	102.315718	412	E
Deua	<i>Ficus racemose</i>	Moraceae	41	15	NA	III	21.101057	102.315889	412	E
Ngom	<i>Toona ciliate</i>	Meliaceae	34	12	LC	II	21.100974	102.317108	411	E
Thone	<i>Albizia chinensis</i>	Fabaceae	63	20	NA	III	21.098527	102.326023	405	E
Tin peth	<i>Alstonia scholaris</i>	Apocynaceae	43	17	LC	NA	21.095823	102.32514	412	E
Thone	<i>Albizia chinensis</i>	Fabaceae	47	15	NA	III	21.094892	102.32608	406	E
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	37	12	LC	II	21.092709	102.329319	407	E
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	34	15	LC	II	21.092709	102.329319	407	E
Deua	<i>Ficus racemose</i>	Moraceae	45	15	NA	III	21.091589	102.33107	408	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	43	12	LC	NA	21.093546	102.335198	403	E
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	68	15	NA	III	21.093828	102.338312	405	E
Ngom	<i>Toona ciliate</i>	Meliaceae	45	15	LC	II	21.093834	102.338609	404	E
Ngom	<i>Toona ciliate</i>	Meliaceae	63	20	LC	II	21.093584	102.343221	405	E
Ngom	<i>Toona ciliate</i>	Meliaceae	34	17	LC	II	21.093584	102.343221	405	E
Lam ngai pa	<i>Nephelium hypoleucum</i>	Sapindaceae	34	8	LC	NA	21.088016	102.345414	406	E
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	34	8	NA	III	21.088414	102.350383	404	E

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Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Deua	<i>Ficus racemose</i>	Moraceae	31	5	NA	III	21.089136	102.352547	405	E
Lam ngai pa	<i>Nephelium hypoleucum</i>	Sapindaceae	32	7	LC	NA	21.084857	102.362438	406	E
Pip	<i>Mayodendron igneum</i>	Bignoniaceae	41	15	NA	NA	21.084605	102.366655	402	E
Deua	<i>Ficus racemose</i>	Moraceae	31	12	NA	III	21.081213	102.372012	401	E
Deua	<i>Ficus racemose</i>	Moraceae	41	15	NA	III	21.079296	102.374763	398	E
Dou	<i>Pterocarpus macrocarpus</i>	Fabaceae	34	12	EN	I	21.078192	102.376784	400	E
Ngom	<i>Toona ciliate</i>	Meliaceae	67	15	LC	II	21.072837	102.375516	401	E
Ngom	<i>Toona ciliate</i>	Meliaceae	73	15	LC	II	21.072837	102.375516	401	E
Ngom	<i>Toona ciliate</i>	Meliaceae	67	15	LC	II	21.072444	102.375346	398	E
Sor	<i>Gmelina arborea</i>	Lamiaceae	31	12	NA	II	21.069535	102.378364	400	E
Sor	<i>Gmelina arborea</i>	Lamiaceae	34	12	NA	II	21.069535	102.378364	400	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	34	15	LC	III	21.069501	102.378409	400	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	34	15	LC	III	21.069188	102.378938	399	E
Ke hom	<i>Cinnmomum sp.</i>	Lauraceae	47	15	NA	NA	21.069188	102.378938	399	E
Lam ngai pa	<i>Nephelium hypoleucum</i>	Sapindaceae	41	15	LC	NA	21.067754	102.379881	399	E
Meuad Pa siou	<i>Symplocos racemosa</i>	Symplocaceae	31	12	NA	NA	21.062577	102.383599	407	E
Meuad Pa siou	<i>Symplocos racemosa</i>	Symplocaceae	30	12	NA	NA	21.062577	102.383599	407	E
Sa thone	<i>Albizia lebbeck</i>	Fabaceae	63	15	LC	III	21.05979	102.387728	400	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	31	12	LC	NA	21.05979	102.387728	403	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	47	15	LC	NA	21.053448	102.398824	402	E
Sor	<i>Gmelina arborea</i>	Lamiaceae	58	20	NA	II	21.0477	102.421539	396	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	47	15	LC	NA	21.047874	102.423511	393	E
Thone	<i>Albizia chinensis</i>	Fabaceae	45	15	NA	III	21.046826	102.427542	395	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	43	15	LC	NA	21.046721	102.427887	394	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	31	7	LC	NA	21.047412	102.431966	392	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	43	15	LC	III	21.051229	102.44918	398	E
Peuay	<i>Lagerstroemia sp.</i>	Lythraceae	34	12	NA	II	21.051208	102.449859	399	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	74	20	LC	III	21.051354	102.452572	392	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	63	20	LC	III	21.051354	102.452572	392	E
Ngom	<i>Toona ciliata</i>	Meliaceae	43	15	LC	II	21.054725	102.454194	397	E

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Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Ngom	<i>Toona ciliata</i>	Meliaceae	45	15	LC	II	21.054725	102.454194	397	E
Deua	<i>Ficus racemosa</i>	Moraceae	34	12	NA	III	21.061245	102.468017	389	E
Sa thone	<i>Albizia lebbbeck</i>	Fabaceae	32	10	LC	III	21.106862	102.308748	419	E
Thone	<i>Albizia chinensis</i>	Fabaceae	53	15	NA	III	21.107388	102.306972	415	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	35	12	LC	NA	21.10648	102.30598	414	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	53	15	LC	NA	21.10648	102.30598	414	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	58	15	LC	NA	21.10648	102.30598	414	E
Len	<i>Albizia lucidior</i>	Fabaceae	34	12	LC	NA	21.106073	102.305772	415	E
Len	<i>Albizia lucidior</i>	Fabaceae	32	12	LC	NA	21.106073	102.305772	415	E
Peuay	<i>Lagerstroemia sp.</i>	Lythraceae	41	15	NA	II	21.10468	102.305532	415	E
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	34	12	LC	II	21.104217	102.305109	417	E
Moung pa	<i>Mangifera sp.</i>	Anacardiaceae	37	15	NA	III	21.104094	102.304888	418	E
Len	<i>Albizia lucidior</i>	Fabaceae	31	15	LC	NA	21.103469	102.303248	419	E
Ngom	<i>Toona ciliate</i>	Meliaceae	47	15	LC	II	21.103541	102.302292	419	E
Ngom	<i>Toona ciliate</i>	Meliaceae	51	20	LC	II	21.103541	102.302292	419	E
Ngom	<i>Toona ciliate</i>	Meliaceae	37	12	LC	II	21.103541	102.302292	419	E
Ngom	<i>Toona ciliate</i>	Meliaceae	38	12	LC	II	21.103541	102.302292	419	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	35	12	LC	NA	21.104611	102.298271	417	E
Ngom	<i>Toona ciliate</i>	Meliaceae	50	20	LC	II	21.102295	102.290006	417	E
Kham phi	<i>Dalbergia oliveri</i>	Fabaceae	34	12	CR	I	21.103334	102.288154	422	E
Sa thone	<i>Albizia lebbbeck</i>	Fabaceae	31	10	LC	III	21.103709	102.285306	419	E
Kham phi	<i>Dalbergia oliveri</i>	Fabaceae	35	12	CR	I	21.101868	102.279334	421	E
Ngom	<i>Toona ciliate</i>	Meliaceae	48	15	LC	II	21.104313	102.27332	419	E
Deua	<i>Ficus racemose</i>	Moraceae	73	20	NA	III	21.103225	102.270569	423	E
Len	<i>Albizia lucidior</i>	Fabaceae	45	15	LC	NA	21.103351	102.268205	422	E
Kham phi	<i>Dalbergia oliveri</i>	Fabaceae	31	12	CR	I	21.103261	102.26648	425	E
Kham phi	<i>Dalbergia oliveri</i>	Fabaceae	45	15	CR	I	21.102734	102.265528	424	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	36	12	LC	NA	21.101372	102.262706	430	E
Thone	<i>Albizia chinensis</i>	Fabaceae	42	15	NA	III	21.100007	102.253152	422	E
Ngom	<i>Toona ciliate</i>	Meliaceae	34	12	LC	II	21.096979	102.251054	425	E

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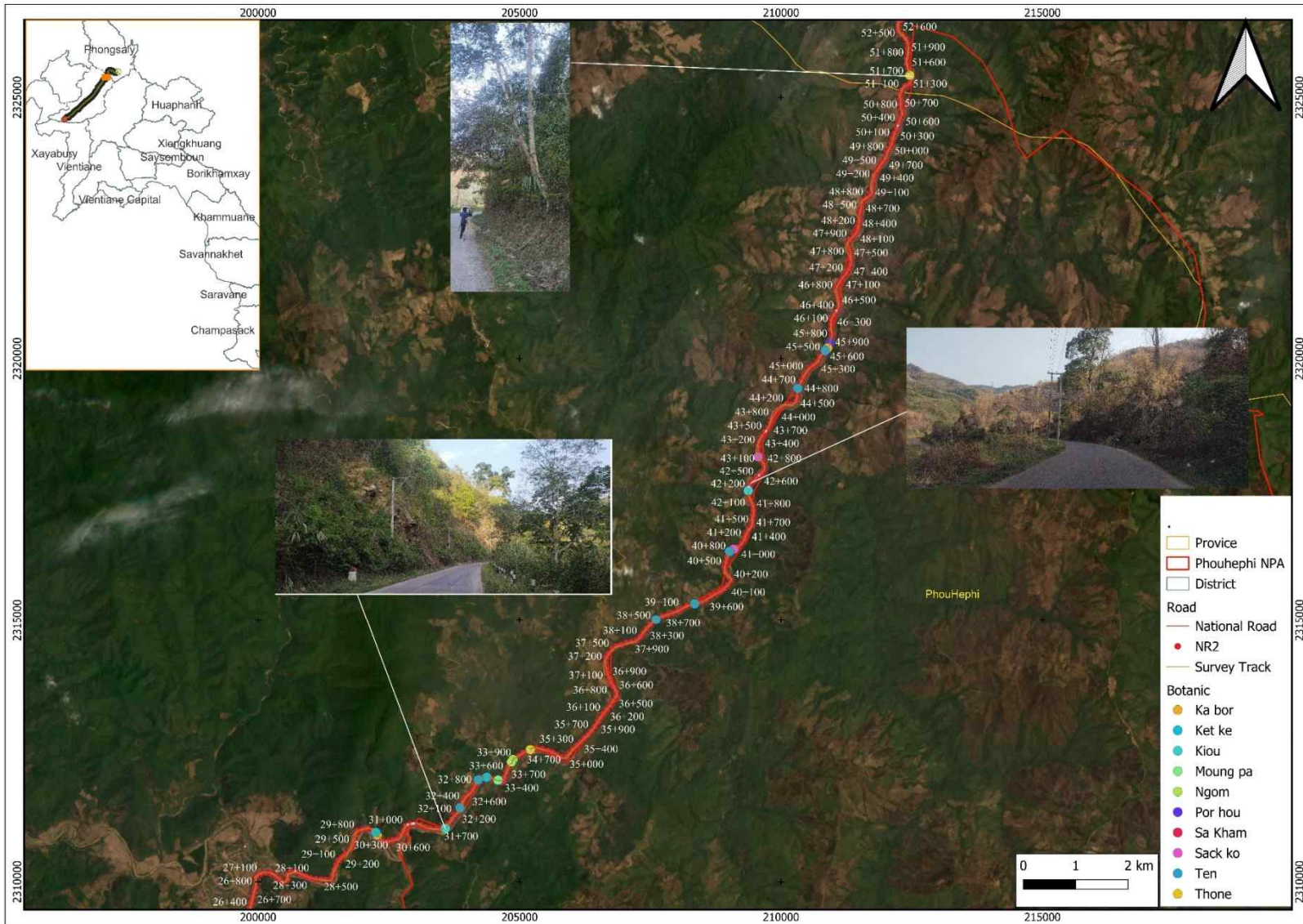
Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Len	<i>Albizia lucidior</i>	Fabaceae	34	12	LC	NA	21.095837	102.249971	427	E
Ngom	<i>Toona ciliate</i>	Meliaceae	36	15	LC	II	21.073879	102.241672	429	E
Ngom	<i>Toona ciliate</i>	Meliaceae	31	10	LC	II	21.069779	102.241687	423	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	45	15	LC	NA	21.069388	102.24144	435	E
Deua	<i>Ficus racemose</i>	Moraceae	45	15	NA	III	21.066327	102.240108	431	E
Ngom	<i>Toona ciliate</i>	Meliaceae	31	15	LC	II	21.057966	102.241294	424	E
Thone	<i>Albizia chinensis</i>	Fabaceae	45	15	NA	III	21.043463	102.241294	423	E
Bong Mi	<i>Litsea glutinosa</i>	Lauraceae	43	12	LC	NA	21.035905	102.239444	425	E
Len	<i>Albizia lucidior</i>	Fabaceae	45	12	LC	NA	21.028725	102.236668	425	E
Peuay dok khao	<i>Lagerstroemia tomentosa</i>	Lythraceae	57	15	LC	II	21.0251	102.234318	427	E
Ngom	<i>Toona ciliate</i>	Meliaceae	31	10	LC	II	21.020925	102.232303	430	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	53	15	LC	NA	21.017669	102.232316	432	E
Sa Kham	<i>Garuga pinnata</i>	Burseraceae	37	12	NA	III	21.016763	102.231951	436	E
Thone	<i>Albizia chinensis</i>	Fabaceae	41	15	NA	III	21.007098	102.234004	430	E
Por hou	<i>Trema orientale</i>	Canabaceae	43	15	NA	NA	20.960597	102.220157	437	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	41	15	LC	NA	20.959765	102.219761	436	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	32	12	LC	NA	20.959765	102.219761	436	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	90	20	LC	NA	20.959321	102.219324	438	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	37	12	LC	NA	20.952717	102.214431	434	E
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	43	15	NA	III	20.9408	102.207353	435	E
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	58	15	NA	NA	20.93494	102.205631	437	E
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	64	20	NA	NA	20.93494	102.205631	437	E
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	57	20	NA	NA	20.93494	102.205631	437	E
Sack ko	<i>Neolamarckia cadamba</i>	Rubiaceae	43	15	NA	III	20.924821	102.203138	439	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	32	12	LC	NA	20.924406	102.202386	440	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	54	15	LC	NA	20.924406	102.202386	440	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	37	12	LC	NA	20.915305	102.196153	441	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	37	12	LC	NA	20.912367	102.189116	442	E
Thone	<i>Albizia chinensis</i>	Fabaceae	31	10	NA	III	20.889543	102.166424	448	E
Ngom	<i>Toona ciliate</i>	Meliaceae	73	20	LC	II	20.88777	102.163288	450	E

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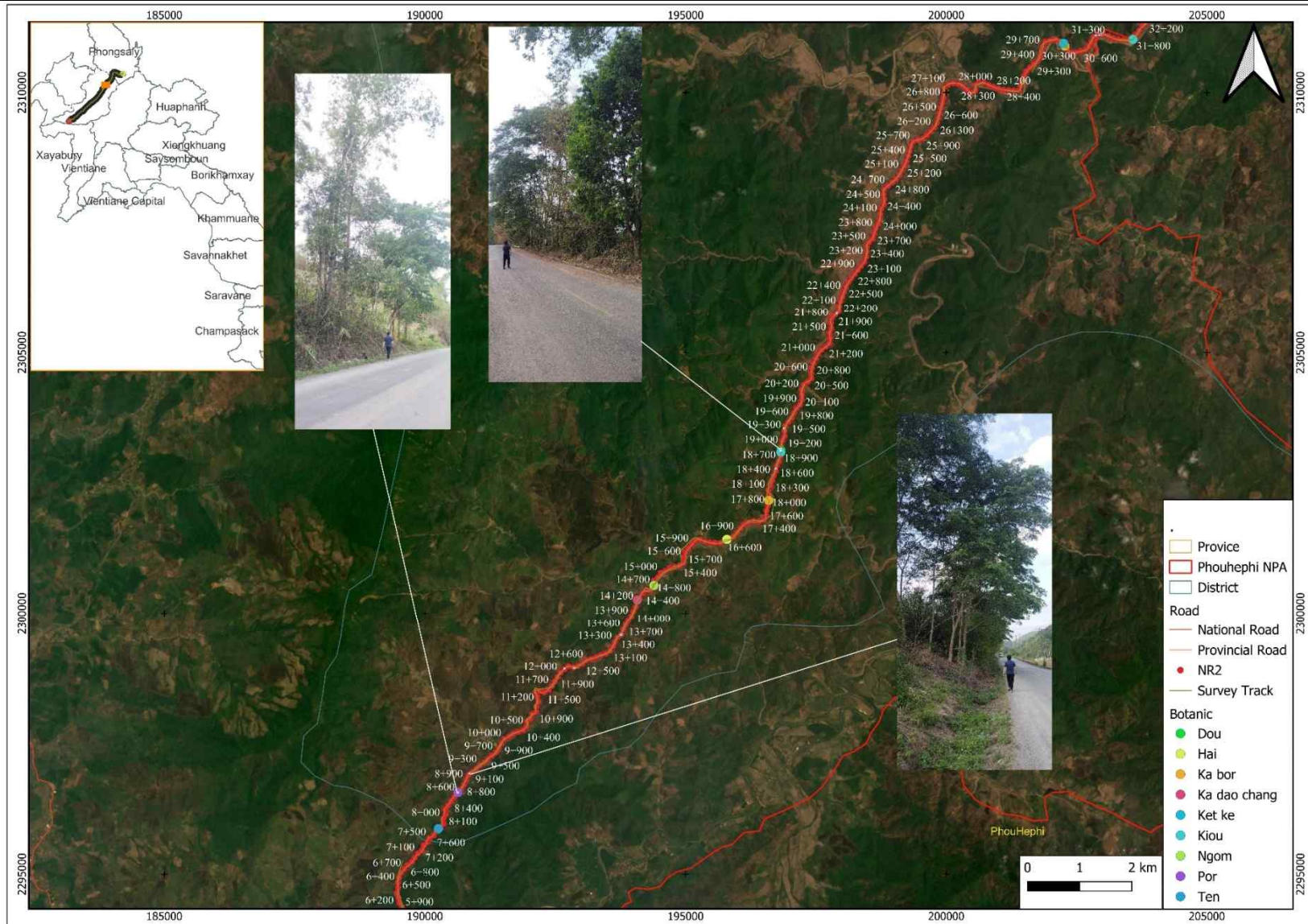
Local Name	Scientific	Family	DBH or Girth (cm)	Total Height (m)	IUCN red list	National list ¹³	N	E	Elevation	Section
Ngom	<i>Toona ciliate</i>	Meliaceae	31	12	LC	II	20.887351	102.163005	453	E
Ngom	<i>Toona ciliate</i>	Meliaceae	43	15	LC	II	20.887351	102.163005	453	E
Sa Kham	<i>Garuga pinnata</i>	Burseraceae	32	10	NA	III	20.884132	102.161254	452	E
Moung pa	<i>Mangifera sp.</i>	Anacardiaceae	37	12	NA	III	20.884189	102.160617	452	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	45	12	LC	NA	20.88466	102.158527	453	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	47	15	LC	NA	20.88466	102.158527	453	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	41	15	LC	NA	20.884194	102.156981	451	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	37	12	LC	NA	20.884194	102.156981	451	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	73	20	LC	NA	20.879297	102.153697	457	E
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	43	15	NA	NA	20.875713	102.151103	456	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	31	12	LC	NA	20.87434	102.138611	462	E
Ket ke	<i>Balakata baccata</i>	Euphorbiaceae	48	15	LC	NA	20.874824	102.138331	462	E
Dou	<i>Pterocarpus macrocarpus</i>	Fabaceae	43	15	EN	I	20.803354	102.087661	631	E
Kiou	<i>Colubrina sp.</i>	Rhamnaceae	37	12	NA	NA	20.803095	102.087623	632	E
Ka bor	<i>Dalbergia assamica</i>	Fabaceae	41	15	LC	NA	20.794731	102.085571	612	E
Hai	<i>Ficus sp.</i>	Moraceae	80	20	NA	III	20.787853	102.077982	612	E
Ngom	<i>Toona ciliate</i>	Meliaceae	63	15	LC	II	20.779654	102.064706	645	E
Ka dao chang	<i>Azadirachta indica</i>	Meliaceae	64	15	LC	III	20.777099	102.061698	648	E
Por	<i>Sterculia villosa</i>	Malvaceae	54	15	LC	III	20.743164	102.029321	695	E
Ten	<i>Duabanga grandiflora</i>	Lythraceae	73	20	LC	NA	20.736843	102.025861	732	E
Len	<i>Albizia lucidior</i>	Fabaceae	54	20	LC	NA	20.714183	102.012493	635	E
Thone	<i>Albizia chinensis</i>	Fabaceae	73	20	NA	III	20.7128	102.012336	644	E
Thone	<i>Albizia chinensis</i>	Fabaceae	63	20	NA	III	20.712692	102.012317	643	E
Thone	<i>Albizia chinensis</i>	Fabaceae	37	20	NA	III	20.713146	102.012377	642	E

Annex 7: Maps show location of trees to be removed

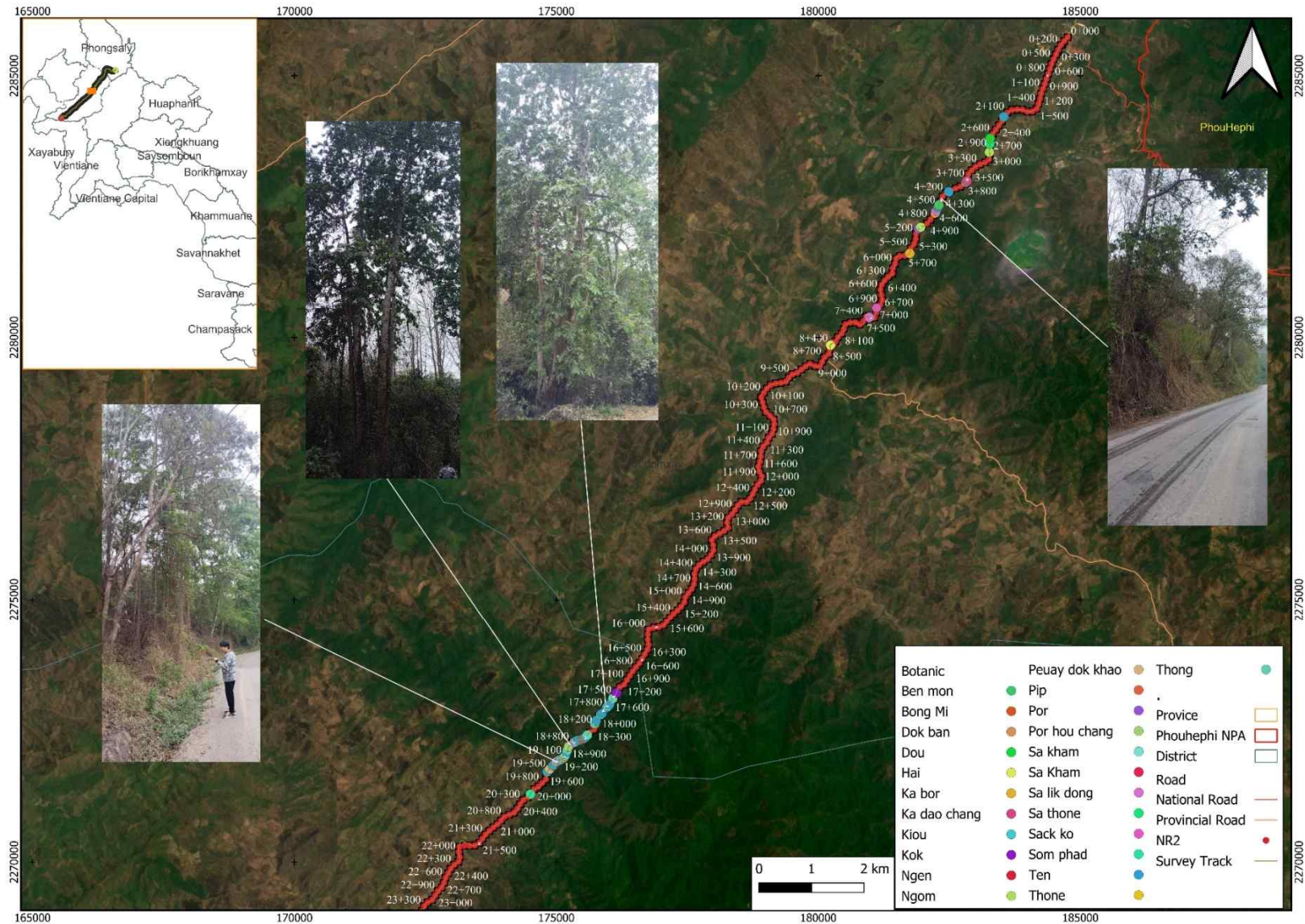




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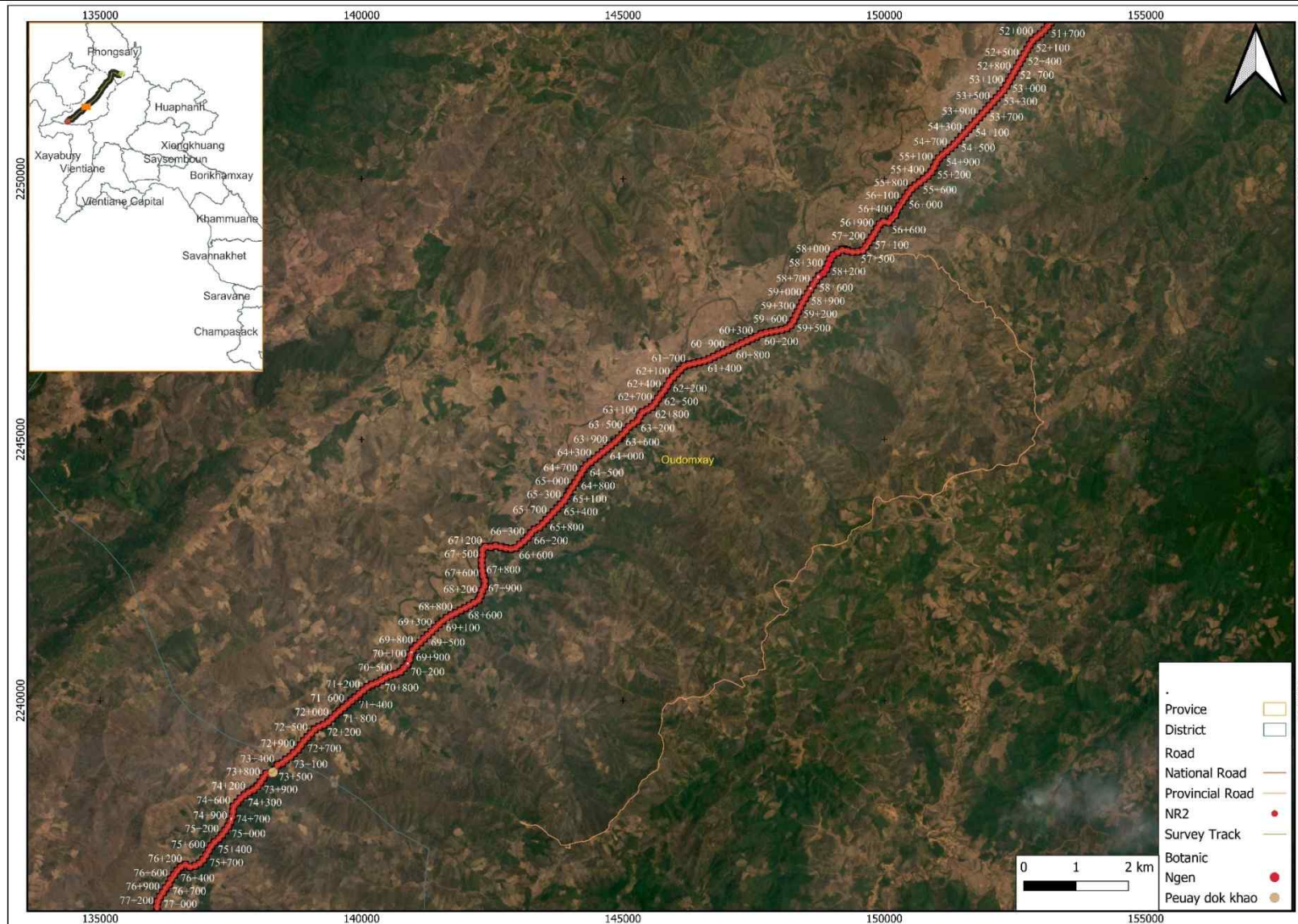


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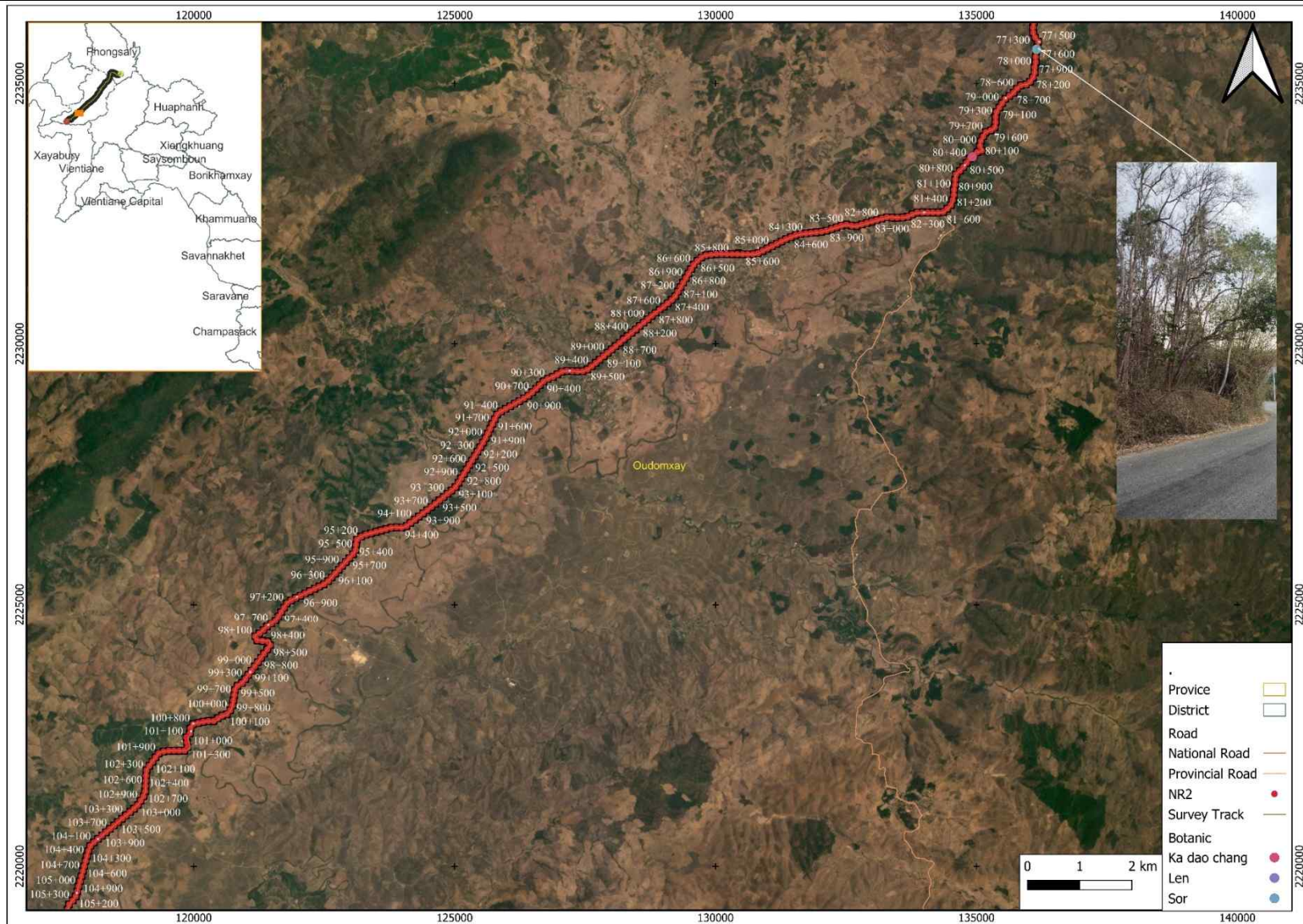
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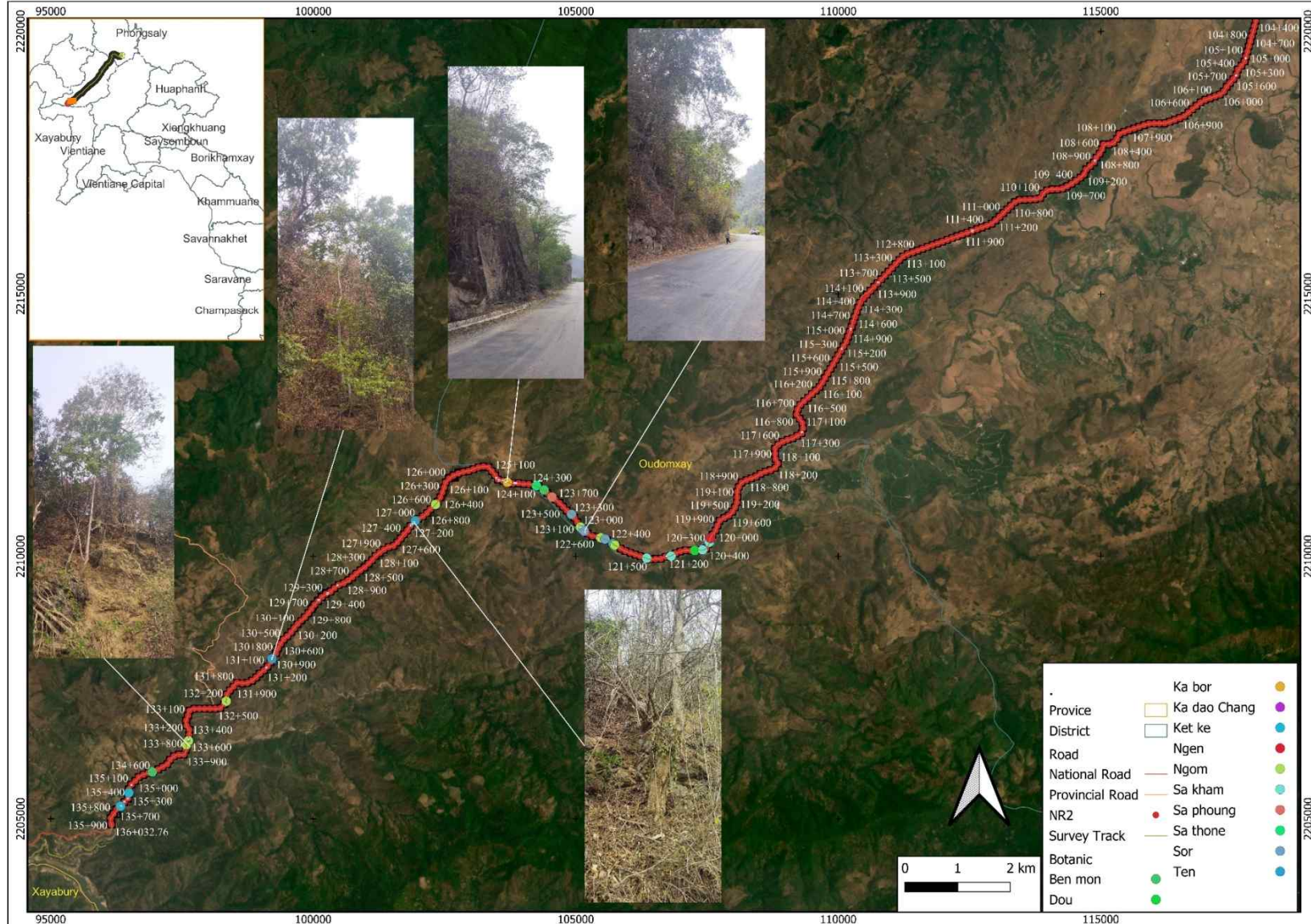
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Biodiversity Management Plan (BMP) for National Road No.2



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