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REPORT

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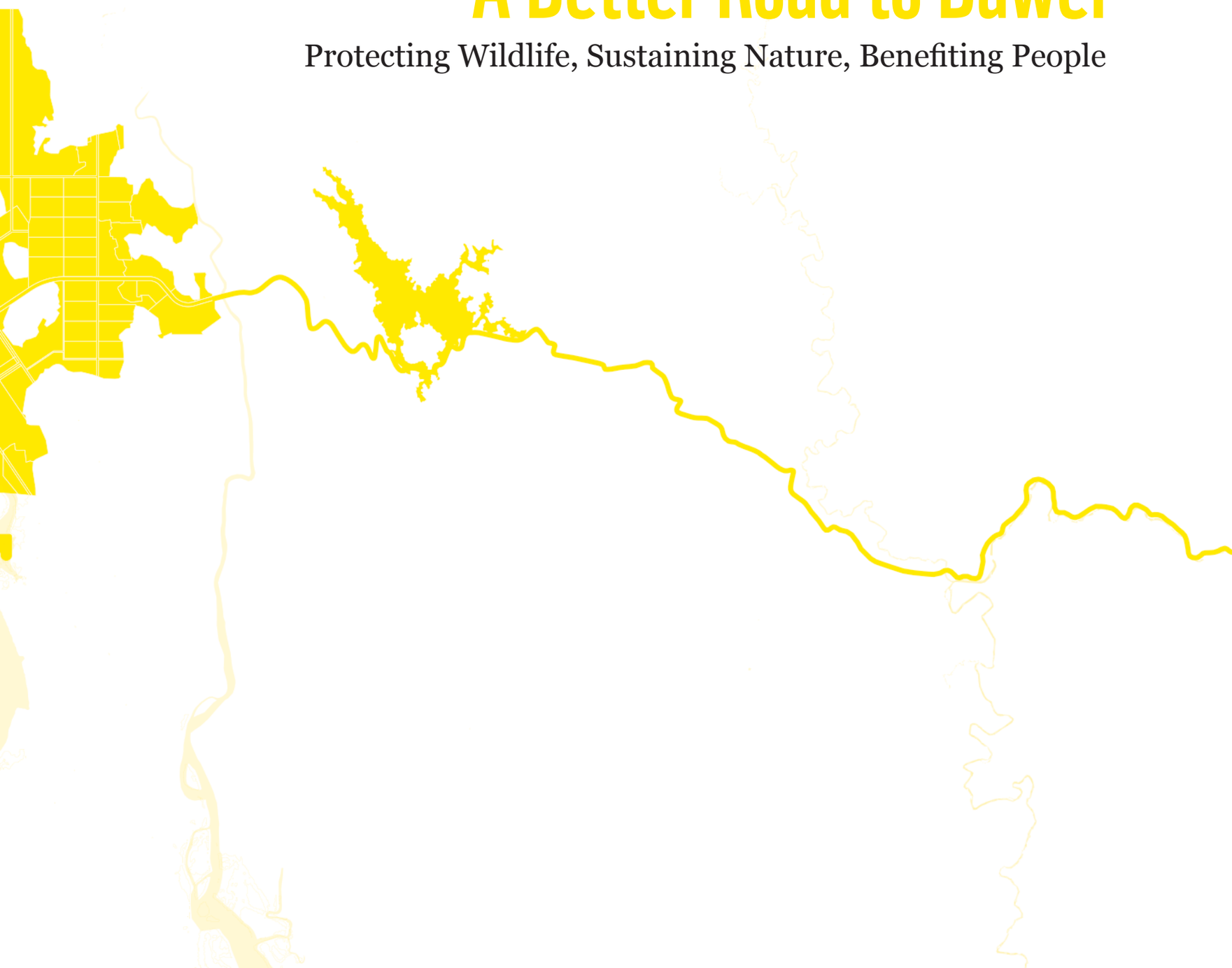
2015

JUNE 2015

An Overview Report

A Better Road to Dawei

Protecting Wildlife, Sustaining Nature, Benefiting People



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WWF Position on the Dawei Project

Given that the proposed Dawei Industrial Development project and associated road to Thailand have been approved and are likely to be built in the coming years, WWF has significant concerns about the potential impacts on the globally important biodiversity of the Tanintharyi Region, including tiger habitat, dense forests, species-rich rivers and marine resources, which are a critical resource for local communities.

The Dawei Project cannot avoid impacting the environment and communities in the region, but WWF believes that those impacts must be minimized by careful planning and use of mitigation measures throughout the process, from design to development to completion and beyond.

WWF calls on the governments of Thailand and Myanmar, as well as the project's developers, to first carry out a comprehensive strategic environmental assessment, including social impacts, of the project, including the sea port, industrial zone and associated industries and the road between the Myanmar Special Economic Zone and Thailand. WWF also recommends that the results of the assessments, be used by technical experts, community representatives, and the project developers to design the project in a way that prioritizes the value of the region's critical ecosystem services, biodiversity and community needs. Negative environmental impacts from the Dawei project should be monitored and mitigated before, during and after construction and fair compensation provided for those affected.

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Special thanks to
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In memory of our colleague Dr. Miklós Puky (1961-2015), who made vital contributions to this study.

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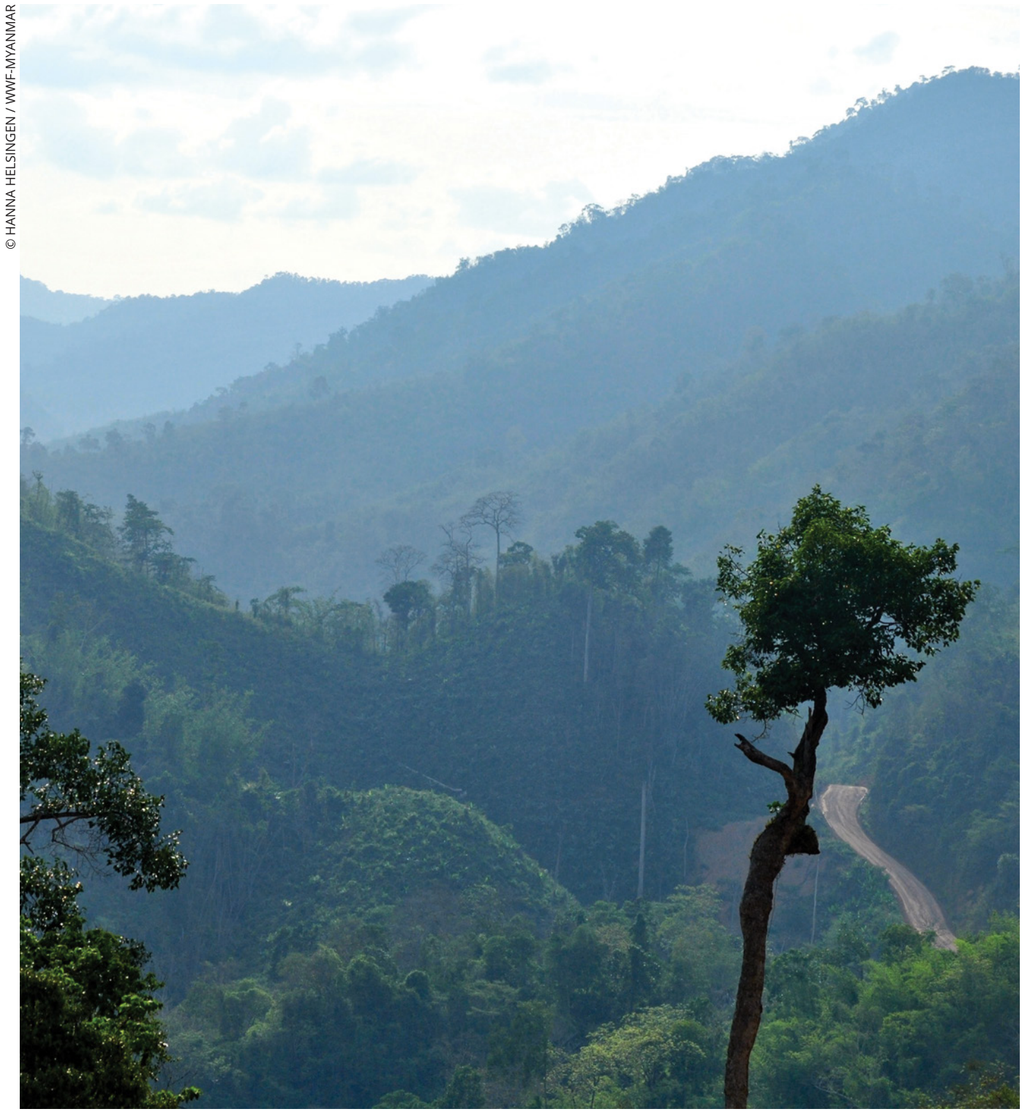


The current access road for the planned Dawei road, near the area of Elephant Cry Hill.

Section 1

Why address ecosystem services and wildlife in the development of the Dawei road?

Introduction

Safe, efficient and environmentally sustainable transport infrastructure can only be developed using a landscape approach.

Roads and other transport infrastructure are necessary for Myanmar's economic development. However, poorly planned infrastructure can have many negative impacts, degrading the essential benefits that the people of Myanmar derive from their natural environment and biodiversity. These benefits include access to clean water, fertile agricultural lands, protection from natural disasters, and social security from medicinal plants and non-timber forest products. In turn, healthy ecosystems can protect infrastructure by reducing damage from natural hazards such as landslides, flooding and erosion. Experience from infrastructure development in Europe and beyond has shown that it is both more cost-efficient and safer if wildlife and ecosystem services are taken into account early on in the planning process. If located and designed thoughtfully and constructed responsibly, roads can increase mobility for people and products while protecting nature and reducing long-term costs of infrastructure maintenance. As Myanmar expands road networks and infrastructure, there is an opportunity to strategically plan and construct these permanent structures from the beginning.

The Dawna Tenasserim Landscape in southern Myanmar is one of the last large intact forest landscapes in the region, harboring a rich array of endangered wildlife found in few other places. This transboundary landscape between Thailand and Myanmar is a high priority for conservation, supporting significant populations of tigers, Asian elephants and a rich variety of other wildlife. The forest blocks running north-south in Tanintharyi region link two forest blocks in Thailand, the Western Forest Complex and Kaeng Krachan Forest Complex. Establishing an ecological corridor would support wildlife and ecosystem services, critical to the well-being of people in the area.

The Dawei Special Economic Zone (SEZ) and its planned road link will cut directly across the Tenasserim Hills connecting Dawei with Bangkok, via Kanchanaburi. If not planned and constructed thoughtfully by taking into account the impacts on nature and society, this area stands to lose much of its wildlife and ecological integrity, with serious consequences for the well-being of local people and Myanmar's economy.

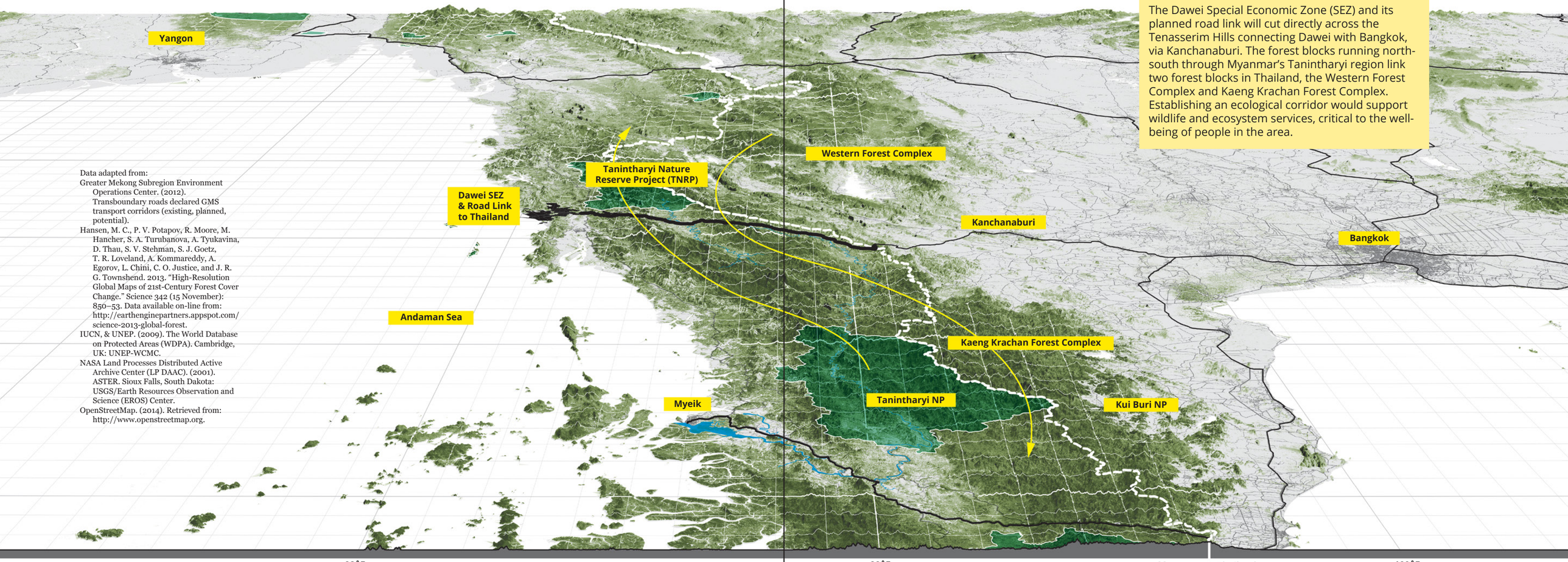
This report aims to help the Dawei road planners and developers to better address these issues, with specific focus on connectivity, wildlife and ecosystem services, in order to ensure that Tanintharyi and its transboundary landscape can continue to sustain present and future generations of people and wildlife.

Section 1 *Why address ecosystem services and wildlife in the development of the Dawei road?*

Section 2 *What do assessments and future scenarios tell us about ecosystem services in Tanintharyi?*

Section 3 *Where can possible technical solutions be located and what measures should be implemented?*

Tanintharyi: Enabling an Ecological Corridor

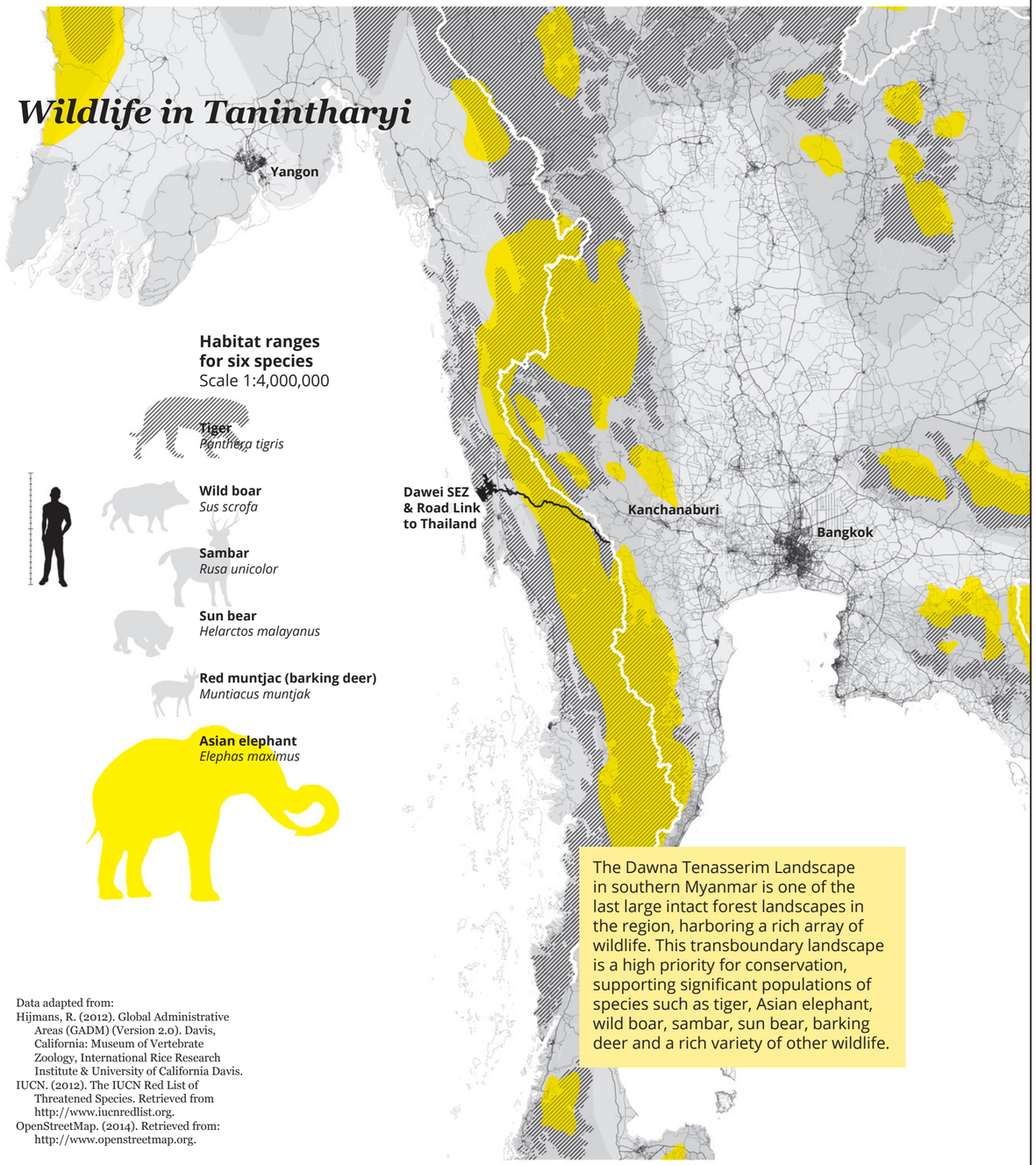


The Dawei Special Economic Zone (SEZ) and its planned road link will cut directly across the Tenasserim Hills connecting Dawei with Bangkok, via Kanchanaburi. The forest blocks running north-south through Myanmar's Tanintharyi region link two forest blocks in Thailand, the Western Forest Complex and Kaeng Krachan Forest Complex. Establishing an ecological corridor would support wildlife and ecosystem services, critical to the well-being of people in the area.

Data adapted from:
Greater Mekong Subregion Environment Operations Center. (2012). Transboundary roads declared GMS transport corridors (existing, planned, potential).
Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Data available on-line from: http://earthenginepartners.appspot.com/science-2013-global-forest.
IUCN, & UNEP. (2009). The World Database on Protected Areas (WDPA). Cambridge, UK: UNEP-WCMC.
NASA Land Processes Distributed Active Archive Center (LP DAAC). (2001). ASTER. Sioux Falls, South Dakota: USGS/Earth Resources Observation and Science (EROS) Center.
OpenStreetMap. (2014). Retrieved from: http://www.openstreetmap.org.

Elevation exaggerated by three times to highlight topographic features. Plantations included in the tree canopy cover estimates.

Wildlife in Tanintharyi



The Dawna Tenasserim Landscape in southern Myanmar is one of the last large intact forest landscapes in the region, harboring a rich array of wildlife. This transboundary landscape is a high priority for conservation, supporting significant populations of species such as tiger, Asian elephant, wild boar, sambar, sun bear, barking deer and a rich variety of other wildlife.

Data adapted from:
Hijmans, R. (2012). Global Administrative Areas (GADM) (Version 2.0). Davis, California: Museum of Vertebrate Zoology, International Rice Research Institute & University of California Davis.
IUCN. (2012). The IUCN Red List of Threatened Species. Retrieved from http://www.iucnredlist.org.
OpenStreetMap. (2014). Retrieved from: http://www.openstreetmap.org.

Natural Capital and Ecosystem Services

Natural capital – the earth's air, water, land and biodiversity – provides us with vital benefits essential for our well-being and prosperity. These benefits, or ecosystem services, include food, clean water, flood regulation, coastal protection from storms, crop pollination and many others.

Forests near the area of Elephant Cry Hill.

How Roads Impact Nature

Example Area 2
West of Myitta

Fragmentation
The ability for wildlife to move around a landscape in search of food, shelter or to mate is negatively impacted by roads and often threatens species survival. The only ways to limit fragmentation are to avoid critical wildlife areas and to maintain corridors by constructing wildlife crossings and managing traffic flows.

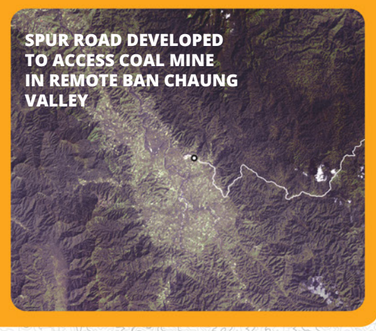
Habitat Loss
Road construction leads to physical change in land cover along the route as natural along the route as natural habitats are replaced or altered. Disturbance and isolation effects lead to an inevitable change in the distribution of species in the landscape.

Wildlife Vehicle Collisions
Millions of animals are killed on roads and railways each year and many more are seriously injured. Wildlife-vehicle collisions also kill and injure many people every year, if preventive measures in design and management of the infrastructure are not considered.

Secondary Impacts
Construction of new transport infrastructure leads to secondary effects such as changes in land use, human settlement patterns or industrial development. These effects need to be considered especially if transport infrastructure is planned to access remote areas.

Wildlife Poaching
Roads that provide access to previously undisturbed areas, could lead to an increase in poaching and illegal wildlife trade, if preventive measures, such as monitoring and enforcement are not taken.

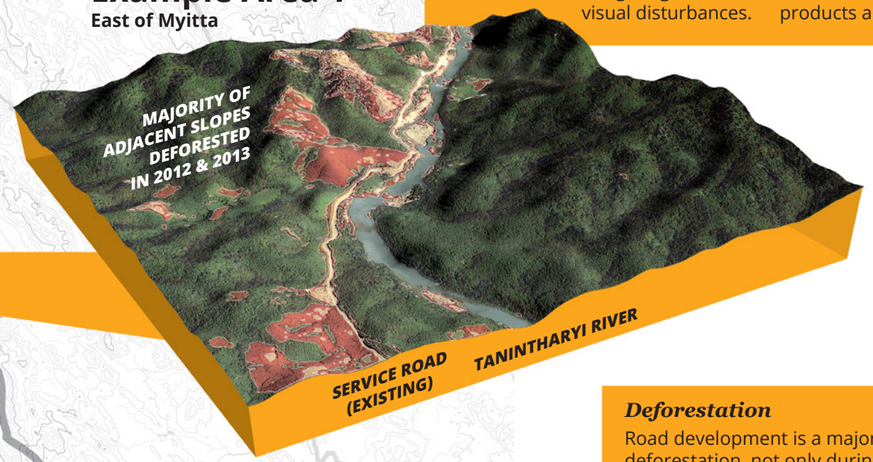
Example Area 3
Ban Chaung Spur Road (Kunchaungyi-Amara Link)



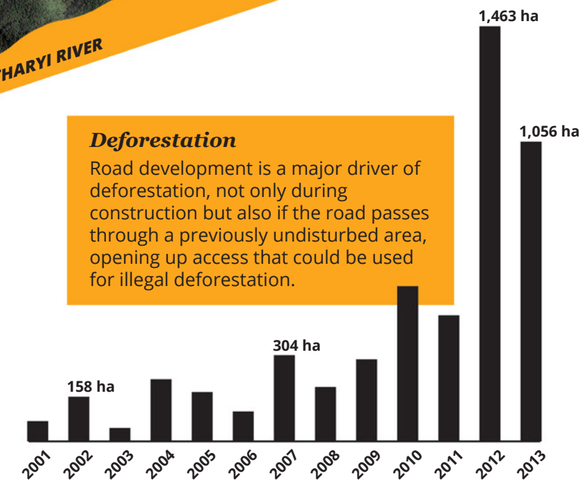
Disturbance & Pollution
Road development and operation alter ecological characteristics of adjacent and distant habitats, which may change the way they are used by wildlife. The main types of disturbances are hydrological changes, chemical and air pollution, noise, vibration, lighting and visual disturbances.

Ecosystem Service Loss
The damage to ecosystems from poorly planned and constructed roads degrades many vital benefits that people obtain from nature. These benefits, essential for human well-being, include provision of clean water, flood and erosion control, forest products and many others.

Example Area 1
East of Myitta



Deforestation
Road development is a major driver of deforestation, not only during construction but also if the road passes through a previously undisturbed area, opening up access that could be used for illegal deforestation.



Deforested area by year within 5 kilometers of the Dawei road alignment

How Roads Impact Nature, pp. 12-13
How Roads Depend on Nature, pp. 14-15

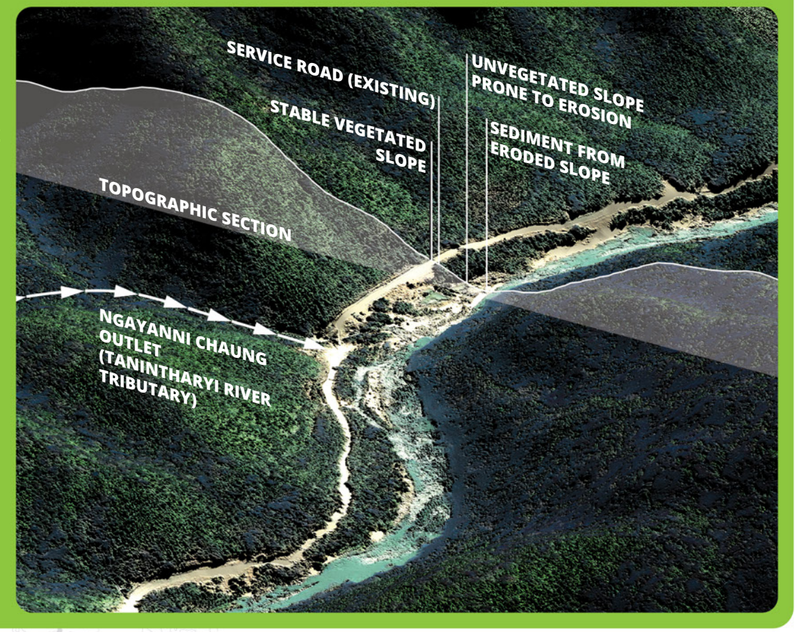
Data adapted from:
Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342 (15 November): 850–53. Data available on-line from: http://earthenginepartners.appspot.com/science-2013-global-forest.
Landsat 8 Level 1 Product. Acquisition January 2015.
NASA Land Processes Distributed Active Archive Center (LP DAAC). (2001). ASTER. Sioux Falls, South Dakota: USGS/Earth Resources Observation and Science (EROS) Center.

How Roads Depend on Nature

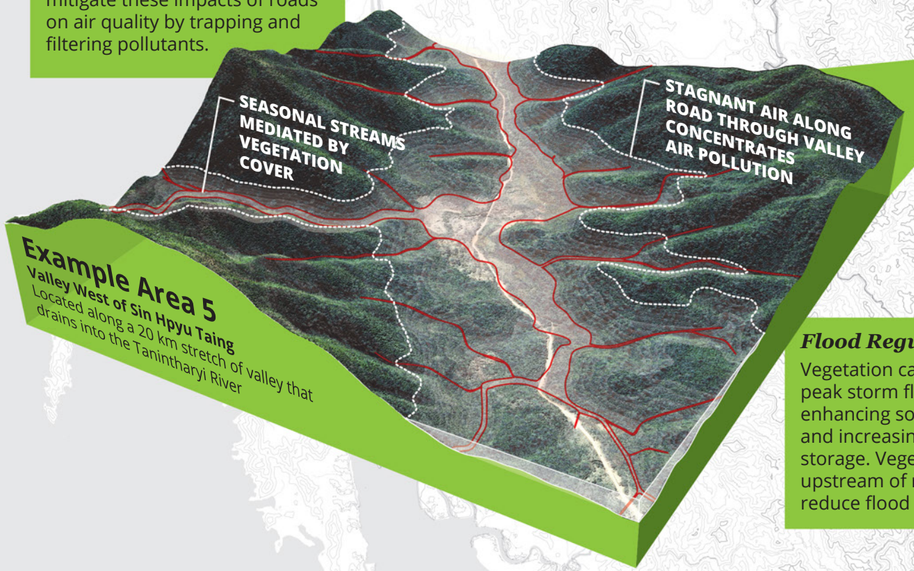
Example Area 4
West (upriver) of Aing Waing Village

Erosion Control
Vegetation holds soil in place, preventing erosion and keeping sediment out of waterways. Maintaining and restoring vegetation upstream of roadways reduces sediment on roads, lowering infrastructure and vehicle maintenance costs.

Landslide Prevention
Vegetation can help to stabilize soils and hillsides, reducing the risk of landslides. This can increase safety for road users and reduce maintenance costs.



Air Quality
Air pollution has negative consequences for human health. Roads, and especially the traffic they generate,reduce air quality. Vegetation can help to mitigate these impacts of roads on air quality by trapping and filtering pollutants.



Example Area 5
Valley West of Sin Hpyu Taing
Located along a 20 km stretch of valley that drains into the Tanintharyi River

Flood Regulation
Vegetation can reduce peak storm flows by enhancing soil infiltration and increasing water storage. Vegetation upstream of roadways can reduce flood risk to roads.

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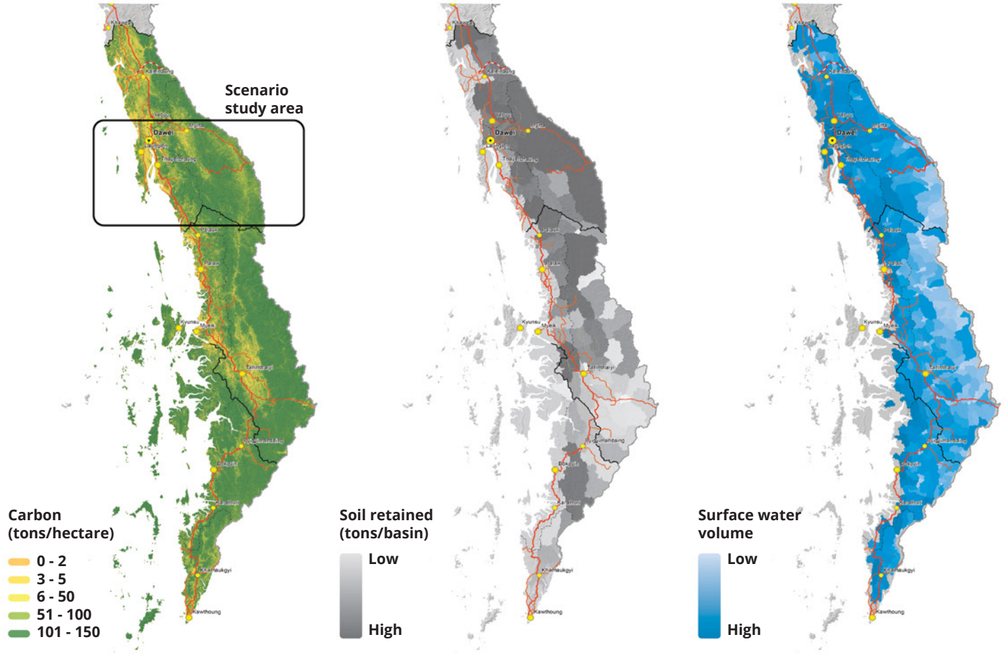
Soil erosion and minor landslides can be observed along the road.

Section 2

What do assessments and future scenarios tell us about ecosystem services in Tanintharyi?

Forests, Soil and Water in Tanintharyi



Vegetation and Forest Cover

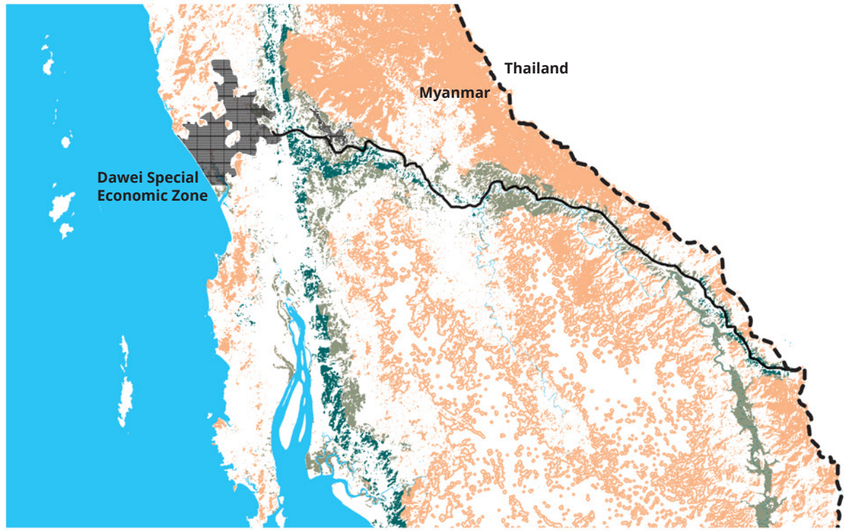
The forests along the planned Dawei road store large amounts of carbon, helping to mitigate climate change. Protecting these remaining forests and working with communities to promote natural resources management will help sustain ecosystem services provided by forests.

Soil Retention (per watershed)

The planned Dawei road runs through a mountainous area. Forests and other vegetation on slopes help stabilize soils and hillsides, reducing soil erosion and landslides. If these forests were lost, increased erosion and landslides would pose serious threats to communities and to the integrity of the road itself. This in turn can result in increased risks to road users, higher maintenance costs, and road closures.

Annual Water Yield (per watershed)

The planned Dawei road passes through an area of high surface water volumes. Proper and well planned road design is essential in order to avoid negative impact on water resources in the area and water damage to the road infrastructure.



Comparison of conversion scenarios
Scale 1:1,000,000

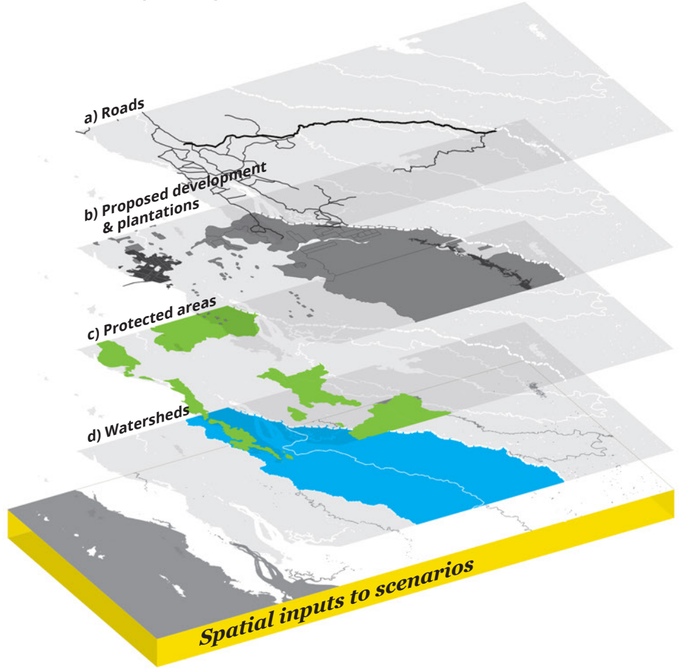
- Limited conversion
- More conversion
- High conversion

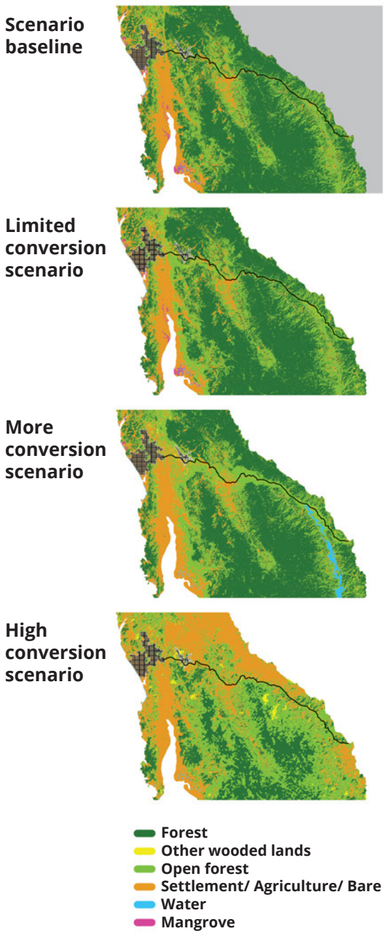
Data adapted from:
WWF 2013 Tanintharyi land cover – Google Earth Engine.
InVEST (Integrated Valuation of environmental services and tradeoffs) Natural Capital Project 2014 http://www.naturalcapitalproject.org/
Myanmar Information Managment Unit (MIMU). The datasets are developed by WFP, UNODC, UNEP, UN OCHA, and MIMU. http://www.themimu.info/gis-resources
Worldpop. http://worldpop.org.uk

Future Development Scenarios

Scenarios can help land use and road planners understand possible future outcomes under different development options. For example, this information can be used to identify key areas that should be avoided for infrastructure development, or areas that need to be protected. Development scenarios can also help to identify communities that may be affected and to locate mitigation measures to address negative social and environmental impacts.

"Limited" and "more" conversion scenarios show expanding frontiers of deforestation primarily concentrated around existing and planned roads and settlements. The high conversion scenario reflects a future where extensive forest conversion is similar to neighboring countries.





Ecosystem Service Outcomes Under Different Scenarios

Carbon Loss

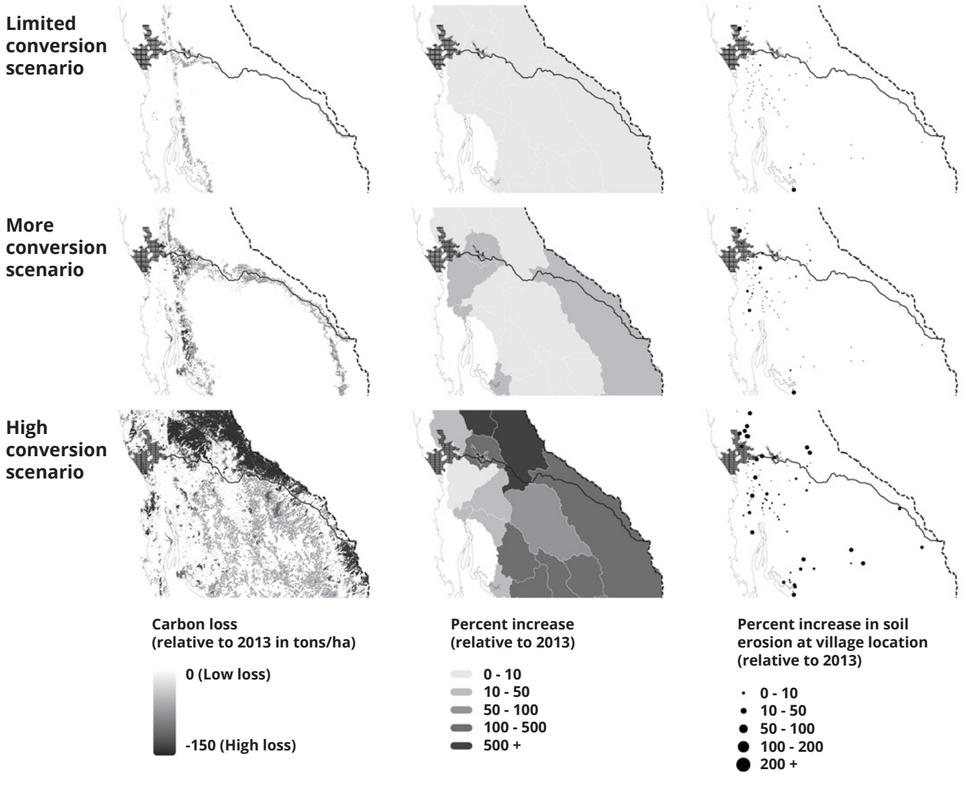
Continued deforestation will result in increased carbon emissions impacting global climate change.

Sediment Export

Soil erosion within sub-catchments increases with deforestation. Negative impacts of soil erosion include reduced water quality, soil deposition on roads, reservoirs and rivers and lower agricultural productivity.

Servicesheds

A serviceshed describes the area providing an ecosystem service to its specific users. Mapping servicesheds of villages can help identify areas from which communities are deriving benefits from nature such as water provision or reduced erosion.

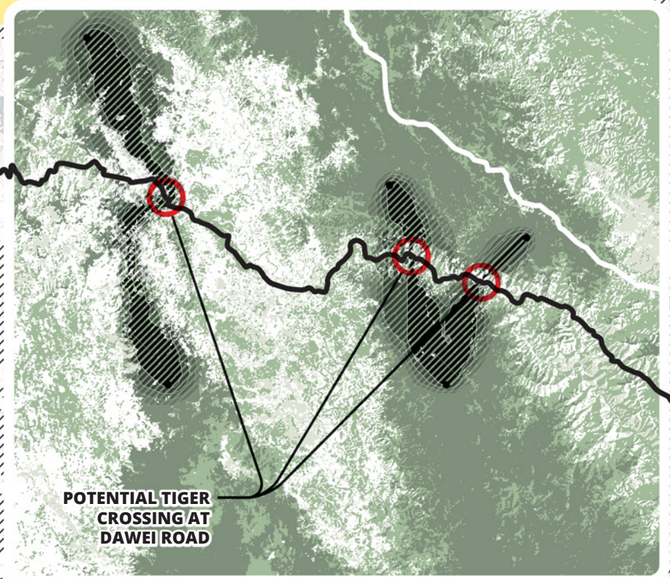


The current access road for the planned Dawei road outside the village of Myitta.

Locating Critical Areas Along the Dawei Road

Example of tiger habitat corridor model

Darker shaded areas indicate stretches of high-quality forest cover that extend up to the edge of the road on both sides of it. Such areas may be preferred by wildlife as corridors for moving across the landscape. Wildlife-vehicle collisions will result where these corridors cross the road. Engineering solutions such as overpasses, underpasses and elevated road sections will reduce collision risks by allowing wildlife to safely access the forest on both sides of the road without needing to cross the road surface.



Habitat range and corridor model
Scale 1:500,000

Tiger
Panthera tigris

Data adapted from:
IUCN. (2012). The IUCN Red List of Threatened Species. Retrieved from http://www.iucnredlist.org.
NASA Land Processes Distributed Active Archive Center (LP DAAC). (2001). ASTER. Sioux Falls, South Dakota: USGS/Earth Resources Observation and Science (EROS) Center.

Section 3

Where can possible technical solutions be located and what measures should be implemented?

Wildlife-vehicle accidents on the rise in the region

Wildlife-vehicle collisions happen every day around the world, and put both humans and wildlife at risk of death and injuries, as well as resulting in considerable costs due to vehicle, property and infrastructure damages. Wildlife-vehicle collisions are on the rise in Asia. In 2013, in Chapramari forest, in the state of West Bengal, India, a passenger train ploughed into a herd of 40 elephants, killing seven and derailing the train. At least 50 elephants have been killed by trains since 2004 in West Bengal alone. Elsewhere in India, over the past five years, 23 leopards have been killed in the state of Karnataka due to road accidents.

In 2014, in Thailand, three wild elephants in search of food walked onto a road near Khao Chamao National Park resulting in a car accident, killing six people and one elephant. Accidents involving animals are all too common on Malaysian roadways as well. According to the Department of Wildlife and National Parks of Malaysia, 1,924 wild animals were killed on roads from 2006 to 2014 because of destruction of wildlife habitats, poor mitigation measures and broken roadside fencing.

Beyond Asia, wildlife-vehicle collisions in the United States result in thousands of human injuries and deaths per year, along with USD 8 Billion in associated costs. As traffic and infrastructure expands across the region, the number of wildlife-vehicle collisions and casualties will continue to rise if proper mitigation measures, planning and designs are not put in place. Solutions to prevent transport infrastructure from becoming a major threat to both humans and wildlife are available and can be implemented.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Slopes along the access road for the planned Dawei road on Elephant Cry Hill.

Recommendations

PLANNING AND CONSULTATION

1) A land use plan for the Tanintharyi region should be developed to guide primary and secondary development, to avoid negative impacts communities, wildlife and the natural environment. Compliance and enforcement measures for this plan should also be developed.

2) A Strategic Environmental Assessment (SEA) should be developed to ensure that environmental and social considerations are taken into account at the outset of the entire Dawei project. It should include a general description of the plan for the Dawei project, its main objectives, and how it relates to other relevant plans and their complementary and accumulative environmental and social impacts.

3) An Environmental Impact Assessment (EIA) for the road should follow International Strategic Environmental Assessment standards and include both environmental and social impacts and recommendations for minimizing, mitigating and offsetting ecological negative impacts. The assessment should also include a comparison of alternative road alignments and their social, environmental and economic costs and benefits, including indirect and cumulative impacts.

4) Civil society and local communities should be involved and informed throughout the planning and construction processes. Additionally, affected communities should receive fair compensation.

5) A natural resource management plan for the management of the road should be developed to guide ecosystem and forest management, including wildlife conservation. This plan should include systems for limiting poaching and illegal wildlife trade, protecting forests and securing key ecosystem services that support human well-being, including the provision of clean water and minimizing flood risks.

6) A multi-disciplinary technical advisory group should be established and include planners, engineers, civil society, wildlife and ecology experts to ensure the road development will meet technical and economic requirements, while minimizing and mitigating social and environmental impacts.

DESIGN AND CONSTRUCTION

7) Avoidance
The road alignment should be adjusted to the topography of the Dawei area using engineering elements to minimize large earthworks. The road alignment should avoid protected areas, important forest areas, watersheds and migration routes to the widest extent possible. To avoid and minimize habitat fragmentation, the road alignment should consider ecological corridors, migration routes, population and distribution of important species, and their national and international conservation status.

8) Mitigation
Where avoidance is not possible, mitigation measures should be properly designed and constructed:

a) Wildlife crossings such as elevated road sections, underpasses or overpasses are needed to maintain connectivity, and to ensure wildlife can safely cross the road, decreasing risks for wildlife-vehicle accidents. Passages should be adapted to various species, including elephants, large carnivores, primates, deer and amphibians. The number of measures required will depend on the behaviour of target species and the distribution of habitat types in the area, but should ensure connection of forested areas and the ability for wildlife movement.

b) Culverts adapted for wildlife would allow small or medium size mammals and amphibians to cross the road. Culverts for small creeks with permanent or temporal water flow should be adapted to secure movements of fish, amphibians, reptiles and small animals.

c) *Fencing and screening* should be put in place where necessary, especially adjacent to wildlife passages to guide wildlife to safe areas for crossing the road -increasing traffic safety. Fencing and walls should reflect local styles and materials. Screening can mitigate noise impact on bird populations and should be carefully designed to blend in with the landscape.

d) *Road signs, speed reduction and other warning systems* should be put in place in sensitive areas to reduce wildlife-vehicle collisions and can be powered by solar energy.

e) *Slope stabilization measures* should be put in place to prevent soil erosion on slopes, which are highly vulnerable in climates with intensive rainy seasons, such as Tanintharyi. Stabilizing slopes along the road early on will prevent future road damages and limit road closure. Measures can include:

- Terraces to break up sides of deep cuttings to overcome visual dominance, benefit structural stability and facilitate vegetation
- Native vegetation in areas with little or no vegetation cover
- Special nets and cover material

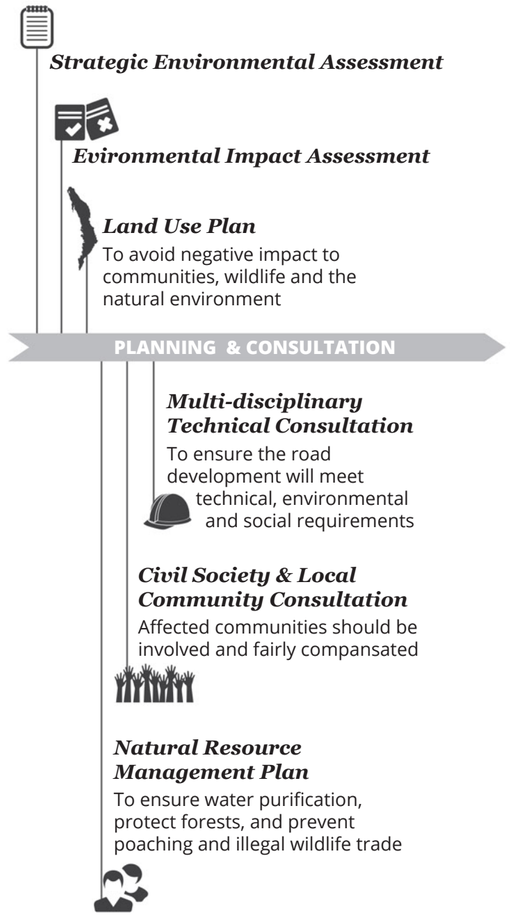
MONITORING AND MAINTENANCE

9) Monitoring and maintenance should be developed in collaboration with forest and wildlife departments, conservation organizations and communities to monitor wildlife movements and behaviour, and to prevent wildlife poaching around wildlife crossings and beyond. To improve traffic safety, data on wildlife casualties on the road should be collected to identify road sections with high risks to drivers and wildlife. Appropriate collision-mitigation measures should then be implemented. Responsibility and costs for monitoring and maintenance should be agreed on and allocated in the planning process.

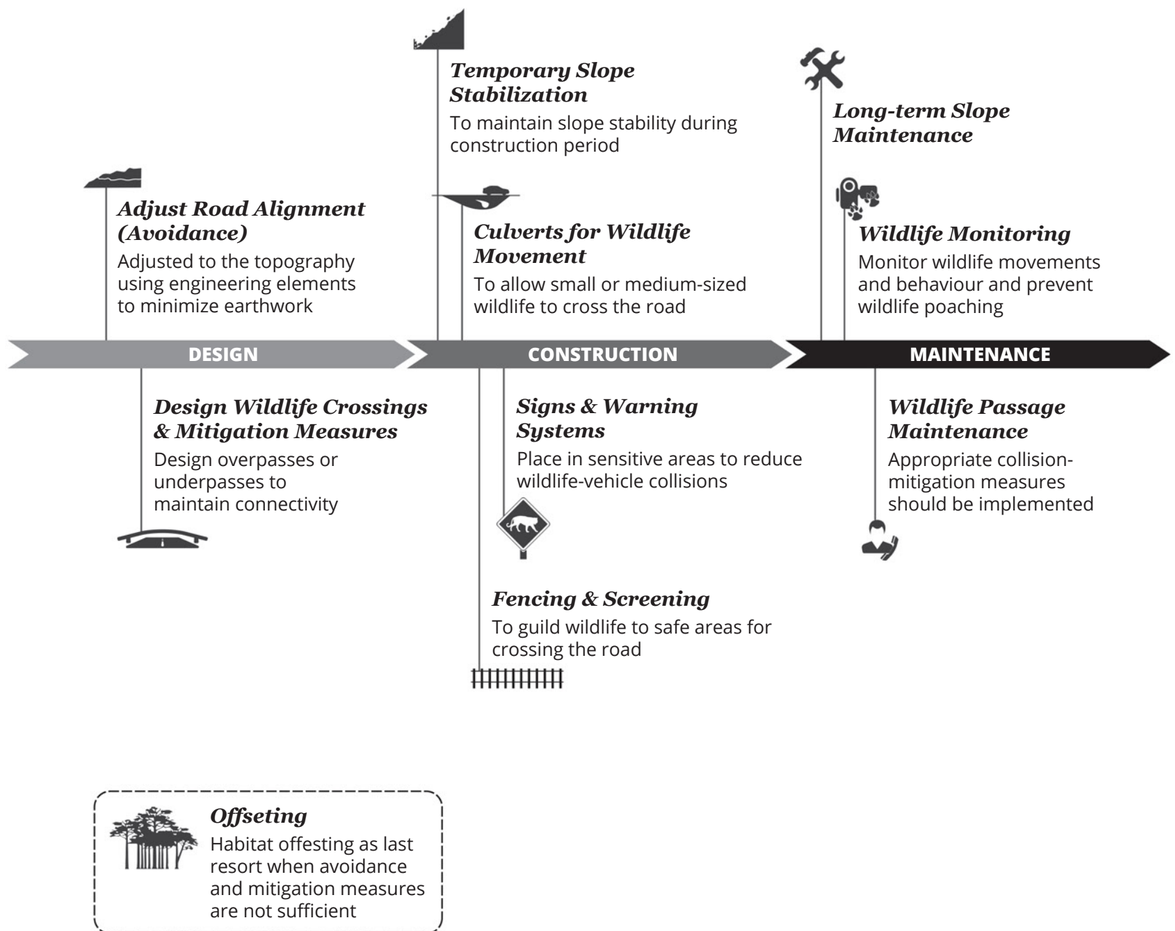
OFFSETTING

10) Offsetting

As a last resort, and only when the above avoidance and mitigation measures are not sufficient at a site of concern, offsetting should be implemented. Offsetting measures include habitat protection, creation or restoration that would increase biodiversity and ecosystem services to an extent equal to or greater than what is lost at the original site. Any project designed for ecological offsetting should be in line with local and national nature conservation targets, and support local natural habitats. However, fragmentation caused by the Dawei road will have to be mitigated by appropriate measures and cannot be addressed through offsetting.



The Road Map: Towards a Better Road to Dawei



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The current access road for the planned Dawei road between the Myanmar-Thai border and the village of Myitta.

Summary

This report has outlined why ecological connectivity, wildlife and ecosystem services should be taken into account in the planning and construction of the Dawei road link. The Dawna Tenasserim Landscape is a transboundary landscape supporting tigers, elephants and a range of other endangered wildlife. Linking two important forested areas, the Western Forest Complex and Kaeng Krachan Forest Complex in Thailand, through Tanintharyi in Myanmar will establish critical ecological corridors - supporting wildlife movement and natural processes - critical to the well-being of communities and wildlife in the area. The planned road link of the Dawei Project will be a great threat to this critical corridor, if measures are not taken.

Roads can have negative impacts on nature, including fragmentation, deforestation, land use change, and loss of ecosystem services. Roads also depend on nature through protection against threats such as landslides, floods and soil erosion. Ensuring that ecosystems are well managed will benefit people, wildlife and infrastructure investments in Tanintharyi. The natural capital assessments undertaken by WWF show that the landscape through which the road is planned is a hydrologically important area. The area contains high levels of surface water, and the presence of forests helps reduce soil erosion. The forests of the landscape also store significant amounts of carbon in forests and vegetation, helping to mitigate climate change. If future deforestation is not controlled, scenarios show high risks of carbon loss, soil erosion and loss of water provisioning services to communities.

With wildlife-vehicle collisions on the rise across Asia, it is important that measures such as wildlife crossings, speed control and barriers are put in place to improve road safety and decrease risks to both people and wildlife in Tanintharyi. In cooperation with road ecology experts from Infra Eco Network Europe (IENE), recommendations have been put forward to safeguard against social and environmental impacts as well as decreasing future economic risks and costs associated with the road. These include:

- Undertake Strategic Environmental Assessments for the entire Dawei project and Environmental Impact Assessment for the road specifically.
- Implement management practices to protect ecosystems, including forests.
- Adjust road alignment to avoid important forest areas, watersheds and wildlife migration routes.
- Implement mitigation measures such as wildlife passages, slope stabilization measures, culverts, fences and wildlife warning systems.
- Develop plans to monitor wildlife passages and wildlife-vehicle accidents and provide maintenance for these structures.
- Establish offsetting projects around and outside the road area to create or enhance natural habitats.

Improving the planning and implementation of the Dawei road would protect wildlife, sustain nature and benefit people. As Myanmar continues to make progress on its development agenda, a better road to Dawei would guide and provide valuable lessons for safe, socially responsible and environmentally sustainable infrastructure development across the country.

Sources

For text in the report see sources below; for visuals see data references on respective pages.

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