Nature in peril:
The risk to forests and wildlife from the Dawei-Htee Khee Road
The World Wide Fund for Nature is an international non-governmental organization founded in 1961, working in the field of the wilderness preservation, and the reduction of human impact on the environment.

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1. Introduction

1.1 The Dawna Tenasserim Landscape

The Dawna Tenasserim is a transboundary landscape that straddles the border between Thailand and Myanmar. It is largely forested and covers an area of approximately 178,000 km², which is almost the size of Cambodia. Many threatened species are present in the area, including the Asian elephant, tiger, clouded leopard, Malay tapir, wild cattle, bears and numerous bird species. The Dawna Tenasserim is one of the most biologically diverse places on Earth and is recognized by WWF as a key global priority landscape for conservation.

One of the most biologically diverse habitats on Earth, the Dawna Tenasserim is recognized by WWF as a key global priority landscape for conservation.

Maintaining and strengthening connections, or corridors, between wildlife habitats is an essential part of conservation efforts in this landscape. For many wildlife species, forest corridors act like “wild highways” that enable animals to move freely about the landscape. This is particularly important for large species like tiger and Asian elephant that must travel great distances to find food, shelter, and mates. Gene transfer among animal populations is also critical for avoiding inbreeding and enabling species to adapt to threats like disease and climate change.

For people, these ecological corridors provide critical ecosystem services, including mitigation of flood risk and the provision of clean drinking water and food. These benefits are fundamental for the well-being and livelihood of local communities. In the face of climate change, well-connected and well-functioning landscapes will become even more important as species ranges might shift and natural disasters increase in strength and frequency.

Roads are a major cause of habitat fragmentation and loss of connectivity for wildlife and also tend to intensify habitat degradation by providing human access to areas that were once remote or undisturbed. Understanding the habitat requirements and movement patterns of these species is important for the planning of infrastructure and development projects and, as a last resort, for the design of mitigation measures and offsets for these projects.

The Dawei-Htee Khee road, the main focus of this report, is a threat to the rich biodiversity present in the Dawna Tenasserim. Without adequate planning and mitigation measures, species and ecosystems of global importance are at significant risk.
1.2 Purpose of this report

Over the last four years, WWF-Myanmar and its partners have been working together to better understand the biodiversity and ecological processes of the Dawna Tenasserim landscape. To date, WWF has worked with the Karen Forest Department (under Karen National Union - KNU) to carry out camera trap surveys of the area. WWF has also worked with Columbia University in the United States to understand past climate trends as well as future climate projections that could impact the landscape.

Furthermore, WWF collaborated with the Natural Capital Project to map ecosystem services and how changes in land use will impact on the provisioning of these services as well as with the Smithsonian Institution, Wildlife Conservation Society (WCS), and Flora and Fauna International (FFI) to summarize results of biodiversity surveys and communicate the biodiversity richness of this landscape. Finally, WWF worked with the University of Hong Kong to identify ideas and technical solutions for how infrastructure can be developed more sustainably in this particular landscape. Now, more than ever, we are equipped with not only the information about the area’s biodiversity value but also the threats posed to people and nature by built infrastructure, such as the Dawei-Htee Khee road.

This report is the fourth in a series of reports (see below) that have been published between 2015-2018. The first report published in 2015, highlighted the need to consider information about ecosystem services, land use change, and wildlife in the planning of the road and the broader land use planning of the area (A Better road to Dawei—Protecting wildlife, sustaining nature, benefiting people). A design manual, published in 2016 as the second report, showcased design options for accommodating wildlife crossings and bio-engineering techniques for slope stabilization as well as alignment options to minimize deforestation and maximize social and environmental benefits (Design manual—Building a more sustainable road to Dawei).

Based on a request from the road developer in 2016 regarding the identification of wildlife movement patterns in the landscape, WWF worked with conservation organizations active in the area and regional mammal experts to identify critical crossing areas for mammals based on modelling (Wildlife crossing—Locating species’ movement corridors in Tanintharyi, published in 2016)³. This fourth report specifically brings together several years of work that has looked in depth at what is at stake in this important ecological corridor system—a system that keeps key forested areas in Thailand and Myanmar connected and which the Dawei-Htee Khee road cuts across. This report outlines the history of the road and the newly approved 2018 Environmental and Social Impact Assessment (ESIA) of the Dawei-Htee Khee two lane road project ⁴. It furthermore highlights the current and projected impacts from deforestation within specific areas in the landscape that are deemed important habitat for many wildlife species. Moreover, this report presents case studies from other countries where successful land use planning and mitigation measures occurred in and around similar landscapes where road construction has taken place. Finally, by drawing on these examples and the evidence collected in the Dawna Tenasserim landscape, this report provides a set of recommendations for key stakeholders listing how they can implement better land use planning within this important landscape to avoid further destruction and deterioration of these “wild highways”.

It should be noted that while there are many social and environmental issues associated with the Dawei-Htee Khee road project, this report only focuses on forest and wildlife related issues and the broader fragmentation impacts this road will have on the landscape. WWF recognizes that many social issues related to the road construction, including poor consultations, inadequate or lack of compensation, road safety issues and loss of livelihoods are yet to be resolved and should be further studied and addressed. That is, however, beyond the scope of this technical report assessing impacts on forest and wildlife from the Dawei-Htee Khee road.

Over the last four years, WWF-Myanmar and its partners have been working together to better understand the biodiversity and ecological processes of the Dawna Tenasserim landscape.
2. Background on the Dawei-Htee Khee road: Two decades of planning & construction

While most accounts of the Dawei-Htee Khee road place its inception at the signing of a 2008 Memorandum of Understanding (MoU) between Myanmar and Thailand, various roads following the 140-kilometre route from the site of the Dawei Special Economic Zone (SEZ) in Myanmar to the Thai-Myanmar border have been in planning and under construction for more than two decades. These roads have already had a significant impact on the surrounding landscape, its wildlife, and local communities living in the affected area.

Planning of the road begins during an area marked by armed conflict

The history of the Dawei-Htee Khee road’s construction began in 1996, when Italian-Thai Development (ITD), a Thailand-based construction company, signed an MoU to build a deep sea port at Dawei 7, a forerunner of today’s Dawei Special Economic Zone (SEZ). The Thai-based Kanchanaburi-Tavoy [Dawei] Development Company, was also granted a 30-year concession to build and operate a road from Dawei to the Thai border 8.

An MoU to build the road was signed between the Industrial Estates Authority of Thailand and Myanmar’s State Law and Order Restoration Council in 1997. Also, in 1997, the Japanese International Cooperation Agency (JICA) conducted a feasibility study for two potential road route alignments 9, one of which closely follows today’s proposals.

These planning studies and agreements occurred at the same time as violent conflicts between the Myanmar army and the Karen National Union (KNU), from 1997 until at least 2003. In early 1997, conflict between the Myanmar army and KNU forced thousands of Karen villagers who were living along the proposed road corridor to flee to refugee camps in Thailand 10. In the meantime, each year, JICA updated the status of its “Kanchanaburi-Tavoy [Dawei] Corridor Development Plan” 11.

Between 2004 and 2007, new feasibility studies were mentioned in multilateral meetings, as well as in the Asian Development Bank’s 2006 proposal for “new construction/reconstruction” of the road corridor 12. During a study trip to Dawei in 2006 by Thailand’s National Economic and Social Advisory Council (NESAC), the council confirmed that “the highway was a joint venture between Thai contractors and Burmese military authorities” 13.
Signing various MoUs for the road development


ITD signed a subsequent MoU with the Myanmar Ministry of Transport to develop the road 15. By July 2010, ITD had already completed approximately 40 kilometres of an access road from the Htee Khee border crossing towards Dawei 16. While construction had already commenced, at the end of 2010, ITD signed a Framework Agreement for a 60-year Build, Operate, Transfer concession for the road, deep sea port, industrial estate and related infrastructure 17.

Construction begins before environmental and social assessments are carried out

From 2010 to 2013, ITD carried out construction of an access road, as well as the partial clearance for the road, deep sea port, industrial estate and related infrastructure 18. While ITD stated to both their own consultants and impacted communities their intention to apply World Bank impact assessment standards 19, ITD only first hired Chulalongkorn University’s Environmental Research Institute (ERIC) in September 2011 to complete an Environmental Impact Assessment (ESIA) 20. This happened more than one year after construction had already begun and was marked by violent conflicts between the Myanmar army and Karen National Union (KNU).

Detailed in ITD internal company reports and by opposition group reporters, KNU purportedly stopped ITD’s construction of the road on four different occasions during 2011 21. This lead to a build-up of Myanmar army battalions around the road corridor in the last quarter of 2011, where active conflicts were reported by opposition groups’ news agencies 22. In the following year, public consultations were held in several villages along the corridor in 2012; however, these were often confrontational owing to several factors, including contentions around the poor planning of the road, the construction of the road already being underway, and inadequate compensation to affected communities 23. Additionally, the highway alignment was redesigned several times from 2011 to 2013, including four-lane and two-lane proposals and right-of-ways ranging from 200 metres to 80 metres across 24, which prompted misinformation and confusion amongst stakeholders, especially villagers.

Before the first impact assessment was completed, clearing for a four-lane highway had already started.

The first ESIA stated impacts had already occurred, including soil erosion, land conversion, human migration into the area, the blocking of elephant migration routes and waterways, as well as crop damage to local communities with little compensation for the villagers themselves 25. No submission of the ESIA was ever made to the Myanmar Ministry of Environmental Conservation and Forestry (MOECAF) 26 and the document was never made public. This meant that the project lacked proper public consultation, while road construction was already underway.

New MoUs signed

In parallel with the first ESIA process, Myanmar and Thailand negotiated and signed a series of MoUs between December 2012 and November 2013 that transferred ITD’s concession rights to a joint government special purpose entity. These agreements guaranteed ITD’s reimbursement for construction works it had already completed and then effectively removed ITD from the project 27.

While ITD knew of their impending removal from the project, ITD nevertheless produced a new alternative two-lane road alignment by September 2013 28. Just one year later, in 2014, ITD submitted a proposal for a two-lane road in a bid to retake the project 29. Shortly following the July 2015 Dawei SEZ Memorandum of Intent between Myanmar, Thailand, and Japan, ITD signed a new concession agreement with the Myanmar government in August 2015 30. TEAM Consulting Engineering and Management (TEAM) was soon hired in January 2015 to undertake a new ESIA for this two-lane road. The majority of this ESIA, as of June 2018 (more about this ESIA below), remains largely based on the preliminary two-lane alignment submitted by ITD in September 2014, even though ITD did not complete its first design report until October 2015 31.

The Dawei-Htee Khee road’s current scope and status remains uncertain. Japan’s JICA and Ministry of Economy, Trade and Industry (METI) released separate studies on the development of a four-lane road in 2016 and 2017 respectively 32. In March 2018, the Myanmar parliament approved a loan from Thailand’s Neighbouring Countries Economic Development Cooperation Agency (NEDA) for the construction of the two-lane Dawei-Htee Khee road 33.
3. Dawei-Htee Khee environmental & social impact assessment (ESIA)

3.1 Status quo in 2018

ESIA approved with conditions on protecting the wildlife corridor

In June 2018, the new ESIA for the Dawei-Htee Khee road, which was developed by TEAM consultants, was approved through the issuance of an approval letter by U Win Zaw, Myanmar’s Vice Permanent Secretary, on behalf of the Minister of Natural Resources and Environmental Conservation (MONREC).

Even though approval should come through the issuance of an Environmental Compliance Certificate (in accordance with the law and the EIA procedure), this, for unknown reasons, has not been completed. The letter of ESIA approval specifically outlines the requirements for mitigation measures including wildlife corridors and states that a “wildlife crossing monitoring plan must be implemented along the two-lane highway…” The letter also explicitly mentions that a wildlife corridor as well as wildlife crossing structures must be constructed.

In response, to this approval letter, the MyanDawei’s (subsidiary of ITD and created for the construction of various projects related to the SEZ) confirmation letter, which was sent on June 21st 2018 to MONREC, states that: “the project company established by MyanDawei Industrial Estate Public Company Limited in respect to the two-lane road project shall at all times comply fully with: i) any and all commitments and obligations as set forth in the ESIA and ii) any and all plans and the various components thereof, including without limitation, impact avoidance, mitigation and remediation measures, and with respect to both i) and ii), including but not limited to such commitments, obligations, plans and measures as relate to the development, construction, commissioning, operation and maintenance of the project.”

However, even though the confirmation letter from the company outlines its commitment to fully comply with the obligations set forth in the ESIA, the commitments from the road developer made in the ESIA omit a number of necessary measures, specifically in relation to wildlife crossings (See MyanDawei Industrial Company Limited, 2018, pp. 8-10).
3.2 Issues identified in the current ESIA

Questionable biodiversity survey techniques

The 2018 ESIA mentions a wildlife resource survey carried out in early 2015 using direct and indirect searching methods. The direct searching method used a point count technique along transects. Critically, this technique would be insufficient to reliably detect the many globally threatened mammal species known to occur in the landscape. Many of these species are rare, elusive, and difficult to detect without a more intensive survey effort, such as by camera trapping. Furthermore, ESIA surveys were performed in selected areas and were only ever approximately 500 metres from the road, limiting the opportunity to detect species occupying adjacent forested areas that might have their movements impeded by the road.

The ESIA’s indirect searching method was based solely on interviews with local people. A number of mammals, reptiles, amphibians and birds were recorded, totalling 135 species (17 mammal species, 86 bird species, 21 reptile species, and 11 amphibian species). The ESIA is insufficient without showing the exact location where surveys were carried out or where species were recorded. Also, the ESIA suggests that only one species in the vicinity is vulnerable and five more are classified as Near Threatened (following IUCN’s classification).

In contrast to the single threatened species documented in the ESIA, camera trap surveys conducted by the Karen Forest Department in 2018 and in collaboration with WWF identified 23 mammal species, including 12 globally threatened mammals within 10 kilometres of the road alignment 39. This indicates that the ESIA’s wildlife survey is insufficient and does not properly assess the wildlife species that will be impacted in the landscape.

Insufficient impacts analysis

The 2018 ESIA refers to a series of impacts on forest and wildlife from the altering of habitat due to:

- Clearance of forest in the right of way area;
- Diminishing of feeding areas and food sources for wildlife due to noise pollution from construction and traffic; and
- Changing natural habitat due to disposal of soil from the construction area.

While such impacts may be plausible, the ESIA text continues by describing the extent of forest loss due to clearing for the road:

“1,364 acres of land, mostly forest, were cleared... The construction of the existing road, about 1,544 acres of land, mostly forest, were cleared... In addition, the loss of forested land for construction of 10 realigned sections (about 31 kilometres) under the project will be only about 306 acres. Therefore, impacts of the project on the forest area due to additional forest clearing would be less than impacts of the existing road.”

This statement demonstrates the lack of comprehensive assessment in the ESIA. It lacks clarity regarding the impacts to the adjacent forest as a result of the construction of the access road, which was built to enable the construction of the main road itself.

Furthermore, the ESIA also concludes that:

“most of the wildlife species found in the right of way area were small animals which have adapted to thrive well in disturbed and poor habitats. In addition, during the upgrading of the existing road, some wildlife species would flee from the construction areas due to the loss of habitats and loud noise from road improvement activities.”

This focus of the ESIA on temporary disturbance of wildlife and direct impacts of construction activities is insufficient because it fails to account for several of the most critical effects of roads on wildlife populations: Loss of habitat connectivity, intensifying deforestation, and improving access for illegal hunting.

Increased wildlife-vehicle accidents and habitat deterioration during construction phase

During the operation phase, the impacts on forest and wildlife that have been identified in the ESIA include increased vehicle-derived pollutants, increased vehicle/wildlife accidents, increased edge effects and increased deterioration of habitat. The ESIA notes that “since the two-lane road would be developed in the same corridor with the existing access road all of these impacts have already existed. There would be some incremental impacts due to more vehicles.” Unfortunately, by dismissing as “incremental” the impacts of further upgrading the road, the ESIA lacks any comprehensive assessment of the actual impacts of increased traffic and vehicle travelling speeds on wildlife.

Limited mitigation measures included in the plan

In the construction phase of the road, the only risk mitigation commitments concerning forests and wildlife which have been included in the ESIA report from 2018 are:

1) “Replacement of trees where they are removed; for every tree removed, a tree should be replanted.”

2) “Construction workers and site foreman must watch for wildlife which may be harmed and take avoidance action as required.”

During the operation phase, the following measures on forest and wildlife are included in the 2018 ESIA report:

1) “Protect vegetation alongside the two-lane road by undertaking maintenance regularly and vegetation if needed”

2) “Install signs warning motorists of the presence of wildlife in the areas of frequent animal crossings.”

These minimal limited mitigation measures fail to include measures such as crossing structures for wildlife or sufficient offsets to compensate for impacts to wildlife habitat in this key wildlife corridor. As a result, the current ESIA falls short of meeting the mitigation requirements for protection of biodiversity and natural resources in the Dawna Tenasserim landscape.

The limited mitigation measures in the ESIA fall short of meeting requirements for protecting biodiversity.

Other mitigation measures included are: to ban all hunting by construction workers, rehabilitation of forest that has been destroyed around the proposed project area, prohibition of logging outside the project area, removal of wildlife from the proposed project area, and prohibition of setting up camp in any surrounding dense forest area. It should be noted that the ESIA refers to Performing...
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Box 1: Missing elements in the ESIA with regards to forests and wildlife:

- A verified list of species in the area (double checked against camera trap surveys undertaken by conservation organizations, Myanmar Forest Department and the Karen Forest Department).
- An impact analysis based on the presence of these species and how the road will likely disrupt movement of these species while directly impacting wildlife habitat through increased deforestation.
- Evaluation of wildlife crossing sites in the key corridor areas (previously identified by WWF and other conservation organizations in 2016).
- Updated record of all rare flora and fauna species in close proximity to the road.
- Biodiversity monitoring plan along the road and at key crossing sites.
- A clear plan for protection of the corridor area and key habitats along the road.
- Replanting of trees due to clearing for road construction should use native species and include sufficient numbers of seedlings to account for losses during the planting/development stages.
- An evaluation of potential offsets to address impacts to biodiversity that can neither be avoided nor mitigated.

Box 2: Proposed mitigation measures to improve forest and wildlife protection in the Dawna Tenesserim Landscape

- Ensure all workers are aware of the location of important flora and fauna.
- Monitor fauna habitats and patterns near the road.
- Construct crossing structures.
- Protect vegetation along the road.
- Minimize removal of vegetation.
- Plant native species.
- Reduce speed limit at night and in the area of frequent animal crossing.
- Install wildlife warning signs.
- Install roadside reflectors to scare animals away from the road.

1. Myanmar Dawei Industrial Estate Company Limited. 2018. pp. 6-72, 6-73
4. Current impacts on biodiversity along the Dawei-Htee Khee road

Roads are a major cause of habitat fragmentation and loss of connectivity for wildlife. They also tend to intensify habitat degradation by providing human access to areas that were once remote or undisturbed. Understanding the habitat requirements and movement patterns of these species is critical to improve infrastructure and development planning and, as a last resort, to design mitigation measures and offsets.

4.1 Deforestation impacts from road construction

Increased deforestation along the road

Researchers at WWF and Smithsonian Institution have performed an analysis of freely available data on forest change to calculate deforestation rates along the Dawei-Htee Khee road corridor (figure 1). Total forest loss was calculated for three separate time periods: prior to construction of the access road (2000-2008), during construction of the access road (2009-2013), and after the initial access road construction period (2014-present).

Although some deforestation during the construction period could be directly attributable to road-building activities, changes over time in non-construction deforestation within the surrounding landscape was also assessed by summarizing forest loss within a 2 kilometres buffer around the road (as seen in figure 1).

During the baseline pre-construction phase, less than 0.2% of the landscape surrounding the road was being deforested annually (figure 2).

During construction of the access road and clearing for the main road, deforestation increased dramatically to rates of around 2% annually within 200 metres of the road, declining to just under 0.5% at 2 km distance away from the road.

During construction of the access road and clearing for the main road, deforestation in the vicinity of the road increased from around 0.2% to around 2% annually.

After construction of the access road and clearing for the main road, deforestation rates remained elevated over the pre-construction baseline, with deforestation rates ranging from 1.9% and 0.7% within 2 km of the road. These post-construction deforestation rates ranged from 6.0 - 2.3 times the national deforestation rate reported for the 2002-2014 period. This indicates that deforestation has remained elevated since the road was built and is likely to increase further when construction of the two-lane road resumes.
Figure 1 (above): Deforestation (red areas) in proximity to the Dawei-Htee Khee road (red).

Figure 2 (right): Deforestation in proximity to the Dawei-Htee Khee road.
4.2 Biodiversity along the Dawei-Htee Khee road

Mammals recorded in camera trap surveys

Historical records and camera trap data from this region highlight the global conservation significance of the Dawna Tenasserim Landscape. For instance, a 2014-2015 biodiversity survey from northern Tanintharyi Region detected some of Asia’s rarest and most threatened mammal species, including clouded leopard, Asian elephant, gaur, and Asian tapir. More recently, and as can be seen in the figure (this page), surveys undertaken by the Karen Forest Department and supported by WWF in 2016-17 and 2017-18 confirmed the continued presence of 12 globally threatened mammal species within 10 kilometres of the current road alignment. Overall, these surveys documented a total of 23 mammal species along the current access road.

Caught on camera

(Figure 3): Camera traps of IUCN-listed vulnerable (VU) and endangered (EN) species captured along the Dawei-Htee Khee road
Disturbance from the existing access road has not been mitigated

As can be seen in figure 4 below, recent camera trap surveys also found fewer mammals at closer distances to the road, which indicates that wildlife may be avoiding moving through areas near the road or have already declined in abundance due to reduced habitat quality. At the same time, greater number of encounters with hunters and dogs suggest that the presence of the road is likely to facilitate the illegal hunting of wildlife by improving access to high-quality forest habitat. This evidence suggests wildlife populations are already being impacted by the previous construction of the access road, and that these and any future impacts must be properly mitigated.

Presence and movement of wildlife in the corridor confirmed

In 2017, WWF, together with Wildlife Conservation Society (WCS), Fauna and Flora International (FFI), Smithsonian Institution (SI), the University of Hong Kong (HKU), and a number of regional species experts, organized a workshop to predict wildlife movement patterns based on knowledge about these species and their habitat use in tropical Asia. As can be seen in the map below (figure 5), the results from the workshop and subsequent analysis showed a number of likely movement routes across the landscape for nine globally-threatened species: tiger, clouded leopard, leopard, Asian elephant, gaur, Asian tapir, sambar deer, sun bear, Asiatic black bear and white-handed gibbon (figure 5, below). The locations of these movement corridors were validated by the recent camera trap survey along the Dawei-Htee Khee road in 2018, which was the first of its kind in the identified wildlife corridor.

Figure 4 (above): Overview of wildlife detection per day and distance to road, based on 2018 biodiversity surveys.

Figure 5 (above) Map showing the main wildlife corridor, including key species recorded along Dawei-Htee Khee road from the biodiversity survey in 2018.
As can be seen in figure 6 below, the 2018 camera trap survey along the road adds to previous research done by WCS, FFI, KFD and WWF in the area and confirms that key mammal species are almost exclusively found in areas predicted by regional experts to have higher wildlife movement rates. Information about wildlife movement in this transboundary area should be used to guide the planning of new infrastructure projects, including the Dawei-Htee Khee road to ensure that critical wildlife habitat and corridors are preserved.

Several roads threaten the connectivity of the Dawna Tenasserim Landscape

Even though avoidance is always the best option for mitigating impacts on biodiversity, for any development projects which are planned or underway, well-planned road alignment and well-designed mitigation measures can help minimize the impacts on ecological connectivity and wildlife movement. This is especially important since a number of other roads are also being planned in the landscape, making the need for maintaining connectivity even greater. The map to the right (figure 7) highlights some of the known projects that potentially threaten ecological connectivity and the healthy functioning of this globally significant wildlife corridor.

Figure 6 (above): Chart showing how results from the camera trap survey in 2018 compared to the expert consensus on where wildlife were likely moving and crossing along the road.

The majority of points are above the thick black line, meaning species were found in areas predicted to have above average likelihood of movement according to our expert consensus.

Figure 7 (above): Map highlighting the existing and planned road projects that fragment the wildlife corridor.
4.3 Benefits of reforestation to people, wildlife, and road investment

Identifying optimal areas for reforestation to benefit local communities and wildlife

Based on forest loss in the area to date and additional forest loss that will occur as part of construction of the Dawei-Htee Khee road (as outlined in the 2018 ESIA), there is a need to define and implement a reforestation plan that will address the impact of development on forests along the road.

This is especially critical for the wildlife corridor area between Myitta and Sinphyudaing in Myanmar. Efforts to reforest and restore, along with the optimal locations to undertake these activities, should be based on information about where forests have the most potential for benefiting biodiversity and generating the ecosystem services that are of highest priority to local communities.

These could include services like clean water, reduced soil erosion, or landslide risks. As can be seen in the map (figure 8, right), a preliminary analysis of Myanmar’s National Forest Landscape Restoration Opportunities Map used The Restoration Opportunities Optimization Tool (ROOT) to demonstrate the optimal watersheds for restoration along the Dawei road. Within this analysis, watersheds are highlighted where they support a reduction in flood risk in areas prone to flooding and with high social potential for restoration and reforestation activities.

Reforestation can help protect the road from erosion, landslides, and floods

The reforestation plan for the Dawei-Htee Khee road could use a similar analysis to ensure that reforestation and restoration is done in areas where benefits will be the highest for people and wildlife living in the area, as well as for securing the road investment itself. This can be implemented by assessing the long-term resilience of the road, if exposed to deforestation. This can be done through a fine-scale evaluation of where the road intersects highly vegetated areas of the landscape. This information, if combined with engineering models, can be used to quantify the margin of safety with respect to surface erosion or landslides and can identify areas where reforestation is crucial not only to preserve wildlife habitat but also to ensure long-term durability of the road.

Figure 8 (right): Map highlighting possible areas optimal for restoration in order to reduce flood risk along the road
NATURE AT RISK: IMPACT FROM THE DAWEI ROAD ON FORESTS AND WILDLIFE

The Dawei Road's impact on forests and wildlife:

The Dawei Road, which connects Dawei and Mawlamyine, is being built by the Myanmar government with the support of the World Wildlife Fund (WWF) and the Smithsonian Institution. This road is expected to have a significant impact on the local wildlife and ecosystems. The road is being built to improve connectivity between different parts of Myanmar, but it will also lead to habitat fragmentation and loss of biodiversity.

The road will be 75 kilometers long and will cut through areas of high conservation value, including forests, wetlands, and coastal areas. This will result in the displacement of local communities and the loss of wildlife habitats. The road is also expected to increase traffic and promote illegal logging, which will further threaten the local ecosystems.

To mitigate these impacts, WWF and the Smithsonian Institution are working with the Myanmar government to develop a road management plan that will minimize the negative effects on wildlife and ecosystems. This plan includes measures such as the creation of wildlife corridors and the establishment of wildlife monitoring and conservation areas along the road.

The plan also includes the identification of areas of high conservation value that should be protected from development. These areas include national parks, wildlife reserves, and important bird areas. The plan also includes the establishment of community-based conservation projects that will involve local communities in the protection of wildlife and ecosystems.

The Dawei Road project is a significant development project in Myanmar, but it is also a major threat to the country's biodiversity. The Myanmar government must take steps to ensure that the road is built in a way that minimizes its negative impact on wildlife and ecosystems. This will require careful planning and monitoring, as well as the involvement of local communities and stakeholders.

In summary, the Dawei Road project presents a significant challenge to the protection of Myanmar's biodiversity. However, with careful planning and implementation, it is possible to minimize the negative impacts of the road and ensure that Myanmar's natural heritage is protected for future generations.
NATURE AT RISK: IMPACT FROM THE DAWEI ROAD ON FORESTS AND WILDLIFE

4.2. Chitwà-Chimpy road

44m 280m 1111m 2210m 5033m 7935m 9116m

The impact of the Daewei road on forests and wildlife is significant. The road has affected the distribution and abundance of several species. For example, the barking deer (VU) has been observed in the area, and its population has been negatively impacted. Similarly, the muntjac (VU) and the clouded leopard (VU) have also been affected by the road.

However, the effects are not uniform across all species. The tailed parrot (VU) and the pygmy hog (VU) have shown resilience, and their populations appear to be unaffected by the road. The black rabbit (VU) and the Serum (VU) have also been observed in the area, but their abundance has decreased due to the fragmentation of their habitat.

The road has also affected the connectivity of certain habitats, which is critical for species that rely on large areas. The tailed parrot (VU) and the pygmy hog (VU) are examples of species that require large tracts of forest to survive. The road has disrupted their movement, making it difficult for them to access their food sources and breeding grounds.

The impact of the road on the habitat is also significant. The barking deer (VU) and the muntjac (VU) are examples of species that are adapted to living in forested areas. The road has cleared large areas of forest, which has impacted their population.

Overall, the impact of the Daewei road on forests and wildlife is significant, and it highlights the importance of preserving and protecting the natural habitats of these species.
Smithsonian Institution (SI),

In 2018, WWF and the Wildlife Conservation Society (WCS) partnered with the Myanmar Forestry Department (FFD) and the World Wildlife Fund (WWF) to assess the impact of road construction on wildlife. This study was conducted in conjunction with the Myanmar Forestry Department and the World Wildlife Fund to assess the impact of road construction on wildlife.

The study found that wildlife populations in the area were negatively impacted by the road construction. The study also highlighted the importance of protecting wildlife corridors and establishing wildlife corridors to connect fragmented habitats. The study recommended that the government and other stakeholders work together to protect and conserve wildlife in the area.

In conclusion, the study shows that road construction can have significant negative impacts on wildlife. It is important to consider the potential impacts of road construction on wildlife and to take steps to protect and conserve wildlife in the area.
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Countries around the world are increasingly addressing negative impacts on wildlife and forests caused by road construction. While successful examples used to be seen primarily from Europe, North America and Australia, there are now more examples from developing countries such as India, Nepal, Malaysia and the latest addition—Thailand, where the first wildlife crossings are being installed.

**Case study 1**

**Keeping landscapes connected in Thailand: First wildlife crossings installed along highway 304**

Highway 304 in Thailand, sections of which were only opened in 2018, divides Dong Phayayen-Khao Yai forest complex, a United Nations Educational, Scientific and Cultural Organisation (UNESCO), World Natural Heritage Site since 2005. UNESCO’s World Heritage Committee expressed concern in 2012, when it learned that Thai authorities planned to expand the highway from a two-lane to a four-lane highway as this would increase the number of traffic accidents that occurred on the precarious curves, particularly at night. In March 2018, a double-decker coach collided with a lorry on the narrow road in the dark, killing 19 people and injuring 31.

To offset the potentially negative ecological impacts of the road expansion, the new road was designed with a mix of underpasses and two flyovers. Incorporating wildlife crossings has been a central feature of the design, particularly given the number of road kill, including the death of a gaur that was hit by a car in 2015 crossing the road to access water. These are the first wildlife crossings ever to be installed in Thailand and represent an important step towards balancing human infrastructure needs with maintenance of healthy, inter-connected wildlife populations.

The crossings include a 430-metre tunnel, the upper part of which is being filled and surfaced with soil to allow for animals to cross. Another wildlife crossing location includes two parallel sections of elevated road, each with two traffic lanes, that will be built eight metres above the ground. This elevated section of road will span a distance of 570 metres, providing a long stretch for wildlife to cross underneath.

This road construction is part of a 1.5 billion Baht deal the department signed with Italian-Thai Development PLC to increase the number of traffic lanes from two to four over a distance of 15.5 kilometres and to construct wildlife crossings.

**Case study 2**

**Keeping landscapes connected in India: The Case of National Highway 37**

Kaziranga National Park, located in the North eastern Indian state of Assam, is a UNESCO world heritage site that contains one of the world’s highest tiger densities, India’s largest population of greater one-horned rhinoceros, and large populations of wild buffaloes, swamp deer, hog deer, and elephants. Kaziranga lies entirely in the floodplains of the Brahmaputra River, meaning that extensive areas of the park are inundated by flood waters during the annual monsoons.

The nearest area of high ground lies to the south in the adjacent Karbi-Anglong hills, and wildlife crossing over from Kaziranga to the hills, especially during flood season, must move through villages, farmlands, and National Highway 37 (NH37) to reach higher ground. Four major wildlife corridors have been identified that allow for safe wildlife movement (fines for speeding, signage notifying drivers to slow down in critical areas, barriers to slow down traffic, speed bumps, etc.). Given that these corridors encompass multiple land use types, WWF has also engaged with communities to build local support for conservation. Community conservation initiatives have included building sustainable livelihood initiatives and awareness campaigns to make humans less vulnerable to harmful encounters with large mammals in the corridors, especially during the monsoon months when animal movement increases.

To monitor wildlife use of these corridors, with intensive monitoring of the Kanchanjuri corridor since 2011. Camera traps have been used to identify key crossing points along the highway and to document seasonal variation in corridor use. In addition, land use types have been mapped in these corridors to identify their effects on animal movement pathways.

These data have been used in various ways to inform the Assam Forest Department’s conservation initiatives, including planning of mitigation measures in infrastructure development that allow for safe wildlife movement (fines for speeding, signage notifying drivers to slow down in critical areas, barriers to slow down traffic, speed bumps, etc.). Given that these corridors encompass multiple land use types, WWF has also engaged with communities to build local support for conservation. Community conservation initiatives have included building sustainable livelihood initiatives and awareness campaigns to make humans less vulnerable to harmful encounters with large mammals in the corridors, especially during the monsoon months when animal movement increases.

5. Regional case studies:
Mitigating impacts on wildlife from road construction
6. Conclusions & recommendations

6.1 Key conclusions from analysing the approved 2018 ESIA for the Dawei Htee Khee road

The 2018 ESIA does not fulfill the requirements stipulated in the Myanmar ESIA procedure—such as how surveys are carried out and presenting maps that clearly identify where they took place. Moreover, the ESIA has also not identified the wildlife corridor between Myitta and Sinphyudaing despite this being a known high-value and sensitive environmental area, which is also a prerequisite in the Myanmar ESIA procedure. Furthermore, the ESIA fails to highlight impacts that have resulted due to the construction of the access road and have therefore already taken place. Finally, the proposed mitigation measures are far from what is needed to fully address the adverse impacts on forests and wildlife that will occur as a direct result of the construction of the Dawei-Htee Khee road.

Summary of shortcomings of the ESIA

1) The ESIA report falls short in describing and applying proper biodiversity assessment methodologies in the specified area where the road is going to be built.
2) The impacts on biodiversity in the area are poorly assessed and many crucial statements in the ESIA report lack rigour and supporting evidence.
3) The mitigation measures identified in the ESIA are very weak considering the globally significant species already confirmed in the area (based on WWF and other organizations’ research). This shows a lack of commitment towards avoiding and fully mitigating impacts.
4) There is a significant discrepancy between the condition of “implementing a wildlife corridor” as outlined in the Minister’s letter approving the ESIA and what the company has committed to in their response letter. This needs to be addressed in an updated Environmental Management Plan as the current one provides no plan for how to construct wildlife crossings, protect the wildlife corridor, and monitor impacts.

6.2 Key conclusions of biodiversity research efforts from 2014-2018

Deforestation along the road has increased significantly since construction of the access road started, which demonstrates that construction of the access road has already had significant negative impacts on the Dawna Tenasserim Landscape and its rich biodiversity. Recent camera trap surveys confirmed the presence of threatened wildlife in the ecological corridor and further demonstrated the rich biodiversity of this area. Wildlife is already being impacted by the existing access road, showing that the road already represents an impact on wildlife habitat and threatens to disrupt movement of wildlife across the landscape.

Summary of key forest and wildlife research findings

1) Deforestation has increased substantially along the road corridor since construction began on the access road and extends to over one kilometre away from the road itself.
2) The presence of many globally threatened mammal species has been confirmed in the forests surrounding the current road alignment.
3) Reduced mammal abundance has been observed along the road and this effect penetrates several kilometres into the surrounding habitat.
4) Areas close to the road have greater numbers of hunters and dogs than areas farther from the road, suggesting the road improves access for illegal hunting.
5) The road and accompanying deforestation now cut across the middle of otherwise high-quality dispersal habitat for several globally-threatened mammal species.

6.3 Recommendations for mitigating impacts on forests and wildlife

Facilitate the full protection of the forest and wildlife corridor

As shown by a number of surveys, including those presented in this report (most importantly in figure 7—the map identifying the main wildlife crossing area), the “wild highway” or ecological corridor which the road section from Myitta to Sinphyudaing cuts across, is of utmost importance for biodiversity and maintenance of ecological processes.

As the road construction will impact habitat connectivity and the ecological functioning of this area, the road project must include a biodiversity action plan for how it will achieve no net loss of biodiversity through the full protection of the adjacent forest and wildlife corridor. This could also include the development of biodiversity offsets from the project that would provide financial means to protect the corridor and involve local communities in natural resource management, including forest and freshwater management and biodiversity protection.

As shown in this report, the area that is most vulnerable to soil erosion/landslides, particularly if forests are cleared, corresponds with the most important area for biodiversity (between Myitta and Sinphyudaing). As such, protecting the forests and restoring these areas will lower the risk of erosion and landslides to the road investment while also protecting wildlife habitat.

The protection of the wildlife corridor should be carried out in collaboration with local authorities, Karen National Union, local communities and conservation organizations.

Plan the two-lane and four-lane simultaneously

Given the likelihood of a future upgrade of this two-lane road to a four-lane highway, there is an imperative need for the project to strategically plan the two-lane and four-lane implementations together from the very start of the project in order to ensure that environmental impact, avoidance, and effective mitigation are fully taken into account. Experience from other countries (see case studies above) shows that this is the most cost effective and environmentally sound approach.

Undertake a comprehensive and fully funded reforestation and habitat restoration plan

Based on the existing and future potential impacts on the forest shown in this report, both during the construction of the access road and during the upgrade of the road, a comprehensive and fully funded reforestation and habitat restoration plan must be designed and implemented by the road developer. This plan should be equivalent to the overall loss of forest area during the construction and upgrading of the access road. Reforestation needs to be carried out in key areas that will deliver and secure forest benefits to people and wildlife. It is also essential that more than 1 tree for every tree removed is planted in order to account for the loss of seedlings during the planting/development stage.

Install wildlife crossings and fencing in the key corridor area between Myitta and Sinphyudaing

Based on the importance of biodiversity in the area and the habitat connectivity needed for a fully functioning landscape and for species persistence, it is
imperative that wildlife crossing structures, such as underpasses or overpasses, are installed along the main corridor between Myitta and Sinphydaing.

This should be carried out in a number of key crossing locations and should accommodate all species identified in the area and come with a proper maintenance and monitoring plan, as well as measures and budget to carry out such work. This should be based on the locations to be identified by WWF in collaboration with partners and based on additional surveys.

The wildlife crossings must also come with required fencing in order to guide wildlife to the crossing areas. Research shows that the most effective crossing sites come with well-planned and maintained fencing.

Apply slope retention using bio-engineering

Using bioengineering and forest protection is essential in order to reduce the risk of soil erosion and landslides, which can protect communities living further downstream and ensure the proper functioning of the river ecosystem and protection of the road investment itself. Bioengineering techniques and terracing should be used for slope retention to protect vegetation along the road and minimize further erosion.

Reduce noise and light reduction

Many of the species in this area are very sensitive to noise and light created by construction work as well as traffic during the operation stage. As such, noise and light reduction measures (including vegetation, screens, fencing and other measures) must be installed in key areas along the road to minimize noise and light impacts on wildlife.

Develop and implement a fully funded wildlife monitoring and research plan

In order to monitor the impacts from the road construction, including the projected impacts from traffic, a wildlife monitoring plan with semi-annual biodiversity surveys and monitoring schemes along wildlife crossing points must be developed and fully funded as part of the environmental monitoring plan.

Planning and implementation of monitoring efforts should be carried out in collaboration with the Myanmar Forest Department, the Karen Forest Department, communities along the road, and key conservation organizations. The results of these surveys need to be made available and used for research and management purposes.

Put in place signage along the road to raise awareness about illegal wildlife poaching and trade

As increased risks of poaching and hunting are common along roads in previously undisturbed areas, awareness raising signs and material (informing about its illegality) must be installed along the road. There should also be collaboration with local law enforcement agencies to report on any poaching incidents or illegal trade activities.

Ensure that Free Prior and Informed Consent (FPIC) is undertaken in all affected villages along the road

The road developer must ensure that communities have been fully consulted and informed about the impacts and risks of this project and how the developer will mitigate them. Proper consent from the villagers needs to be sought. This is especially important considering the history of conflict in the area and villagers' strong dependency on the forest, water resources and other natural resources.

Develop a biodiversity offset mechanism

As part of addressing any impact that can be neither avoided nor mitigated, an offset mechanism must be developed. This offset should secure the financial needs for biodiversity conservation in the area and provide support to local communities on natural resource management. The offset could be funded through an endowment, financial contribution, or as an added percentage onto the road toll. These funds could be managed by a selected stakeholder under the guidance of an advisory committee. The funding generated for the offset should support biodiversity monitoring and research, local communities' involvement in protecting the wildlife corridor, managing the forest and river along the road, and efforts to raise awareness and ensure enforcement with regards to illegal wildlife poaching and trade.

1 An offset mechanism compensates for the adverse effects caused by development projects on a variety of ecosystems and that cannot be avoided through mitigation measures. The overall objective is to have no net loss of biodiversity. There are various ways to design an offset mechanism and can include a direct buyout contribution to protect and manage certain areas or funds can be generated through a pollution pays scheme, where for example a percentage and be added to the road toll, creating a sustainable stream of funding supporting conservation in the area.


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