



# **Environmental Analysis of the Greater Mekong Subregion Regional Investment Framework**

**Applying a Spatial Multicriteria Assessment  
Approach**

**November 2013**

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Applying a Spatial Multicriteria Assessment Approach

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## ABBREVIATIONS

ADB	–	Asian Development Bank
ASEAN	–	Association of Southeast Asian Nations
CAM	–	Cambodia
CC	–	climate change
CEC	–	Central Economic Corridor segment
EEC	–	Eastern Economic Corridor segment
EOC	–	GMS Environment Operations Center
EWEC	–	East-West Economic Corridor
GEF	–	Global Environment Facility
GHG	–	greenhouse gas
GIS	–	geographic information system
GMS	–	Greater Mekong Subregion
HRD	–	human resource development
ICD	–	inland container depot
KBA	–	key biodiversity area
Km	–	Kilometer
LAO	–	Lao People’s Democratic Republic
MCA	–	multicriteria assessment
MYN	–	Myanmar
NEC	–	Northern Economic Corridor segment
NEEC	–	North Eastern Economic Corridor segment
NSEC	–	North-South Economic Corridor
NTFP	–	nontimber forest product
PA	–	protected area
PES	–	payment for ecosystem services
PRC	–	People’s Republic of China
REDD+	–	Reducing Emissions from Deforestation and Forest Degradation
RIF	–	Regional Investment Framework
SCEC	–	Southern Coastal Economic Corridor segment
SEC	–	Southern Economic Corridor
SEZ	–	special economic zone
SMCA	–	spatial multicriteria assessment
SPS	–	sanitary and phyto-sanitary
THA	–	Thailand
TTF	–	trade and transport facilitation
VIE	–	Viet Nam
WEC	–	Western Economic Corridor

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# 1. Background

Greater Mekong Subregion (GMS) leaders endorsed the GMS Strategic Framework 2012–2022 at the 4<sup>th</sup> GMS Summit in December 2011, and requested that the Asian Development Bank (ADB) lead a regional planning exercise to identify the next generation of multisector investments. This planning exercise resulted in the GMS Regional Investment Framework (RIF) 2013–2017, which will be presented for endorsement at the 19th GMS Ministers Meeting in December 2013.

ADB prepared the RIF investment portfolio through a bottom-up approach, beginning with extensive country inputs and consultations in early 2012. In addition to country assessments, sector assessments covering agriculture, energy, environment, human resource development (HRD), labor migration, tourism, transport and related services, and urban development informed and helped to shape the RIF.

In support of RIF development, ADB commissioned a study to bring together the various assessments to date, using the principles endorsed by the 18th GMS Ministerial Conference in Nanning, PRC, in December 2012. The study involved a spatial prioritization of investments based on economic, employment, connectivity, environmental, social and climate change (CC) criteria. The Environment Operations Center, which implements the GMS Core Environment Program, supported this prioritization process by developing an environmental analysis methodology focusing on the GMS economic corridors and landscapes.

# 2. Introduction

Over the past two decades, the GMS has experienced rapid economic growth. Much of this growth has been generated by domestic and foreign direct investments into agriculture, forestry, mining, energy and tourism. As investment volume increases, finding locations for sustainable investments becomes more challenging. Natural capital is increasingly concentrated in remote areas, and investments into these areas now come with increased environmental and social risks. If not located carefully, these investments can create risks to the natural capital that outweigh the benefits of the investment. At the same time, synergies between the environment and other sectors do exist, and, once identified, can enhance and sustain the performance of development sector investments while simultaneously protecting the region's natural capital.

In addressing these challenges and opportunities, the RIF needs to recognize that the natural resource base of the GMS is a key driver of the region's economic growth and success, and as such, the utilization of its natural capital needs to be sustainable in order to maximize economic growth and social development outcomes over the longer term.

Achieving the right balance between natural resources consumption and maintenance of economically critical environmental services through landscape and ecosystem protection is one of the main objectives of the Core Environment Program, the environmental arm of the GMS Program. One of the key tasks under the current phase of the program is to ensure – through sound environmental review, valuation, and analysis – that the GMS RIF investment portfolio realizes its economic potential without putting environmental and social interests and achievements at risk.

This report describes an environmental analysis of the RIF portfolio that formed part of the overall prioritization process for RIF pipeline investments. The aim was to provide decision makers with a better understanding of risks and opportunities, and a comparison of investments. As such, the assessment pays particular attention to sustainable natural resource management and the maintenance of environmental services.

A team of evaluators used Multicriteria Assessment and Spatial Multicriteria Assessment methods to weigh proposed investments with the unique risks and opportunities presented by the different landscapes in the GMS and thereby assist in the selection, prioritization, location and mitigation planning for investments. The outputs provided RIF stakeholders and decision makers with the information necessary to:

- (i) Assess and compare the risks of individual investments (i.e. tradeoffs), and identify opportunities for investments into environmental services.
- (ii) Understand and better manage the diverse environmental sensitivities existing in the different GMS Economic Corridors.
- (iii) Assess and compare the suitability of geographic locations (e.g. economic corridors) against the risk profile of investments.
- (iv) Recommend the most appropriate location-specific mitigation measures for high risk investments.

### 3. Methodology

**Multicriteria Assessment (MCA)** is a decision-support tool that allows options, in this case RIF investments, to be compared and assessed according to economic, environmental, and social criteria. For the RIF assessment, the MCA generated a risk score for each investment, thereby allowing decision makers to rank them and evaluate the suitability of any project, either in absolute terms or as relative to alternative projects.

Although users can tailor the methodology to specific applications, all MCAs include four basic steps:

- (i) Identifying risk variables, e.g., protected areas (PAs).
- (ii) Quantifying risk variables, turning variables into criteria, e.g., not within a PA.
- (iii) Translating criteria into a common risk scale, e.g., not within PA = 1, within PA = 0.
- (iv) Weighting criteria against each other to reflect stakeholder and country priorities, e.g., PAs = 30% of the total environmental risk score.

**Spatial Multicriteria Assessment (SMCA)** is an MCA that uses geographic information to map risk scores. The maps created provide a visual geographic overview of high to low risk areas for RIF investments. SMCA usually complements rather than replaces MCA, as not all risk types have adequate spatial data sets available (e.g., CC variables), or are difficult to map (e.g., risk to groundwater).

The MCA and SMCA methods developed for the RIF analysis used simple computation, were designed for practicality, had simple data needs, and produced logical results that nontechnical experts could easily understand. The RIF analysis team applied the MCA to investments to determine their level of environmental, climatic and social risk, while the SMCA analyzed the geographic suitability of economic corridors and landscapes for different types of investments.

## 4. Multicriteria Assessment of the Regional Investment Framework Pipeline

The team used MCA to identify and assess the potential risks associated with each of the RIF investments. To determine the level of risk, they screened each investment against three risk groups: environmental, CC, and social. For these three risk groups, 10 equally weighted risk variables were identified:

**Environmental risk variables:** national PAs; key biodiversity assets; forest resources; watersheds; wetlands and water courses; terrain type and land use.

**Climate change risk variables:** adaptation and mitigation.

**Social risk variables:** vulnerability.

Table 1 shows the division of each risk variable into relevant risk types. The assessors then weighted these risk types based on their relative importance, with the weightings for each individual risk variable summing to 1.

**Table 1: Types and Relative Importance of Environmental, Climatic and Social Risks**

Risk Group	Risk Variable	Type of Risk	Weighting
Environmental risks	National PAs	Loss of area	0.29
		Habitat degradation	0.24
		Habitat fragmentation	0.24
		Increased ease of access	0.18
		Visual risks	0.06
	Biodiversity assets	Loss of diversity	0.29
		Resource degradation	0.36
		Fragmentation	0.29
		Visual risks	0.07
	Forest resources	Forest loss	0.29
		Forest degradation	0.24
		Forest fragmentation	0.18
		Increased ease of access	0.12
		Fire risk	0.18
	Watersheds	Land use changes	0.13
		Loss of ecosystem services	0.33
		Nonpoint source pollution	0.27
		Effects on groundwater	0.27
	Wetlands and water-courses	Riparian forest loss	0.25
		Changed hydrology	0.31
Point source pollution		0.19	
Nonpoint source pollution		0.25	
Terrain type	Land clearing	0.24	
	Extent of land-take	0.24	
	Soil erosion	0.29	
	Increased run-off	0.24	
Land use	Land-take	0.21	
	Change of land use	0.21	
	Change in intensity of use	0.29	
	Use of pollutants	0.29	

Risk Group	Risk Variable	Type of Risk	Weighting
Climate change risks and vulnerability	CC mitigation	Direct carbon-stock loss	0.29
		Indirect carbon-stock loss	0.29
		Greenhouse gas (GHG) emissions from fossil fuel	0.21
		Other GHG emissions	0.21
	CC adaptation	Vulnerability to flood	0.28
		Vulnerability to drought	0.22
		Vulnerability to temperature change	0.17
		Vulnerability to storm events	0.17
Social risks	Social risks	Vulnerability to sea level rise	0.17
		Poverty	0.22
		Indigenous people	0.17
		Gender	0.13
		Human trafficking	0.17
		Health/communicable diseases	0.17
		Resettlement	0.13

The assessors assigned a severity rating for each risk type to all RIF investments, ranging from 1 (very high), 2 (high), 3 (medium), 4 (low) to 5 (negligible). Expert judgment informed the severity ratings, supported by maps and other materials for guidance. Finally, the assessors averaged the severity ratings into risk scores for each of the three risk groups, using the same 1 to 5 scale. Table 2 illustrates an example of how an overall risk score is calculated.

**Table 2: Sample Subset Showing Aggregation of Multicriteria Assessment Risk Scores**

Risk Type	Weighting	Severity Rating	Weighted Severity Rating	Risk Variable	Sum of Weighted Severity Rating	Risk Group	Risk Score
Land-take	0.21	3	0.63	Land use	4.08	Environmental	3.59
Change of land use	0.21	4	0.84				
Change of intensity of use	0.29	5	1.45				
Use of pollutants	0.29	4	1.16				
Loss of diversity	0.29	3	0.87	Biodiversity Assets	3.10		
Resource degradation	0.36	4	1.44				
Fragmentation	0.29	2	0.58				
Visual impacts	0.07	3	0.21				

The assessment team based its final decisions on risk severity ratings on the type of investment and its location, supported by detailed information on each RIF investment and by maps showing the spatial distribution of each of the environmental variables. Table 3 shows the available map layers. Ideally, the MCA would have also incorporated maps for CC and social risk variables, but data sets with spatial resolution and thematic detail were not available.



**Table 3: Map Layers Used in the Environmental Multicriteria Assessment**

<b>Variable</b>	<b>Spatial Data Map Layer</b>	<b>Observations</b>
National Protected Areas	Map layer of officially gazetted national protected areas including national parks or sites of equivalent status.	Includes suitably defined buffer zones.
Biodiversity	Map layer showing areas of high biodiversity-value defined at site-level according to important mammal, bird and freshwater habitats and key species.	Based on key biodiversity area spatial data from the International Union for Conservation of Nature, Birdlife International, Conservation International, and the Alliance for Zero Extinction.
Forests	Map layer of forest types classified as closed, open, mosaic or mangrove/flooded.	Classification derived from multiple spatial sets.
Watersheds	Map layer of watershed (sub-basin) areas in the nine major GMS river basins classified as upper, middle and lower.	Upper watershed areas considered more sensitive.
Wetlands and watercourses	Map layer of wetland areas and significant water courses and sites in proximity to them.	Sensitive to point/nonpoint water pollution risks.
Terrain type	Topographical map layer classified by slope class.	Steeper slopes with lighter soils considered more sensitive.
Land use	Map layer of agricultural land use types classified as irrigated, intensive rain fed and extensive rain fed.	Extensive rain fed considered more sensitive to climate change.

The following notes apply to the MCA methodology used:

- Feasibility studies, project design and other project preparatory investments were assessed as if the planned investments were to proceed.
- For regional investments covering more than one country, the assessment addressed the risks over all participating countries and the same rating was used for each country.
- The MCA was a generalized assessment in cases where the location of the investment was not specified.
- Assessment of resettlement included land-take and loss of assets, as well as physical resettlement of dwelling places.
- For some RIF investments, insufficient information was available to make a realistic assessment. These cases are flagged in the result tables in Appendix 1.
- The MCA exercise did not involve the relevant sector experts familiar with the projects, and the assessments are based solely on the information available in the RIF consolidated pipeline documentation.

## Results by Country

The team conducted MCA for nearly all RIF investments and Appendix 1 includes complete result tables showing scores for each. The remainder of this section summarizes and discusses key results for each country.

### Cambodia

Twenty-seven pipeline investments for Cambodia were included in the RIF, with a fairly even distribution across all sectors. The team could not assess one investment (CAM 19) due to insufficient information.

From an environmental perspective, the team assessed only two investments, both medium-scale transport projects, as highly sensitive. The first, the Phnom Penh-Sihanoukville Highway Improvement Project (CAM 18) was rated high risk because of its close proximity to PAs and the environmentally sensitive terrain it passes through. Analysis of these sensitivities identified minimum-width road right-of-ways and reforested roadside verges adjacent to PAs as possible mitigation strategies. In addition, the team proposed support for PA planning and management to address the new threats posed by the road project over the longer term.

The second investment of high-sensitivity was the project to deepen the southern economic corridor (CAM 19), which includes provincial/feeder road improvement. In this case the higher sensitivity was due to the intensified land use that would result from corridor deepening, leading to increased land conversion, more intensive production systems, and greater use of agrochemicals. Mitigation measures identified to address these anticipated threats included support for green agricultural practices, as well as soil and water conservation programs.

The assessment showed HRD and environment investments to be neutral, and indeed, many are likely to have positive effects on the environment. Two tourism development investments (CAM 7 & 8) were assessed as medium level environmental risks, due mainly to increased access and the pressure this puts on biodiversity assets. The team identified mitigation measures to counter this, including: (i) the conduct of biodiversity risk assessments for all planned tourism infrastructure, (ii) avoiding tourism infrastructure in critical watersheds, and (iii) ensuring the compatibility of tourism investments with PA management plans. It is important to note that the plans for the proposed second phase investment of GMS Tourism Infrastructure for Inclusive Growth had lower risks than the first phase, indicating that implementers had learned lessons from the first phase and used them to mitigate the environmental risks.

The MCA showed climate vulnerability risks to be generally low to moderate across all sectors. It demonstrated risk in the transport sector risks from flood damage, particularly for road projects in low-lying, flood-prone terrain. Similarly, the findings showed that social risks are not severe, but may have some limited effects on poverty (through land-take), and health and human trafficking (through increased regional connectivity).

### People's Republic of China

Fifty-six pipeline investments for the People's Republic of China (PRC) were included in the RIF, over 75% of them in the transport sector. The team could not assess nine of these investments (all in the transport sector) due to insufficient information.

Transport sector investments mainly consisted of road and rail development projects, with the latter having only low or moderate environmental risks. In fact, the MCA indicated that

planned investment in the electrification of some rail lines should have net positive effects on the environment along the railway through reduced mobile source pollution.

The risks associated with investments in roads are highly dependent on location. The MCA found urban expressway development projects to have low environmental risks, while rural roads, particularly in mountainous and forested areas have significant risks. The assessment showed two road investments (PRC 12 & 13) to be particularly sensitive because of the valuable forest and biodiversity resources through which they pass or are adjacent to. One of them, the Ruili to Kyaukpyu (Myanmar) highway, is particularly sensitive from environmental, climate, and social perspectives, and will require significant safeguard measures to mitigate these threats. Minimum width rights-of-way and reforested roadside verges, particularly in places close to PAs, could mitigate the risks, in addition to careful route planning. The assessment suggests that support for PA planning and management should be considered as a possible environmental investment to address the new threats posed by these sensitive road projects over the longer term.

Social risks from transport sector investments will mainly impact on the poor through land-take, and were generally similar for both rural roads and urban expressways. Transparent compensation systems will be required to safeguard against these risks. The assessment also shows increased social risks through the spread of communicable disease and human trafficking where roads link with international borders. In these cases, improved surveillance and control systems at international border posts will be required. The MCA showed the Yuxi-Mohan railway and the Emei to Miyi rail projects (PRC 51 and 52) to have particularly severe social risks due to their transboundary linkages.

The energy, tourism, and agriculture sector investments were mainly of low or moderate environmental, social and climatic risk.

## **Lao People's Democratic Republic**

Sixty-six pipeline investments for the Lao People's Democratic Republic (Lao PDR) were included in the RIF, over half of them in the transport sector. The team could not assess one investment (LAO 41) due to insufficient information available.

Many of the energy sector investments in Lao PDR involve power transmission lines, and the MCA showed these to have low or moderate environmental, climatic, and social risks. One exception in the energy sector was the proposed investment in the development of a number of hydropower schemes (LAO 10), which would affect high-value forests and river hydrology. These schemes also have significant climate and social risks due to rainfall variability and the effect of resettlement on poverty. Because a single RIF investment included a number of different schemes, analysis was rather generalized, and it is possible that the assessment may have somewhat over-estimated the severity of the risks. Ideally, the team should have assessed different schemes separately, but the information needed for this was not available in this instance. The generalized nature of the available information also meant that the team could not identify specific mitigation measures for the various schemes.

The environmental risks associated with the numerous transport sector investments in road construction are highly dependent on location, and are more severe where the proposed route is through steep terrain adjacent to or cutting through PAs and/or high value forest. Proposed mitigation measures to reduce these risks include road right-of-way and median strip reforestation and greening, and support for PA planning in the face of the new threats.

The climatic vulnerability risk of these transport sector projects is also highly sensitive to terrain, with extreme storm events posing the greatest risks in steeply-sloping, mountainous

areas. Mitigation measures required here include alternative route options and the use of clear and rigorous road construction standards and safeguards.

Social risks associated with transport sector investments are mainly through land-take, but also through communicable disease spread and human trafficking in instances where roads cross international borders. Transport sector investments to improve international border crossing points are all relatively benign from environmental, climate and social perspectives. These investments also provide high economic, employment, and connectivity benefits, and consequently tend to rate as high priority RIF investments.

## **Myanmar**

Thirty-eight pipeline investments for Myanmar were included in the RIF, almost half of them in the transport sector.

The MCA showed investments in the tourism, agriculture and HRD sectors to have relatively low environmental risks. Transport sector investments, particularly for road construction in sensitive terrain or in close proximity to PAs and high-value forest pose the highest risk. These risks will require adequate mitigation measures, including re-routing, construction standard safeguards and width limitations for road rights-of-way.

The assessment team generally rated energy sector investments as fairly benign from an environmental standpoint, with the exception of the Bokpyin 600 MW Coal-Fired Power Plant (MYN 6) that Myanmar plans to jointly develop with Thailand. The investment is deemed to have high environmental risks due to the nature of its operations and also its sensitive location near Lenya National Park and high value forests and marine resources. The same project also has high climatic and social risks and will undoubtedly require significant safeguard and mitigation costs if it goes ahead.

Climatic vulnerability is once again highest in the transport sector, particularly where proposed roads pass through steep terrain sensitive to extreme storm events. In such cases, the investments will require climate proofing safeguards and mitigation measures that are likely to be quite costly. Social risks are also highest in the transport sector, due mainly to the increased risks associated with communicable disease and human trafficking, particularly where international road links are involved. The assessment found one case in particular, the proposed Kyaington to Monglar road, to be extremely sensitive from a social perspective (gambling and related issues).

## **Thailand**

Nineteen pipeline investments for Thailand were included in the RIF, with a fairly even distribution among the different sectors.

The MCA showed investments in the transport, tourism, agriculture, and HRD sectors to have low or moderate environmental, climate and social risk, while biofuel investments pose higher environmental and social risks. The assessment team found that the promotion of biofuel production may lead to land use changes of threat to food security and could also increase the use of agrochemicals. Proposed mitigation measures here include the promotion of green biofuel production technologies and studies to assess biofuel and food security trade-offs.

The MCA indicated that energy sector investments in grid interconnection and power line development pose some environmental risks associated with forest and habitat fragmentation. However, with adequate mitigation measures in place these risks should be manageable. The assessment team found that the Bokpyin 600 MW Coal-Fired Power Plant located in Myanmar (THA 5) to be jointly developed with that country has high environmental risks due to the nature of its operations and its sensitive location. The same project also has

high climatic and social risks and will certainly involve significant safeguard and mitigation costs if it goes ahead.

## **Viet Nam**

Twenty-nine pipeline investments for Viet Nam were included in the RIF, evenly distributed across the different sectors.

The MCA indicated that investments in the energy, tourism, agriculture, and HRD sectors all have low or moderate environmental, climate, and social risks. Transport sector investments were generally also fairly benign, although two road projects (VIE 19 & 22) have high environmental risks due to the environmentally sensitive terrain through which they will pass. The MCA showed that these risks will increase habitat fragmentation and access to PAs. As such, the two projects will require adequate mitigation measures including right-of-way width limitations and support for PA planning to cope with the increased threats. The same two investments also have high social risks due to land-take and an increased spread of communicable diseases and human trafficking.

As in the other GMS countries, environment sector investments had near perfect ratings for all criteria. However, the evaluation team anticipates some social risks from the Global Environment Fund (GEF) Regional Biodiversity and Forestry Program (VIE 26) which could impact negatively on the poor by restricting access to forest products due to strengthened PA enforcement. Although better PA protection is a desirable outcome, implementation plans should consider mitigation measures to compensate local villagers, possibly including nontimber forest product (NTFP) domestication, home garden development, aquaculture promotion, and ecotourism. In some cases, such environmental investments are already in place as part of biodiversity conservation efforts under two ADB initiatives: the Core Environment Program and Biodiversity Conservation Corridors Initiative, as well as the Biodiversity Conservation Corridors Project.

## **Mitigation Measures and Environmental Synergies**

The MCA results helped to identify investments with high environmental, climatic and social risks. The team also conducted further analysis to develop appropriate mitigation measures and interventions to reduce negative impacts from medium and high risk projects. The MCA results also identified environmental interventions that could enhance and sustain the performance of investments over the longer term, and GMS decision makers may consider such investments for possible future inclusion in the environment sector portfolio of the RIF. Figure 1 presents an example of the opportunities created and potential benefits from using MCA results in this way.

**Figure 1: Examples of Mitigation Measures and Economic Opportunities Identified by the Multicriteria Assessment**

RIF Investment	Major Risks	Mitigation Measures	Environmental Measures	Opportunities Created
Highway construction in country X (assessed as high risk)	Risks to PAs (assessed as high)	Road alignment recommendations	PA planning and management support	— Enhanced protection — Enhanced tourism potential — Gene pool maintained
		Right-of-way restrictions	Low carbon transport corridor support	— Enhanced energy security — Better transport efficiency — Enhanced scenic values
	Sensitive terrain risks (assessed as high)	Road alignment recommendations	Reforestation/enrichment program along highways	— REDD payments — Enhanced timber value — Scenic values enhanced
		Right-of-way restrictions	Road climate proofing research support	— Lower road maintenance — Reduced road repair costs — Reliable transport system

Table 4 presents a full set of mitigation and enhancement measures for pipeline investments in Cambodia as examples of MCA outputs. Similar analyses drawing from the MCA results could be conducted for the other GMS countries, but ideally this should be done in close cooperation with relevant sector planners in these countries.

**Table 4: Potential Mitigation and Enhancement Measures to Address Risks Associated with Regional Investment Framework Pipeline Investments in Cambodia**

Investment (CAM ref.)	Risk		Major risks identified	Possible mitigation measures	Potential environmental investment enhancement measures
	Type	Rating			
1. Rural electrification/ off-grid power	Env.	4	Soil erosion in sensitive terrain	Guidelines for base construction & pylon erection	Studies on routing plan to enable power line rights-of-way to act as forest fire breaks
	CC	5	Neutral	None required	Studies on climate proofing power transmission lines
	Social	5	Neutral	None required	Research on community-based power generation options
2. Biofuel technologies and value chains	Env.	3	Increased land use intensity	Green biofuel production extension programs	Development of green biofuel production technologies
	CC	5	Neutral	None required	Research on climate resilient biofuel production technologies
	Social	5	Neutral	None required	Studies to assess biofuel and food security trade-offs
3. CAM-LAO-VIE power trade grid	Env.	4	Biodiversity fragmentation	Route power lines around PA/KBAs	Studies on maintaining understory cover in power line rights of way
			Soil erosion in sensitive terrain	Pylon construction guidelines for sensitive terrain	Soil and water conservation farming under in power line corridors
	CC	5	Neutral	None required	Studies on climate-proofing power transmission lines
	Social	4	Limited resettlement	Revised routing plan, resettlement safeguards	Environmentally friendly livelihood development activities
4. Higher education development	Env.	5	Neutral	None required	Research and teaching on key environmental issues relevant to the respective corridor
	CC	5	Neutral	None required	Research and teaching on key CC issues relevant to the respective corridor
	Social	5	Neutral	None required	Research and teaching on key social issues relevant to the respective corridor
5. GMS communicable diseases control	Env.	5	Neutral	None required	Promotion of GMS “One Health” approach (human/livestock/ecosystem health)
	CC	5	Neutral	None required	Studies of CC impacts on communicable disease spread
	Social	5	Neutral	None required	Awareness-raising programs
6. Technical vocational education training.	Env.	5	Neutral	None required	Mainstreaming environment in vocational training curricula
	CC	5	Neutral	None required	Mainstreaming CC in vocational training curricula
	Social	5	Neutral	None required	Mainstreaming social issues in vocational training curricula
7. Tourism infrastructure development I	Env.	3	Biodiversity risks	Risk assessments on all infrastructure proposals	Support to enhance protection status of KBAs that are not National PAs
			Risks on watersheds	Avoid tourism infrastructure in critical watersheds	Strengthened national watershed classification systems and supporting legal framework
	CC	4	Flood and sea level rise	Alternative locations for infrastructure	Climate resilient tourism infrastructure development
	Social	4	Ethnic risks, trafficking	Capacity development for ethnic minorities	Development of cultural tourism assets
8. Tourism infrastructure development II	Env.	4	Biodiversity risks	Risk assessments on all infrastructure proposals	Enhance protection status of KBAs that are not National PAs
			Risks on PAs	Ensure compatibility with PA management plans	Support for PA management planning
	CC	4	GHG fossil fuel emissions	Green eco-friendly tourism infrastructure	Low carbon tourism transport strategy
	Social	4	Ethnic risks, trafficking	Community empowerment for ethnic groups	Development of cultural tourism assets
			Communicable diseases	Early warning systems	Development of border point surveillance and control systems
9. Tourism development in green triangle	Env.	3	Risks on PAs	Ensure compatibility with PA management plans	Support for PA management planning
			Biodiversity risks	Risk assessments on all infrastructure proposals	Enhance protection status of KBAs that are not National PAs

Investment (CAM ref.)	Risk		Major risks identified	Possible mitigation measures	Potential environmental investment enhancement measures
	Type	Rating			
	CC	4	Indirect carbon stock loss	Corridor carbon sequestration as offsets	Low-carbon freight corridor investments
			GHG fossil fuel emissions	Green, eco-friendly tourism infrastructure	Low carbon tourism transport strategy
	Social	4	Health, ethnic, trafficking	Border point surveillance/control systems	Capacity development and empowerment for ethnic minorities
10. Tourism technical/ vocational education	Env.	5	Neutral	None required	Mainstreaming environment in tourism training curricula
	CC	5	Neutral	None required	Mainstreaming CC in tourism training curricula
	Social	5	Neutral	None required	Mainstreaming social issues in tourism training curricula
11. Agricultural value chain development.	Env.	4	Land use	Environmentally friendly cropping practices	Sustainable NTFP management systems
			Terrain type	Soil and water conservation practices	Agroforestry system development
	CC	4	Flood vulnerability	Support for flood tolerant rice varieties	Participatory climate vulnerability assessments
	Social	4	Neutral	None required	NTFP domestication and value added processing to enhance gender inclusivity
12. Biosafety, disease, invasive species control	Env.	5	Neutral	None required	-
	CC	5	Neutral	None required	Research on impacts of CC on invasive species distribution patterns in GMS
	Social	5	Neutral	None required	-
13. Food safety and quality standards	Env.	5	Neutral	None required	-
	CC	4	Flood, drought, temp. change	Post-harvest and processing safeguards	Research on climate resilient crop and livestock systems
	Social	4	Poverty and ethnic risks	Capacity development for vulnerable groups	Livelihood diversification support
14. Agrotourism value chain development	Env.	5	Neutral	None required	-
	CC	4	Climate adaptation issues	Climate proofing guidelines	Climate proofed agricultural production system development
	Social	4	Gender/ethnic issues	Inclusive tourism planning and development	Handicraft production program using sustainably managed forest product
15. Food security by resilient production systems	Env.	5	Neutral	None required	-
	CC	5	Neutral	None required	-
	Social	5	Neutral	None required	-
16. Poipet-Aranyaprathet bypass	Env.	5	Risks to natural forests	Limited-width of right-of-way, forest protection	Road right-of-way and median strip greening and forestation program
	CC	4	Increased fossil fuel use	Implement fuel-efficient vehicle standards	Low carbon transport corridor development to offset increased freight traffic
	Social	4	Limited resettlement	Revised routing plan, resettlement safeguards	Environmentally friendly livelihood development support
17. Port access road Sihanoukville	Env.	5	Limited pollution	Implement vehicle emission controls	Low carbon transport corridor development to offset increased freight traffic
	CC	4	Sea level rise	Revised routing plan	Climate resilient infrastructure support
	Social	4	Health issues	Emission controls, road safety training	Regional vehicle emission standards and controls
18. Phnom Penh-Sihanoukville highway improvements	Env.	2	Risks to PA	Minimum right of way next to PAs	Support for PA planning and management
			Sensitive terrain risks	Road construction safeguard guidelines	Reforestation/ enrichment planting along highways
	CC	3	In/direct carbon stock loss	Minimum right of way/central median forestation	Low carbon transport corridor investments
	Social	3	Land-take and poverty	Fair and transparent compensation procedures	Environmentally friendly livelihood development activities
19. Deepening corridor connectivity	Env.	2	Intensified land use	Soil and water conservation program	Support for development of green farming practices
			Risks to natural forests	Enhanced forest protection	Environmental awareness, community forestry management programs
	CC	4	Indirect carbon stock loss	Enhanced forest protection	Jurisdictional REDD+ where feasible



Investment (CAM ref.)	Risk		Major risks identified	Possible mitigation measures	Potential environmental investment enhancement measures
	Type	Rating			
	Social	4	Neutral	None required	Labor migration support and controls
20. Construction of Cambodia-Thai rail bridge	Env.	4	Risks to riparian forest	Riparian forest safeguard procedures	Awareness raising on role of riparian forests
	CC	5	Neutral	None required	-
	Social	5	Neutral	None required	-
21. Railway from Batdoeung (CAM) to Lock Ninh (VIE)	Env.	4	Sensitive terrain	Analysis of potential route options	Develop rail track construction safeguard guidelines
	CC	4	Flood vulnerability	Climate proof track design	Climate resilient infrastructure support
	Social	4	Land-take and poverty	Fair and transparent compensation procedures	Environmentally friendly livelihood development support
22. Multipurpose terminal	Env.	n/a	Could not be assessed due to insufficient information		
	CC	n/a			
	Social	n/a			
23. Thai-Cambodia border crossing improvement	Env.	5	Neutral	None required	-
	CC	5	Neutral	None required	-
	Social	5	Neutral	None required	-
24. SPS system strengthening	Env.	5	Neutral	None required	-
	CC	4	Indirect carbon stock loss	Corridor carbon sequestration as offsets	Feasibility studies on jurisdictional REDD+
	Social	4	Poverty	Help to small farmers to meet SPS standards	Livelihood diversification support
25. Corridor town development	Env.	4	Land use	Urban land use planning and zoning	Green town development
	CC	3	CC vulnerability	Climate resilient urban infrastructure	Capacity development on CC vulnerability assessment and adaptation planning
	Social	3	Neutral	None required	-
26. GEF biodiversity forestry program	Env.	5	Neutral	None required	Activities already included in RIF environment sector portfolio
	CC	5	Neutral	None required	Activities already included in RIF environment sector portfolio
	Social	4	NTFP access restrictions	Alternative livelihood activities	NTFP domestication studies
27. Community competitiveness/resilience	Env.	5	Neutral	None required	Activities already included in RIF environment sector portfolio
	CC	5	Neutral	None required	Activities already included in RIF environment sector portfolio
	Social	5	Neutral	None required	Activities already included in RIF environment sector portfolio

Table 4 Abbreviations: CAM = Cambodia, CC = climate change, Env = environmental, GEF = Global Environment Facility, GMS = Greater Mekong Subregion, KBA = key biodiversity area, n/a = not applicable, NTFP = nontimber forest product, PA = protected area, REDD+ = Reducing Emissions from Deforestation and Forest Degradation, RIF = Regional Investment Framework, SPS + sanitary and phyto-sanitary, VIE – Vietnam.

## 5. Spatial Multicriteria Assessment of Landscapes and Economic Corridors

SMCA is an extension of MCA that adds a spatial analysis dimension through the use of Geographic Information System (GIS) techniques. SMCA uses spatial layers as the basis for evaluation, and generates maps of scores and rankings (suitability/vulnerability maps) that help sector planners to better locate investments. While SMCA follows the same principles as MCA, more extensive data sets are required to create maps for each risk type. Consequently, fewer risk types are usually included in SMCA due to data constraints.

For the purposes of the RIF analysis, the assessment team used SMCA to measure the suitability of GMS landscapes and economic corridors for different sector investments by putting risk scores on the map and into relation with each other. They considered economic opportunities alongside environmental risks, and gave both equal weightings. Table 5 shows the fourteen risk/opportunity types the team used, weighted according to their relative importance:

**Environmental risk types:** PAs, key biodiversity areas, forest value, forest accessibility, terrain sensitivity, and watersheds.

**Economic opportunity types:** urban centers, population density, access to special economic zones (SEZs), economic corridor roads, railways, seaports, international airports, and domestic airports.

The SMCA analysis did not include sector assets (cropland, hydropower catchments, tourist sites, etc.), but the team did take these assets into account to assist planners with spatial prioritization decisions. Sector assets could be included in specially-tailored, sector-specific SMCAs, ideally as part of future RIF sector assessments.

**Table 5: Risk/Opportunity Types Evaluated by the Spatial Multicriteria Assessment**

Risk/ Opportunity Group	Risk type	Weighting	Severity rating
<b>Restriction</b>	Protected areas (PAs)	–	No development within PA boundaries
<b>Environmental Risk (50%)</b>	Distance to PA	0.35	Decreasing risk with increasing distance from PA (up to 10 km)
	Distance to key biodiversity areas	0.20	Decreasing risk with increasing distance from key biodiversity areas (up to 10 km)
	Forest value	0.15	Dense forest = high risk; open forest = medium risk; no forest = low risk
	Distance to forest	0.05	Decreasing risk with increasing distance from forest (up to 10 km)
	Terrain sensitivity	0.20	Increasing risk with increasing slope (up to 15 degree slope)
	Distance to upstream water courses	0.05	Decreasing risk with increasing distance to water course (up to 1 km)
<b>Economic Opportunity (50%)</b>	Distance to urban center	0.20	Decreasing opportunity with increasing distance (up to 50 km)
	Population density	0.15	Decreasing opportunity with decreasing density (up to 100/km <sup>2</sup> )
	Distance to Special Economic Zone	0.15	Decreasing opportunity with increasing distance (up to 50 km)
	Distance to road of economic corridor	0.15	Decreasing opportunity with increasing distance (up to 50 km)
	Distance to railway	0.10	Decreasing opportunity with increasing distance (up to 50 km)

Risk/ Opportunity Group	Risk type	Weighting	Severity rating
<b>Economic Opportunity (50%)</b>	Distance to seaport	0.10	Decreasing opportunity with increasing distance (up to 300 km)
	Distance to international airport	0.10	Decreasing opportunity with increasing distance (up to 150 km)
	Distance to domestic airport	0.05	Decreasing opportunity with increasing distance (up to 25 km)

The assessment matched each risk/opportunity type with the relevant GIS map layer (Appendix 2) from which scores were generated, ranging from 0 (low opportunity/high risk) to 1 (high opportunity/low risk). Finally, the individual risk/opportunity scores were aggregated to produce an overall score from which risk and suitability maps were produced. The assessment team produced two types of maps for the GMS: landscape maps and economic corridor maps.

## Landscape Assessment

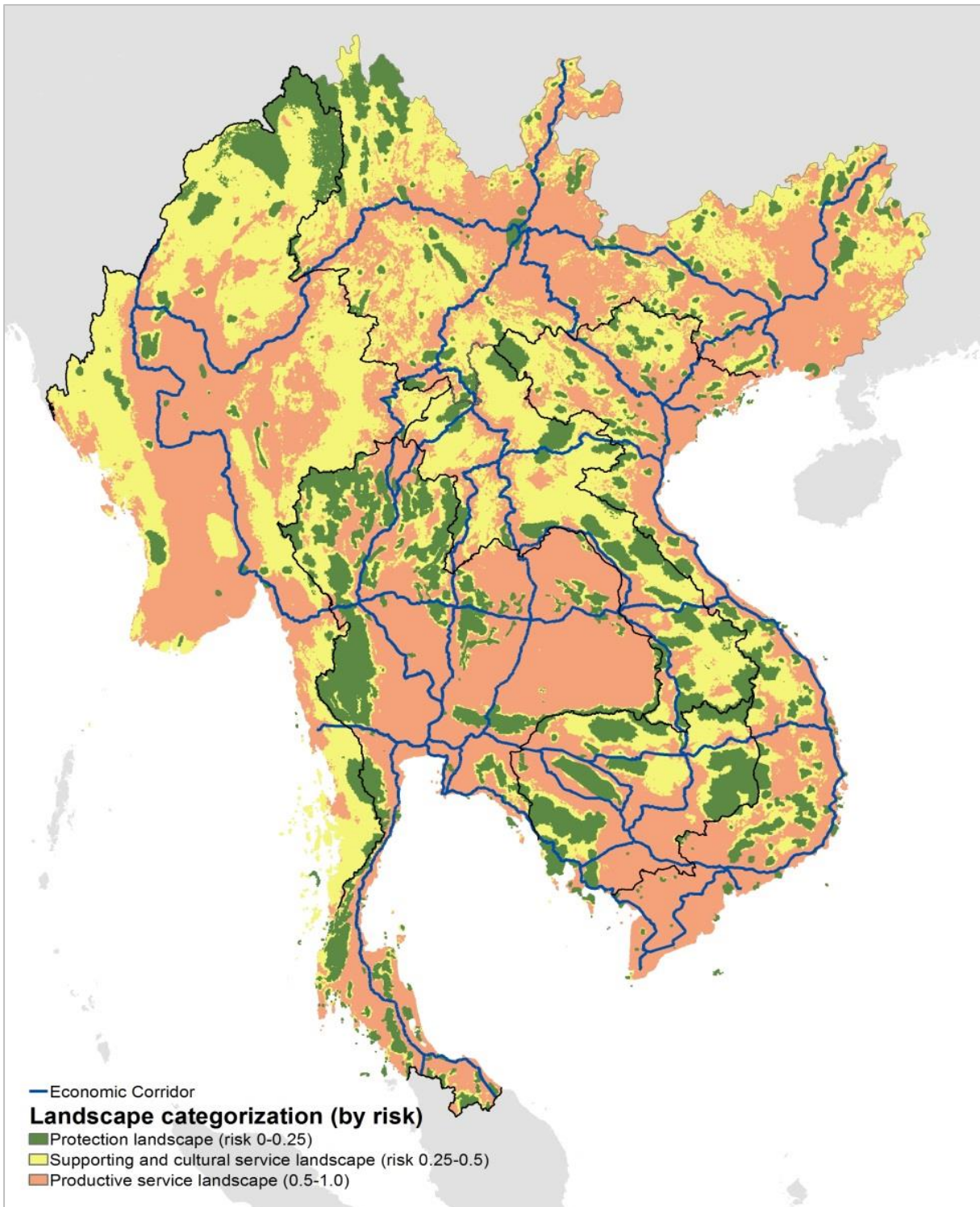
Based on the risk scores described above, Figure 2 shows the three GMS landscape categories that the SMCA identified and mapped:

*Low Risk Landscapes:* Land areas with low risk scores (0.51-1.0) are generally suitable for a wide range of investments in agriculture, industry and manufacturing, urban expansion, and infrastructure development.

*Medium Risk Landscapes:* Land areas with medium risk scores (0.26-0.5) are suitable for investments that do not have a high impact on ecosystem services, but can benefit from sustainable use of these services. For example: sustainable forestry, tourism, and organic or niche agriculture. Using these land areas for investments that have a high impact on the environment could result in significant and possibly irreversible losses of ecosystem functions.

*High Risk Landscapes:* Land areas with high risk scores (0-0.25) are environmentally sensitive to development. The ecosystem services they provide (e.g., carbon sequestration, climate regulation, hydrological cycling for clean water, gene pool maintenance, and pollination) not only support livelihoods in these areas, but also maintain the productivity of the low risk and medium risk landscapes. High risk landscapes should only be targeted for investments that have minimal risk or positive ecosystem impacts. Examples include conservation or protection forestry with associated nonextractive use of resources, e.g., ecotourism. These investments would be suitable for generating payments for ecosystem services such as from REDD+.

**Figure 2: Spatial Multicriteria Assessment Map Identifying Three Investment Landscape Categories**



Although all GMS development sectors rely on the ecosystem services provided by these three landscape categories, different sectors interact with the environment in different ways:

*Low Risk Landscapes:* Through changes in land use, the agriculture, forestry, mining, and urban development sectors alter natural ecosystems to capitalize on their Productive Services (soil fertility, mineral resources, groundwater, etc.).

*Medium Risk Landscapes:* The hydropower, transport and tourism sectors rely on conserving ecosystems to capitalize on their Supporting and Cultural Services (water discharge, rainfall infiltration, river flow, scenic value, cultural makeup, etc.).

*High Risk Landscapes:* The environment, HRD, and scientific sectors have a vested interest in protecting ecosystems to capitalize on their Regulating Services (climate regulation, nutrient cycling, gene pool maintenance, scientific value, etc.).

The above highlights two important interrelationships between the different types of ecosystem services. Firstly, maximizing (overexploiting) Productive Services can compromise supporting and cultural services. For example, forest conversion to agriculture increases rainfall runoff and decreases soil infiltration rates, resulting in slower aquifer recharge and reduced groundwater reserves, which in turn impact negatively on irrigation potential crucial to agriculture. Similarly, agricultural intensification replaces natural nutrient cycling and pest predation with agrochemicals that can further threaten other natural ecosystem processes such as pollination, organic matter breakdown, soil nutrient accumulation, etc.

Secondly, conserving and protecting supporting and regulating services helps to enhance and sustain the economic benefits that productive services can generate and in some cases, can generate additional income flows. For example, watershed protection not only extends the commercial life of hydropower schemes, but can also generate income from payment for ecosystem services (PES). Similarly, forest protection and sustainable management not only enhances ecosystem services, but can also qualify for carbon credit payments under REDD+.

As the map in Figure 2 shows, the majority of GMS economic corridors are located in the lower-risk, productive services landscapes however, corridor segments do run near, and sometimes through, higher-risk protection landscapes and medium-risk supporting landscapes. Caution will be required for locating RIF investments in or between these corridor segments.

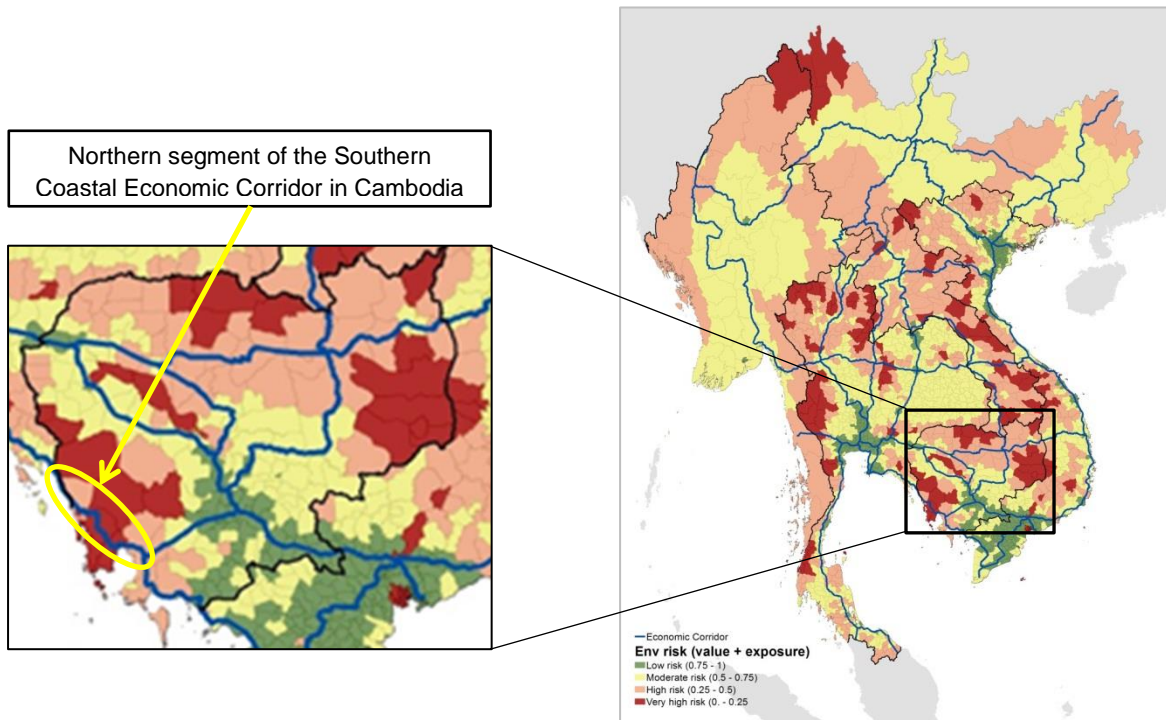
## **Economic Corridors Assessment**

Deepening corridor connectivity is a key step in the development of a transport corridor into a fully-fledged economic corridor. In this regard, it is important to note that the MCA identified investments in corridor-deepening as having high environmental risks (e.g. CAM 19). The SMCA methodology explored the environmental sensitivities of economic corridor development to assist strategy formulation for economic corridor development

The assessment team conducted an environmental analysis of economic corridor segments using SMCA methods. The analysis used the aggregate environmental risk value for each district that the corridor passes through to identify, delineate and describe corridor segments from an investment suitability standpoint. For each segment identified, the team assessed the respective environmental characteristics and sensitivities and used them to develop appropriate environmental management guidelines and investment suitability recommendations. Appendix 2 presents the results of these for all countries.

Figure 3 presents an example of how SMCA identified the environmental sensitivities and produced management guidelines for the northern segment of the Southern Coastal Economic Corridor in Cambodia.

**Figure 3: Sample Spatial Multicriteria Assessment Map of Economic Corridor Risks**



**Environmental Sensitivities**

- Very high biodiversity values.
- High value forest areas.
- Steeply sloping, sensitive terrain.
- Critical upper watershed area.
- Contains proposed hydropower dams.
- 0.15 (very low investment suitability, very high environmental risk).

**Management Guidelines**

- Restricted investments with a high level of protection for natural capital assets.
- Investments could include forestry and watershed protection with associated benefits from PES, e.g., REDD+, ecotourism, low impact or organic agriculture, etc.

**6. Lessons Learned**

The assessment described in this report was conducted after the RIF sector and country assessments were finalized and priority investments identified. As a result, the assessment had a distinct *ex-post* character, constraining its influence on the selection and prioritization of investments in the draft RIF. Due to time constraints, the assessment did not involve the wider range of experts ideally needed to refine the criteria framework used for scoring, mapping, and allocating risk scores and weightings.

Despite these challenges, the methodology developed for the RIF provides a rapid and useful means of screening investments. To enable MCA and SMCA to become more powerful tools for GMS national and regional planners, the following improvements are recommended:

- (i) **Timeliness of inputs:** The analysis should run ahead of (*ex-ante*), or in parallel with, RIF sector assessments and its results should be integrated into the investment identification and prioritization processes at the sector level.

- (ii) **Participation and feedback:** The design of the MCA and SMCA criteria framework should involve stakeholders from a wide range of relevant disciplines to generate consensus and objectivity, particularly during criteria development and weighting processes. This will also generate ownership.
- (iii) **Database development:** The accuracy of the MCA scores and SMCA maps is closely tied to data quality. More resources need to be allocated to produce data at a sufficient level of detail and to keep them up to date.
- (iv) **A learning process:** The understanding generated in practitioners from using MCA and SMCA is highly important. To create additional benefits for GMS sector planners, the methods used in this analysis need to be further simplified and supported by a user manual and pre-prepared regional data sets to enable sector planners to apply the methods themselves.

## 7. Conclusion

There is considerable potential for MCA and SMCA to support sector planning in the GMS. The Environment Operations Center intends to further develop and broaden the application of the approach in cooperation with government partners in the subregion. Key concluding messages about the application of MCA and SMCA on the RIF are as follows:

- (i) MCA and SMCA have the potential to become useful and widely accepted tools to help decision makers prioritize investments, identify appropriate development sites, and plan mitigation measures to reduce anticipated risks.
- (ii) Further testing and development of the methodology in close cooperation with the relevant sector planners will help realize this potential.
- (iii) There is significant scope for improving the process for screening investments, such as those in the RIF portfolio, by applying MCA and SMCA early in the planning cycle, ideally during initial sector assessments.
- (iv) MCA and SMCA can be used effectively for many sector- and area-based plans, for example, power development plans, transport sector strategies, land use plans, watershed management, etc.
- (v) The multidisciplinary nature of MCA and SMCA is suited for interdisciplinary use and building multiagency consensus. As such, it could be valuable tool for promoting multisectoral approaches to RIF investment planning and prioritization.
- (vi) Because of its logical and transparent nature, MCA and SMCA have the potential to enhance rural environmental governance at local, national and regional levels, a stated requirement of the 5<sup>th</sup> GMS Economic Corridors Forum, 2013.



## Appendices

### Appendix 1: Multicriteria Assessment Results for Regional Investment Framework Pipeline by Country

Cambodia					
Sector	Ref CAM	Project description	Environ-ment	Climate change	Social
Energy	1	Rural electrification and off-grid power development	4	5	5
Energy	2	Second generation biofuel technologies and value chains	3	5	5
Energy	3	Cambodia-Lao PDR-Viet Nam power trade grid	4	5	4
HRD	4	Regional cooperation on higher education	5	5	5
HRD	5	GMS communicable diseases control project	5	5	5
HRD	6	Technical vocational education training development	5	5	5
Tourism	7	GMS tourism infrastructure for inclusive growth I	3	4	4
Tourism	8	GMS tourism infrastructure for inclusive growth II	4	4	4
Tourism	9	Tourism infrastructure development in green triangle/Prea Vihea	3	4	4
Tourism	10	GMS tourism technical and vocational education and training	5	5	5
Agri	11	Climate friendly agribusiness green value chain development	4	4	4
Agri	12	GMS biosafety, disease and invasive species control	5	5	5
Agri	13	Enhancing food safety, quality & smallholder market access	5	4	4
Agri	14	Agrotourism value chain development	5	4	4
Agri	15	Enhanced food security by resilient production systems	5	5	5
Trans.	16	Aranyaprathet-Poipet bypass and associated infrastructure	5	4	4
Trans.	17	Sihanoukville port access road improvements	5	4	4
Trans.	18	Phnom Penh-Sihanoukville highway corridor improvements	2	3	4
Trans.	19	Deepening of southern economic corridor project	2	4	4
Trans.	20	Construction of Cambodia-Klong Loeuk (Thailand) rail bridge	4	5	5
Trans.	21	Railway from Batdoeung (Cambodia) to Lock Ninh (Vietnam)	4	4	4
Trans.	22	Construction of multipurpose terminal	Insufficient information to support assessment		
Trans.	23	Bot border crossing facilities improvement (Thai-Cambodia)	5	5	5
TTF	24	Modernization of SPS agencies for trade facilitation project	5	4	4
Urban	25	Corridor town development project II	4	3	3
Env.	26	GEF regional biodiversity and forestry program	5	5	4
Env.	27	Ecosystem approach to community competitiveness/resilience	5	5	5

Severity of risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.



People's Republic of China					
Sector	Ref PRC	Project description	Environment	Climate change	Social
Energy	1	Second generation biofuel technologies and value chains	3	5	4
Energy	2	PRC-Lao PDR-Thailand 500 kV Interconnection	3	4	3
Energy	3	Viet Nam-PRC 500 kV Power Interconnection	4	4	3
Tourism	4	Sino-Vietnam Detian-Ban Gioc Waterfall Tourism Zone	3	3	3
Tourism	5	Tourism technical and vocational education	5	5	5
Tourism	6	China-Association of Southeast Asian Nations Tourism Industry Park	4	5	3
Tourism	7	Guangxi Jingxi County Goose Spring Scenic Area	3	3	3
Agri.	8	Biosafety, transboundary diseases & invasive species control	5	5	5
Agri.	9	Regional food safety, quality and smallholder market access	5	4	4
Agri.	10	Agritourism value chain development	5	4	4
Agri.	11	Food security by resilient food production systems	5	5	5
Trans.	12	Ruili (China)-Kyaukpyu (Myanmar) Highway	2	2	2
Trans.	13	Daluo (China)-Tachilek (Myanmar) Highway	2	4	2
Trans.	14	Zhaotong-Maliuwan Expressway	3	4	3
Trans.	15	Gongshan-Daibu Expressway	3	4	3
Trans.	16	Zhaotong-Huize Expressway	3	4	3
Trans.	17	Mengzi-Wenshan-Yanshan Expressway	3	4	3
Trans.	18	Lijiang-Xianggelila Expressway	3	4	3
Trans.	19	Xinping-Zhenyuan-Lincang Expressway	3	4	3
Trans.	20	Baoshan-Lushui Expressway	3	4	3
Trans.	21	Leye-Baise Expressway	2	4	3
Trans.	22	Hechi-Baise Expressway	2	4	3
Trans.	23	Lipu-Yulin Expressway	4	4	3
Trans.	24	G323 Baise-Banshui Highway	3	4	3
Trans.	25	Tian'er-Fengshan Highway	3	3	3
Trans.	26	Malu-Dongzhong Highway	Insufficient information to assess		
Trans.	27	Guangxi Western Mountainous Road Safety Project			
Trans.	28	Yunnan Pu'er Regional Integrated Roads Project			
Trans.	29	Nanning-Wuzhou 3000 tons Waterway Project			
Trans.	30	Guangxi Xijiang Waterway Corridor Support Facility			
Trans.	31	Dali-Ruili new rail line	3	4	2
Trans.	32	Guiyang-Liuzhou rail line capacity enlargement	Insufficient information to assess		
Trans.	33	Huangtong-Baise Railway			
Trans.	34	Hepu-Zhanjiang Railway	3	4	4
Trans.	35	Hechi-Nanning Railway	3	4	4
Trans.	36	Liuzhou-Zhaoqing Railway	3	4	4
Trans.	37	Nanning-Pingxiang Section of Xiang Gui Railway	n/a	n/a	n/a
Trans.	38	Fangcheng-Dongxing Railway	4	4	3
Trans.	39	Jingxi-Longbang Railway	3	4	3
Trans.	40	Auxiliary Line for Nanning-Nali Section of Nan Kun Railway	4	5	4
Trans.	41	Auxiliary Line for Nali-Baise Section of Nan Kun Railway	4	5	4
Trans.	42	Litang-Zhanjiang Electrification	5	5	5
Trans.	43	Hengyang-Liuzhou Electrification of Xiang Gui Railway	5	5	5
Trans.	44	Huaihua-Liuzhou Electrification of JiaoLiu Railway	5	5	5
Trans.	45	QianGui Railway Expanding and Rebuilding	Insufficient information to assess		
Trans.	46	Expanding Yongzhou-Yulin Section of YiZhan Railway	5	4	4
Trans.	47	Liuzhou Railway Station Expanding	5	5	4
Trans.	48	Nanning Container Freight Station	5	5	4
Trans.	49	Louzhou Container Freight Station	5	5	4
Trans.	50	Beibuwan Container Freight Station	5	5	4
Trans.	51	Yuxi-Mohan railway	3	4	2
Trans.	52	Emei to Miyi railway	3	4	2
Trans.	53	Upper Mekong River navigation channel China - Luang Prabang	5	4	4
Trans.	54	GMS transport cooperation (PRC, THA, LAO, MYN)	5	5	3
Env	55	GEF Regional Biodiversity and Forestry Program	5	5	4
Env	56	Biodiversity landscape management in Mekong Headwaters	5	5	5

Severity of negative risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.

Lao PDR					
Sector	Ref LAO	Project description	Environment	Climate change	Social
Energy	1	Design and funding of backbone grid for Lao PDR	4	4	3
Energy	2	Thailand-Viet Nam power line interconnection	4	5	3
Energy	3	Rural electrification and off-grid power development	4	5	5
Energy	4	Second generation biofuel technologies and value chains	3	5	4
Energy	5	Nabong-Udon 500 KV Substation Transmission Line Facility	5	5	4
Energy	6	Cambodia-Lao PDR-Viet Nam Power Trade Grid	4	5	4
Energy	7	Cambodia-Lao PDR-Viet Nam Power Grid Assessment	5	5	5
Energy	8	East-West Corridor power transmission and distribution	5	5	4
Energy	9	PRC-Lao PDR-Thailand 500 kV Interconnection	3	4	3
Energy	10	Various hydropower projects Nam Khan/Nam Ou	2	2	1
HRD	11	Regional cooperation on higher education	5	5	5
HRD	12	GMS Communicable Diseases Control Project	5	5	5
HRD	13	Technical Vocational Education Training Development	5	5	5
Tourism	14	GMS Tourism Infrastructure for Inclusive Growth I	3	4	4
Tourism	15	GMS Tourism Infrastructure for Inclusive Growth II	4	4	4
Tourism	16	Tourism Infrastructure Development in the Green Triangle	3	4	4
Tourism	17	GMS tourism technical & vocational education & training	5	5	5
Agri	18	Climate friendly agribusiness green value chain development	4	4	4
Agri	19	GMS biosafety, disease and invasive species control	5	5	5
Agri	20	Enhancing food safety, quality and smallholder market access	5	4	4
Agri	21	Agrotourism value chain development	5	4	4
Agri	22	Enhanced GMS food security by Resilient Production Systems	5	5	5
Trans	23	Upgrading of NR1A (portion from Lantui to Bounneau, 145km)	4	4	2
Trans	24	Upgrading NR13 (portion from Oudomxay to Pakmong, 82 km)	3	4	2
Trans	25	Upgrading NR13N Vang Vieng–Vientiane (130km)	4	4	2
Trans	26	Upgrading of NR8 (132 km) East-West Transport Route	3	3	2
Trans	27	Transport network improvement Luang Prabang–Samneua	2	3	3
Trans	28	Road Luang Prabang–Dien Bien Phu (107 km)	3	3	2
Trans	29	Muong Ngeune–Chomphet–Luang Prabang	3	3	3
Trans	30	Road Muong Ngeune–Muong Kob–Pak Tha (122 km)	3	3	3
Trans	31	Road Pakse–Champassak–Muong Khong 14A (152 km)	3	3	3
Trans	32	Road Napong–Saravan–Lalay on Viet Nam border (147 km)	2	3	2
Trans	33	Road Pakse–Sekong–VN: NR16 East-West Route to Viet Nam	3	3	3
Trans	34	Road Phiafay–Attapeu: East-West Route NR18A (261 km)	3	3	3
Trans	35	L. Namtha–Xiengkok–Myanmar Bridge: NR17 (140 km)	3	4	4
Trans	36	Detailed FS and DD of Vientiane–Thakaek–Muya Railway	4	4	3
Trans	37	Thanaleang–Nongkai Railway Extension Project	5	5	3
Trans	38	Vientiane–Boten Railway Project (420 km)	3	4	2
Trans	39	Savannakhet–Lao Bao Railway Project (220 km)	4	4	3
Trans	40	Pakse–Ubon Railway Project	4	4	3
Trans	41	Construction of ICD and Dry Ports	Insufficient information to support assessment		
Trans	42	Mekong River Bridge between Xiengkok–Kainglap	4	3	3
Trans	43	Mekong River Bridge at Pakbeng on NR2	4	4	3
Trans	44	Mekong Bridge at Paklay	3	4	3
Trans	45	Mekong Bridge at Luang Prabang	4	4	3
Trans	46	Mekong Bridge at Paksan–Bungkane	4	5	3
Trans	47	Selamphao Bridge on NR14A between Lao PDR - Cambodia	3	4	2
Trans	48	Nam Phao Border Crossing Point between Lao PDR - Viet Nam (NR8)	5	5	5
Trans	49	Na Phao Border Crossing Point between Lao PDR - Viet Nam (NR12)	5	5	5
Trans	50	Lalay Border Crossing Point between Lao PDR - Viet Nam (NR15)	5	5	5
Trans	51	Dak Chung Border Crossing between Lao PDR - Viet Nam (NR16)	5	5	5
Trans	52	Vangtao Border Crossing Point between Lao PDR - Thailand	5	5	5
Trans	53	Thanaleng Border Crossing Infrastructure Improvement Project	5	5	4
Trans	54	Xiengkok River Port	5	5	4
Trans	55	Ban Mom River Port	5	5	4

Sector	Ref LAO	Project description	Environment	Climate change	Social
Trans	56	Houai Sai River Port	5	5	4
Trans	57	Pakbeng River Port	5	5	4
Trans	58	Luang Prabang River Port	5	5	4
Trans	59	Thanalang-Vientiane Railway Construction Project	4	5	3
Trans	60	Hongsa-Ban Chiangman Road Improvement Project	3	4	2
TTF	61	Modernization of SPS Agencies for Trade Facilitation Project	5	4	4
Urban	62	Corridor Town Development Project II	4	3	5
Env.	63	GEF Regional Biodiversity and Forestry Program	5	5	4
Env.	64	Low carbon forestry in GMS Economic Corridors	5	5	5
Env.	65	Ecosystem approaches to community competitiveness & resilience	5	5	5
Env.	66	Low carbon freight corridors	5	5	5

Severity of negative risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.

Myanmar					
Sector	Ref MYN	Project description	Environment	Climate change	Social
Energy	1	Conventional rural electrification programs	5	5	5
Energy	2	500 kV Line from Mawlamyine to the Main Grid	5	5	5
Energy	3	Demonstration of second generation biofuel technologies	3	5	4
Energy	4	Extension of energy access in Myanmar from Thailand and PRC	4	4	3
Energy	5	Extension of the East-West Energy Corridor to Mawlamyine	3	4	3
Energy	6	Bokpyin 600 MW Coal-Fired Power Plant with Thailand	2	2	2
HRD	7	Cooperation and development in higher education	5	5	5
HRD	8	GMS Communicable Diseases Control Project	5	5	5
HRD	9	GMS Technical Vocational Education Training	5	5	5
HRD	10	GMS Tourism Infrastructure for Inclusive Growth II	4	4	4
HRD	11	GMS Tourism Technical and Vocational Education	5	5	5
Tourism	12	Pro-poor tourism development	5	4	4
Tourism	13	Strengthening tourism vocational training institutions	5	5	5
Agri.	14	Climate friendly green agribusiness value chains	4	4	5
Agri.	15	Biosafety, transboundary diseases & invasive species control	5	5	5
Agri.	16	Regional food safety, quality and smallholders market access	5	4	4
Agri.	17	Agritourism value chains development	5	4	4
Agri.	18	Enhancing food security by resilient food production systems	5	5	5
Trans.	19	Maubin-Phyarpon road Delta Region	4	3	4
Trans.	20	Kawkareik-Eindu Road WEC and EWEC	2	4	2
Trans.	21	Road rehabilitation in the Delta Region	4	2	4
Trans.	22	Loilem-Kyaington road section (359 km)	3	3	2
Trans.	23	Kyaington-Monglar road (93 km) NSEC	3	4	1
Trans.	24	Thaton-Payagyi Road Improvement Project	3	4	4
Trans.	25	Thilawa-East Dagon Road Improvement Project	5	4	4
Trans.	26	Ruili (PRC)-Kyaukpyu (Myanmar) Highway	2	2	2
Trans.	27	Daluo (PRC)-Tachilek (Myanmar) Highway	2	4	2
Trans.	28	Yangon-Pyay Track Upgrading Project (259 km)	5	5	5
Trans.	29	East Dagon-NR1 Road Improvement Project	5	5	4
Trans.	30	Bago-Dawei Track Upgrading Project (507 km)	5	5	5
Trans.	31	Bridges on the Kyaington-Lyainglin-Taunggyi Road	5	3	5
Trans.	32	Bridges on the Minelar-Kyaington-Tarchilate Road	5	3	5
Trans.	33	Mae Sot-Myawaddy Border Crossing Improvement	4	4	3
Trans.	34	Myanmar ICD Investment Projects	5	5	4
Trans.	35	Bridges on the Lyainglin-Pankaytu-Thipaw Road	4	4	5
Urban	36	Corridor Town Development Project III	4	3	5
Env	37	GEF Regional Biodiversity and Forestry Program	5	5	4
Env	38	Low carbon forestry in GMS economic corridors	5	5	5

Severity of negative risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.

Thailand					
Sector	Ref THA	Project description	Environment	Climate change	Social
Energy	1	Thailand-Viet Nam power line interconnection	4	5	3
Energy	2	Second generation biofuel technologies and value chains	3	5	4
Energy	3	Nabong-Udon 500 KV Substation Transmission Line Facility	5	5	4
Energy	4	PRC-Lao PDR-Thailand 500 kV Interconnection	3	4	3
Energy	5	Bokpyin 600 MW Coal-Fired Power Plant	2	2	2
Tourism	6	GMS tourism technical & vocational education & training	5	5	5
Agri.	7	GMS biosafety, disease and invasive species control	5	5	5
Agri.	8	Enhancing food safety, quality and smallholder market access	5	4	4
Agri.	9	Agrotourism value chain development	5	4	4
Agri.	10	Enhanced GMS food security by resilient production systems	5	5	5
Trans.	11	Arranyapraphet-Poipet Bypass Road & associated infrastructure	5	4	4
Trans.	12	Bang Yai-Kanchanaburi Intercity Motorway Project	4	4	4
Trans.	13	Mae Sot-Myawaddy Border Crossing improvements	4	5	3
Trans.	14	Development of Laem Chabang Port Basin III	5	4	3
Trans.	15	Development of Coastal/Inland Canal Terminal at Laem Chabang	5	4	5
Trans.	16	Laem Chabang Port Rail Transfer Terminal	5	4	5
Env	17	GEF Regional Biodiversity and Forestry Program	5	5	4
Env	18	Transboundary biodiversity landscape management	5	5	5
Env	19	Low carbon forestry in GMS Economic Corridors	5	5	5

Severity of negative risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.

Viet Nam					
Sector	Ref VIE	Project description	Environment	Climate change	Social
Energy	1	Thailand-Viet Nam power line interconnection	4	5	3
Energy	2	Second generation biofuel technologies and value chains	3	5	4
Energy	3	Lao PDR – Viet Nam Power Transmission Interconnection	3	4	3
Energy	4	Cambodia-Lao PDR-Viet Nam Power Trade Grid	4	5	4
Energy	5	Viet Nam-PRC 500 kV Power Interconnection	4	4	3
HRD	6	GMS Communicable Diseases Control Project	5	5	5
Tourism	7	GMS Tourism Infrastructure for Inclusive Growth I	3	4	4
Tourism	8	GMS Tourism Infrastructure for Inclusive Growth II	4	4	4
Tourism	9	Tourism Infrastructure Dvt. in the Green Triangle - Prea Vihea	3	4	4
Tourism	10	Detian-Ban Gioc Waterfall International Tourism Zone	3	3	3
Tourism	11	GMS tourism technical & vocational education & training	5	5	5
Tourism	12	Guangxi Jingxi County Goose Spring Scenic Area	3	3	3
Agri.	13	GMS biosafety, disease and invasive species control	5	5	5
Agri.	14	Enhancing food safety, quality and smallholder market access	5	4	4
Agri.	15	Agrotourism value chain development	5	4	4
Agri.	16	Enhanced GMS food security by resilient production systems	5	5	5
Trans.	17	Southern Coastal Corridor Roads (additional financing)	5	3	5
Trans.	18	Central Mekong Delta connectivity	4	3	4
Trans.	19	Kunming-Haiphong Transport Corridor-Noi Bai-Lao Cai Highway	2	3	2
Trans.	20	GMS Ben Luc-Long Thanh Expressway PFR 2	5	4	3
Trans.	21	Second GMS Southern Coastal Corridor	4	3	3
Trans.	22	National Highway 14D Improvement Project	2	3	2
Trans.	23	GMS Ha Noi-Lang Son Expressway (156 kms)	3	4	4
Trans.	24	Second Yen Vien-Lao Cai Railway Upgrading	4	5	3
Urban	25	Corridor Town Development Project II	4	3	5
Env.	26	GEF Regional Biodiversity and Forestry Program	5	5	4
Env.	27	Transboundary biodiversity landscape management	5	5	5
Env.	28	Ecosystem approaches to community competitiveness/resilience	5	5	5
Env.	29	Low carbon freight corridors	5	5	5

Severity of negative risk: 1 = very high, 2 = high, 3 = medium, 4 = low, 5 = very low or zero.

## Appendix 2: Map Layers Used for the Spatial Multicriteria Assessment

Layer	Information	Source	Remarks
Protected areas	Polygons, Distance raster	GMS Environment Operations Center (EOC)	Compiled from national sources and United Nations Environment Programme World Conservation Monitoring Center (parts of Yunnan and Guangxi)
Key biodiversity areas	Polygons, Distance raster	Critical Ecosystem Partnership Fund	
Forest value	Raster (1km grid)	European Space Agency GlobCover V2.3	Classes aggregated by EOC
Terrain (slope)	Raster (1km grid)	SRTM 90 V4	Original resolution 90m
Upstream water courses (rivers)	Polylines, Distance raster	Food and Agriculture Organization of the United Nations	Using Strahler values to separate smaller/upstream rivers from large/downstream rivers
Urban centers	Raster (1km grid)	Schneider, A., M. A. Friedl and D. Potere (2009) A new map of global urban extent from MODIS data. Environmental Research Letters, Volume 4, article 044003	Original resolution 500m
Population distribution	Raster (1km grid)	Oak Ridge National Laboratory LandScan Global Ambient Population (2010)	Original resolution 1km
Special Economic Zones	Points, Distance raster	EOC	Mapped using materials provided by ADB Resident Missions and internet research.
Economic Corridors	Polylines, Distance raster	EOC	Regional road data and GPS tracks with ADB maps used as reference
Railways	Polylines, Distance raster	EOC	Includes existing railway and railway under construction. Uses ADB maps as reference.
Seaports	Points, Distance raster	EOC	Internet research
Airports	Points, Distance raster	EOC	Processed using Openflights database

## Appendix 3: Environmental Analysis of Economic Corridor Segments

### 1. Cambodia Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Safeguards and Environmental Management Guidelines
<b>Southern Coastal Economic Corridor (SCEC)</b>	Northern section	Very Low (0.15)	A generally very narrow corridor running from the Thai border to Sre Ambel through or adjacent to high value forest and important PA/KBAs in the upper reaches of the Pouthisat watershed.	<ul style="list-style-type: none"> <li>• Very high biodiversity values</li> <li>• Critical upper watershed area of the Tonle Sap</li> <li>• Contains catchments of proposed hydropower schemes</li> <li>• Contains high value forest areas</li> <li>• Steep terrain sensitive to land-use change/soil erosion</li> <li>• Key access route to SEZs around Sihanoukville port</li> </ul>	Restricted investments and high level of protection needed for natural capital assets and biodiversity values in this corridor segment. REDD+ and hydropower opportunities that do not impinge on PAs could be exploited. Organic/sustainable agriculture and high-end ecotourism in PA/KBAs is possible.
	Southern section	Medium (0.47)	A somewhat deeper corridor running from Sre Ambel to the Viet Nam border at Kep following the coast.	<ul style="list-style-type: none"> <li>• Contains coastal mangrove forests</li> <li>• Important coastal tourism zone</li> <li>• Contains important natural capital tourism assets</li> <li>• Key access route to SEZs around Sihanoukville port</li> </ul>	Appropriate for productive investments in agriculture/forestry and suitable for selective tourism infrastructure development. Caution required in relation to mangrove areas.
<b>Central Economic Corridor (CEC)</b>	Northern section	Medium (0.49)	A medium depth corridor running from the Lao PDR border to Sandan containing forest and PA/KBAs close to the Mekong river.	<ul style="list-style-type: none"> <li>• High biodiversity values and natural capital assets</li> <li>• Important Mekong River tourism route</li> <li>• Catchment area of proposed hydropower projects</li> <li>• Generally flat lowland terrain</li> </ul>	Restricted investments and high level of protection needed close to the Mekong, River, otherwise amenable to productive investments in agriculture, forestry, etc.
	Central section	High (0.75)	An extremely wide/deep corridor running from Sandan via Phnom Penh to the western border of Kampong Speu through intensive rice production areas, with many SEZs around Phnom Penh.	<ul style="list-style-type: none"> <li>• Largely flat, low-lying, nonsensitive terrain</li> <li>• Mainly intensive agricultural land use</li> <li>• Sensitive to pollution of Mekong River</li> <li>• Flood prone for much of its length</li> </ul>	Suitable for all types of productive investments including industry and transport infrastructure. Safeguards needed for point-source pollution control and a high level of climate proofing will be necessary for infrastructure development.
	South-western section	Medium (0.49)	A narrow corridor running from the Kampong Speu border via the SCEC through or adjacent to high value forest to Sihanoukville port.	<ul style="list-style-type: none"> <li>• Contains high biodiversity values/ natural capital assets</li> <li>• Forestry concessions exist in high value forest areas</li> <li>• Catchment for proposed small hydropower schemes</li> <li>• Important tourism route to the coast</li> <li>• High volume freight route from port – Phnom Penh SEZs</li> </ul>	Protection needed in areas of high value forest along with safeguards/mitigation measures for road development. Need clear guidelines and restrictions for tourism infrastructure development in coastal areas.
<b>Southern Economic Corridor (SEC)</b>	Northern section	Medium (0.54)	A wide corridor running from Poipet around both sides of the Tonle Sap to Kampong Chnang, comprising paddy and recession rice land and containing important KBAs adjacent to the Tonle Sap PA.	<ul style="list-style-type: none"> <li>• Important biodiversity values in the Tonle Sap PA</li> <li>• Contains major rice producing areas of Cambodia</li> <li>• Sensitive to point/nonpoint source pollution of Tonle Sap</li> <li>• Contains Angkor Park World Heritage site</li> <li>• Important tourism assets centered on Siem Reap</li> <li>• Highly vulnerable to flooding</li> </ul>	Suitable for agricultural development, but strong protection/safeguards needed close to the Tonle Sap PA zone. Climate-proofed infrastructure and climate resilient farming systems development will be required to combat the threat of floods.
	Southern section	Very High (0.82)	A wide corridor from Kampong Chnang via Phnom Penh-Viet Nam border at Bavet through intensive paddy and recession rice areas in the lower Mekong watershed.	<ul style="list-style-type: none"> <li>• Largely flat, nonsensitive terrain</li> <li>• Sensitive to point/nonpoint source river pollution</li> <li>• Contains major rice producing areas of Cambodia</li> <li>• Highly vulnerable to flooding</li> <li>• Key access route to large SEZs centered on Bavet</li> </ul>	Generally suitable for all forms of productive investment, particularly agriculture. Safe-guards needed for point-source pollution control, and a high level of climate-proofing will be necessary for transport and irrigation infrastructure.

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Safeguards and Environmental Management Guidelines
	East-West section	Medium (0.43)	A relatively narrow/shallow corridor running from Siem Reap to the Viet Nam border through high value forest and some PAs and KBAs.	<ul style="list-style-type: none"> <li>• Contains high biodiversity values/ natural capital assets</li> <li>• Includes forestry concessions in high value forest areas</li> <li>• Runs through critical upland watersheds</li> <li>• Proposed hydropower dams on major tributaries and the Mekong mainstream</li> <li>• Steeply sloping, sensitive terrain at the eastern end</li> <li>• Extensive upland farming areas at east/west extremities</li> <li>• Important tourism assets centered on Siem Reap</li> <li>• Contains numerous agricultural, forestry and mining concessions</li> </ul>	Suitable for investments in large scale hydropower (coupled with PES), agroforestry and nature tourism. Opportunities for biodiversity offsets from land concessions and mining. Safeguards and protection required in the proximity of PAs and KBAs and in sensitive terrain areas in the upper catchments of critical watersheds. Agrotourism and organic/niche agricultural production should be encouraged.

<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability

## 2. People's Republic of China Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>North-South Economic Corridor (NSEC)</b>	Northern section	Medium (0.56)	A fairly wide/deep corridor created by its convergence with the NEC in the upper Yangtze and Xun Jiang watersheds, running from Kunming to Yuxi through PAs for most of its length.	<ul style="list-style-type: none"> <li>• Bisects two PAs</li> <li>• Contains highly fragmented medium value forest</li> <li>• Traverses critical upper watershed areas</li> <li>• Upper catchment area of nine operational hydropower schemes</li> <li>• Contains natural tourist sites</li> <li>• Contains intensive and extensive rain fed farming land</li> </ul>	High level of caution needed due to high development pressures next to the PAs. Reforestation/protection required in PA buffer zones. Suitable for agriculture, forestry and tourism development outside the PAs if supported by soil and water conservation measures due to its critical location in the upper Yangtze and Sun Jiang catchments.
	Southern section	Medium (0.44)	A narrow corridor running from Yuxi to Jinhong through steep mountains and river valleys in the middle reaches of the Hong (Red River) and Mekong watersheds.	<ul style="list-style-type: none"> <li>• Runs through high-value forest at higher elevations</li> <li>• Bisects important PA/KBAs at its southern end</li> <li>• Contains highly-sensitive, steep terrain</li> <li>• Contains extensive agriculture land in valley bottoms</li> <li>• Forms the catchment of numerous operational hydropower dams</li> <li>• Encompasses many natural tourism sites</li> </ul>	Safeguards and protection required in the proximity of PAs and KBAs in the south and in sensitive terrain. Agrotourism and organic/niche agricultural production could be encouraged. Suitable for investments in large scale hydropower (with PES), agroforestry and nature tourism.
	South-west branch	Medium (0.46)	A narrow/shallow corridor running from Jinhong to the Myanmar border through medium-value forest and extensive farmland.	<ul style="list-style-type: none"> <li>• Runs through medium-value forest at higher elevations</li> <li>• Adjacent to a large PA at its southern end</li> <li>• Contains mainly extensive agriculture land in valley bottoms</li> </ul>	Protection needed in and around the PA in the south. Good potential for nature tourism and sustainable agriculture development. Also suitable for investments in hydropower (with PES) outside the PA.
	South-east branch	Low (0.40)	A very narrow corridor running from Jinhong to the Lao PDR border through high-value forest and important transboundary PAs in the Mekong watershed.	<ul style="list-style-type: none"> <li>• Runs through high-value forest areas</li> <li>• Contains many PAs along its entire length</li> <li>• Important tourist route to Lao PDR and Thailand with numerous nature tourism assets</li> <li>• Dominated by highly sensitive, steeply sloping terrain</li> </ul>	High level of protection needed for critical transboundary PAs, otherwise appropriate for hydropower, forestry and sustainable agriculture development. Presents excellent opportunities for transboundary ecotourism
<b>Northern Economic Corridor (NEC)</b>	Western section	Medium (0.49)	A fairly narrow/ shallow corridor running from the Myanmar border to Dali through high and medium value forest with some extensive rain fed farm land, particularly towards the east.	<ul style="list-style-type: none"> <li>• Contains high and medium value forest areas</li> <li>• Contains PAs at its eastern and western extremities</li> <li>• Contains highly-sensitive, steeply-sloping land</li> <li>• Includes critical upper watershed areas of the Irrawaddy, Salween and Mekong rivers</li> <li>• Supports some extensive agriculture production</li> <li>• Contains many natural tourism assets</li> <li>• Includes the Erhai Lake National Park and proposed World Heritage site</li> </ul>	High level of protection needed for PAs and buffer zones, particularly for the Erhai Lake proposed World Heritage site. Feeder road and transport infrastructure development will require special safeguards in sensitive terrain. Suitable for investments in hydropower, forestry and tourism. Good potential for agriculture intensification, particularly through irrigation infrastructure development.



Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
	Middle section	Medium (0.52)	A wider corridor running from Dali via Kunming to Quianxinan through mainly flat or rolling terrain, supporting intensive rain fed agriculture.	<ul style="list-style-type: none"> <li>• Bisects PA around Kunming</li> <li>• Includes critical upper reaches of Xun Jiang watershed</li> <li>• Traverses some high-value forest to the west of Kunming</li> <li>• Contains numerous natural tourism assets</li> <li>• Supports intensive and extensive agriculture production</li> <li>• Significant irrigated agriculture areas east of Kunming</li> </ul>	Generally amenable to most types of investment but caution is needed around PAs. Good potential for hydropower, tourism, forestry and agricultural intensification, particularly through irrigation development. No serious terrain constraints to development.
	Eastern section	Medium (0.52)	A narrow corridor segment running from Quianxinan to Baise through high and medium value forest with some extensive farming areas.	<ul style="list-style-type: none"> <li>• Contains high and medium value forest areas</li> <li>• Runs through and adjacent to many PAs</li> <li>• Traverses highly sensitive, steeply sloping terrain</li> <li>• Critical upper watershed area of Xun Jiang river basin</li> <li>• Supports some limited extensive agriculture</li> <li>• Contains natural tourism assets</li> </ul>	Safeguards and protection required for the many PAs, including buffer zones. Good potential to establish conservation corridors between the PAs. Hydropower and PES opportunities exist, particularly where PAs form reservoir catchments. Good potential for agricultural intensification.
	Southern section	Medium (0.57)	A deep/wide corridor running from Baise via Nanning to the South China Sea at Fangchenggang through mainly flat valley-bottom land.	<ul style="list-style-type: none"> <li>• Contains fragmented pockets of high-value forest</li> <li>• Contains some PAs in its southern portion</li> <li>• Largely nonsensitive valley-floor terrain</li> <li>• Supports extensive rain fed agriculture</li> <li>• Some natural tourist sites in its southern portion</li> </ul>	Generally suitable for most investments, but buffer zones should be established for PAs in the south. Good potential for agricultural intensification. No serious terrain constraints to development.
<b>Eastern Economic Corridor (EEC)</b>	Western segment (northern section)	Medium (0.55)	A fairly wide/deep corridor in the upper reaches of the Xun Jiang watershed, running from Kunming to Mengxi.	<ul style="list-style-type: none"> <li>• Bisects PA/ KBAs near Kunming</li> <li>• Contains fragmented forest areas that provide important open forest habitat</li> <li>• Forms the catchment for two operational hydropower dams</li> <li>• Supports extensive rain fed agriculture</li> <li>• Contains two natural tourism sites</li> </ul>	Protection required for PAs buffer zones near Kunming. Reforestation/enrichment-planting advisable, particularly in hydropower catchments. Good potential for tourism and agricultural intensification, possibly linked to agrotourism.
	Western segment (southern section)	Medium (0.54)	A narrower/shallow corridor running from to Mengxi to the Viet Nam border through high value forest, PAs and KBAs.	<ul style="list-style-type: none"> <li>• Contains significant high-value forest areas</li> <li>• Runs adjacent to PA and KBAs</li> <li>• Traverses sensitive, steeply sloping terrain</li> <li>• Supports some small pockets of extensive agriculture</li> <li>• Contains natural tourism assets</li> </ul>	Protection needed in and around the PA in the corridor. Good potential for nature tourism and agriculture development. Also suitable for sustainable NTFP management and domestication. Hydropower development (with PES) is possible outside the PAs.
	Eastern segment	High (0.63)	A wide/deep corridor in the Xun Jiang watershed, running southwest from Nanning to the Viet Nam border.	<ul style="list-style-type: none"> <li>• Contains fragmented low-value forest areas</li> <li>• Bisects a number of important PAs/ KBAs</li> <li>• Runs through largely flat or rolling nonsensitive terrain</li> <li>• Contains some natural tourism sites</li> </ul>	Generally suitable for most investments including infrastructure, but buffer zones should be established around the PAs. No serious terrain constraints with good potential for agriculture intensification.

<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability

### 3. Lao PDR Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>North-South Economic Corridor (NSEC)</b>	Entire Lao PDR segment	Low (0.35)	A very narrow, highly sensitive corridor in the Mekong watershed running from PRC to the Thai border at Huayxai through high-value forest and important national PAs, including the Nam Ha ASEAN Heritage Site.	<ul style="list-style-type: none"> <li>• Bisects and runs adjacent to important PA/KBAs</li> <li>• Bounded by high value protected forest</li> <li>• Large rubber production areas along the corridor</li> <li>• Important tourist route linking sites in PRC and Thailand</li> <li>• Contains a number of key nature tourism sites and assets</li> <li>• Steep terrain sensitive to soil erosion</li> <li>• Includes Nam Ha catchment with hydropower plans.</li> <li>• High levels of ethnic diversity</li> </ul>	High level protection needed for critical transboundary PAs with controls on rubber expansion to reduce PA encroachment. High potential for ecotourism and opportunities for PES from planned hydropower schemes. Good potential for sustainable NTFP management, domestication and sale.
<b>North-Eastern Economic Corridor (NEEC)</b>	Eastern section	Low (0.36)	A very narrow corridor running from the Viet Nam border via Sam Neua to Vieng Kham through steep terrain with high-value forests and PAs in the upper reaches of sensitive transboundary watersheds.	<ul style="list-style-type: none"> <li>• Contains very high value forest areas</li> <li>• Bisects and runs adjacent to high biodiversity value areas</li> <li>• Critical upper watershed area for numerous proposed hydropower projects in Lao PDR and Viet Nam</li> <li>• High elevation, steeply sloping terrain sensitive to erosion</li> <li>• High ethnic diversity (predominantly Hmong-Mien)</li> <li>• Numerous natural tourism assets</li> </ul>	High level of protection and buffer zone establishment needed for PAs. Transboundary watershed management needed for critical upper catchment area of Vietnam. Climate-proofed transport infrastructure required. Good potential for ecotourism and sustainable NTFP management.
	Mid-section	Medium (0.47)	A narrow corridor running from Vieng Kham via Luang Prabang to Xayaboury through well-forested, high elevation, steep terrain.	<ul style="list-style-type: none"> <li>• Contains high value forest areas</li> <li>• Steeply sloping, sensitive terrain</li> <li>• High ethnic diversity (predominantly Hmong-Mien)</li> <li>• Planned hydropower schemes on Mekong tributaries</li> </ul>	Protection required for forests and NTFPs in the corridor. Opportunities for hydropower, PES, REDD and ecotourism. Some potential for NTFP domestication and niche agriculture. Safeguards needed for road construction in areas of steep terrain.
	South western section	Medium (0.48)	A narrow corridor, deepening in its southern extremities, running from Xayaboury town to Thai border through medium value forest.	<ul style="list-style-type: none"> <li>• Contains important open forest habitat</li> <li>• Runs adjacent to an important PA/KBA (<i>Nam Pui</i>)</li> <li>• Largely less sensitive, valley-floor terrain</li> <li>• Supports extensive rain fed agriculture at its southern end</li> <li>• Includes catchments of a number of proposed dams, including the Mekong mainstream Xayaboury dam</li> </ul>	Protection needed for Nam Pui transboundary PA and open forests, a key habitat for many important wildlife species. Watershed protection needed for proposed hydropower catchments. Opportunity for agricultural intensification and irrigation development in the south.
<b>Central Economic Corridor (CEC)</b>	Northern section	Medium (0.50)	Narrow corridor entirely in the Mekong watershed, running from PRC via Luang Prabang to Vang Vieng through mountainous terrain containing high value forest areas.	<ul style="list-style-type: none"> <li>• Contains high value forest areas</li> <li>• High-elevation, steep-sloping terrain sensitive to erosion</li> <li>• No significant PAs or KBAs</li> <li>• Includes natural, historical and religious tourism assets</li> <li>• Encompasses catchments of many current and planned hydropower projects</li> <li>• Important tourist route to northern Lao PDR</li> </ul>	Protection required for forests and NTFPs and safeguards needed for road construction in areas of steep terrain. Watershed protection needed in hydropower catchments. Opportunities for hydropower, PES, REDD and ecotourism, and potential for NTFP domestication and niche agriculture.

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
	West central section	Medium (0.59)	A deep corridor following the Mekong river, running from Vang Vieng via Vientiane to Mayparkngum district through intensive lowland farming areas in the Mekong valley.	<ul style="list-style-type: none"> <li>• Corridor is in close proximity to a national PA</li> <li>• Largely flat, nonsensitive, valley-floor terrain supporting significant areas of rain fed and irrigated agriculture</li> <li>• Significant urban and industrial development near Vientiane</li> </ul>	Generally suitable for most investments including infrastructure development. A buffer zone should be established around Phou Panang PA. No serious terrain constraints with good potential for infrastructure development and agriculture intensification.
	East central section	Low (0.32)	A narrow corridor following the Mekong from May Paknngum to Thakhek with irrigation close to the river and good forest and three important PAs to the east of the road.	<ul style="list-style-type: none"> <li>• Adjacent to eight national PAs and KBAs</li> <li>• Includes catchments for proposed hydropower schemes</li> <li>• Includes many natural, historical and religious tourist sites</li> <li>• Supports intensive rain fed and irrigated agriculture</li> <li>• Transboundary with Thailand throughout its length</li> <li>• Major intersection with EWEC and important tourist route to southern Laos</li> </ul>	Safeguards and buffer zones needed for PAs with watershed protection for hydropower catchments. Good potential for all forms of tourism and agricultural development close to the Mekong. Controls on rubber expansion needed. Sustainable NTFP management and marketing possible.
	South central section	High (0.63)	A wide corridor following the Mekong running from Thakhek to Songkhone, supporting intensive lowland, rain fed and pump irrigation agriculture in fertile valley bottomland.	<ul style="list-style-type: none"> <li>• Wide corridor comprising flat or gently rolling topography</li> <li>• Supports intensive rain fed and irrigated agriculture</li> <li>• Downstream area of a number of hydropower schemes</li> <li>• Transboundary with Thailand throughout its length</li> <li>• Major tourist route to Southern Laos</li> </ul>	Generally suitable for investments in agriculture and processing. A buffer zone should be established around Phou Panang PA. No serious terrain constraints with good potential for infrastructure development and agriculture intensification.
	Southern section	Low (0.39)	A fairly wide corridor following the Mekong river running from Songkhone to the Cambodian border in the south. The corridor is adjacent to four important PAs and supports intensive and extensive agriculture.	<ul style="list-style-type: none"> <li>• Runs in close proximity to four important PAs</li> <li>• Contains a number of proposed hydropower schemes</li> <li>• Contains significant areas of irrigated farmland</li> <li>• Contains the ecologically important Khong falls and the Siphandorn (4000 Islands) area.</li> <li>• Has many natural and historical tourism sites</li> <li>• Major tourist route to Cambodia</li> </ul>	Conservation and sustainable management of numerous wetland resources vitally important in this corridor segment. Protection of cultural heritage is also important for sustainable tourism based on the wealth of historical assets. NTFP management and marketing has good potential.
<b>East-West Economic Corridor (EWEC)</b>	Western section	Medium (0.52)	A wide corridor running from the Thai border at Savannakhet to Phin district through intensive agricultural land on the flat Mekong valley floor.	<ul style="list-style-type: none"> <li>• Some fragmented forest resources remaining</li> <li>• Important tourist route between Thailand and Viet Nam</li> <li>• Largely flat, nonsensitive, valley-floor terrain</li> <li>• Supports intensive irrigated and rain fed agricultural land</li> <li>• Largely Lao-Tai ethnic population</li> </ul>	No serious terrain constraints, and generally suitable for investments in agriculture, NTFPs and processing. Potential for rice intensification through development of pump irrigation.
	Eastern section	Low (0.37)	A narrow corridor running from Phin to the Viet Nam border at Nong through high value forest areas adjacent to two PAs.	<ul style="list-style-type: none"> <li>• Contains high value conservation and production forests</li> <li>• Contiguous with two National PAs/KBAs</li> <li>• An important tourist route containing many natural and historical tourism assets</li> <li>• Largely Mon-Khmer ethnic population</li> </ul>	Safeguards and buffer zone establishment needed for the two PAs, particularly in regard to mining concessions. Good potential for eco-tourism and sustainable NTFP management and marketing.

<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability

#### 4. Myanmar Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>Western Economic Corridor (WEC)</b>	Northern section	High (0.60)	A narrow corridor running in the upper Irrawaddy watershed from the Bangladesh border to Pakoku through river valleys supporting extensive rain fed farming.	<ul style="list-style-type: none"> <li>• Contains some forested areas on the steeper slopes</li> <li>• Adjacent to some high biodiversity value PA/KBAs</li> <li>• Critical upper Irrawaddy watershed area</li> <li>• Extensive shifting cultivation areas in sensitive terrain</li> <li>• Catchment for operational/proposed hydropower schemes</li> </ul>	Any investments should not negatively affect the PAs and should have watershed protection safeguards in this critical upper catchment area. Potential for agricultural intensification and irrigation development in valley bottom land.
	Central section	High (0.65)	A deep/wide corridor running from Pakokku to Bago through intensively farmed river valley floors in the mid and lower Irrawaddy and Sittang watersheds.	<ul style="list-style-type: none"> <li>• Comparatively low biodiversity values</li> <li>• Largely nonsensitive, flat valley-floor terrain</li> <li>• Intensive irrigated and rain fed agricultural zone</li> <li>• Contains upper Sittang watershed that services Yangon</li> <li>• Contains catchments for operational and proposed dams</li> <li>• Contains a number of natural tourism destinations</li> </ul>	Investments should respect protection of PAs and include stringent watershed protection safeguards in these critical catchments. Hydropower development should include PES, which could be partly used for PA management. Potential for agro-based industry and processing.
	Southern section	High (0.61)	Narrow corridor running from Bago to Mawlamyine in the lower Salween and Sittang watersheds, adjacent to forest areas and PA/KBAs.	<ul style="list-style-type: none"> <li>• Adjacent to significant high value forest areas</li> <li>• Adjacent to high biodiversity value PA/KBAs</li> <li>• Encompasses important mangrove forest areas</li> <li>• Supports significant areas of extensive agriculture</li> <li>• Contains natural, historical and cultural tourist sites</li> </ul>	Although a range of investments are possible, care should be exercised to ensure that there are no significant risks on PAs, KBAs, high value forest or mangrove areas. Climate proofing of any infrastructure will also be important in this low-lying corridor.
<b>Northern Economic Corridor (NEC)</b>	Western section	High (0.66)	Narrow corridor in the mid-Irrawaddy watershed running from the WEC to Mandalay through open-canopy forest and extensive farmland.	<ul style="list-style-type: none"> <li>• Includes important PA/KBAs</li> <li>• Contains natural and historical tourism assets</li> <li>• Contains planned and operational hydropower projects</li> <li>• Nonsensitive terrain in middle Irrawaddy watershed</li> <li>• Supports significant rain fed and irrigated agriculture becoming more intensive as it approaches Mandalay</li> </ul>	Safeguards and buffer zone establishment needed around the two PAs. Good potential for tourism based on natural and historical tourist assets. Opportunities for agro-industry and processing.
	Eastern section	Medium (0.57)	Wider/deeper corridor in the mid Irrawaddy watershed, running from Mandalay to PRC border through open forest land.	<ul style="list-style-type: none"> <li>• Contains extensive areas of open-forest wildlife habitat</li> <li>• Bisects a national PA at the western end</li> <li>• Catchments for operational hydropower schemes</li> <li>• Supports extensive rain fed farming areas</li> </ul>	Safeguards needed as the corridor passes through the PA. Good potential for ecotourism in the PA based out of Mandalay. Opportunities for agricultural intensification and irrigation development in valley floors.
<b>East-West Economic Corridor (EWEC)</b>	Entire Myanmar segment	Medium (0.52)	Moderately deep corridor running from Mawlamyine to Thai border through mainly rain fed farmland.	<ul style="list-style-type: none"> <li>• Bisects a KBA</li> <li>• High value forest along the southern perimeter</li> <li>• Contains intensive and extensive rain fed farmland</li> <li>• Flat coastal area, but traverses steep terrain near the Thai border</li> </ul>	Protection needed for the KBA that does not yet have PA status. Safeguards required for road construction in steep terrain. Potential for agriculture intensification and irrigation development.

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>Southern Economic Corridor (SEC)</b>	Entire Myanmar segment	Medium (0.48)	Narrow corridor running from Dawei to the Thai border through dense high value forest.	<ul style="list-style-type: none"> <li>• Bisects high value transboundary forest.</li> <li>• Adjacent to Thai Western Forest PA complex</li> <li>• Access route to marine PA nature-tourism assets</li> <li>• Contains steeply sloping sensitive terrain</li> </ul>	Existing forest needs to be maintained to protect sensitive terrain along with transport infrastructure safeguards.
<b>North-South Economic Corridor (NSEC)</b>	Entire Myanmar segment	Medium (0.49)	Very narrow corridor in the Mekong watershed running from PRC to Thakilek on the Thai border through high and medium value forest, linking Jinghong in PRC with Thailand.	<ul style="list-style-type: none"> <li>• Bisects and runs adjacent to an important PA/KBA</li> <li>• Bounded by high and medium value forest</li> <li>• Relatively very limited agricultural production areas</li> <li>• Important tourist route linking sites in PRC and Thailand</li> <li>• Potential to develop nature tourism in two PAs</li> <li>• Extremely steep and highly sensitive terrain</li> </ul>	Protection required for PAs/KBAs and surrounding forest areas. Illegal wildlife trade controls on this sensitive tri-boundary transport route. Road construction safeguards needed in sensitive terrain areas. Good potential for ecotourism development.

<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability

## 5. Thailand Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>North-South Economic Corridor (NSEC)</b>	Northern section	Medium (0.50)	A moderately narrow corridor in the upper Chao Phya watershed running from the Myanmar border in Chiang Rai to Kampaeng Phet through extensive agriculture land bounded by medium value forest.	<ul style="list-style-type: none"> <li>• Close to some PAs/KBAs</li> <li>• Bounded by medium value forest</li> <li>• Traverses critical northern watersheds containing operational and proposed hydropower projects</li> <li>• Many natural and religious tourist sites</li> <li>• Largely nonsensitive, flat or rolling terrain</li> </ul>	Protection needed in areas of high value forest along with safeguards/mitigation measures for infrastructure development in these areas. Good potential for tourism, but need clear guidelines for associated infrastructure. Agriculture development should focus on low-input sustainable farming.
	Southern section	High (0.75)	A deep/wider corridor running from Kampaeng Phet to Bangkok through flood-plains of the lower Chao Phya watershed.	<ul style="list-style-type: none"> <li>• Largely nonforested, highly fertile floodplain land</li> <li>• Contains mainly irrigated, intensive agriculture land</li> <li>• Largely nonsensitive, flat or rolling terrain</li> <li>• Critical flood-prone SEZs in the southern extremity</li> <li>• Contains many historical tourism sites</li> </ul>	Suitable for all types of productive investments, particularly intensive irrigated agriculture. A high level of climate proofing will be necessary for all investments, including infrastructure development.
<b>North-Eastern Economic Corridor (NEEC)</b>	Northern section	Medium (0.42)	A moderately wide/deep corridor running from the Lao PDR border to Petchabun town through good forest and PAs/KBAs.	<ul style="list-style-type: none"> <li>• Contains some high value forest areas</li> <li>• Bounded by high biodiversity value PA/KBAs</li> <li>• Supports some extensive agriculture production</li> <li>• Contains some natural tourism assets</li> </ul>	Suitable for hydropower (with PES), agroforestry and nature tourism. Safeguards and protection required in the proximity of PA/KBAs and in sensitive terrain. Agrotourism and niche agricultural production should be encouraged.
	Southern section	High (0.70)	A deep/wide corridor running from Petchabun town to the NSEC at Saraburi through mainly flat or rolling farming land.	<ul style="list-style-type: none"> <li>• Contains very little remaining forest</li> <li>• No important PAs or KBA</li> <li>• Largely nonsensitive valley floor or rolling terrain</li> <li>• Supports extensive rain fed agriculture</li> </ul>	Suitable for most types of productive investments particularly rain fed agricultural intensification as potential for irrigation is limited. Climate proofing should emphasize drought tolerance.
<b>Central Economic Corridor (CEC)</b>	Entire Thailand segment	High (0.75)	A deep/wide corridor mostly in the Mekong watershed, running from the Lao PDR border at Nong Khai to the Gulf of Thailand eastern seaboard.	<ul style="list-style-type: none"> <li>• Contains very little forested area</li> <li>• Rolling, largely nonsensitive terrain</li> <li>• Bisects an important PA/KBA complex</li> <li>• Supporting intensive rain fed agriculture.</li> <li>• Includes many mainly cultural tourism assets</li> <li>• Includes operational &amp; proposed hydropower dams</li> </ul>	High level of protection needed around PAs in Wang Nam Khieo and Na Di districts. Otherwise, suitable for productive investments, particularly rain fed agricultural intensification and small scale irrigation development and scheme improvement where water is available.
<b>East-West Economic Corridor (EWEC)</b>	Western section	Low (0.40)	A narrow corridor in the upper Salween watershed, running from the Myanmar border through high value forest and PAs to Tak.	<ul style="list-style-type: none"> <li>• Bisects two national PAs</li> <li>• Adjacent to the important Western Forest Complex</li> <li>• Provides important open forest habitat</li> <li>• Largely steeply sloping, sensitive terrain</li> <li>• Watershed for one operational hydropower scheme in Thailand and two proposed schemes in Myanmar</li> <li>• Supports extensive rain fed agriculture</li> <li>• Provides access to natural tourism sites</li> </ul>	Safeguards and high level of protection required next to PAs/KBAs and in the critical upper watersheds of hydropower schemes. Agriculture development should take account of the sensitive terrain, with organic and niche farming being promoted. Nature and agrotourism has good potential, but tourism infrastructure development should be closely controlled.

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
	Midwest section	High (0.63)	A wide/deep corridor running from Tak to Phitsanulok through intensive agricultural land in the Chao Phya watershed.	<ul style="list-style-type: none"> <li>• Contains only limited low value forest areas</li> <li>• Adjacent to one PA</li> <li>• Flat valley floor land in the middle reaches of the Chao Phya river basin</li> <li>• Supports intensive irrigated and rain fed agriculture</li> <li>• Contains some natural and historic tourism assets</li> </ul>	Protection required next to the PA, particularly for the ancient cultural assets around Sukothai. Suitable for agricultural intensification and irrigation development. Climate resilience (flooding) required where the corridor crosses the Ping and Nan rivers.
	Middle section	Low (0.32)	A moderately narrow corridor running from Phitsanulok to the western border of Khon Kaen Province, traversing steep, high elevation forest land and PAs.	<ul style="list-style-type: none"> <li>• Transverses high value forest areas</li> <li>• Bisects a number of important PAs</li> <li>• Critical upper watershed areas of both the Mekong and Chao Phya basins</li> <li>• Catchment of two operational and two proposed hydropower dams</li> <li>• Contains numerous natural tourism sites</li> </ul>	High level of protection needed around PAs, particularly in Nam Nao, Khon San and Phu Pha Man districts. Watershed protection also important in steeply sloping, sensitive terrain to safeguard existing hydropower projects. Good potential for nature and agrotourism development, but controls will be needed.
	Eastern section	Medium (0.60)	A wide/deep corridor running from Khon Kaen to Lao PDR border at Mukdahan through rolling terrain supporting intensive farming.	<ul style="list-style-type: none"> <li>• Bisects/runs adjacent to PAs at its eastern end</li> <li>• Very little forested areas remain</li> <li>• Supports intensive rain fed agriculture</li> <li>• Contains some natural tourism sites</li> </ul>	Suitable for some productive investments, particularly agro-processing and rain fed agricultural intensification (potential for irrigation is limited). Climate-proofing (drought and flood) for agriculture will be needed.
<b>Southern Economic Corridor (SEC)</b>	Western section	Medium (0.33)	A comparatively narrow corridor running from the Myanmar border to Kanchanaburi, traversing steep, higher-elevation forest land and PAs.	<ul style="list-style-type: none"> <li>• Contains some high value forest areas</li> <li>• Contiguous with very important PAs/KBAs in Thailand's Western Forest Complex</li> <li>• Provides access to numerous natural tourism sites</li> <li>• Supports extensive/intensive agriculture production</li> </ul>	Very high level of protection needed for PAs to protect the extremely important Western Forest Complex lying directly to the north. High potential for nature and ecotourism development, but tight controls on tourist infrastructure are needed.
	Mid-section	Very High (0.88)	A very wide and deep corridor where four economic corridors converge, running from Kanchanaburi through Bangkok to Prachin Buri with large industrial areas.	<ul style="list-style-type: none"> <li>• No forest remaining</li> <li>• Flat floodplain supporting intensive irrigated farming</li> <li>• Highly urbanized and industrialized</li> <li>• Contains many flood-prone residential complexes</li> <li>• Critical flood-prone SEZs in and around Bangkok</li> </ul>	Suitable for all types of productive investments, particularly intensive irrigated agriculture. Climate proofing (flooding) will be necessary for all investments, including road, infrastructure and urban development.
	Eastern section	High (0.74)	A narrower corridor running from Prachin Buri to the Cambodia border in Sakeo through rolling agricultural land.	<ul style="list-style-type: none"> <li>• Some limited highly fragmented forest still remaining</li> <li>• Adjacent to Thailand's Eastern Forest Complex PAs</li> <li>• Rolling terrain supporting intensive rain fed farming</li> <li>• Numerous religious tourism sites at eastern end</li> </ul>	Good protection needed around Eastern Forest Complex PAs, otherwise suitable for most types of productive investment, particularly intensive rain fed agriculture. Good potential for cultural tourism towards its eastern end.
<b>Southern Coastal Economic Corridor (SCEC)</b>	Western section	Very High (0.85)	A deep/wide, highly industrialized corridor running from Bangkok to Rayong following the Gulf of Thailand coast line and providing access to numerous SEZs.	<ul style="list-style-type: none"> <li>• Virtually no forest remaining</li> <li>• Includes one PA</li> <li>• Sensitive mangrove areas along coastline</li> <li>• Supports intensive rain fed agriculture</li> <li>• Sensitive to sea level rise</li> <li>• Potential for marine pollution</li> </ul>	A highly industrialized zone prone to industrial accidents and air and sea pollution, particularly from the petrochemical industry. Good protection and safeguards needed, particularly near residential areas. Improved zoning for urban/industrial development would be valuable.

	Eastern section	Medium (0.56)	A narrower corridor running from Rayong to the Cambodia border in Trat through open forest and rolling farmland.	<ul style="list-style-type: none"> <li>• Runs through fragmented forest areas</li> <li>• Includes PA/KBAs and marine PAs</li> <li>• Some mainly extensive agriculture production</li> <li>• Important coastal tourism route</li> </ul>	High level of protection needed around PAs, towards the eastern end, otherwise suitable for coastal and marine tourism development and intensive rain fed farming development.
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<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability



## 6. Viet Nam Economic Corridor Segments

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>Eastern Economic Corridor (EEC)</b>	Upper North section	High (0.71)	A short corridor in the Upper Xun Jiang watershed running from the PRC border to Bac Giang through well-forested terrain adjacent to two PAs.	<ul style="list-style-type: none"> <li>• Contains good forest resources</li> <li>• Runs adjacent to national PAs</li> <li>• Contains many natural tourism sites</li> <li>• Runs through well-forested hilly terrain</li> <li>• Three economic zones on the border with PRC</li> <li>• Contains some extensive agriculture land</li> </ul>	Safeguards needed in the vicinity of two PAs, with watershed protection in the critical upper Xun Jiang watershed which supports many hydropower schemes in Guangxi, PRC. Potential for nature tourism development and ecotourism in the PAs.
	Upper West section	High (0.78)	A corridor widening in its lower half following the Red River valley from the Yunnan border bottom land, supporting extensive agriculture with industrial zones along its entire length.	<ul style="list-style-type: none"> <li>• Contains PAs towards its western end</li> <li>• Some remaining forest resources, mainly in the west</li> <li>• Contains some natural tourism assets</li> <li>• Generally flat or slightly hilly terrain</li> <li>• Fertile Red River valley bottom land</li> </ul>	Suitable for most types of productive investments, particularly in agriculture and industrial development. Valley-bottom areas may be prone to flooding. Some potential for nature tourism development.
	Upper East section	Very High (0.92)	Very wide corridor running from Bac Ninh to Hanoi entirely within the Red River catchment, with flat or rolling topography supporting intensive agriculture and industry.	<ul style="list-style-type: none"> <li>• Generally nonsensitive flat land</li> <li>• Important coastal tourist route to Ha Long Bay</li> <li>• Intensive rain fed agriculture with some irrigation</li> <li>• Highly industrialized, with many industrial zones</li> <li>• Fertile river valley, bottom land</li> </ul>	Suitable for all types of productive investments, including industry and transport infrastructure. Potential for agricultural intensification and irrigation development. Pollution controls and other safeguards will be necessary to protect important coastal tourism assets.
	Northern section	Very High (0.84)	A wide corridor mainly in the Red River basin centered on Hanoi, running from Bac Giang to Ha Tinh, with many industrial zones. Supports intensive agriculture with significant irrigation in the south.	<ul style="list-style-type: none"> <li>• Highly industrialized urban conglomeration</li> <li>• Includes numerous industrial zones</li> <li>• Largely nonsensitive flat, valley-floor terrain</li> <li>• Supports intensive rain fed farming on fertile soils</li> <li>• Contains important natural tourist sites on the coast.</li> </ul>	Suitable for all types of productive investments, particularly industrial and agricultural development, but safeguards will be necessary to protect important coastal tourism assets. Pollution controls and climate-roofing will be required for industrial/SEZs.
	Coastal section	High (0.65)	A long narrow corridor running north-south from Ha Tinh to Ho Chi Minh City following the coastline with numerous industrial zones along its length.	<ul style="list-style-type: none"> <li>• Runs next to high value forest on its inland side</li> <li>• Adjacent to many important PAs/KBAs</li> <li>• Includes numerous coastal nature tourism sites</li> <li>• Generally flat, nonsensitive terrain</li> <li>• Contains numerous industrial zones and SEZs</li> <li>• Vulnerable to CC and sea level rise</li> </ul>	Suitable for most types of investments, including industry and transport infrastructure. Potential for agricultural intensification and irrigation development in lowland areas. Safeguards will be necessary to protect important coastal tourism and historical tourism assets.
	Mekong Delta section	Very High (0.85)	A very wide, highly industrialized corridor centered on Ho Chi Minh City running to Ca Mau in the Mekong Delta.	<ul style="list-style-type: none"> <li>• Very little forest cover remaining</li> <li>• Highly industrialized urban conglomeration</li> <li>• Flat, river delta with highly productive irrigated rice area</li> <li>• Prone to flooding and salt water intrusion</li> <li>• Highly vulnerable to CC/sea level rise</li> </ul>	Suitable for all types of productive investments, particularly industry and agriculture with pollution control. High level of climate-roofing will be essential for all forms of investment to safeguard against flooding and salt water intrusion.

Corridor	Segment	Suitability Rating <sup>1</sup>	General Characteristics	Key Environmental Characteristics and Sensitivities	Environmental Management Guidelines
<b>Southern Coastal Economic Corridor (SCEC)</b>	Entire Viet Nam segment	High (0.71)	A very wide coastal corridor on the western side of the Mekong delta, running from the Cambodia border to the southernmost tip of Viet Nam, supporting intensive agriculture and some industry.	<ul style="list-style-type: none"> <li>• Some fragmented medium value forest remaining</li> <li>• PAs/KBAs along the coast-line and offshore</li> <li>• Flat, river delta with rain fed farming along the coast</li> <li>• A highly productive irrigated rice area inland</li> <li>• Prone to flooding and salt water intrusion</li> <li>• Highly vulnerable to CC/ sea-level rise</li> </ul>	Suitable for most investments, particularly agricultural intensification and processing. Safeguards will be necessary to protect marine PAs and important coastal and offshore tourism sites. High degree of climate proofing will be required for all types of investment.
<b>North Eastern Economic Corridor (NEEC)</b>	Entire Viet Nam segment	High (0.64)	Narrow corridor running from the Lao PDR border to the Eastern Economic Corridor at Than Hoa through steep forest land adjacent to a number of PA with more intensive agriculture towards its eastern end.	<ul style="list-style-type: none"> <li>• Transverses medium value forest at its western end</li> <li>• Runs adjacent to PAs at its western end</li> <li>• Traverses steep-sloping sensitive terrain in the west</li> <li>• Contains operational hydropower projects</li> <li>• Supports extensive rain fed agriculture, becoming more intensive in the east</li> <li>• Contains some natural tourism assets</li> </ul>	Suitable for many types of investment in the east, but protection needed for PAs and forest areas in the west. Climate proofing for transport infrastructure will be required in steep terrain in the west. Potential for nature tourism development in the west and agricultural intensification and processing in the east.
<b>East-West Economic Corridor (EWEC)</b>	Entire Viet Nam segment	Medium (0.56)	Short, narrow corridor running from the Lao PDR border to Dong Ha and the Eastern Economic Corridor	<ul style="list-style-type: none"> <li>• Transverses medium value forest at its western end</li> <li>• Runs adjacent to one PA and a KBA</li> <li>• Traverses steep, sensitive terrain in central portion</li> <li>• Contains one operational hydropower project</li> </ul>	Restricted investments and protection needed for PA, KBA and forest areas. Watershed protection recommended for hydropower catchment. Potential for agriculture intensification in the east.
<b>Southern Economic Corridor (SEC)</b>	Entire Viet Nam segment	High (0.62)	A narrow corridor running through degraded forest and extensive agricultural land from the Cambodian border to the Eastern Economic Corridor at Quy Nhon	<ul style="list-style-type: none"> <li>• Transverses degraded medium-low value forest</li> <li>• Runs adjacent to some small PAs</li> <li>• Contains one operational hydropower project</li> <li>• Runs mainly through nonsensitive flat/rolling terrain</li> <li>• Supports rain fed agriculture particularly in its western half</li> </ul>	No major terrain constraints and suitable for most types of investment, but protection and buffer zone establishment needed for the PAs. Potential for industry and agricultural intensification through irrigation development, particularly in the east.

<sup>1</sup> < 0.2 = Very Low Suitability; 0.20-0.39 = Low Suitability; 0.40-0.59 = Medium Suitability; 0.60-0.79 = High Suitability; > 0.80 = Very High Suitability