



FOCUS-BRI Country Report

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

Zambia

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Acronyms

| | |
|--------|--|
| BRI | Belt and Road Initiative |
| CARI | China Africa Research Initiative |
| CBI | Composite Biodiversity Index |
| CBNRM | Community Based Natural Resource Management |
| CDB | China Development Bank |
| CHEXIM | China Export-Import Bank |
| ECF | Extended Credit Facility |
| EIA | Environmental Impact Assessment |
| DNPW | Department of National Parks and Wildlife |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Product |
| GMA | Game Management Area |
| GNI | Gross National Income |
| ICT | Information and Communication Technology |
| IMF | International Monetary Fund |
| IUCN | International Union for the Conservation of Nature |
| KBA | Key Biodiversity Areas |
| LI | Linear Infrastructure |
| MLNR | Ministry of Lands, Natural Resources and Environmental Protection (Zambia) |
| NBSAP | National Biodiversity Strategy and Action Plan |
| PA | Protected Area |
| SEA | Strategic Environmental Assessment |
| UN | United Nations |
| TFCA | Trans-Frontier Conservation Area |
| ZAWA | Zambian Wildlife Agency |
| ZEMA | Zambian Environmental Management Agency |

Zambia Factsheet



Figure 1. Political map of Zambia. Source: Nationsonline.org.

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

| | |
|------------------------------------|--------------------------|
| Region | Southern/Central Africa |
| Capital | Lusaka |
| BRI Corridor | No official |
| BRI investment (\$ in millions) | 8,600 (2010-2019) |
| Income Status | Lower middle |
| Population | 18,383,000 (2020) |
| GDP | 19.32 billion USD (2020) |
| Land Area (km ²) | 743,390 |
| Protected Areas (km ²) | 281,744 |
| Protected Areas (percent) | 39.7% |
| Species Richness (ranking) | 5 |
| Biodiversity Intactness (ranking) | 23 |
| Climate vulnerability (ranking) | 142 |
| GDP Growth Rate Projections | 1.15% (for 2022) |
| Inequality (Gini Coefficient) | 57.1 (from 2015) |
| Human Development Index (HDI) | 0.584 (from 2019) |
| Key exports | Copper |

I. Introduction

Zambia's current debt to Chinese financiers has reached an estimated US\$6.6 billion, more than double the figure reported by the outgoing government (Bräutigam & Wang, 2021). Second only to Angola and Ethiopia in the scope of loans (China Africa Research Initiative & Boston University Global Development Policy Center, 2021) and leading the way for the total number of distinct financiers (Bräutigam & Acker, 2021), this landlocked African nation has become a symbol for the influence of Chinese financing on the continent. These factors, alongside incredible natural systems and varied cultural landscapes, make Zambia a vital node in understanding the state of play for Chinese-funded linear infrastructure and their safeguarding on the African continent.

The Republic of Zambia straddles Southern, Central, and Eastern Africa, and is home to abundant cultural diversity, natural resources, and biodiversity. The nation comprises almost 20 million people (United Nations Department of Economic and Social Affairs, 2019) from approximately 73 different ethnic groups (Hobson et al., 2022). Most of this population is located in and around the capital of Lusaka and the Copperbelt Province to the north, which is named for the country's dominant export. With the famous Victoria Falls on its southern border and a network of 20 National Parks and 34 game management areas across its varied grassland, thicket, woodland, and forest ecosystems, Zambia is well-known for its high levels of biodiversity and ecological intactness.

At a glance, Zambia is moving toward managing its natural resources more sustainably; it is committed to the UN Convention on Biological Diversity and its Aichi targets, as well as the UN Sustainable Development Goals. In 2014, Zambia developed its second National Biodiversity Strategy and Action Plan (NBSAP-2), intended to shape natural resource management for 2015-2025 such that biodiversity is conserved, ecosystem services are maintained, and all Zambians can benefit (Ngimbu, 2015). Ideally, this focus on biodiversity would filter down into the government's planning and management of linear infrastructure development, but so far, the evidence is scant. This is understandably so in a country where, in 2015, over fifty percent of the population lived below the international poverty line (Finn, 2020). With a staggering 81% of rural people living in poverty, the balance between sustainably using natural resources and ensuring that basic needs can be met is razor thin (Finn, 2020).

Sharing a border with Angola, the single largest recipient of Chinese loans on the continent (China Africa Research Initiative & Boston University Global Development Policy Center, 2021) and hosting several important cross-border ecosystems, environmental processes, and infrastructure projects, Zambia is part of a broader ecological, governance, and cultural landscape. Ecologically important transboundary areas include the Kavango Zambezi, Lower Zambezi Mana Pools, and Malawi-Zambia TFCA. The Tazara (Tanzania-Zambia Railway) Project is the most well-known international infrastructure project – a section of rail over 1000 km in length, connecting Zambia's Copperbelt to the port of Dar es Salaam. Completed in the 1970s, this railway was the largest Chinese foreign investment at the time (approximately US\$2.7 billion in today's dollars) (NYT, 1971). It allowed Zambia to connect to international markets without relying on the white-minority-controlled Rhodesia and South Africa. A major step in the history of Sino-African relations and often referred to as the Great Uhuru (Freedom) railway, Tazara was a turning point for Chinese foreign development lending. However, much has changed since the 1970s, especially in foreign direct investment and linear infrastructure.

Linear Infrastructure in Zambia is extensive and intersects with many of the nation's protected areas (Fig. 2). Among Zambia's protected areas, almost all have many instances of incursion by roads, railways,

and transmission lines. This is especially true for Game Management Areas (GMAs), which fall within IUCN Category VI.

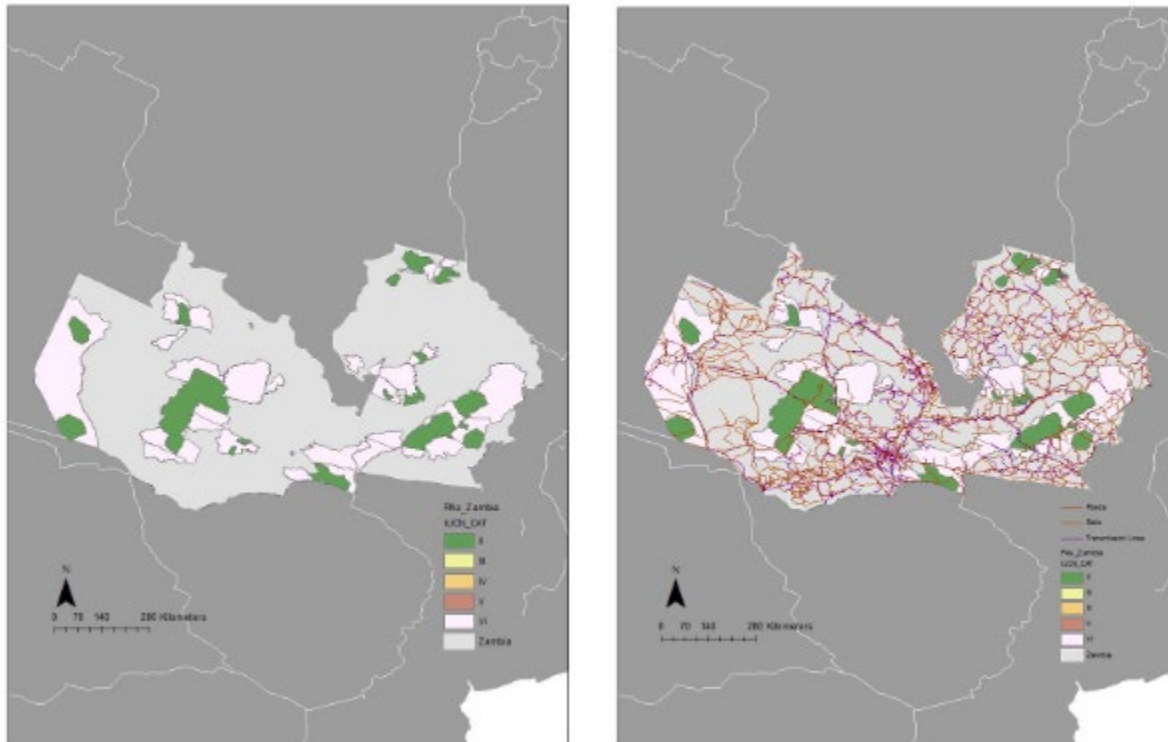


Figure 2. (left) The protected areas in Zambia as categorized according to IUCN classification, where category I is the most regulated and IV is the least. (right) Linear infrastructure in Zambia; LI already compromises many protected areas across the country. See Appendix A for Methodology.

II. The BRI and Chinese activities in Zambia

When it comes to Chinese infrastructure construction, African countries are often cited in reference to the much-criticized “debt-trap diplomacy” of Chinese lending institutions. The case of Zambia has indeed been construed this way. In 2019, the China-Africa Research Initiative (CARI) estimated that all development loan commitments to Chinese lenders were equivalent to nearly 43% of the country’s gross national income (GNI) for that year (Bräutigam & Acker, 2021). This figure is far greater than the norm, as the average debt for African nations was just 10% of GNI during this time (Bräutigam, 2021). In November 2020, Zambia’s debt distress became more apparent: it was the first country in Africa to default on its Eurobonds and stopped servicing nearly all of its foreign debt obligations. To understand foreign investment in infrastructure in Zambia, this section proceeds with an overview of existing linear infrastructure (LI) projects in the country, followed by an examination of the factors that induced current debt distress, and, finally, the lessons to be gleaned from it (see Chinese FDI for linear infrastructure detailed in Table 2).

While Canada, Switzerland, the United Kingdom, and South Africa also hold large FDI investment positions in Zambia; China is by far the largest (China Africa Research Initiative & Boston University Global Development Policy Center, 2021), (U.S. Department of State, 2021). Between 2010 and 2019, Zambia and its State Owned Enterprises entered into at least 53 different loan contracts with Chinese

fundings, totaling approximately US\$8.6 billion (China Africa Research Initiative & Boston University Global Development Policy Center, 2021). Table 2 aggregates the two most comprehensive datasets to demonstrate the portion of Chinese funding specific to the transportation and energy sectors (and therefore LI): a staggering US\$2.37 billion. This amounts to nearly a quarter of all Chinese lending to Zambia in these databases. Other sectors with high Chinese investment include defense, Information, and Communication Technology (ICT), water, and other social projects.

Table 2. *The amounts of Chinese FDI financing for linear infrastructure in Zambia, split between the sectors of transportation (road and rail) and electricity transmission, for the years 2010-2019, aggregated from the Chinese Loans to Africa Database (China Africa Research Initiative & Boston University Global Development Policy Center, 2021) and the Geolocated Dataset of Chinese Overseas Development Finance (Ray et al., 2021).*

| | Loan amount (in millions, USD) | Number of Loans |
|--------------------------|--------------------------------|-----------------|
| Transportation | 1,874 | 10 |
| Electricity Transmission | 498 | 6 |
| Total | 2,372 | 16 |

In 2016, Chinese loan commitments exploded, nearly tripling from ~US\$750 million in 2015 to ~US\$2.2 billion in 2016. In 2021, Bräutigam (2021) effectively delineated several important points about the state of Chinese lending in Zambia. First, because copper comprises most of the export market, the economy's health heavily depends on copper prices. According to Bräutigam, this has influenced lending dynamics in important ways: as prices drop, the need to develop diverse, sustainable drivers of GDP independent of copper becomes more widely acknowledged, driving an uptick in loan commitments aimed at such projects. Second, Zambian politics typically stressed the importance of delivering completed infrastructure projects, especially roadways. When a new candidate or party is elected into office, it has become an expectation that they will deliver road projects. The proponents often cite economic advantages, but never actually calculate these advantages, leading to road construction and upgrades that are simply not justified by traffic levels (Raballand & Whitworth, 2012).

Given the characteristics of the national and regional/local governments, where individual influence plays an outsized role, checks and balances are at a minimum, and legislation is often vague enough to be circumvented, individuals seem to have been able to influence lending practices. The figure below shows the correlation between copper prices, election cycles, and loan commitment totals (Fig. 3).

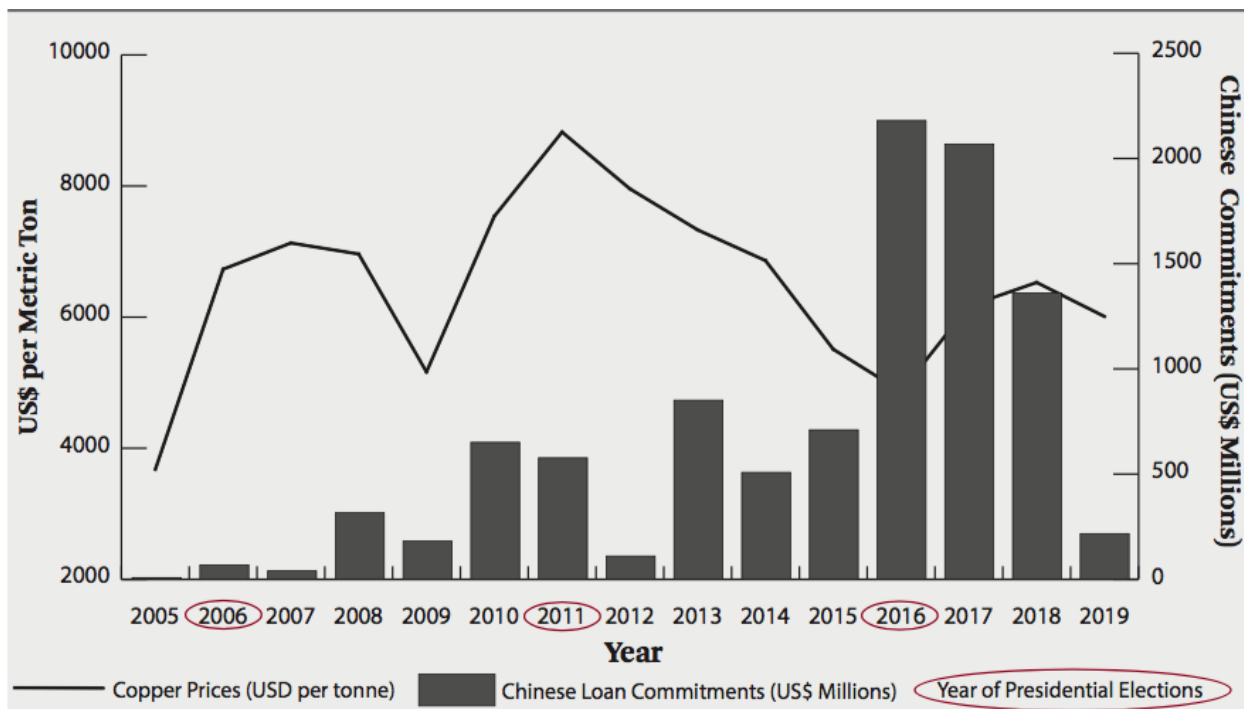


Figure 3. Copper prices, Chinese loan commitments, and Zambia presidential elections. From Bräutigam (Bräutigam, 2021), this figure demonstrates the correlations with copper prices and presidential elections. Edward Lungu, an eager lender, first became president in 2015, completing Sata’s term, and then was elected in 2016.

In Zambia, Bräutigam convincingly posits, there is a combination of a tragedy of the commons - where the various actors pursued their own self-interest and in so doing generated unsustainable outcomes - and moral hazard - where a history of debt-forgiveness may have led to an expectation of future debt forgiveness (Bräutigam, 2021). A host of different Chinese lenders were seeking, and acquiring, lucrative contracts without any centralized coordination ensuring overall sustainability (details - see Table 3). This is in contrast to the notion of “debt trapping” as a coordinated effort from Beijing to influence national policy and decision-making. It also highlights the contention that increased lending may have resulted from, or is at least connected to, Zambia’s democracy – tight contests between parties and the expectation of delivering infrastructure projects, if elected, incentivized increased lending (Bräutigam, 2021). Over time, many loans that were extended to complete projects were written down substantially, meaning the principal amount to be repaid was reduced. This only reinforced the idea that political expediency was worth it because the obligations of the loans would likely not need to be repaid in full.

Regardless of the reason for the explosion in debt obligation, Zambia has struggled with repayment – a state of affairs that has worsened since the onset of the COVID-19 pandemic. On September 22, 2020, Zambia called for a deferment of payment to private creditors, followed swiftly by a default on its Eurobond payments in November. It wasn’t until late the following year, after the inauguration of President Hakainde Hichilema (in August, 2021), that any sign of respite appeared. On December 6, 2021, Zambia reached a staff-level agreement with the IMF for US\$ 1.4 billion, 3-year assistance under the IMF’s Extended Credit Facility (ECF) (International Monetary Fund, 2021). A non-commercial loan, this arrangement carries a zero percent interest rate with a 5½-year grace period (International Monetary Fund, 2022). A “staff-level” agreement means that the deal requires approval by the IMF board before being implemented, an event that has not yet occurred (as of early April, 2022). The idea is

that this agreement will provide macroeconomic stability and a short respite for Zambia’s struggling economy.

This situation has important implications for the future of Chinese FDI, both in Zambia and farther afield. The unsustainable sovereign debt burden taken on by Zambia has the potential to negatively impact Chinese lenders. The potential debt write-downs not only carve into profits, but can induce steep losses – similar to those suffered by western banks during the last debt crisis (Brautigam, 2021). The threat of these potential forfeitures for lenders in Zambia can act as an important case study to help drive reforms in Chinese banks, companies, and institutions. Ideally, these reforms would increase coordination and oversight, thus curbing similar multi-party lending free-for-alls and the debt “tragedy of the commons” they may precipitate. With a number of other African nations also facing unsustainable debt burdens, the way Zambia navigates these burdens, and the impacts it will have on lenders, will inform responses across the continent and perhaps the world.

Table 3. CDB and CHEXIM loans to Zambia between 2009-2019.

| Project | Type | Borrower | Lender | Signed | Total (USD millions) |
|--|--|----------|--------|--------|----------------------|
| Government complex building Construction | Other Government Support | Public | CHEXIM | 2009 | 25.00 |
| 720MW Kariba North Bank Hydropower Project Extension | Hydropower | Public | CHEXIM | 2008 | 315.60 |
| Non-intrusive container scanning equipment Purchase | National Security | Public | CHEXIM | 2009 | 46.00 |
| Lusaka National Stadium Construction | Spectator Sports | Public | CHEXIM | 2010 | 86.00 |
| Airforce Residential Housing Unit Construction | Residential Building Construction | Public | CHEXIM | 2010 | 365.50 |
| Z-9 Helicopters Purchase | National Security | Public | CHEXIM | 2010 | 105.00 |
| Mobile Hospital Project | General Medical and Surgical Hospitals | Public | CHEXIM | 2010 | 47.00 |
| Mongu Kalabo Road Rehabilitation (Mongu-Tapo Section) | Highway, Street, and Bridge Construction | Public | CHEXIM | 2011 | 244.00 |
| Mansa to Luwingu Road Construction | Highway, Street, and Bridge Construction | Public | CDB | 2013 | 176.00 |
| Lusiwasi Lower Hydropower Expansion & Lunzua Hydropower Rehabilitation | Hydroelectric Power Generation | SOE | CHEXIM | 2013 | 183.00 |
| Mbala to Nakonde Road Construction | Highway, Street, and Bridge Construction | Public | CHEXIM | 2013 | 196.00 |
| Lusaka Urban Road L400 Construction (Phase I) | Highway, Street, and Bridge Construction | Public | CHEXIM | 2013 | 296.00 |
| Kariba North Bank and Kafue West Transmission | Electric Power Distribution | SOE | CHEXIM | 2014 | 45.00 |
| Lusaka International Airport | Scheduled Air Transportation | Public | CHEXIM | 2014 | 360.00 |
| Smart Zambia National ICT Development (Phase I) | Data Processing, Hosting, and Related Services | Public | CHEXIM | 2015 | 66.00 |
| Digital Migration (Phase II and III) | Radio and Television Broadcasting | Public | CHEXIM | 2015 | 93.00 |
| SMEs Development Loan | Administration of General Economic Programs | PPP | CDB | 2015 | 30.00 |
| Mansa to Luwingu Road Construction | Highway, Street, and Bridge Construction | Public | CDB | 2016 | 30.00 |
| Public Security Network III Project | Security Systems Services | Public | CDB | 2016 | 179.00 |
| Solar-Powered Milling Plants | Grain and Oilseed Milling | PPP | CDB | 2016 | 170.00 |

| | | | | | |
|--|--|--------|--------|------|---------------------------|
| Ndola International Airport (Phase I) | Scheduled Air Transportation | Public | CHEXIM | 2016 | 338.00 |
| Lusaka Urban Road L400 Construction (Phase II) | Highway, Street, and Bridge Construction | Public | CHEXIM | 2016 | 313.00 |
| Lusaka-Kafue Bulk Water Supply Project | Water, Sewage and Other Systems | Public | CHEXIM | 2016 | 128.00 |
| Communication Towers Project (Phase II) | Wired and Wireless Telecommunications | Public | CHEXIM | 2017 | 281.00 |
| Kabwe Pensulo Second 330kV Line | Electric Power Distribution | SOE | CHEXIM | 2017 | 114.00 |
| Kafue Gorge Lower Hydropower Project; 750MW (with ICBC) | Hydropower | SOE | CHEXIM | 2017 | 1700.00 |
| Defense Project | National Security | Public | CHEXIM | 2018 | 171.00 |
| D019 Road Upgrade (Kawambwa to Mporokoso) | Highway, Street, and Bridge Construction | Public | CHEXIM | 2018 | 121.00 |
| Defense Project | National Security | Public | CHEXIM | 2018 | 30.00 |
| Copperbelt Province C400 Road Construction | Highway, Street, and Bridge Construction | Public | CHEXIM | 2018 | 197.00 |
| Lusaka Urban Roads (L400) Upgrade; 400km (Phase III)-Eximbank part | Highway, Street, and Bridge Construction | Public | CHEXIM | 2018 | 205.00 |
| | | | | | Total:US\$ 6656.10 |

III. Zambia's Biodiversity Landscape

Zambia's physical geography can be broadly described as a land of high plateaus, with occasional hills and mountains, bisected by river valleys. Lying within the latitudes of 8° and 18° S, its climate is tropic, though tempered by its elevation (1,200 m on average). Generally, the country's most important biodiversity landscapes are forests and wetlands. Zambia, and the region more broadly, is characterized by dryland ecosystems that oscillate between extremes of precipitation and water availability during the wet and dry seasons; this induces an increased reliance on mobility for both humans and animals, and adds significance to ecological connectivity in the region. Protection and management of water catchments is thus also vital to the country and its people; as demonstrated in the designation of National Forests whose specific function is to "protect and conserve major water catchments and their biodiversity" (MLNR, 2015).

There is a national focus on ecosystem services and their sustainability in its biodiversity planning (see the NBSAP-2). In addition, agroecosystems are also considered vital biodiverse landscapes. The country has an interesting history of disallowing genetically modified crops, thereby attempting to bolster traditional practices and agricultural diversity amongst agriculturalists.

In contrast to regions with large, well-articulated, and universally acknowledged biodiversity hotspots, Zambia is more akin to a large patchwork of important ecosystems. Certainly, areas protected as national parks, such as portions of the Kafue ecosystem in the heart of Zambia's western portion, itself a part of the larger Kavango Zambezi TFCA, can be counted as hotspots. Other lesser-known areas include the Mafinga Hills in the northeast or the Luangwa Valley on the eastern edge of the country. But to limit consideration to only these more famous areas might undermine landscape integrity and biodiversity.

To better visualize the biodiversity across the country, including its protection and threats, Figure 4 displays a Composite Biodiversity Index (see appendix A, CBI), Key Biodiversity Areas (KBAs), and Zambia’s National Parks. They also include the Chinese-funded LI captured in Custer et al. (2021). The lands that are protected by parks tend to have extremely high biodiversity. On the flip side, these parks cover a mere 45% of the 90th percentile biodiversity cores. That is, of the most biodiverse lands in the country, less than half are protected to the full extent of the law. While much of the rest of the area of the 90th percentile core is protected by Game Management Areas (GMAs), the later discussion on trends and threats in these areas demonstrates a huge threat to the country’s biodiversity. Further description of the methodology and several summary tables of the spatial distribution of biodiversity, protected areas, and linear infrastructure are detailed in Appendix A.

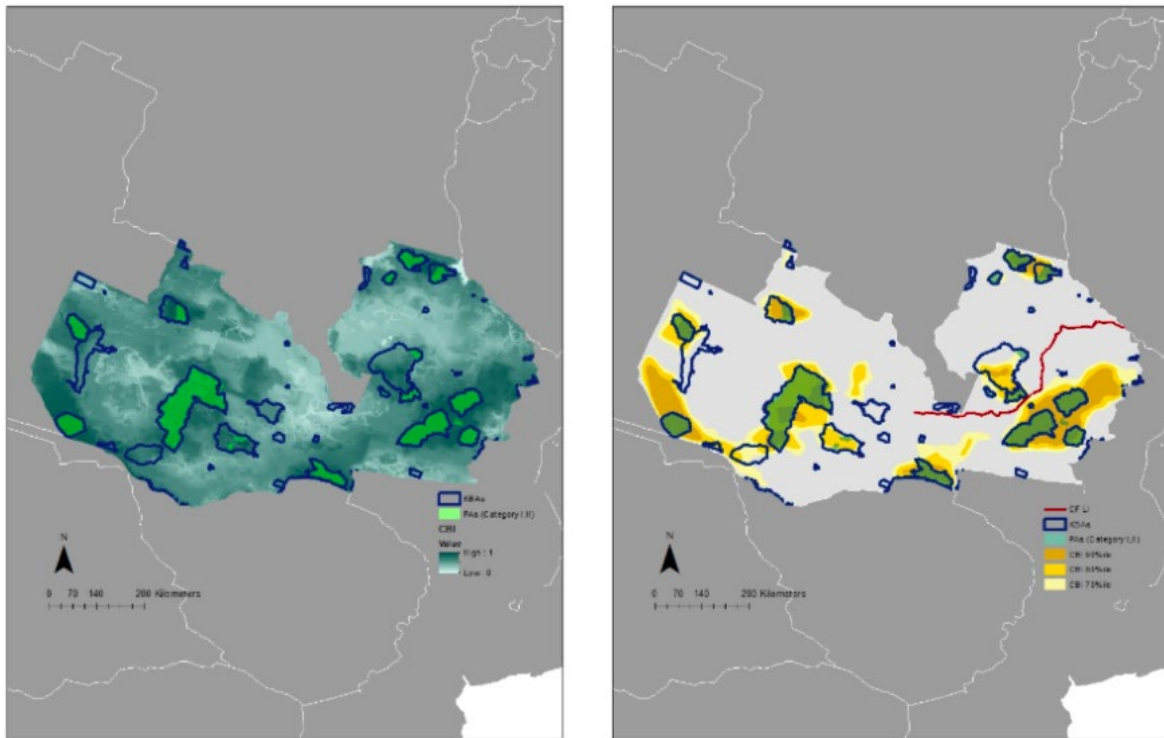


Figure 4. (a) In Zambia, PAs with the highest protection (at IUCN Category II) and KBAs overlap to a great degree and cover some areas of high CBI values. **(b)** Many CBI core areas remain unprotected - see the western edge of the county, for instance. Chinese-funded linear infrastructure refers to roads, rails, and transmission (or power line) projects from Aid Data’s Chinese development projects shapefile (Custer et al. 2021). Methodology and further analysis in Appendix A.

Figure 5 (below) demonstrates a more extensive take on the matter, that of the Zambian Ministry of Lands, Natural Resources and Environmental Protection (MLNR), highlighting the National Parks, Game Management Areas, and Forest Reserves in Zambia. It is worth noting the presence of some larger “core areas,” such as the Kafue river area or the Luangwa to lower Zambezi. These complexes of protected areas may serve as an indicator of core habitats. When examined in this light, there are numerous other interconnected areas of important habitat, whose conservation depends on connectivity (Hilty et al., 2012). However, as discussed in the following section, designation as a protected area does not guarantee protection from encroachment and degradation.

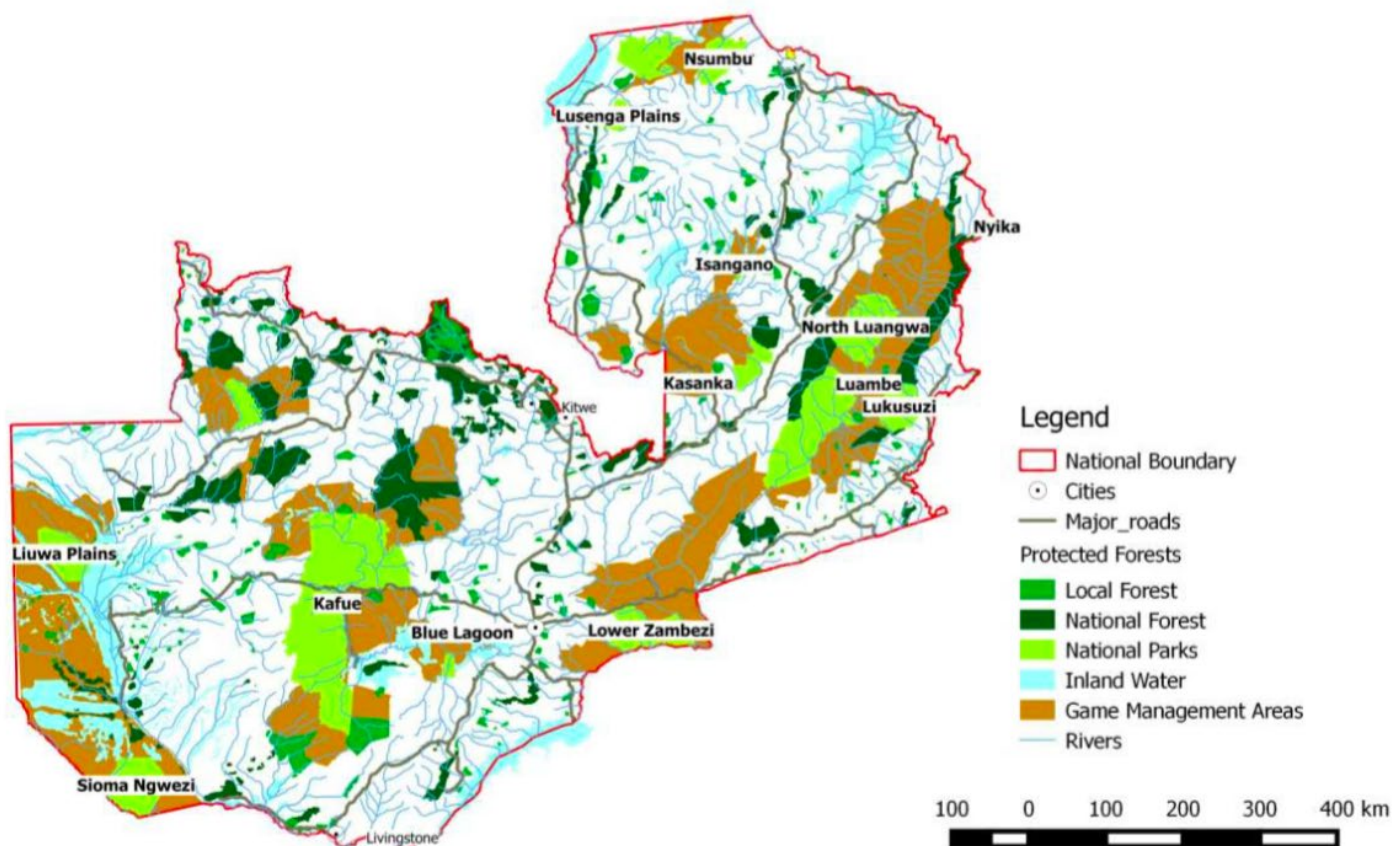


Figure 5. National Parks, Game Management Areas, and Forest Reserves in Zambia; Local Forest Reserves are focused on conserving ecosystem services to meet the needs of present and future generations of local people, while National Forest Reserves aim to conserve major water catchments and their biodiversity; from the Fifth National Report (MLNR, 2015).

In its fifth (and most recent) National Report (MLNR, 2015), the MLRN concluded that approximately 40% of the country’s landmass comprises statutory Protected Areas. At the same time, it acknowledged that not all of these protected areas are faring well: two of its 20 National Parks are degraded by invasive plants, and six have been encroached on by communities and impacted by excessive illegal hunting (MLNR, 2015). No National Report has been released, but other studies have come to similar conclusions about degradation. The fourth Zambia Environment Outlook Report from 2017, for instance, estimated that the level of encroachment in national and local forests is 52%, representing a whopping 8.2% of the land cover of the entire country (Zambia Environmental Management Agency, 2017).

The country’s many Game Management Areas (GMAs) also face deteriorating conditions. As of 2013, 40% of GMAs are human-modified habitats, land-use conversion is happening at the highest rate in the country (0.69% annually as compared to 0.03% in National Parks and 0.51% outside of national parks), and wildlife populations are declining (Lindsey et al., 2013). Not only are GMAs failing ecologically, but they are also failing to provide the intended livelihood, economic, and social benefits (Lindsey et al., 2013). This can lead to a negative cycle of interactions between communities and the natural resources of the GMAs: without viable alternatives, unsustainable levels of resources must be extracted to meet basic needs, threatening the function of the GMA’s and further reducing their benefits, in turn leading to

more extraction. Even more alarming, according to one key informant, the demographic and resource pressures underlying these trends have only increased in the last decade. The problem appears partially structural; community-based natural resource management (CBNRM) mechanisms do not involve local communities directly enough in decision-making processes and therefore are not empowered to manage resources sustainably (Milupi et al., 2020). Collaborating across scales and institutions, equitable local participation, and long-term financial stability have also been consistent challenges to the CBNRM model of Zambia's GMAs (Adeyanju et al., 2021).

Due to the immediacy of most environmental conservation efforts in Zambia, a limited portion of the primary conservation actors focus on landscape-scale issues and connectivity conservation (see the Zambia Carnivore Program, for example). Generally, conservation work focuses on local communities, anti-poaching initiatives, collaborative resource management, and occasionally scientific animal movement studies. These efforts are especially active near National Parks and Game Management Areas or within the Transfrontier Conservation Areas. The balance between local community needs and conservation outcomes necessitates that almost all NGOs engage with local communities: whether with education, economic incentives (job creation), agriculture/harvesting practices, or resource decision-making processes.

For those organizations able to consider landscape-level issues, habitat connectivity has been a long-standing focus due to the increased need for fauna to move between core habitat areas in the context of strong seasonal water patterns. This recognition creates a ripple of awareness across the conservation community that ecological connectivity issues intersect directly with land use and LI. However, translating this into action has yet to yield much in the way of results. Outside of protected areas, there are no mechanisms to designate "no-go" zones for linear infrastructure development in what might be vital habitats for connectivity. Fortunately, this might change; as of May 2021, the government has instituted a new policy concerning Strategic Environmental Assessments (SEAs). Ideally, these SEAs will require more ministerial coordination (i.e., MLNR will receive project plans from other ministries much earlier in the project life) and incorporate environmental concerns more effectively into project selection, development, construction, and monitoring. As the policy is quite new, it is difficult to find evidence of its use and, therefore, to judge its effectiveness. What is clear is that even in protected areas, LI or other development projects are sometimes still given the greenlight (see the Kangaluwi Mine case study below) due to insufficient SEA/EIA processes, conflicting ministerial priorities, and incentive structures that consistently favor development projects.

Most smaller conservation organizations are busy "putting out fires" in their local areas and could not lead broader landscape initiatives or coalitions. Some examples of these NGOs can be found in the Stakeholder mapping figure below. That said, many of these groups pursue the vital work of building relationships with local communities and traditional leaders. In Zambia, the voices of these leaders, especially when informed, collected, and delivered to the government, are a powerful force. According to one conservationist from a more locally-focused organization, WWF Zambia has done exactly that. They are viewed as a vital player and leader in policy, landscape-level issues, and coalition building, not only among NGOs but also communities and their leaders. This role is compelling given the importance of government involvement/buy-in on initiatives and WWF's extensive connections across ministries. To date, much landscape-level work has been reactive rather than proactive. Still, with additional support, the foundational capacities and networks to help push biodiversity safeguarding, strategic planning, and holistic linear infrastructure exist in Zambia.

An area that could contribute substantially to certain types of connectivity (especially for native insects, birds, and other fauna) is traditional farming. Perhaps in part, thanks to Zambia disallowing the use of genetically modified crops, and modeling policy on the precautionary principle, there remains a relatively large traditional agriculture sector. As of 2012, approximately 1.5 million small households were involved in the sector, producing approximately 80% of the nation’s crop output (Ngimbu, 2015). These numbers are falling, however; between 2004 and 2011, the sector grew only 1.5%, less than the population growth rate of 2.8% for the same period (*The National Agriculture Policy 2012-2030*, 2011).

IV. Country policy and planning landscape for biodiversity & infrastructure

National and international commitments to conserve biodiversity

The Zambian government has developed and committed to a host of national and international regulatory mechanisms to better incorporate biodiversity, environmental, and social concerns into law-making, governance, and management (Tables 4 and 5).

Table 4. Zambia’s international commitments to conserve biodiversity

| Convention/Instrument | Main Purpose |
|---|--|
| Convention on Biological Diversity (CBD) | To conserve species, genetic, and ecosystem diversity |
| Convention on International Trade in Endangered Species (CITES) | To control trade in endangered species of plants and animals |
| United Nations Framework Convention on Climate Change (UNFCCC) | To monitor and reduce greenhouse gas emissions |
| United Nations Convention on Combating Desertification (UNCCD) | To combat desertification and mitigate the effects of drought |
| Ramsar Convention of Wetlands of International Importance Especially as Waterfowl Habitat | To designate and protect wetlands of international importance |
| UNESCO Convention | To protect the world’s great cultural and natural heritage |
| Water Convention on the Protection and Use of Transboundary Watercourses and International Lakes | To establish frameworks for cooperative international water bodies |
| The Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora | To establish protocols and activities to reduce and eliminate illegal trade in flora and fauna |

Table 5. Zambia's national commitments to conserve biodiversity

| Legislation | Main Purpose |
|--|---|
| Statutory Instrument No. 48 of 2021 | To provide the foundation for SEAs and strengthen environmental regulation |
| Constitution of Zambia Amendment Act No. 2 of 2016 | To provide for the baseline rights by which all other legislation must be shaped |
| The Zambia Wildlife Act of 2015 | To provide for the establishment, control and management of NPs, bird, and wildlife sanctuaries, and the conservation and enhancement of wildlife ecosystems |
| The National Forestry Policy 2014 | To promote the protection and management of Zambia's environment and natural resources in designated forests |
| Environmental Management Act No. 12 of 2011 | To provide for integrated environmental management (inc. EIAs) and domesticate provisions of the CBD |
| The Water Resources Management Act No. 21 of 2011 | To provide for the management, development, and conservation of water resources and ecosystems |
| Mines and Minerals Act No. 7 of 2008 | To provide regulation for the management of mining rights and the control of mining activities with regard to environmental protection |
| National Policy on Environment of 2007 | To provide for the welfare of the nation's environment, balancing socioeconomic development and the integrity of the environment |
| Local Government Act No. 8 of 2003 | To provide for the establishment of Councils and stipulates functions of Local Authorities and the local government system |
| The Water Supply and Sanitation Act No 28 of 1997 | To provide for the regulation of water and sanitation systems |
| The Fisheries Act No. 13 of 1994 | Provides for the development of commercial fishing in Zambia; controls fishing and registration of fishermen and their boats. |
| National Heritage Conservation Commission Act No. 13 of 1994 | To provide for the conservation of ancient, cultural and natural heritage, and other objects of aesthetic, historical, archaeological, or scientific interest |
| Noxious Weeds Act No. 2 of 1993 | Provides for the control, declaration, and eradication of noxious weeds |
| The Zambezi River Authority Act No. 17 of 1987 | To provide for the interstate agreement between Zambia and Zimbabwe relating to the utilization of the Zambezi River |

Relevant Zambian laws and decrees surrounding biodiversity and infrastructure safeguards

Zambia has a diverse array of policy instruments for the conservation of biodiversity and sustainable management of natural resources, including the most recent Environmental Management Act (2011), the Constitution of Zambia (Amendment) Act (2016), the Forest Act No. 4 (2015), Zambia Wildlife Act (2015), the National Policy on Climate Change (2016), and many more (for a complete list, see Chisompola & Sinclair, 2019). Despite the comprehensive nature of these policies, their language, coverage, and implementation are insufficient to truly protect Zambia's Natural resources and the communities that depend upon them. While there is a fairly broad spectrum of policies, in practice, most binding conservation-oriented natural resource policies (i.e., those relevant to safeguarding linear infrastructure projects) focus on protected areas, watersheds, and EIAs. Unfortunately, as clarified above, this has not been enough to protect even these areas from the deterioration of resources.

Ministries are the key decision makers regarding potential projects within their purview. For example, the Department of National Parks & Wildlife (DNPW) may submit a technical position against a new development within a national park. In many cases, the project can also be brought to other ministries for further opinions, such as the Ministry of Environment. Regardless of ministerial findings, the government (through another ministry - i.e., mines - or through parliament) can decide to appeal these decisions. Upon an appeal, the structure of decision-making becomes less regulated. The 3rd party Minister (i.e., of mines) can either directly decide or assemble a committee. At this stage, political interest often appears to outweigh the scientific evidence and arguments against a project – and the process is not very public.

The Zambian government has incorporated important language about biodiversity and community-based concerns into many planning documents and announcements. However, this verbiage is often non-binding, and the development goals of individuals, parties, or development planning (i.e., the commercial aspects of Vision 2030) are prioritized by key decision-makers who may have a stake or interest in a project. This can be seen, for example, in the outcomes of the first NBSAP, which after a decade had resulted in “very weak direct results” (Secretariat of the Convention on Biological Diversity, 2018). Without a strong legal and regulatory framework, integrated financing coordination, or effective monitoring, the current implementation of these goals in Zambia relies heavily on the EIA process.

The Environmental Management Act (2011) outlines the steps for Environmental Impact Assessments (EIAs) for development projects in Zambia. All EIAs are overseen by the Zambia Environmental Management Agency (ZEMA), an independent environmental regulator and coordinating agency. Unfortunately, implementing the EIA process has yielded limited concrete protections for biodiversity in the face of development. After analyzing the entire legislative regime for EIA administration in Zambia, Sishekanu and Katati (2021) and Manatsa (2015) highlight at least six distinct shortcomings:

1. The lack of scientific criteria for evaluating environmental risk creates an extremely subjective “regulatory ethos” (Sishekanu & Katati, 2021).
2. The lack of clarity of roles and responsibilities across multiple sectoral agencies leads to duplicate efforts and institutional conflicts, and necessitates additional coordination.
3. Strikingly, “there is no definitive mechanism to ensure that EIAs are considered in decision-making” (Manatsa, 2015).
4. There are no criteria for the appointment of ZEMA officers (i.e., qualifications, conflict of interest status, etc.).
5. Poor enforcement and compliance incentives undermine implementation.

6. The act that codified EIAs has numerous grammatical mistakes, omissions, and other indicators that it was done in haste.

Furthermore, one interviewee noted that the consultants performing EIAs are always paid for by the developer, a potential conflict of interest that they believed baked biases into the process. The above issues mean that EIAs in Zambia are subject to “a highly subjective approval system bereft of objective scientific standards of regulation” (Sishekanu and Katati, 2021). This has become obvious in certain controversial approvals over the last decade, for instance, the large agriculture project in the Kasanka National Park buffer zone, or the open pit copper mine in the Lower Zambezi National Park, detailed in the case study below. Such shortcomings have led scholars to call not just for amendments, but for entirely new EIA legislation in the country.

A recent law (May 2021) has introduced Strategic Environmental Assessments (SEAs) as an important new tool to improve natural resource management in Zambia. As of yet, however, there is no public information about the actual implementation of the SEA policy, as it is currently in development. In theory, SEAs could include a wider spectrum of project planning, management, and selection concerns. One interviewee was hopeful to see the result of the SEA development process of these SEAs, as they believed that SEAs have the potential to incorporate landscape level concerns, such as connectivity, and ideally could help identify “no-go” zones outside (and within) National Parks.

It is difficult to trace exactly which Ministries have jurisdiction and oversight over which projects or even the current ministerial structure. This is a broader issue in Zambia, as Ministries may have overlapping purviews but differing mandates. For example, MLNR (and its DNPW) and the Ministry of Mines are conflicted regarding mining projects in National Parks - both are entitled to administer such projects but with vastly different goals. Even among conservationists working in Zambia for decades, the distinctions between these Ministries are not always clear. The commonplace reshuffling of ministerial structure exacerbates this. For instance, the Zambia Wildlife Agency (ZAWA) was created in 1999 and, in less than two decades, replaced by the DNPW (in 2015). That being said, generally speaking, the Ministry of Energy is responsible for transmission projects, and the Ministry of Transport and Communication is responsible for transportation projects. Ideally, projects are also overseen by the Ministry of Lands and Natural Resources vis-a-vis consultations and EIAs prepared for ZEMA. The Ministry of Finance is also ostensibly responsible for signing off on large international loan agreements. One interviewee suggested that one of the largest potential opportunities for investment is an inter-ministerial body that can help to orchestrate work across ministries, resolve disputes, and potentially ensure that concerns of one ministry are considered by other ministries (i.e., if the Ministry of Health builds a hospital, they can't do it in a national park).

With the potential for a huge increase in exploration and mining globally - to meet the high demands of the transition to renewable energy sources - Zambia is likely to face increasing pressure in this sector. Given that even IUCN Category II areas are not safe from LI incursions related to mining, it is very likely that the pressures across the entirety of CBI cores in the country will expand as exploration for rare earth minerals, manganese, and other critical minerals increases. This is especially likely given the working cadastral system (an advantage over countries like Ghana and the DRC) and the apparent friendliness of the newly elected administration towards the mining industry.

V. Project Profile: Kangaluwi Copper Mine

Project type: Copper mine

Description: A new, open pit copper mine covering 12km² including a new ~20 km long access road, in the center of the Lower Zambezi National Park.

Operators: Zambezi Resources Limited (Australia), Mwembeshi Resources Limited (Bermuda)

Investment: Approximately \$500 Million USD.

Status: Approved for development as of June 2021

While not a BRI project specifically, and only incorporating LI for access purposes (i.e., not as the main goal), the Kangaluwi Copper Mine provides many important lessons about the implementation of large development projects in Zambia. Specifically, it demonstrates the ability, or lack thereof, of Zambian governance systems and institutions to safeguard biodiversity, incorporate community interests, and adhere to the spirit of international agreements like the Convention on Biological Diversity. The case also highlights several NGOs that are active in influencing large-scale projects, and how these organizations attempt to intervene.

News of the planned mine first became widespread in 2011, when the government granted developers Zambezi Resources and Mwembeshi Resources a mining permit for a site located in the heart of the Lower Zambezi National Park. Over the next decade, an EIA was completed by the developers, then subsequently rejected, accepted, and then hotly contested in court. As of June 2021, however, the most recent injunction was removed, clearing the way for developers to go ahead with the project. While the majority of the public, and even the current president, have expressed strong objection, the Green Economy and Environment Minister Collins Nzovu confirmed the project would go ahead “under strict adherence to measures set by [ZEMA]” (Lusaka Times, 2022). What exactly these measures are, however, remains to be seen.

A 2014 report demonstrated several key shortcomings in the EIA process, unincorporated environmental impacts, and important takeaways surrounding the mine (Leigh, 2014, Fig. 6). In short, the approved EIA was woefully inadequate: it failed to detail the scope and life of the mine, incorporate any of the concerns of local communities, or even include many harmful environmental impacts. Additionally, the resource mined was altered from copper sulfide to copper oxide after submission, and no revisions to the document were required or supplied. The report also demonstrated the risks of long-term environmental damage, flawed economics underlying the project, and economic risks to the tourism sector and beyond, proving invaluable to the ever-increasing number of opponents. The uptake of the report demonstrates the potential influence of CBA to inform stakeholders in Zambia and help galvanize support for biodiversity in the face of the common, and often under-supported, “infrastructure development is always good” narrative.

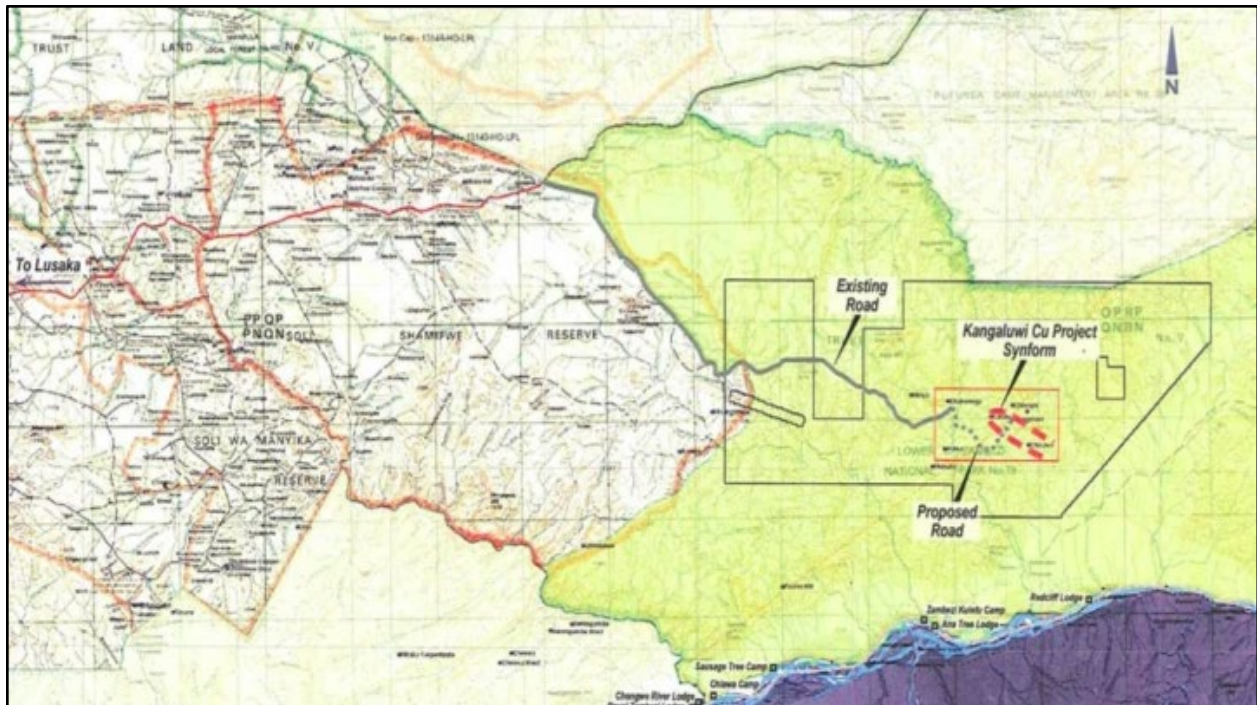


Figure 6. Topographical map of the area surrounding Kangaluwi Copper Mine showing game management areas.

Besides the obvious shortcomings in EIA law and practice, the report also identified one of the same weaknesses as the later legal analyses: a lack of specific details leaves room for unsustainable practices (Leigh, 2014). For instance, the right to extract mineral resources from National Parks is protected in the law, as long as more stringent protocols and monitoring are incorporated. But these requirements are never explicitly defined, leaving the national parks vulnerable to environmental degradation. Other similar vulnerabilities exist across Zambia's environmental law.

Opponents were galvanized by the disastrous potential impacts not just in the Lower Zambezi but extending through the Zambezi River to the cross-border Mana Pools ecosystem spanning Zambia, Zimbabwe, and Mozambique. Local and international conservation organizations, individuals, tourism operators, and more joined together to create change through the legal system and a series of protests, petitions, news conferences, and more. The newly created Zambian youth group IMPI was integral in organizing these extra-legal actions and represented a new generation of environmentally-minded citizens. Other prominent organizations (Venturi, 2022) include:

- WWF Zambia
- Zambia Community Based Natural Resource Management Forum,
- Zambian Institute of Environment Management
- Zambia Climate Change Network
- Chalimbana River Head Waters Conservation Trust
- Green Living Movement
- Conservation International
- OXFAM Australia
- Action Aid

According to an interview with a Zambian conservation expert, one big sticking point for progress is that the four traditional local leaders (i.e., chiefs) are divided on their position on the project: two are among the opposition and two are proponents. These leaders have substantial influence within their communities; as the key informant explained: “once a chief has spoken for a project, no one in the community will speak against him” and “If a leader votes one way, his tribe will as well.” This influence has huge implications for politicians and project developers. In this case, the lack of a majority has left the door open for ongoing debate about the project’s future.

A tripartite meeting between a prominent local ecologist, ZEMA, and the developers was held to discuss the specifics of the strict biodiversity offsets and related project management and monitoring. Outcomes of this cooperation are difficult to substantiate, perhaps partly due to a new legal battle being fought over the EIA for the project. Zambian law provides a requirement for how recent an EIA must be. After years of opposition, the EIA for the Kangaluwi mine had outlived its validity (see timeline in Fig. 7). However, the company simply amended it instead of developing a new EIA. This has given an opening to opposition for another legal intervention. As of March 2022, this new case has not yet produced any result (i.e., an injunction); therefore, it appears the project will move forward until such a time.



Figure 7. Timeline of key events since the 2003 approval of the Kangaluwi Copper Mine. Source: Conservation Lower Zambezi.

Lessons from Kangaluwi:

1. Shortcomings in the ability of the Zambian legal system to protect biodiversity
 - a. EIA law as subjective and lacking specific, rigorous character.
 - i. Environmental impact assessment process lacking:
 1. Integration of community concerns
 2. Specific scientific requirements/evidence
 3. Protection from political influence
 - b. A lack of specific, binding protections across multiple important sectors - with the intersection of mining and national parks highlighted here.
 - c. A lack of formal spaces where communities, conservationists, and individuals outside of government and developers can be heard in large infrastructure projects
2. A vocal citizenry (when informed) is interested in protecting the natural resources of their national parks.
3. The importance of local chiefs.

VI. Understanding stakeholders and power dynamics

The question of who can influence the implementation of large LI projects in Zambia and how is central to this report. Like every complex system, gaining leverage is no simple task and depends on the specific characteristics and actors of the system. Due to governance and political structures in Zambia, several key players have a disproportionate ability to enact change or influence the system, for instance, the ministers in relevant ministerial bodies or the financiers and developers creating, administering, and financing these projects (Fig. 8). Influencing these leaders is one potential strategy, providing information and guidance in ways that fit into their goals, culture, and standard operating procedures. With these actors, the question is how to creatively and ethically engage in ways that don't undermine democratic governance structures and civil society faith.

Outside this limited group of actors, the levers to influence project selection, planning, and implementation are not as obvious, especially regarding environmental safeguarding. Given the lack of a strong legal or regulatory framework for these projects and limited capacities or interaction on the part of the various ministries, avenues to influence these processes are more limited. In Zambia, these avenues appear to deal more directly with creating the conditions enabling civil society actors to have a larger impact, assisting in structural and implementation improvements among government actors, and strengthening existing policy, among many others.

Stakeholder Mapping

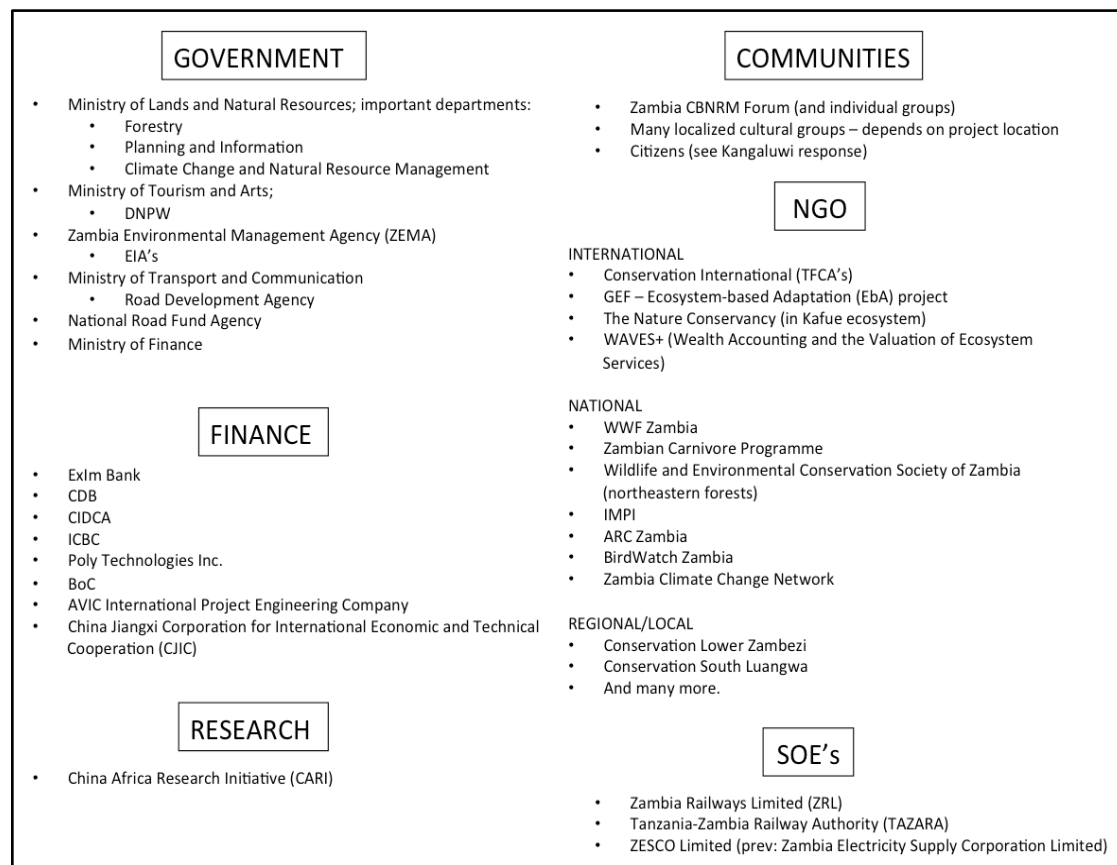


Figure 8. Key stakeholders by group.

Key actors and interests

Civil society, non-governmental and intergovernmental organizations

Avenues of influence:

- Public Engagement
 - Education, community work, rallying support, organizing protests.
- Civil Action (lawsuits)
- Engaging with government
 - Engaging (limited) with EIA process
 - Helping build capacity for government officials/offices
 - Sharing information and expertise with government
- Data creation and distribution
 - Scientific research
 - Information sharing
- Coordination across stakeholder groups
 - Coalition building (often intra-community)
 - Coordinating government, private, and community stakeholders

Dynamics:

- Environmental NGOs are often reactive - “putting out fires”
- NGOs tend to have a more limited geographic or thematic focus - i.e., local communities, in part due to the intensity and nature of threats.
- Official spaces to effectively engage with government/development systems are limited
- In large LI projects, NGOs must often work “both sides” - with some pursuing legal action, coalition building, etc., and others maintaining relationships across government, distributing information, and building capacity across ministries, for example.

Government

Avenues of Influence

- Individuals - Powerful actors (i.e., ministers)
- Ministerial purview
 - Ministry of Finance - signs off on large, international loan agreements
 - Ministry of Lands and Natural Resources - houses DNPW, management and protection of National Parks
 - Project relevant Ministries - i.e., Ministry of Mines for a copper project.
- Legislation
 - Existing law - EIA process, new SEA process, other.
 - Amendments
 - New legislation
- Guidelines
 - Guidelines for biodiversity protection (e.g., NBSAP-2), incorporation into projects, etc exists, but little is effective or binding.

Dynamics

- Actual decision-making processes for large projects unclear - potential for high levels of political influence from powerful actors.
- Lack of effective ministerial interchange - often little to no information exchange; when present, often conflicting rather than collaborative.
- Legal system for EIAs (and environmental protection more broadly) is not currently adequate to effectively protect biodiversity

- Seen as vital to engage with in order to influence large LI projects

Private sector

Avenues of Influence

- Project Development
- Responsible for producing EIA reports

Dynamics

- Appear to be viewed positively by the government - due to resource investment, job creation, and other development drivers
- Are responsible for not only funding, but also hiring consultants who implement EIS - favorable incentive structure for developers
- Potential to have a large influence on powerful individuals in government

VII. Recommendations

Priority (shorter-term) recommendations

1. Research and tracking responses to and development of the debt situation in Zambia to be used to influence Chinese lending practices, understand the ripple effects and educate other potential borrowing nations/stakeholders.
 - a. The Zambia case provides an incisive example of the characteristics and conditions which lead to debt crises and the perception of “debt trap diplomacy.” Understanding and avoiding these conditions is vital to host countries and to the profitability of lenders, and positive environmental and social outcomes. Additionally, the ramifications of how the current crisis is solved and the behavior of Chinese actors, IFIs, the Zambian government, and more should be closely tracked. There are important lessons to integrate into Chinese policy and financier guidance, lessons which will likely ripple across the continent, and the world, to other nations struggling with considerable (Chinese) debt burdens.
2. Taking Advantage of the Debt Crisis
 - a. The current debt crisis provides an additional opportunity (to the above recommendation to track the outcomes): a respite in the active signing of new loan commitments and, therefore, new large LI projects. While some active projects are still in development, this respite creates an uncommon event, a larger interval to attempt to intervene in processes in a proactive, rather than reactive manner. It creates the opportunity to influence the capacity and structure of existing systems without attention and resources split between actively working on specific large projects. Therefore, it is an opportune time to pursue the recommendations listed below (i.e. inter-ministerial coordination). Additionally, giving the international attention and nature of the debt crisis, advancing initiatives to fund the payments for ecosystem services, debt forgiveness for biodiversity, or other similar financial interventions could be especially influential in this current period.
3. Collecting and collating more research on the state of biodiversity, connectivity, and infrastructure development in Zambia - whether this includes funding research directly, or developing a more in-depth process to collect existing data, there is a huge information gap in the realms of biodiversity/connectivity and the state of infrastructure projects. This connects to

cross-cutting ideas around building relationships as a primary way to increase capacity/connections regardless of the state of the country.

4. Confronting direct threats to biodiversity in GMAs: ensuring benefits are received by community members, the importance of local chiefs, etc.

Longer-term recommendations

1. Inter-ministerial coordination
 - a. Working with WWF Zambia and others to help establish an inter-ministerial coordinating body within the government (ideally - according to one interviewee - housed in the office of the Vice-President for most impact). The role of such a body would be to ensure coordination, cooperation, data-sharing, and more across ministries. These siloed bodies are now seen as detrimental because there are very few clear channels by which information is shared between them. Missions and actions are often contrary in nature, leading to conflict rather than coordination.
2. Legislation
 - a. An overhaul, or at the very least amendments, aimed at incorporating scientific standards, clear regulatory frameworks, and reducing subjectivity in the EIA process.
 - b. Incorporating other legal structures to ensure a greater role for the MLNR in safeguarding projects across ministries and bolsters their effectiveness in interventions.
 - c. Incorporating more official spaces for interchange with development (and therefore LI) projects.
3. With future LI projects - Holistic CBA into the hands of local leaders and government officials. Narrowly considered “development” often overrides other concerns. This strategy may help overcome the simplistic narrative “development is good” while tying into existing values.

Important Considerations

1. Working with the government is key
 - a. Increasing capacity
 - b. Ensuring that different ministries are communicating/coordinating for relevant projects.
 - c. Traditional local leaders (chiefs) can influence government processes
 - d. Opportunity with the new Green Economy and Environment Ministry
2. WWF Zambia is a key actor across the country: rallying not just the conservation community, but also local communities, with many direct contacts across government.
3. Importance of working with communities
 - a. Influence of local chiefs
 - b. Ensuring benefits to local communities (or effectively educating re: impacts)
4. Lack of opportunities to engage/ access to information
 - a. IF local groups or NGOs are given the opportunity, it is often...
 - i. When the planning phase is nearly complete
 - ii. In a very limited timeframe (i.e., 24 hours)
 - iii. Ignored in final outcomes
 - b. Often NGOs will hear about new projects “through the grapevine,” and there is no effective system of publishing and sharing info about these projects.
 - c. According to one interview, this is especially true when the Zambian government is developing a project.
 - i. Political influence can further hamstring the effectiveness of opportunities to engage and the EIA process.
5. Importance of capacity building

- a. Opportunity is supporting the creation of an inter-ministerial body (housed in the office of the vice president) to ensure appropriate coordination and cooperation between ministries.
 - b. Most organizations are working on only the most direct threats (i.e., poaching, local communities, etc.) and don't have the capacity to focus on larger-scale structural problems, etc.
 - c. Levels of legislative and institutional effectiveness are generally low
 - d. How to support capacity more broadly in ways that lead toward LI mitigation AND positive outcomes more generally (across sectors)
 - i. Such as a focus on LI might be more specific (and less supported) than necessary, aim for initiatives that increase capacity more generally (and consequently for LI)
6. Importance of Coordination among Chinese lenders
- a. Zambia as a case study of what this lack of coordination can do
 - i. Debt distress
 - ii. Loss of profits
 - iii. Allegations of "debt trapping"
 - b. Other nations are looking to how Zambia is handled to learn about the consequences of such debt distress.
 - c. Avoiding multi-party lending free-for-alls and debt tragedy of the commons
7. Importance of sound CBA in projects
- a. Many road projects developed on the assumption of increased traffic/utility
 - b. Opportunity to more deftly persuade local leaders, for example.
8. Supporting GMAs/local CBNRM. Key needs are:
- a. Collaboration across scales and institutions
 - b. equitable local participation
 - c. long-term financial stability
9. Investment must also benefit local communities - this can lead to paradigm shifts in how biodiversity is valued.

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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 prior to carrying out interviews. In this way, researchers became familiar with the country context, the relevant bodies of work, and potential interviewees who are actively involved in work related to either 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 into 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 the completion of individual country case studies, a process of synthesis 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 aim of the first set of maps was 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 construction and that our maps offer problem setting context but underrepresent the extent of LI interacting with wildlife habitat.

B. Composite Biodiversity Index and cores

We created a Composite Biodiversity Index (CBI) to identify regions of high biodiversity. To develop a CBI layer for each country, we applied a method created by Dr. Tyler Crech for the Center for Large Landscape Conservation. Dr. Crech 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 annex¹. The amount of overlap between PAs and CBI is of importance 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 important 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 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,

¹ 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: Crech 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.

and transmission 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 over time. 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 and, thus, our methods did not lead to a comprehensive review.

Appendix B: Spatial Data Tables

The following tables provide summary information for Figure 2

PA's (IUCN categories I and II) and CBI cores overlap

| Zambia | 70th Percentile Core | 80th Percentile Core | 90th Percentile Core |
|---|----------------------|----------------------|----------------------|
| CBI Core Area (km ²) | 225227 | 149961 | 74792 |
| Overlap with Protected Areas (km ²) | 60620.7 | 54772.2 | 33990.3 |
| CBI Core Area within PAs (%) | 26.9154 | 36.5243 | 45.4464 |

Chinese funded LI across Zambia

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

| LI Mode | Length |
|-------------------|------------|
| Road (km) | 0 |
| Rail (km) | 866.914001 |
| Transmission (km) | 0 |

Length of Chinese funded LI within PAs (IUCN categories I, II) in Zambia

The Chinese funded LI dataset was clipped within the PA boundaries.

| LI Mode | Length |
|-------------------|--------|
| Road (km) | 0 |
| Rail (km) | 0 |
| Transmission (km) | 0 |

Length of Chinese-funded LI within CBI Cores in Zambia

The Chinese-funded LI dataset was clipped by boundaries of every percentile core and line length of each LI Mode within each core was calculated.

| LI Mode | 70th Percentile Core | 80th Percentile Core | 90th Percentile Core |
|-------------------|----------------------|----------------------|----------------------|
| Road (km) | 0 | 0 | 0 |
| Rail (km) | 51.080502 | 0 | 0 |
| Transmission (km) | 0 | 0 | 0 |