



Photo: Jessica DiCarlo

FOCUS-BRI Country Report

**Framing Opportunities for Conservation by Understanding Safeguards
in the Belt and Road Initiative**

Laos

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Acronyms

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
ASEAN	Association for Southeast Asian Nations
BRI	Belt and Road Initiative
CBI	Composite Biodiversity Index
CDB	China Development Bank
CDE	Centre for Development and Environment (University of Bern)
CHEXIM	China Export-Import Bank
CICPEC	China-Indochina Peninsula Economic Corridor
CSO	Civil Society Organization
ECC	Environmental Compliance Certificate
EdL	Électricité du Laos
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Safeguards
FDI	Foreign Direct Investment
GEF	Global Environment Facility
GiZ	German Agency for International Cooperation
GoL	Government of Laos
GRM	Grievance and Redress Mechanism
IFC	International Finance Corporation
IMA	Independent Monitoring Agency
IMF	International Monetary Fund
INGO	International non-governmental organization
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
LI	Linear Infrastructure
MAF	Ministry of Agriculture and Forestry, Lao PDR
MDB	Multilateral Development Bank
MoEM	Ministry of Energy and Mines, Lao PDR
MOFCOM	Ministry of Commerce, People's Republic of China
MoNRE	Ministry of Natural Resources and Environment, Lao PDR
MoU	Memorandum of Understanding
MPI	Ministry of Planning and Investment, Lao PDR
MPWT	Ministry of Public Works and Transport, Lao PDR
MRLG	Mekong Region Land Governance project
NDRC	National Development and Reform Commission of the People's Republic of China
NGO	Non-governmental organization
ODA	Official Development Assistance
ODI	Outward Direct Investment
PA	Protected Area
PAFO	Provincial Agriculture and Forestry Office, Lao PDR
SoE	State-owned enterprise
UNDP	United National Development Programme
WB	The World Bank
WCS	Wildlife Conservation Society

Lao PDR Factsheet



Figure 1. Political map of Lao PDR. Source: Nationsonline.org.

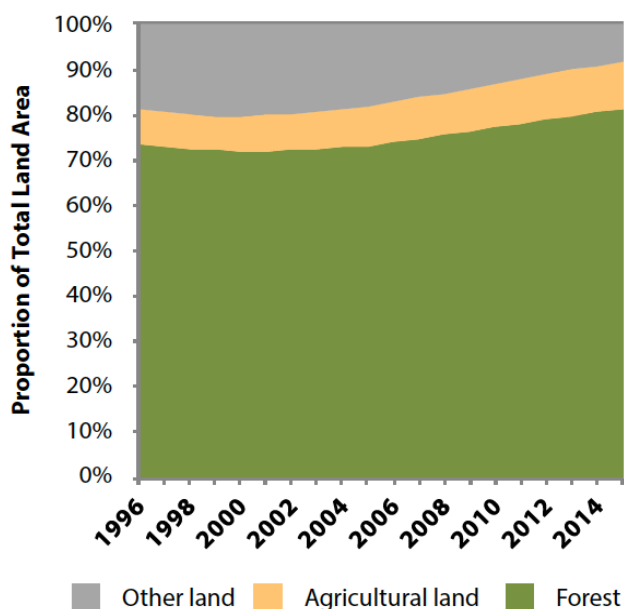
Table 1. Lao PDR country statistics. Information assembled from the Stimson Center, World Bank, and the Convention on Biological Diversity.

Region	Southeast Asia
Capital	Vientiane
BRI Corridor	China-Indochina Peninsula (CICPEC)
BRI investment	US\$ 5,500 million
World Bank Logistics Performance Index (LPI)	2.70, ranking Laos 82 of 160 countries globally
Income Status	Lower middle-income
Population	7,169,000 (2019 est)
GDP	USD 18.17 billion (2019)
Land Area	237,950 km ²
Protected Areas (km ²)	27,563 km ²
Protected Areas (ranking)	17
Species Richness (ranking)	2
Biodiversity Intactness (ranking)	7
ND-GAIN Country Index; Climate vulnerability (ranking)	137
GDP Growth Rate Projections	2.3% in 2021, usually around 6.8% annually
Inequality (Gini Coefficient)	61.2
Human Development Index (HDI)	0.64
Key exports	Hydropower, tourism, wood, clothing, coffee, rubber, metals

I. Introduction

Laos is the only landlocked country in Southeast Asia. The mountainous country spans 236,800 km² and is bordered by China to the north, Vietnam to the east, Cambodia to the south, and Thailand and Myanmar to the West (Fig. 1). There are two major mountain ranges – the Annamite Range and the Luang Prabang Range – and between them lie three plateaus – the Bolaven plateau, the Xiangkhoang plateau, and the Khammouane plateau – as well as the Mekong River. The Mekong is a vital transport route, source of hydroelectric energy, and means of livelihood for crops and fishing. Much of the population lives near the Mekong, which winds 2,600 miles through Laos from China in the north to Cambodia, the Vietnam delta, and eventually the South China Sea. See Table 1 for additional country statistics.

Much of the Lao PDR's terrain (80%) is mountainous or forested hills. Many are too steep to live or farm, leaving only 7.9% of land suitable for agriculture. Land area cover is dominated by forest (Fig. 2; Fig. 3). Lowland, montane, and azonal forest cover much of the territory and provide resources to local communities and several ecosystem services such as watershed protection. In addition, 40% of the country's plant species depend on forest ecosystems. However, deforestation is a serious issue due to the expansion of land-based investments, such as commercial plantations and infrastructure.



Laos is diverse not only in landscape but people. It is home to approximately 7.4 million people from 49 ethnic groups, including the dominant Lao Loum (lowland, 68%), Lao Theung (upland, 22%), and the Lao Soung (highland) such as the Hmong and the Yao (9%), as well as ethnic Vietnamese/Chinese (1%). Most of the population lives in rural areas, with 77% of the total workforce engaged in agriculture and rates as high as 90% in upland areas (Epprecht et al. 2018a). The country is classified as lower middle-income, with a generally poor rural population. Laos is ranked 91 of 119 countries in the Global Hunger Index. Reliance on agriculture and land-based resources is highly dependent on biodiversity, agrobiodiversity, and the effects of climate change.

Figure 2. Proportion of total land area in Laos by primary use.
Source: Centre for Development and Environment.

The government of Laos (GoL) has designated 24 National Protected Areas and two protection corridors that cover 3.8 million hectares, or 18% of the land. In addition, at the central level, the state has three categories of forest: Protection, Conversation, and Production. Provincial and district-level authorities can also establish local forest areas under these designations. As of 2016, there were twenty-six Important Bird Areas (IBAs) that totaled 23,850 km²; however all but eight of these fall under the PA system.

Source: SERVIR-Mekong (2015)

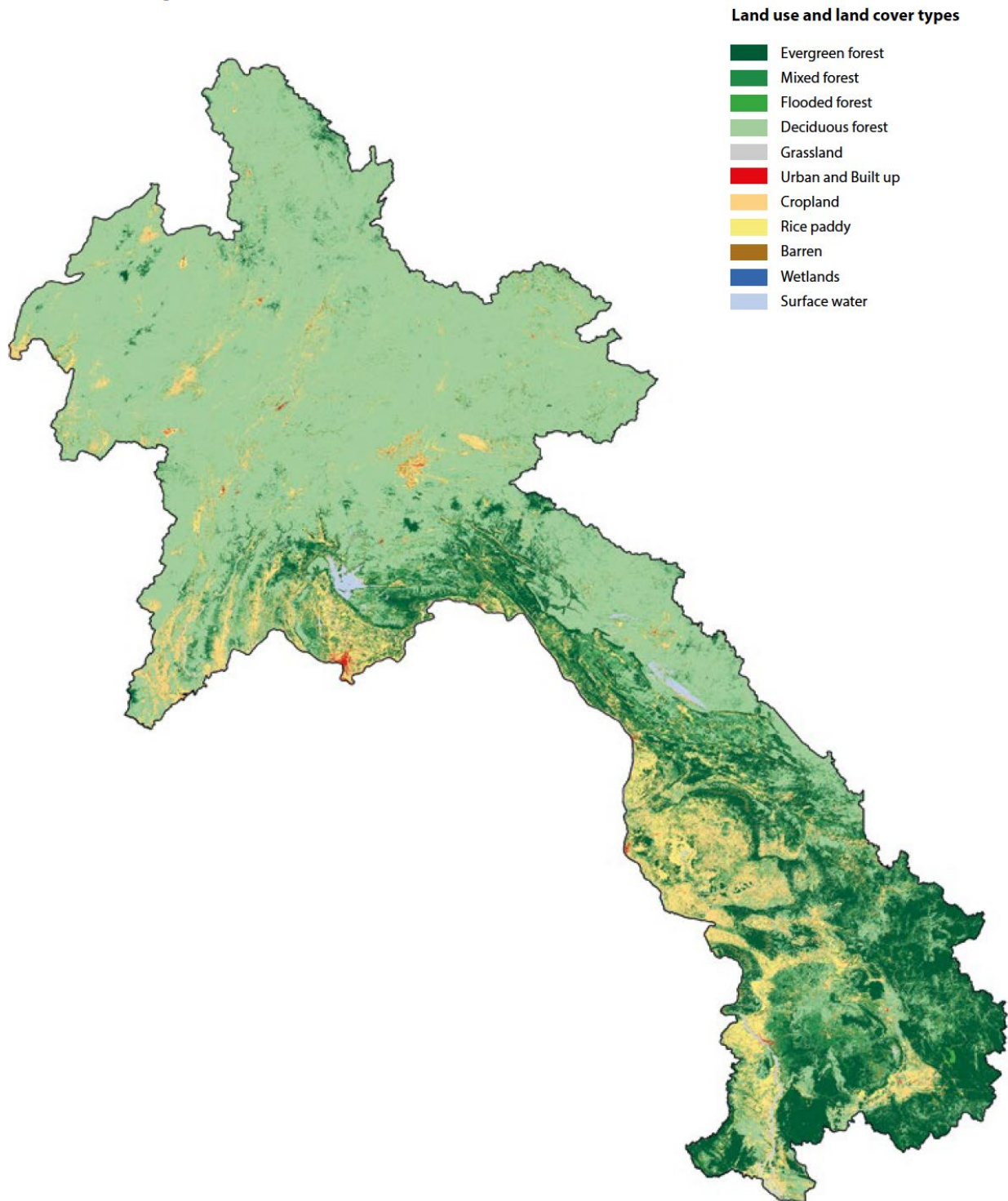


Figure 3. Land Use and Land Cover in Lao PDR. Source: CDE Atlas.

Since 2000 the Lao economy has grown at a rate of approximately 7% per year due to the mining and hydropower sectors and infrastructure development. According to the World Bank, however, this growth has strained natural resources and poses environmental risks. Inadequate infrastructure and an unskilled workforce are often cited as critical constraints to Laos’ socio- and macro-economic development. The mountainous landscape has been a challenge for transportation development (roads and railways) since the early 20th century, as such, river transport was often favored. Since Laos’ Sixth Party Congress (1996), infrastructure has been central to Lao government plans for economic development and to ensure that the country “graduates” from Least-Developed Country (LDC) status.

In addition to national infrastructure plans, starting in 1992, the Asian Development Bank’s Greater Mekong Subregion (GMS) offered a vision of increased trade and connectivity via road networks and economic zones. Infrastructure is also one of ASEAN’s (Association for Southeast Asian Nations) main pillars to support regional development. Through these initiatives, Laos has been envisioned as the “battery of Southeast Asia” (due to the rich hydropower potential) and transforming from “land-locked to land-linked” through the construction and upgrading of energy and transportation infrastructures. Both visions rely on massive and expensive project development. The government anticipates that by 2025 hydropower will become the country’s most significant source of revenue. However, neighboring Vietnam, Thailand, and Cambodia have raised concerns about the environmental impact of Lao dam-building projects along the Mekong River. While for linear infrastructure (LI) such as road, rail, and transmission lines, large land concessions have followed LI and have been criticized for environmental impacts.

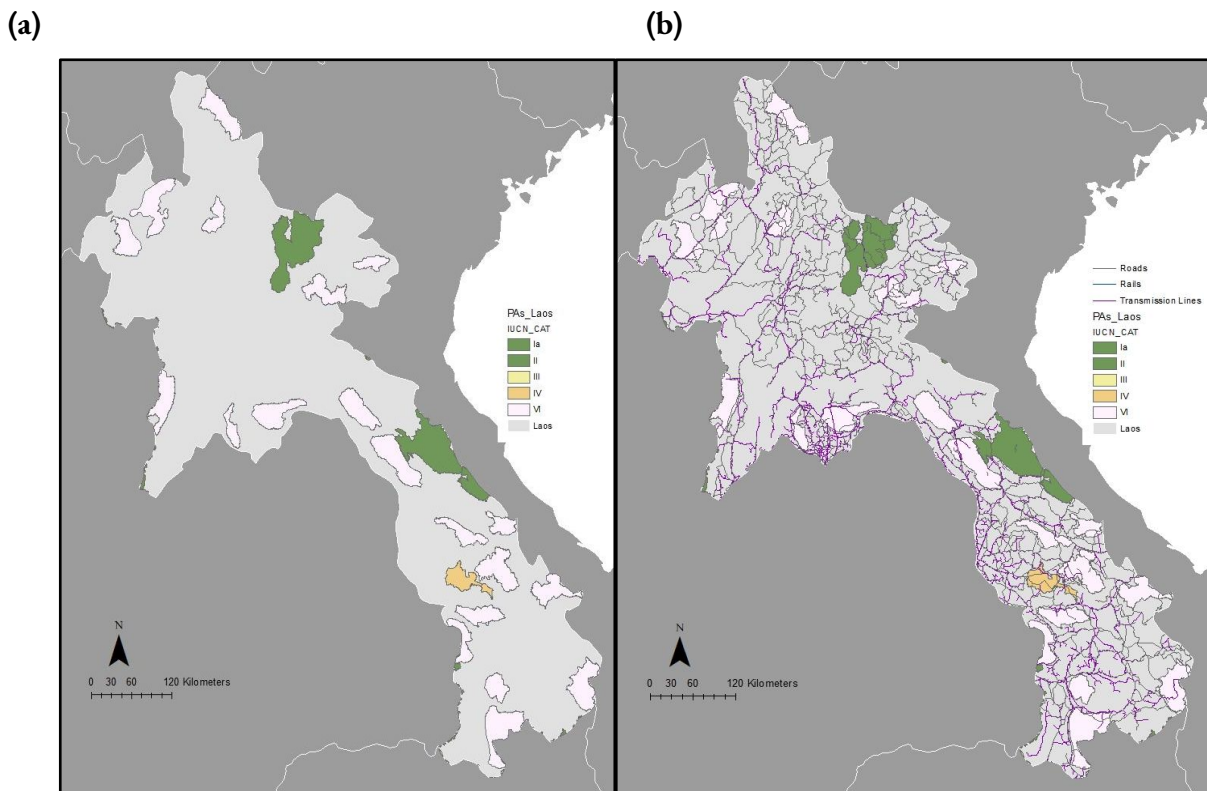


Figure 4. (a) The protected areas in Laos as categorized according to IUCN classification, where category I is the most regulated and IV is the least; **(b)** Linear infrastructure mapped on protected areas across the country. See Appendix A for Methodology.

Planned infrastructure development adds to an already extensive network of LI. The maps (Fig. 4) above illustrate the constellation of protected areas in Laos according to their IUCN classification and the existing LI network, as captured by four distinct datasets (Appendix A). This overlay provides an overview of the extent of the road systems and their prevalence across Laos's PA system. The protected area system of Laos does not exclude roads from its bounds, and its road network is fairly extensive, even across less developed areas and steep mountainous terrain. Therefore, incorporating environmental and community concerns in the development of LI projects is especially critical in this haven for biological and cultural diversity.

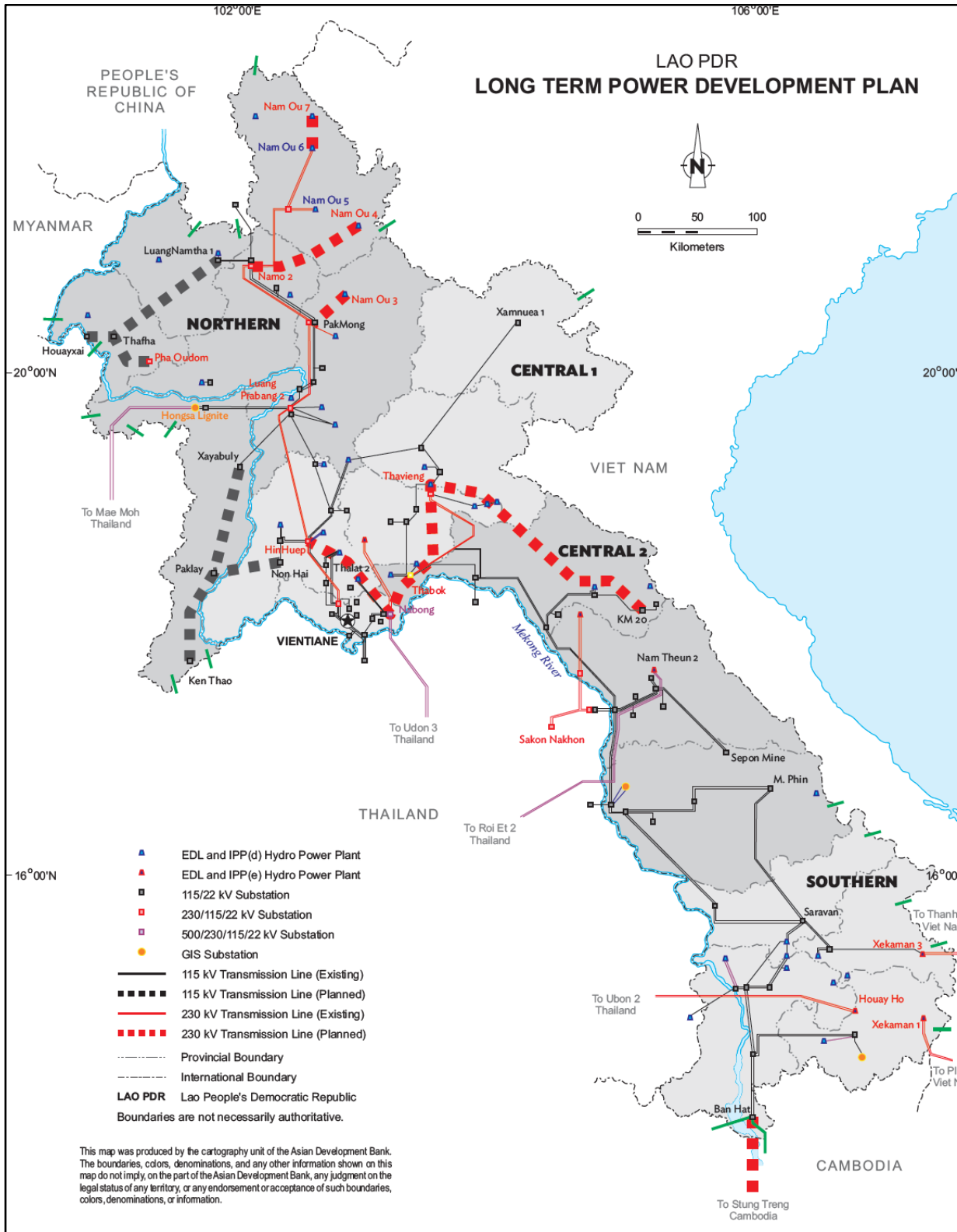
II. Linear infrastructure investment landscape

Linear infrastructure in Laos consists of energy transmission and transportation infrastructure. Laos is an increasingly central transportation hub within Southeast Asia and to/from China. Regarding roads and railways, the Stimson Center identified 47 projects in the country: 1 railway, 14 national road upgrades, and 32 National road projects (with roads totaling 11,203 km). The country's first railway – the Laos-China Railway – opened in December 2021 to much fanfare. Prior, roads and waterways were the main modes of transportation.

Additionally, economic corridors have been central to the economic growth model of Laos and the region long before the BRI. The Asian Development Bank's (ADB) GMS is based on an economic corridor model that aims to upgrade or build roads and reduce bottlenecks. This aligned with the government strategy to transform the country from "land-locked" to "land-linked." The second dominant development strategy centers on making Laos the "battery of Southeast Asia" due to its wealth in hydropower resources. Linear infrastructures for energy and transportation have thus been the backbone of the Lao government's economic development strategy since the 1990s. Although the GMS is ongoing, the BRI has invigorated and accelerated this development model.

Energy Transmission

LI for energy transmission has not kept pace with the boom in investment in energy generation. As of 2017, a mere 1% of energy investment was for transmission. This has begun to change with larger proposed transmission line projects, many of which are Chinese-backed. Overseen by state-owned utility company Électricité du Laos (EdL), the energy grid in Laos is divided into four regional grids: northern, central 1, central 2, and southern. They are largely unconnected and consist of a system of low-voltage domestic lines. According to the Mekong Infrastructure Tracker, the majority of the 42 operational lines are 115kV and 230kV. The remaining 14% are extra high voltage and intended to export energy to Thailand and Vietnam. In August 2020, China Southern Power Grid Co. signed a Memorandum of Understanding with the Lao government to evaluate the possibility of developing a national grid. See Fig. 5 for the current grid layout and future expansion plans.



*Figure 5. Laos' existing energy transmission network (solid lines) and long-term development plans (dotted lines).
Source: Asian Development Banks.*

Railway

The 414-km Laos-China Railway runs through the center of northern Laos from the Chinese border to the capital city of Vientiane. It opened for operation on December 3, 2021, after five years of construction. The only existing rail line in the country runs a mere 3.5 km from the Thai border east of Vientiane to a small station at Thanaleng, which opened to traffic on March 5, 2009. The other line in discussion is the Savannakhet–Lao Bao Railway (often called the Laos–Vietnam Railway). It was first proposed in 2012 by a Malaysian Company. This southern line would run from Laos’s second largest city of Savannakhet to Lao Bão, a small town on the border with Vietnam. For a comprehensive project profile, see Chen and DiCarlo (2021) on The People’s Map of Global China.

Roads

Roads are the most prevalent form of transportation. Of the 51,600km of roads, 46% are rural, while 14% are more extensive paved national routes. Only 78% of the national road length is paved. Of the local roads (provincial, district, and rural roads), 9% of their length is paved, with 50% in good or fair condition; less developed roads take up a majority (74%) of the total road length in Laos (DFID, n.d.)

Due to fiscal constraints, most LI development for transportation and transmission is funded by foreign donors or external actors through loans, grants, or technical assistance programs. For example, the Laos-China Railway was financed by Chinese policy banks, Chinese state-owned enterprises (SOEs), and the Lao government (12%). Highway 3, which connects Thailand and China through northwestern Laos, was jointly developed by the Chinese government, the Thai government, and ADB. The Japanese government and the World Bank funded other road construction and upgrade projects. The Table 2 below outlines the actors and institutions financing LI projects in Laos. The Lao government’s lack of capital has led officials to develop a model of land-based financing (see Pathammavong et al.’s (2017) description of the 450 Road Project), in which land surrounding the road was expropriated and sold to private developers to raise funds, often at the expense of local communities. The government has increasingly turned to Public-Private Partnerships (PPPs) to attract investment.

Table 2. Key sources of multilateral and bilateral LI finance and cooperation.

Multilateral
World Bank
International Finance Corporation (IFC) <ul style="list-style-type: none">• <u>Power</u>: April 2019 MOU with Laos government to attract private investments in power transmission infrastructure
Asian Development Bank (ADB) <ul style="list-style-type: none">• <u>Transport</u>: enhance connectivity in towns along GMS central corridor
Asian Infrastructure Investment Bank (AIIB) <ul style="list-style-type: none">• <u>Transport</u>: April 2019 approved loan for road maintenance project
Japan International Cooperation Agency <ul style="list-style-type: none">• <u>Transport</u>: develop infrastructure and networks

<ul style="list-style-type: none"> • <u>Energy</u>: develop more reliable power generation and transmission infrastructure
<p>KfW Development Bank (Germany)</p> <ul style="list-style-type: none"> • <u>Transport</u>: finance construction/repair of roads, tracks and bridges in rural areas
<p>European Investment Bank (EIB)</p> <ul style="list-style-type: none"> • <u>Transport</u>: financing for paving and stabilization of roads, finance for bus system • <u>Power</u>: financing for hydropower project
<p>Korea International Cooperation Agency</p> <ul style="list-style-type: none"> • <u>Transport</u>: finance study on railway link between Laos and Vietnam • <u>Power</u>: financing for Xe Pian Xe Nam Noy hydropower plant in 2015
Bilateral
China, e.g. CHEXIM, CBD
Japan, e.g. JICA
South Korea
Thailand
Vietnam

Regarding official development assistance (ODA), China is not among the top ten donors in Laos. Instead, the top three ODA donors in Laos are the ADB, Japan, and International Development Association (Fig. 6). However, this does not imply that China is inactive. Rather, most Chinese funding and financing come in the form of loans. These loans are both concessional and non-concessional and emanate from various sources: government institutions (central, state, or local), policy banks, and enterprises with commercial interests. Chinese sources do not make the ODA list because financing with a commercial focus or low concessional rates is not counted in ODA statistics, and such sources represent most of the Chinese funding in Laos. That said, according to the Ministry of Planning and Investment (MPI), China is the largest foreign investor and largest contributor in the form of loans. Although sources of project support vary, the levers of power lie within Chinese financing, not with “traditional” development actors, but with policy banks or commercial enterprises.

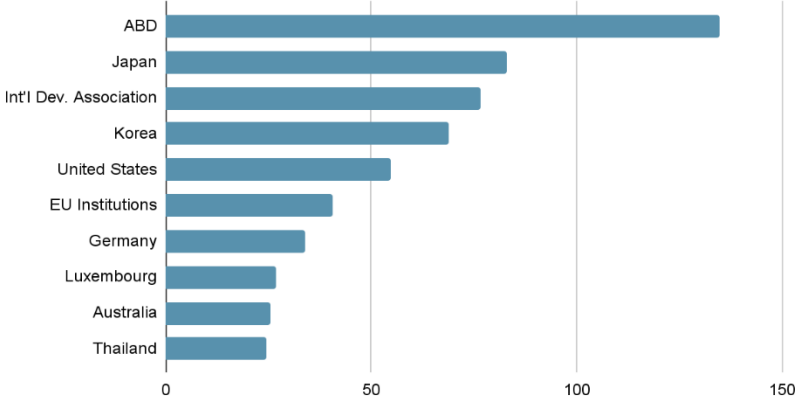


Figure 6. Top ODA donor to Laos, 2018-19 (USD millions). Source: <https://public.tableau.com/>.

BRI activities in Laos

The Lao government is an enthusiastic supporter of the BRI and LI development that long-preceded the BRI (Kuik 2021; DiCarlo 2021). According to the MPI, from 2011 to 2017, Chinese investments totaled US\$4.3 billion. Most BRI infrastructure projects are financed through the China Development Bank (CDB) or China Export-Import Bank (CHEXIM). Between 2009-2019, these two banks offered US\$11 billion in financing for projects in Laos. Looking at projects funded in Laos by these banks since 2009, many include those that have become major BRI projects – all are large-scale infrastructure projects, and many are for hydropower development (Table 3).

Table 3. CDB and CHEXIM loans in Laos between 2009-2019.

Project	Type	Borrower	Lender	Signed	Total (USD millions)
Nam Khan 2 Hydropower Project	Hydropower	Public	EXIM	2009	308
Laos China Railway	Railway	Public	EXIM	2010	5950
Mekong Bridge at Pakbeng	Bridge	Public	EXIM	2010	50
Houay Lamphan Gnai Hydropower Plant, Sekong	Hydropower	Public	EXIM	2011	206
Nam Ou Hydropower Project, Phase 2 (Dams #1,3,4,7)	Hydropower	JV	CDB	2011	1000
Wattay International Airport upgrade	Airport	Public	EXIM	2011	37.6
Nam Ngiep 2 Hydropower Project	Hydropower	JV	CDB	2011	345
Nam Ou Hydropower Project, Phase 1 (Dams #2,5,6)	Hydropower	JV	CDB	2012	660
Nam Khan 3 Hydropower Plant	Hydropower	Public	EXIM	2012	127
Pakbeng-Ngeun Bridge	Bridge	Public	EXIM	2012	31.2
Laos – Spaceflight	Satellite		EXIM	2012	258
Xeset III Hydropower Project	Hydropower	Public	EXIM	2014	50.73
Nam Ngum 4a Hydropower Station	Hydropower	Public	EXIM	2016	322
Salavan-Sekong II Power Transmission Project	Energy transmission	Public	EXIM	2016	377
Pak Lay Hydropower Project	Hydropower	Public	EXIM	2017	89.77
Nam Phay Hydropower Project	Hydropower	JV	EXIM	2017	367.29
Pak Ngeuy-Pha Oudom Transmission Lines and Substation	Energy transmission	Public	EXIM	2017	169
Nam Chiane Hydropower Station	Hydropower	Public	EXIM	2017	
Nam Tha 1 Hydropower Project	Hydropower	JV	EXIM	2018	400
Thavieng-Laksao & Nam Phay HPP-Thongkoun2	Energy	Public	EXIM	2018	199

Transmission Lines	transmission				
				Total: <i>approx. US\$11 billion</i>	

III. Laos’ biodiversity landscape

Laos ranks at the very top of the 2021 Natural Capital index.¹ According to this metric, natural capital is divided into five categories: water availability, biodiversity, agricultural fertility (domestic food security), availability of natural resources, and climate change risk. In terms of biodiversity, it is ranked fourth on the list. Laos is located in one of the ten most significant global biodiversity ecoregions (World Bank 2020) and is part of the Indo-Burma Hotspot, which spans much of the GMS and includes Laos, Myanmar, Thailand, Cambodia, Vietnam, and areas of southern China. It also ranks as a top ten global biodiversity hotspot for irreplaceability and in the top five in terms of threat (CEPF 2020). The country spans a diversity of landscapes from lowland plains to karst mountains that are divided into four regions: the Northern Highlands, the Annamites Mountain Range, the Indo-Chinese karsts, and the fertile floodplain of the Mekong River.

The Lao uplands, in particular, are some of the world’s most biologically and ethnically diverse landscapes. Much of the biological diversity among plant and tree species were cultivated by ethnic minorities living in the hills. As a result, the diverse soils, climate, and resources are home to important species, flora, and forest diversity comprising seven-hundred bird, two-hundred mammal, ninety bat, five-hundred fish, and one-hundred and sixty-six reptile/amphibian species (Lao Conservation Trust for Wildlife). There are several endemic, migratory, and threatened species, such as the Asian elephant, clouded leopard, gaur, saola, gibbon, Siamese crocodile, and the white-winged duck. Laos is also home to the red panda, giant Mekong catfish, and king cobra. Of the more than 247 mammal species, three are solely found in Laos: the giant flying squirrel, the saola, and the Laotian rock rat (ProCEED, n.d.). Within Laos, 60 mammal and 74 bird species are classified as threatened or nearly threatened.

As Fig. 7 reinforces, biodiversity hotspots are spread throughout the country, from the southern tip to the northern border with China. And unlike other contexts, the majority of the areas between these hotspots retain relatively high biodiversity values. While the most stringently regulated PAs align with important biodiversity cores and Key Biodiversity Areas (KBAs), most of these vital landscapes are not classified as IUCN Category I or II PAs. This mismatch further supports the importance of safeguarding large development projects across the country, beyond PA boundaries. While the data is incomplete, the second map (Fig. 7b) demonstrates that the captured Chinese-funded LI projects do avoid critical biodiversity areas reasonably well, only majorly intersecting with them in the very north of the country.

¹ The top ten in descending order are: Laos, Colombia, Bolivia, Venezuela, Paraguay, Iceland, Brazil, Peru, Sweden, and Norway.

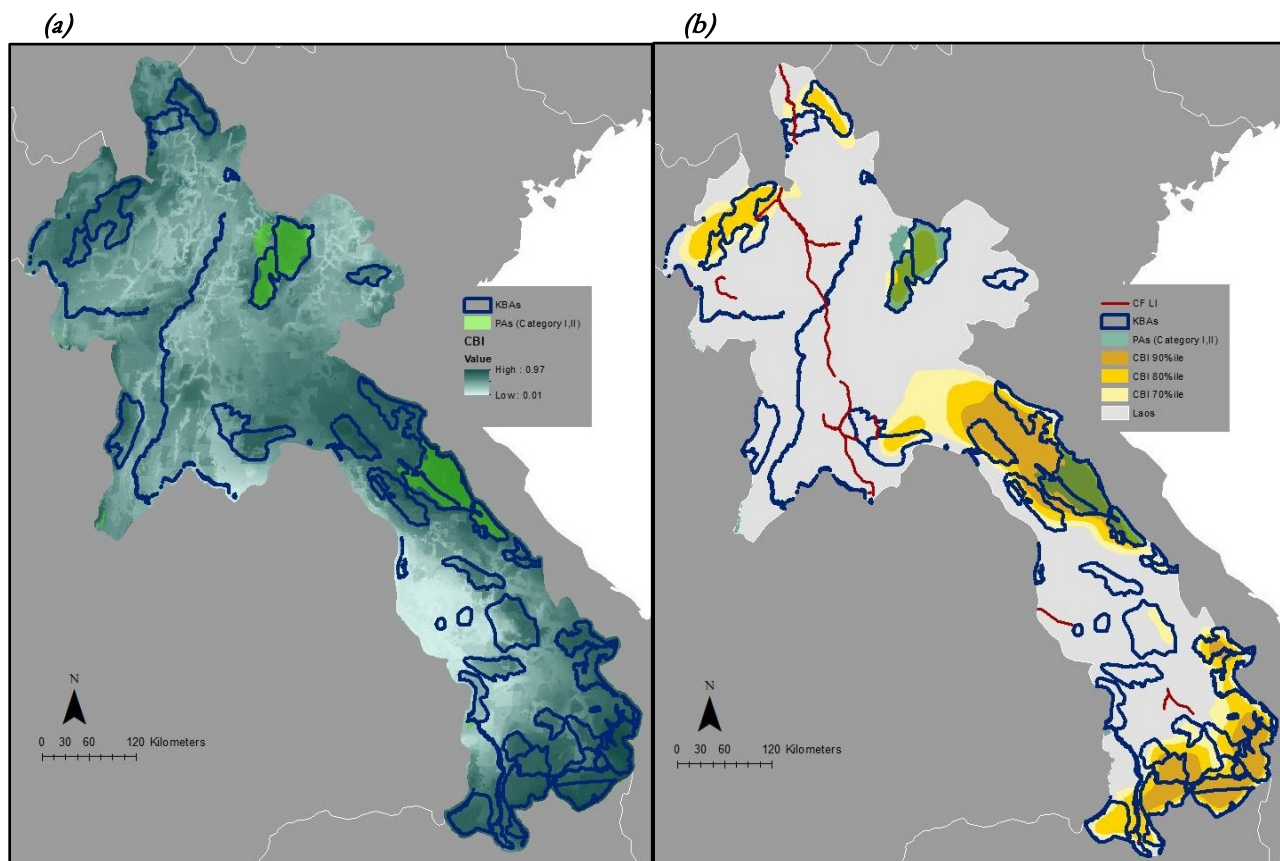


Figure 7. (a) In Laos, Protected Areas (PAs) with the highest protection (at IUCN Category II) and (Key Biodiversity Areas) KBAs overlap to a great degree and cover some areas of high Composite Biodiversity Index (CBI) values. **(b)** Chinese-funded linear infrastructure - as captured by Custer et al., 2021 - along with PAs and KBAs overlaid over CBI cores. Methodology and further analysis are in Appendix A.

Threats to biodiversity in Laos have been tied to the growth of commercial agriculture and monocultures, logging, climate change, resource extraction, and the illegal wildlife trade and hunting. Hydropower and infrastructure development, as well as related settlement expansion increasingly contribute to habitat loss and fragmentation. Wildlife trade is already under-monitored and will likely increase with improved access: for example, the sale of bear bile in the border areas with China (see Livingstone et al. 2018) as well as other species sold as pets, bushmeat, trophies (e.g., horns), or medicinal use to Thailand and Vietnam. A report on country-level biodiversity concluded: “Plants are hardly monitored at all.” (ProCEED, n.d.)

Protected Areas

The Lao government has acknowledged the richness of the country’s landscape and biodiversity and the challenges they face. In 2004, the government ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora. It has also signed international conventions, established a conservation and protected areas system, and enacted regulations to manage natural resources. In 2010, the First National Biodiversity Strategy and Action Plan (NBSAP) proposed an agenda for the next ten years that centered on: (i) Scientific Data and Biodiversity Knowledge Development; (ii) Biodiversity Management; (iii) Human Resource

Development; (iv) Public Awareness and Involvement; (v) Legal Frameworks; (vi) NBSAP Implementation, and (vii) International Cooperation.

Regarding conservation spaces, Laos' national forest research system was established in 1993, encompassing 2.4 million hectares (ha) across 18 National Protected Areas (NPAs), or about 10% of the territory. Since then, NPAs have expanded to 3.8 million ha or 14% of the region. An additional 1.4 million ha were designated as protected forests by the provincial and district authorities. Across the country, forests are considered relatively intact. There is awareness within the government of the importance of forest resources, as evidenced by its 2018 commitment to increase the country's forest cover to 70 percent.

National conservation spaces in the Lao PDR consist of:

1. *National Protected Areas (NPAs) or National Biodiversity Conservation Areas (NBCA)*
2. *National Protection Forest*
3. *National Production Forest*

Laos has 21 National Biodiversity Conservation Areas (NBCA) spanning 29,775 km². The largest protected area, the 4,270 km² Nakai-Nam Theun, is home to the Asiatic black bear and the saola, a forest-dwelling bovine and one of the rarest animals on earth. The government also established 51 National Production Forests (3.1 million ha) and 49 National Protection Forests (7.5 million ha). Together, these three forest categories cover 14.5 million ha or 61% of the land area of Laos. Table 4 lists the main protected areas in Laos. In January 2018, the governments of Laos and Vietnam signed an MoU to support a transboundary World Heritage Site. From this, Hin Nam No NPA in Khammouane Province was nominated as Laos' First Transboundary UNESCO Natural World Heritage along with Phong Nga Ke Bang across the border in Vietnam.

Table 4. Protected Areas in Laos

<ol style="list-style-type: none"> 1. Bokeo Nature Reserve 2. Buddha Park 3. Dong Ampham National Biodiversity Conservation Area, 20,000 ha 4. Dong Hua Sao National Biodiversity Conservation Area, 110,000 ha 5. Hin Namno National Park, 82,000 ha 6. Khammouane Limestone (Phou Hinpoun) National Biodiversity Conservation Area, 150,000 acres 7. Nakai-Nam-Theun National Park, 353,200 ha 8. Nam Et National Biodiversity Conservation Area, 170,000 ha 9. Nam Ha East National Biodiversity Conservation Area, 69,000 ha 10. Nam Ha West National Biodiversity Conservation Area, 102,500 ha 11. Nam Kading National Biodiversity Conservation Area, 169,000 12. Nam Kan, 77,500 ha 13. Nam Phoun (Poui) National Biodiversity Conservation Area, 191,200 ha 14. Nam Phouy National Biodiversity Conservation Area 15. Nam Theun river corridor 62,000 ha 16. Nam Theun Extension National Biodiversity Conservation Area, 64,500 ha
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17. Nam Xam National Biodiversity Conservation Area, 70,000 ha
18. Phou Dindeng National Biodiversity Conservation Area, 222,000 ha
19. Phou Kateup (Bolovens Northeast), 93,500 ha
20. Phou Kathong, 88,000 ha
21. Phou Khao Khouay National Biodiversity Conservation Area, 200,000 acres
22. Phou Loeuy National Biodiversity Conservation Area, 150,000 ha
23. Phou Theung, 113,000 ha
24. Phou Xang He National Biodiversity Conservation Area, 109,900 acres
25. Phou Xiang Thong National Biodiversity Conservation Area, 120,000 ha
26. Phu Luang (Bolovens Southwest), 62,000 ha
27. Xe Bang Nouane National Biodiversity Conservation Area, 150,000 ha
28. Xe Khampho, 78,000 ha
29. Xe Pian National Biodiversity Conservation Area, 240,000 ha
30. Xe Xap National Biodiversity Conservation Area, 133,500 ha

People, livelihoods, and agrobiodiversity

On one hand, protected areas in Laos have promoted environmental and biodiversity protection and on the other, placed restrictions on local communities. NPAs and NBCAs are not only national parks; rather many Lao citizens live in these areas where they continue to collect forest products, hunt, and cultivate local crops. Emplacing conservation values on the landscape has, in some places, resulted in constrained local livelihood and agricultural practices. For example, inside forest areas, people cannot build structures, hold a land title, collect non-timber forest products, expand agrarian areas, or practice shifting cultivation. In reality, many communities lived in these areas *before* they received a protected designation from the government. According to the World Bank (2020):

“Over 840,000 people in over 1200 villages are situated within or on the boundary of 23 national biodiversity reserves. Most of these villagers, from a range of ethnic groups, depend heavily on the sustainable use of natural resources within these reserves for their nutrition and livelihoods.”

Because 80% of the Lao population lives in rural areas and relies on the environment for subsistence and income, agricultural and forest land distinctions are also important because of how these shape agricultural land availability for households. In addition to the NPAs above, forest land is often used for household production, and subsistence in these landscapes depends on agrobiodiversity, or the variety of animals, plants, and microorganisms used for food, livelihoods, and incomes. Land and forest systems produce diverse species and cultivars for household consumption, house construction, medicine, and local markets. Yet, many have been converted to monocultures of non-native species to serve export markets destined for China, Vietnam, Thailand, and elsewhere.

Finally, it cannot go without highlighting that Laos remains the most bombed country in the world due to the American War in Vietnam. This has implications for local lives, infrastructure construction, and conservation and should be at the heart of each of these efforts.

IV. Country policy and planning landscape for biodiversity & infrastructure

National and international commitments to conserve biodiversity

Laos' National Biodiversity Strategy and Action Plan (NBSAP) was written in 2004 to conserve the country's biodiversity as a means of poverty alleviation. This was Laos' first NBSAP, which laid out plans in 2010 and a strategy to 2020. According to the 2010 NBSAP, "biodiversity has been mainstreamed at the Ministerial level by the creation of the Ministry of Natural Resources and Environment (MoNRE) ... at the sectoral level by the establishment of the Natural Resource Management and Environment Sector Working Group (SWG; 2012) ... [and] at the Policy level, through the five-year National Socio-Economic Development Plans (NSEDPP)." In 2016, MoNRE prepared an updated NBSAP for 2016-2025 with technical support from the International Union for Conservation of Nature, Lao PDR Country Office. In addition, the government has:

- signed the Convention on Biological Diversity (CBD) (1996);
- designated more areas for protection than is the global target for 2020;
- prioritized its Environmental Performance Index and biodiversity in protected areas under its 8th National Socioeconomic Development Plan (NSEDPP);
- updated the National Biodiversity Strategy and Action Plan (NBSAP);
- and, most recently, in 2021, updated the Protected Area Decree.

Relevant Lao laws and decrees surrounding biodiversity and infrastructure safeguards

It is well-recognized within the government that enforcement and monitoring are the country's biggest challenges. One reason for this is that oversight of projects falls to different ministries with different mandates. Regarding LI oversight, energy transmission and power line projects fall under Ministry of Energy and Mines (MoEM) supervision, while roads and railways are under the Ministry of Transportation and Public Works (MPWT). Other high-level institutions engage with Chinese investment, including the Ministry of Planning and Investment (MPI).

Key laws that highlight biodiversity and could help reduce conservation challenges include the Forestry Law (2019), Land Law (2019), and Protected Area Decree (2021). Most recently, for the Protected Area Decree, the Department of Forestry convened a meeting with the Prime Minister's Office and Ministry of Justice, as well as non-governmental actors, including the Wildlife Conservation Society (WCS) and the French Agency for Development, with European Union Support. WCS (2021), who acted as a technical partner in drafting the Decree, was motivated by the new 2019 Forestry Law and Laos's international environmental commitments and green growth priorities. It proposes more clearly defined PAs, improved management and planning in line with international standards, coordination with communities and the private sector, and modes of finance to manage PAs.

Development projects are technically required based on Lao laws and regulations. However, although there are laws and safeguards for projects and institutions to follow, enforcement and monitoring are critical challenges in Laos. As key informant interviews indicated, laws have been written, but there are numerous reasons why they may not be followed, including project importance or personal profiteering as well as low law enforcement capacity.

The ESIA Process in the Lao PDR

Each investment project is required to conduct an Environment and Social Impact Assessment (ESIA). The Table 5 below provides the list of Lao ESIA-related policies, laws, and regulations. There have been efforts within the Lao government to update and improve these processes in recent years, with many changes in the past few years in terms of both company practices and community knowledge. Challenges that arose around past land-based investments motivated improvements in the legal framework. One stronger area, for example, is the recognition of community participation, as evidenced in the Protected Area Decree described above.

Table 5. *List of policy, legal and institutional frameworks applicable to this ESIA.*

Name of legislation and policy	Year of adoption or amendment
Environmental and Social Policy on Power Sector (No. 581)	2001
Environmental and Social Policy in Lao PDR (No. 561)	2005
Law on Environmental Protection (Amended 2013)	2012
Law on Land Transport	1997
Law on Public Roads	1999
Law on Urban Planning	1999
Land Law (Amended)	2019
Forest Law (Amended)	2019
Law on Construction	2009
Law on Investment Promotion	2016
Electricity Law (Amended)	2017
Labor Law	2013
Law on Water and Water Resources (Revised)	2017
Law on Resettlement and Occupation	2018

Decree on Protection Forest	2010
Decree on Protected Areas	2020
Decree on Compensation and Resettlement of People from Development Project No. 84	2016
Decree on Environmental Impact Assessment No. 21	2019

The key ministry in the safeguard, ESIA, and monitoring processes is the Ministry of Natural Resources and Environment (MoNRE). MoNRE oversees the ESIA and establishes a Provincial monitoring unit (PMU) for each project. Lao officials or external Lao environmental monitoring companies handle the ESIA processes on the ground. The process involves a series of consultations and fieldwork. First, the Terms of Reference (TOR) for a specific ESIA are developed by the ESIA Consulting Firm and Developer and approved by the Department of Environment, MoNRE. Then, data is collected by the ESIA Consulting Firm with the participation of relevant provincial departments, district offices, and village authorities. Next, the ESIA report, including an Environmental and Social Management and Monitoring Plan (ESMMP), is prepared. The draft ESIA report is then used for consultations at different levels of administration. Hierarchically, consultations are organized at the village/district first, followed by Central and provincial levels. The ESIA/ESMMP is revised based on comments from each consultation, and approval from MoNRE is needed before the next level of consultations can be organized. Finally, MoNRE issues an Environmental Compliance Certificate based on the final ESIA.

There are, however, ongoing ESIA challenges. Although regulations and project processes are spelled out, and there is increased awareness, several hurdles remain to *consistent* and *quality* implementation. On the one hand, some laws remain vague, leaving them open to different interpretations across sectors or levels of the Lao government. On the other, access to statutes for Chinese stakeholders appears low for several reasons. First, Chinese policy banks and SOEs often follow a policy of deferential finance and non-interference, meaning they defer to host country regulations. However, this does not mean a dedicated Chinese actor is responsible for understanding the legal landscape in Laos. Most Laos laws are written in the Lao language, and although several are translated into English, fewer are available in Chinese. Instead, Chinese stakeholders tend to have a Lao partner – often from the government for large projects or a sort of middleman for smaller investments (i.e., in agriculture). In addition, there is often a mismatch between existing laws and implementing Chinese-backed projects. Some Chinese investment projects, especially government-supported projects, do not undertake consultations and compensation per the Lao regulations.

Environmental and social safeguard (ESS) standards are high in Laos and have improved in China. Within China, domestic actors know that they must follow ESS, or they could be fined. However, in Laos, the same consequences may not exist because there is weak implementation of safeguards and monitoring. In general, safeguards for small, medium, and large investments are happening similarly. In some cases, a Lao government official becomes the broker or the middleman to arrange all of the processes for the investors. They are able to

deal with the Lao government directly. This person is often a key player because they know top-level officials at the Ministry or Politburo level.

Regulations and ESIA requirements apply to both private and state investments. While regulations do not distinguish between public/private, they appear to differentiate by the scale of a project and the origin of the investor. What really matters in terms of safeguards is pressure from the financial institution. The World Bank, ADB, and AIIB each broadly follow international safeguards. Banks from China defer to regulations in host countries. According to an expert, Chinese projects are not subject to the same requirements as international organizations, which have strong regulations about their funding. It “seems like Chinese investment does not have to follow the standards like other financial institutions.”

Although MoNRE has been very serious about improving compliance, exceptions exist. There are several reasons, and no ‘rule’ to this. In some cases, it is due to the importance of the projects or how certain other ministries (MPI, MoEM, MAF) define their importance. Mainly, projects are designated as ‘priority projects’ (*kongan bulimasit*), where there are some high-level backers on the Lao side. This might mean the PM office because of political motivation (such as the railway for Laos-China relations and because of its high profile, or various Lao-Viet friendship investments) or simply because a powerful family in Laos has a stake in the project, or an official has been offered a bribe to ensure the project goes through. In practice, when the term ‘priority project’ is invoked (explicitly or otherwise), everyone knows that their job is to ensure it goes as easily and quickly as possible so that regulations may be loosely enforced or some inspections overlooked. This leads many to the conclusion that Chinese investments often do not have to comply with rules and regulations.

In summary, for large-scale projects (those approved at the central level), monitoring and enforcing the ESIA is the responsibility of MoNRE. The developer or company is responsible for the actions, but it is up to MoNRE to ensure their compliance. Thus, when there are challenges, local officials encourage people to bring them to MoNRE. In addition to the role of MoNRE, companies can take charge of addressing investment impacts by specifying measures they will take in the ESIA.

V. Understanding stakeholders and power dynamics

Key actors and interests

Government

- Ministry of Planning and Investment (MPI)
- Ministry of Natural Resources and Environment (MoNRE)
- Ministry of Energy and Mines (MoEM)
- Ministry of Agriculture and Forestry (MAF)

Relevant government departments at the national, provincial, and district levels involved in issues of land, forest, conservation, investment, and development include:

- Department of Land (DOL)/Ministry of Natural Resources and Environment (MONRE)
- Department of Environment (DoE), MONRE.
- Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF)
- Department of Agricultural Land Management (DALM), MAF.

- Lao Front for National Development (LFND)
- Lao Women’s Union (LWU)

Lao PDR Mass Organizations

1. Lao Front for National Development (LFND): The Lao Front for National Development (LFND), via the Department of Ethnic Affairs (DEA), is the main line agency for ethnic peoples’ (EPs) issues in the country. LFND is a government of Laos mass organization with a strong territorial presence in all provinces and districts.
2. Lao Women’s Union (LWU): Originally established in 1955 to mobilize women for the Lao People’s Revolutionary Party. In 1991 the LWU was recognized under the Constitution of the Lao People’s Democratic Republic (Lao PDR) as having responsibility for: responding to women’s development needs; promoting the status and role of women; and promoting unity amongst women of different ethnic groups and social strata throughout the country.

Finance

- China Export-Import Bank
- China Development Bank
- Asian Infrastructure Investment Bank
- Asian Development Bank
- Bilateral funders (above)

Research

- Land Information Working Group (LIWG)
- National University of Laos
- Centre for Development and Environment (Laos), University of Bern.
- National Agriculture and Forestry Research Institute (NAFRI), under the Ministry of Agriculture and Forestry, to consolidate agriculture and forestry research activities within the country and develop a coordinated National Agriculture and Forestry Research System.
- National Institute for Economic Research (NIER): Under the Ministry of Planning and Investment; to create a cooperation framework for economic research with the Development Research Center (DRC) of the State Council of China.

NGO, CSO, Communities

A directory of non-governmental organizations (NGOs) in Laos is available at <https://directoryofngos.org/>, though some may not be active. The following is a list of active and key civil society organizations (CSOs), non-governmental organizations (NGOs), and iNGOs (international) working on issues of land, conservation, and vulnerable groups (Table 6).

Table 6. List of key CSOs, NGOs, and iNGOs in Lao PDR.

Mekong Region Land Governance Project (MLGP)	Aims to improve land tenure security for smallholder farmers in the Mekong Region. Main projects focus on customary tenure and responsible agriculture investment
Laos Land Information Working Group (LIWG)	A civil society network that was set-up in 2007 and has over 80 Core Members representing approximately 40 organizations, and more than 180 individual Supporting Members. Most LIWG members are from international and local civil society organizations and some individuals - their work centers on land issues in Lao PDR.
Village Focus International (VFI)	An international NGO with an exclusively local mission that focuses on human trafficking, land rights, and food security
Association Anoulak	A French-registered association (registered in September 2014) dedicated to the long-term conservation of biodiversity and human minority communities' resilience in Lao PDR, in particular in the Annamite Mountains
HELVETAS Laos	A Swiss organization whose activities in Laos focus on ethnic minority communities in the mountainous northern regions of the country. People here preserve traditional farming method; they further advocate for social justice and against domestic violence.
Environmental Education Association (EEA) Laos	EEA's activities bring together individual and organizational leaders in environmental education, communication, and awareness raising
Green Community Alliance	GCA is Lao local civil society organization and an independent local group that supports the rights and roles of local people on lands and natural resources management.
Oxfam International	Oxfam partners with Lao government agencies and local authorities on livelihood programs for vulnerable communities. Main Themes include citizen participation and civil society development, gender justice, building resilient communities, and sustainable development.
Save the Children International	Strive to ensure that children's rights to education, health, protection, and participation are fulfilled at all times, including during disasters.
CARE International	CARE is working closely with some of the most affected marginalized urban women and remote ethnic women, to help provide tools for sustainable change. Their work in Laos focuses on food and livelihood security, de-mining and development, health, and emergency response
World Wildlife Fund (WWF GMS)	WWF formally established their country office in 2001 but have been active in Laos since the late 1980s. WWF envisions a future in which the people of Laos and nature are in harmony. As part of the WWF Greater Mekong Programme, the country office also contributes to regional conservation in Cambodia, Myanmar, Thailand, and Vietnam.
Wildlife Conservation Society (WCS)	The WCS vision in Lao is that the unique ecosystems of the country thrive in perpetuity and remain valued by people locally and globally for high biodiversity and services rendered. A core theme of work is capacity building of government and local stakeholders, improving management of wildlife and wild places through community engagement, and combating illegal wildlife trade - all to enhance biodiversity value in decision making

	and management.
International Union for the Conservation of Nature (IUCN)	IUCN Lao PDR maintains a strategic focus on three program areas: biodiversity, environment, and communities; climate change; and water and wetlands
Swiss Agency for Development and Cooperation (SDC)	SDC builds inclusive societies in the wider Mekong region, with a focus on Cambodia and Laos, via encouraging equitable and sustainable development. Additionally works on governance and democratic decision making - includes citizen participation (especially for vulnerable groups), climate change, natural resources management and inclusive economic development.

There is additional existing support for mainstreaming biodiversity protection as a foundational aspect of sustainable development, including:

- [GiZ](#)'s Protecting forest ecosystems and biodiversity project: ProCEED (Promotion of Climate-related Environmental Education): A Lao-German development project between MoNRE and GIZ.
- Multiple engagements from the Global Environment Facility (GEF), ADB, and World Bank. For example, GEF's Forest and Biodiversity Program in the GMS
- [The McConnell Foundation](#) project entitled Fostering Conservation of Biodiversity, Sustainable Livelihoods and an Empowered Civil Society in Lao PDR.
- [WCS Laos](#)'s project on Ecosystem Conservation through Integrated Landscape Management in Lao PDR (ECILL), which uses a landscape approach and green growth model. WCS also focuses on "improved regulatory frameworks to secure Lao PDR's forests, biodiversity and assist rural communities in sustainably managing their natural resources."
- The US government and USAID launched initiatives in Laos – e.g. Asia EDGE, Infrastructure Transaction and Assistance Network, and Clear Choice constitute a BRI counter-strategy (Schindler et al. 2021). According to a USAID officer in Laos, "[n]o country can compete with China in terms of money for infrastructure," hence US programs aim to "build [Lao] government capacity to make better decisions and negotiate better terms [with Chinese actors]" (personal communication, March 2019). Their approaches focus on "building capacity" and training within the Lao government.

SOEs, Companies

Regarding BRI infrastructure investment, the corporate enterprises involved are primarily Chinese companies (state-owned enterprises or private developers). Portions of projects are subcontracted to Lao companies, but they often do not have decision-making power. To explore ways to influence corporate enterprises operating in Laos, it is critical to begin with the Chinese developers. Chinese SOEs operating in the infrastructure construction sector in Laos include Sinohydro, PowerChina, China Datang Corporation, China Southern Power Grid, China-ASEAN Information Harbor Company, China State Construction Engineering Corporation, China Railway International, China Railway Materials International Group Corporation (CRM International), with a Lao subsidiary registered in 2017: China Railway Materials Laos Co., Ltd.), and China Railway Construction Corporation (CRCC).

VI. Recommendations

The following recommendations focus on how various actors can help ensure projects and ESIA are more rigorous, transparent, and community engaged.

ESIA mandates

Chinese financiers, developers, and contractors could encourage and be involved in ESIA processes and their enforcement for all projects that include Chinese funding or construction. Chinese state authorities can aid improved practices in Lao by mandating compliance with both Lao legal frameworks and international practices for state-owned and non-state enterprises seeking access to investment funds, loans, or import quotas. China's position of non-interference can remain intact while ensuring its funding, loans, and projects match those of international standards in compliance with other lending peers and national law. Further research should be conducted to compare how other lenders, such as ADB or JICA, implement and monitor safeguards.

Monitoring

An Independent Monitoring Agency (IMA) could undertake monitoring before and through the construction phases. There is precedence for this in Laos. However, each step of the IMA process must be conducted to ensure efficacy and transparency. The current IMA processes in Laos are as follows. Investors provide a dedicated trust fund to MoNRE. The monitoring role is appointed by MoNRE on a competitive basis and financed from the fund. The IMA provides technical review of the ESIA reports and regular site inspections, supporting the government monitoring agency throughout the project, starting with more intensive monitoring during start-up stages, low-intensity monitoring throughout operations, and more intensive monitoring during closure and restoration stages. Reports are provided to MoNRE. A requirement for community involvement exists in Laos's legal framework (Part IV of the PM Decree 21 on the Environmental Impact Assessment). However, more significant efforts should be made to invite representatives from local communities and mass organizations to participate in the monitoring process.

Grievance and Redress Mechanisms (GRM)

As per local legislation and guidelines, company-based and independent mechanisms could be instituted for affected communities. There may be interest from Chinese stakeholders to receive information regarding grievances concerning Chinese companies, which could lead to longer-term improvement of project guidelines. Following company GRM, there may be a secondary option for financier GRM. However, this must be set up for specific projects, as people are often unaware of official channels. Even if they are aware of grievance channels, the existing ones are usually ineffective, taking a long time to resolve any complaints.

Priority projects

Projects with high political significance or visibility are a priority, but this should not imply license for (or even mandate) the lack of applying best-practice standards. An incentive to move government departments towards this shift in business-as-usual could be by funder-driven practices and internal discussions of meeting multiple international commitments for social and conservation goals. A key interacting element is transparency in governance, so projects that only aid a few individuals are not prioritized at the cost of many and the environment.

Improving Environmental and Social Safeguards

This depends on MoNRE, the primary agent for ESIA and monitoring. An important step is to ensure that the ESIA requirement of conducting public consultation is fulfilled. Another possible avenue to consider is to support a GoL-run website to disclose projects seeking ESIA approvals, approved project ESIA reports and relevant information, and another for company registry that is accessible to the public.

Research on environmental and project impacts

Research and academia are often overlooked yet can play a unique role in Laos. While within the line agencies and everyday society, many topics are off-limits for discussion, the government allows much more independence to academic research. As long as reporting is factual and argument balanced (and anonymized in terms of not pointing fingers and specific individuals to companies), there is a surprising degree of criticism that is allowed. No other entity can do this, not the press, not CSOs, etc. This suggests that – in Laos especially – academia is a critical stakeholder. There is an important role that Lao academics can play in building a system and body of knowledge to support environmental needs, safeguarding, and information sharing. In addition, there could be capacity for academics/experts to support environmental and social assessment and monitoring processes (e.g., conducting local site visits and independent or third-party monitoring).

CSOs, NGOs, and communities

Although limited in comparison to government and company actions, there are also opportunities for CSOs, NGOs, and communities. First, CSOs and NGOs should continue to support regulatory systems in Laos (e.g., provision of best practice guidelines, support for legal framework reforms, capacity building for Lao government authorities) as well as strengthen transparency in Laos's investment sector overall, such as that being done by the Land Concession Investment System (supported by CDE, University of Bern) and the investment compliance and quality of investment systems (sponsored by MRLG, GiZ, and UNDP). Second, NGOs and CSOs often work directly with communities. They could thus assist with the transference of knowledge, such as project and legal information, or how to submit grievances. See, for example, the Lao legal calendar, which was developed by LIWG. Using simplified language and illustrations of daily life, it provides relevant regulatory and legal information to communities on land and natural resources. It is distributed to households and is also used as a training tool. Third, Grievance and Redress Mechanisms (GRM) are a key concern, particularly for CSOs and NGOs who work more closely with people seeking access to GRM. CSOs/NGOs may be able to help ensure this exists, and that affected people can report their complaints.

Multilateral funding and development organizations

Finally, it may be useful to engage multilateral development organizations to learn from their experiences in Laos and improve environmental outcomes for LI projects. These organizations have their own relationships with ministries, which in turn builds trust with the government. Several key agencies can effectively support safeguarding communities and the environment and talk more openly about these issues in siloes where others with expertise remain excluded. These organizations include the WB, ADB, IFC, European Union, Japan International Cooperation Agency (JICA), and Australian Development Aid. Here, because the Lao PDR welcomes other multilateral standards, there is an opportunity for the broader community of funders to rally for Chinese standards to evolve towards their own.

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Appendix A: Methodology

The complexity of LI project development and safeguarding means that understanding local and regional cultural, political, historical, and environmental conditions is essential. The FOCUS BRI research process was developed to ensure consultation with the experts in their fields and locations, who also either constitute or represent overlooked or marginalized perspectives. To this end, the project relied on key informant interviews, focus groups, and the field expertise of its team members. Below, we detail our methodology across two key contributions of FOCUS BRI:

1. Country Case Studies

A. Country Selection

Country selection played an important role in defining project bounds and ensuring that goals may be effectively and efficiently met. Countries without involvement with the BRI (as evidenced by an MoU) were removed from our list, leaving 140 countries (as of September 2021). Next, we decided to focus our efforts in Africa and Asia, which represent the majority of BRI investment. Additionally, CLLC maintains a widespread professional network, decades of combined experience, and ongoing programmatic work in these regions. To further narrow the list, a dataset of indicators was built around the key selection criteria, including:

1. Level of Chinese investment
2. Biodiversity
3. Existing network and stakeholder connections
4. Climate vulnerability

With different metrics populated for each category and remaining country, we developed a function to combine and rank countries, which resulted in a prioritized list. We then selected twelve countries from the top 30, with an eye toward a diverse and representative suite of country case studies.

B. Case Study Development

The twelve country cases were developed through two main methods: a desk-based research process and key informant interviews. We opted to conduct in-depth reviews of relevant secondary data before conducting interviews. In this way, researchers became familiar with the country context, the relevant bodies of work, and potential interviewees actively involved in work related to environmental or biodiversity conservation or infrastructure development. This process consisted of a secondary literature review guided by a research template to ensure consistency and efficiency across the country cases. The literature review captured relevant academic work and gray literature pertaining to biodiversity issues, Chinese infrastructure development and relations, and national policy and implementation landscapes for biodiversity protection and LI project development. The following briefly summarizes the report sections:

1. **Introduction** - including country context, relations with China, and broader transboundary issues.
2. **Linear infrastructure investment landscape** - including statistics, projects, type of projects, and agencies involved.
3. **Biodiversity landscape** - describing the biodiversity characteristics and hotspots, national conservation spaces and policy frameworks, and the key work focused on conserving biodiversity. Agrobiodiversity considerations were also noted where relevant.

4. **Country policy and planning landscape for biodiversity and infrastructure** - the national environmental and biodiversity laws and regulations, ESIA processes, actors in charge and their role, and especially the way these pieces play out in the context of large LI projects.
5. **Exemplary projects** - describing illustrative projects, whether successes or failures, to add texture to the above information.
6. **Understanding stakeholders and power dynamics** - highlighting the network of stakeholders and the degree and ways in which these stakeholders can influence processes.
7. **Recommendations** - gathered from research and interviews; what interventions and investments can best improve LI development outcomes for biodiversity, local communities, and climate, and how might they proceed.

Following the secondary literature review, interviews were organized and conducted by the country research lead. To connect with interviewees, leads contacted existing CLLC connections in the country, relied on personal networks, and reached out to voices identified as especially relevant in these fields in-country. Interviewees thus consisted of actors from the academy, non-governmental organizations, government, the private sector, or communities. We aimed to gather 3-5 key informant interviews to ground the research, add texture to the information, fill gaps and connect to resources, and share their expert opinions on barriers, opportunities, and more.

Interviews followed a semi-structured template, tailored to the informational needs of the specific report and interviewee. The main sections of the interviews were:

1. Introduction to the FOCUS project, interview, and purpose.
2. The current country “landscape” of implementation processes, actors, and resources.
3. Understanding the formal and informal spaces for coordination and inclusion of diverse stakeholders and interests in these processes.
4. The barriers to safeguard implementation and how to overcome them.
5. Any additional/more specific questions
6. Concluding remarks

Interviews were recorded for ease of transcription and information gathered during interviews was then integrated into reports. Upon completing individual country case studies, a synthesis process was initiated to uncover the trends and common threads found across these twelve countries and within each region (Africa, Central Asia, Southeast Asia). These findings were then incorporated into the summary report.

2. Spatial Context and Mapping

A. Context maps

We used ARCMAP 10.8 and R Studio 2021.09.1+372 to develop all maps for this project. The first set of maps aimed to provide contextual detail by capturing the intersections between protected areas (PAs) and existing infrastructure in a given country. To visualize the diversity of PA uses within a country, we classified them according to the IUCN categories (Ia, Ib, II, III, IV, V, and VI). These categories are internationally recognized standards that classify PAs according to their management objectives. All PA polygons were acquired from the World Protected Areas layer found on the Protected Planet clipped to country boundaries (Table A). To add

existing linear infrastructure (LI) line shapefiles for each LI type (roads, rails, and transmission lines) were clipped to the countries' borders. These layers were overlaid with the PAs to highlight the intersection of LI and PAs. The Global Roads Open Access Data Set (gROADS) (CIESIN - Columbia University, and ITOS - University of Georgia, 2013), a global road layer for 1980-2010, was used to represent the road network. The railway layer was acquired from the World Food Program's global railway dataset, which was last updated in 2017. For the transmission lines we used Aderne et al.'s (2019) dataset, which was last updated in 2019 (Table A).

A more updated road layer (up to 2018), the Global Roads Inventory Project (GRIP) roads dataset was clipped to the country boundary and is represented in a separate map. The higher density of roads in the GRIP dataset often overshadows railways and transmission lines if visualized on the same map with PAs. We include the more recent dataset to highlight that spatial data needs regular updating to reflect continued LI build-out. Our maps offer problem-setting context but underrepresent the extent of LI interaction with wildlife habitats.

B. Composite Biodiversity Index and cores

We created a Composite Biodiversity Index (CBI) to identify regions of high biodiversity. We applied a method created by Dr. Tyler Creech for the Center for Large Landscape Conservation to develop a CBI layer for each country. Dr. Creech created the CBI based on nine existing biodiversity indices related to species richness, endemism, abundance, intactness, ecological condition, rarity, and complementarity. The value of CBI ranges from 0 (lowest biodiversity value) to 1 (highest biodiversity value). We selected three percentile cut-offs from the CBI layer, representing biodiversity richness areas by the 70th, 80th, and 90th percentile, which we refer to as biodiversity cores. For more details of the CBI methodology, see the LISA project spatial annex². The overlap between PAs and CBI is essential to spatial planning for LI as not all CBI areas have formal protection but provide for connected wild populations. To demonstrate this point, we overlay PAs from IUCN Categories Ia, Ib, and II, (i.e., areas with higher protection regulations and supported by country environmental and biodiversity laws), Key Biodiversity Areas (KBAs) - which enjoy wide acknowledgment as necessary for long-term conservation of wildlife though are not always formally protected, - and CBI. We acquired KBAs from Birdlife International (updated 2021) and clipped them to the respective country's boundaries. We then overlaid the resulting PAs and KBAs over the CBI layer to highlight protection provided to important biodiversity areas.

Finally, to identify where Chinese-funded projects intersect with PAs and top percentile CBI cores, we looked to Chinese-funded LI in the AidData dataset within each country. AidData captures projects with development, commercial, or representational intent that are supported by official financial and in-kind commitments (or pledges) from China between 2000 and 2017, with implementation details covering a 22-year period (2000-2021) (Table A). Given the inconsistent sharing of data, dearth of publicly available geospatial information for LI projects, and the many disparate institutions involved, AidData's list is one of the most comprehensive and publicly available to date. We filtered results to include only roads, rails, and transmission

² USAID ((U.S. Agency for International Development). 2021. Annex 1: Spatial analyses of linear infrastructure threats to biodiversity in Asia. *In*: Building a foundation for linear infrastructure safeguards in Asia. Authors: Creech T, Stonecipher G, Bell M, Clevenger AP, Ament R. Prepared by Perez, APC for Contract no. AID-OAA-I-15-00051/AIDOAA-TO-16-00028, ESS WA#13. U.S. Agency for International Development, Washington, DC. 98 pp.

projects. The layer for Chinese-backed LI was overlaid with PAs, KBAs, and the three percentile cores, summarizing the impact of such LI on biodiversity-rich regions and the incidences of Chinese LI impinging on PAs.

C. Summary statistics from our analyses (Appendix B)

We converted CBI cores for each percentile (70th, 80th, and 90th) to polygons, then calculated the area of each polygon using the ‘Calculate Geometry’ tool in Arcmap. Each of the cores was clipped to the category I and II PA boundaries, resulting in layers representing the overlap of each core with PAs. The area of the overlap layers was similarly calculated using the ‘Calculate Geometry’ tool. We then determined the percentage of the PA overlap area with the total core area. We then clipped AidData’s LI layer to each country boundary. The length of each of the line attributes within the clipped layer was calculated using the ‘Calculate Geometry’ tool. The linear length of each LI type (roads, rails, and transmission lines) was calculated using the ‘summary statistics’ function. We repeated this process for each of the percentile cores by clipping the LI to each core boundary in the first step. Finally, the Chinese LI layer was also clipped using the PA (Category I and II) polygons. The length of each of the line attributes within the clipped layer was calculated using the ‘Calculate Geometry’ tool. The length of road for each of the LI type (roads, rails, and transmission lines) was calculated using the ‘summary statistics’ function.

Table A. Datasets used to visualize protected areas and linear infrastructure in each of the 12 countries chosen for FOCUS-BRI

Dataset	Year Last Updated	Geographic Scale	Dataset Format	Source	Data Download link
World Protected Areas (WDPA)	2021	Global (separated by continents)	Vector polygon shapefile	UNEP-WCMC and IUCN (2021)	Explore the World's Protected Areas (protectedplanet.net)
gROADS	2010 (1980-2010)	Global	Vector lines shapefile	CIESIN - Columbia University, and ITOS - University of Georgia(2013)	https://www.globio.info/download-grip-dataset
GRIP Road Data	2018	Global	Vector lines shapefile	Meijer et al. (2018)	https://sedac.ciesin.columbia.edu/data/set/groads-global-roads-open-access-v1

Global Transmission Lines	2019	Global	Vector lines shapefile	Arderne, Christopher, Nicolas, Claire, Zorn, Conrad, & Koks, Elco E. (2019). Data from: Predictive mapping of the global power system using open data [Data set]. In Nature Scientific Data (1.1.0, Vol. 7, Number Article 19). Zenodo. https://doi.org/10.5281/zenodo.3538890	Data from: Predictive mapping of the global power system using open data Zenodo
Global Railway	2017	Global	Vector lines shapefile	World Food Program/Humdata	https://data.humdata.org/dataset/global-railways
Key biodiversity areas - KBA	2021	Global	Vector polygon shapefile	BirdLife International (2021)	Key Biodiversity Areas GIS Data Request
Chinese development projects	2021	Global	Vector polygon shapefiles	Custer et al., 2021 - AidData	https://github.com/aiddata/china-osm-geodata

Limitations

This project was exploratory and survey-oriented in nature. It is intended to be a first step that sketches the biodiversity, infrastructural, and local policy landscapes in each country. As such, it was also intended to raise important and possibly overlooked questions and issues for funders to direct their money. Given the scale and scope of this project, there were several limitations. First, it would be practically impossible to detail the complete policy landscape of each country, as they are both vast and constantly evolving. Second, we used spatial data to set the context for this project. Due to data limitations, our maps are likely very conservative. They do not include spatial data for planned LI nor the expansion of existing LI. Instead, we highlighted only existing LI to showcase how biodiversity is currently impacted. Finally, due to the exploratory nature of this project, we gathered information to address particular foci in our reports; thus, our methods did not lead to a comprehensive review.

Appendix B: Spatial Data Tables

The following tables provide summary information for the spatial maps.

PA_s (IUCN categories I and II) and CBI cores overlap

Laos	70th Percentile Core	80th Percentile Core	90th Percentile Core
CBI Core Area (km ²)	68652	45977	22485
Overlap with Protected Areas (km ²)	8432.35	6932.54	3959.47
Percentage of CBI Core within PA _s (%)	12.2827	15.0783	17.6094

Chinese-funded LI across Laos

The Chinese funded LI dataset was clipped by Laos's boundaries and line length of each LI Mode was calculated.

LI Mode	Length
Road (km)	376.069453
Rail (km)	433.268005
Transmission (km)	296.684993