

# A Better Amazon Road Network for People and the Environment

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# Roadmap for the Presentation

- Motivation
- Methodology
- Findings
- Recommendations



# Background on the Analysis



- Network of planned roads in the Amazon
- How could we help governments make smarter investments in roads?
- Our hypothesis



# Why Analyze Road Projects?

## Positive Benefits

- Improve employment opportunities and mobility
- Reduces transport costs
- Support regional development

## Negative Impacts

- Deforestation
- Biodiversity loss
- Displacement of indigenous communities

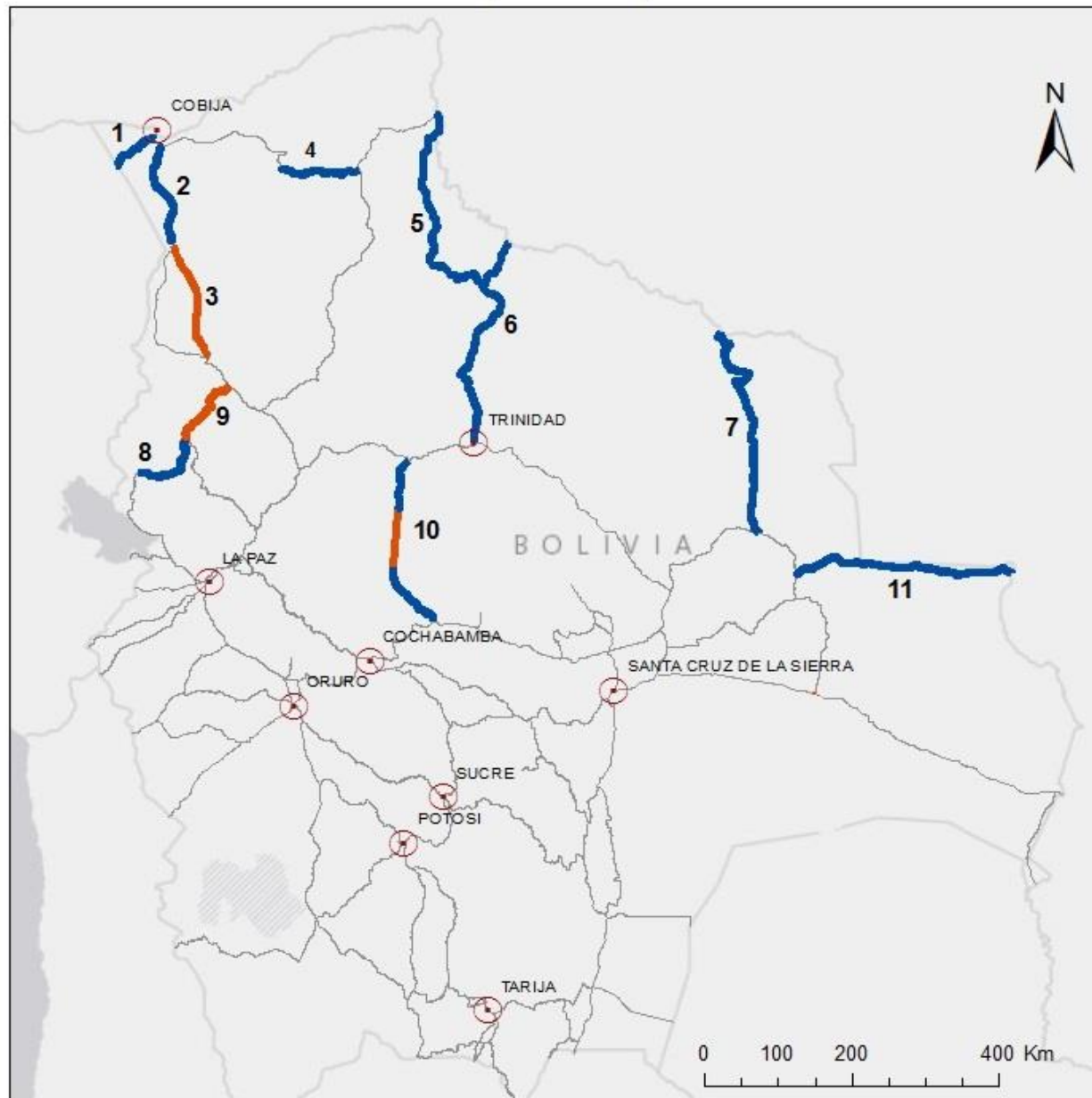


# The Set Up

- Five countries
- Planned new roads and improved roads – 75 in total
  - 12,263 km (7,620 miles)
  - US\$ 27 billion



# Mapa Proyectos Viales Bolivia



## NOMBRE DE CARRETERAS SELECCIONADAS

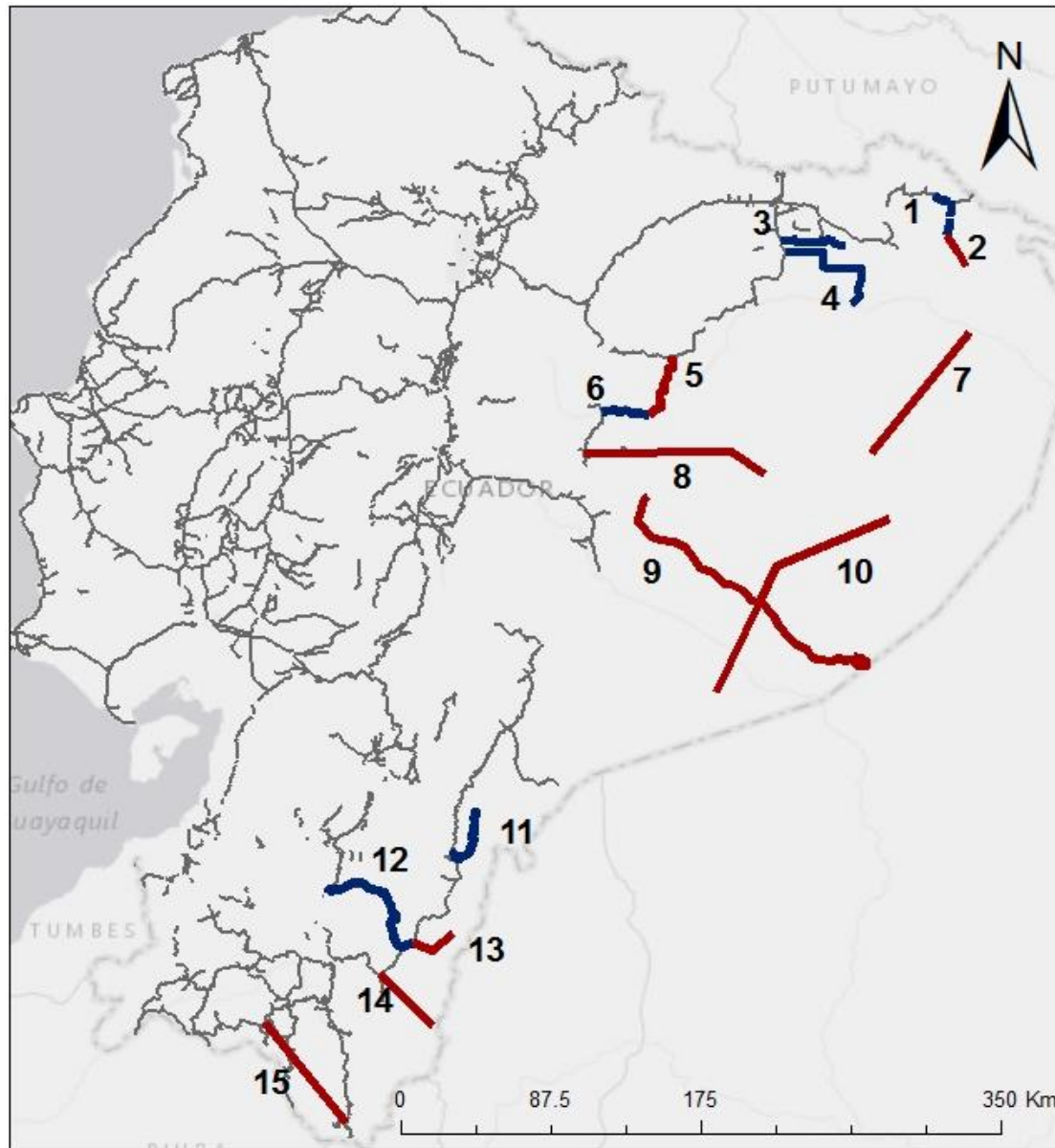
1. Zofra - Extrema
2. Chivé - Porvenir
3. Ixiamas - Chivé
4. El Sena - El Chorro
5. San Javier - Guayaramerín
6. San Javier - Puerto Ustárez
7. Santa Rosa de la Roca - El Remanso
8. Charazani - Apolo
9. Apolo - Tumupasa
10. Villa Tunari - San Ignacio de Moxos
11. San Ignacio de Velasco - San Matías

## Leyenda

- Capitales departamentales
- Proyectos de mejoramiento de carreteras
- Proyectos de construcción de carreteras
- Red Vial Fundamental



# Mapa Proyectos Viales Ecuador



## NOMBRE DE CARRETERAS SELECCIONADAS

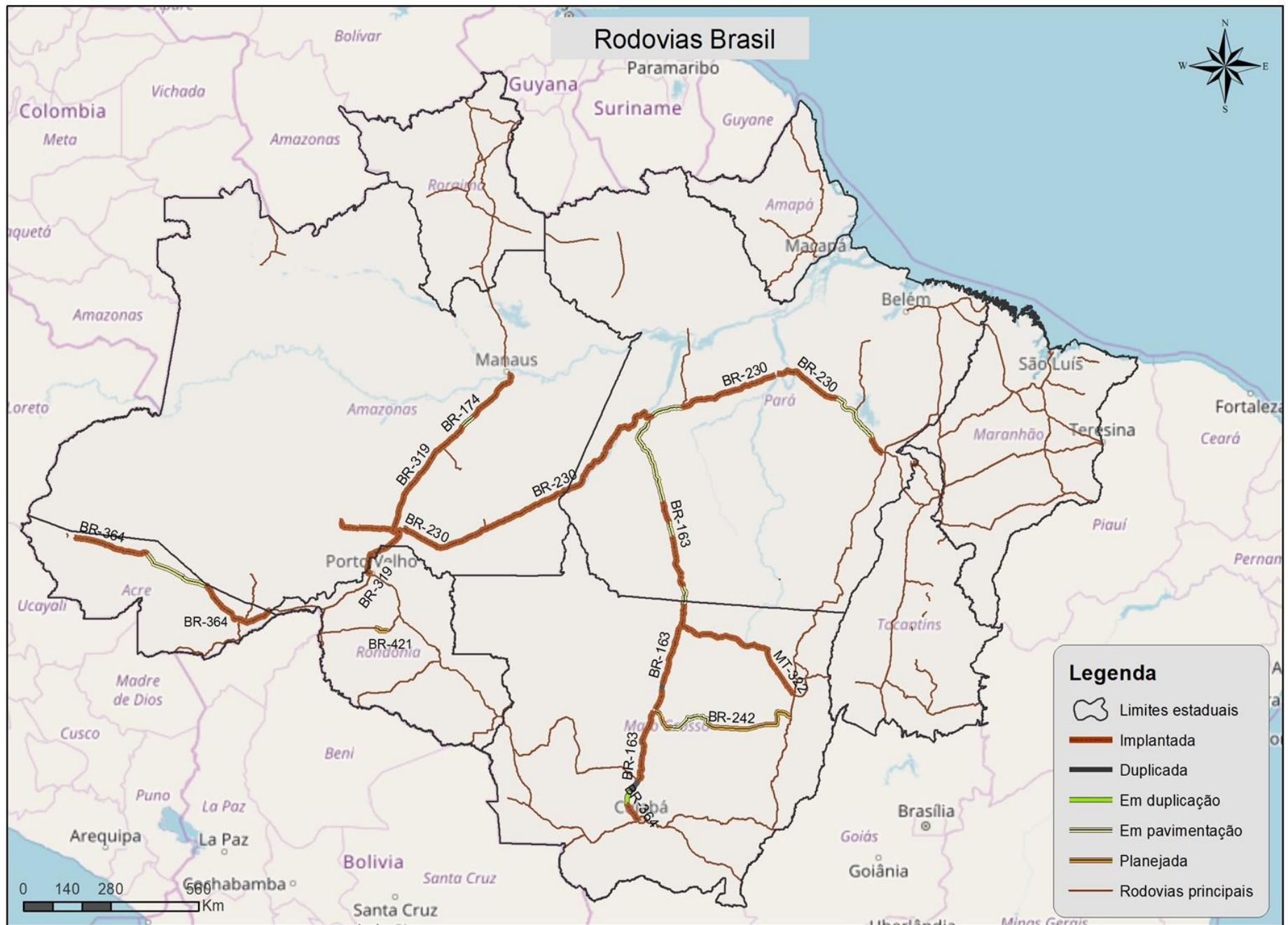
1. Palma Roja - Cuyabeno
2. Puerto Bolívar - Cuyabeno
3. San Pedro de los Cofanes - Alipamba
4. Jivino - Shushufindi - Yamanunca - Puerto Provi.
5. Ahuano - Loreto
6. Puerto Napo - Ahuano
7. Capitán Augusto Rivadeneira - Reperado
8. Santa Clara - Golondrina - Curaray
9. Puyo - Villano - Río Corrientes
10. Huasagua - Montalvo - Cunambo - Río Curaray
11. 4. Gualaquiza - San Carlos de Limón
12. Zumbi - 28 de Mayo - Saraguro
13. Zumbi - Paquisha - Río Zarsa
14. Zamora - Shaime
15. Cariamanga - Zumba

## Leyenda

- Proyectos de construcción de carreteras
- Proyectos de mejoramiento de carreteras
- Carreteras Primarias

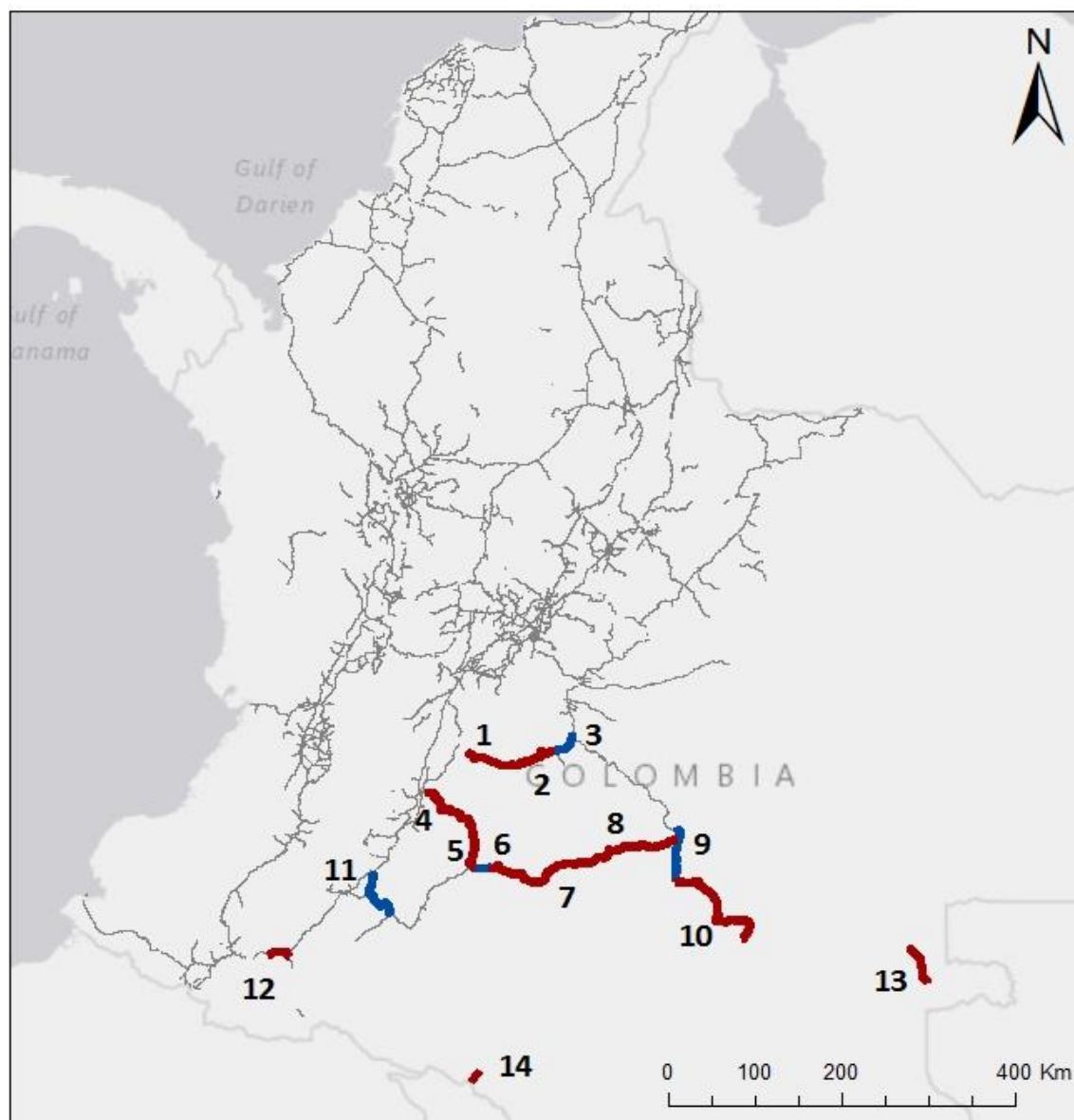








# Mapa Proyectos Viales Colombia



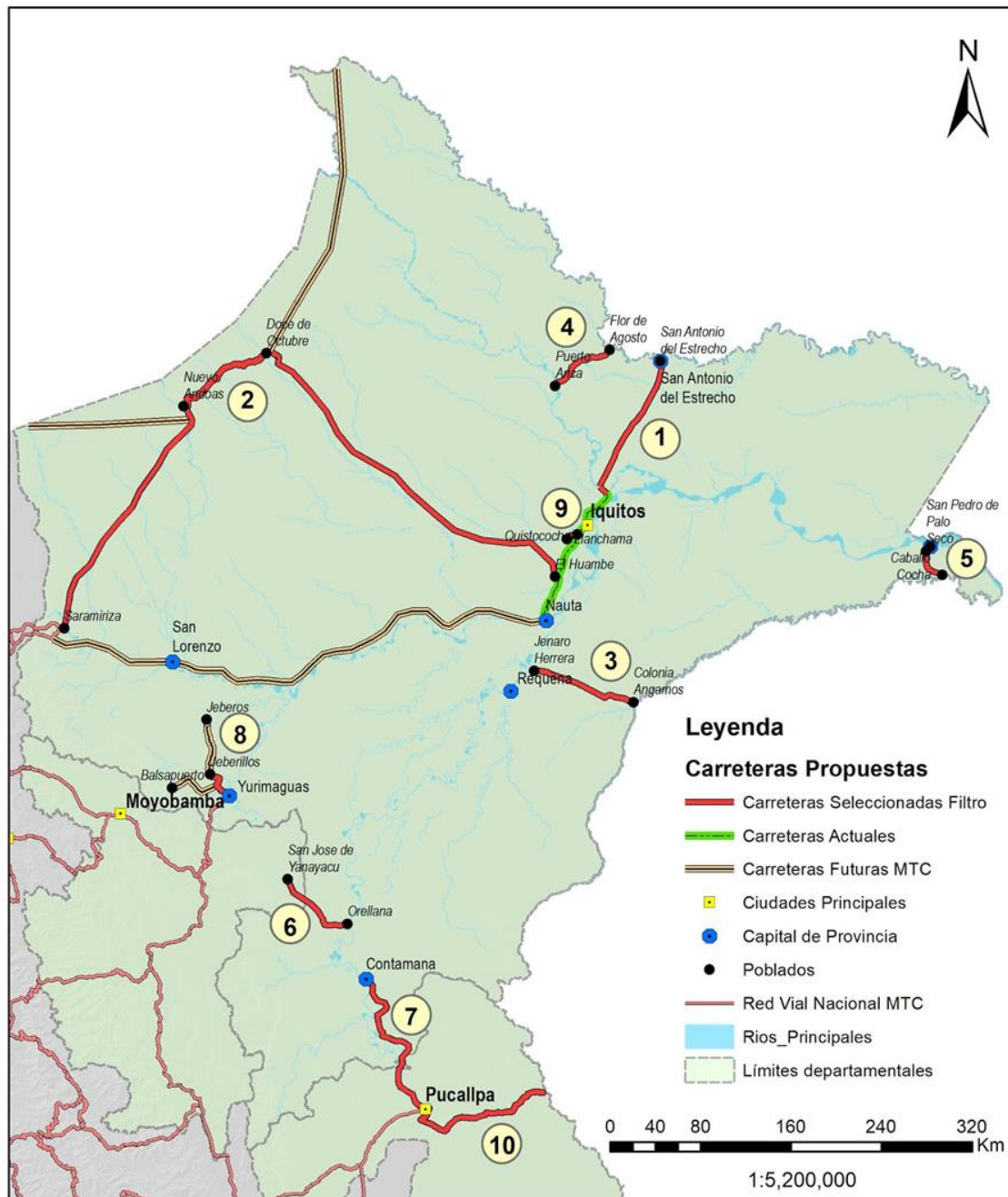
## NOMBRE DE CARRETERAS SELECCIONADAS

1. Colombia - La Uribe
2. La Uribe - San Juan de Arama
3. San Juan de Arama - Granada
4. Neiva - Mina Blanca
5. Puerto Rico - Mina Blanca (tramo corto)
6. San Vicente del Caguan - Los Pozos (tramo corto)
7. Los Pozos - La Macarena
8. La Macarena - La Leona
9. Calamar - San José del Guaviare
10. Calamar - Miraflores
11. Depresión El Vergel - Florencia
12. San Francisco - Mocoa
13. Mitu - Monforth
14. Puerto Leguizamo - La Tagua

## Leyenda

- Proyectos de construcción de carreteras
- Proyectos de mejoramiento de carreteras
- Carreteras primarias





#### NOMBRE DE CARRETERAS SELECCIONADAS

1. C. Bellavista, Mazan, Salvador, El Estrecho
2. C. Iquitos, Santa Maria de Nanay, 12 de Octubre, Andoas, Saramiriza
3. C. Jenaro Herrera, Colonia Angamos
4. C. Pto Arica, Flor de Agosto
5. C. Caballo Cocha, Palo Seco, Buen Suceso
6. C. Huallaga, Orellana
7. C. Pucallpa, Contamana
8. C. Yurimaguas, Jeberos
9. C. Quistococha, Zungaro Cocha, Yanchama
10. C. Pucallpa, Cruzeiro do Sul
11. C. Puerto Esperanza-Iñapari

#### MAPA DE CARRETERAS PERÚ



# Road selection process

- Prioritized for implementation
- Inside the Amazon Basin (RAISG)
- Data available





# Challenges in the Analysis


- Lack of data
- Especially in remote places in the Amazon region
- Political priorities



# Current situation

- Roads that don't make economic sense are built
- Socioenvironmental impacts are greater than they need to be
- Public funds are not being used wisely and effectively

# Our Approach

- Set of road investments
  - Multicriteria approach:
    - Environmental
    - Social
    - Economic
- Single Index
- 

$$\text{Efficiency} = \frac{\text{Net Economic Benefit}}{0.5 \times \text{Environmental Damage} + 0.5 \times \text{Net Social Benefit}}$$



# The Bad



- 45% don't make basic economic sense
- 1.1 million hectares will be deforested
- Loss of US\$ 7.6 billion

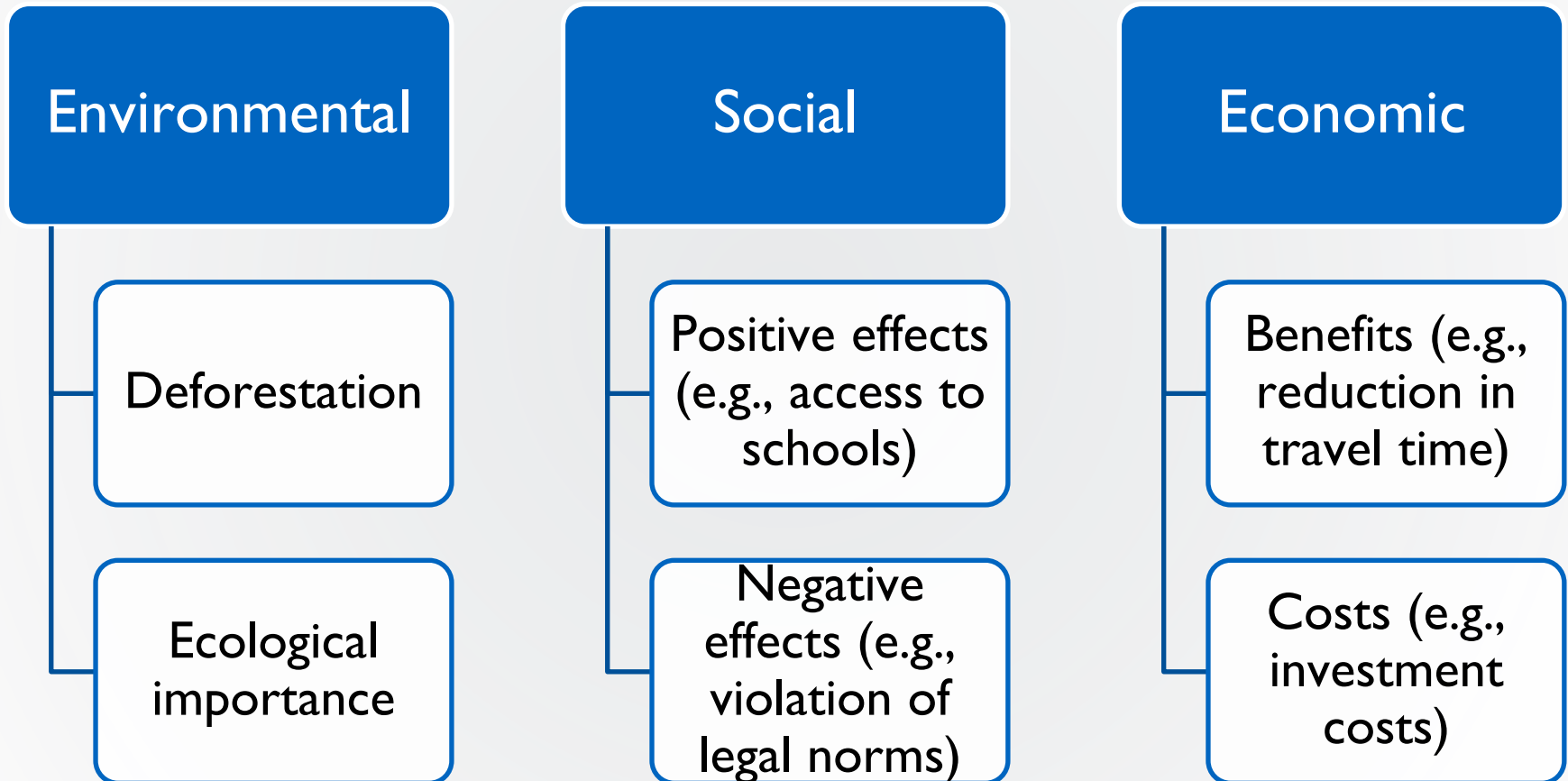
# The Good



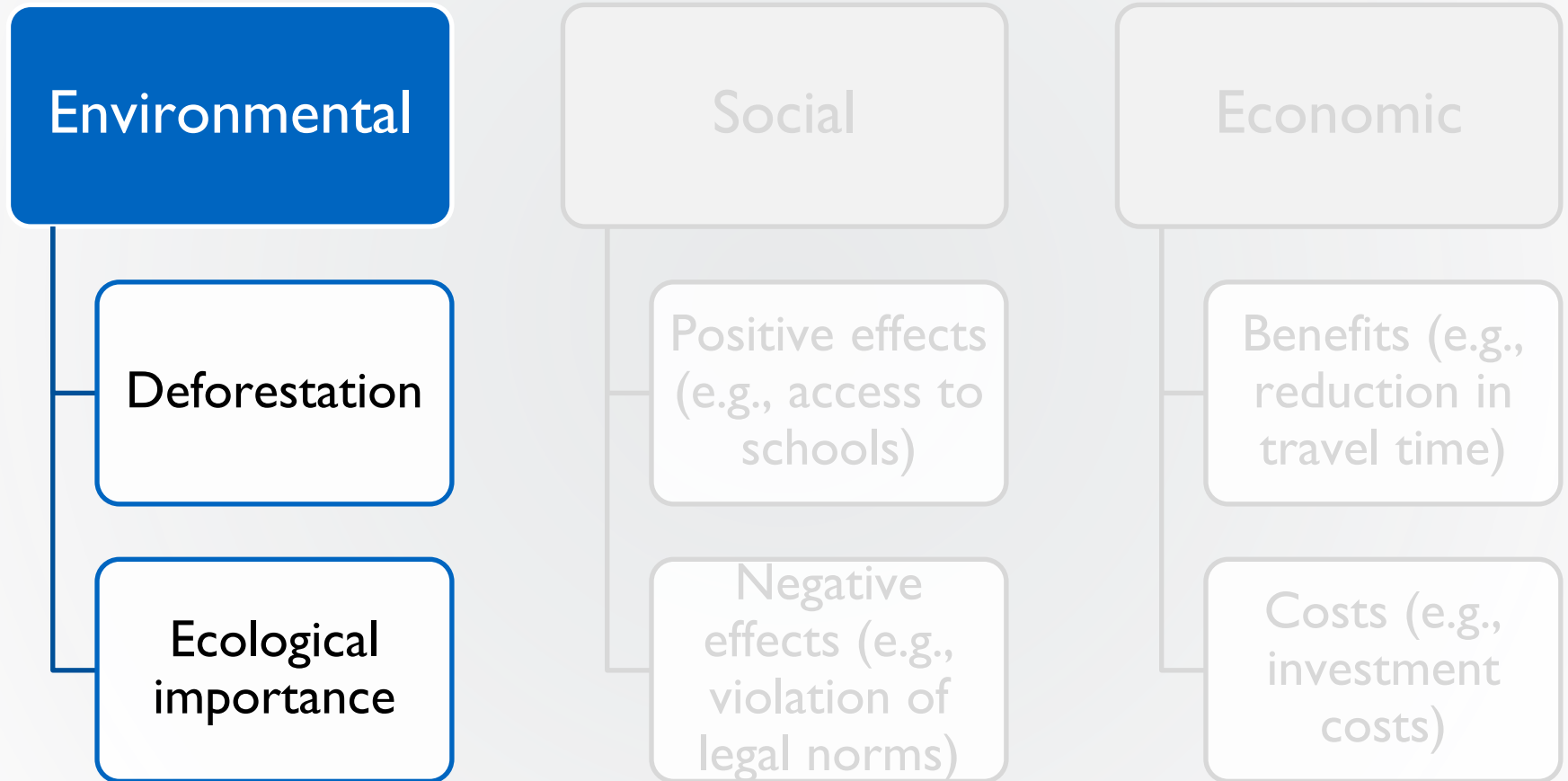
- Smaller set of road projects:
- Large economic benefit at a lower social and environmental damage



# Our Criteria



# Environmental Impact





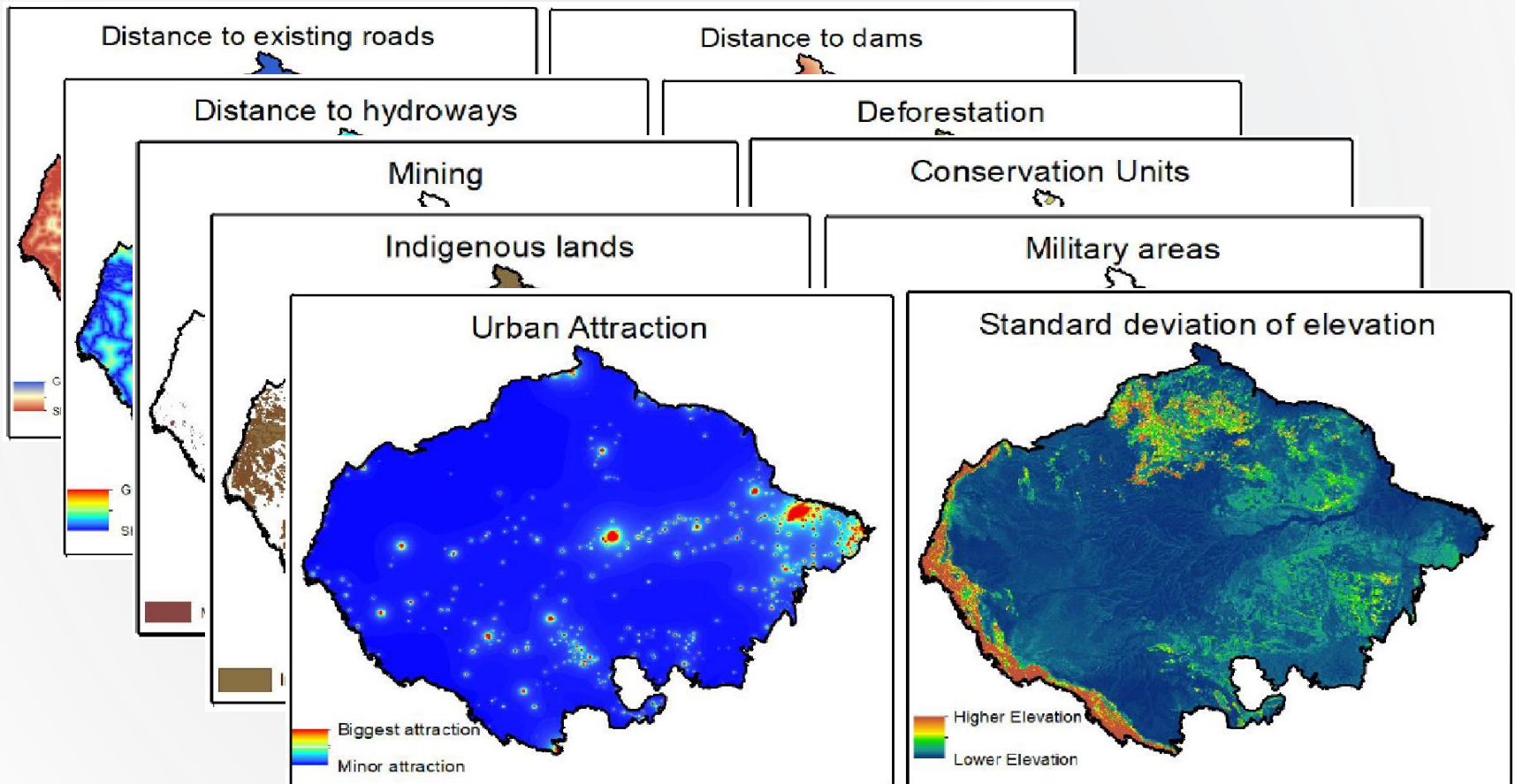
# Deforestation Scenarios



- Two scenarios (20-km buffer):
- No change to the existing road network
- Inclusion of all road projects in our sample

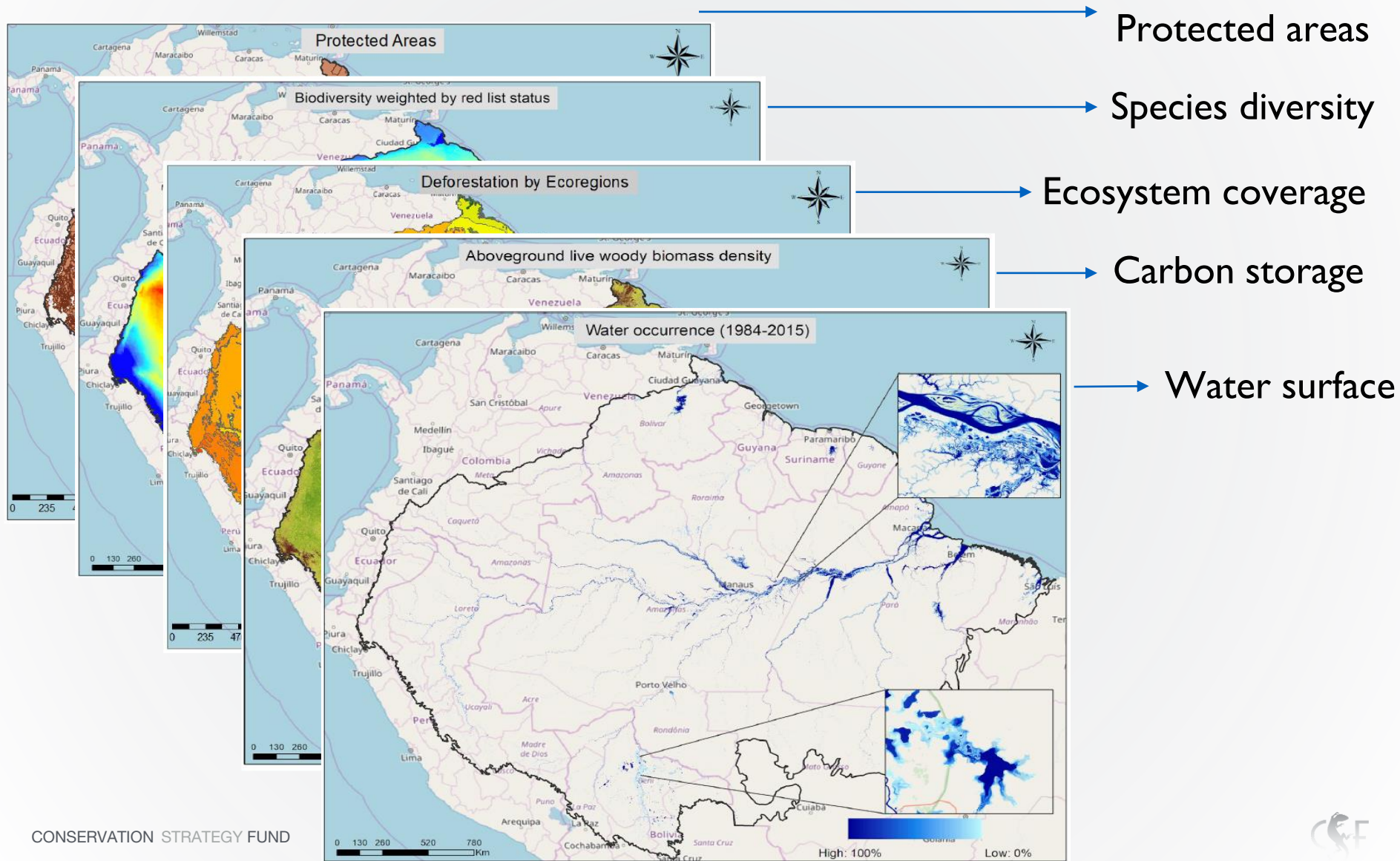
# Deforestation Prediction

- Dinamica EGO

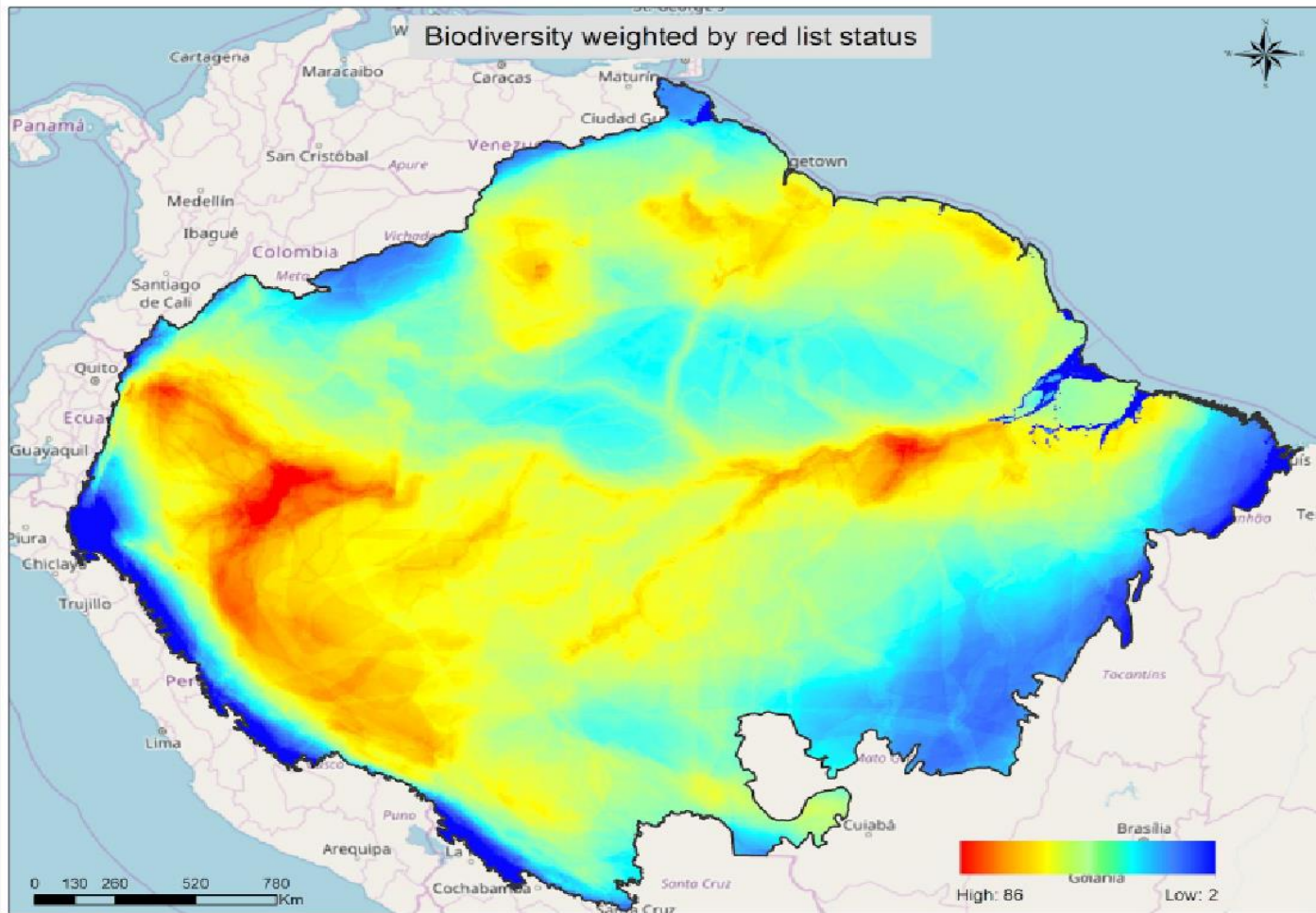




# Ecological Importance



# An Example: Biodiversity Risk






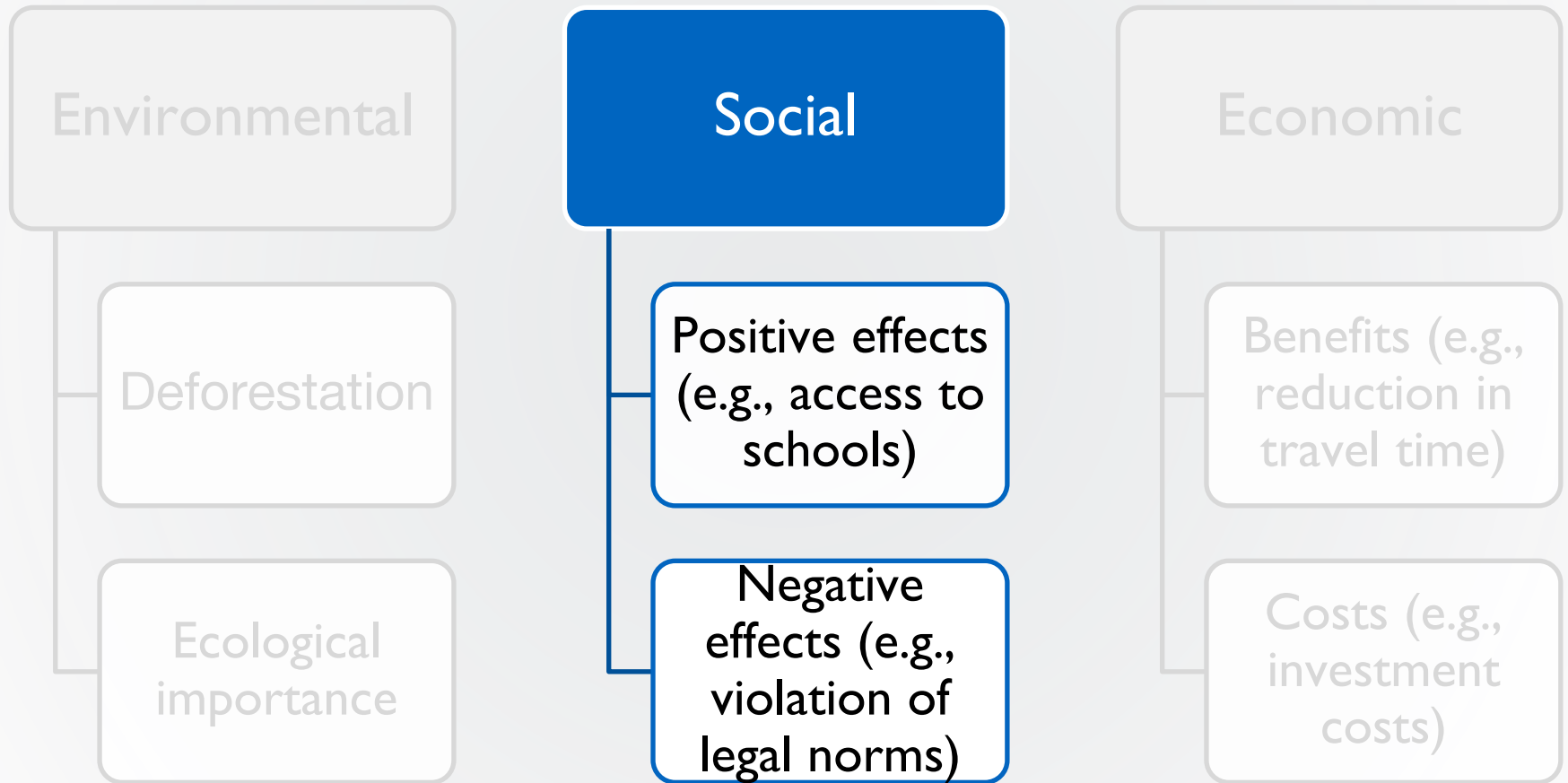
# Environmental Damage Score

- Normalization (from 0 to 1)

$$\text{Efficiency} = \frac{\text{Net Economic Benefit}}{0.5 \times \text{Environmental Damage} + 0.5 \times \text{Net Social Benefit}}$$


$$\begin{aligned} \text{Environmental score} = & 0.2 \times \text{biodiversity} + 0.2 \times \text{ecoregion} \\ & + 0.2 \times \text{water} + 0.2 \times \text{carbon} + 0.2 \times \text{protected areas} \end{aligned}$$

# Social Impact





# Social Benefits (20-km buffer)

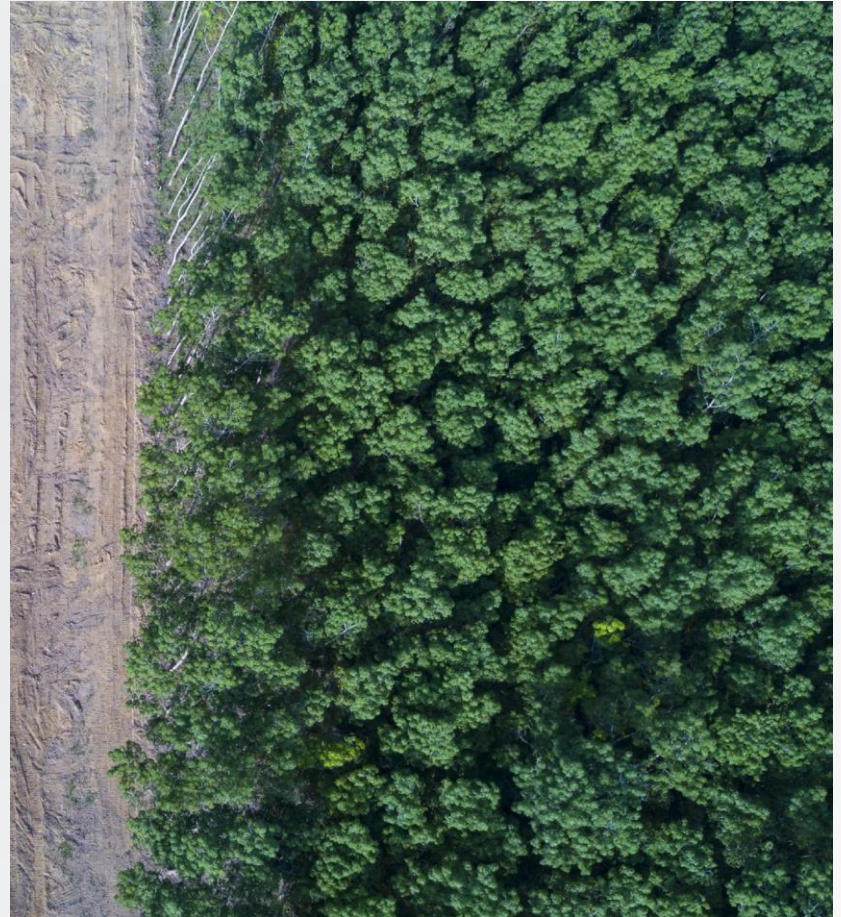
- Population
- Access to schools and health centers
  - Total number
  - Average distance





# Negative Impacts (20-km buffer)

- Spatial data:
  - Territory of indigenous peoples in voluntary isolation
- Survey data (questionnaire):
  - Degree of rejection
  - Violation of any legal norm






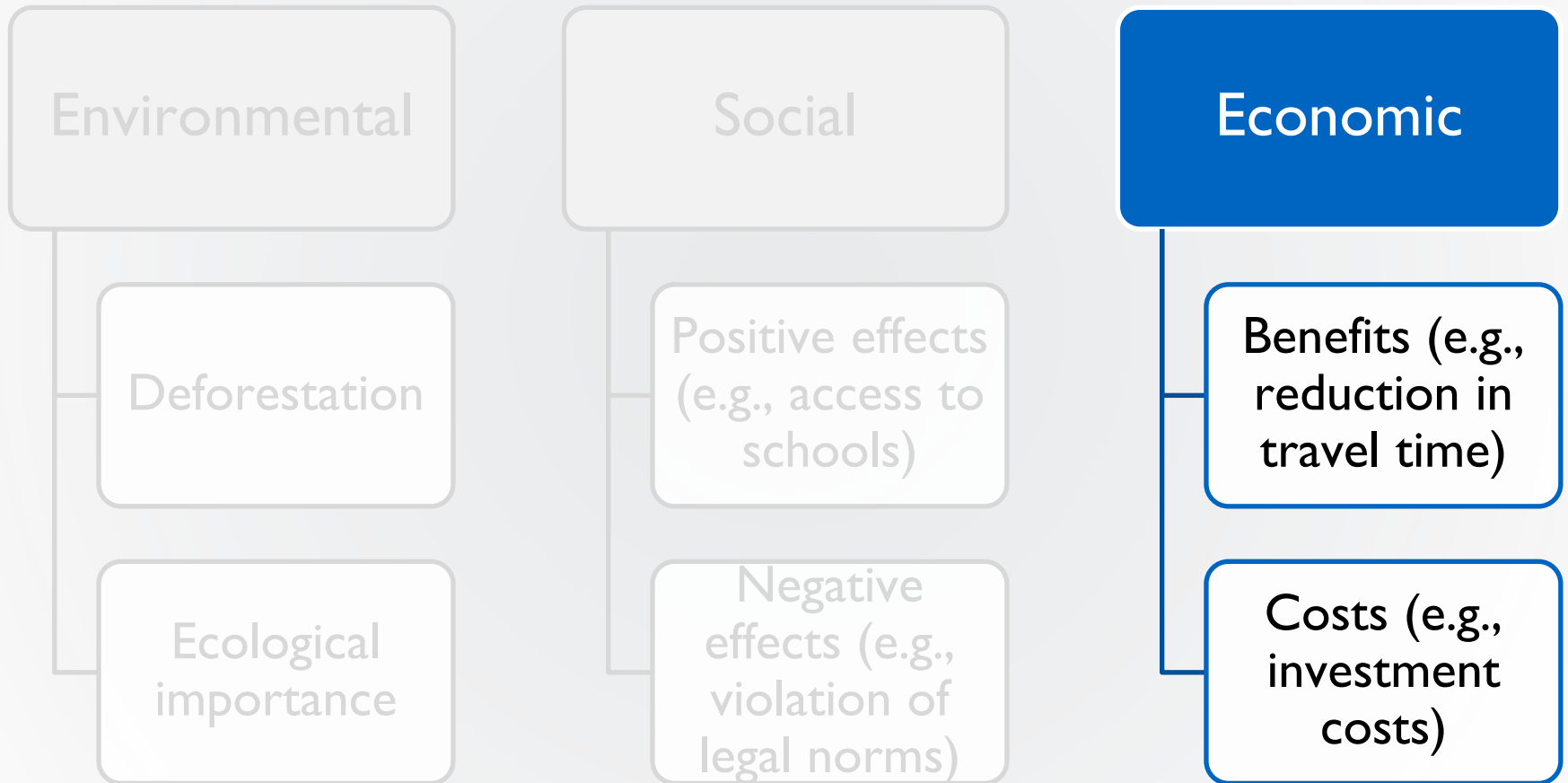
# Net Social Benefit Indicator

- Normalization (from 0 to 1)

$$\text{Efficiency} = \frac{\text{Net Economic Benefit}}{0.5 \times \text{Environmental Damage} + 0.5 \times \text{Net Social Benefit}}$$

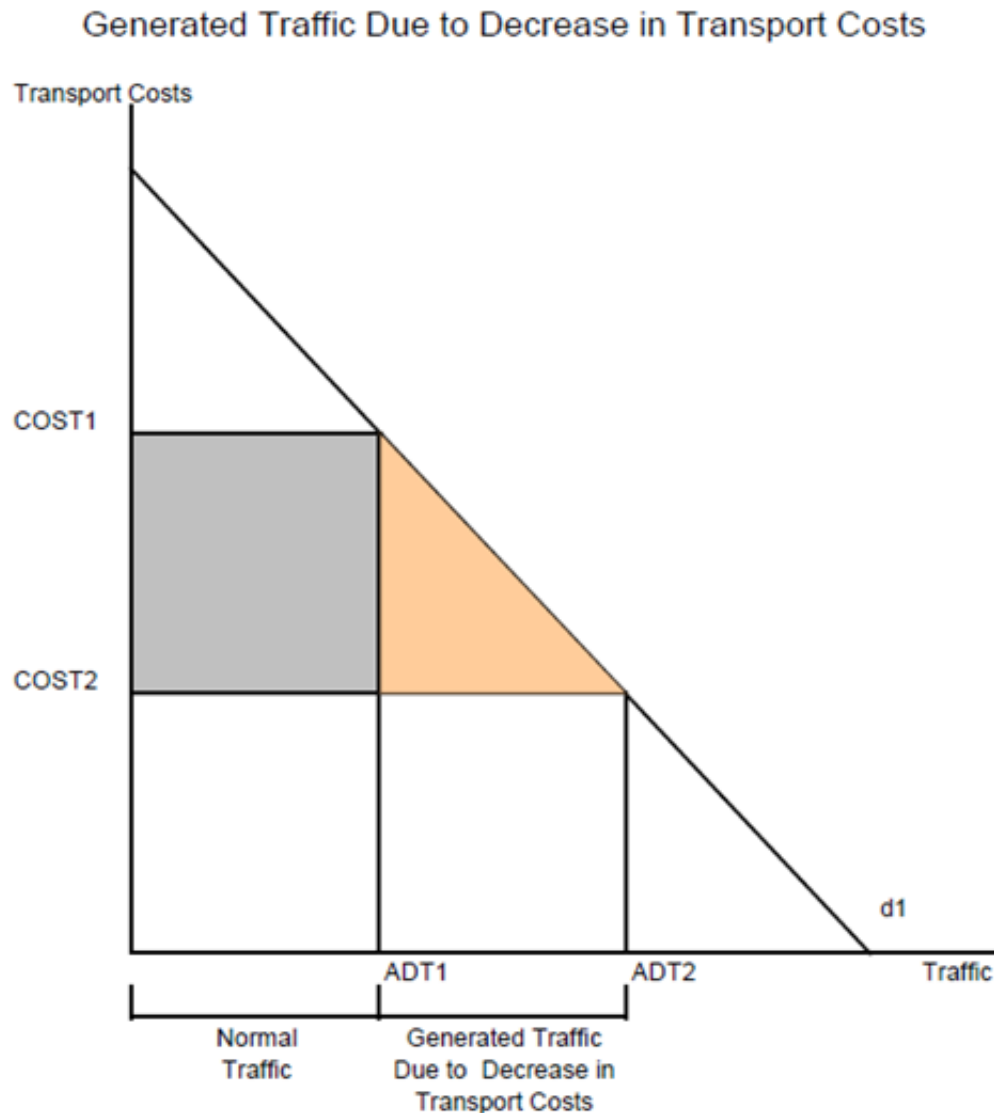

$$\text{Social score} = \sum_i 0.125 \times \text{Social Variable}_i$$

# Economic Impact





# Gross Economic Return



User enters:

- Percent of normal traffic or
- or
- Price elasticity of demand =

$$\frac{\text{Percent Increase in Traffic}}{\text{Percent Decrease in Transport Cost}}$$

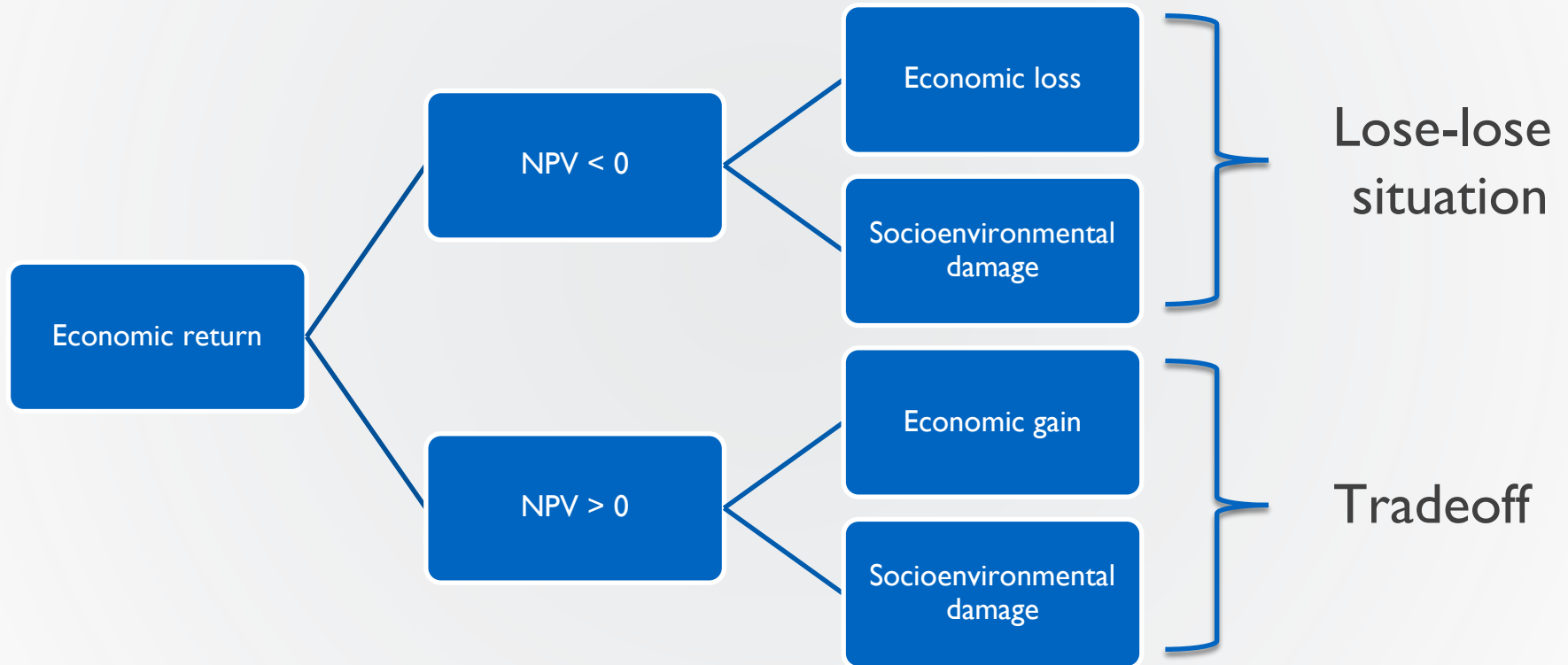


# The Red Model

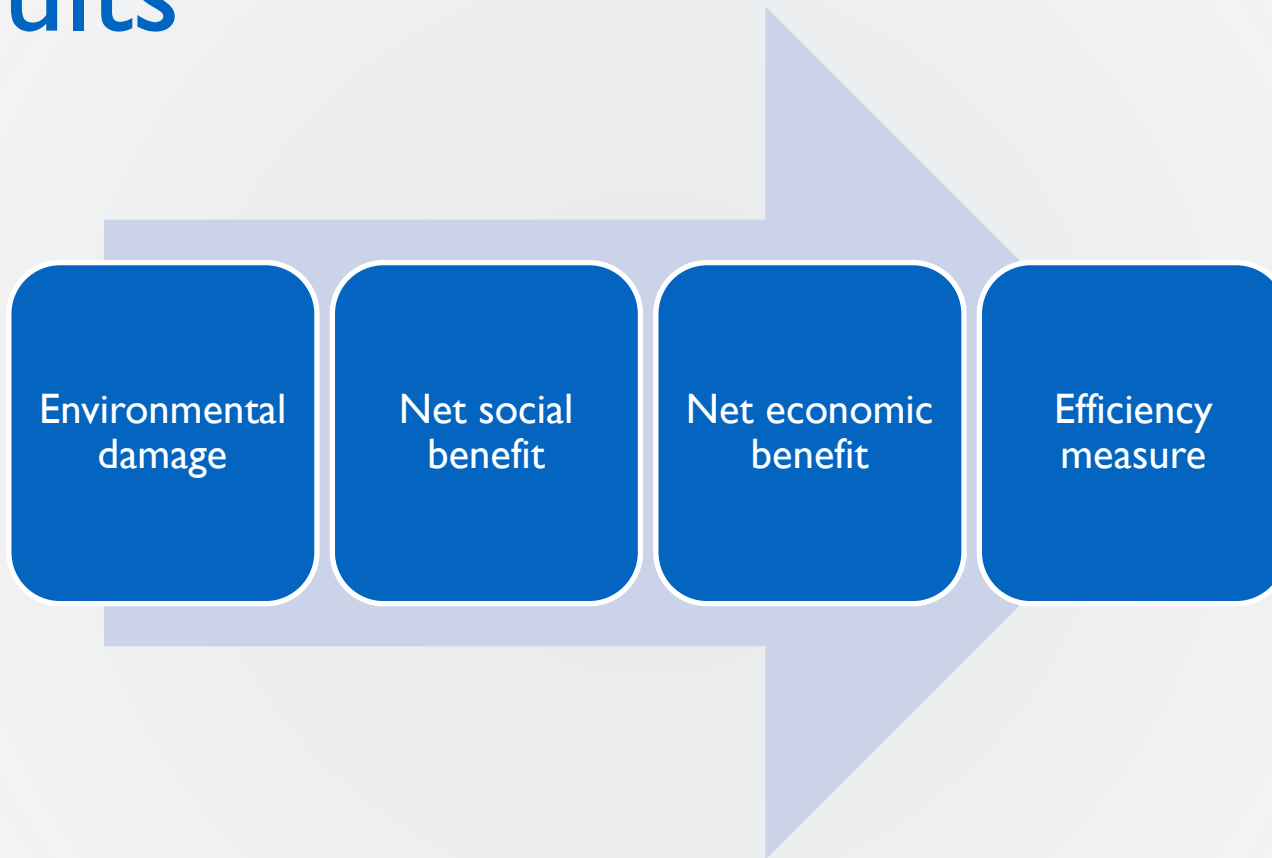
- Improvement projects
- New projects
- Traffic estimation



# Analytical Framework

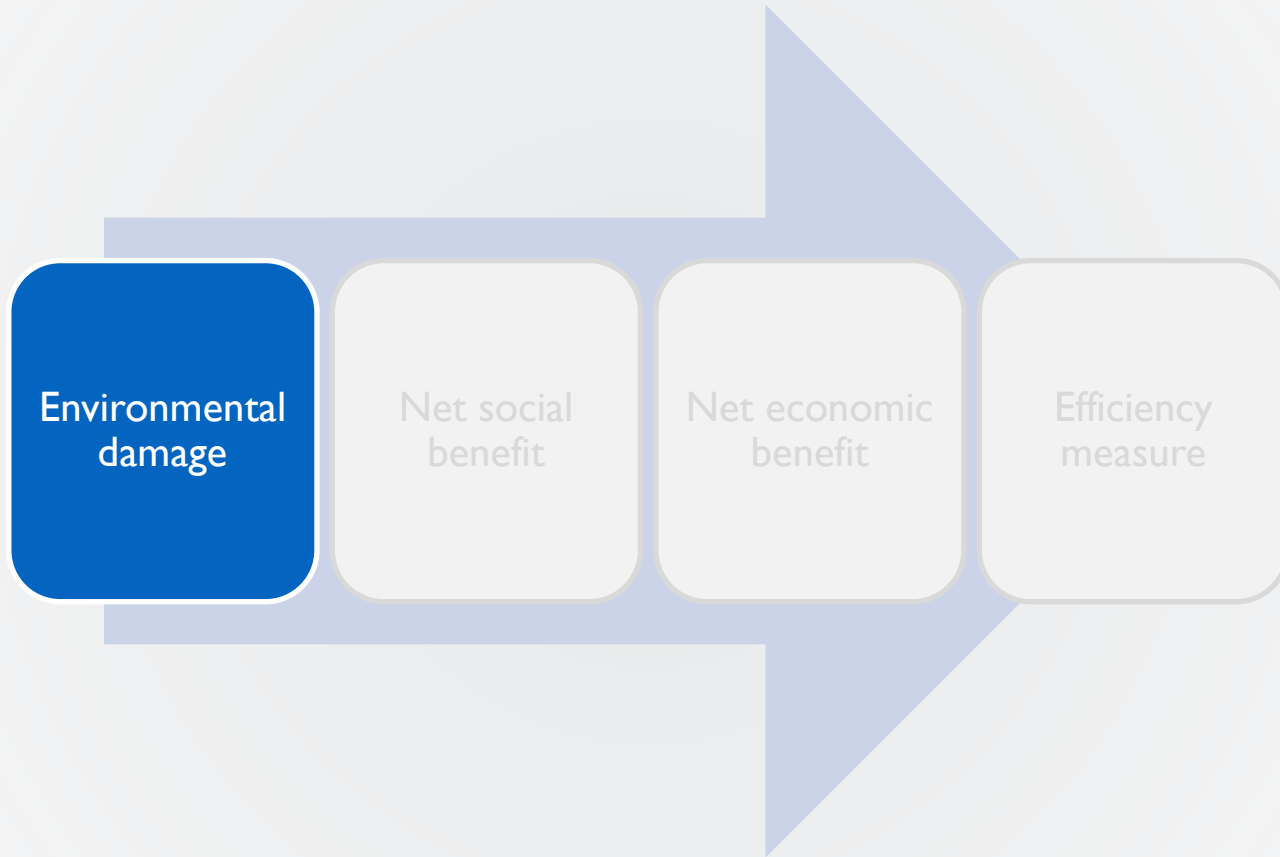


# Results





# Environmental Damage



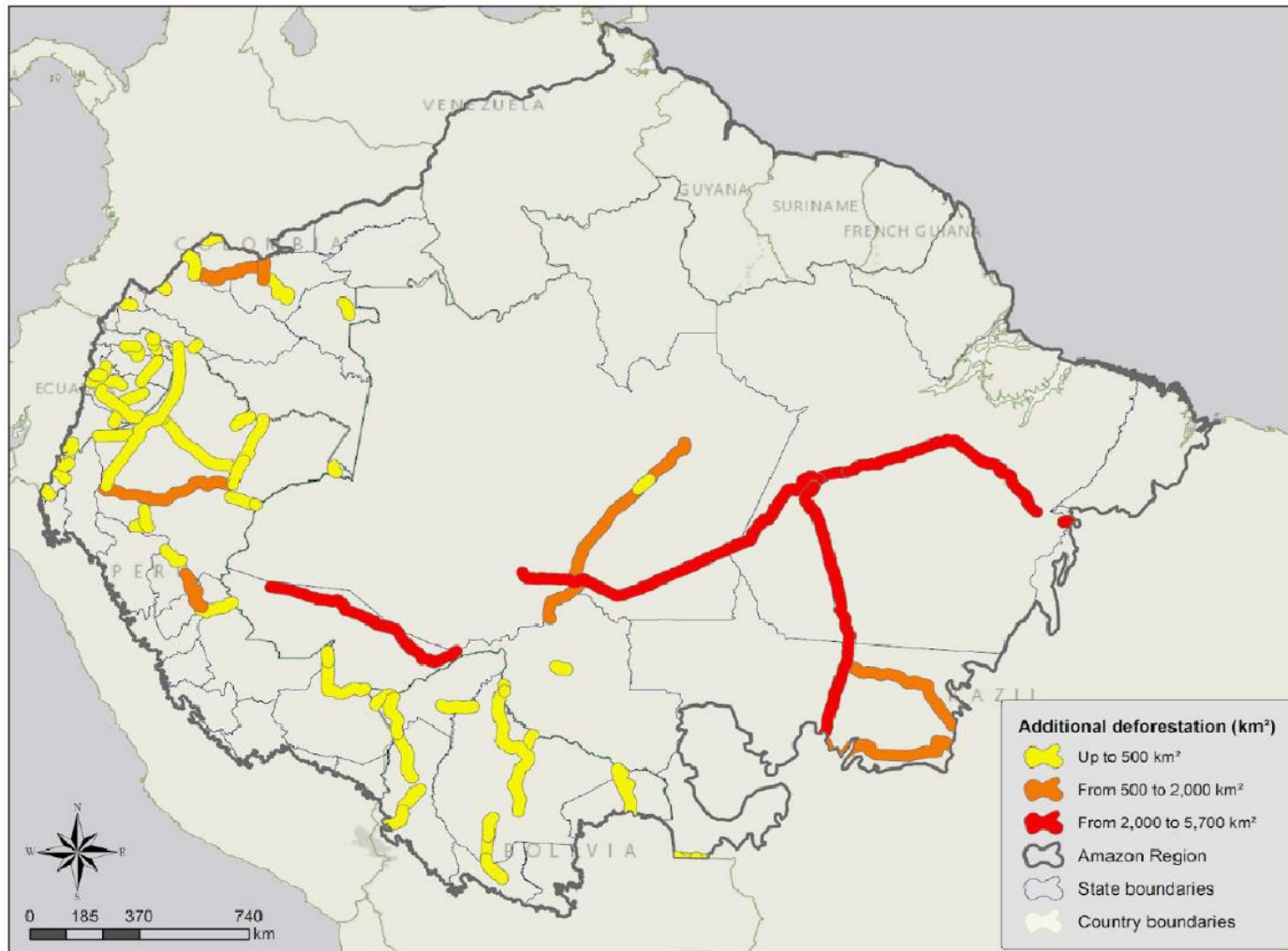


# Roads Negatively Impact the Environment

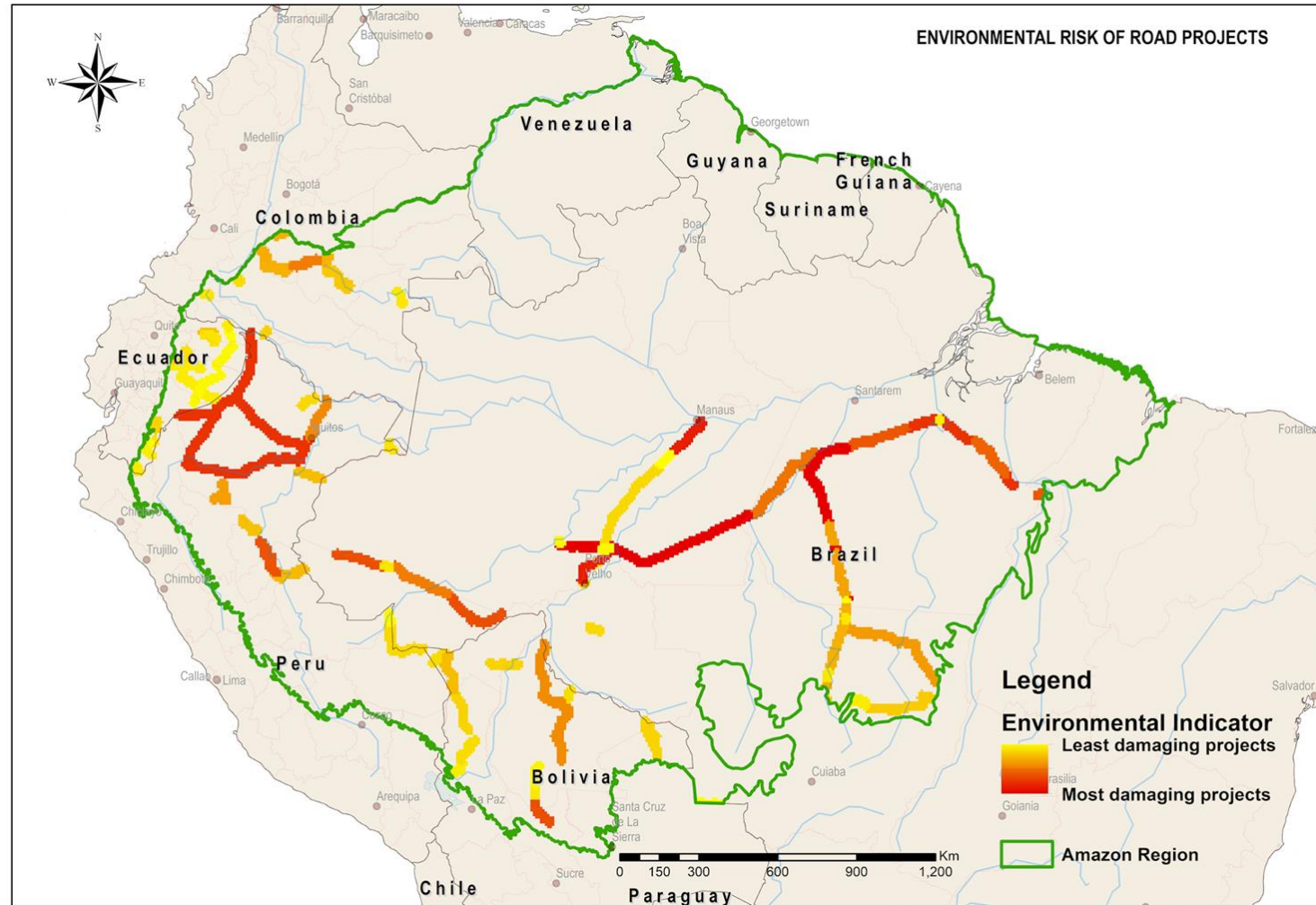
- If all roads are implemented:
  - Deforestation of 2.4 million hectares over the next 20 years



# Additional Deforestation

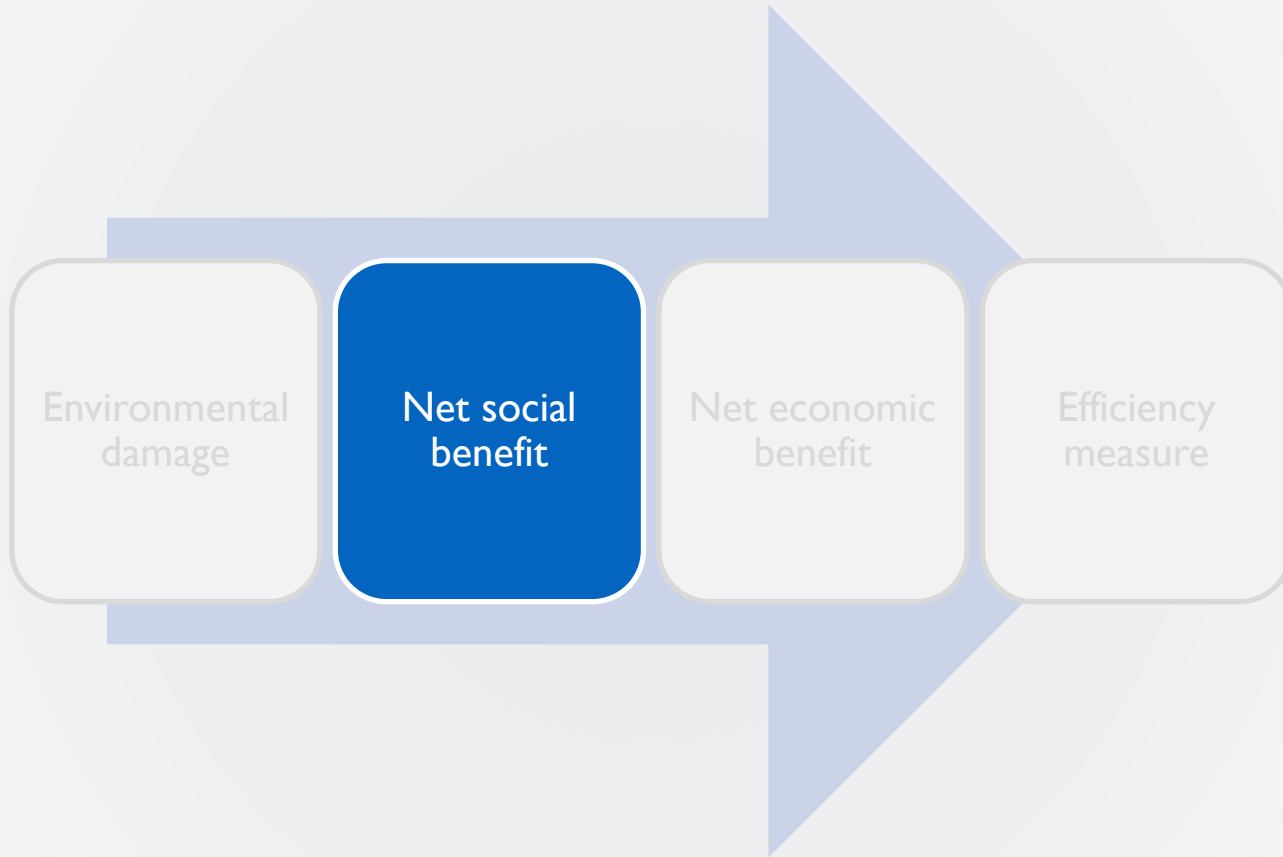


# Environmental Risk





# Net Social Benefit



## Negative Social Impacts

- Legal infractions: 17%
- Territory of indigenous peoples: 4%

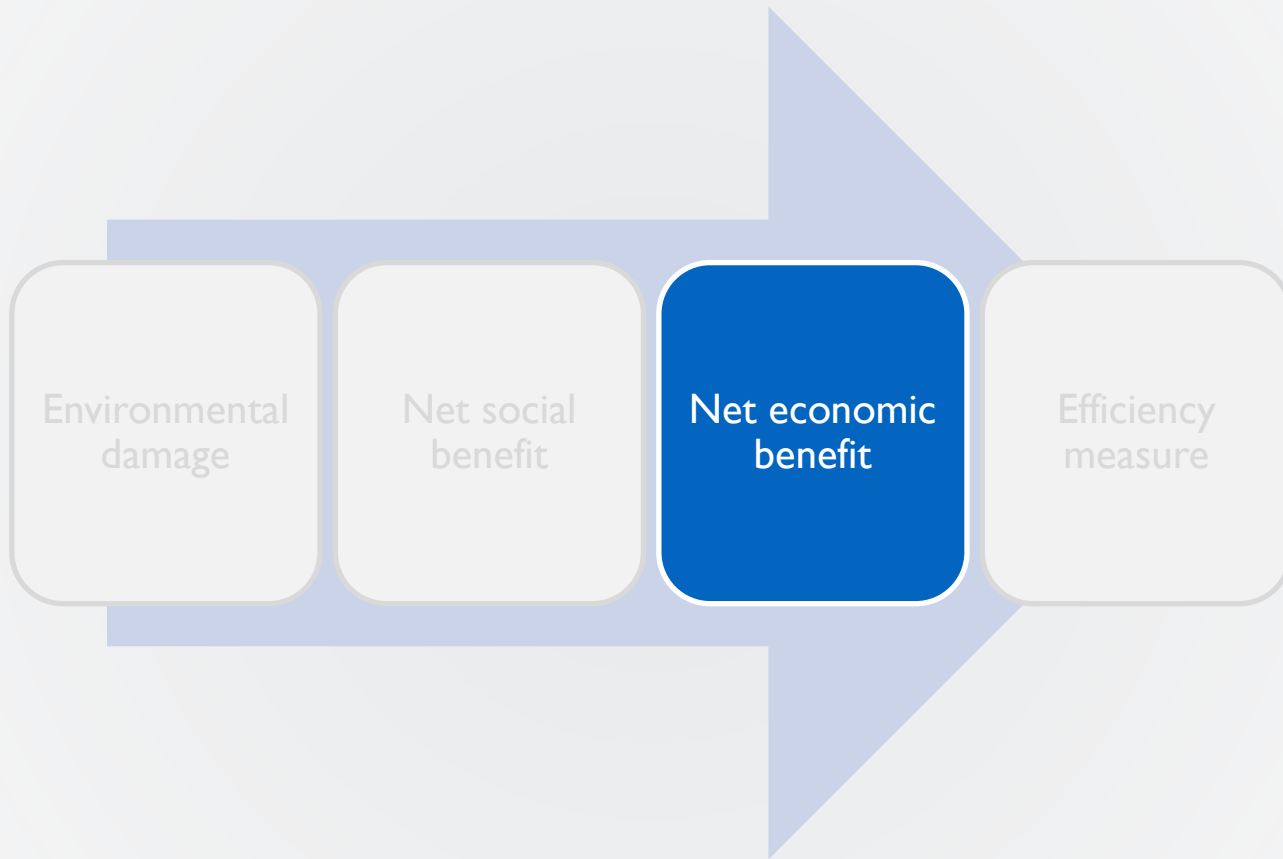
## Positive Social Impacts

- Improve access to schools and health centers: ~50%

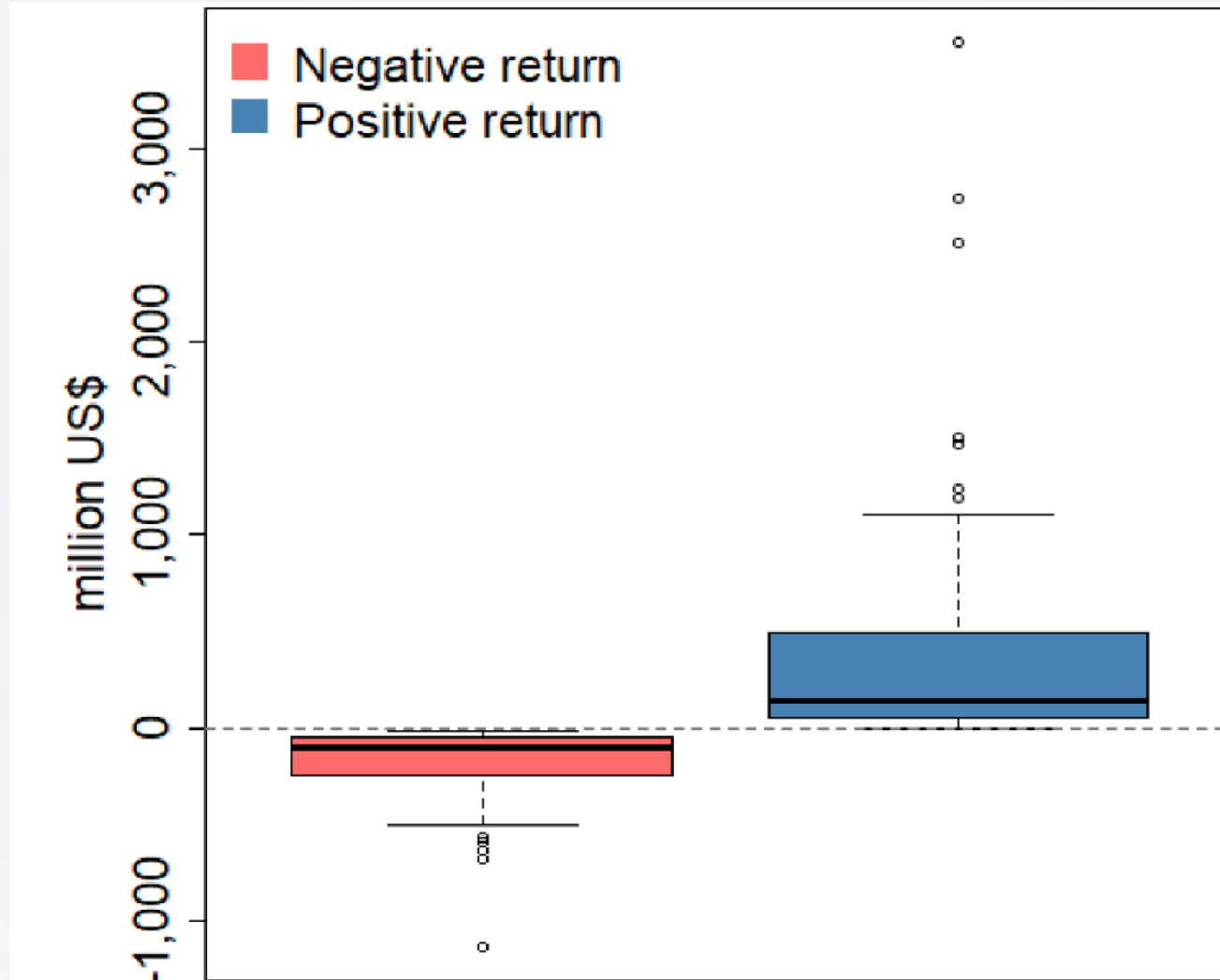




# Net Economic Benefit



# Nearly Half of Roads Don't Make Economic Sense



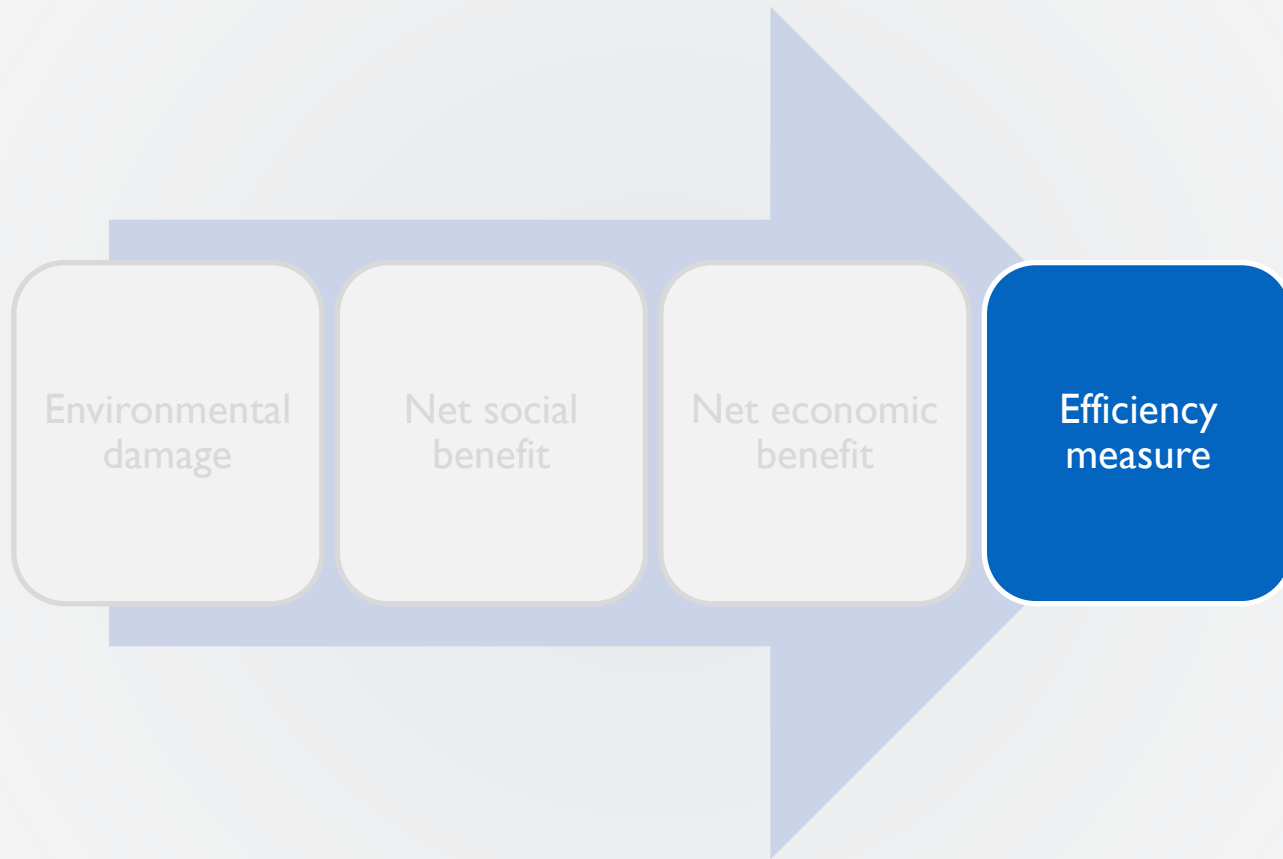


# Impacts of NPV < 0 Projects

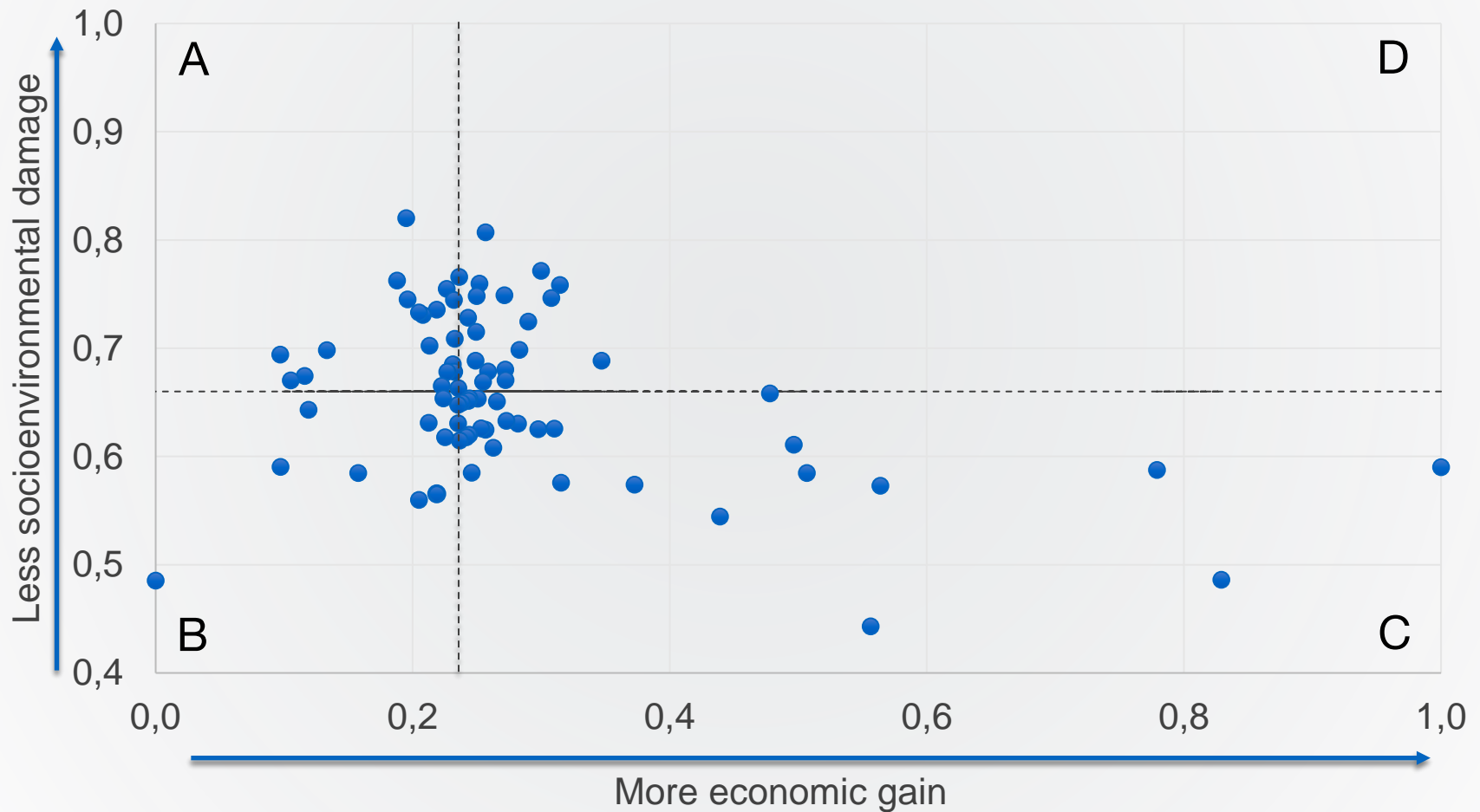


- Loss of US\$ 7.6 billion
- Deforestation of 1.1 million ha

# Integration of the Three Indicators

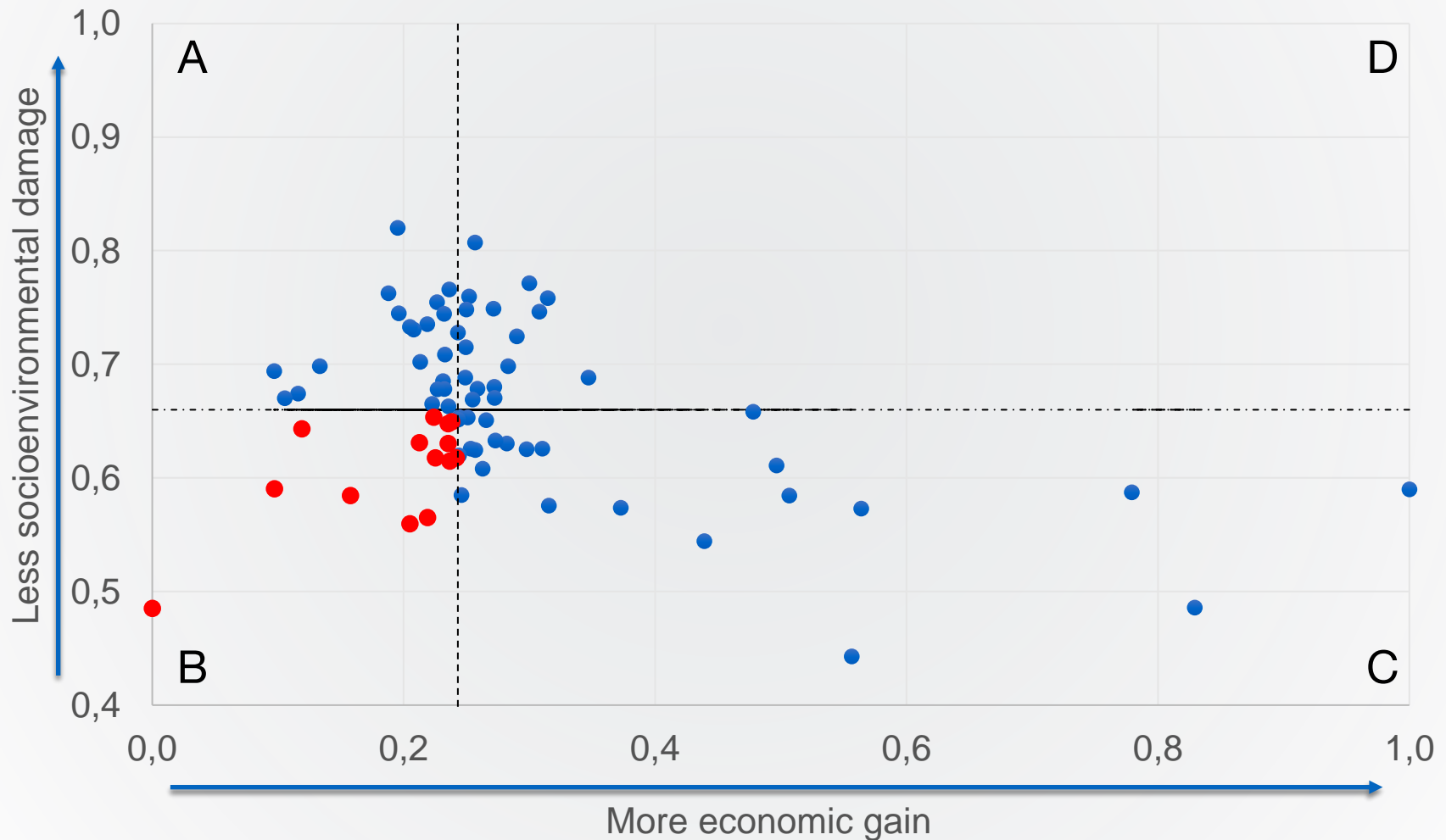


# Which Projects to Choose?

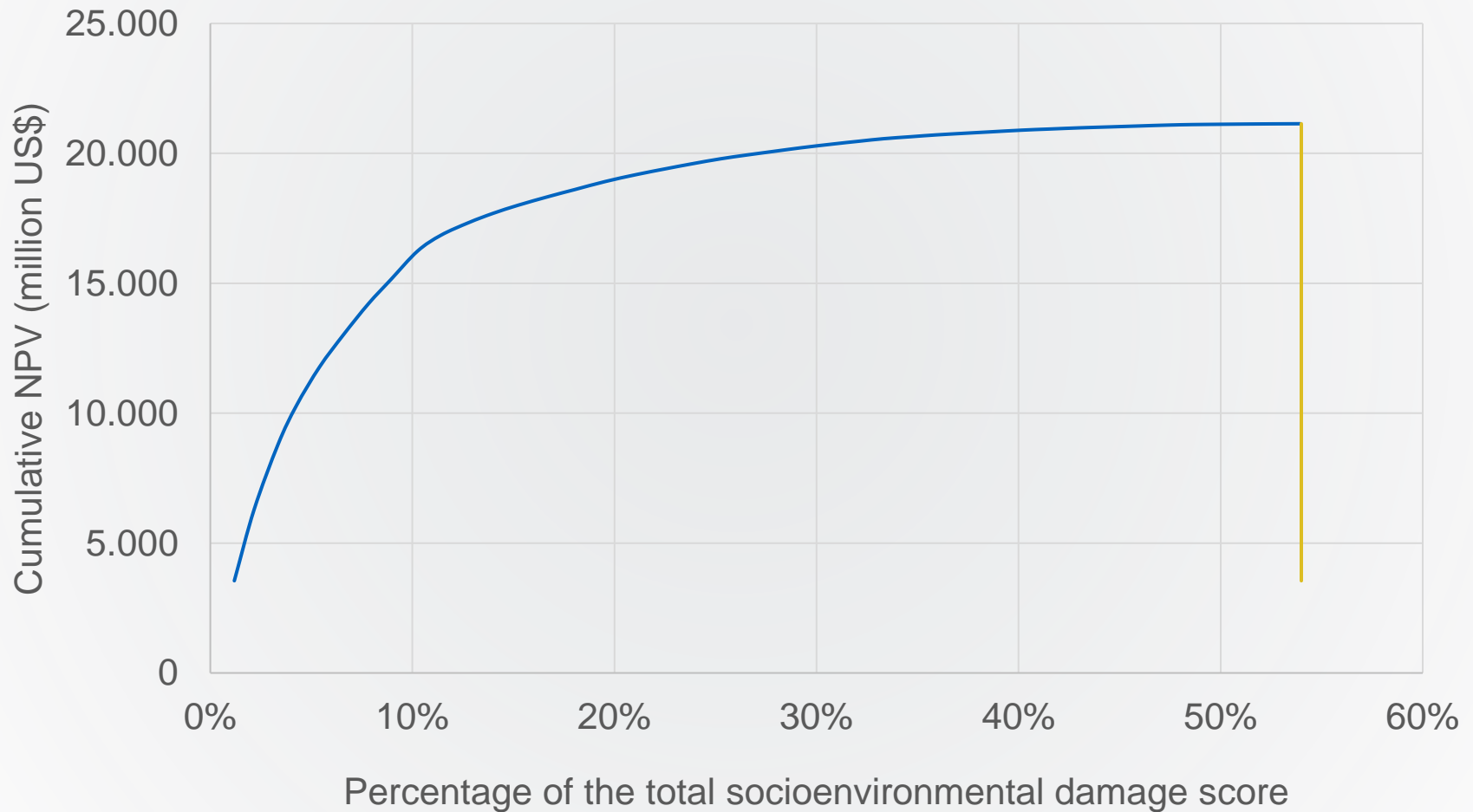




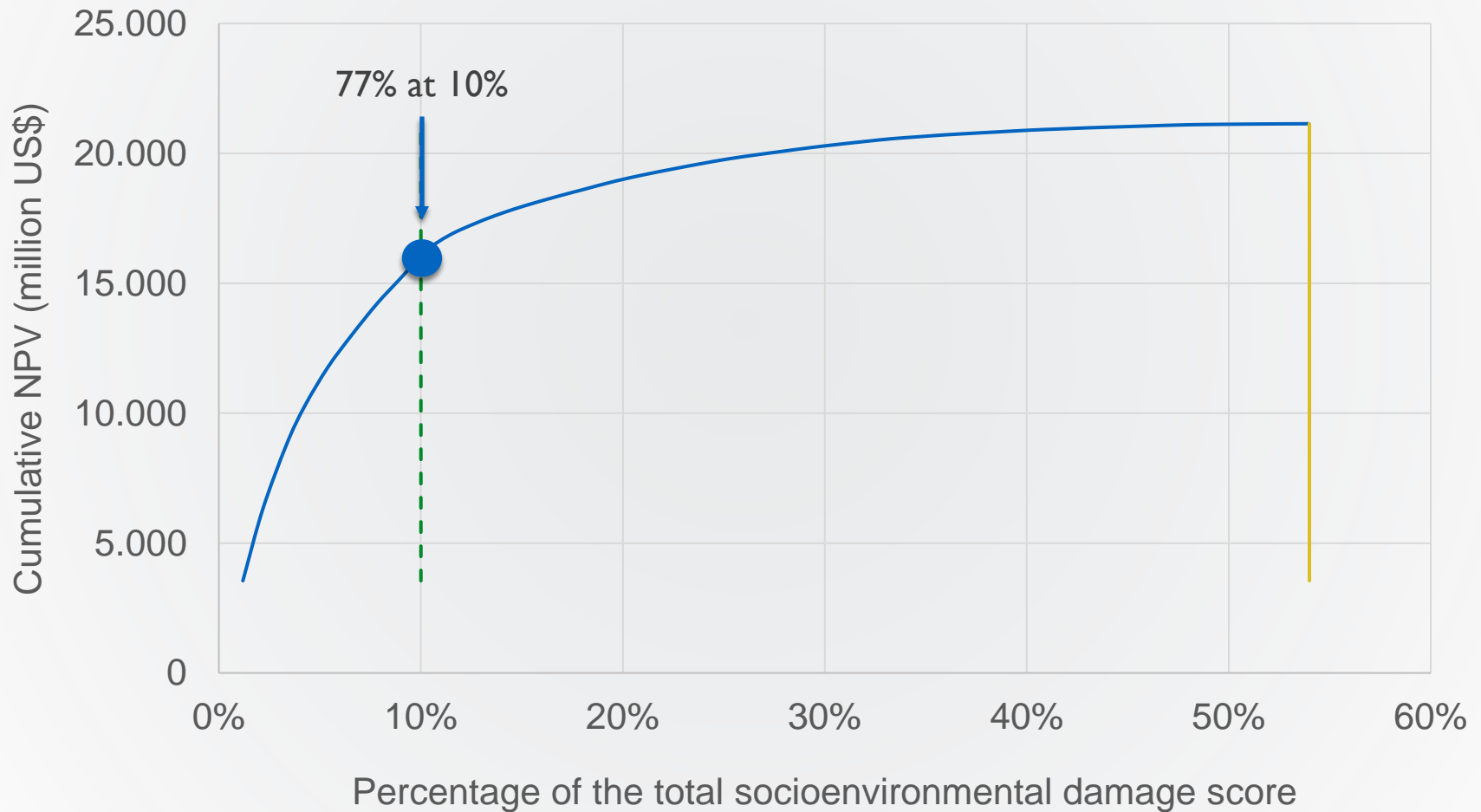
# Which Projects to Choose?



# From the Most to the Least Efficient

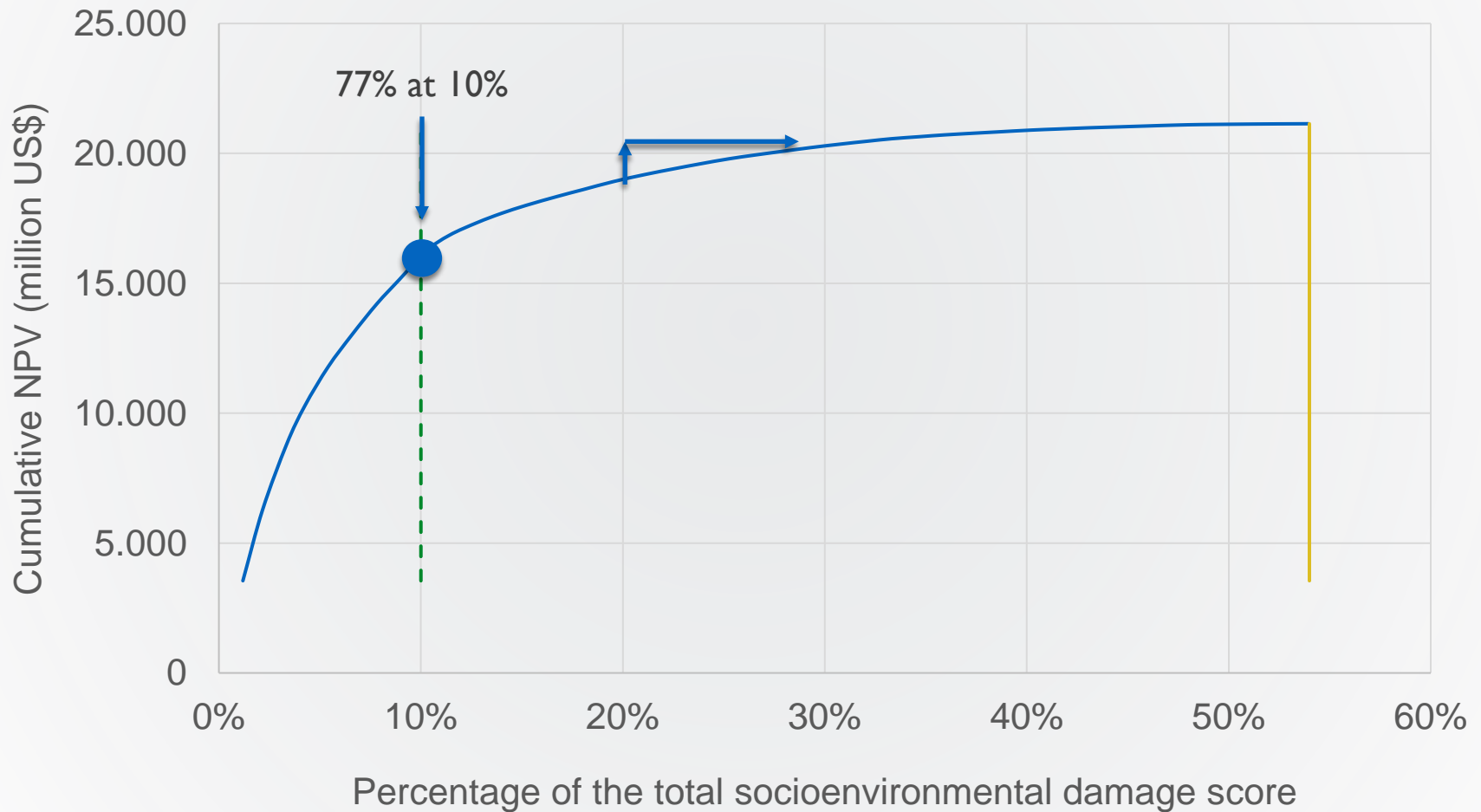


# Smarter Choices





# Smarter Choices



# Our Recommendations

1. Don't build roads that don't make economic sense, i.e.  $NPV < 0$
2. For projects with  $NPV > 0$ , use this tool to consider the social and environmental costs too
3. Be fully aware of the tradeoffs BEFORE making investment decisions



# Thank you!

For more information or additional resources from our study,  
please email Thais at: [thais@conservation-strategy.org](mailto:thais@conservation-strategy.org)