



Independent  
Evaluation Office  
GLOBAL ENVIRONMENT FACILITY

# Geospatial Impact Evaluation and Valuation of Land Degradation Projects

Juha Uitto<sup>1</sup>, Geeta Batra<sup>1</sup>, Anupam Anand<sup>1</sup>, Dan Runfola<sup>2</sup>, Ariel BenYishay<sup>2</sup> and Jyothy Nagol<sup>3</sup>

<sup>1</sup>Independent Evaluation office, Global Environment Facility

<sup>2</sup>College of William and Mary

<sup>3</sup> Global Land Cover Facility, University of Maryland

Impact of GEF Land degradation interventions?

Factors associated with the environmental outcomes?

Value for Money in terms of Carbon sequestered?

Objectives

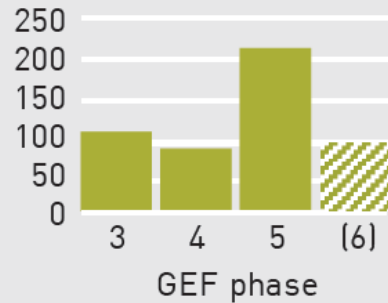
## PORTFOLIO HIGHLIGHTS

**237**  
projects

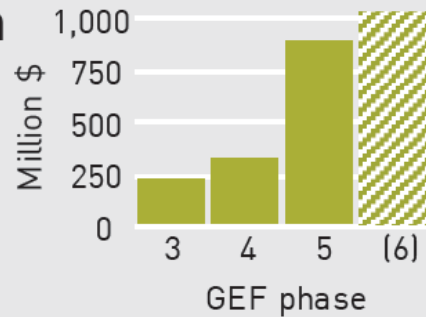
**\$630 million**  
in grant funding

**\$2.97 billion**  
in cofinancing

Number of projects\*



Grant amount\*



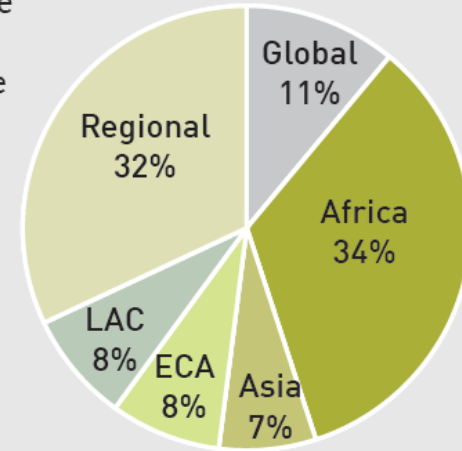
Top 3 agencies\*

43% UN Development Programme  
17% World Bank Group  
17% UN Environment Programme

Regional distribution\*

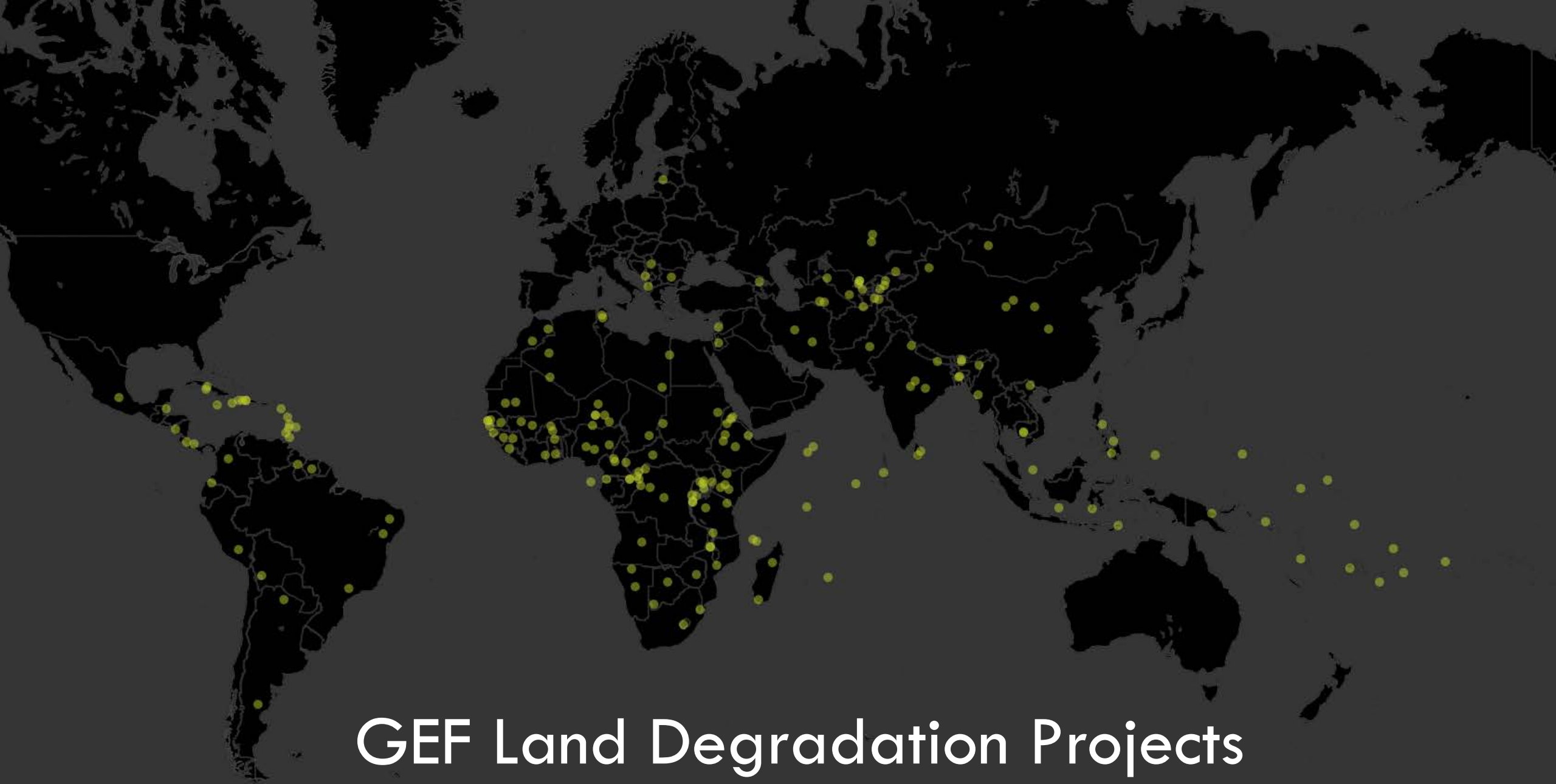
34% Africa  
24% Asia  
20% Latin America & Caribbean  
13% Europe and Central Asia  
7% Global  
2% Regional

Total GEF funding per region\*



\*Includes LDFA and multifocal projects.

# GEF Land Degradation Focal Area



## Framework for Monitoring and Reporting on SDG Target 15.3

**Indicator 15.3.1**  
Proportion of land that is degraded over total land area



**Land Productivity**



**Carbon Stocks above/below ground**



**Sub-Indicators**  
UNCCD (CBD, UNFCCC)  
Reporting Mechanisms

**Land Cover and Land Cover Change**



**Official Statistics and Earth Observation**



**Land Use and Management Practices**



**Surveys, Sampling and Citizen Sourcing**



**Data from multiple sources**  
FAO, GEF and other  
Reporting Mechanisms

Forest Cover(Tier 1)

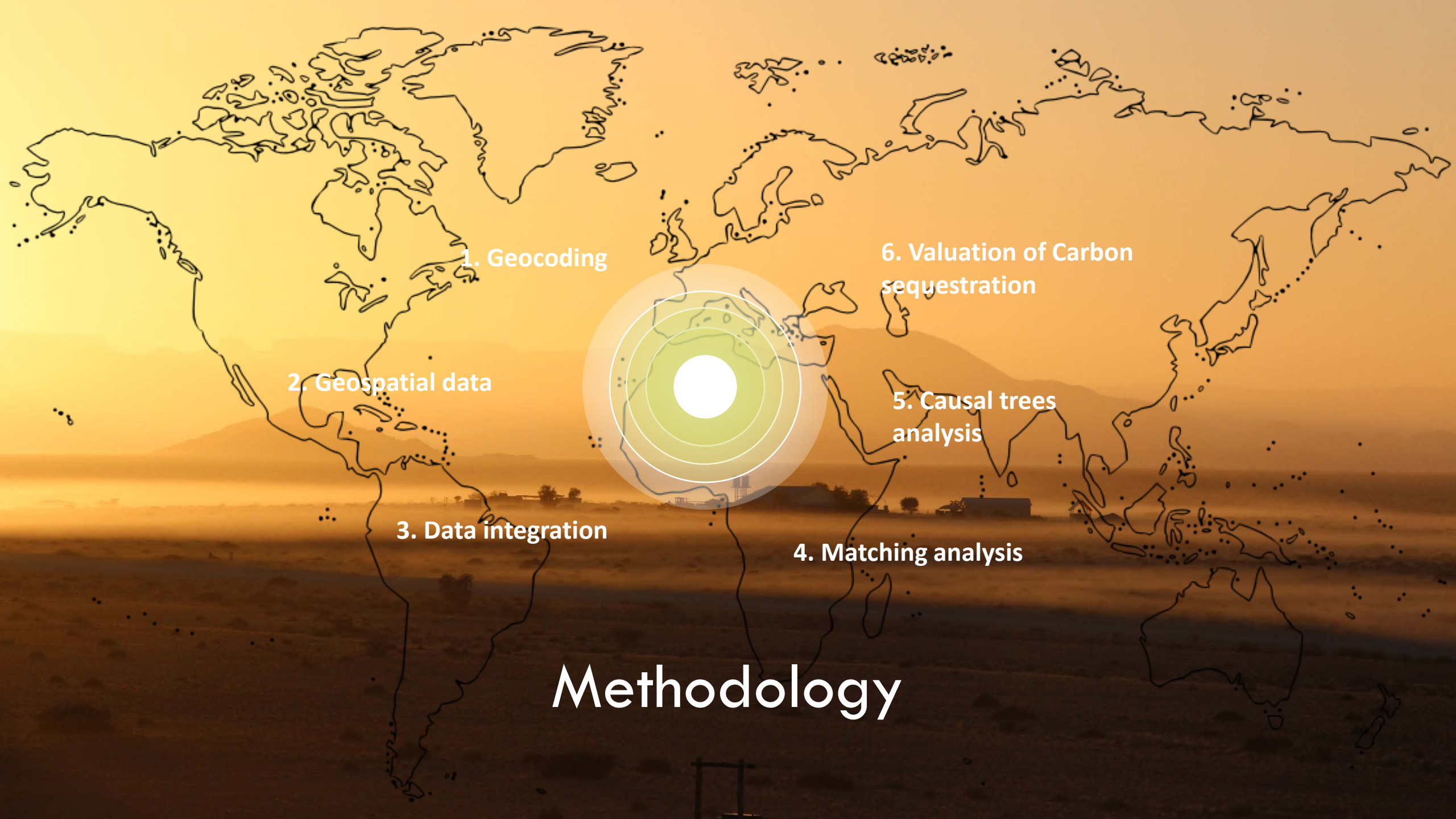
Vegetation Productivity(Tier 2a)

Carbon Sequestration(Tier 2b)

Forest Fragmentation(Tier 3a)



# Indicators



1. Geocoding

2. Geospatial data

3. Data integration

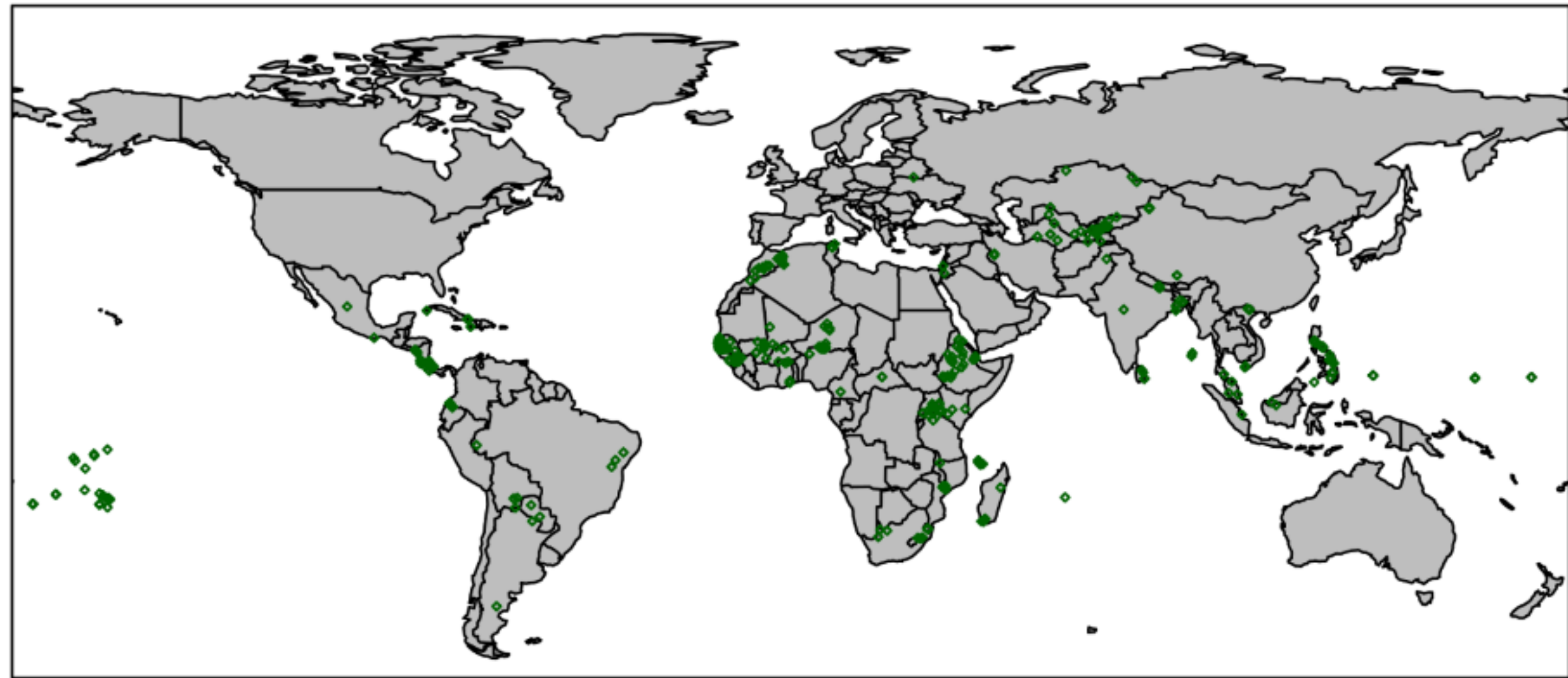
4. Matching analysis

5. Causal trees analysis

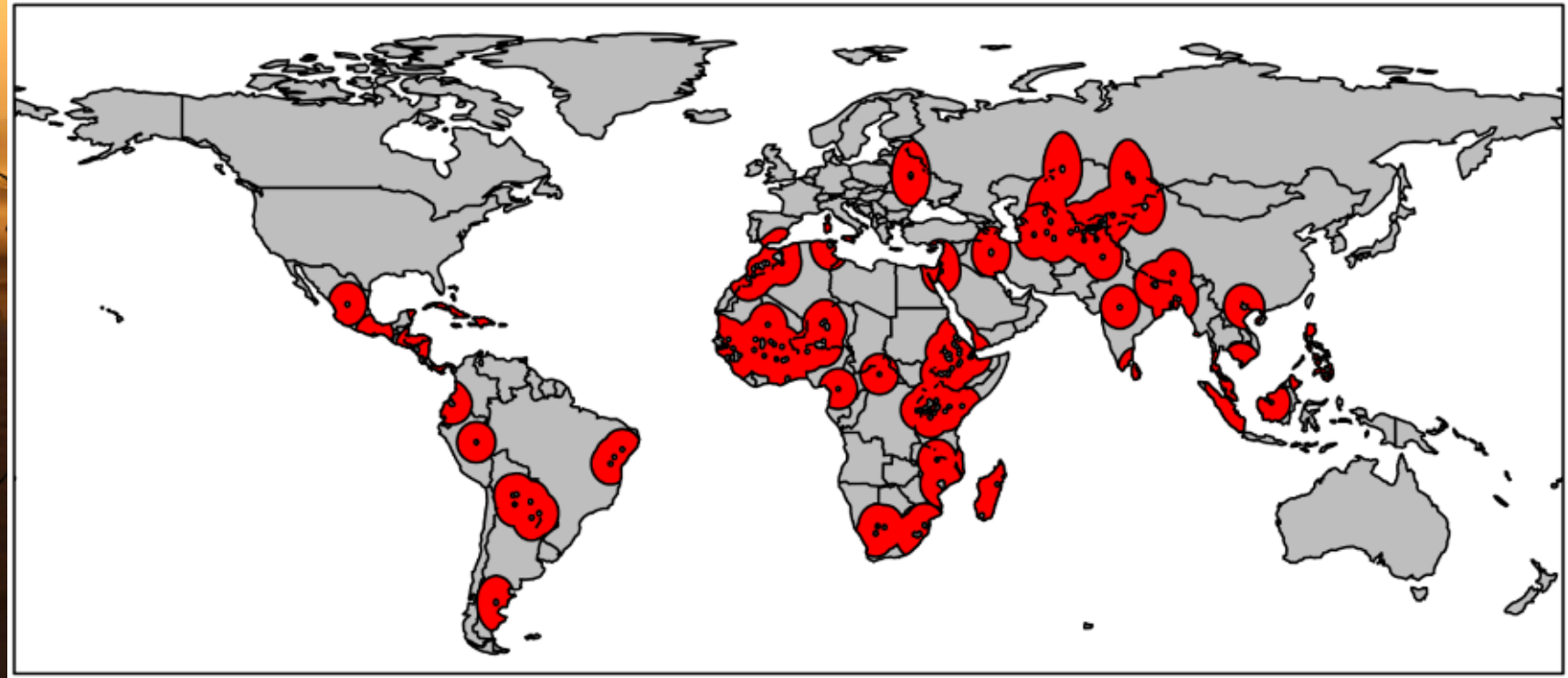
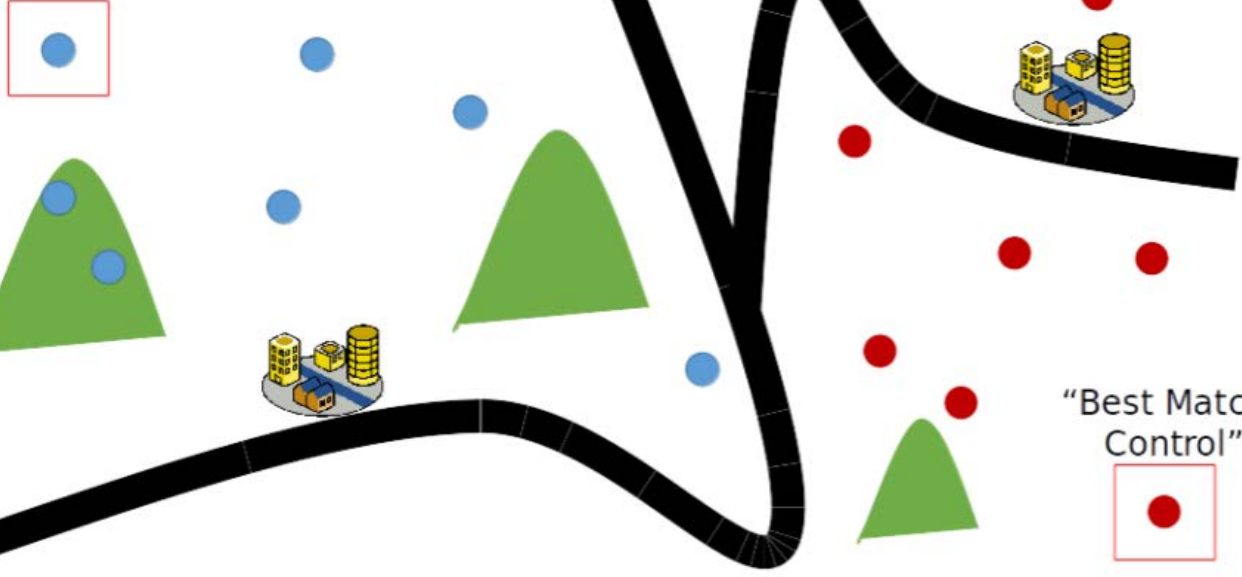
6. Valuation of Carbon sequestration

# Methodology

## Location of GEF Land Degradation Projects Known with a High Degree of Geographic Precision

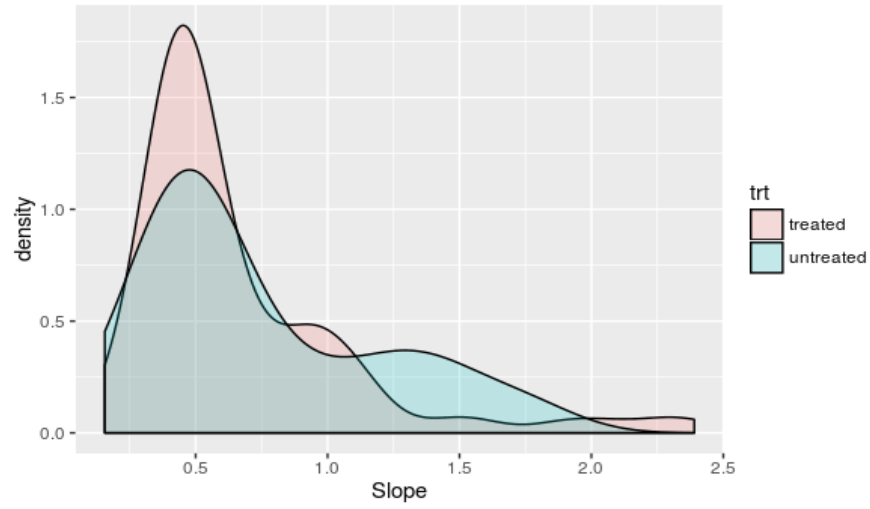


"Treatment"

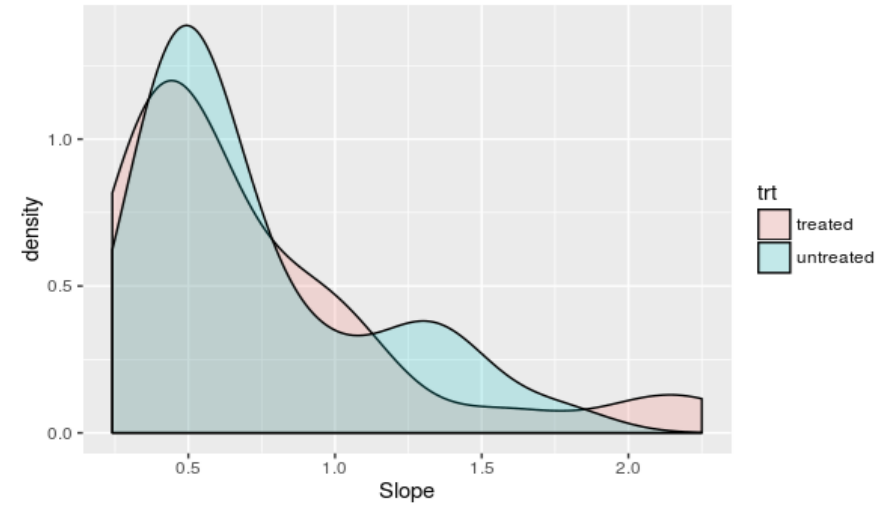




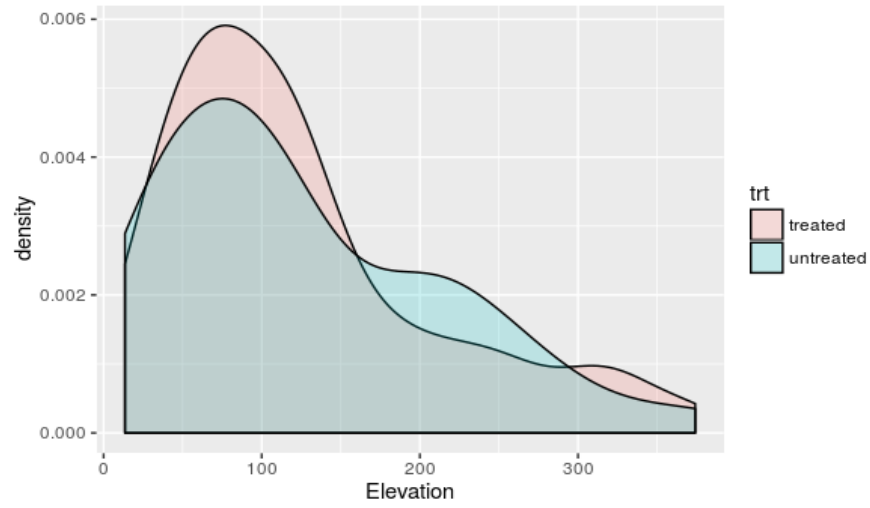
Pre-Balancing: (Slope)



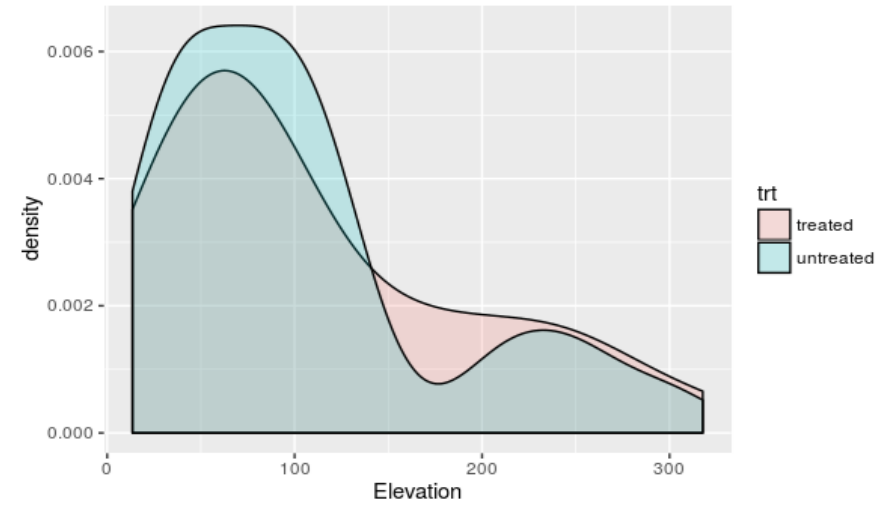
Post-Balancing: (Slope)

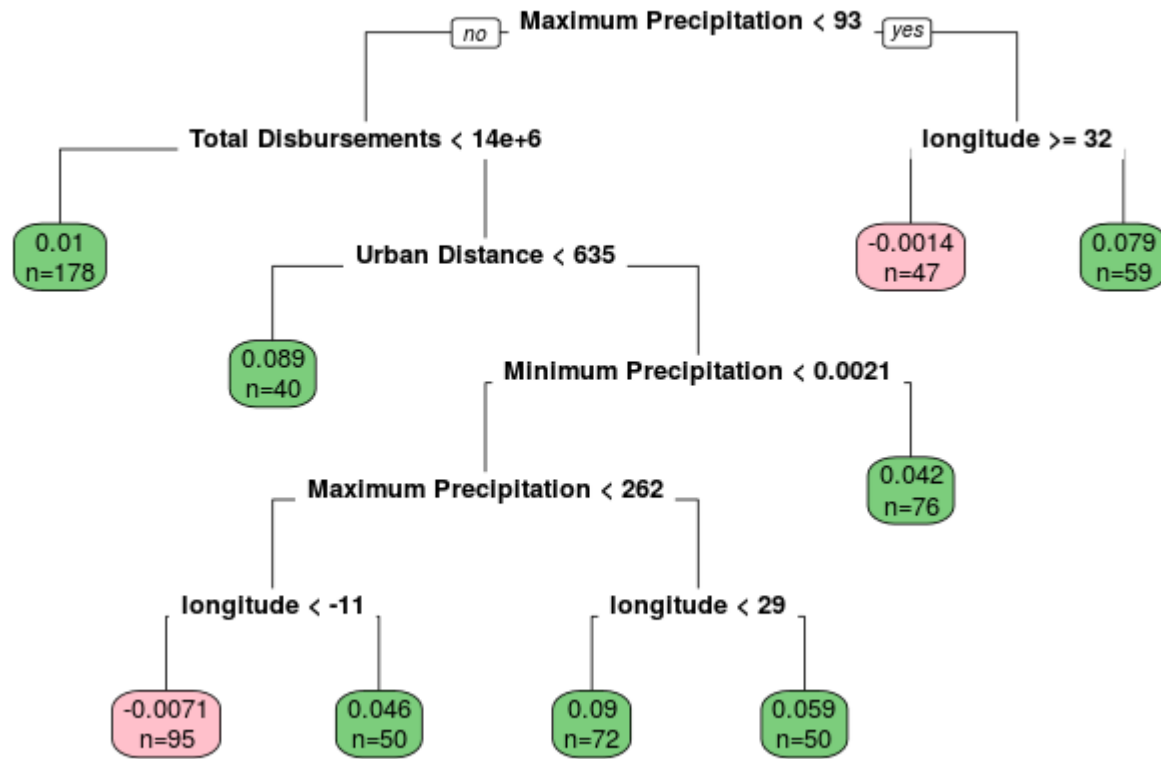


Pre-Balancing: (Elevation)

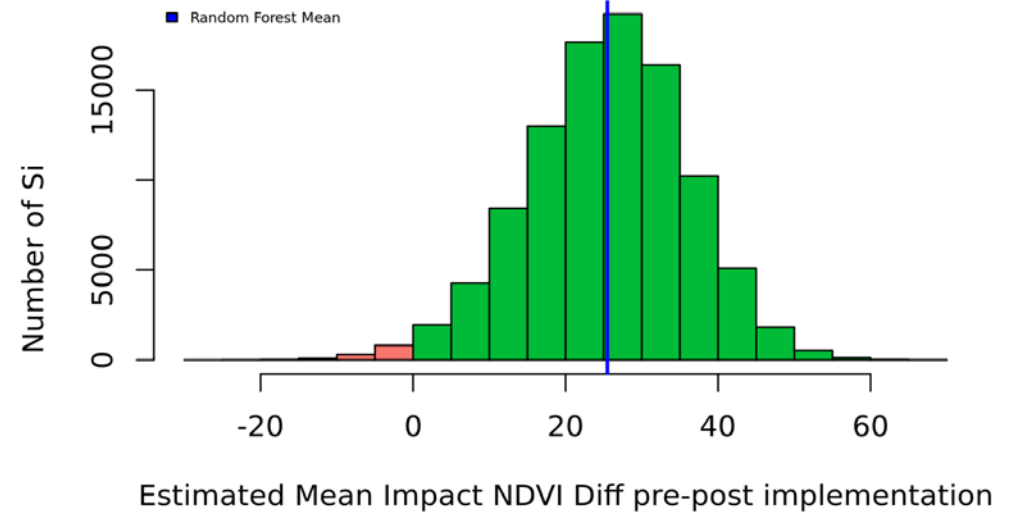


Post-Balancing: (Elevation)

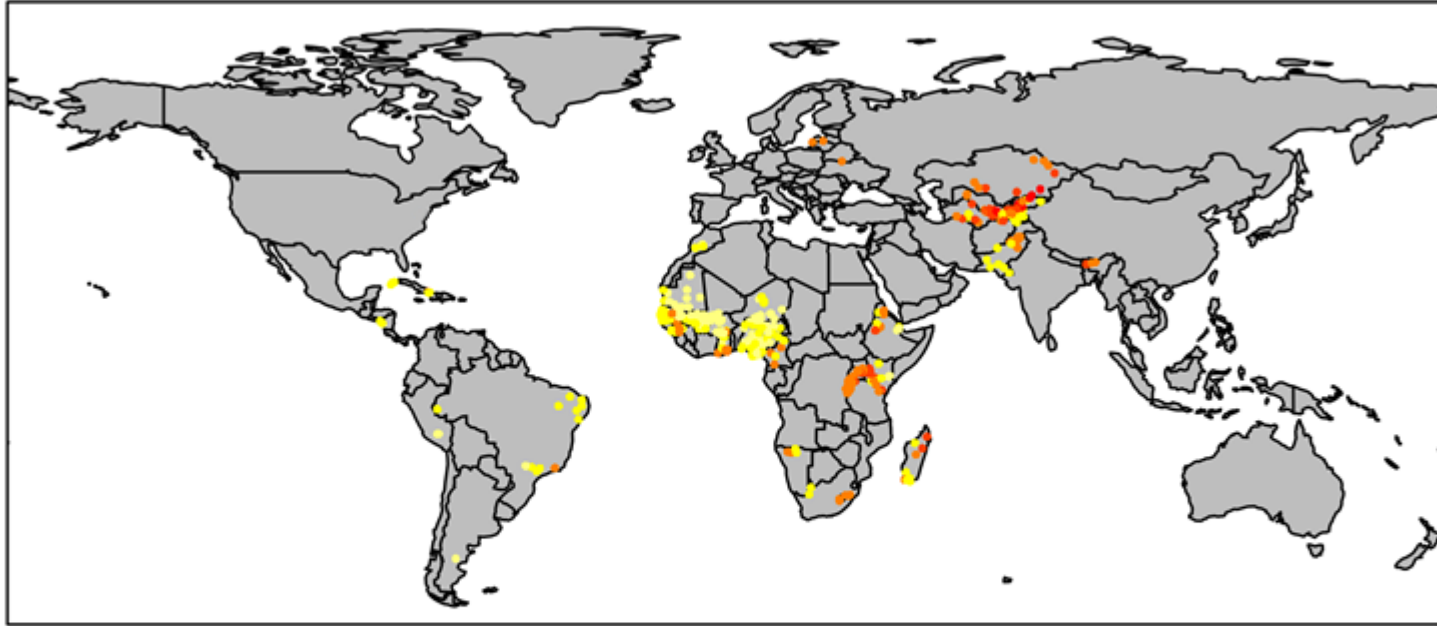




### Model Uncertainty



Uncertainty in Estimates (+/- @ 95% Confidence Interval)



- [96.86,130.8]
- (130.8,164.8]
- (164.8,198.8]
- (198.8,232.8]
- (232.8,266.7]

Dependent variable:

NDVI Diff pre-post implementation

|  |                         |
|--|-------------------------|
| treatment                                    | 0.08*** (0.03, 0.14)    |
| Dist. to Rivers (m)                          | -0.04 (-0.14, 0.07)     |
| Dist. to Roads (m)                           | 0.06* (-0.01, 0.12)     |
| Elevation (m)                                | -0.18*** (-0.31, -0.06) |
| Slope (degrees)                              | -0.11** (-0.21, -0.02)  |
| Urb. Dist. (rel)                             | -0.01 (-0.08, 0.07)     |
| Pop. Density (2000)                          | 0.06 (-0.04, 0.17)      |
| Protected Area %                             | 0.09*** (0.03, 0.14)    |
| Treecover (2000, %)                          | 0.05 (-0.04, 0.13)      |
| Latitude                                     | -0.09* (-0.18, 0.003)   |
| Longitude                                    | -0.13*** (-0.22, -0.03) |
| Max Precip. (2002, mm)                       | -0.42*** (-0.58, -0.27) |
| Min Precip (2002, mm)                        | -0.08* (-0.17, 0.01)    |
| Mean Precip (2002, mm)                       | 0.27*** (0.08, 0.45)    |
| Max Temp (2002, C)                           | 0.004 (-0.33, 0.34)     |
| Min Temp (2002, C)                           | -0.28 (-0.78, 0.22)     |
| Mean Temp (2002, C)                          | -0.23 (-0.98, 0.52)     |
| Nighttime Lights (2002, Relative)            | -0.02 (-0.10, 0.06)     |
| NDVI (2002, Unitless)                        | 0.01 (-0.07, 0.10)      |
| Urb. Dist. (rel) *Treatment                  | -0.004 (-0.08, 0.07)    |
| Dist. to Rivers (m) *Treatment               | -0.04 (-0.14, 0.07)     |
| Dist. to Roads (m) *Treatment                | -0.03 (-0.10, 0.04)     |
| Pop. Density (2000) *Treatment               | -0.06 (-0.17, 0.04)     |
| Latitude *Treatment                          | 0.03 (-0.06, 0.12)      |
| Longitude *Treatment                         | 0.08 (-0.02, 0.17)      |
| NDVI (2002, Unitless) *Treatment             | 0.07* (-0.01, 0.15)     |
| Elevation (m) *Treatment                     | 0.25*** (0.12, 0.37)    |
| Slope (degrees) *Treatment                   | -0.12** (-0.22, -0.02)  |
| Treecover (2000, %) *Treatment               | -0.03 (-0.11, 0.06)     |
| Max Temp (2002, C) *Treatment                | 0.57*** (0.24, 0.90)    |
| Mean Temp (2002, C) *Treatment               | -1.05*** (-1.80, -0.31) |
| Min Temp (2002, C) *Treatment                | 0.80*** (0.30, 1.30)    |
| Max Precip. (2002, mm) *Treatment            | -0.06 (-0.21, 0.10)     |
| Mean Precip (2002, mm) *Treatment            | 0.06 (-0.12, 0.25)      |
| Min Precip (2002, mm) *Treatment             | -0.12*** (-0.20, -0.03) |
| Nighttime Lights (2002, Relative) *Treatment | 0.01 (-0.06, 0.09)      |
| Protected Area % *Treatment                  | -0.02 (-0.07, 0.04)     |
| Constant                                     | -0.01 (-0.06, 0.05)     |
| Observations                                 | 966                     |
| R <sup>2</sup>                               | 0.30                    |
| Adjusted R <sup>2</sup>                      | 0.27                    |

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Findings about location



Positive increase in  
NDVI



25 km of  
protected area



Low density



Variable  
characteristics



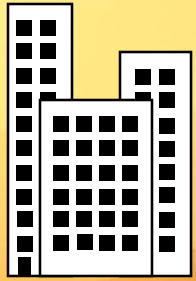
Some without  
forest cover

# Causal tree

## NDVI

NDVI





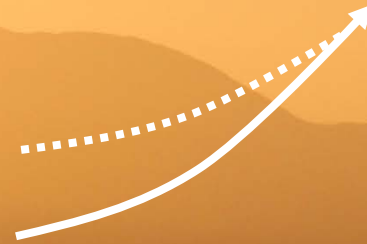
Less effective near  
urban areas



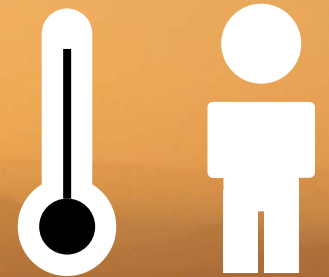
Time  
required



Multifocal



Initial conditions



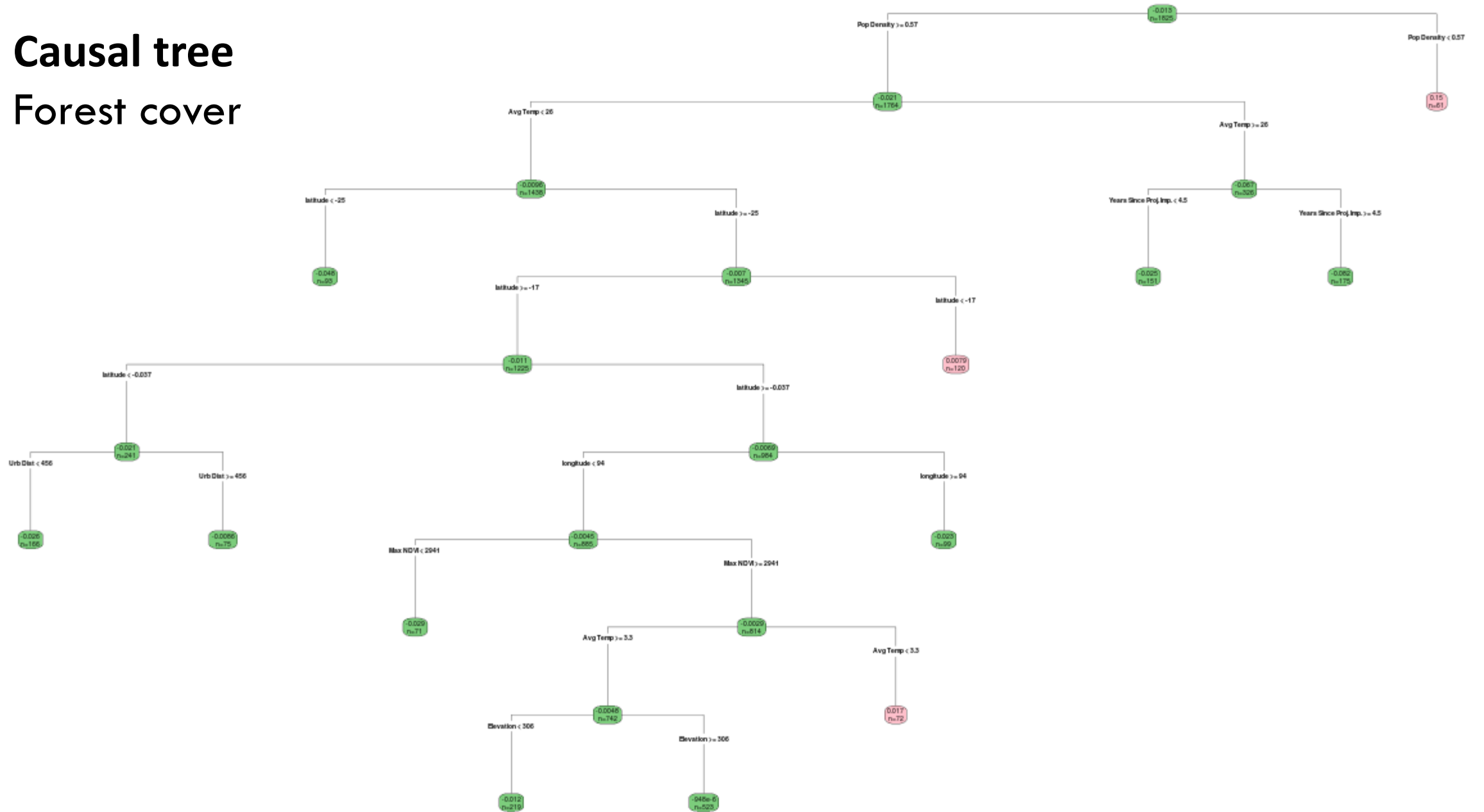
Environmental  
and social  
characteristics

Findings: NDVI

# Causal tree

## Forest cover

### Forest Landcover

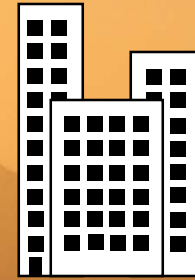




4.5 years after



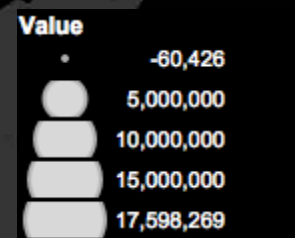
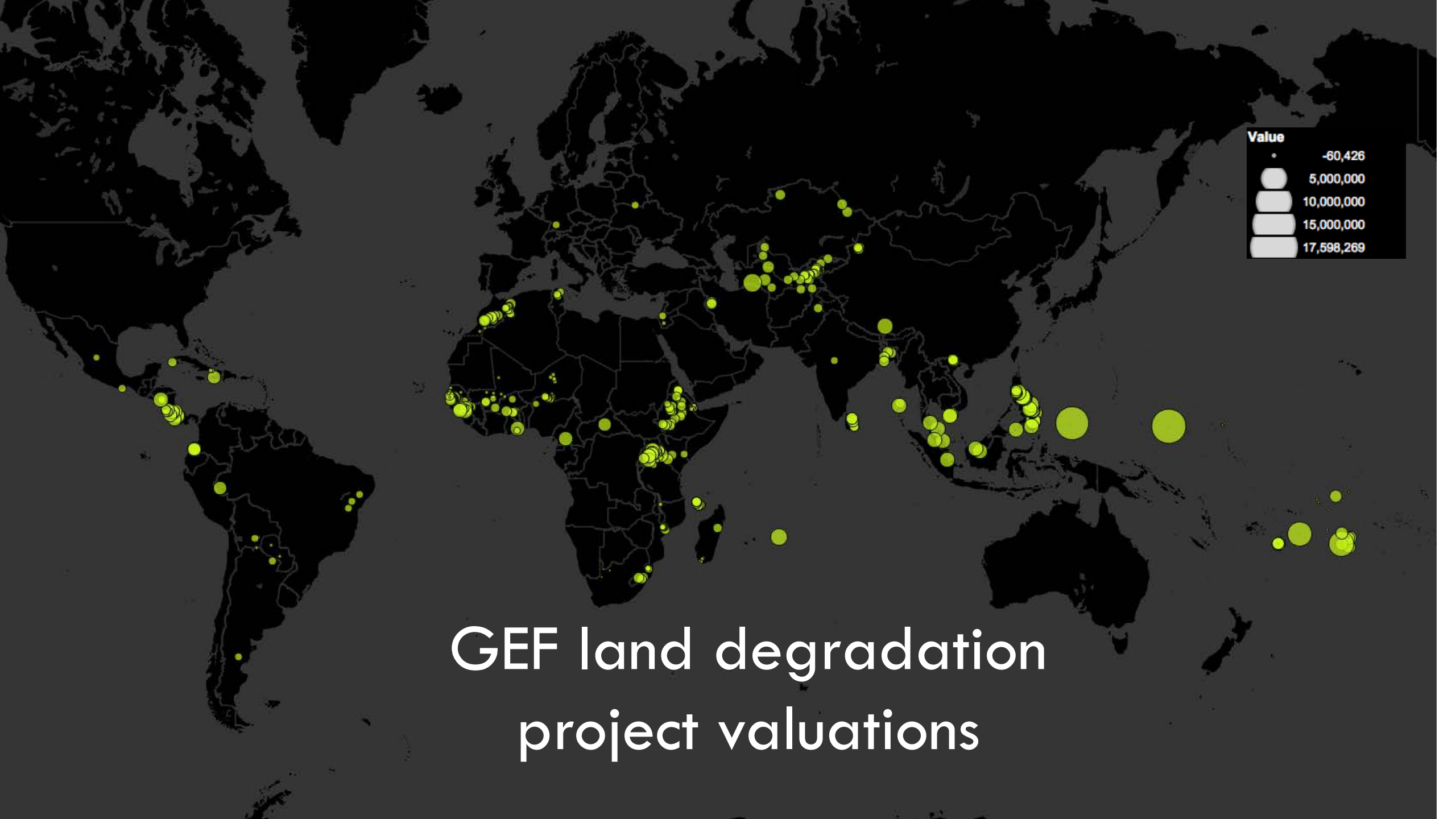
Population  
density



More effective  
near urban areas

Findings: Forest cover





GEF land degradation  
project valuations



43.52

tons of carbon sequestered  
per hectare

108,800

tons of carbon sequestered per  
project location

\$7,500,000

contributed by sequestration alone

Findings

Use a learning-based approach as an initial screening tool for project planning

Collect the exact geographic information of GEF land degradation activities on an ongoing basis

Need to mainstream proposed by the UNCCD's Land Degradation Neutrality Framework.

**Suggestions**



Thank you