



Framing Opportunities for Conservation by Understanding Safeguards in the Belt and Road Initiative (FOCUS-BRI)

Opportunity Report

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Center for Large Landscape Conservation 2023

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Impacts of Linear Infrastructure

While necessary for societal development, the rapid and extensive expansion of linear infrastructure (LI) is one of the most significant contributors to ecological and environmental degradation worldwide.¹ Across the world, nearly 300 million rural dwellers lack access to suitable road networks, and roughly 13% lack access to electricity.² To meet the targets of the United Nations' Sustainable Development Goals, the installation of new infrastructure and the expansion of existing systems is necessary as reliable infrastructure is critical for community well-being by creating access to trade, health services, and jobs.

The wide-reaching benefits of infrastructure development must be balanced with the negative environmental impacts, which are especially acute in many tropical regions due to their rich biodiversity and the pace and influence of the environmental change wrought by LI developments, especially roads.³ The scope and scale of rapid development projects can lead to significant social and ecological impacts, including soil destabilization and increased susceptibility to landslides, habitat loss and fragmentation, wildlife mortality from collisions and electrocution, poaching, and illegal harvesting.⁴

While economic costs and benefits dominate decision-making around infrastructure projects, there is a pressing need to mainstream biodiversity conservation into infrastructure decision-making. Encouragingly, key synergies are emerging between development and conservation work. Funders, planners, and practitioners are beginning to recognize the need to include biodiversity considerations that serve ecological, social, and economic goals.^{5,6} By centering biodiversity and cultural considerations on par with economic benefits, governments have a tremendous opportunity to ensure community prosperity and healthy natural systems while realizing national development goals.

There are proven methodologies that can be used to address the negative effects that LI can have on nature, most notably the well-researched mitigation hierarchy (below). Using the mitigation hierarchy while planning and designing LI projects safeguards the environment, supports local nature-based cultural traditions, and enables cost-effective LI project implementation with measurable positive conservation outcomes. The mitigation hierarchy is a five-step approach, although it should be noted that not all steps will be utilized in every project.⁷

- Avoid Avoidance may be accomplished by relocating LI development away from critical habitats. Projects that avoid sensitive biodiversity areas may be slightly longer than the most direct route but may require fewer expensive mitigation measures and potentially better serve local communities. The remainder of the mitigation hierarchy must still be considered even after alternative alignments are selected.
- **Minimize** Examples of effective minimization measures may include a reduction in project scale, short-term actions during construction to reduce soil erosion, or more permanent efforts during operation to reduce contamination from pollution.
- Mitigate Mitigation measures often involve technological or construction strategies to moderate unavoidable impacts. Commonly used mitigation measures in infrastructure projects are noise and light barriers to prevent spillover into adjacent habitats, wildlife crossing structures, and associated fencing to provide for ecological connectivity and minimize collisions with wildlife.

- **Restore** Restoration is aimed at reversing habitat degradation and typically occurs near the site of a development project. Restoration is most effective when well-established, practical techniques are maintained and monitored for long-term success.
- Compensate and/or Offset Offsets are used for residual impacts not addressed by the previous steps. They aim to rehabilitate or restore degraded habitats and reduce or prevent biodiversity loss in predicted areas. Compensation usually involves payments as offsets to fund and implement management plans for PAs, support research that enhances biodiversity protection, or enhance enforcement activities and infrastructure.

Demystifying the BRI

China's Belt and Road Initiative (BRI) is one of the world's most significant infrastructure development efforts, extending from China to Southeast Asia, Africa, western Europe, and beyond. In 2021, China's BRI investment totaled US\$13.9 billion.⁸ More than 140 countries have signed onto the initiative, impacting millions of people and places globally. One of the primary goals of the BRI is to promote regional economic development with mutual benefits for BRI countries through the construction of large-scale infrastructure.

The scope of BRI activity has sparked much debate and misunderstanding around the BRI's impacts, intentions, geoeconomics, and geopolitics. Although the emphasis in recent years has shifted towards developing BRI-related linear infrastructure more sustainably, the often negative impact on biodiversity and habitat remain a key concern. There are robust assessments on the direct effects of LI on biodiversity but comparatively less is known about the opportunities to balance conservation, development goals, and economic growth by engaging policy, science, and implementation tools and capacity while developing linear infrastructure.^{9–11}

It is important to note that while the BRI is quick to garner headlines, it is not the only infrastructure development scheme happening at a global scale. The European Union, India, Japan, Taiwan, and the United States have all established programs in response to China's BRI. The wide range of infrastructure projects expands the variety of mechanisms for incorporating economic, ecological, and social-cultural safeguards during LI development. To better understand these complex factors and the critical levers of influence that include the financier, project, context, and country, we have researched the capacity of receiving countries to implement LI development that adequately addresses biodiversity and ecosystem function impacts and the associated social and cultural impacts. While climate change adaptation and mitigation are increasingly integrated into national development plans, similar mainstreaming is necessary for biodiversity conservation and the rights and needs of local people.

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

Framing Opportunities for Conservation by Understanding Safeguards in The Belt and Road Initiative (FOCUS-BRI) explores the issues, actors, and policies surrounding the implementation of Chinese-funded linear infrastructure projects, specifically roadways, railways, and power lines, in twelve countries. including the project-level challenges of the for achieving adequate safeguards for biodiversity during the implementation of BRI projects.

Ultimately, FOCUS-BRI aims to highlight critical areas for intervention by philanthropic funders, conservation practitioners, governments, communities, and national agencies to conserve biodiversity and ecological connectivity while developing linear infrastructure.

FOCUS-BRI took a three-pronged approach to this year-long fact-finding effort:

- 1. Developed twelve country case studies based on available literature and interviews centering key local and regional informants.
- 2. Used spatial analysis to produce maps showing how biodiversity and protected areas are intersected by existing and planned infrastructure in each country to identify 'no-go' areas that should remain free of LI development.
- 3. Assessed opportunities to use existing economic approaches to reconcile infrastructure development and social-ecological considerations.

We explored 12 BRI investment-recipient countries to identify opportunities to avoid and mitigate the negative impacts of LI development and the broad challenges of reconciling the social benefits of development, conservation of biodiversity, and climate mitigation. Countries were selected through a process that ranked BRI involvement, biodiversity, climate risk, and the Center's regional expertise. We relied on the available literature, key informant interviews, and our team's expertise to explore each policy landscape in the following 12 high biodiversity BRI-recipient countries across Asia and Africa:

- <u>Cambodia</u>
- <u>Democratic Republic of the Congo</u>
- <u>Kazakhstan</u>
- <u>Kenya</u>
- Laos
- Mongolia

- <u>Nepal</u>
- <u>Pakistan</u>
- <u>Rwanda</u>
- <u>Tanzania</u>
- <u>Vietnam</u>
- <u>Zambia</u>



A Composite Biodiversity Index (CBI) was utilized to identify regions of high biodiversity within each country. 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).

The overlap between protected areas (PAs) and CBI is important to spatial planning for LI as not all CBI areas have formal protection but provide ecological connectivity. Also, we found that PAs and Key Biodiversity Areas (KBAs) do not comprehensively overlap with high biodiversity areas in our CBI cores. PAs often have legacies centered around charismatic species conservation, whereas KBAs and our CBI cores are built using multiple biodiversity datasets. With strong economic development agendas in these landscapes, high biodiversity areas remain extremely vulnerable to threats from LI development.

Opportunities for Engagement

Within each country, our research teams focused on opportunities to support conservation actions in the face of rapid linear infrastructure development. The five categories below represent some of the key findings: they are enabling conditions that need to be in place to ensure LI development that maximizes economic, environmental, and socio-cultural benefits. In the country reports, we address the most pressing specific opportunities in each category for each country. although all countries would likely benefit from engagement in all of the following areas:



Increasing Capacity - Workforce training, guidelines, best practices, and other capacity-building measures are needed across all countries and sectors. There is a need to focus specifically on government officials, planners, engineers, and financiers to ensure these decision-makers have a base level of knowledge on the importance of conserving biodiversity, the effects of LI, and options for avoidance and mitigation. Increasing the capacity of local and regional conservation NGOs is also crucial, as these are likely the organizations that can best transfer this knowledge to other sectors, such as local communities. There is also a widespread need to translate key documents,

training materials, policies, and data sources into multiple languages, including English, Chinese, and local dialects.



Strengthening ESIA processes - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. LI project funders should encourage, fund, and facilitate transparent ESIA processes and the enforcement of resulting recommendations by mandating compliance with national legal frameworks and international best-practice for state-owned and private enterprises. It is the hub for understanding policy opportunities or need for change in each country.



Collaboration and coordinating entities – Developing, facilitating, and funding landscape-level and multi-stakeholder coalitions are critical to breaking down silos and ensuring effective coordination during all stages of an LI project. Facilitating dialogues between the decision-makers and other stakeholders (including communities, planners, contractors, industry, etc.) offers an opportunity to take a proactive conservation approach. Such groups also bring a higher degree of accountability and transparency. Across all BRI recipient countries, a lack of inter-ministerial coordination and transparency in governance is a huge challenge for conservation practitioners.



Open Access Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within BRI recipient countries. Such resources could host information from biodiversity data, spatial data layers, development project plans, funding schedules, and more. Open-access data allows for more informed decisions and increases available baselines for biodiversity monitoring.

Country Specific Research- Many countries require further research to better prepare for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. These research needs might relate to biodiversity, policy, context specific mitigation measures and more.

	Increasing Capacity	Strengthening ESIA processes	Collaboration and Coordinating Entities	Open Access Data	Country Specific Research
Cambodia					
DRC					
Kazakhstan					
Kenya					
Laos					
Mongolia					
Nepal					
Pakistan					
Rwanda					
Tanzania					
Vietnam					
Zambia					

Opportunities for Engagement

Country cases

The following country case summaries highlight spatial analysis insights and cover key engagement opportunities and future research needs.

Cambodia

Cambodia's protected areas cover much of the country's high-value biodiverse regions, although these protected areas vary between IUCN management categories. As such, it is imperative to ensure future LI development does not incur further into these biodiversity strongholds. One clear example is the Snuol Wildlife Reserve, where a road incursion and the subsequent degradation of this PA eventually led to its degazetting in 2018, as there was "almost nothing left to protect".¹² Particular attention should be paid to the Cardamom Mountains, a biodiversity-rich landscape currently threatened by multiple dams and LI development.



Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Cambodia has the capacity within wildlife NGOs to provide expertise: WCS has pursued similar work in electric transmission projects, and WWF is well-placed to interface with high-level stakeholders. Other notable NGOs can be found as partner organizations of WCS and WWF on a landscape-by-landscape basis.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. There is a need to improve the ESIA processes through the availability of biodiversity data and Further training for professionals carrying out ESIAs and for regulators reviewing them. There is a need for conservation practitioners to work directly with external funders to enhance ESIA requirements by providing wildlife data and expertise.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Leveraging the abundance of NGO-led coalitions in Cambodia to better conservation outcomes, these can be made aware of tools to use to engage with landscape planning and communities.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Cambodia. Policy and capacity support for the use and further development of a biodiversity

information platform that can inform decision-making, guide alternatives, and galvanize a community of active practice in this space.

Research needs - Further research is needed to better prepare Cambodia for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Further research within the Cardamom Mountains (a biodiverse region currently threatened by development) is needed as well as the creation of a collaborative effort to coordinate conservation groups active in the region to provide standardized, open-access biodiversity data to ensure development funders and planners are making informed decision.

Democratic Republic of the Congo

The Democratic Republic of Congo is one of the planet's most biologically important forested ecosystems. Approximately 68% of the DRC is forested, and 13% of the country's land is designated PAs. As such, a considerable percentage of unprotected forest habitats and areas of high biodiversity value are at risk of being severed by new LI development. LI development because of mining pressure is a crucial concern for conservation practitioners in DRC. New development should carefully consider the costs of creating new infrastructure footprints in forested areas in a country heavily impacted by LI.



Opportunities for Engagement

EIA process - DRC is plagued with corruption at almost all levels of governance. Despite the existence of protocols and due processes, there have been many instances where decision-making was biased and skewed toward benefiting the industry instead of the country. For instance, despite a detailed, standard procedure for tendering and procurement for infrastructure development in DRC, certain companies were selected even before official tenders were published. Contracts between the government and these companies were dated before the official tender publication date.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. The DRC has a complex administrative structure with several ministries and departments under those ministries functioning as independent units. While it would be expected that with a clear outline of roles and responsibilities, governance in the country would be smooth, in the case of DRC, this has resulted in a lack of coordination. There is a lack of mandated communication and coordination between the different ministries - leading to siloed decision-making. Facilitating multi-stakeholder discussions at various levels of decision-making would improve many of the issues that currently exist because of siloed decision-making.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within the DRC.

Kazakhstan

Kazakhstan is one of the least protected biomes on earth, leaving many biodiverse areas open to LI development. The most significant pressures on biodiversity in Kazakhstan are linked to extractive industries. The resulting development of roads, railways, and power lines poses threats to the country's migratory species like the saiga antelope and Steppe eagle. Saiga antelope migration patterns have changed due to recent LI development, and a railway expansion through the Ustyurt and Betpak-Dala populations has been link ed to local extinctions.^{13,14} Monumental efforts are currently underway to protect more of Kazakhstan's biodiverse regions and secure the historical range for the saiga antelope. Future development will need to avoid these critical migratory paths.



Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Translating essential policy documents from Russian to languages researchers, activists, and investors speak (i.e., primarily English and Chinese) is necessary.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. The most pressing challenge in Kazakhstan is the need for a well-trained workforce that can conduct ESIAs for LI projects. Biodiversity NGOs, like ACBK, directly influence how Environmental Impact Assessments are conducted but require a more extensive, well-trained workforce familiar with all relevant species to conduct robust ESIAs.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Kazakhstan to develop and promulgate more sustainable alternatives to LI plans.

Research needs - Further research is needed to better prepare Kazakhstan for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. There is a need for further monitoring of migratory species and an assessment of ecological connectivity across key migratory pathways. The Association for the Conservation of Biodiversity of Kazakhstan (ACBK) has expertise in this area and would be a key partner.

Kenya

Approximately 8% of Kenya's terrestrial habitat is formally designated as PA's, but 65% of Kenya's megafauna exist outside of PA's.¹⁵ With so much of the country's wildlife located outside of PAs, LI development will likely have a detrimental impact on biodiversity without proper avoidance and mitigation measures. Infrastructure development to bolster Kenya's economy has coalesced around the designation of two megadevelopment corridors (geographical areas identified as a priority for investments to spur economic growth and development): the Lamu Port and Lamu-Southern Sudan-Ethiopia Transport (LAPSSET) and the Standard Gauge Railway (SGR).

Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation



practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Emphasis should be placed on education of government officials and the Institution of Surveyors Kenya, creating a more substantial knowledge base at the upper echelon of decision-making. There is a need for training on conducting effective and meaningful stakeholder engagement, focusing on government entities. Capacity building workshops are needed within three key organizations, Kenya Highways Authority, Kenya Railways Authority, and Kenya Power & Lighting Company, on the importance of biodiversity and existing best practices for protection and mitigation during development.

EIA process - Kenya has a great need for increased training for professionals carrying out ESIAs and for regulators reviewing them. There is also a need for the creation of more specific language within the Environmental Management Act, the legal baseline for public participation during project planning.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Kenya.

Research needs - Further research is needed to better prepare Kenya for LI development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Systematic research on the impacts of power lines on vulnerable species in Kenya (specifically raptors and cranes) is needed to significantly increase baseline data, which can inform future infrastructure project planning. Partners ready to engage include the Center, the Peregrine Fund, and the National Museums of Kenya. There is also a need for coordination between existing research institutions and NGOs to implement a citizen science effort to increase information on wildlife mortality from roads and railways. African Conservation Centre has previously expressed interest in working with the Center to implement its citizen science roadkill data collection application, ROaDS (Roadkill Observation and Data Systems).

Laos

Laos ranks within the top ten global biodiversity hotspots for irreplaceability and in the

top five regarding threats. Biodiversity hotspots are spread throughout the country, with the most stringently regulated PAs aligned with areas of high biodiversity. It is critical within Laos for future LI developments to adequately safeguard biodiversity.

Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Translation of relevant Lao policy into English and Chinese and aggregating them into a centralized, publicly available source is needed.

Collaborative Platforms / Coordinating Entities - There is a

need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Although limited in comparison to government and company actions, there are opportunities to support regulatory systems in Laos – provision of best practice guidelines, support for legal framework reforms, and strengthening transparency.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Laos. There is also a need to translate relevant Lao policy documents into English and Chinese and aggregate them into a centralized, publicly available source.

Research needs - Further research is needed to better prepare Laos for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Specific funding for baseline biodiversity assessments on which to build long-term pre- and post-construction monitoring efforts would be valuable. Developing a monitoring protocol and standardizing data collection methods to monitor the effects of linear infrastructure development and its associated impacts on wildlife and habitat within Laos is recommended to expand the field of knowledge further.



Mongolia

Rich in mineral resources and surrounded by Russia and China, mining exports account for 80% of total exports and about a quarter of Mongolia's GDP. The pressure to develop LI is intense, and Mongolia's road and rail network is rapidly increasing. Mongolia has plans to construct more than 6000 km of paved roads by 2030 and add 5684 km of railway in three phases - mostly tied to the development of mining projects.¹⁶ A recent road development between the Oyu Tolgoi mining site to the Gashuun-Sukhait (OT-GS road) offers a wide variety of lessons learned that can be applied to further development. Lessons learned include the need for phased construction to allow wildlife to adapt to the new structure on the landscape and to increase monitoring of animal movements pre- and post-construction.



Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Emphasis is needed on training and knowledge transfer to local communities and participation in collaborative initiatives such as community-based rangeland management (CBRM). Other opportunities include supporting anti-poaching educational programs to help educate the public and raise awareness.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. There is a need to enable and support the involvement of conservation practitioners and communities in the official ESIA council. Support for using open-access data platforms, such as The Global Initiative on Ungulate Migration (GIUM), should be elevated for use in ESIAs in Mongolia.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Key informants suggest that no individual organization can hope to work towards sufficient implementation of safeguards for wildlife - making an inclusive, collaborative platform or network a practical approach.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Mongolia.

Research needs - Further research is needed to better prepare Mongolia for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Developing a monitoring protocol and standardizing data collection methods to monitor the effects of linear infrastructure development and its associated impacts on wildlife and habitat within Mongolia is recommended to expand the field of knowledge further.

Nepal

Nepal is home to diverse flora and fauna due to the country's massively varied ecosystems and geographic conditions. Nepal has areas of high biodiversity spread throughout the country, much of which lies outside of PAs. The ministry of physical planning and construction has set a target to develop 4,000 km of railway tracks in the next 20 years. These proposed railway projects are in various planning and development stages, including completing feasibility studies, land acquisition processes, and clearing forest areas for laying tracks. LI development



without high-quality environmental safeguards are discouraged within key landscapes, including the Terai Arc, Sacred Himalayan, Kailash Sacred, Chitwan Annapurna, and Kanchenjunga.

Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures.

EIA process - Most practitioners perceive the EIA process in Nepal as highly complicated and lengthy. While the process has undergone some recent amendments – details are not always accessible since all of Nepal's policy is in the local language. A vital first step is translating regulatory documents into English and Chinese. There is also a need for training programs to clarify the ESIA process for practitioners, including standards of public inclusion of local communities into the process. Public disputes of an assessment often go into multiple cycles of claims and counterclaims as "indirect impacts" of a project are not quantified in the ESIA process and thus cannot be proven. Due to such loopholes, most environment-related disputes initiated by communities not directly impacted, as per the ESIA, tend to drag on for a long time (The Asia Foundation, 2021).

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Nepal has landscape-level management plans developed by conservation agencies and forest department personnel.

Data - There is a need for open-access data repositories and portals to aid LI project development and monitoring within Nepal. Government ministries and international funding agencies have set up resources and portals to aid project monitoring. These resources host information ranging from spatial data layers, development project plans, funding schedules, and more, and could be collated into a single toolkit or portal with access to all stakeholders. An important next step would be to mandate all actors within the project planning processes (i.e., EIA agents, policymakers, and civil society organizations) to not only refer to the portal

but also contribute to it by updating new layers, research, and data, to ensure that information on the portal remains updated and relevant. There is also a need to translate and collate existing resources into additional languages for broader access.

Pakistan

Despite the prevalence of government institutions dedicated to environmental sustainability, biodiversity conservation remains a weak priority in Pakistan, especially concerning LI and economic development.

Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. The most pressing challenge in Pakistan is the lack of a well-trained workforce that operates within high standards to conduct environmental impact assessments of linear infrastructure projects. An evaluation and enforcement tool could also be effective, such as federally-designated criteria for robust ESIAs.



Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards.

Communities - While there is growing recognition of the importance of biodiversity safeguards for LI amongst advocacy groups, this is not the case for government officials (specifically in the CPEC Authority) or rural and tribal populations. These key stakeholder groups fall prey to an antiquated industrial-era development narrative that posits economic development comes at the expense of environmental conservation and sustainability and that people must exploit their natural resources for development. One of the most significant challenges to encouraging biodiversity safeguarding for LI in Pakistan is thus reframing the commonly accepted narrative of investment versus environment.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Pakistan.

Research needs - Further research is needed to better prepare Pakistan for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. There is a need to establish multi-stakeholder platforms to engage individuals from local and indigenous groups, civil society, government, industry, and others to discuss regional biodiversity conservation. WWF is leading the way in this effort and has already designed a methodology that requires funding and additional capacity. Additionally, Gilgit-Baltistan has many LI projects still in the planning stages allowing for proactive conservation efforts to be focused within the region.

Rwanda

Rwanda is home to an impressive breadth of biodiversity, especially in the Albertine rift, which is home to more species of vertebrates than anywhere else in Africa. PAs in Rwanda have supported an increase in the country's iconic mountain gorillas and thus far remain relatively unimpacted by major infrastructure development. However, outside of these PAs high level of biodiversity exists in a fragmented landscape. Mining essential minerals utilized in the transition to renewable energy sources is a particular concern in this landscape, where mineral deposits frequently overlap areas of high biodiversity.



Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. There is a clear need in Rwanda to mainstream Biodiversity into ESIA processes. This could be achieved by reissuing the ESIA Guidelines from 2006 to include clear and actionable directives for these managers. In May of 2021, Rwanda requested to do precisely this. The current status of the project does not appear to be publicly available. There may be room to facilitate and support this process. Building capacity for ESIA by providing training, tools, and investments to the professionals involved in EIA processes in Rwanda could help boost limited capacity and ensure a more effective process. There are already civil society groups to plug directly into, for example, the Rwanda Association of Professional Environment Practitioners. Some of them acknowledged needs include training related to implementation, annual environmental audits, and monitoring. Providing explicit standards for public inclusion into ESIA, as there are currently no directives or requirements ensuring that the space is inclusive, well-advertised, and fairly facilitated such that all voices are heard.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Mandating and funding REMA to pursue high-level coordination on large infrastructure projects. There is currently no centralized biodiversity institution, so REMA is the best option to facilitate high-level coordination between ministries, developers, financiers, NGOs, and other stakeholders for large LI projects.

Tanzania

Five major development corridor projects are underway in Tanzania; the extensive infrastructure development within these corridors threatens endemic biodiversity, a UNESCO World Heritage Site, and ecological connectivity. Despite Tanzania's high percentage of protected areas (38%), the presence of many wide-ranging species like elephant, lion, cheetah, wildebeest, and African wild dog may be lost from even the most extensive natural areas if agricultural land conversion, infrastructure development, and urbanization continue to fragment and isolate protected areas.¹⁷

Opportunities for Engagement

Capacity building - Workforce training, guidelines, best practices, and other capacity-building measures are needed



to provide expertise for project proponents and conservation practitioners to plan LI that avoids critical habitat or implements effective mitigation measures. Particular emphasis should be paid to government officials' capacity-building efforts to ensure a more substantial knowledge base at the upper echelon of the decisionmaking process. Open access and easy-to-understand literature on the importance of environment and climate are needed for all levels of LI project actors.

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. There is a need for further training for Tanzanian professionals and regulators carrying out ESIAs, including training on best practices for effective and meaningful stakeholder engagement.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. This could be done by coordinating with existing research and NGOs to create a collaborative network of practitioners in a transboundary initiative with Kenya, building off existing relationships from the Southern Kenya Northern Tanzania (SOKNOT) work.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Tanzania. Establishing a long-term repository of wildlife data related to linear infrastructure (i.e., roadkill or electrocutions) would benefit various stakeholders.

Research needs - Further research is needed to better prepare Tanzania for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Developing a monitoring protocol and standardizing data collection methods to monitor the effects of linear infrastructure development and its associated impacts on wildlife and habitat within Tanzania is recommended. There is a need to develop and implement a proactive mitigation plan for safeguarding wildlife from future energy infrastructure through engagement with USAID's Power Africa-funded East Africa Energy Program (EAEP).

Vietnam

Vietnam has exceptionally high endemism, and new species are frequently being described. The country boasts 30 national parks, 58 nature reserves, 11 conservation sites, 45 landscape protection sites, and 20 sites for scientific research and experimentation.¹⁸ As roads support the vast majority of transportation, the government of Vietnam has planned to expand national highways significantly in the next few years, especially to improve regional connectivity and better support trade flows. Future development includes eight national road upgrades and 136 National road projects (with roads totaling 33,458 km), highlighting the need to safeguard biodiversity from the negative impacts of LI development.

Opportunities for Engagement

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. Formal procedures and protocols are needed for ESIA practitioners. Project developers are responsible for hiring ESIA consultants (instead of



government departments). This creates an increased risk of ESIA consultants being pressured to underplay or minimize the detrimental impacts of LI in their reports.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. The lack of interministerial coordination and transparency in governance is a huge challenge in Vietnam. Developing, facilitating, and funding coordination groups and coalitions could aid in breaking down these silos.

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Vietnam. A centralized data portal, including biodiversity data, would benefit stakeholders.

Zambia

Zambia is home to a large patchwork of important ecosystems, and LI poses a severe threat to ecological connectivity across these systems. 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. The current debt crisis provides a unique opportunity thanks to 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.



Opportunities for Engagement

EIA process - The Environmental and Social Impact Assessment (ESIA) is a critical tool in assessing a linear infrastructure development project's impact on the environment and society. Zambia needs an overhaul, or at the very least amendments, aimed at incorporating scientific standards, clear regulatory frameworks, and reducing subjectivity in the EIA process. Incorporating other legal structures to ensure a more significant role for the Ministry of Lands, Natural Resources and Environmental Protection in safeguarding projects across ministries and bolster their effectiveness in interventions.

Collaborative Platforms / Coordinating Entities - There is a need to create a coordinating entity that includes developing local or landscape-level working groups that include developers, contractors, and conservation practitioners to enable the implementation of existing policies, rules, and safeguards. Facilitating interministerial coordination by working with WWF Zambia and others to help establish a coordinating body within the government (ideally - according to one interviewee - housed in the office of the Vice-President for most impact).

Data - There is a distinct need for open-access data repositories and portals to aid LI project development and monitoring within Zambia. A centralized data portal, including biodiversity data, would benefit stakeholders.

Research needs - Further research is needed to better prepare Zambia for linear infrastructure development that is climate resilient, meets the needs of society, and avoids or mitigates negative impacts on biodiversity. Specific funding for baseline biodiversity assessments on which to build long-term pre- and post-construction monitoring efforts would be valuable. Developing a monitoring protocol and standardizing data collection methods to monitor the effects of linear infrastructure development and its associated impacts on wildlife and habitat within Zambia is also recommended to expand the field of knowledge further.

Citations

- 1. van der Ree, R., Smith, D., & Grilo, C. (2015). *The Ecological Effects of Linear Infrastructure and Traffic* (pp. 1– 9). https://doi.org/10.1002/9781118568170.ch1
- 2. United Nations. (2021). *The Sustainable Development Goals Report 2021*. United Nations. https://unstats.un.org/ sdgs/report/2021/The-Sustainable-Development-Goals-Report-2021.pdf
- 3. Laurance, W. F., Goosem, M., & Laurance, S. G. W. (2009). Impacts of roads and linear clearings on tropical forests. *Trends in Ecology & Evolution*, *24*(12), 659–669. https://doi.org/10.1016/j.tree.2009.06.009
- Wu, S., & Li, B. V. (2022). Sustainable linear infrastructure route planning model to balance conservation and socioeconomic development. *Biological Conservation*, 266, 109449. https://doi.org/10.1016/j.biocon.2022.109449
- Gavin, M. C., McCarter, J., Berkes, F., Mead, A. T. P., Sterling, E. J., Tang, R., & Turner, N. J. (2018). Effective Biodiversity Conservation Requires Dynamic, Pluralistic, Partnership-Based Approaches. *Sustainability*, *10*(6), Article 6. https://doi.org/10.3390/su10061846
- 6. IPBES. (2022). Summary for policymakers of the methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Zenodo. https://doi.org/10.5281/zenodo.7075892
- 7. Ament, R., Clevenger, A. P., & van der Ree, R. (2023). Addressing ecological connectivity in the development of roads, railways and canals (Forthcoming) (Protected Area Technical Report Series). IUCN.
- 8. Wang, D. C. N. (2022). China Belt and Road Initiative (BRI) Investment Report 202. 28.
- 9. Hughes, A. C. (2019). Understanding and minimizing environmental impacts of the Belt and Road Initiative. *Conservation Biology*, 33(4), 883–894. https://doi.org/10.1111/cobi.13317
- Wang, X., Wong, Y. D., Yuen, K. F., & Li, K. X. (2020). Environmental governance of transportation infrastructure under Belt and Road Initiative: A unified framework. *Transportation Research Part A: Policy and Practice*, *139*(C), 189–199.

11. Loughlin, N., & Grimsditch, M. (2021). How local political economy dynamics are shaping the Belt and Road Initiative. *Third World Quarterly*, *42*(10), 2334–2352. https://doi.org/10.1080/01436597.2021.1950528

12. Boyle, D., & Turton, S. (2019). *Plundering Cambodia's forests*. AlJazeera. https://interactive.aljazeera.com/aje/2019/plundering-cambodias-forests/index.html

- Kaczensky, P., Kuehn, R., Lhagvasuren, B., Pietsch, S., Yang, W., & Walzer, C. (2011). Connectivity of the Asiatic wild ass population in the Mongolian Gobi. *Biological Conservation*, 144(2), 920–929. https://doi.org/10.1016/j.biocon.2010.12.013
- 14. Olson, K. A., & van der Ree, R. (2015). Railways, Roads and Fences Across Kazakhstan and Mongolia Threaten the Survival of Wide-Ranging Wildlife. In *Handbook of Road Ecology* (pp. 472–478). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118568170.ch58
- 15. Western, D., Russell, S., & Cuthill, I. (2009). The Status of Wildlife in Protected Areas Compared to Non-Protected Areas of Kenya. *PLOS ONE*, *4*(7), e6140. https://doi.org/10.1371/journal.pone.0006140
- 16. Huijser, M. P., Clevenger, A. P., McGowen, P., Ament, R., & Begley, J. S. (n.d.). *Oyu Tolgoi Roads and Wildlife Mitigation Report*. 119.
- 17. UNEP-WCMC. (2022). Protected Area Profile for United Republic of Tanzania from the World Database of Protected Areas. www.protectedplanet.net
- Ministry of Natural Resource and Environment. (2020). Vietnam national biodiversity Strategy. https://www.cbd.int/doc/world/vn/vn-nbsap-v3-en.pdf