Photo: Increased vehicular movement produces air pollution, noise pollution, vibrations, light pollution and wildlife–vehicle collisions. © Jacqueline Rohen

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

CHAPTER 5

Roads, Apes and Biodiversity Conservation: Case Studies from the Democratic Republic of Congo, Myanmar and Nigeria

Introduction

As demonstrated throughout this volume, road construction is a leading cause of habitat fragmentation and loss. It reduces wildlife connectivity, threatening the survival of species by impeding their ability to move across a landscape in search of food and shelter and to mate. It also increases human access to, and the destruction and degradation of, previously remote and undisturbed areas, including essential forests (Laurance, Goosem and Laurance, 2009).

In addition to land use changes and loss of connectivity, road development alters the characteristics of habitats both close to and distant from the road, thereby changing the way wild animals use these habitats. Roads affect the movement of water and the patterns

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

and severity of erosion, while increased vehicular movement produces air pollution, noise pollution, vibrations, light pollution and wildlife–vehicle collisions. By facilitating wildlife poaching, improved access has a particularly significant impact on species survival (Laurence *et al.*, 2009).

Increased human encroachment into ape habitat exposes apes to greater hunting pressure and an increased risk of disease transmission, while also confronting them with a loss of habitat and connectivity. In 2002 the United Nations Environment Programme (UNEP) projected that by 2030 only 10% of the original gorilla range would be free of human impact, primarily as a result of infrastructure development, agricultural expansion and logging (Nellerman and Newton, 2002). This habitat destruction and fragmentation is one of the major threats to ape survival.

At the same time, roads can result in substantial economic and social benefits, which tend to form the cornerstone of national economic development plans, although these are not always realized (Berg *et al.*, 2015; see Chapter 2, pp. 60–77). There are therefore trade-offs between improving human well-being and protecting the environment.

This chapter explores how advance planning that is evidence-based, inclusive and effectively implemented, monitored and evaluated can help to minimize the negative impacts of road development on biodiversity. To that end, it examines the interface between road development and the environment, focusing on the impact on apes in particular. The chapter presents three case studies on proposed and continuing road development in ape ranges in Africa and Asia:

- the Cross River superhighway of Cross River State, Nigeria;
- the Dawei road link between Thailand and Myanmar; and
- the High-Priority Roads Reopening and Maintenance (Pro-Routes) project of the Democratic Republic of Congo (DRC).

The first case study presents the context of the proposed Cross River superhighway, which is to connect a new deep seaport at Calabar in southeastern Nigeria to landlocked Chad and Niger. While the rationale behind the project appears to have some merit, the proposed highway will stop about 1,000 km short of Nigeria's northern border. Furthermore, Nigeria already has eight major seaports and experts doubt there is sufficient economic justification for constructing another one in Calabar (Shipping

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Position Online, 2016). Moreover, the Calabar River is relatively shallow and prone to siltation, which is exacerbated by surrounding logging and deforestation, and consequently the "deep seaport" will require periodic and expensive dredging (Vanguard, 2015). In addition to considering the project's environmental and social impacts, the case study examines the role that local and international non-governmental organizations (NGOs) can play, especially in relation to drawing attention to the lack of adequate impact assessments, consultation and planning. It also highlights that thoroughly conducted environmental impact assessments (EIAs) are key tools for ensuring the integration of biodiversity conservation into all types of infrastructure planning (see Box 1.6).

The second case study focuses on the proposed 138 km road from the Thai border to the planned Dawei Special Economic Zone (DSEZ), an area that is to cover 250 km² (25,000 ha) in Myanmar's southernmost region, on the border with Thailand. The road's planned route bisects crucial ecological connectivity. Maintaining that connectivity in an area of weak governance, competing transnational interests and civil struggle urgently requires sustained, innovative approaches to infrastructure planning and design, as well as to conservation and environmental policy. In 2015 and 2016,

Photo: Road construction is a leading cause of habitat fragmentation and loss; one of the major threats to ape survival.
© WWF Myanmar/ Adam Oswell

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

a multidisciplinary team from the World Wide Fund for Nature (WWF) and the University of Hong Kong (HKU) launched a campaign to promote ecological connectivity and sustainability in the region by increasing awareness and building capacity with stakeholders and decision-makers. In addition to several outreach strategies, the team released three reports: the first highlights the ecological systems at risk from the proposed road and argues for robust environmental policies; the second, a manual of sustainable road design, focuses on mitigating impacts on wildlife; and the last provides an explicit yet flexible method of locating wildlife mitigation measures and crossings, despite extremely limited biological and physical data for the area (Helsingen *et al.*, 2015; Kelly *et al.*, 2016; Tang and Kelly, 2016). In light of Myanmar's recent political shift, this case study explains these and other regional conservation initiatives in the context of decades of conflict and recent economic development.

The third case study traces the evolution of the Pro-Routes project, a major road rehabilitation project in the DRC, funded by the International Development Association and the United Kingdom's Department for International Development (DFID). It focuses specifically on the 523 km Kisangani–Bondo segment of this rehabilitation project and its anticipated impact on the Bili–Uélé Hunting Domain and the Bomu Faunal Reserve, referred to hereafter as the Bili–Uélé Protected Area Complex (BUPAC). At the outset, the project stakeholders aimed to consider the potential environmental and social impacts of the road's rehabilitation and planned to implement recommendations to mitigate projected negative impacts. As the case study reveals, however, there is almost no evidence that recommendations were implemented as planned. The study discusses the need for expertise in responsible infrastructure development, the critical role of external conservation specialists and the importance of timely and effective monitoring and evaluation.

Key findings of this chapter include:

- In the case of conflicting priorities, conservation organizations can play an important role in building relationships between various stakeholders by working with government agencies, local communities, industry, political actors and others who are sympathetic to conservation objectives.
- The fact that EIAs are required in relation to road development in all environmentally sensitive areas is useful, but not sufficient for ape conservation, as poorly conceived and conducted assessments can enable ill-advised or poorly designed infrastructure development in essential African and Asian ape habitats.
- Modeling is a valuable method for evaluating potential impacts of infrastructure, as it allows conservation actors to illustrate various scenarios and options to a wide range of stakeholders and decision-makers.
- By engaging with experts from relevant disciplines, project leaders can ensure that environmental factors are adequately addressed in project planning to allow for the development of effective mitigation measures.
- In the context of infrastructure development, integrated land use planning can serve to mitigate environmental and social impacts while also contributing to greater coordination, such as across ministries and within national agencies.
- Wherever landscapes do not have explicitly delineated areas for more traditional conservation planning, it is critical that conservation and environmental actors join forces, avoid overlaps in engagement and speak with one voice.

► p. 164

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

CASE STUDY 5.1

On a Road to Nowhere? The Proposed Calabar–Ikom–Katsina Ala Superhighway Project in Cross River State, Nigeria[1]

Introduction

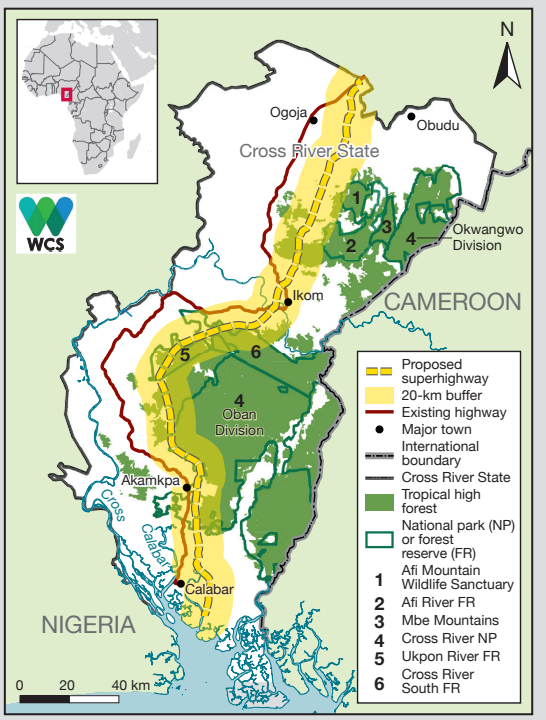
With a population of more than 180 million people and massive oil reserves, Nigeria is Africa's giant, and, despite a recession, Africa's largest economy (*The Economist*, 2014). But the country has failed to live up to expectations for growth and development since independence in 1960 and now lags far behind comparable countries, such as Malaysia and Indonesia (Sanusi, 2012). The reasons behind this underdevelopment are complex, but endemic corruption and chronic mismanagement by a series of military and civilian governments are most likely to blame (Ojeme, 2011). Promising to tackle corruption, Nigeria elected a new leader, Muhammadu Buhari, in May 2015. New governors, who traditionally enjoy unrivalled autonomy in Nigeria, were elected at the same time in all 36 states of the federation.

The self-proclaimed environmentalist Benedict Ayade was appointed as the new governor of Cross River State. He soon announced a number of signature projects, including the construction of a six-lane, 20-km-wide, 260-km-long superhighway to connect a new deep seaport with northern Nigeria. The governor further boasted that this "digital superhighway" would be designed for the 21st century, with Internet connectivity along its entire length. Although Nigeria is in the grips of its biggest recession to date and Cross River is one of the most indebted states in the country—due to massive borrowing by previous governors to fund their own signature projects—an estimated US$2.5 billion has been budgeted for this ambitious project (Olawoyin, 2017; PGM Nigeria, 2016a, 2016b). Funding sources have not been disclosed, however, and although some potential investors reportedly pulled out, perhaps due to delays and controversy, it appears that a number of Chinese investors are still interested in the project (*This Day*, 2016). Designed to create jobs and sustainable revenue for Cross River State, the superhighway and deep seaport are to be developed and managed through a public–private partnership. At the time of writing, the superhighway was to pass through some of the state's most pristine remaining forests, including Cross River National Park, with catastrophic consequences for wildlife (Akpan, 2016a).

In September 2015, the initial groundbreaking ceremony for the superhighway was canceled at the last minute when the federal government realized that no EIA had been undertaken. In Nigeria, the law requires EIAs for all major development projects (Federal Republic of Nigeria, 1992). This was a huge political embarrassment for Governor Ayade. A compromise deal was soon reached, however, and the Federal Ministry of Environment issued an "interim EIA" to allow the groundbreaking ceremony to go ahead, on the understanding that no work would start until an EIA was submitted and approved.

FIGURE 5.1

The Proposed Cross River Superhighway



© WCS

Amid much pomp and ceremony, President Buhari arrived in Calabar on October 30, 2015, and performed the groundbreaking event. Through this act, Buhari tacitly gave the federal government's consent for the superhighway project, but Environment Minister Amina Mohammed would play a key role in ensuring that the state government had to produce an acceptable EIA (Akpan, 2016b).

Background

UNESCO has proposed that Cross River National Park—Nigeria's richest site for biodiversity—be listed as a Man and the Biosphere Reserve and potentially a World Heritage Site. WWF and the International Union for Conservation of Nature (IUCN) recognize the park as a Centre of Plant Diversity, and Birdlife International classifies it as an Important Bird and Biodiversity Area (Fishpool and Evans, 2001).

Within Cross River National Park lie the Oban Hills, whose biological importance was recognized as early as 1912, when a large part of the area was gazetted as a forest reserve (Oates, 1999). In 1991, the reserve was upgraded to create the Oban Division of Cross River National Park, through which the superhighway is now expected to pass (Oates, Bergl and Linder, 2004). Covering around 3,000 km² (300,000 ha) of lowland rainforest, the Oban Division is the largest remaining

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

area of rainforest in Nigeria and is contiguous with the Korup National Park in Cameroon. With peaks reaching between 500 m and 1,000 m, the Oban Hills are also an extremely important watershed, giving rise to numerous rivers that guarantee a perennial supply of freshwater to hundreds of downstream communities in Cross River State (Caldecott, Bennett and Ruitenbeek, 1989).

In addition to apes, Oban contains a number of rare and endangered species, such as the Nigeria–Cameroon chimpanzee (*Pan troglodytes ellioti*), drill (*Mandrillus leucophaeus*), Preuss's red colobus monkey (*Procolobus preussi*), leopard (*Panthera pardus*), forest elephant (*Loxodonta cyclotis*), the slender-snouted crocodile (*Mecistops cataphractus*) and the gray-necked rockfowl (*Picathartes oreas*), as well as 75 plant species that are endemic to Nigeria (Oates *et al*., 2004). The area is a center of species richness and endemism, particularly for primates, birds, amphibians, butterflies, fish and small mammals (Bergl, Oates and Fotso, 2007; Oates *et al*., 2004). But the same area is also subject to intense hunting pressure to supply the wild meat trade, and rates of deforestation are among the highest in the world (Bassey, Nkonyu and Dunn, 2010; Fa *et al.*, 2006; FAO, 2015; Okeke, 2013). Given that it combines high levels of species richness and endemism with a high degree of threat, the area represents a biodiversity hotspot of global significance (Myers *et al.*, 2000).

Impact on Apes

Two different apes are found in Cross River State: the critically endangered Cross River gorilla (*Gorilla gorilla diehli*), the most endangered taxon of ape in Africa, and the endangered Nigeria–Cameroon chimpanzee (*Pan troglodytes ellioti*), the most threatened of four subspecies of chimpanzee (Morgan *et al.*, 2011). Due to hunting and habitat loss, these apes are restricted to two protected areas within the state—Cross River National Park and the Afi Mountain Wildlife Sanctuary—as well as a small area of community-managed land within the Mbe Mountains.

The Oban Division of Cross River National Park is expected to bear the brunt of the impact of the superhighway, while its Okwangwo Division will be relatively unaffected (see Figure 5.1). Although Oban supports an estimated 150–350 Nigeria–Cameroon chimpanzees, it does not contain any Cross River gorillas, a species found only in the Okwangwo Division, the Mbe Mountains and the Afi Mountain Wildlife Sanctuary (Dunn *et al.*, 2014; ellioti.org, n.d.). The superhighway only skirts the western edge of the sanctuary, however it directly threatens the Afi River Forest Reserve, a critically important corridor that links the sanctuary to the Mbe Mountains (Dunn *et al.*, 2014). The loss of such corridors in the landscape would be catastrophic for the Cross River gorilla and the Nigeria–Cameroon chimpanzee, as both survive in small isolated groups. The superhighway is expected to lead to massive deforestation along the entire route as farmers from neighboring states move into the area, and as improved access facilitates hunting (Laurance *et al.*, 2017a).

International Pressure Mounts

On October 20, 2015, ten days before the groundbreaking ceremony, a coalition of 13 international and national NGOs, including Birdlife International, the Wildlife Conservation Society (WCS) and the Zoological Society of London, submitted a letter to President Buhari expressing concern about the superhighway. In the letter, they conveyed support for the ongoing EIA but declared their outrage concerning plans for the superhighway to traverse Cross River National Park.[2] The route of the superhighway was subsequently adjusted, yet some argued that it was still too close to the edge of the national park and objected on the grounds that it would pass through some important community forests and forest reserves (Cannon, 2017b).

On January 22, 2016, the Cross River government published a notice of revocation of rights of occupancy within a 20-km-wide land corridor along the entire highway route (MLUD, 2016; see Figure 5.1). This single act dispossessed more than 185 communities within the corridor of their land, subjecting them to displacement at any time. With the notice, the state seized a land area of 5,200 km^2 (520,000 ha), or about 25% of the state's total area. Communities that had initially supported the superhighway rose up in revolt when they realized that they had been robbed of their ancestral lands overnight. Many people within the state began to call the superhighway project an elaborate land grab in disguise (Abutu and Charles, 2016).

Once freed of its occupants, this vast area of forest would represent an opportunity to generate significant revenue, first through the sale of the timber and then through conversion of the land to oil palm plantations. Even though the EIA had not yet been finalized, in February 2016 a number of bulldozers started the clearing and felling of trees along the proposed route. Some of the affected communities, such as Old and New Ekuri, blocked the bulldozers from entering their forest, but many more were powerless to prevent the destruction of their forests.

Direct intervention finally came in the form of a stop work order, issued by Environment Minister Mohammed in March 2016. The order forced the governor to suspend activities on the superhighway and await the outcome of the EIA (Ihua-Maduenyi, 2016). That same month five ambassadors of the UNEP–UNESCO Great Apes Survival Partnership sent a letter to the environment minister expressing concern regarding increasing threats to the integrity of the rainforests of Cross River National Park and requesting that the Nigerian government respect commitments made as part of the 2005 Kinshasa Declaration on Great Apes and UN-REDD (Reducing Emissions from Deforestation and Forest Degradation).[3]

Environmental Impact Assessment and Review Process

The EIA law in Nigeria exists to safeguard the population and environment with regard to any form of environmental degradation resulting from development projects. This legislation prohibits activities from being carried out in sensitive areas in the absence of mandatory studies.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Photo: The Cross River gorilla survives in small isolated groups in the Cross River National Park, Afi Mountain Wildlife Sanctuary and a small area of community-managed land in the Mbe Mountains. © WCS Nigeria

The environmental management consultancy PGM Nigeria Limited prepared an EIA of more than 400 pages on behalf of the government of Cross River State; in March 2016, it was submitted to the federal government for approval (PGM Nigeria, 2016a). Environment minister Mohammed appointed an independent review panel to assess the EIA and the document was circulated for public comments in April 2016. A professional review of the EIA, completed by the consultancy Environmental Resources Management on behalf of the international NGOs, identified 11 main flaws in the EIA. The review found that due to these flaws, the assessment could not be used as intended, namely to identify potential impacts of the project or to recommend adequate mitigation measures (ERM, 2016). The 11 main flaws were that:

- the scoping process was inadequate and provided no information on the rationale or analytical process that was adopted;
- baseline data were unclear, inconsistent, frequently contradictory and often incorrect;
- the project description was fundamentally flawed, most critically in that it failed to consider any impacts due to the 20-km-wide corridor of land acquired by the government of Cross River State along the entire route of the proposed superhighway;
- the EIA did not provide cost–benefit analyses for any of the proposed routes, a clear economic justification for the superhighway or reasons for building a new road as opposed to upgrading the existing highway;
- the EIA failed to consider the impacts of the superhighway on nearby protected areas, namely Cross River National Park, Afi Mountain Wildlife Sanctuary, Afi River Forest Reserve, Ukpon River Forest Reserve and Cross River South Forest Reserve;
- stakeholder engagement was extremely limited and failed to meet accepted standards as outlined by Nigerian legislation;
- the EIA failed to identify measures required to monitor effective mitigation of the impact of the superhighway;
- mitigation measures were described at a conceptual level only, with insufficient detail for implementation;
- the EIA failed to mention the presence of many rare and endangered species within the area, such as the critically endangered Preuss's red colobus and the slender-snouted crocodile;
- although more than 185 communities are likely to be affected by the proposed project, the socioeconomic study focused on only 21 communities and failed to assess the full impact on all affected communities, their livelihoods and vulnerability; and
- there was no consideration of any cultural heritage data (ERM, 2016).

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

NGOs Increase the Pressure

In May 2016 a second letter—this one from 13 international NGOs, including the Arcus Foundation, Fauna and Flora International (FFI), WCS and WWF—expressed further concern about the quality of the recently concluded EIA, requested that it be redone and called for compensation to be paid to affected communities.[4] In addition to these international NGOs, a number of national NGOs have also played a key role in the campaign against the superhighway (Uwaegbulam, 2016). Many local NGOs issued press releases or sent letters of protest, some on behalf of local communities, and a number of local NGOs brought lawsuits against the state government, although none was successful. Among the most active NGOs were the Ekuri Initiative, which has received international accolades for forest stewardship, the Nigeria office of the Heinrich Böll Foundation, the NGO Coalition for the Environment, and the Rainforest Resource and Development Centre (Akpan, 2017).

Rainforest Rescue in Germany organized an online petition against the superhighway, which drew more than 254,000 signatures—34,000 from Cross River State and 220,000 from concerned individuals worldwide. In September 2016, the petition was delivered to President Buhari through the Ministry of Environment in Abuja (Akpan, 2016c). Both the traditional press and social media have carried numerous stories and updates on the issue (Ingle, 2016). By April 2017, another 135,000 people had signed a separate WCS online campaign against the superhighway (WCS, n.d.).

A public meeting was held in Calabar in June 2016 to allow all stakeholders to present their views and opinions to the official review panel (Akpan, 2016b). The Federal Ministry of Environment, which eventually gave the EIA a "D" rating for gaping oversights and errors, ordered the assessment to be redone (Dunn, 2016). It subsequently rejected the revised EIA, a document of more than 600 pages submitted in September 2016, on the grounds that it still failed to meet basic international standards and that:

- there still had been no public consultation or dialog with important stakeholders, such as Cross River National Park;
- baseline data were still absent or weak;
- there was no consideration of the impacts of the 20-km-wide corridor;
- the economic justification for building a new superhighway, rather than simply upgrading the existing Calabar–Ogoja federal highway, had not been clearly demonstrated;
- there was insufficient consideration of the negative impact on local people;
- the EIA used the proposed national park boundary, which was never gazetted, rather than the current *legal* park boundary;
- the EIA failed to acknowledge the fact that the superhighway, as proposed, would pass through the national park;
- the EIA stated that there are no protected areas within the project area or within 50 km of the proposed area and that there are no protected areas within the sphere of influence of the proposed project, yet there are no fewer than five protected areas within the project area and the proposed route of the superhighway would pass directly through three different protected areas—Cross River National Park, Ukpon River Forest Reserve and Cross River South Forest Reserve—and the 20-km-wide corridor would also impact the Afi Mountain Wildlife Sanctuary and Afi River Forest Reserve (Dunn, 2016; Dunn and Imong, 2017; PGM Nigeria, 2016b).[5]

In the absence of an approved EIA, tensions mounted and the state government threatened to resume work on the superhighway, even without approval from the federal government (Vanguard, 2017). During preparation of a third version of the EIA, the Cross River State government finally became attentive to the environmental concerns and approached WCS for help. After a number of meetings with WCS, the state government announced in February 2017 that it was dropping all plans for the 10-km corridor on either side of the highway (Ihua-Maduenyi, 2017). However, since the route was still due to pass through some important Ekuri, Iko Esai and other community forests on the edge of Cross River National Park, as well as Ukpon River Forest Reserve and Cross River South Forest Reserve, conservation groups called on the government to do more (Cannon, 2017c).

Options for the superhighway were discussed, including rerouting it around the forests, even though such modifications would make the highway slightly longer and would increase the overall cost. In March 2017 in Calabar, at a stakeholder forum convened by the Federal Ministry of Environment to review the third version of the EIA, Governor Ayade announced the willingness of the Cross River State government to reroute the highway around the Ekuri community forest (Cannon, 2017a). While this was welcome news, stakeholders continued to demand that the highway be rerouted away from the Ukpon River Forest Reserve and Cross River South Forest Reserve. Finally, in April 2017, the state government agreed to reroute the highway away from most of the remaining forest (Cannon, 2017b; see Figure 5.1).

The fourth version of the EIA and a new biodiversity action plan were submitted to the Federal Ministry of Environment in May 2017 (PGM Nigeria, 2017). Significant improvements included the revocation of the 20-km-wide corridor and the rerouting of the superhighway to avoid important community forests and forest reserves on the edge of the national park. However, this version of the EIA also relied on inadequate data, and therefore its proposed mitigation measures could not be considered valid. Moreover, the EIA failed to assess indirect long-term impacts of hunting and habitat loss on Cross River National Park despite its proximity to the superhighway and improved access to the forest.[6]

Although WCS and others recommended that both the EIA and the biodiversity action plan be rejected, the Federal

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Photo: The superhighway is expected to lead to massive deforestation along the entire route as farmers from neighboring states move into the area, and as improved access facilitates hunting. © WCS Nigeria

Ministry of Environment issued provisional approval of the EIA in July 2017. In so doing, the ministry specified no fewer than 23 conditions to be addressed and requested that the EIA be revised and resubmitted within two weeks. These conditions included the development of a biodiversity offset; a revised map on which the new route was to be clearly indicated; a resettlement action plan, including a list of affected communities; and compensation payments to affected communities.[7] At the time of writing, these conditions had not been met and, despite some misleading reports in the press, the ministry had not yet approved the EIA, nor had it issued an environmental impact statement or an EIA certificate.

REDD, Climate Change and Conflicting Policies

In September 2008, the UN Development Programme, UNEP and the Food and Agriculture Organization jointly established the REDD+ program in Nigeria, where it is being piloted in Cross River State. Three years later, Nigeria received a US$4 million REDD+ grant to realize the program's Readiness Project, which includes the preparation and implementation of REDD+ strategies with the active involvement of indigenous peoples, forest-dependent communities and other local stakeholders. In September 2016, the REDD+ program in Nigeria approved a new US$12 million strategy, one designed to deepen the initiative nationwide to combat climate change through improved forest governance (Uwaegbulam, 2016). That same month, President Buhari signed the Paris climate agreement and promised commitment from Nigeria as part of the global effort to reverse the negative effects of climate change. The construction of the superhighway as proposed would certainly conflict with the proposed REDD+ program under pilot in Cross River State, threatening the continuation of future funding from the UN.

Conclusion

Nigeria's Ministry of Environment has played an exemplary role in upholding the law, notably by insisting that the Cross River State government produce an EIA and by subjecting that EIA to critical review. In this respect, the leadership of Amina Mohammed, federal minister of environment at the time and currently Deputy Secretary-General of the United Nations, was instrumental. Without the strong leadership of the ministry, NGO concerns over the superhighway may have been brushed aside. The role of NGOs, both national and international, in opposing the superhighway has also been critical; NGOs were able to exploit social media and online petitions to generate publicity for their campaign.

Although the most recent EIA integrates an environmental and social management plan as well as a biodiversity action plan, it still fails to evaluate the long-term costs of the project. Given that every version of the EIA was paid for by the proponents of the very project it was meant to assess, it is not surprising that the analysis and results were unduly influenced. Despite significant environmental, social and financial concerns, the federal government is likely to succumb to political pressure and may eventually allow the superhighway to proceed without a comprehensive EIA and even though the construction of the deep seaport remains uncertain.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

CASE STUDY 5.2

Engineering Conservation: Stories and Models of Infrastructure, Impact and Uncertainty in Southern Myanmar

Introduction

Tanintharyi, Myanmar's southernmost region, shares an extensive border with Thailand along the Dawna and Tenasserim mountain ranges and harbors some of the last remaining large forest areas in the Greater Mekong subregion. This landscape is home to several endangered species, including the lar gibbon (*Hylobates lar*), Asian elephant (*Elephas maximus*), northern pig-tailed macaque (*Macaca leonina*), stump-tailed macaque (*Macaca arctoides*), langur (*Semnopithecus*) and tiger (*Panthera tigris*) (WCS, 2015a; WWF, 2016).

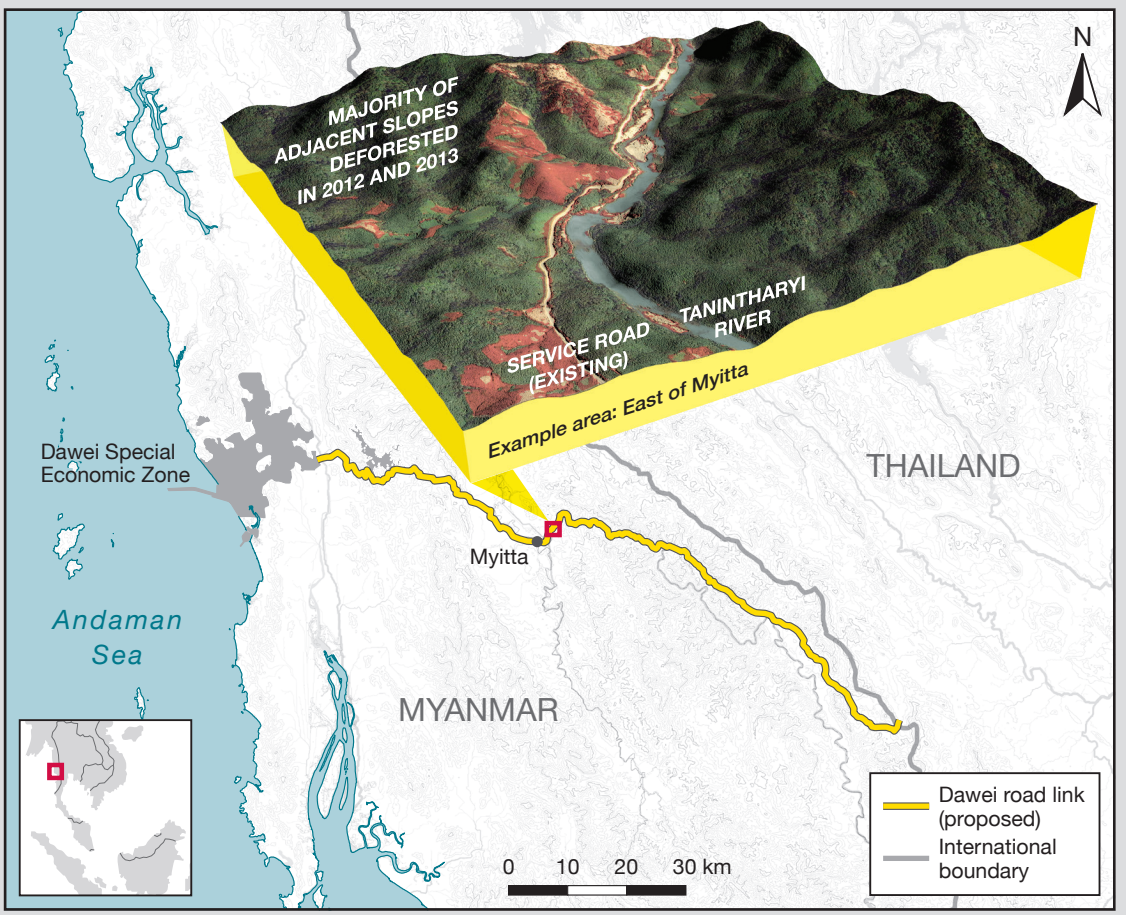
Isolated politically and economically due to more than half a century of civil war between ethnic groups and the Myanmar military regime, this region is now witness to intense pressure from domestic and transnational development proposals, weak land rights and large-scale exploitation of natural resources (Hunsberger *et al*., 2015; Simpson, 2014). Since 2012, a ceasefire has been in effect between the Myanmar government and the Karen National Union (KNU), an opposition group that represents the Karen ethnic groups and still controls large areas of Tanintharyi Region (KNU, 2012).

New Conservation Efforts along the Road Corridor

Starting in 2008, the governments of Myanmar and Thailand agreed to collaborate on a series of projects, including the Dawei Special Economic Zone. Critical to the planned 250-km^2 (25,000-ha) DSEZ is a 138 km road link that will connect the economic zone to the Thai border (see Figure 5.2).

FIGURE 5.2

The Dawei road link and deforestation East of Myitta



Source: Helsingen *et al*. (2015, p. 13)

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

This relatively short segment is the western end of the Greater Mekong Subregion's Southern Economic Corridor, a largely completed major trade route connecting Bangkok and Ho Chi Minh City (ITD, 2012). While the DSEZ and Dawei road link are key projects for renewed investment in Myanmar, political uncertainty related to the country's 2011 democratic transition, coupled with Thailand's 2014 military coup, KNU control of the border area and increasing civil society presence, limited investment. As a result, the project's scope has varied greatly over time, alternating between eight-, four-, and two-lane alignments, with and without rail, power lines and gas pipelines (ITD, 2011).

In view of these proposed development projects and the threats they pose to some of the most poorly documented yet biodiversity-rich forests in the Greater Mekong subregion, several international and domestic NGOs began to increase their presence throughout Tanintharyi in 2014. Their efforts have included:

- village and customary mapping by FFI and WCS;
- land cover change mapping by the Smithsonian Institution and a Myanmar-based NGO, Advancing Life and Regenerating Motherland, or ALARM;
- supporting forest management plans of the regional government; and
- biodiversity surveys completed by FFI and WCS, as well as by WWF in partnership with the Karen Environmental and Social Action Network and Karen Wildlife Conservation Initiative (Connette *et al.*, 2016; WCS, 2015a; WWF, 2016).

While land use planning among local government offices, the KNU and NGOs is ongoing and has been somewhat effective in controlling the expansion of agroindustry and mining exploration, road development remains relatively unchecked, despite recent national environmental impact legislation (DDA, TYG and TripNet, 2015; METI, 2015).

Two Decades of Conservation and Ethnic Conflicts

Intense distrust between local civil society and both domestic and international institutions has long plagued conservation efforts in Tanintharyi. This distrust can be traced back to the mid-1990s, when multinational investment financed the precursors of today's DSEZ projects. In 1996, Thailand and the military-ruled Myanmar governments announced an industrial estate and road link, whose scopes and scales were similar to those of today's projects; the Industrial Estate Authority of Thailand completed a feasibility study and the Italian–Thai Development Company, which remains today's principal developer, carried out an initial survey (Arunmart, 1996).

Overlaid on these development proposals was the Myanmar government's controversial Myinmoletkat Nature Reserve, which was gazetted with the help of WCS and the Smithsonian Institution to include KNU-held protected areas, the proposed industrial estate and the road link, as well as the site of Total's Yadana gas pipelines (Mason, 1999; Noam, 2007). The reserve was drawn predominantly on lands governed by the KNU ethnic armed group.

Between 1996 and 2004, the local villagers' landmark lawsuit and settlement against Total's partner Unocal in U.S. courts over the Yadana pipeline drew international attention (ERI, 2009). Given the Myinmoletkat Nature Reserve's link to the Myanmar military government, suspected endorsement by multinational oil companies, unjustifiably large expanse, and a record of forced relocations and disregard for human rights in the protected area, the Myinmoletkat Reserve was heavily criticized by the conservation community abroad (Brunner, Talbott and Elkin, 1998; Mason, 1999).

Within months of Myinmoletkat's establishment in 1997, the Myanmar military made a violent sweep of the planned transport corridor in KNU-controlled Tanintharyi. A Western aid worker noted that "bulldozers were flattening a broad swathe on the heels of the advancing army" (Moorthy, 1997). They destroyed at least eight Karen villages along the route and, in collusion with Thai logging companies, forced repatriation of refugees from Thailand to Myanmar, into an area of heavy fighting (Moorthy, 1997). In 1998, gas started flowing in the Yadana pipeline, which has since accounted for a significant portion of the national government's export income (Simpson, 2014).

In 2005, Myinmoletkat was turned into the substantially smaller Tanintharyi Nature Reserve Project, about 30 km north of the planned Dawei road link corridor; the reserve served as part of Total's contested corporate social responsibility program, itself funded by the lawsuit settlement and characterized by forced labor and other human rights abuses (ERI, 2009).

Current Status of the Road Corridor

The Dawei road link remains unpaved, despite an upgrade that was carried out between 2009 and 2012 (ITD, 2011, 2012).[8] At the time of writing, construction of the road had stalled due to a lack of investment; the developers were awaiting a final decision from the new civilian Myanmar government.[9] Meanwhile, the situation on the ground remained complicated by demands from villagers for appropriate compensation, competing land ownership claims among internally displaced persons and migrants, imminent refugee return from across the Thai–Myanmar border and military-sanctioned agroindustry land grabs (DDA, 2014). The democratization of land policies, notably in the 2012 Farmland Law and accompanying Vacant, Fallow and Virgin Lands Management Law, has opened up previously protected village lands to market interests and widespread land degradation (Oberndorf, 2012; Simpson, 2015).

In view of the complex situation of conservation and development in Tanintharyi, policy experts and conservation biologists from WWF teamed up with landscape planners, designers and civil engineers from the University of Hong Kong to construct a series of scenarios to predict possible outcomes, build capacity and provide tools for sustainable infrastructure development in southern Myanmar (Helsingen *et al.*, 2015; Kelly *et al.*, 2016; Tang and Kelly, 2016).

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Photo: The forests along the Dawei road, east of Myitta, February 2016. © WWF-Myanmar/Adam Oswell

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Predicting Impact on the Landscape

The best way to limit forest fragmentation as a result of road development is to avoid critical wildlife areas; if that step cannot be taken, it is possible to mitigate fragmentation by maintaining corridors through the construction of wildlife crossings and the management of vehicular traffic. Experience from infrastructure development in Europe and elsewhere has shown it is both more cost-effective and safer when wildlife and ecosystem services are taken into account early on in the planning process (Damarad and Bekker, 2003). Environmental and social considerations, supported by information on ecosystem services and wildlife, are effective when integrated further upstream in planning processes, well before road alignments are proposed.

Due to longstanding deforestation along the Thai border, the terrain running north–south in Tanintharyi is the last remaining link between two of the most significant forest conservation landscapes in tropical Asia: the Western Forest Complex and the Kaeng Krachan Forest Complex in Thailand. These landscapes are home to the lar gibbon and probably support the largest tiger population outside of India and Nepal (WCS, 2015a). Landscape connectivity is critical for both gibbons and tigers, especially as they require large home ranges and intact forest cover. The lar gibbon is a high-canopy species and is rarely found in the understory; loss of canopy connectivity and habitat isolates gibbons and leads to multiple negative effects on the population (Gron, 2010). Establishing and maintaining this ecological corridor would support the movement of gibbons, tigers and other wildlife along the trans-boundary landscape (Kelly *et al*., 2016). Without appropriate measures, the planned road link will lead to increased land cover change and threaten this corridor (Helsingen *et al*., 2015).

Land Change and Impacts on Wildlife

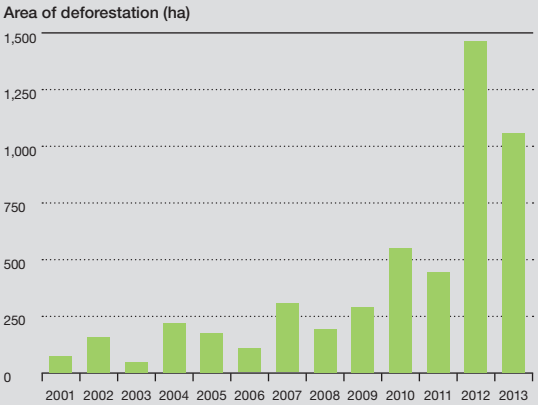
While the current access road for the Dawei road link has existed in some form since around 2000, deforestation has increased significantly in tandem with recent access road construction and upgrades over the past several years (BurmaNet News, 2000; Helsingen *et al*., 2015; see Figures 5.2 and 5.3). Construction of the road link has not yet formally begun, but the access road has been fortified and extended into new areas since 2010. These disturbances and the creation of isolated forest patches change the distribution of species. Unless urgent steps are taken to address deforestation, either through land use controls, infrastructure and investment regulations, or participatory forest management programs, significant habitat loss will continue to threaten Tanintharyi's remaining species.

Cases from Thailand bear witness to the increase in wildlife–vehicle collisions across the region. In one such incident, in 2014, a car crashed into three wild elephants on a road near Thailand's Khao Chamao–Khao Wong National Park, leaving six people and one of the elephants dead (Barbash, 2014). Without appropriate measures, the frequency of wildlife–vehicle accidents on the Dawei road link is likely to rise in ▸

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

FIGURE 5.3

Deforestation within 5 km of the Planned Dawei Road Link, 2001–13



Source: Helsingen *et al*. (2015, p. 13)

line with the increase in traffic volume, speed and number of large vehicles. Gibbons are at high risk of car accidents, as they are uneasy travelling on the ground, while macaques and langur species tend to travel by and inhabit the ground more, which also exposes them to the risk of collisions (Baskaran and Boominathan, 2010). A further complication is that the proposed Dawei road link is meant for nighttime traffic,[10] which means that headlights from passing vehicles will pose particular risks to light-sensitive species such as leopards and other nocturnal wildlife.

Roads also enable poaching and promote the illegal wildlife trade by providing access to previously remote, undisturbed areas (Espinosa, Branch and Cueva, 2014; Clements *et al*., 2014; Laurance *et al*., 2009; Quintero *et al*., 2010). Myanmar is recognized as a major source of illegal animal parts to consumer and re-export markets in China and Thailand (TRAFFIC, 2014). As the road network in Myanmar's rural areas has essentially been unchanged for the past 50 years, options for trafficking wildlife are limited to the main transport corridors (Clements *et al*., 2014). Wildlife markets already exist in the area where the Dawei road link is planned. One wildlife market is held at Three Pagodas Pass, a border crossing between Myanmar and Thailand, just a few hours' drive north of Dawei (Shepherd and Nijman, 2008).

Once constructed, the Dawei road link will significantly shorten travel time to the Thai border. In turn, it is likely to contribute to the illegal wildlife trade—unless preventive measures, such as monitoring and enforcement, are put in place. During field visits in 2015 and 2016, the authors of this study observed numerous hunters and noted that wild meat, including gibbon and langur stew, was served in restaurants along the road. One restaurant owner reported that he bought primate meat from hunters from the surrounding forests for about US$1.50 per pound (US$3.30 per kg). As road traffic increases, wild

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Photo: Deforestation along the access road for the Dawei road link, east of Myitta, February 2016.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Photo: The Dawei road link currently remains unpaved, and already the majority of adjacent slopes have been deforested. The project's scope has varied greatly over time, alternating between eight-, four-, and two-lane alignments, with and without rail, power lines and gas pipelines.

game is reportedly becoming scarcer and the price paid for primate meat is rising (WWF, 2014). There is a need for further studies in this area.

Applying Algorithms and Strategic Road Designs in Scenario Modeling

This section outlines how scenario modeling can be used to decide how and where on the planned Dawei road link to implement road mitigation measures specific to primate habitat and movement patterns.

Scenario modeling is a process often used in regulatory instruments such as EIAs to evaluate the potential impact of infrastructure on the environment. An EIA typically describes the proposed scenario and simulates the environmental, social and economic outcomes of a given project. It lays out the threats and possible mitigation measures required to encourage sustainable development. It also models alternative options such as a "no-build" scenario or "best-case" scenario, along with associated outcomes, in order to aid planners and governments in making informed decisions.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

However, while a typical scenario modeling process provides options, it does not offer enough flexibility to support decision-making in rapidly changing contexts with poor legislation enforcement, such as in Myanmar. The evolving economic, social and political context of the Dawei road link requires an alternative approach to typical scenario modeling (Alcamo, 2008). As described below, WWF and HKU undertook several alternative approaches, both technical and story-based, to support the sustainable development of the transport corridor and raise community and government awareness of sound environmental and engineering choices.

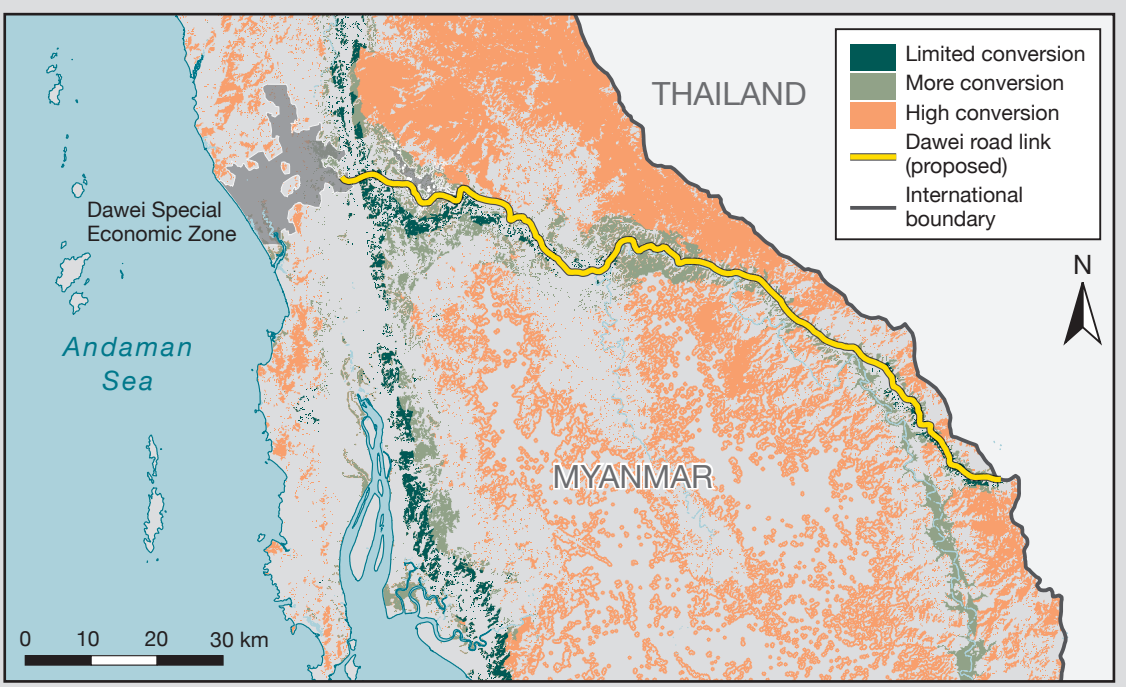
In three reports on the planned Dawei road link, WWF and HKU utilized different yet complementary methods of modeling scenarios. The first predicts land use conversion due to development and the resulting environmental threats; it calls for a considered and transparent planning process that involves multiple stakeholders. The second offers a toolkit for sustainable infrastructure design, construction and maintenance possibilities; it constructs scenarios and their impacts for typical sites along the road link. While not scenario-based, the third model was pioneered and used to predict multispecies movement patterns and to identify locations for mitigating the road link's impact on wildlife.

For the first approach, land use conversion was modeled using Natural Capital Project's InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) Scenario Generator (see Figure 5.4). Three land use scenarios were produced using selected inputs, including the likelihood of change, the different kind of physical and environmental factors that influence change and the quantity of change under different scenarios (McKenzie *et al*., 2012). In the "limited" and "more" land use conversion scenarios, expanding frontiers of deforestation are primarily concentrated around existing and planned roads and settlements. In contrast, the "high" land use conversion scenario predicts a future with extensive forest conversion, at a rate similar to those of neighboring countries (Helsingen *et al*., 2015). Future steps for this work would include using additional participatory approaches to better understand the different inputs, including likelihood and quantity of change. However, for now they serve as a basis for decision-making and understanding of different possible futures and implications.

These land use conversion scenarios are complemented with a second approach, an illustrated design manual on sustainable road construction techniques and mitigation measures that provides tools for decision-making across a wide range of stakeholders. The manual outlines sustainable principles for the road's alignment, alternative engineering technologies and road design guidelines specifically for wildlife endemic to the landscape surrounding the road corridor. As part of this design manual, three typical sites were chosen along the road link. For each site, the following graphically illustrated scenarios were displayed:

FIGURE 5.4

Baseline Plus Three Conversion Scenarios for the Proposed Dawei Road Link



Source: Helsingen *et al*. (2015, p. 19)

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

- a business-as-usual engineering approach with no consideration for wildlife or ecological connectivity;
- an upgrade of the current access road using minimal construction standards; and
- an approach demonstrating the combination of "soft" engineering with vegetation (for slope retention), sustainable maintenance and mitigation measures for wildlife (Tang and Kelly, 2016).

These three scenarios were turned into 3D-printed models, which are much more effective for communicating the various options for alignment and mitigation measures to lay audiences in stakeholder meetings (see Figure 5.5).

Locating Wildlife Crossings for Many Species

Up to this point, WWF and HKU had built an argument for better planning processes and specified design guidelines to encourage and sustain wildlife habitat connectivity, but there were insufficient data on wildlife populations to identify crucial sites for mitigation measures that could link the landscapes north and south of the road link corridor (Kelly *et al*., 2016). Consequently, the team opted for a modeling method using techniques that simulate how electric current (as a proxy for wildlife) might flow—in this case, across a landscape (McRae *et al*., 2008). To that end, a multidisciplinary group of landscape planners, computation experts, conservation geographers and wildlife specialists from WWF and HKU's network compiled information about individual species' habitat preferences with regard to factors such as forest cover, human settlement, rivers and roads, so as to model individual species' rates of movement across a landscape.

However, while this technique for mapping critical areas for wildlife connectivity is well established for single species, it has frequently proved to be challenging to combine the movement preferences of multiple species and limited in its potential application to identifying sites for small-scale interventions, such as wildlife crossings (Brodie *et al*., 2015; McRae *et al*., 2008). To enable modeling multiple species and apply these methods to the specific landscapes along the road, the team's landscape designers and computation experts developed a framework for optimizing identification of wildlife crossing locations along the expected route of the road (Kelly *et al*., 2016).

Importantly, the final recommendations are flexible enough to accommodate pragmatic concerns such as alignment adjustments, engineering options and construction costs, while still providing enough crossings and maximizing the

FIGURE 5.5

Infrastructure Design Scenarios as 3D-Printed Models

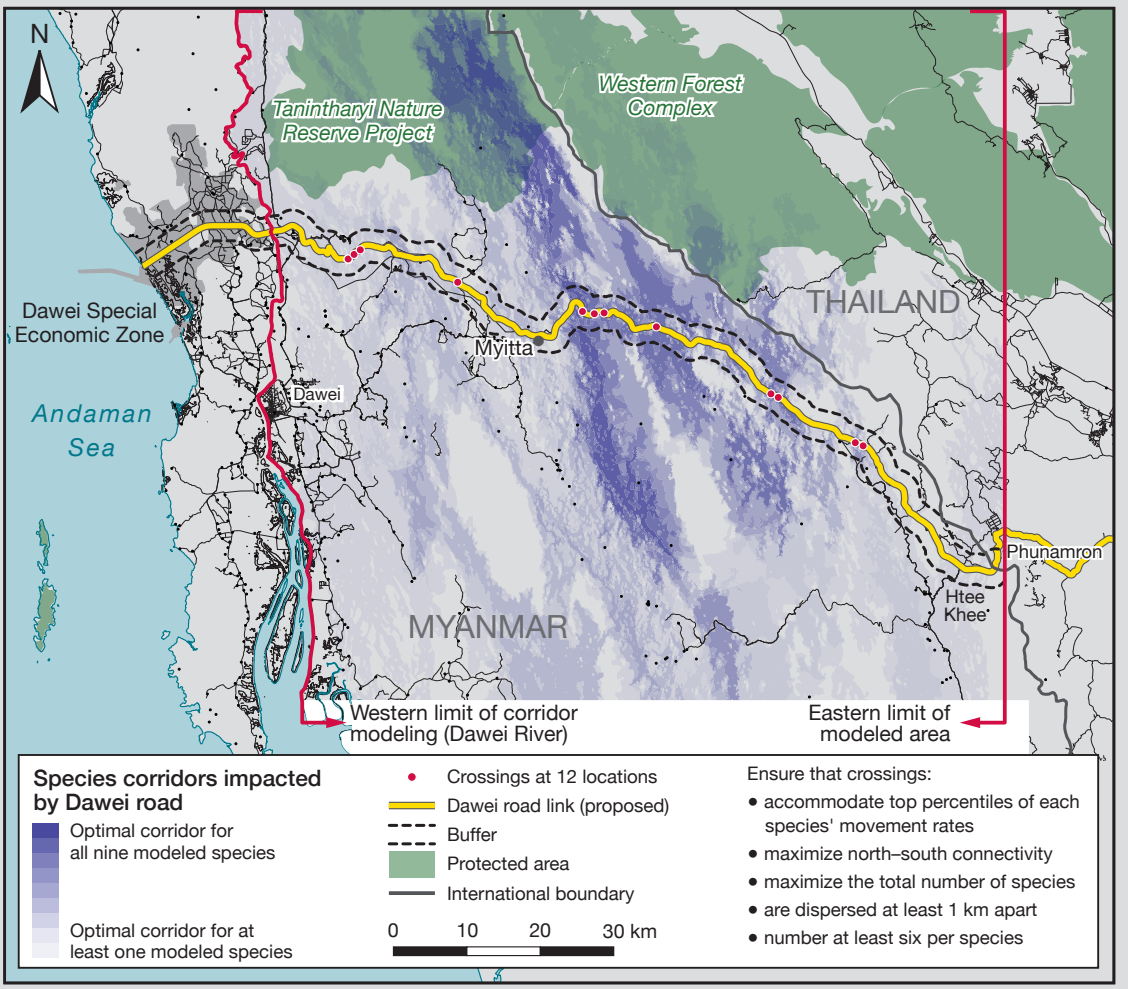
Notes: For a single site along the planned Dawei road link, these three models represent potential alignments, construction technologies, mitigation measures and impacts on surrounding land cover. The models show (a) the developer's likely alignment; (b) an upgrade of the existing access road; and (c) bioengineering and wildlife mitigation (Tang and Kelly, 2016).

Photo: © Ashley Scott Kelly, University of Hong Kong

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

FIGURE 5.6

Multispecies Movement Prediction Modeling



Source: Kelly *et al*. (2016, pp. 24–5)

number of included species. As shown in Figure 5.6, the crossing locations are not merely points, but rather segments measuring approximately 1 km in length that can take into account local cost engineering and a variety of mitigation measures. These measures are outlined for specific wildlife species in the accompanying design manual and are intended for the identified critical corridors, as well as mitigation strategies and sustainable construction technologies along the length of the Dawei road link.

Analytical modeling is most effective when decision-makers—who are often non-specialists—are able to understand the principles and factors involved. The Dawei road link combines "design thinking," which encourages scenario building with iterative approaches to problem solving, and the story-and-simulation approach, a hybrid of quantitative simulations and qualitative narratives (Alcamo, 2008). For instance, the creation of the design manual began with a series of specific example sites along the planned Dawei road; each of these sites was then used to develop potential sustainable engineering principles that could be useful along the entire route. In the end, these options were catalogued to provide a useful set of tools and recommendations. For the land use conversion scenarios, as an example of a story-and-simulation approach, technical modeling was coupled with narratives of environmental destruction and economic loss, each of which fed back into the other and demonstrated the decision-making processes—not necessarily the factors—that were critical to the desired outcome.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Wildlife and Ecosystem Services in the Infrastructure Development Process

In 2015, the government of Myanmar formally adopted EIA procedures (Thant, 2016). This was an important step towards better environmental management in the country. However, these procedures do not incorporate specific guidelines for different sectors, which would ensure that design, construction and mitigation measures are accounted for in both the EIA and the environmental management plan (ECD, 2016; MCRB, 2016). The Ministry of Construction recently formed an environmental safeguards division, a sign of more sector-level attention that may be able to mainstream ecosystem services and wildlife considerations at the national level. Moreover, public participation guidelines for consultations are under development, as is a system for the formal sharing of EIAs with the public.[11] Ideally, these efforts will improve consultations and access to EIAs, which currently lack transparency.

Nevertheless, in the EIA undertaken by the Dawei road link developer—ITALTHAI, Thailand's largest engineering and construction company (ITALTHAI, n.d.)—the sections on biodiversity and ecosystems are far from adequate. Perhaps most flagrantly, the EIA does not include biodiversity surveys for the area and only sets aside a very small amount of the budget for addressing negative environmental impacts. In response, WWF provided constructive criticism directly to the road developer and the EIA consultant. The three reports by WWF and HKU were also presented to the Myanmar EIA review committee and to the relevant ministries of the Myanmar government on several occasions, in efforts to encourage sector-specific guidelines for infrastructure nationally. At meetings and during capacity building initiatives, WWF presented Helsingen *et al.*'s *A Better Road to Dawei* and ongoing work on the design of mitigation measures to Dawei University and several government agencies, including the Ministries of Livestock, Fisheries and Rural Development; Environmental Conservation and Forestry; Construction; Agriculture; and Planning.

Building Capacity and Increasing Awareness

To support capacity building on how to plan, design and construct more sustainable roads, WWF facilitated attendance at conferences and organized a workshop for reviewers of EIAs from Myanmar's Ministry of Natural Resources and Environmental Conservation, as well as the Ministries of Transport and Construction. In addition, in September 2015, WWF, HKU and Stanford University's Natural Capital Project took 19 regional government officials from nine departments on a field visit to the project area to support their understanding of the connections between the environment, people and infrastructure. Government officials discussed what changes could be observed in the landscape, what factors were driving those changes, and how impacts might be addressed and mitigated to better protect forests and vegetation and prevent soil erosion and landslides along the road. This visit highlighted the need for integrated land use planning—especially with regard to infrastructure—and for greater coordination both horizontally among ministries and vertically within national bodies.

Last Resort: Offsetting Impact

Finally, as a last resort, options for offsetting or compensating for impact are under development. In April 2016, WWF showed the road developer an initial scoping study for one option concerning a financial mechanism that could support sustainable management of forests north and south of the proposed Dawei road link. The road developer subsequently requested a suite of options for a financial mechanism. According to WWF's initial assessments, the forests north and south of the road provide important sediment retention services that would protect planned bridges from damage and scouring.[12]

Considering the large amount of rainfall this region receives over short periods of time, the forests play a crucial role in regulating water and reducing the risk of floods and landslides. Erosion modeling undertaken by WWF in 2015 shows a number of sections at high risk from landslides (see Figure 5.7). Investing in the management of forest ecosystems adjacent to the road will help sustain the provision of services and reduce maintenance costs, while simultaneously reducing impacts from soil erosion and floods on surrounding communities and ensuring the long-term integrity of the landscape. At the time of writing, further studies to identify a set of design options for a financial mechanism were to be presented to the road developer. Until then, consultations with communities and civil society are necessary to understand the immediate needs of local people.

Conclusions and Lessons Learned

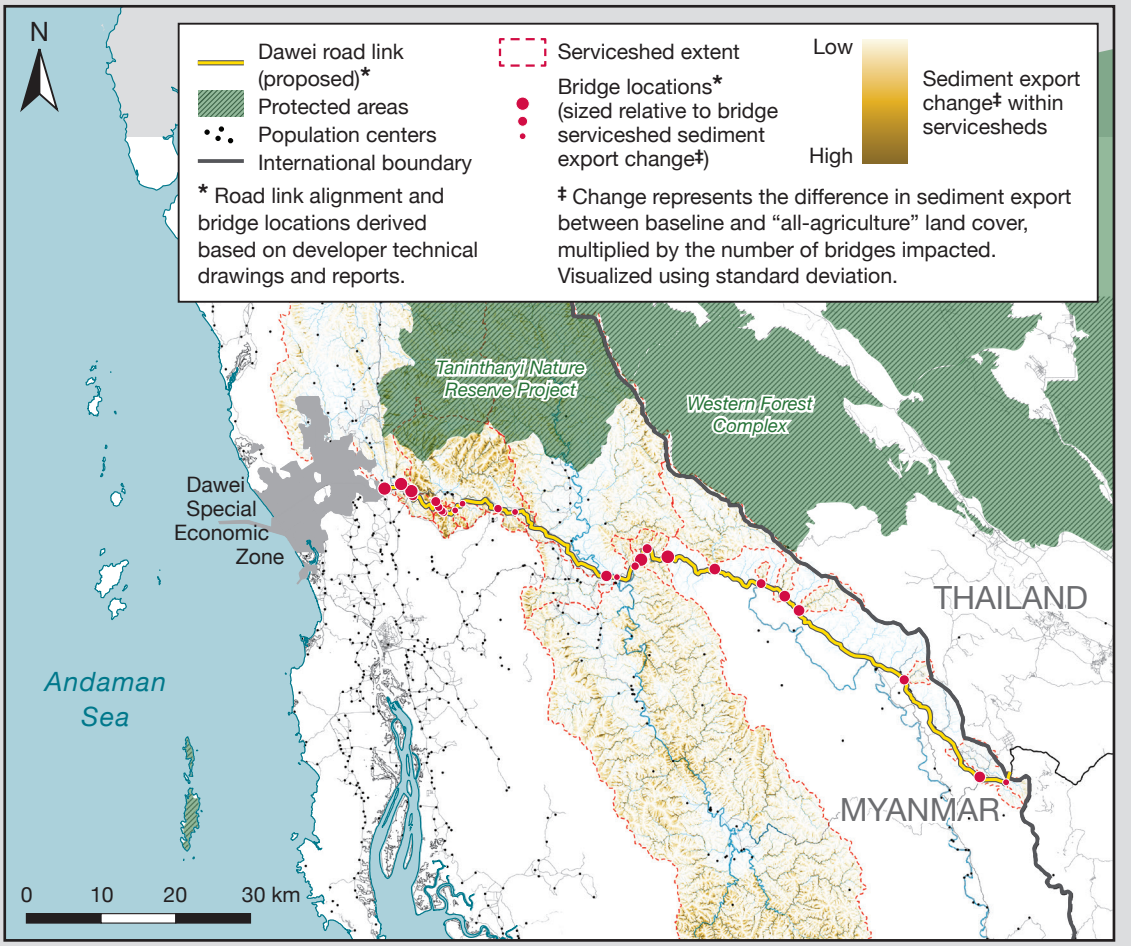
Having emerged in response to the Yadana pipeline case and gained experience in frequent cross-border exchanges with Thai counterparts, civil society in Tanintharyi has remained protest-oriented (ERI, 2009). Local groups seldom seek or accept collaborations with international NGOs. Their overall position regarding the DSEZ and Dawei road link frequently incorporates both rejection and acceptance, exemplifying Harvey and Knox's definition of an "impossible public" (Harvey and Knox, 2015).

In practice, Tanintharyi's civil society has claimed that much of WWF and HKU's work has aided the developer and argued "for the road"; however, this team did not see the comparative advantage of arguing from a singular or "protest"-oriented stance. A more suitable approach is to suggest alternative options and innovative solutions that would help mitigate and negotiate impacts. Opaque development plans, including a non-public EIA, also required more innovative approaches. Given this position, the team's efforts were developed to simultaneously offer toolkits in the form of future land change scenarios, design and construction scenarios, and wildlife prediction modeling to influence and build capacity with the national government, the local government,

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

FIGURE 5.7

Modeled Areas or "Servicesheds" that Impact the Proposed Dawei Road Link through Erosion and Landslides



civil society and the road developer. These tools are foremost intended to influence upstream planning, yet with enough geographic, physical and technical description and flexibility to negotiate infrastructural implementation in the absence of strong governance and environmental legislation.

Construction on the Dawei road link is anticipated to continue in 2018, as it has "continued" with or without necessary approvals, ambiguous land rights and tentative investment since agreements were signed between Myanmar and Thailand in 2008. While it is too early to tell whether WWF and HKU's spatially explicit strategies, designs and recommendations will be effective or implemented by the Thai road developer, in all likelihood they will suffice to inform civil society and the government of alternative and sustainable practices. However opportunistic, the scope of these efforts is also chosen to move beyond the uncoordinated and often competitive nature of NGO work in the region. Importantly, given many competing and overlapping interests, they have not explicitly delineated areas for more traditional conservation planning. Nor have they incorporated social and cultural knowledge into the process; the work remains largely within the technical and environmental silos. Nevertheless, these studies and toolkits help support a multitude of stakeholders in their different objectives. Critical to success for biodiversity conservation is flexibility, not only for land use and infrastructure planning, but also so that diverse stakeholders may appropriate these tools for their own use in securing ecological connectivity across the region.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

CASE STUDY 5.3

Conservation in the DRC: Road Rehabilitation and the Bili–Uélé Protected Area Complex

Introduction

Aspiration 1 of the African Union's Agenda 2063 envisions a "prosperous Africa based on inclusive growth and sustainable development" (AU, 2015, p. 2). As part of that aspiration, the agenda pictures a continent on which "[c]ities and other settlements are hubs of cultural and economic activities, with modernized infrastructure, and people have access to [. . .] the basic necessities of life" (pp. 2–3). It goes on to visualize "Africa's unique natural endowments, its environment and ecosystems, including its wildlife and wild lands [as] healthy, valued and protected, with climate resilient economies and communities" (p. 3).

The continent is indeed experiencing a dramatic growth in infrastructure development, a process that is often accompanied by serious, irreversible environmental changes (Laurance *et al*., 2015b). Donors and policymakers are increasingly aware of the need to factor in environmental considerations at the onset of an infrastructure development project. In contrast, some current policies and guidelines appear to be lagging behind the growing intention to avoid causing a net loss to biodiversity, and perhaps to advance conservation goals in the process.

This case study examines the Pro-Routes project, a major road rehabilitation undertaking in the DRC that triggered the World Bank's strictest environmental safeguards (see Box 5.1 and Annex VI). In particular, this study considers the 523 km Kisangani–Bondo segment, the RN4, which is certain to have an impact on the Bili–Uélé Protected Area Complex (BUPAC) (see Figure 5.8).

A Brief Description of the BUPAC

For the purposes of this study, the BUPAC comprises the Bili–Uélé Hunting Domain (32,748 km²/3.3 million ha), a partial faunal reserve with low protection status, and the Bomu Faunal Reserve (10,667 km²/1.1 million ha).[13] With an area of more than 43,000 km² (4.3 million ha), this complex is the largest contiguous protected area in the DRC. Yet, very little is known about it and, until recently, no conservation organizations were working in the landscape and no protected area management was being undertaken.

The IUCN has identified the BUPAC as one of the most critical chimpanzee conservation units, as it harbors an estimated 20,000 endangered eastern chimpanzees (*Pan troglodytes schweinfurthii*). These individuals account for about half the DRC's population and one of Africa's largest contiguous populations (Hicks *et al*., 2010; Plumptre *et al*., 2010).

The BUPAC is remote and the few existing roads are barely accessible by car, if at all. Despite the near absence of infrastructure and low human densities, the threats to biodiversity are high; hunting and poaching have spread and illegal trade in wild meat and young orphaned chimpanzees is thriving locally, regionally and across the DRC's borders, in the Central African Republic and South Sudan. The situation is compounded by an increase in human encroachment, growing social conflict and small groups of presumed Lord's Resistance Army members terrorizing communities in the region (Gauvey Herbert, 2017; Hicks *et al*., 2010; LRA Crisis Tracker, 2016; Spittaels and Hilgert, 2010). The artisanal gold and diamond mining industries are also extensive, especially in the western area of the BUPAC (Hicks and van Boxel, 2010). While biodiversity in the complex previously seemed secured by the area's inaccessibility, this growing human encroachment—together with poor governance and law enforcement—has contributed to its depletion.

In 2014, the African Wildlife Foundation (AWF) and the Congolese Institute for Nature Conservation (ICCN) conducted a scoping mission in the region to support conservation action. The study resulted in a conservation and securitization program initiated by AWF, Maisha Consulting and ICCN in a core area of the BUPAC—the Bili–Mbomu Forest Savanna Mosaic—which covers about 11,000 km² (1.1 million ha) (AWF, 2015, 2016). Over the first year, 25 newly selected and trained rangers conducted reconnaissance walks covering more than 2,000 km. Having georeferenced and destroyed about 100 hunting camps, they were able to confirm that poachers had a substantial presence throughout the protected area.[14] In 2016, AWF and ICCN signed a co-management agreement to strengthen management of the protected area (AWF, 2016; Ondoua Ondoua *et al*., 2017). Without adequate protection and conservation action, further losses to biodiversity are inevitable.

The Need for Infrastructure and the Birth of the Pro-Routes Project

In early 2000, the transport sector of the DRC was in a very poor state. Following a decade of conflicts and a quasi-absence of management, the formerly operational, multimodal transport network—which integrated roads, railways and waterways nationwide—had collapsed. The majority of roads were impassable, including more than 90% of the estimated 58,000 km national and provincial network (World Bank, 2008).

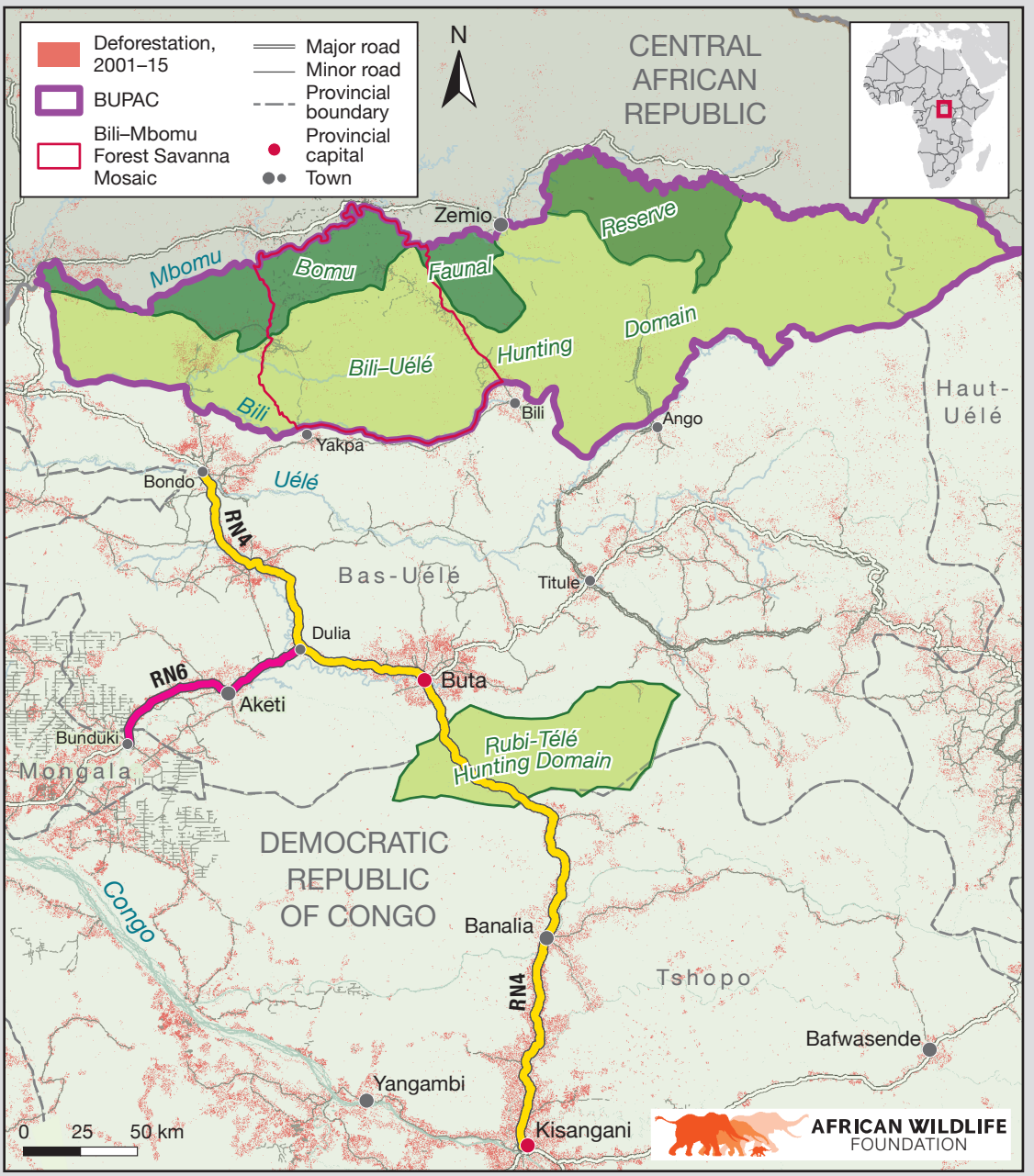
This situation has exacerbated rural poverty, particularly by impairing communities' access to social services and markets. More generally, it has hindered post-conflict economic recovery. In response, the government has strongly emphasized the critical importance of investing in transport infrastructure. It has presented a solid, well-maintained network as key to supporting the growth of the two pillars of the country's economy—the agriculture and extractive industry sectors—and to fostering trade at the national and regional levels (World Bank, 2008).

In 2004, the European Commission and the World Bank jointly created an infrastructure unit—the Cellule Infrastructures (CI)—as a financially autonomous body under the ▸

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

FIGURE 5.8

The Pro-Routes Project and the Bili–Uélé Protected Area Complex (BUPAC)



Data source: UNEP–WCM C and IUCN (2017)

authority responsible for infrastructure development, the DRC's Ministry of Infrastructure, Public Works and Reconstruction. CI provides institutional and technical support to the ministry, including capacity building. It also oversees the Pro-Routes project, which DFID initiated in 2005 (World Bank, 2008).

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

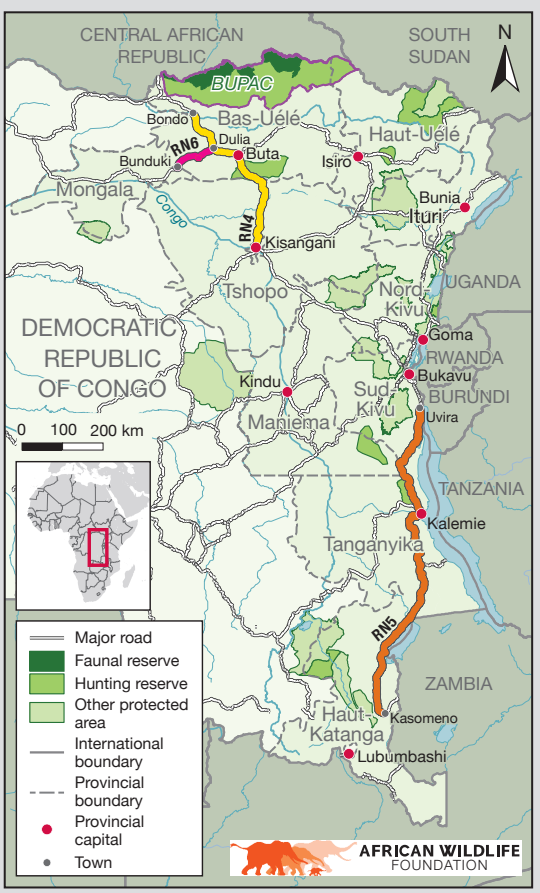
The main objective of the Pro-Routes project is to "re-establish lasting access between the provincial capital and districts, and districts and territories [. . .] in a way that is sustainable for people and the natural environment" (World Bank, 2008, p. 7). To support the project's implementation, DFID, together with the International Development Association, created a multi-donor trust fund administered by the World Bank. In 2008, agencies contributed US$123 million to this funding mechanism and to finance the rehabilitation of selected road segments (World Bank, 2008).

In the phase of upstream planning, the stakeholders concluded that the rehabilitation of existing roads would be the most economical and timesaving approach. The existing network had already reflected patterns of human activities, as corroborated by deforestation trends in 2001–15 (see Figure 5.8). Upgrading the network is expected to lead to a typical 10%–20% increase in deforestation, primarily within a 2-km radius of the targeted road segments, and largely close to urban centers such as Buta and Kisangani (Damania *et al*., 2016).

The national roads that were identified for rehabilitation in 2007—the RN4, the RN6 extension and the RN5—account for about 1,800 km within a 9,135-km-long target network (World Bank, 2008; see Figure 5.9). Importantly, the RN4 crosses the Rubi-Télé Hunting Domain; at its northern end, it stops at Bondo town, just before reaching the Bili–Uélé Hunting Domain of the BUPAC. The most severe negative impact on the environment is thus expected in the Rubi-Télé protected area, which is already severely degraded, with only 5–25 surviving elephants and virtually no ICCN presence (Hart, 2014; Thouless *et al*., 2016). As the BUPAC is considered the most biodiverse protected area in the region, it is the focus of this case study.

FIGURE 5.9

The Pro-Routes Project: Roads Selected for Rehabilitation



Data sources: UNEP–WCMC and IUCN, 2017; WRI and MECNT, 2010

The Environmental Component of the Pro-Routes Project

Since the World Bank administers the Pro-Routes donor fund, its safeguard policies apply to the project (see Box 5.1 and Annex VI). Accordingly, under the auspices of CI, an environmental consultancy drew up an environmental and social management framework that identified the key potential impacts and recommended measures for managing them (AGRECO, 2007). Another consultancy then produced an environmental and social impact assessment (ESIA) to further explore potential negative impacts and recommend specific measures to address them (EDG, 2007).

Based on these studies, the project appraisal document (PAD), the design document of the Pro-Routes project, paved the way for the consideration of environmental and social impacts (World Bank, 2008). In assessing the critical risks to the environment as high, the PAD stresses the need for capacity building of ICCN and support to ICCN and the Ministry of Environment, Conservation of Nature and Tourism "in managing and protecting natural habitats, biodiversity, and forests and enforcing the pertaining laws" (World Bank, 2008, p. 36). Significant resources—US$18.7 million—were earmarked within the Pro-Routes project budget to support an environmental and social program, including US$8.18 million for environmental activities (pp. 62–66, 68).

In 2009, CI contracted a consultancy firm, SOFRECO, to lead project implementation as a delegated management contractor and to play the role of Bureau d'Études Spécialisés en Gestion Environnementale et Sociale (consultancy for environmental and social management, or BEGES) (DFID, 2010). The task of BEGES was to provide ICCN and the ministry with technical, operational and financial assistance to manage natural ecosystems and enforce related regulations and laws with regard to wildlife and protected areas, as outlined in the PAD (World Bank, 2008). In accordance with the project's classification under the World Bank's safeguard policy, CI recruited experts for an environmental and social advisory panel (ESAP), which was to provide guidance with respect to the management of environmental and social aspects (see Annex VI).

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

BOX 5.1

The World Bank Infrastructure Development Imperative

A Low Infrastructure Baseline

When it comes to infrastructure, Africa lags behind the rest of the world on almost every development metric. The region has the lowest road density and levels of electrification, and few of its urban dwellers have access to piped drinking water or adequate sanitation (Foster and Briceño-Garmendia, 2010). At the same time, the infrastructure deficit is set to worsen with a burgeoning population that is expected to double by about 2050 (UN Population Division, 2017). Infrastructure development, including the provision of electricity, safe drinking water and transportation, is widely recognized as essential to reducing extreme poverty. It is also fundamental to achieving sustainable development and boosting shared prosperity.

The Challenge

In Africa, as elsewhere, infrastructure investments undertaken carelessly or without consideration of potential externalities can be counterproductive and undermine many of the sources of growth and livelihood in an economy. Evidence suggests that in Africa, where poverty is predominantly a rural phenomenon, the very poorest are the most dependent on forests for their livelihoods. In most cases, the poorest quintile derive more income from forests and the commons than from agriculture. An immediate implication is that forest income deserves at least as much attention from policymakers and at the project level as other sources of income. Neglect of such a significant component of economic value to the poor inevitably compromises the effectiveness of poverty reduction policies (Anderson *et al*., 2006b; Angelsen *et al*., 2014; Byron and Arnold, 1999; IUCN, 2016d).

Environmental and natural resources contribute to economic well-being and the ability to fight poverty sustainably. In that sense, they play a pivotal role in development, one that cannot be done justice if they are treated as mere afterthoughts in the development dialog (PROFOR, 2012; Sunderlin, Dewi and Puntodewo, 2007). Renewable natural resources in Africa merit particular scrutiny since the continent's poor are especially dependent on them.

Biodiversity Implications

With respect to biodiversity in general and ape conservation in particular, investments in two types of infrastructure—roads and dams—are especially relevant.[15]

Roads. In the process of connecting people—including the rural poor—with markets and services, roads are of fundamental importance. Ideally, they help to reduce poverty and stimulate economic development; in practice, however, these goals are not always achieved (see Chapter 2, p. 60). In sensitive locations, roads that are built or upgraded without adequate precautions can threaten apes and other biodiversity through their direct and induced (indirect) impacts. Direct impacts involve the footprint of the road itself, including forest fragmentation, altered drainage patterns and wildlife road kills. Induced impacts result from human activities that are made possible by new or improved roads, through improved access to remote areas; these impacts include new settlements, deforestation, logging and hunting of vulnerable species.

The most important planning decision available to address both direct and induced impacts of road development is careful site selection. In most cases, the World Bank requires that new roads—and major upgrades of existing ones—be located so as to avoid areas of high biodiversity value, including ape habitats. The one "special case" exception to this rule occurs when a road to a protected area might be supported by conservation authorities because it would allow for improved management or sustainable tourism. By avoiding remote forested areas where apes reside, new and improved roads are likely to benefit larger numbers of people by traversing more densely settled rural areas.

Approaches that consider potential road impacts at the very outset of the planning process enable decision-makers to steer development away from biodiversity hotspots towards areas where benefits can be maximized and adverse impacts largely avoided (see Box 1.6). The tools now exist to conduct detailed assessments of likely road impacts; some were pioneered in a recent analysis in the DRC (Barra *et al*., 2016). These tools offer a standardized and scientific way of assessing the environmental risks of an infrastructure investment, while also offering alternatives that may be equally beneficial, but less risky. A number of biodiversity-related databases—including the A.P.E.S. Portal, the Digital Observatory for Protected Areas (DOPA) and Integrated Biodiversity Assessment Tool (IBAT)[16]—provide easily accessible information on the locations of ape habitats and other important biodiversity areas. In planning roads and other infrastructure, a landscape approach is the most effective way to consider ape habitats within and outside of protected areas, as well as the potential connectivity between them.

Dams. In many African countries, hydroelectric and other dams are considered a key source of low-carbon electricity, potable water for cities and towns, and irrigation water to sustain agriculture (see Chapter 6). As with roads, site selection of dams is extremely important for avoiding and minimizing harm to apes and other biodiversity. A single proposed hydroelectric dam in Guinea, for instance, could adversely affect a major stronghold of the critically endangered western chimpanzee (*Pan troglodytes verus*), unlike other dams in the same river system.

In some cases, dam projects can further conservation goals through biodiversity offsets. For example, the World Bank-supported Lom Pangar Hydropower Project in Cameroon involved the establishment and on-the-ground strengthening of Deng Deng National Park, which protects an important population of the western lowland gorilla (*Gorilla gorilla gorilla*) (Ledec and Johnson, 2016; see Case Study 6.1). Many dams depend on the conservation of upper catchment areas for their long-term functioning; that dependence provides an important incentive for conserving upland forests and other natural habitats. Well-managed hydroelectric and water ▶

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

supply dams also generate annual revenues, a fraction of which can be devoted to recurrent costs of managing associated conservation areas.

Besides proper site selection and design, building infrastructure that is biodiversity-friendly means paying close attention to the construction practices used (see Box 6.1). The loss and degradation of natural habitats can be minimized through the establishment and enforcement of strong environmental rules for contractors (see Box 1.6), especially if these are reflected in the bidding documents and contracts for large infrastructure projects. Particularly important for apes and other wildlife are strict prohibitions on hunting, wildlife capture and the purchase of wild meat by all contractors and construction workers.

Getting It Right

Since much of Africa has yet to develop a basic infrastructure stock, there is potential for the process to be undertaken with due concern for the conservation of apes and other biodiversity, while avoiding many of the environmental mistakes that have often been made in other parts of the world. Getting it right will require more focused attention to biodiversity than has been the case to date in many countries.

The World Bank's commitment to biodiversity conservation as an integral part of infrastructure development is underpinned by its safeguard policies, particularly the Natural Habitats Operational Policy (OP) 4.04 and Forests OP 4.36 (World Bank, 2013b, 2013c). In July 2016, the Bank's board of executive directors approved a new Environmental and Social Framework, which will go into full effect in 2018; this framework includes Environmental and Social Standard 6 on biodiversity conservation and sustainable management of living natural resources (World Bank, 2017; World Bank, n.d.-d). The International Finance Corporation—the Bank's private sector affiliate—already operates under the very similar Performance Standard 6 on biodiversity conservation and sustainable management of living natural resources (IFC, 2012c). Beyond these mandatory environmental standards, the World Bank Group's Forest Action Plan for 2016–20 seeks to ensure that forests—including ape habitats—are effectively integrated within national development planning efforts and that new infrastructure investments follow a "forest-smart" approach to avoid or minimize any adverse impacts (World Bank, 2016a).

Balancing economic growth with environmental protection is a challenge faced by every nation on earth. There is growing recognition that degrading natural resources for short-term economic gain is ultimately a counterproductive strategy that can undermine development and growth. Recent technological advances have made available the information and analytical tools needed to avoid damage while harnessing and maximizing the net economic benefits of infrastructure development. The challenge lies in ensuring that governments, donors and policymakers use these tools to make better-informed and more effective decisions.

Assessments and Recommendations

By establishing four posts on the Buta–Kisangani road to control the illegal wild meat trade, BEGES immediately initiated implementation of the recommendations formulated by the environmental and social management framework and the PAD. Another ESIA for the 125 km section connecting Dulia to Bondo was carried out between 2012 and 2013. In addition, WWF and the consultancy TEREA released a study of Pro-Routes' impact on protected areas (WWF and TEREA, 2014). These studies resulted in the development of a two-fold approach.

The first element of the approach—the "emergency intervention package"—focused on poaching, which was expected to increase in the western part of the BUPAC due to the rehabilitation of the nearby RN4. The proposed wildlife conservation activities required technical and financial support to ICCN for improved anti-poaching measures in priority areas within the BUPAC, and support to communities to reduce dependence on the protected area. The latter component included the creation of a local development fund, awareness building and improved coordination between ICCN and communities living adjacent to the BUPAC's priority areas (WWF and TEREA, 2014).

The second element—the "priority action plan"—provided guidance on how to implement an ICCN-led participatory process to assess the BUPAC's status and revise the land use planning and management of the complex. The adjusted management objectives, governance mechanisms and spatial delimitation of the protected area complex would then be outlined in a management plan for the BUPAC. This design phase was established as a key step towards the effective management of the complex over time (WWF and TEREA, 2014).

Although WWF and TEREA strongly recommended the implementation of the full two-fold approach for the BUPAC, CI only prioritized the emergency intervention package. In author interviews, stakeholders suggested that BEGES had insufficient funding available for the implementation of the priority action plan, but this study was not able to corroborate this assessment.[17]

Implementation and Evaluation

From an economic perspective, the road rehabilitation project provided the expected benefits for users. Travel time between Kisangani and Buta was reduced from 3–4 weeks by bicycle to six hours by car, and corresponding travel costs plummeted. In towns along the road, the knock-on effects were immediate: the price of fuel fell by 50%, that of salt by 30% (World Bank, 2016d).[18]

Data are more elusive when it comes to evaluating the implementation of the mitigation measures designed to minimize environmental and social impacts of the Pro-Routes project on the BUPAC. The safeguard policies, recommendations and management approaches seem like a promising blueprint for the implementation of such measures. In the event, however, CI did not formally approve the approaches until after construction was

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

well under way. In fact, the rehabilitation of the Kisangani–Buta and Buta–Dulia road sections was completed in 2013, six months before WWF and TEREA's recommendations were approved (Radio Okapi, 2013).[19]

Moreover, this study uncovered limited evidence that the mitigation measures were actually being applied. Road checkpoints are the only visible sign of such activity, but the staff does not appear to keep organized records. Beyond that, no reports or evidence is seemingly available on the implementation of the emergency intervention package. In author interviews, various stakeholders indicated that ongoing activities included anti-poaching patrols, meetings with local communities and collaboration with community-based organizations, yet none of these assertions is supported by verifiable reports, nor were such activities evident on the ground during this review.

In the absence of empirical evidence, it is difficult to confirm whether mitigation strategies are being implemented as intended and, if they are, whether they are effective. The project-wide lack of transparency may be partially attributable to the insular nature of the organizations in charge of overseeing the mitigation strategies. As discussed, CI delegated assessment and implementation responsibilities to a consultancy firm, which took on the role of BEGES. In turn, BEGES delegated the responsibility for implementation to government institutions, such as ICCN. BEGES was also tasked with contracting "an experienced and independent NGO of international renown" to work alongside the ESAP, in line with the PAD recommendation. This step was not taken for reasons that remain unclear but that may be linked to capacity constraints or conflicting priorities (World Bank, 2008, p. 12). As a result, BEGES was relegated to playing an intermediary role between government institutions, and was limited to facilitating the transfer of statements between the implementing and directing agencies, CI, ICCN and the World Bank.

A major weakness in the execution of this project, identified during the research for this case study, concerns the inertia exhibited by BEGES. The unit was charged with the implementation of the full array of policies and recommendations, both environmental and social. The wide diversity of expertise required to carry out this work would be difficult to gather in any single organization. Had BEGES solicited the input of a range of specialized organizations to implement specific aspects of the project, as initially envisioned, it could potentially have served as the linchpin of effective implementation (see Box 1.6).

Meanwhile, AWF, ICCN and Maisha Consulting successfully followed the two-fold approach recommended by WWF and TEREA in implementing their conservation and securitization program in the BUPAC's Bili–Mbomu Forest Savanna Mosaic. The project prioritized technical, operational and financial support to ICCN for improved anti-poaching measures in identified priority areas. Largely in line with the priority action plan, AWF and ICCN also conducted a participatory land use planning process for the affected region, including the BUPAC, in 2016. AWF provided the technical and financial support for staff selection, capacity strengthening, ecological monitoring and anti-poaching efforts, the creation and operation of a steering committee, and baseline data collection (AWF, 2016).[20] Although these activities overlapped with the Pro-Routes project recommendations and AWF requested that BEGES finance the implementation of local development plans and community-based management of natural resources, funding was not provided by the Pro-Routes project.[21]

Conclusion

Nowadays, the availability of economic data and georeferenced information on forest cover renders upstream planning both feasible and cost-effective (Damania *et al*., 2016). At its inception, the Pro-Routes project involved sound upstream planning that took account of potential environmental and social impacts of infrastructure development and identified options for the rehabilitation of habitat. Reinforcing this process, the World Bank's safeguard policies called for thorough environmental and social impact assessments and recommendations for the mitigation of adverse effects on the landscape.

In practice, however, these efforts have not yielded verifiable environmental mitigation measures within the reviewed aspects of the Pro-Routes project. On the whole, efforts to mitigate the impacts of the project lagged behind the roadwork, if they were undertaken at all. This study found no evidence that BEGES and ICCN actually implemented the emergency intervention package, which had initially been prioritized for action; nor did this study identify verifiable reasons that might explain why the priority action plan was not selected for implementation. In the end, neither component of the two-pronged approach was pursued even though the goals of each dovetailed with those of the Pro-Routes project. The road checkpoints remain the most visible concrete action, yet evidence as to their impact and effectiveness is limited. The results of this case study thus reveal that upstream planning alone is not sufficient to ensure effective, timely and coordinated implementation of mitigation measures.

The study also demonstrates that the input of external environmental experts can be invaluable. In this case, AWF and Maisha Consulting joined forces with ICCN, launching a conservation and securitization program that is contributing to the objectives of the Pro-Routes project—albeit without its financial support. If Pro-Routes had been developed as outlined in the PAD, BEGES—or a specialized conservation NGO contracted by BEGES—would have provided ICCN with technical, operational and financial assistance to manage natural ecosystems and to enforce related regulations and laws with regard to wildlife and protected areas. In reality, AWF played a role that BEGES should have played or facilitated, and financed.

This examination of the Pro-Routes project shows that the modernization of infrastructure and the protection of biodiversity in Africa—focal points of Aspiration 1 of Agenda 2063—require more than the establishment of goals and institutions, and more than upstream planning and donor funding. The implementation of recommendations to reduce the negative impacts of such development projects calls for relevant expertise and capacity, a clear allocation of tasks, continuous monitoring and recordkeeping, and the prioritization of environmental and social considerations by all stakeholders. In this context, the potential contributions of external conservation organizations cannot be overstated, regardless of whether they work in parallel or jointly with state structures.

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Overall Conclusion

> "Only if decision-makers understand the various economic, social and environmental benefits and costs of a project can they take informed planning decisions."

The construction of roads poses unique problems for environmental conservation. As the case studies illustrate, complex governance, technical and economic constraints can undermine the attainment of conservation goals, which may also compete with the need to ensure the welfare of affected communities. The studies demonstrate that the sustainable development of roads cannot be addressed by state or subnational governments alone. Active and sustained participation by various stakeholders is necessary to safeguard the environment and ensure equitable planning and implementation of large infrastructure projects.

Specifically, this chapter highlights the importance of advocacy by local and international NGOs in Nigeria, civil society engagement with industry and government actors in Myanmar, and the inclusion of specialized agencies in the planning and implementation of mitigation measures in the DRC. All case studies underscore the relevance of advocating for the integration of ecosystem and wildlife considerations into the planning and design of roads. In the case of Myanmar, the inclusion of civil society early in the planning process allowed for engagement with engineers and the production of multiple designs. This type of exploration may not have been fostered had conservationists not introduced environmental constraints prior to construction. The chapter also emphasizes that the building of relationships with local civil society groups requires respect and time, especially if there is a history of mistrust, as in Thanintharyi.

This chapter also demonstrates the various options for such advocacy, which ultimately relies on effective communication through a variety of channels. These include the media, direct engagement with government officials and developers, and the presentation of land use conversion scenarios to raise awareness of how infrastructure planning threatens to fragment or drastically alter remaining ape habitat and other areas of significant biodiversity. Only if decision-makers understand the various economic, social and environmental benefits and costs of a project can they take informed planning decisions. A first step in building that knowledge is conducting and disseminating state- and country-wide assessments of natural capital, biodiversity and ecosystem services needed by local people. Such analysis allows stakeholders to consider potential cumulative impacts of various projects, along with their viability.

A range of tools can be deployed to enhance our understanding of the risks and costs to the environment and society, including well-targeted scenario modeling. Also relevant is ongoing monitoring and evaluation of impacts and mitigation measures, as these activities permit stakeholders to respond to infrastructure development plans with suitable, evidence-based actions or adjustments. By presenting varied and cost-effective solutions, an evidence-based approach can help developers and policy-makers plan and build more sustainable roads. Conservation actors therefore have a role to play in ensuring adequate scientific data are available to inform action. However, unless political actors and decision-makers prioritize environmental considerations, conservation organizations will be left to rely on financial institution safeguards, and regulations around impact assessments, to prevent biodiversity from being marginalized in large-scale infrastructure developments.

Acknowledgments

Principal authors: Andrew Dunn,[22] Jef Dupain,[23] Hanna Helsingen,[24] Ashley Scott Kelly,[25] Cyril Pélissier,[26] Helga Rainer[27] and Dorothy Tang[28]

Contributors: Hans Bekker, Nirmal Bhagabati, Ashley Brooks, Isaac Ho Wan Chiu, Grant Connette, Nicholas Cox, Richard Damania, IENE (Infra Eco Network

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press

Europe), Lazaros Georgiadis, Thomas Gray, Elke Hahn, HKU, George Ledec, Lisa Mandle, Natural Capital Project, Kity Tsz Yung Pang, Smithsonian Institution, Paing Soe, Robert Steinmetz, Amanda Ton, Joseph Vattakaven, A. Christy Williams, Stacie Wolny, World Bank and WWF

Case Study 5.1: Andrew Dunn

Case Study 5.2: Ashley Scott Kelly, Hanna Helsingen and Dorothy Tang

Case Study 5.3: Jef Dupain and Cyril Pélissier

Text Box 5.1: Richard Damania and George Ledec

Annex VI: Jef Dupain and Cyril Pélissier

Reviewers: Miriam Goosem, Ben Phalan and Kate Newman

Endnotes

1 This case study is adapted and updated from Dunn (2016) and Dunn and Imong (2017).

2 Copy of the letter reviewed by the author.

3 Copy of the letter reviewed by the author.

4 Copy of the letter reviewed by the author.

5 EIA reviewed by the author.

6 EIA reviewed by the author.

7 The letter from WCS to the Federal Ministry of Environment was written by the author and he reviewed the government's response.

8 Based on author observations of multispectral imagery and orthophotos acquired in 2013 and 2015.

9 Based on author meetings with authorities and the road developer, Bangkok, Thailand, 2015; Dawei, Myanmar, 2015; and Naypyidaw, Myanmar, 2015.

10 Author interviews with the road developer, Bangkok, Thailand, 2015; author review of unpublished technical documents.

11 Author interviews with authorities, Naypyidaw, Myanmar, September 2016.

12 The WWF assessments were not published but were presented to local stakeholders in September 2016.

13 Experts disagree as to the precise area encompassed by the BUPAC. This study relies most heavily on WRI and MECNT (2010).

14 Internal project reports and 2015 AWF project report to Global Forest Watch, all reviewed by the authors.

15 The extractive industries and industrial agriculture are also key drivers of habitat loss for apes and other species. These topics are examined in *State of the Apes* volumes 1 and 2.

16 For details on these databases, see European Commission (n.d.), IBAT (n.d.) and Max Planck Institute (n.d.-a).

17 Author interviews with CI, ICCN and World Bank representatives, DRC, 2016.

18 Author interviews with AWF field staff, CI and ICCN representatives, and community representatives, DRC, 2016–17.

19 Author interviews with ICCN and World Bank representatives, DRC, 2016.

20 Internal project reports and 2015 AWF project report to Global Forest Watch, reviewed by the authors.

21 Project correspondence and internal project reports reviewed by the authors.

22 WCS (www.wcs.org).

23 AWF (www.awf.org).

24 WWF Myanmar (www.wwf.org.mm/en/).

25 HKU (www.arch.hku.hk).

26 Independent consultant.

27 Arcus Foundation (www.arcusfoundation.org).

28 HKU (www.arch.hku.hk).

https://doi.org/10.1017/9781108436427.007 Published online by Cambridge University Press