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POLICY  
BRIEF

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# Green Economy Modeling of a Transport Corridor in the Greater Mekong Sub-region



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The new transport corridor will cross the Dawna-Tenasserim Landscape, which provides valuable ecosystem services.

## OVERVIEW

**COUNTRY:** Thailand

**KEY POLICY MESSAGE:** WWF conducted a socioeconomic and environmental modeling study – a Green Economy modeling study – on the land use change from the proposed transport corridor between Bangkok and a planned deep sea port development at Dawei in Myanmar. The study demonstrates the importance and value of conducting green economy modeling when making infrastructure decisions particularly in their impact on land use. It shows how a green economy approach over a business as usual approach can prove to not only be the most sustainable choice, but also the more economical choice in the long run that helps healthy economies and societies to grow.

# CONTEXT

Thousands of transport corridors are currently being planned and implemented around the world.

## Target audiences

- Donors - development banks (e.g. Asian Development Bank), governments and private sector.
- National government agencies that are involved in **transport planning**. In Thailand this is the Ministry of Transport and Communications; especially the Office of Transport and Traffic Policy and Planning, and The Department of Highways.
- National government agencies that are involved in **land use planning**. In Thailand this is:
  - Land Development Department within the Ministry of Agriculture and Cooperatives; and
  - Department of National Park, Wildlife and Plant Conservation; Royal Forestry Department; and Office of Natural Resources and Environmental Policy and Planning within the Ministry of Natural Resources and Environment.
- National government agencies that are involved in assessing and approving **environmental impact assessments**. In Thailand this is the Office of Natural Resources and Environmental Policy and Planning within the Ministry of Natural Resources and Environment.
- National government agencies that are involved in **financing** of infrastructure projects. In Thailand this is the Ministry of Finance.

Serving as physical connections between urban hubs/nodes, these corridors look to harness the economic potential within fast-developing regions. However, more often than not, the impact assessments of these corridors emphasize their economic development benefits and rarely look at the entire impacts that they may be having, particularly in terms of environmental and social well-being. Impacts that are being created by the development of these corridors are becoming an increasingly pressing concern within the Greater Mekong Sub-region (GMS).

In order to secure a viable future for the GMS, sustainable infrastructure development needs to become priority for the region's governments and donors alike. Sustainable infrastructure means that it must service an increasing population, reduce the impact from infrastructure, and adapt to a changing climate. This policy brief reflects on a Green Economy Modelling study conducted by a WWF project team in 2013 '*Green Economy Modelling of Ecosystem Services in the Dawna Tenasserim Landscape (DTL) along the 'Road to Dawei'*', looking specifically at the sustainable transport infrastructure options for the Dawna Tenasserim Landscape (DTL) along the 'Road to Dawei'. The study analyzes the interaction of social, economic and environmental factors in shaping future land use through a transparent system dynamics simulation model. Projections were generated up to 2035 to analyze the short, medium and longer-term consequences of road construction on society and land use in the DTL.

The aim was to allow policymakers, land use planners and other interested stakeholders to examine the multi-dimensional impact of green economy interventions to inform better land use planning decisions in the project area. The study quantified the negative economic impacts of road construction under a Business As Usual (BAU) scenario on natural capital and the impacts of this loss on the livelihoods of the local communities within the locality of the project and also on national economic priorities (e.g. sectoral development, poverty reduction, jobs). Results were also estimated for two Green Economy scenarios, which showed sensible improvements on several social, economic and environmental indicators. The results have been presented and communicated in biophysical and economic terms, including the economic valuation of natural capital (which is defined as stocks and services of biodiversity and its ecosystems).

### **The Dawei Special Economic Zone and Its Related Project Areas**

The development of a deep-sea port in Dawei, the “capital” of the Tanintharyi Division, the southernmost region of Myanmar is currently being planned and estimated to be finished by 2020. This project involves the construction of a road link from Dawei to Bangkok. This road will pass through the DTL, a mountainous and forested area, particularly rich in biodiversity as well as agricultural areas on the Thai side of the project. Phase 1 of the Dawei Project involves the construction of a highway section between Kanchanaburi and Dawei. The geographical focus of this particular modeling study was on the Thai side of the road construction area, between the town of Kanchanaburi and the Thailand-Myanmar border (Figure 1). The road in this phase will largely cut through agricultural areas (Figure 2).

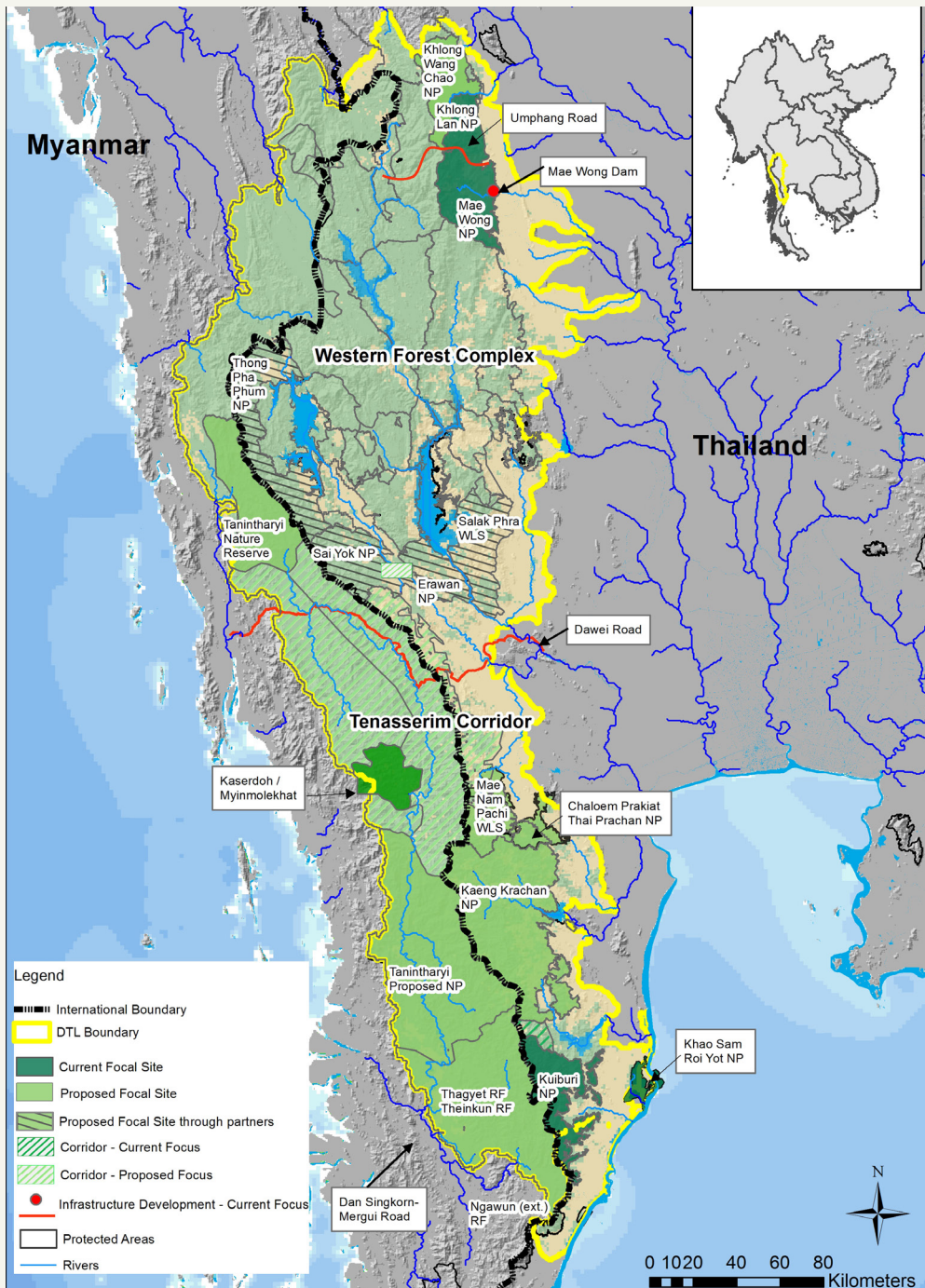


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The new road which will connect Dawei to the Thai border in the Tanintharyi region of Myanmar.



FIGURE 1: The location of 'The Road to Dawei'- through the Dawna-Tenasserim Landscape.



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## PROBLEM STATEMENT

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Unsustainable infrastructure development generally results from poor land use planning which is then further compounded by the lack of

economic information at hand to properly assess potential trade offs.

This results in the critical undervaluation and non-recognition of natural capital and the exclusion of nature's values in national accounting systems. There is also a lack of information of how land use and natural capital planning is undertaken once there is a decline in the ecosystem services from the construction of the unsustainable infrastructure project. In the DTL, the loss of forest cover, for example, is likely to impact upon several ecosystem services, including carbon storage, maintenance of soil fertility and nutrient discharge, regulation of the hydrological cycle, water and air purification, and maintenance of wildlife habitats – all of which are essential and contribute to a sustainable healthy landscape which then feeds into a healthy economy and society.

## THE GREEN ECONOMY MODELING APPROACH

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Green economy modeling involves computer models that have been used to perform integrated analysis of socio-economic environmental systems. The modeling exercise provided a pilot of the Integrated Model for Land and Economic Planning (IM-SLEP), based on the Green Economy Model (GEM) that has been successfully applied in several countries . IM-SLEP was created using three main methodologies; firstly an InVEST model was created that generated spatial information and estimates about the natural capital and ecosystem services; secondly, this information was coupled with a socio-economic analysis to create a 'map' (Causal Loop Diagram) of the socio-economic and environmental system analyzed; thirdly a System Dynamics model was created that highlighted the direction and magnitude of the relationship between the socio-economic and ecosystem service variables of the area and road construction. It was conducted to allow policy makers, land use planners and other interested stakeholders to test the differences in impact of the corridor in four scenarios:



- A **no-road scenario**, under which the construction of the road does not occur. This scenario assumes the continuation of historical and present trends. It was used as a benchmark for projected positive and negative impacts of road construction on the economy, society and environment.

- A **road scenario / business as usual (BAU)** case that assumes the construction of the road without additional policies to mitigate possible negative impacts on natural capital. Under this scenario, the full impact of road construction is projected on the economy, society and environment.

- Two **Green Economy (GE) scenarios**, which include the BAU scenario with additional interventions for the protection of natural capital. The first scenario (GE 1) included policies that are introduced to expand ecological agriculture practices and reforestation of degraded land. The second scenario (GE 2) expanded on the first by also including sustainable urban planning measures that reduced the settlement land per capita. The GE 1 is an easier “win”, and more likely to occur. GE 2 represents an even greater investment and ambition level for sustainable land use management.



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A Green Economy approach - see the use of green infrastructure here - can help to mitigate the social and environmental impacts of development.

# OUTCOMES

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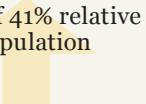


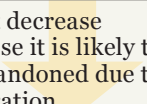

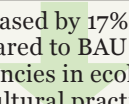
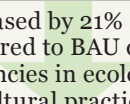
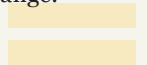

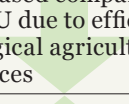
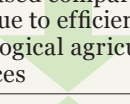

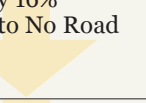

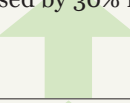


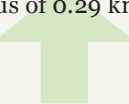
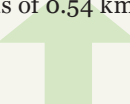




Overall, the results show that whilst a business as usual approach to the road construction is likely to create short term economic gains for the country, the fact that natural capital would go unaccounted for, would mean that the ecosystem services in the surrounding area would be either be lost or destroyed. This loss and degradation would not only jeopardize the livelihoods of the local communities in the area but it would also, over the long term, negatively impact on the local and national economy. Green economy interventions, on the other hand, would mitigate these environmental, social and economic risks (Table 1).

## Key findings:

- The medium and longer-term cumulative impacts of road construction under the BAU scenario are likely to outweigh the local short-term benefits of road construction. As a result, the green economy interventions have a critical role in determining the social well-being and sustainability of the ecosystem in the DTL.
- Expanding organic agriculture practices, whilst initial transition costs may be high, is likely to increase productivity and reduce water consumption, at the same time creating employment and improving livelihoods of local communities. It will also reduce the use of chemical fertilizers that would prevent soil erosion and water pollution.
- The sustainable use of degraded and abandoned land for reforestation and settlements would avoid deforestation, thereby preserving key ecosystem services. Reforestation is likely to help preserve the hydrological cycle, enhance water retention, prevent river siltation and sedimentation, and eventually reduce the impacts of floods on local communities and agricultural production. In addition, the adoption of sustainable forest management practices would contribute to preserve biodiversity, and mitigate climate change through higher carbon sequestration.



**TABLE 1:** Snapshot of the Green Economy modeling results of 'The Road to Dawei'. These are the results for long-term projections (2035) comparing the four scenarios for some of the categories analyzed. Business as Usual (BAU) models construction of the road without additional policies to mitigate possible negative impacts. Green Economy (GE 1 and GE 2) expands on the BAU scenario with additional interventions for the protection of natural capital.

	No Road	Business As Usual	Green Economy 1	Green Economy 2
<b>Total population</b>	Limited employment drives emigration 	Increase of 41% relative to 2007 population 	Equal to BAU 	Equal to BAU 
<b>Area of agricultural land</b>	Slight decrease because it is likely to be abandoned due to emigration 	Increased by 60% compared to No Road 	Decreased by 17% compared to BAU due to efficiencies in ecological agricultural practices 	Decreased by 21% compared to BAU due to efficiencies in ecological agricultural practices 
<b>Chemical fertilizer use</b>	No change. 	Increased due to expansion of agricultural land 	Decreased compared to BAU due to efficient ecological agricultural practices 	Decreased compared to BAU due to efficiencies in ecological agricultural practices 
<b>Area of forest cover</b>	Slight decrease 	Reduced by 16% compared to No Road 	Increased by 21% from BAU 	Increased by 30% from BAU 
<b>Water balance</b>	Slight increase 	Deficit of - 0.61 km2 	Surplus of 0.29 km2 	Surplus of 0.54 km2 
<b>Carbon sequestration</b>	Slight decrease to 96 million tonnes of CO2 = 11.88 billion baht 	83 million tonnes of CO2 = 10 billion baht 	101 million tonnes of CO2 = 12 billion baht 	105 million tonnes of CO2 = 31 billion baht 

# POLICY RECOMMENDATIONS

Green economy modeling should be used when making land use decision, particularly in the context of large infrastructure projects.

This modeling should take into account:

- short, medium and longer-term impacts, across sectors and social, economic and environmental dimensions;
- the distribution of costs and benefits across different actors; and
- the evaluation of costs and benefits, as well as broader advantages and disadvantages, of project implementation.

To implement a green economy approach as modeled in this study, the following are recommended:

- Use a combination of instruments to support the agriculture sector, including **incentives** (e.g. payments given to farming systems and practices that preserve environmentally sensitive land and biodiversity, for example, through a payment for ecosystem service scheme; or one-off grants and loans to support conversion to organic farming practices) and **regulations** (e.g. impose charges on excess use of environmentally-damaging inputs such as chemicals).
- Implement dedicated policy interventions for different economic actors to ensure fair and inclusive development.
- Organic agriculture incentives and other supportive measures should be phased out over time once returns will be higher than conventional agricultural practices, to allow the sector to innovate.
- Reforestation activities should be conducted in the framework of public transparent land-use plans and created via broad stakeholder consultations.
- The historic, cultural and livelihood value of forests should be taken into consideration throughout the policy formulation and implementation process. Proper compensation to those who will be negatively impacted by losses of these values should be provided.
- Skills and technology transfer programs should complement policy implementation; innovative technologies and agriculture practices should be adapted to local market conditions, and adequate training should be provided.
- Institutional cooperation should be enhanced to facilitate the effective implementation of green economy policies.

## Why use this Green Economy modeling approach?

The study identified an opportunity for green economy modeling that has been little explored to date. Other INGO/academic actors develop economic rationale for conservation; but few produce studies at the scale of decision-making or visualize development scenarios spatially. Also, current tools to support decision-making are used separately by different practitioner communities. This prevents holistic assessment of land-use change impacts. The strength of the proposed approach is that it:

- Provides economic policy makers with a useful approach to undertake spatially explicit socioeconomic and environmental analysis of development choices;
- Builds the capacity of affected communities to participate in decision-making for transport corridor development;
- It is a model with environmental, social and economic indicators, allowing for comprehensive baseline assessment;
- Allows for desired conservation outcomes to be modeled as economic and social benefits to assist identification of interventions to offset impacts.
- It can be used as an assessment tool that incorporates different measures or variables from socioeconomic to pure ecosystem integrity considerations.



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A Green Economy approach can help to mitigate the social and environmental impacts of development.



# NEXT STEPS AND FURTHER ACTIVITIES

Modeling socio-economic and environment outcomes from transport and land use scenarios, such as for the 'Road to Dawei', can help support responsible government and private sector investment and economic incentives. This study demonstrates the possible use and value of an integrated approach to evaluate the broader impacts of infrastructure development, not only in the DTL region but also in the broader GMS region and beyond. The same approach and information could be easily further customized to analyse a variety of infrastructure projects. The results of the study could also be expanded upon by ensuring that stakeholders validate the model, that a pilot testing stage is run on the ground and then to run the modeling assessment using this more comprehensive data set.

The private sector companies that profit from the creation of such transport corridors often rely on the natural capital in the surrounding areas. Determining how to mobilize the private sector investment for sustainable transport corridor infrastructure will be the next challenge for national governments in the GMS. Modeling studies such as this one discussed will provide critical information about the economic and social value of natural capital to support policy decisions about private sector investments.

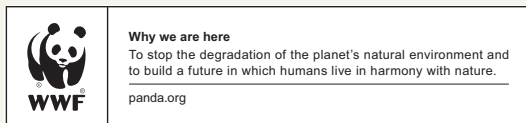
## More information

WWF (2014). *Green Economy Modeling of ecosystem services in the Greater in the Dawna Tenasserim Landscape (DTL) along the 'Road to Dawei'*. Available at: [http://d2ouvy59podg6k.cloudfront.net/downloads/final\\_greenecomony\\_tnl\\_lr.pdf](http://d2ouvy59podg6k.cloudfront.net/downloads/final_greenecomony_tnl_lr.pdf)

UNEP (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Available at: <http://www.unep.org/greenecomony/GreenEconomyReport>

## CASE STUDY SERIES: TESTING SUSTAINABLE FINANCING FOR CONSERVATION IN THE GREATER MEKONG

The WWF-Greater Mekong Sustainable Finance for Conservation case study series brings to light high quality examples of different models in the Mekong countries for economic valuation of natural capital, payments for ecosystem services and benefits sharing mechanisms.



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