



Independent
Evaluation Office
GLOBAL ENVIRONMENT FACILITY

Leveraging geospatial science for tracking the SDGs through measurement and evaluation of GEF interventions

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United Nations
Framework Convention on
Climate Change



Convention on
Biological Diversity



United Nations
Convention to Combat
Desertification



US\$14.5 billion,
and the leverage
of US\$75.4 billion

4,000 projects in
167 countries

18 implementing
agencies

5 major
environmental
conventions

Established in 1992

Innovator and Catalyst

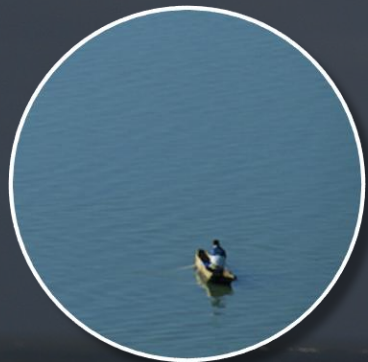
Unique Partnership

Financial Mechanism

The Global Environment Facility

Thematic Areas

International Waters



Land Degradation



Biodiversity



Cities



Commodities



Food Security



Chemical and Waste



Climate Change



Thematic Area Specific tracking tools and indicators



Reduced nutrient load

Marine protected areas (ha)



Chemical Use

Environmental management



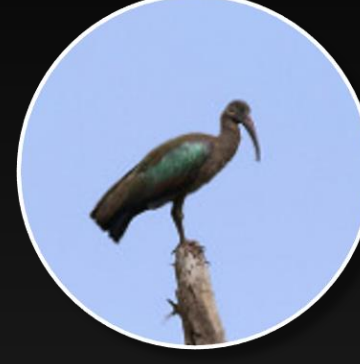
Area under SLM

Area restored



GHG Emissions Avoided

Number of beneficiaries

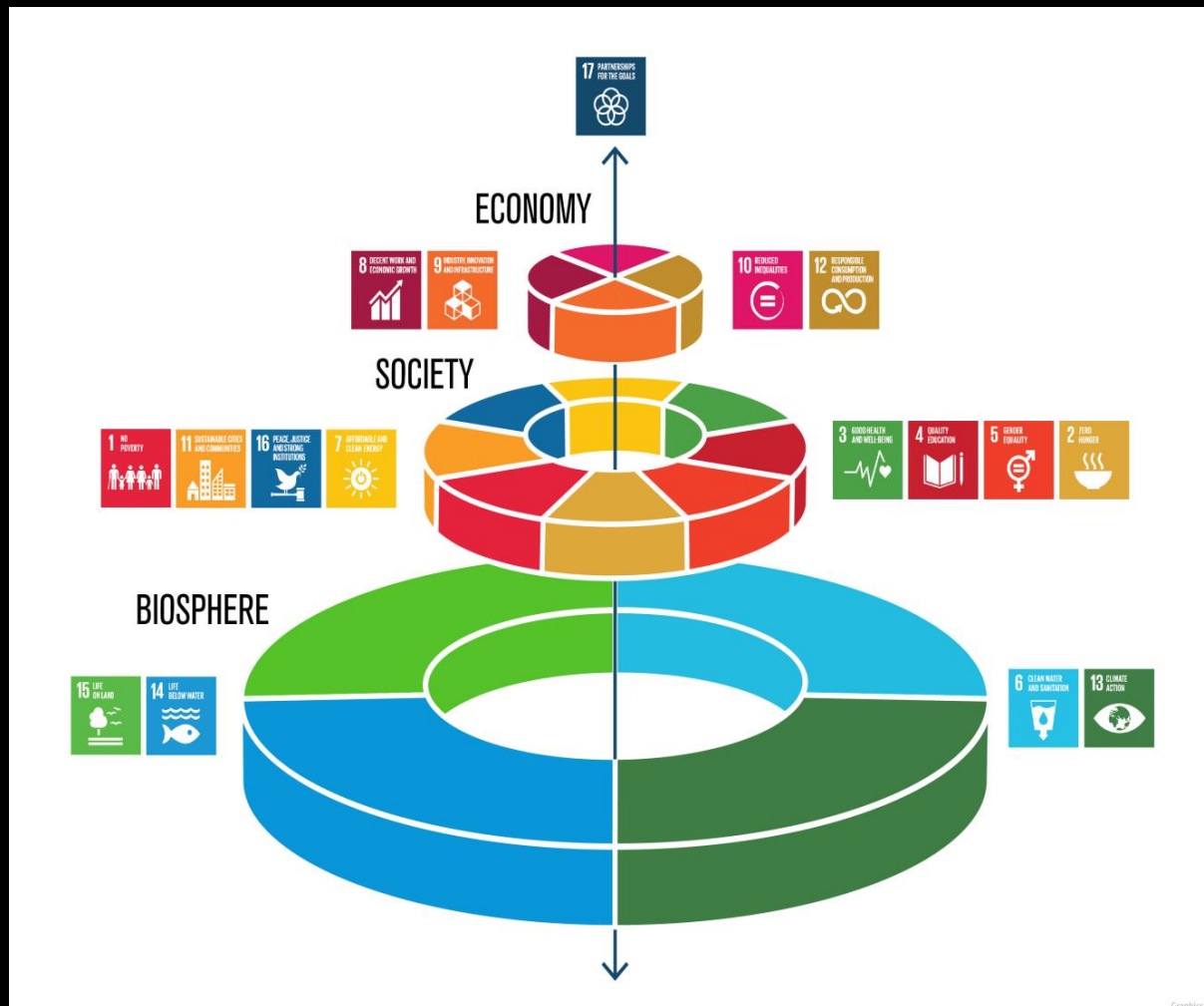


Management Effectiveness(METT)

PA coverage

.....Indicators have limitations

The GEF and the SDGs



Credit: Stockholm Environment Institute



Q: How many SDG Goals, Targets
and indicators are there ?

A: SDGs- 17 goals, 169 targets
and 232 indicators

Huge Data Needs

SDGs and Earth Observation(EO)



Data from satellite imagery and sensor networks make environment and development indicators increasingly measurable

Geospatial Information and SDGs

Sustainable Development Goals										Earth Observations in Service of the Agenda 2030			
Target										Goal		Indicator	
Contribute to progress on the Target yet not the Indicator per se										Direct measure or indirect support			
							1.4	1.5		1	1.4.2		
					2.3	2.4	2.c		2	2.4.1			
					3.3	3.4	3.9	3.d	3	3.9.1			
									4				
								5.a	5	5.a.1			
		6.1	6.3	6.4	6.5	6.6	6.a	6.b	6	6.3.1	6.3.2	6.4.2	6.5.1
					7.2	7.3	7.a	7.b	7	7.1.1			
								8.4	8				
					9.1	9.4	9.5	9.a	9	9.1.1	9.4.1		
					10.6	10.7	10.a		10				
	11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11	11.1.1	11.2.1	11.3.1	11.6.2
				12.2	12.4	12.8	12.a	12.b	12	12.a.1			
				13.1	13.2	13.3	13.b		13	13.1.1			
		14.1	14.2	14.3	14.4	14.6	14.7	14.a	14	14.3.1	14.4.1	14.5.1	
	15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15	15.1.1	15.2.1	15.3.1	15.4.1
									16				
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17	17.6.1	17.18.1		

Targets and indicators that can be supported by Earth Observations
Credit: GEOS

	Population distribution	Cities and infrastructure mapping	Elevation and topography	Land cover and use mapping	Oceanographic observations	Hydrological and water quality observations	Atmospheric and air quality monitoring	Biodiversity and ecosystem observations	Agricultural monitoring	Hazards, disasters and environmental impact monitoring
 SUSTAINABLE DEVELOPMENT GOALS										
1 No poverty										
2 Zero hunger										
3 Good health and well-being										
4 Quality education										
5 Gender equality										
6 Clean water and sanitation										
7 Affordable and clean energy										
8 Decent work and economic growth										
9 Industry, innovation and infrastructure										
10 Reduced inequalities										
11 Sustainable cities and communities										
12 Responsible consumption and production										
13 Climate action										
14 Life below water										
15 Life on land										
16 Peace, justice and strong institutions										
17 Partnerships for the goals										

Alignments of the Goals with Geospatial information

Questions we seek to answer through evaluation

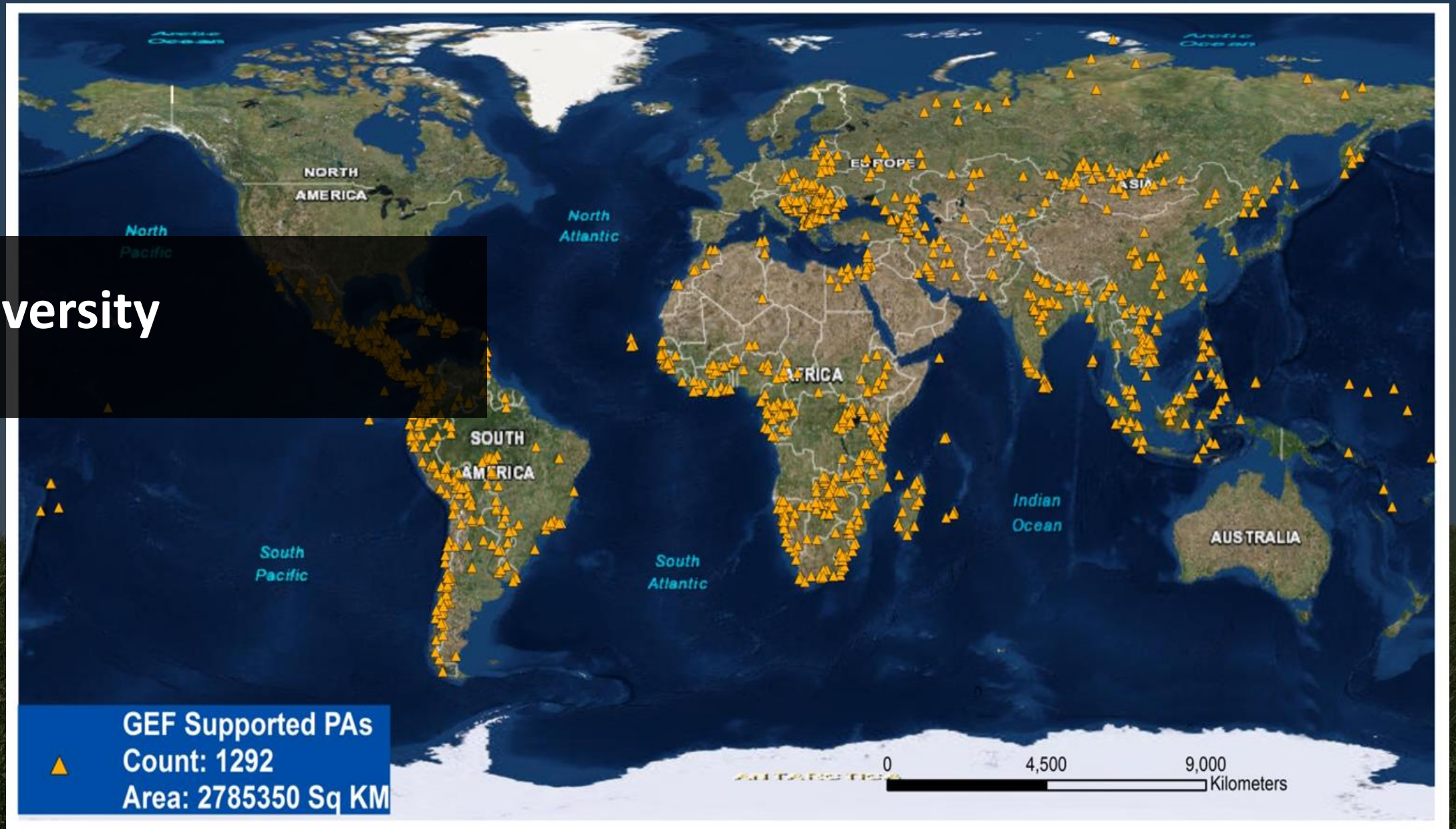
- Relevance of the intervention—is it in the right context?
- Trends in performance and impacts going far back in time...even if we didn't have baseline data?
- Attribution: Did the GEF make a difference? – counterfactuals
- Does the intervention deliver value for money?

Biodiversity

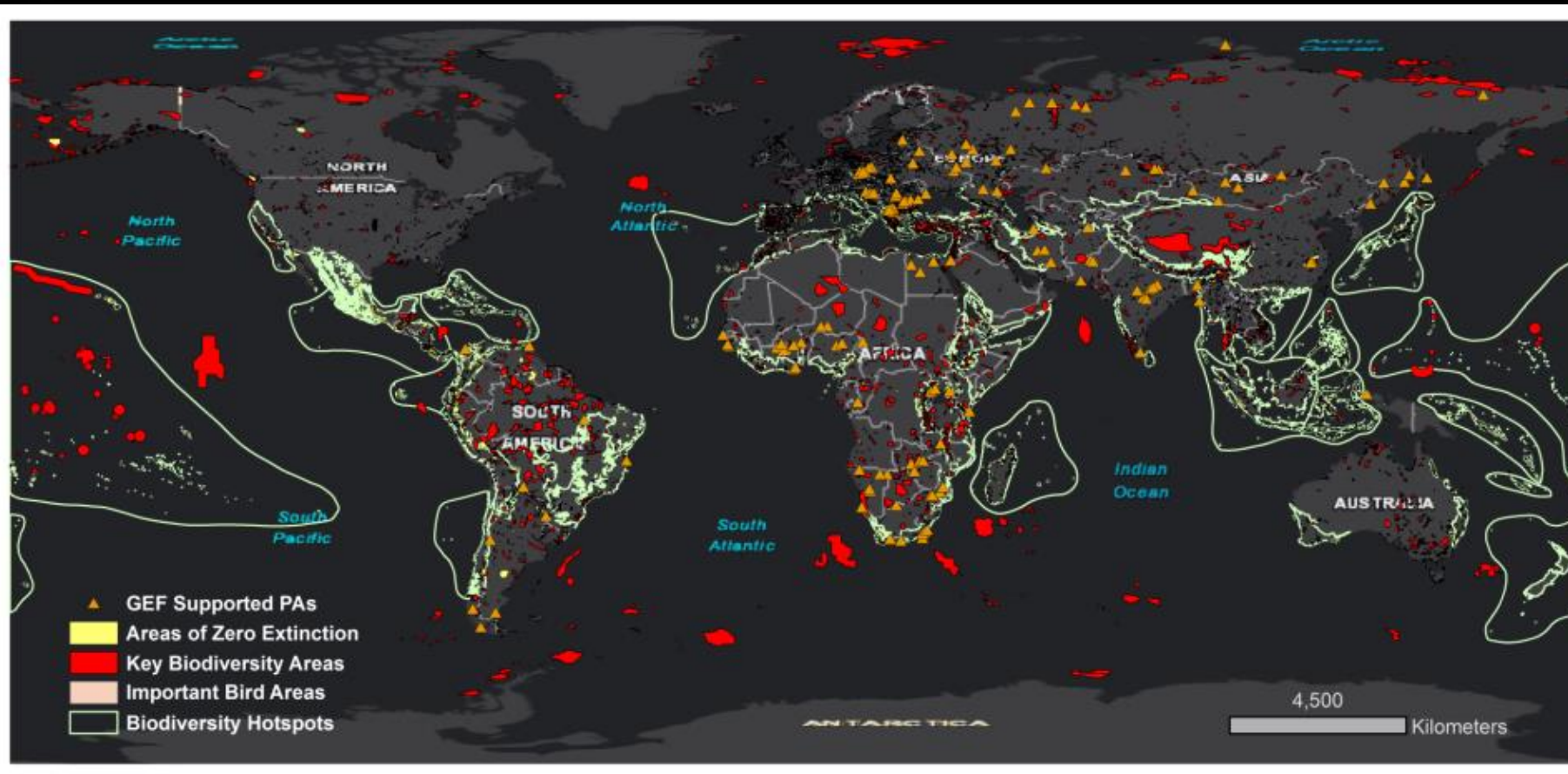


- **Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss**
- **Indicators**
 - Annual change in forest area and land under cultivation*: Geospatial data
 - Area of forest under sustainable forest management as a percent of forest area: Geospatial data/Administrative data
 - Red List Index: Telemetry, Tracking Data, Surveys/International monitoring
 - Protected areas overlay with key biodiversity areas (KBAs)

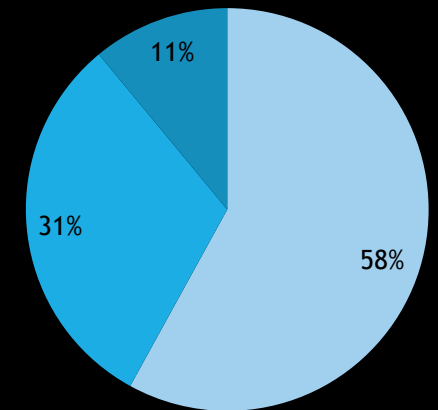
Biodiversity



Biodiversity: Relevance

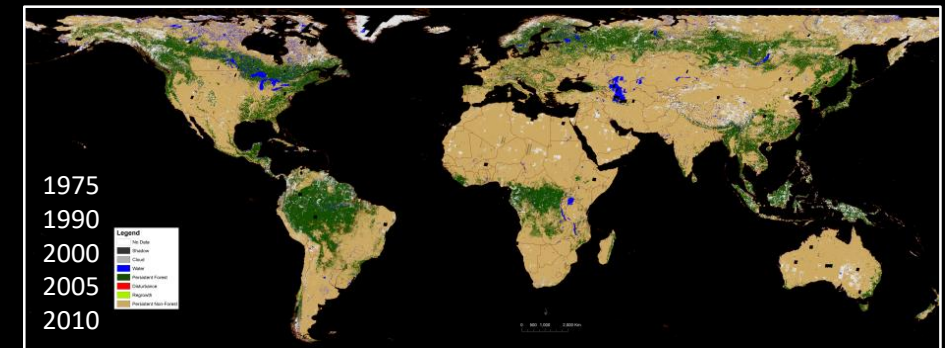
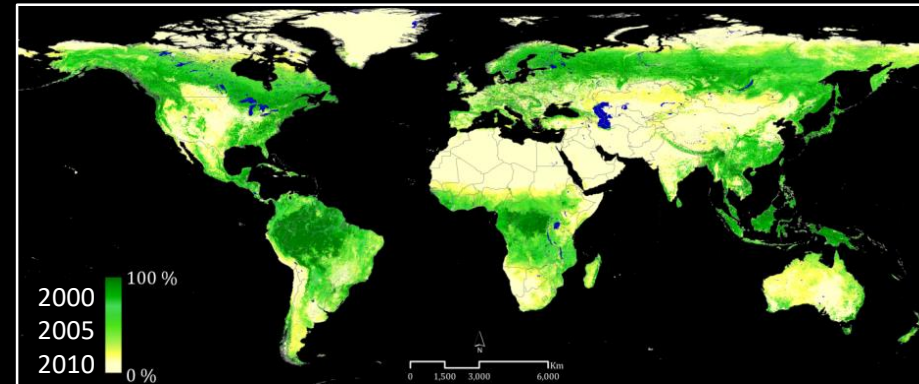
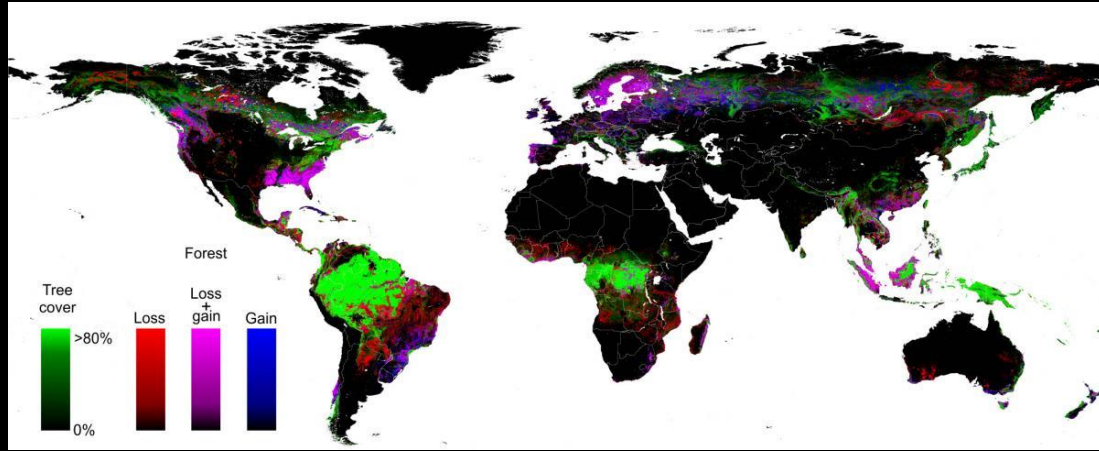


KEY BIODIVERSITY AREAS, highest scientific designation of global biodiversity significance

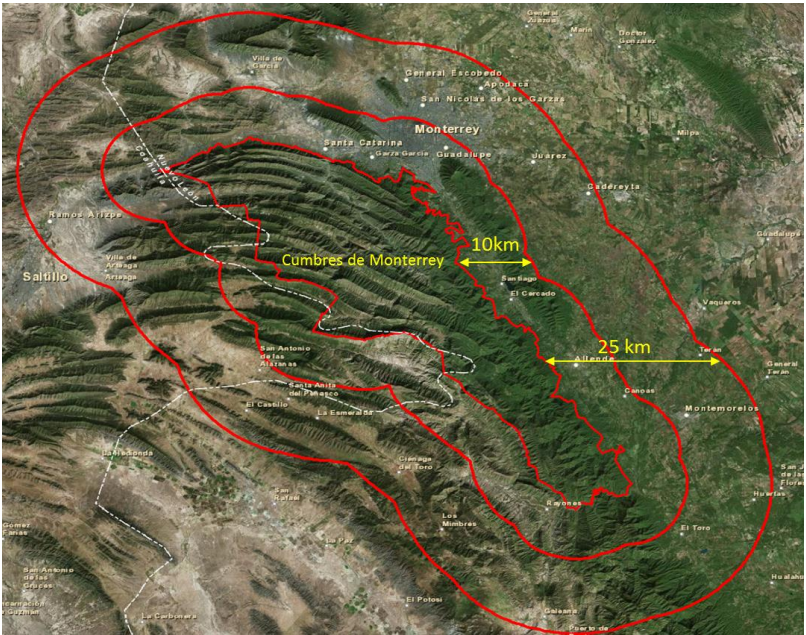


■ KBA ■ International Designation ■ National Importance

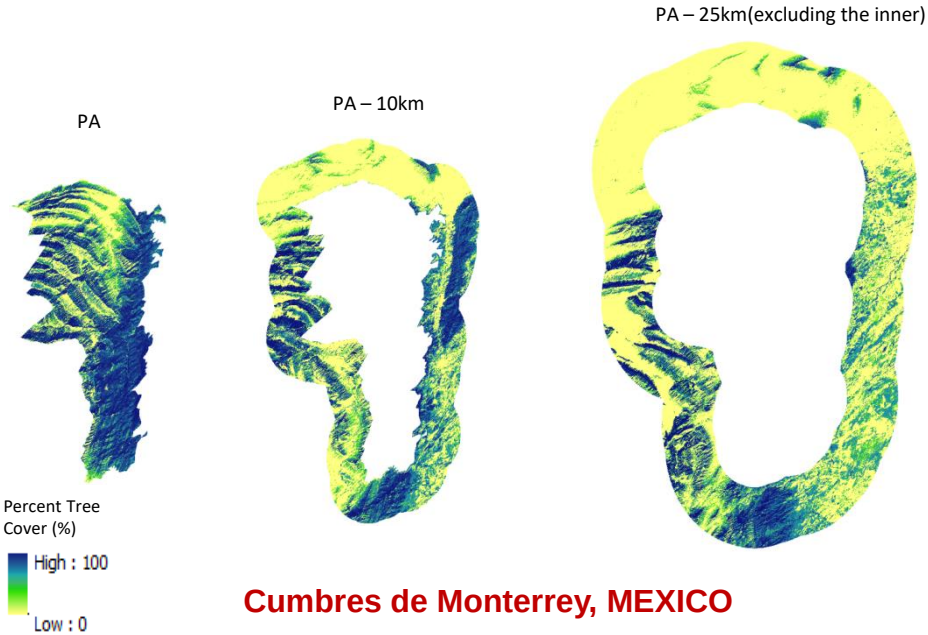
Study the impact of GEF support to 1292 global protected areas across 147 countries.



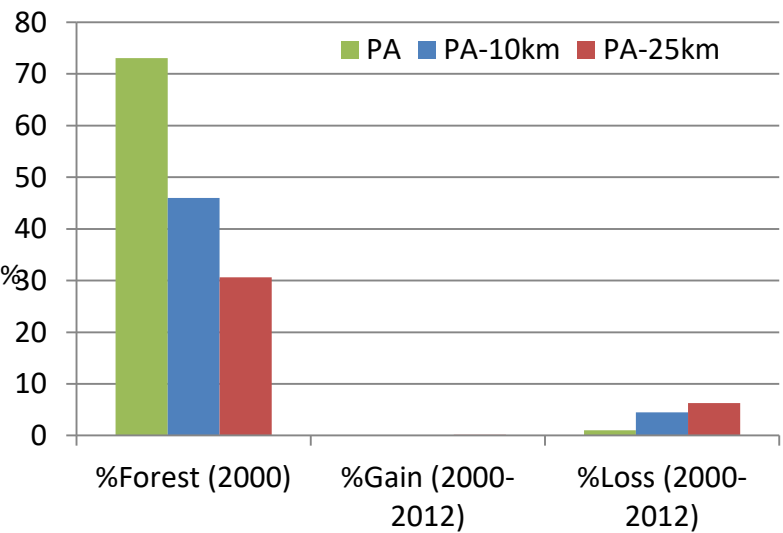
Forest Cover Change Analysis



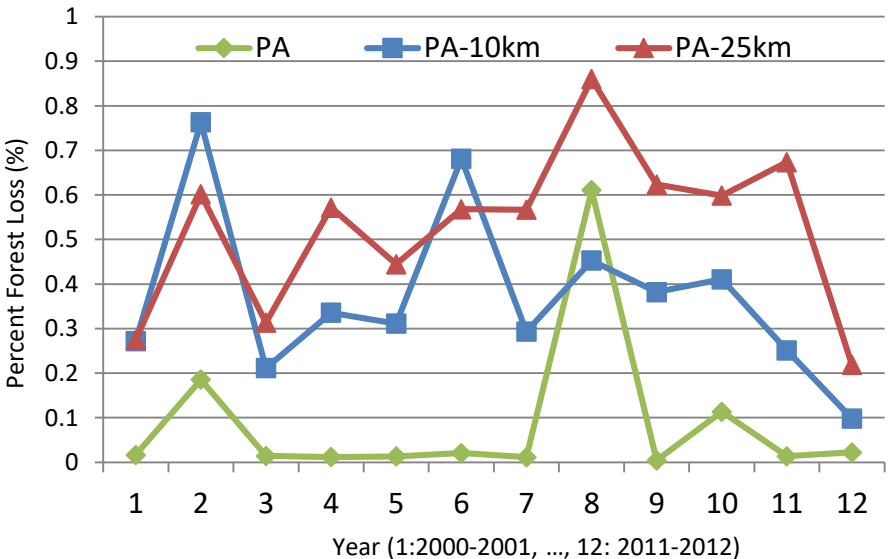
Percent Tree Cover (2000)



Decadal Forest Cover, Gain and Loss (2000 – 2012)



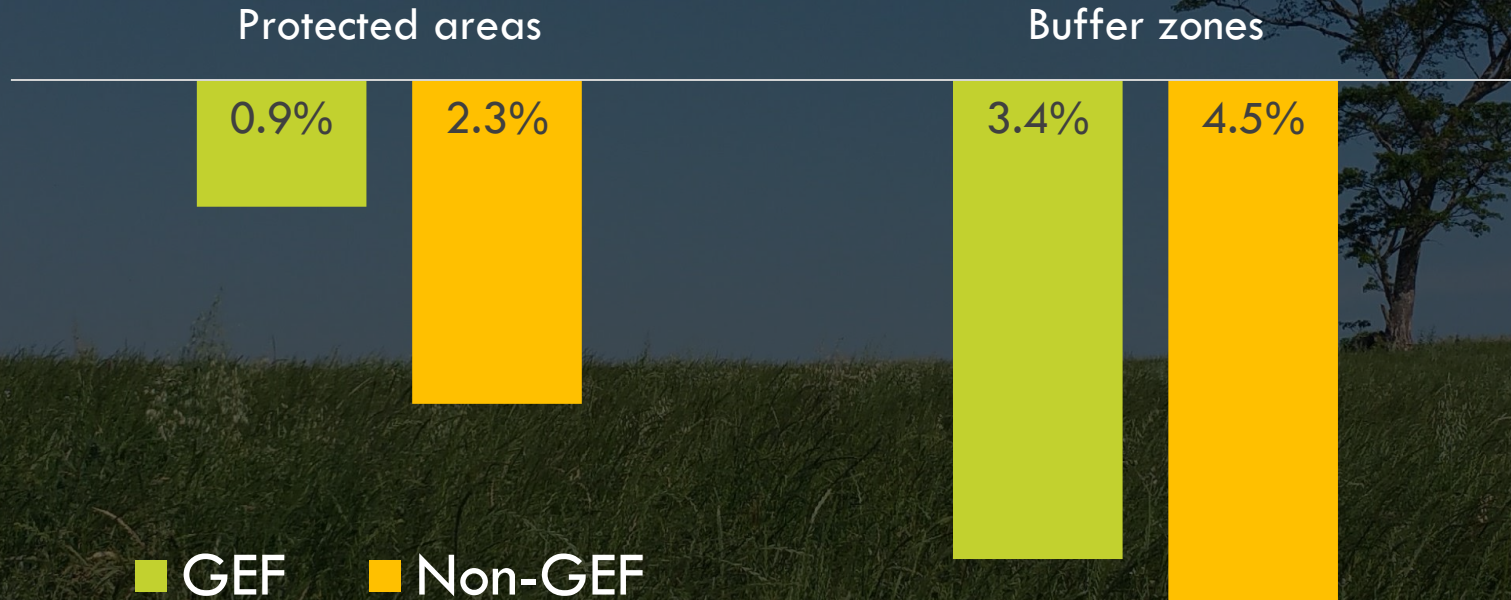
Yearly Percent of Forest Loss (2000 – 2012)

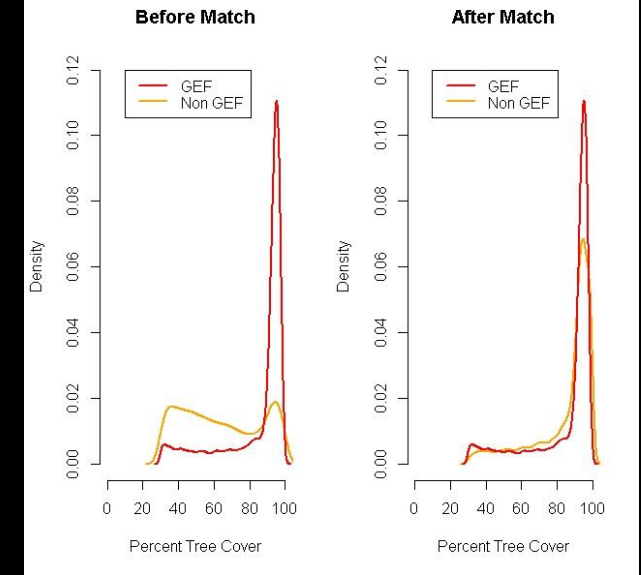
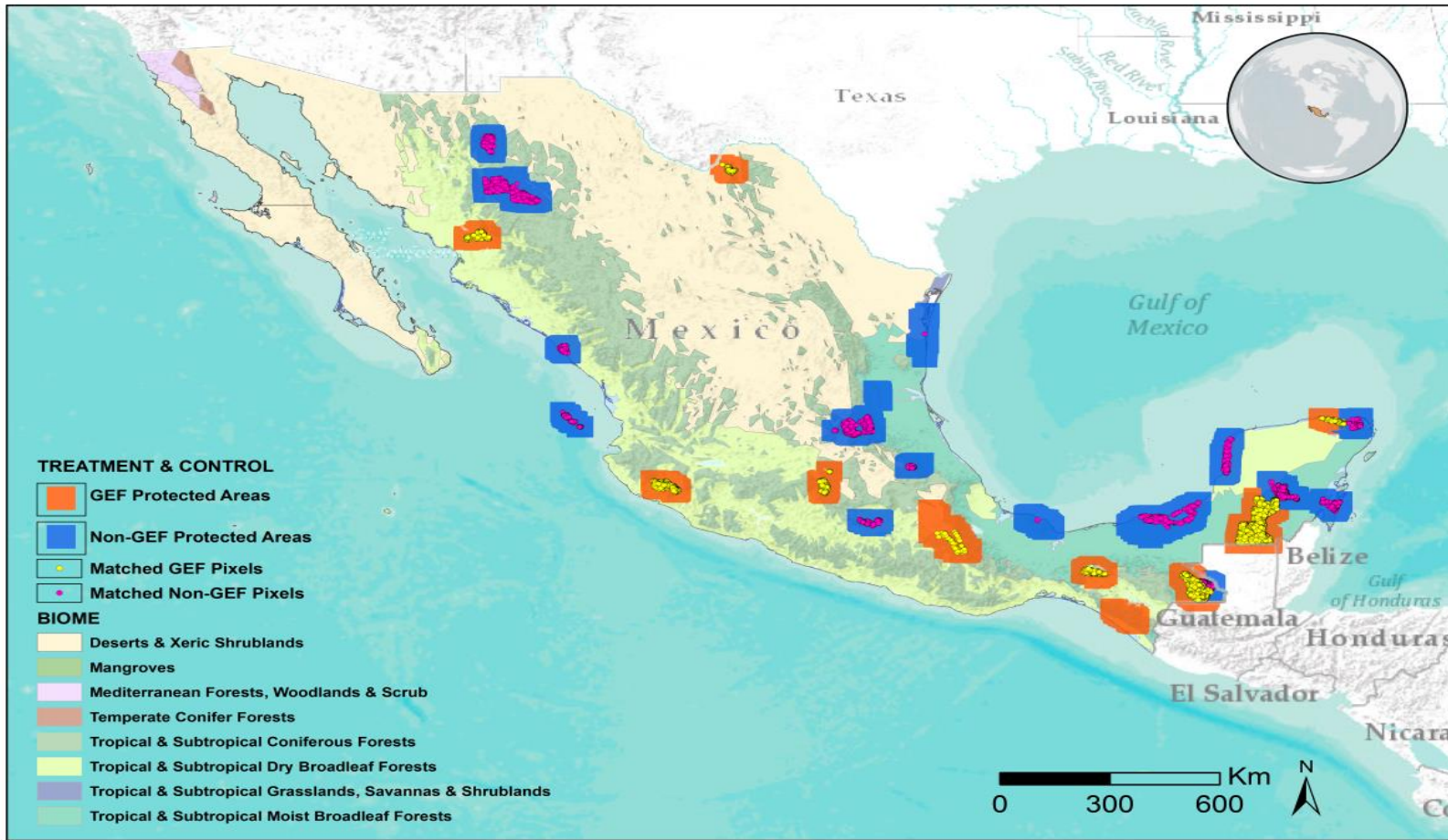


DEMONSTRATING IMPACT

Biodiversity: Global

Forest cover loss (2000-2012)



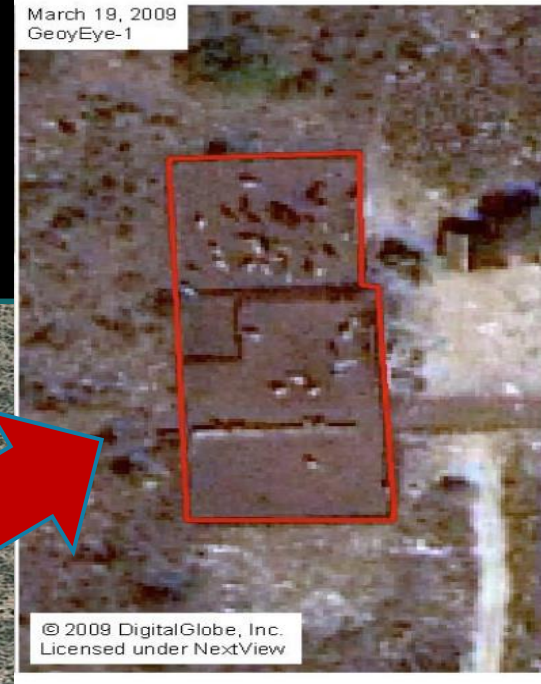
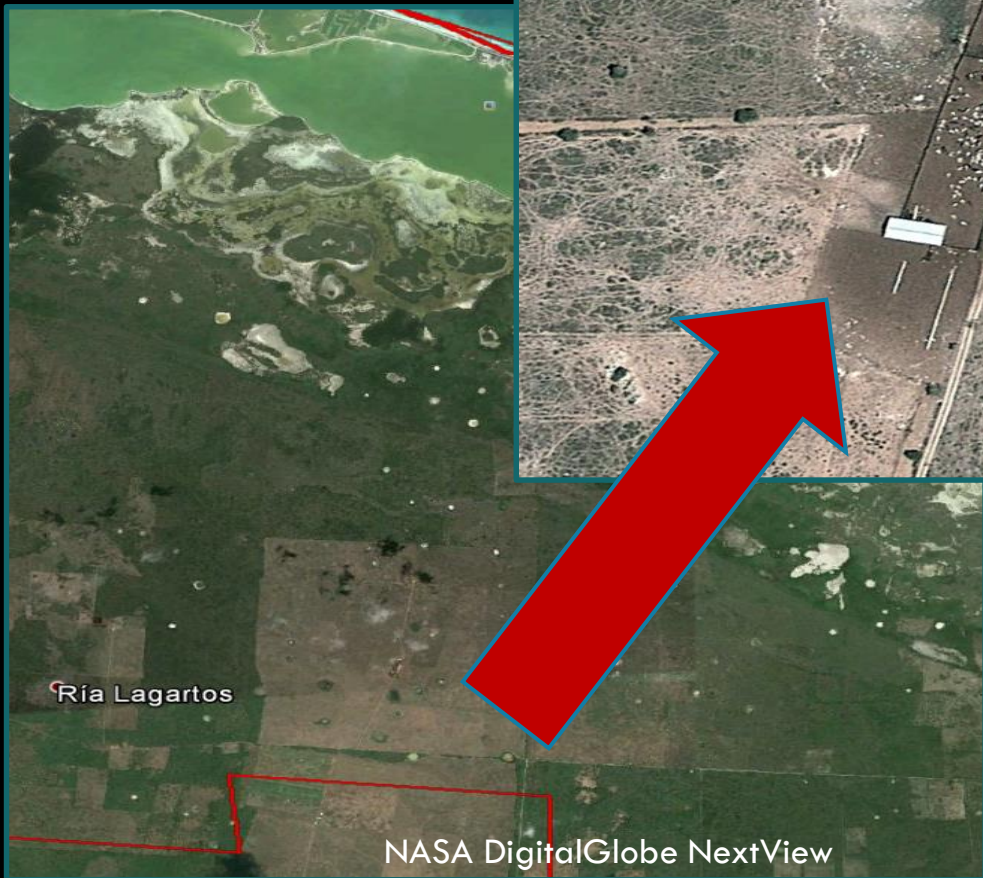


GEF-supported PAs have
23% less forest loss

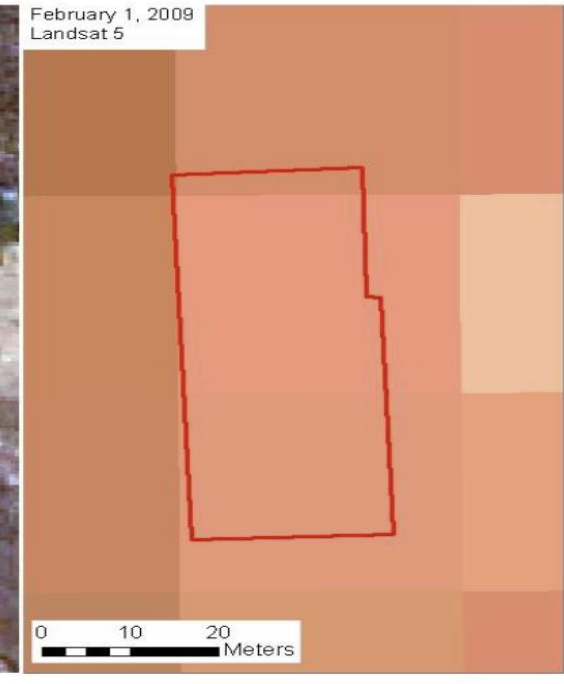
Attribution: Did the intervention cause the change?

Quasi-experimental evaluation design based on Propensity score matching

Identify the drivers



2.5 m



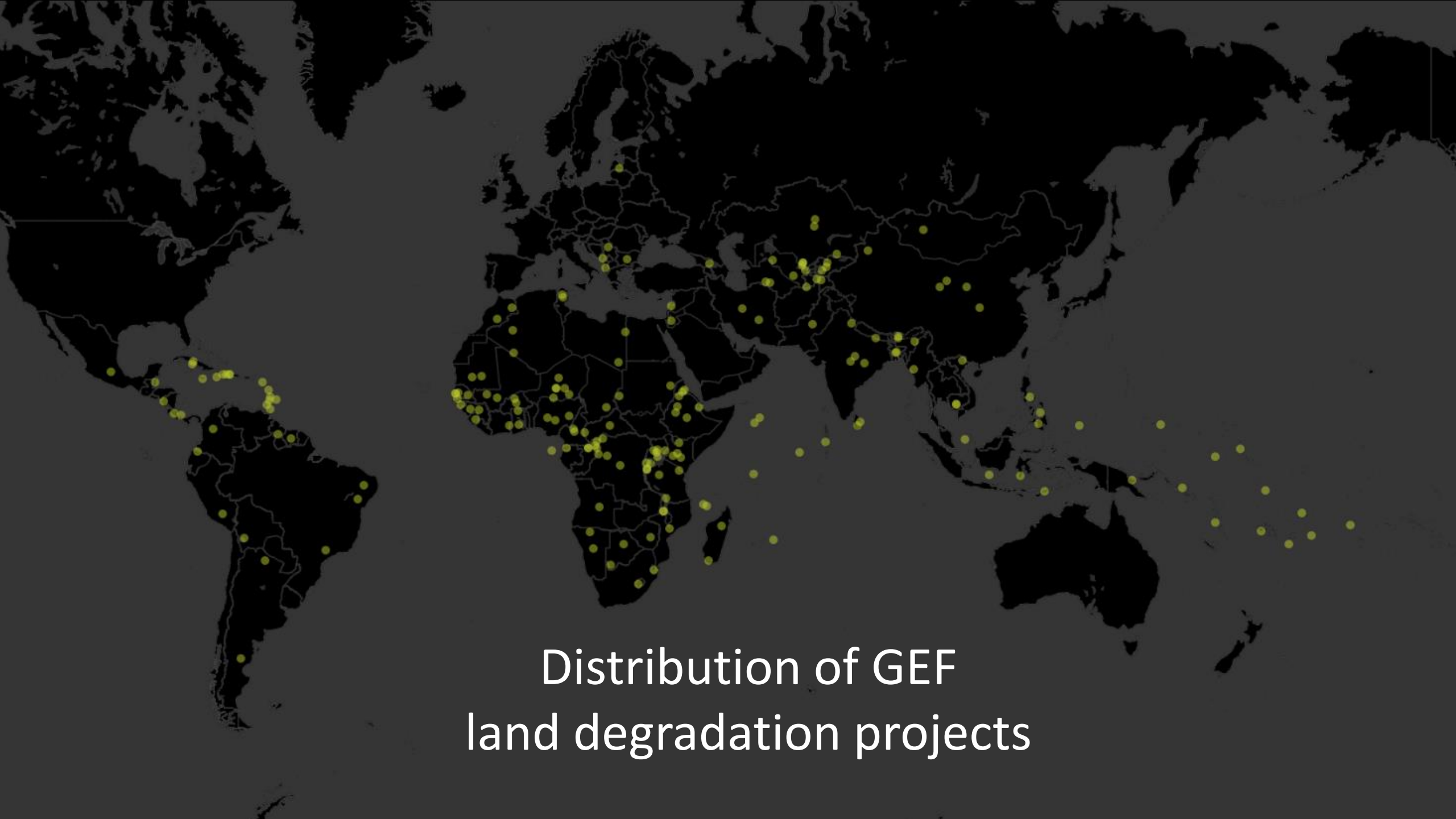
30 m zoomed in to 2.5 m

Images at 2.5 to 0.5 m resolution used to identify drivers of change that hinder success of GEF support

Land degradation



- Goal 15: Sustainably manage forests, combat desertification, halt and reverse **land degradation**, halt biodiversity loss
 - Indicator for Goal 15
 - Annual change in degraded or desertified arable land (% or ha): Remote sensing/satellite and administrative data.
- UNCCD Indicators for Land Degradation Neutrality(LDN)
 - Vegetation productivity (NDVI)
 - Landuse and landcover change and
 - Carbon sequestration



Distribution of GEF
land degradation projects

LAND DEGRADATION

Value for money analysis: 3 main objectives

1

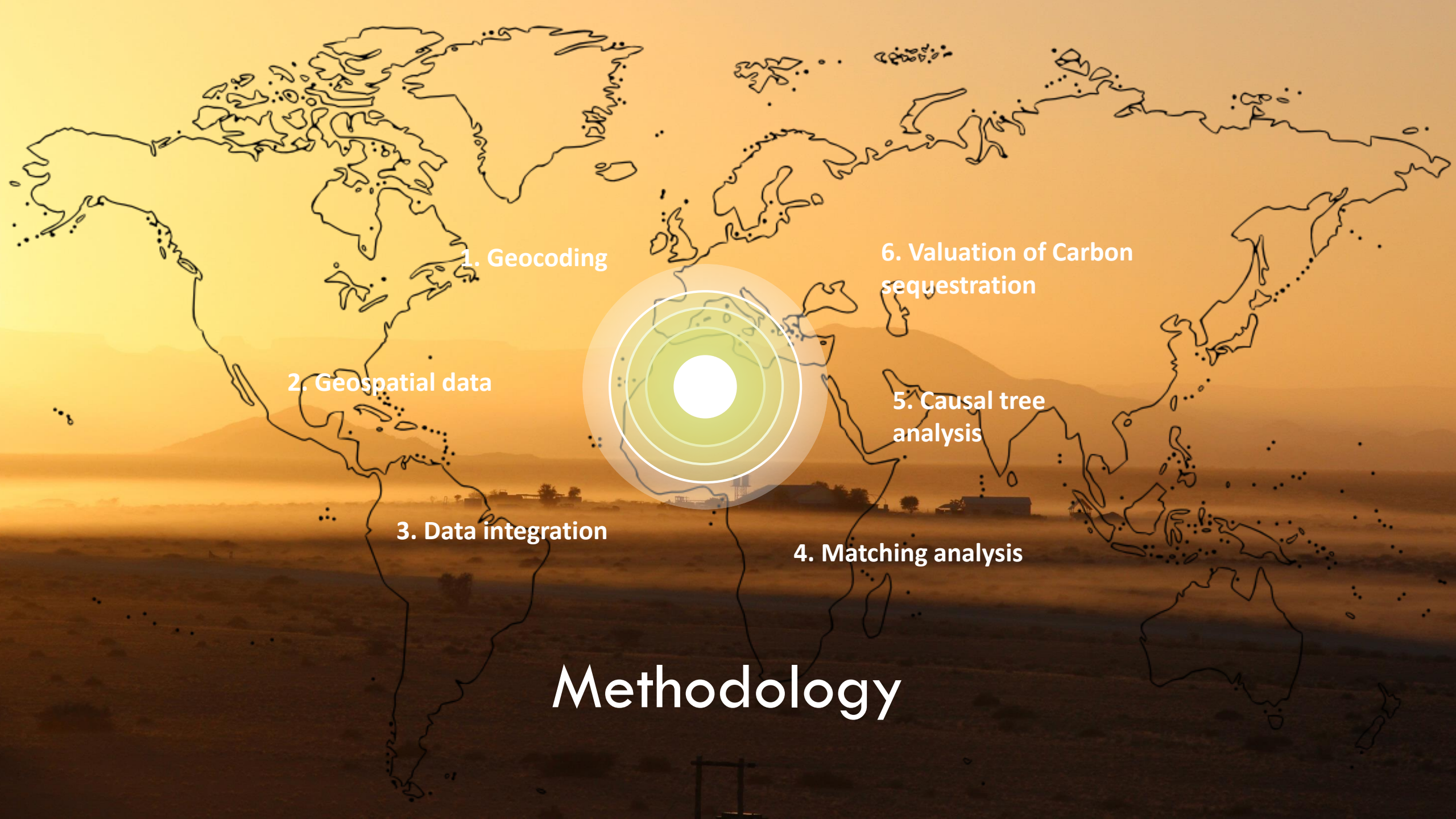
Impact of GEF land degradation interventions

2

Factors associated with the environmental outcomes

3

Value for money in terms of carbon sequestered



1. Geocoding

2. Geospatial data

3. Data integration

4. Matching analysis

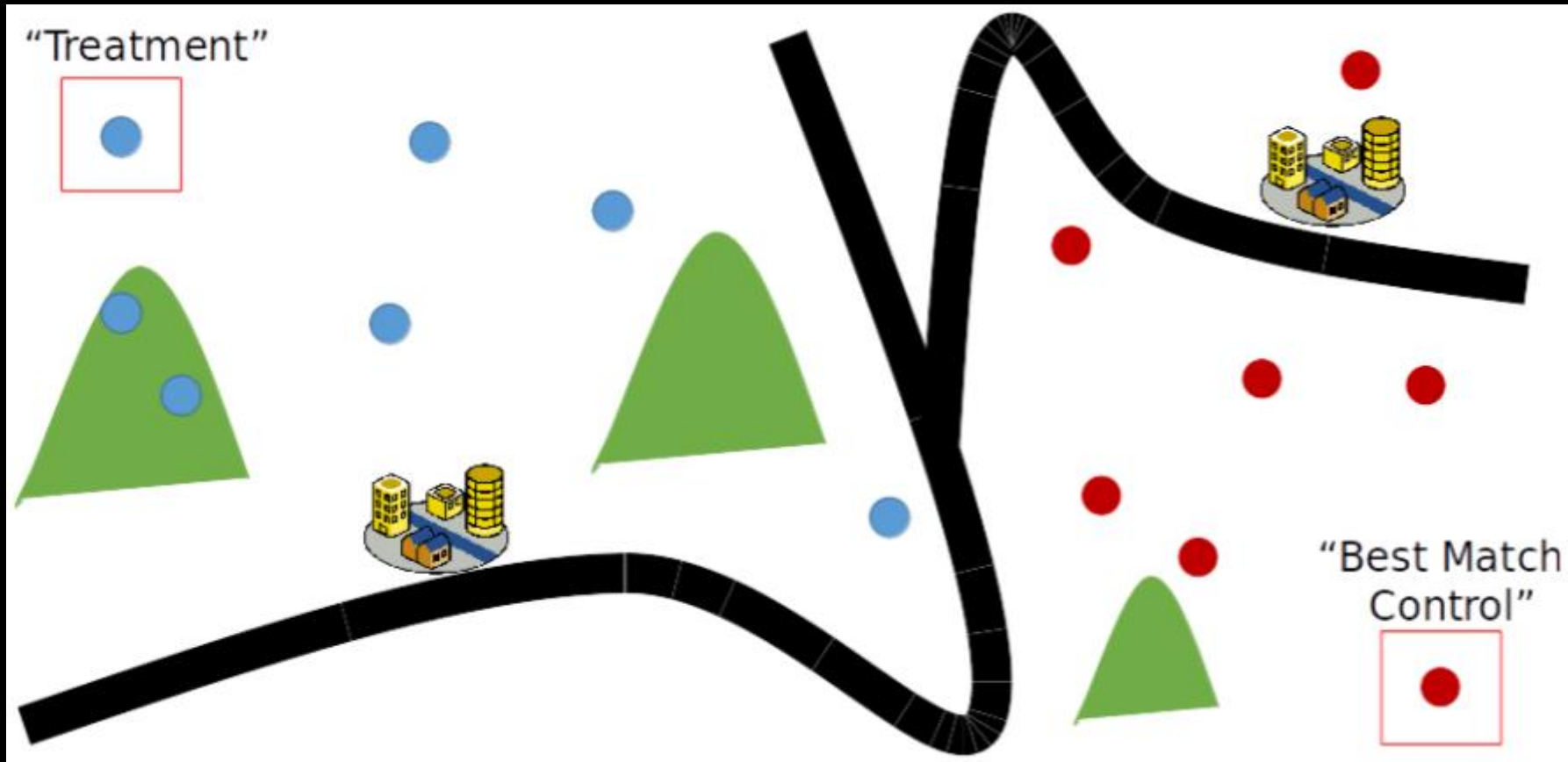
6. Valuation of Carbon
sequestration

5. Causal tree
analysis

Methodology

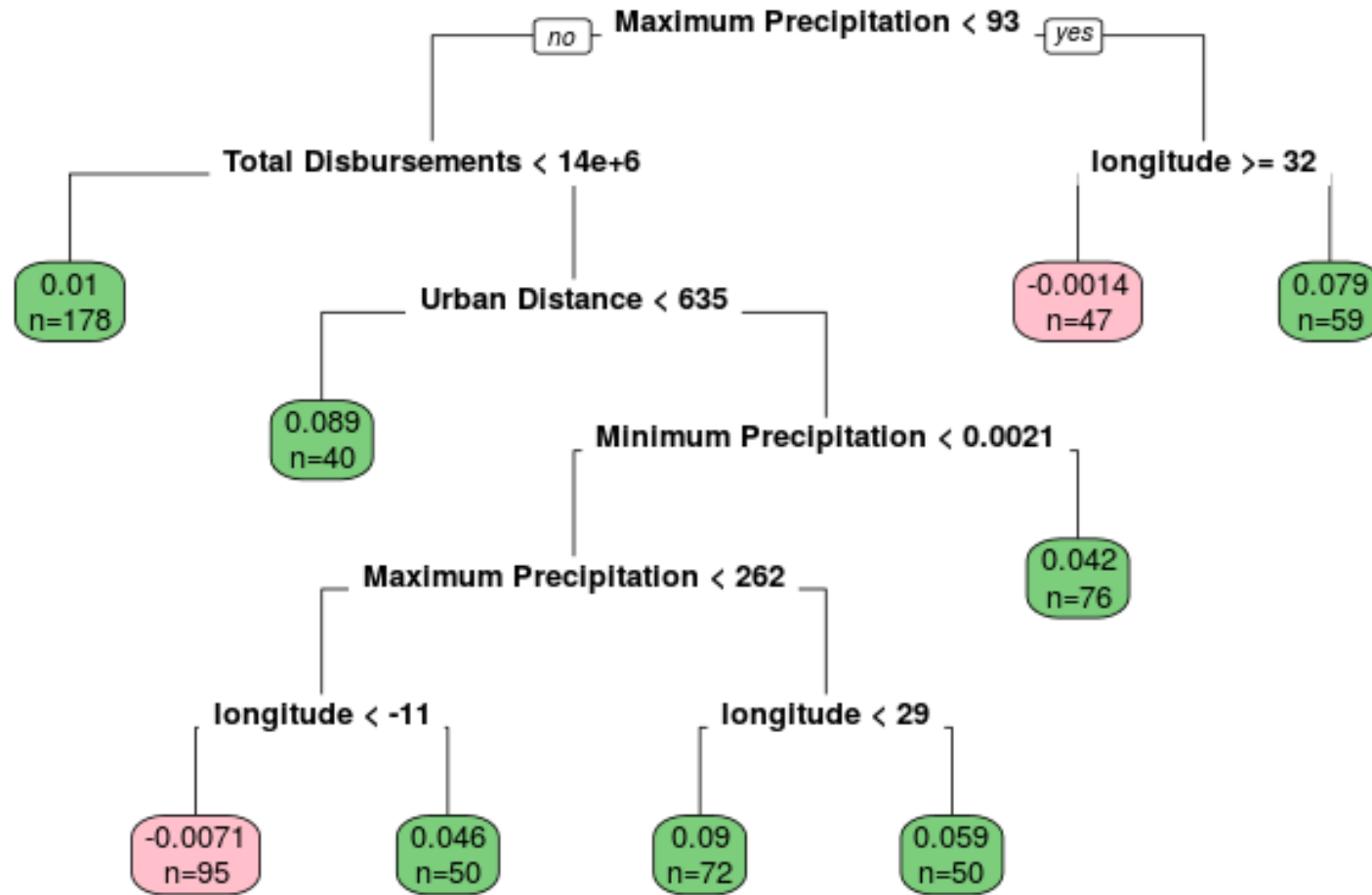
LAND DEGRADATION

Quasi-experimental method



LAND DEGRADATION

Machine learning and causal tree



LAND DEGRADATION

Finding: value for money



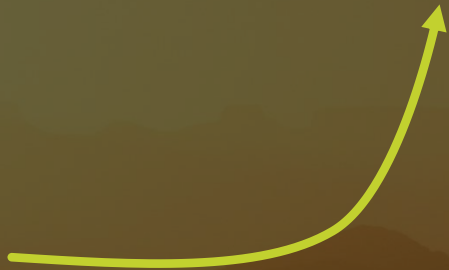
**Vegetation
productivity**



**forest loss and
land fragmentation**

LAND DEGRADATION

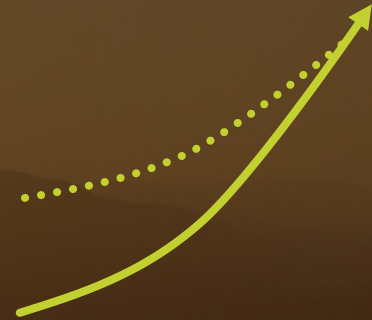
Findings: value for money



Lag time of
4.5 to 5.5 years for
impacts to be
observed



Access to electricity
associated with higher
impact

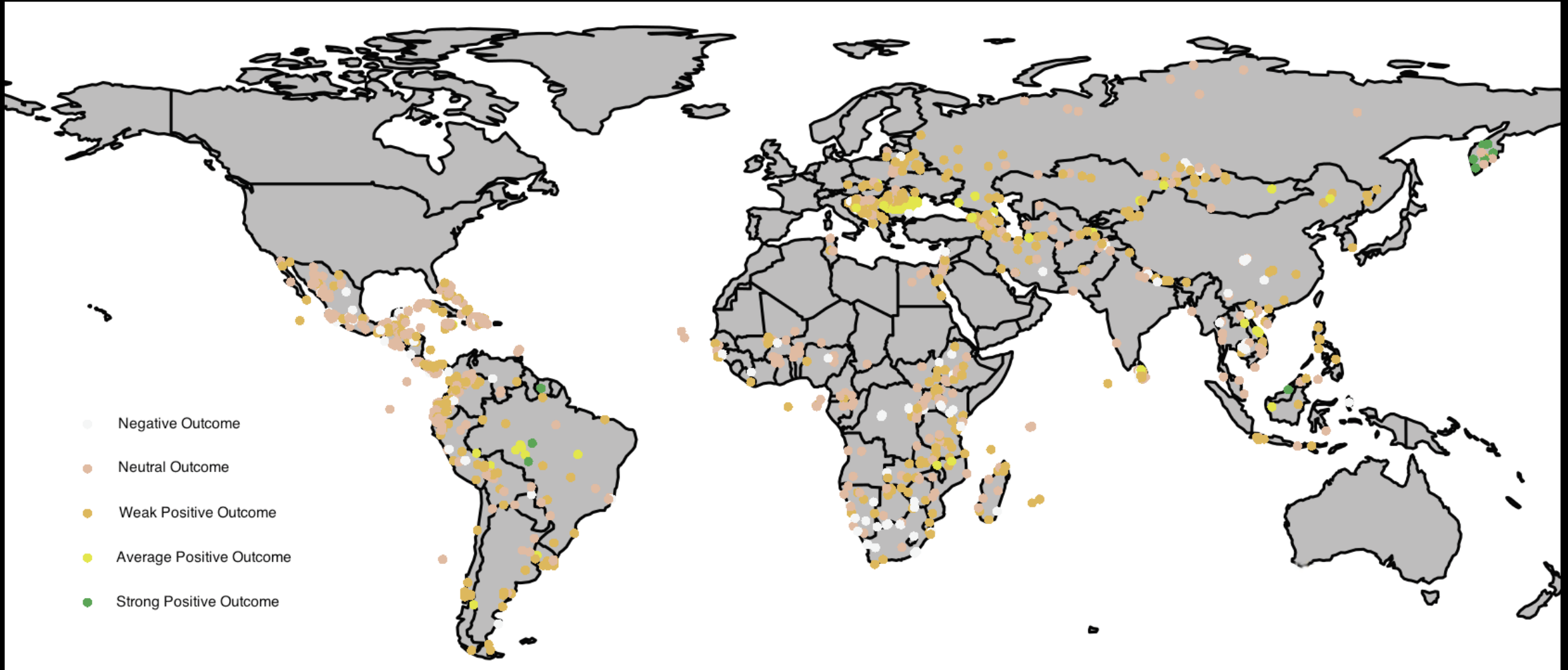


Higher impact observed
in areas with poor initial
conditions

LAND DEGRADATION

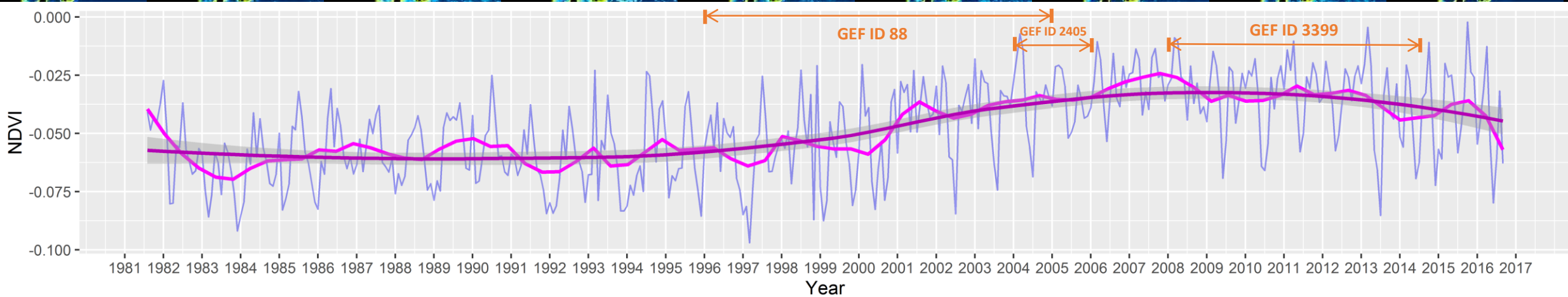
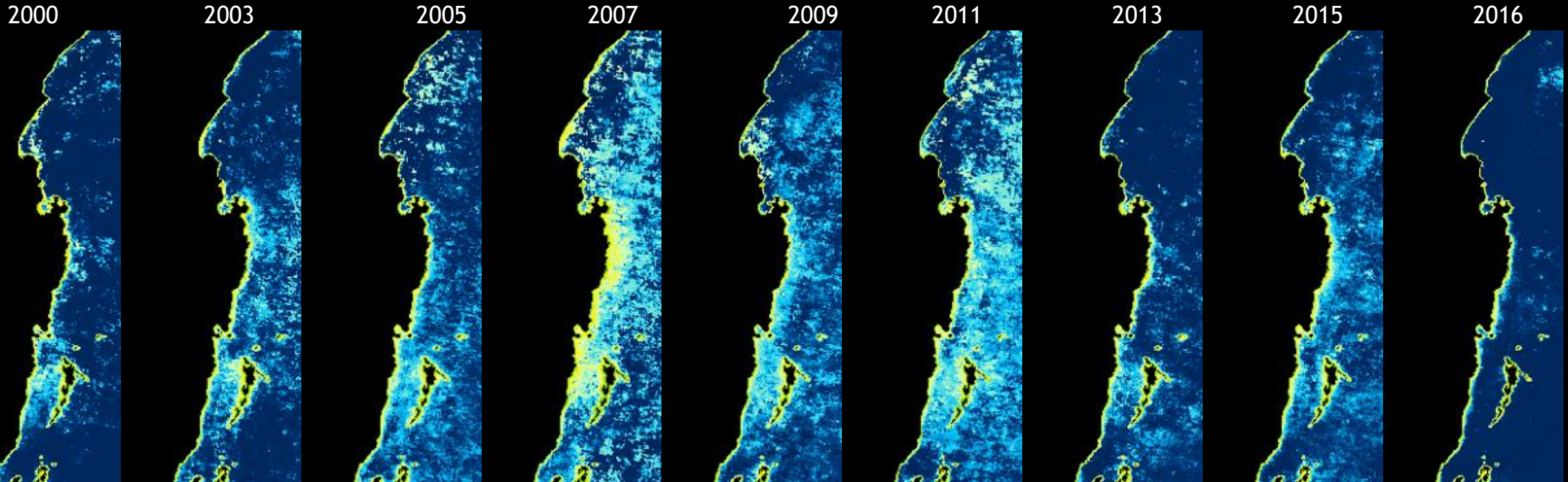
Bang for the buck

\$1:1.08

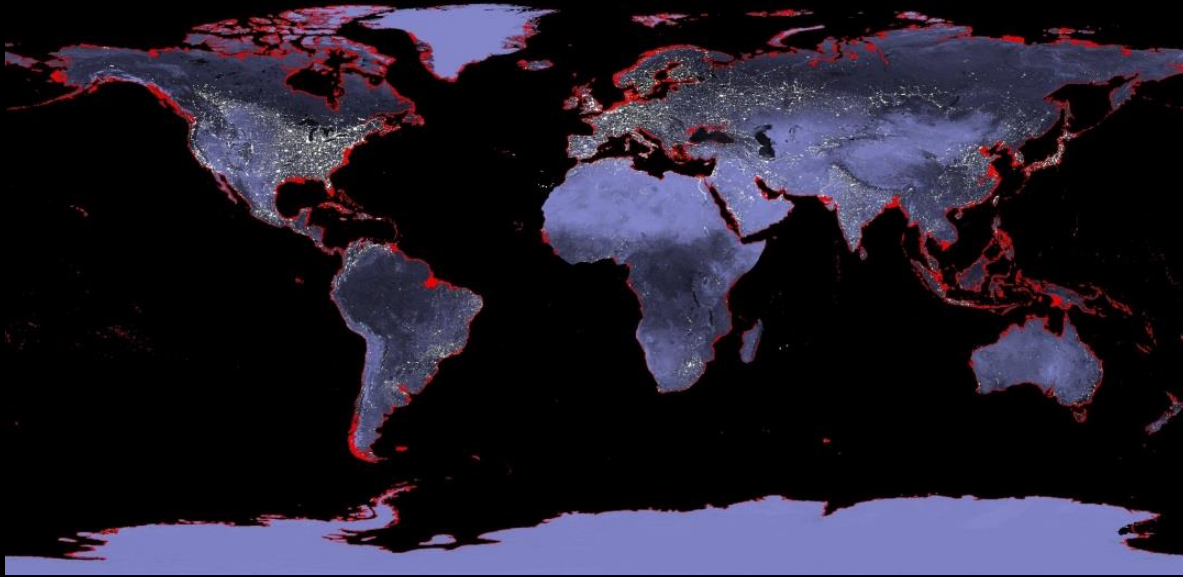


DEMONSTRATING IMPACT

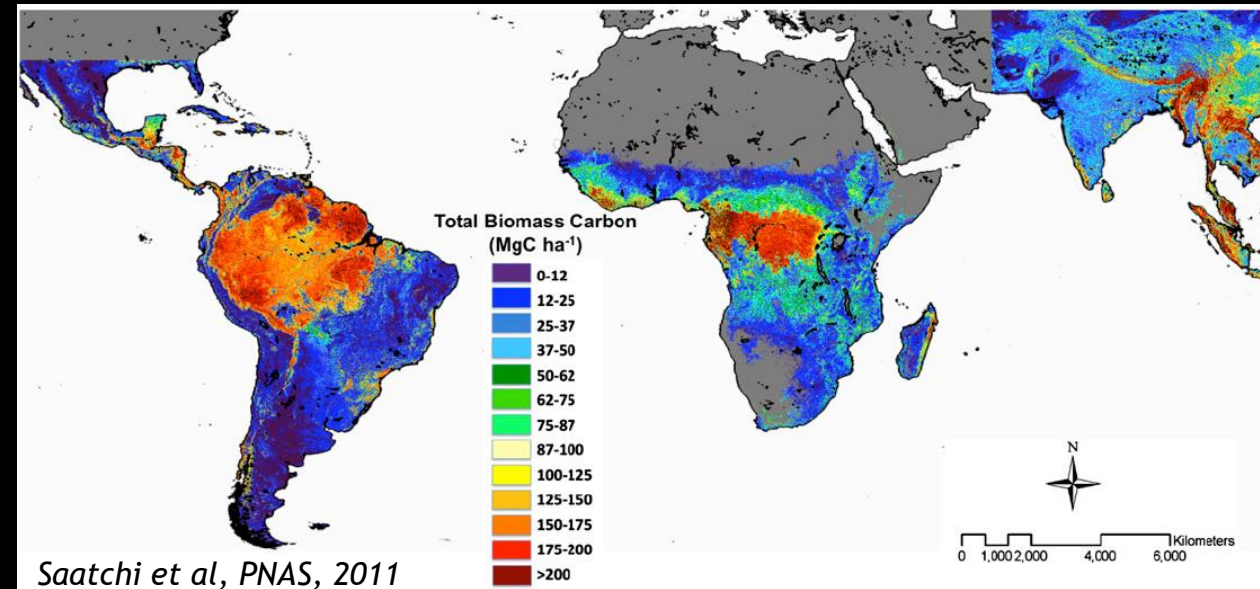
International waters: Lake Victoria



Climate Action



Areas vulnerable to sea level rise



Saatchi et al, PNAS, 2011

Aboveground biomass

Ecological forecasting: Predicting the future

1

Estimating the impact

2

Project design

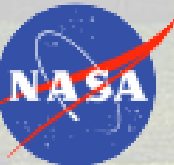
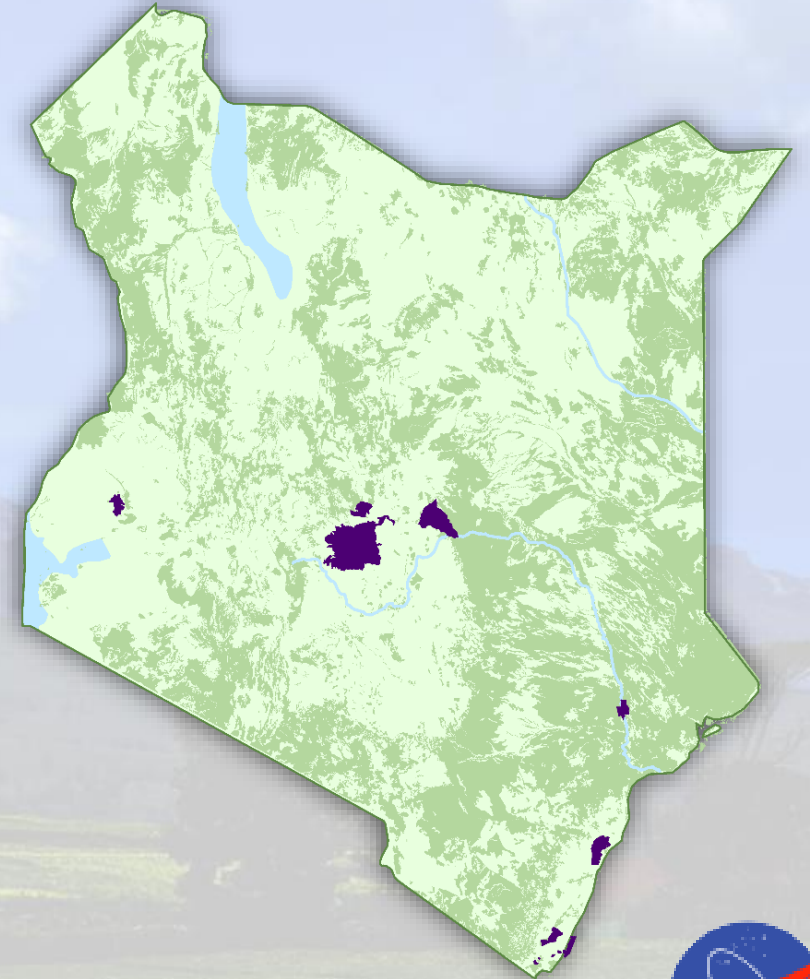
3

Scenario building

Kenya Ecological Forecasting

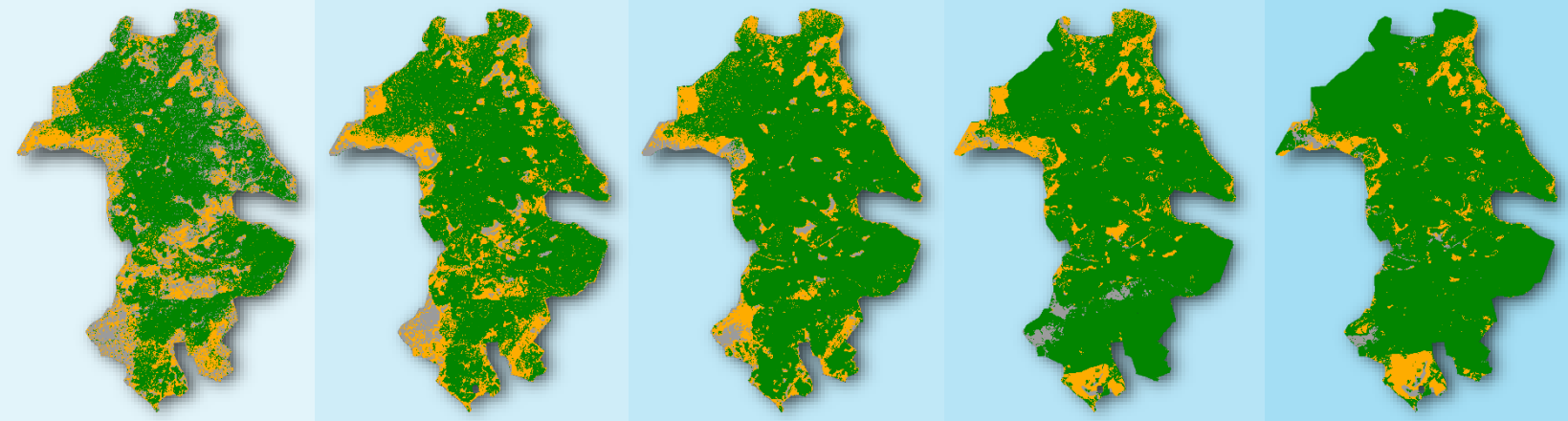
“Estimating Carbon Sequestration within Global Environment Facility (GEF) Funded Protected Areas in Kenya to Aid Future Policy”

- Research collaboration between the Global Environment Facility’s Independent Evaluation Office (GEF-IEO) and NASA DEVELOP program
- Evaluated land cover and aboveground carbon stocks for 12 GEF protected areas in Kenya

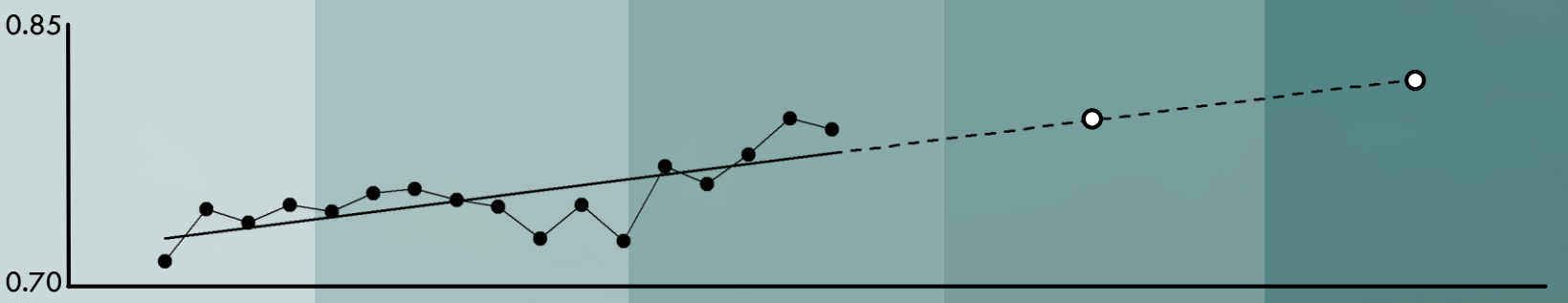


Land Cover Change

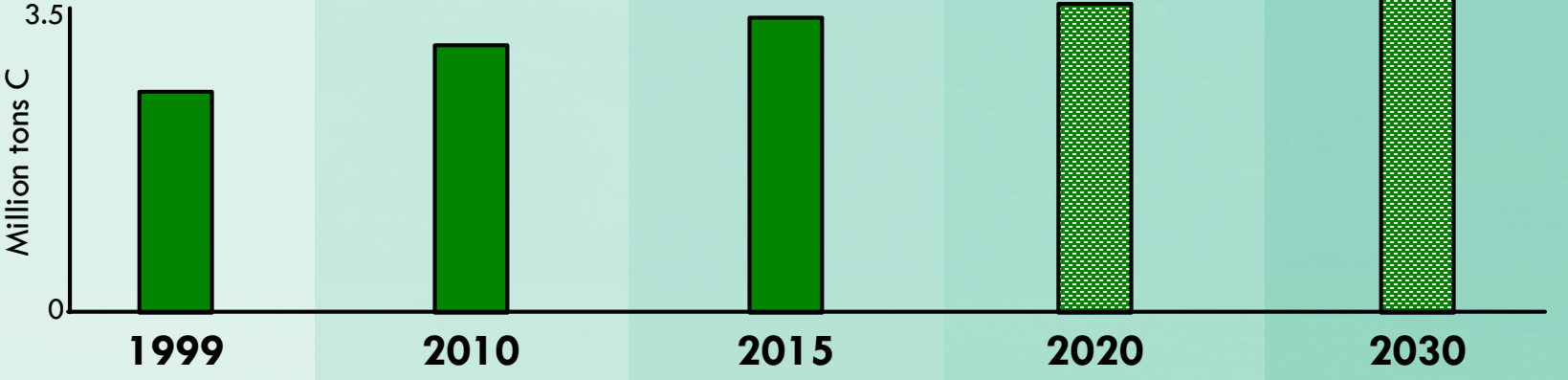
Forest Non-vegetated Shrub



NDVI

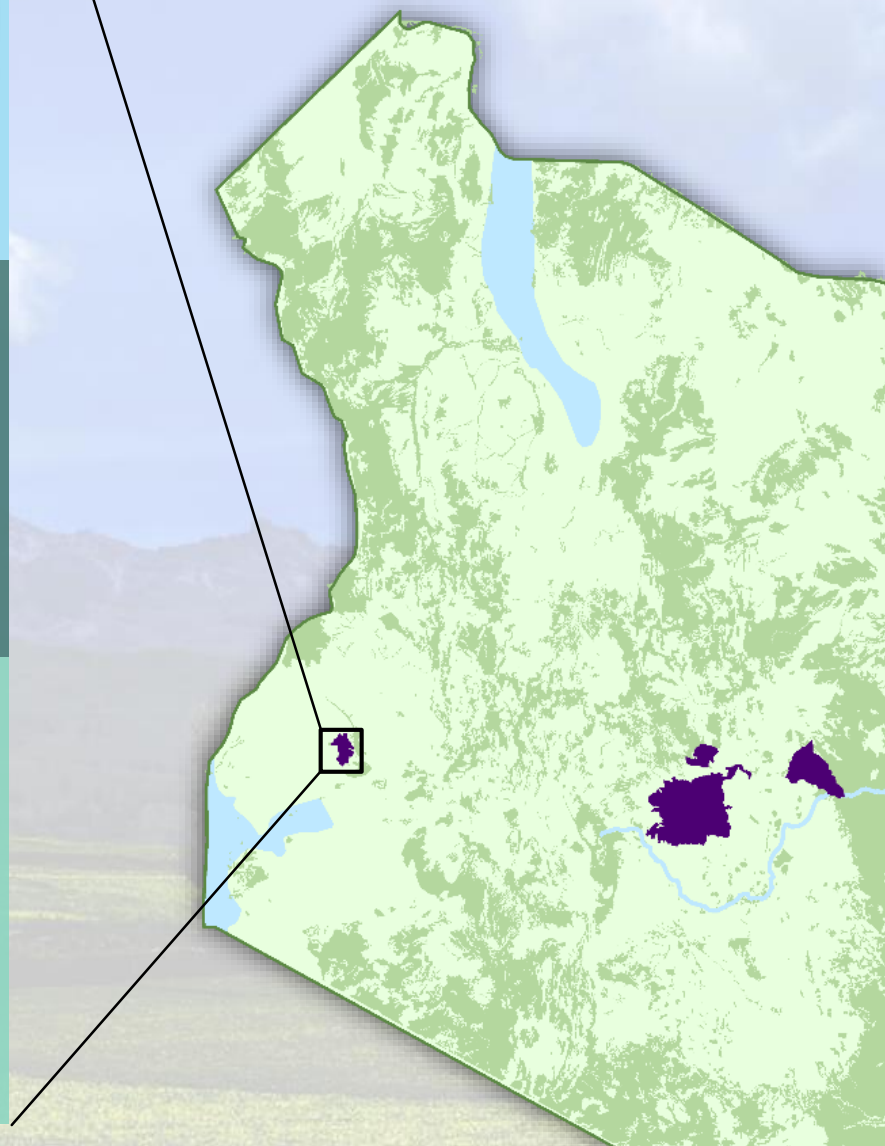


Carbon Sequestration



Case Study:

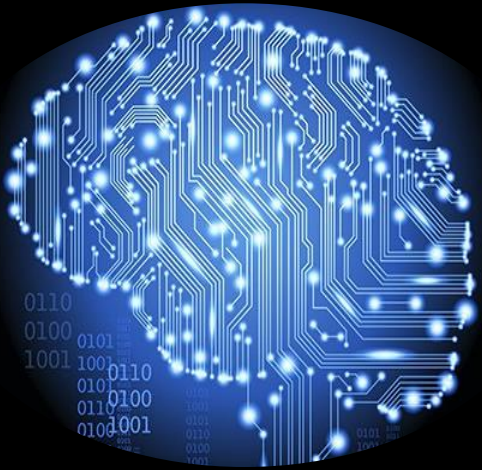
Kakamega Forest Reserve



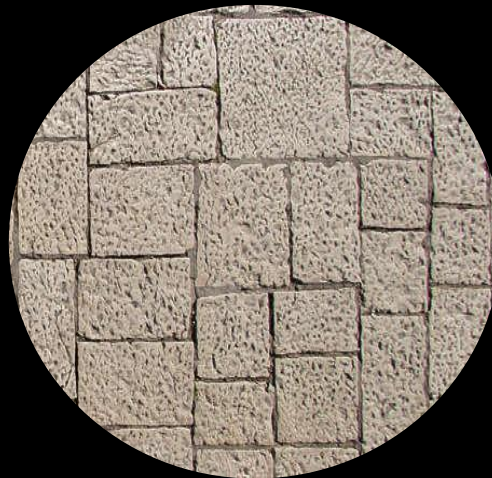
Triangulating Across Methods



Challenges and Limitations



High computing
power and
technical skills
needed



Uneven availability and
accuracy of contextual
variables across sites



Cannot always answer
"how" and "why"
questions



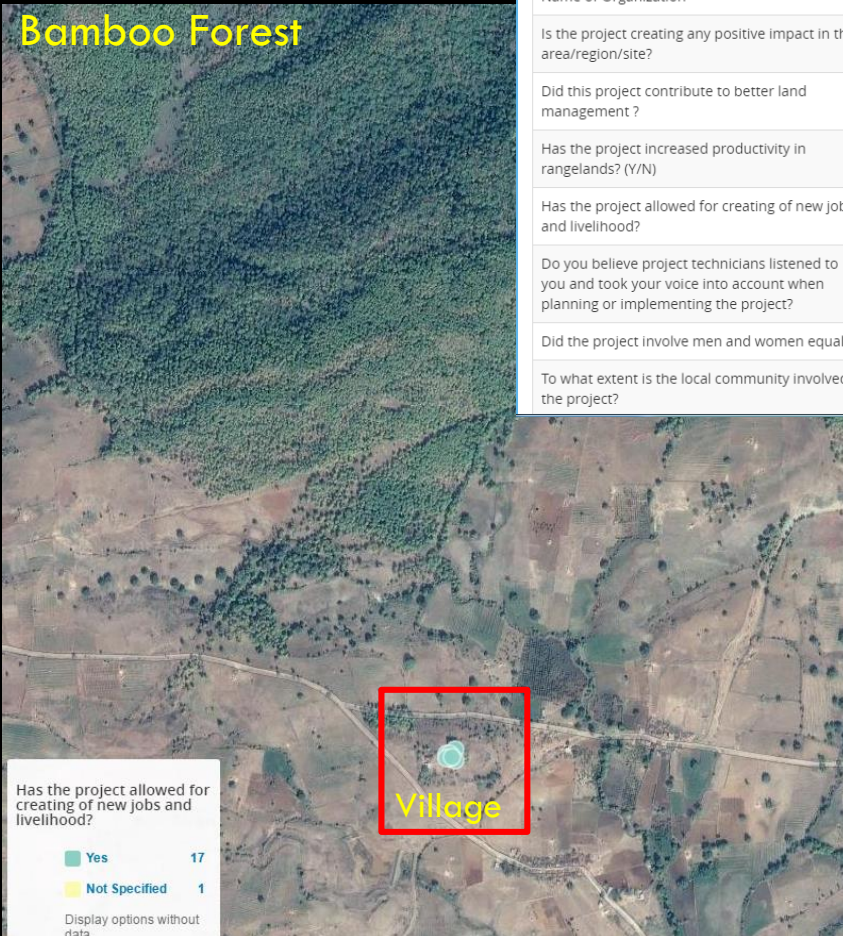
Need for field
verification/
groundtruthing

Beneficiary survey

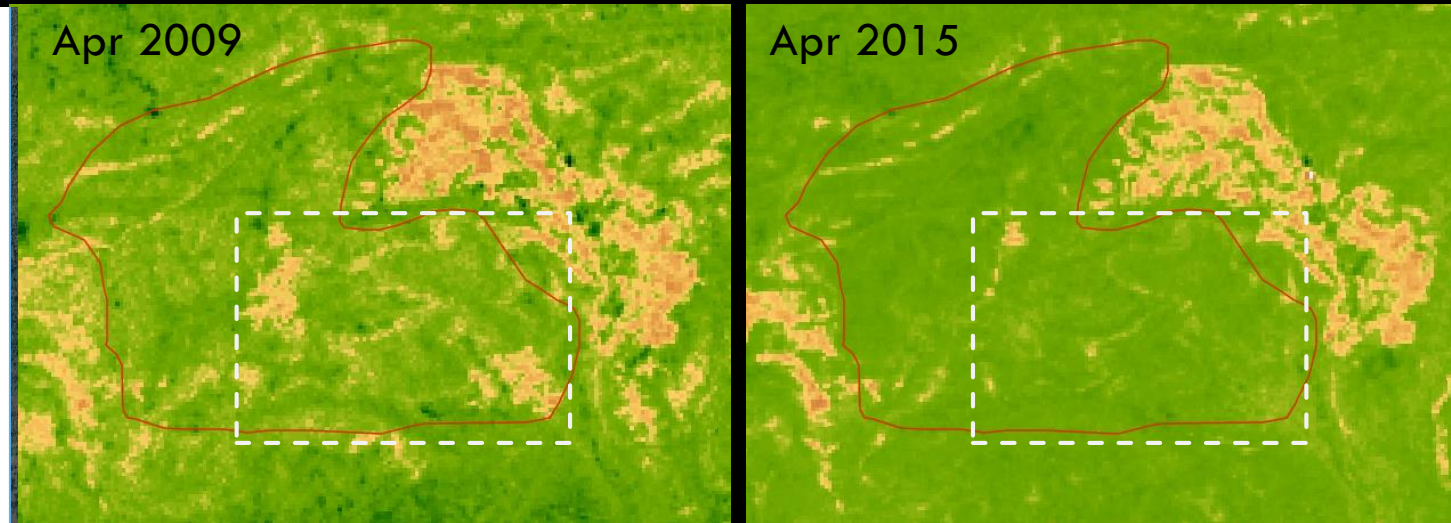


Question	Response
Whats the current date and time	2016-09-18T13:27:00.000+05:30
Where is this interview taking place?	21.76722166205057 78.66110602300134 486.3959563433866 24.0
Can I take a picture?	
Name of interviewee(s)	Premlal anke
What is your role in the project?	beneficiary
Name of Organization	Borpani
Is the project creating any positive impact in the area/region/site?	yes
Did this project contribute to better land management ?	to_a_moderate_
Has the project increased productivity in rangelands? (Y/N)	yes
Has the project allowed for creating of new jobs and livelihood?	yes
Do you believe project technicians listened to you and took your voice into account when planning or implementing the project?	to_a_moderate_
Did the project involve men and women equally?	yes
To what extent is the local community involved in the project?	to_a_moderate_

Bamboo Forest



Time series analysis using Satellite data



Mixed methods and triangulation of findings

Qualitative methods

- Case study
- Field visits
- Focused group interview
- Stakeholders interview

Lessons for the future



**Partner with
global institutions**

**Use mixed
approaches and
methods**



**Continue exploring
new methodologies and
data sources**

**Approach evaluation as
a dynamic learning
process**



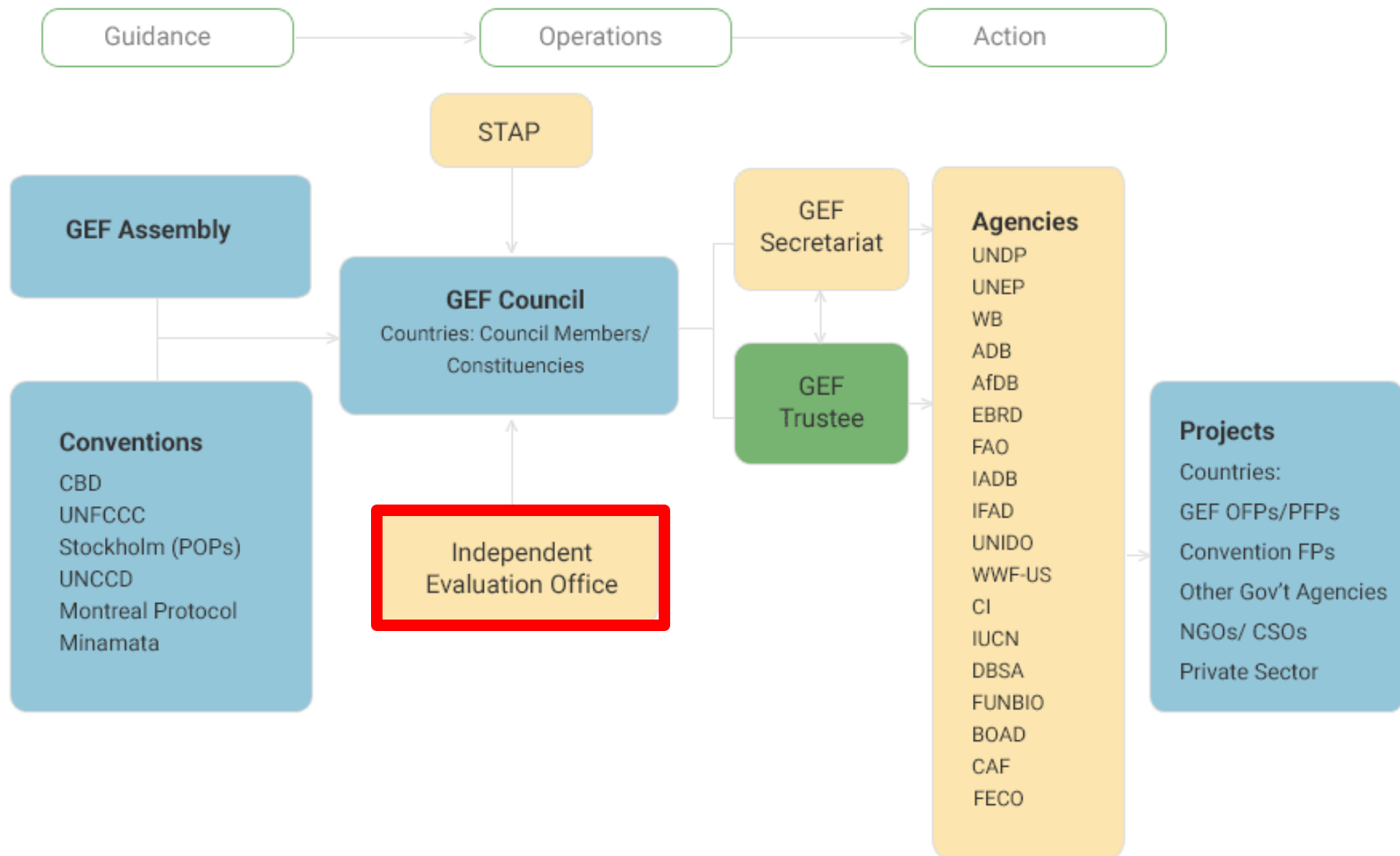
Thank you

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GEF: Institutional Framework

Earth Observation Data



Abstract:

Measuring, monitoring and evaluating the sustainable development goals(SDGS) would be a daunting task given the 169 targets and 230 proposed indicators. The support of the Global Environment Facility (GEF) to various interventions across the globe closely aligns with the SDGs on climate, biodiversity, land degradation, terrestrial and marine ecosystems and resources. Through this session, we share the experience of the GEF on the use of geospatial science complementing other mixed methods approaches for evaluating GEF projects. We draw from both our past and ongoing evaluations in focal areas such as biodiversity(SDG 15), Land degradation(15), International Waters (SDG 14) and Climate change (SDG 13). We demonstrate the use of geospatial science, earth observation and big data, analytics, e-devices and the relevance and applicability of these innovative mixed methods for keeping track on the progress of the SDGs.