Independent Evaluation Office
GLOBAL ENVIRONMENT FACILITY

Evaluating the Nexus between Environment, Climate Change and Development

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Outline

- Module 1: Introduction
- Module 2: Sixth Comprehensive Evaluation of the GEF (OPS 6)
- Module 3: Results and methods
- Module 4: Governance and Institutional issues
- Module 5: The road ahead

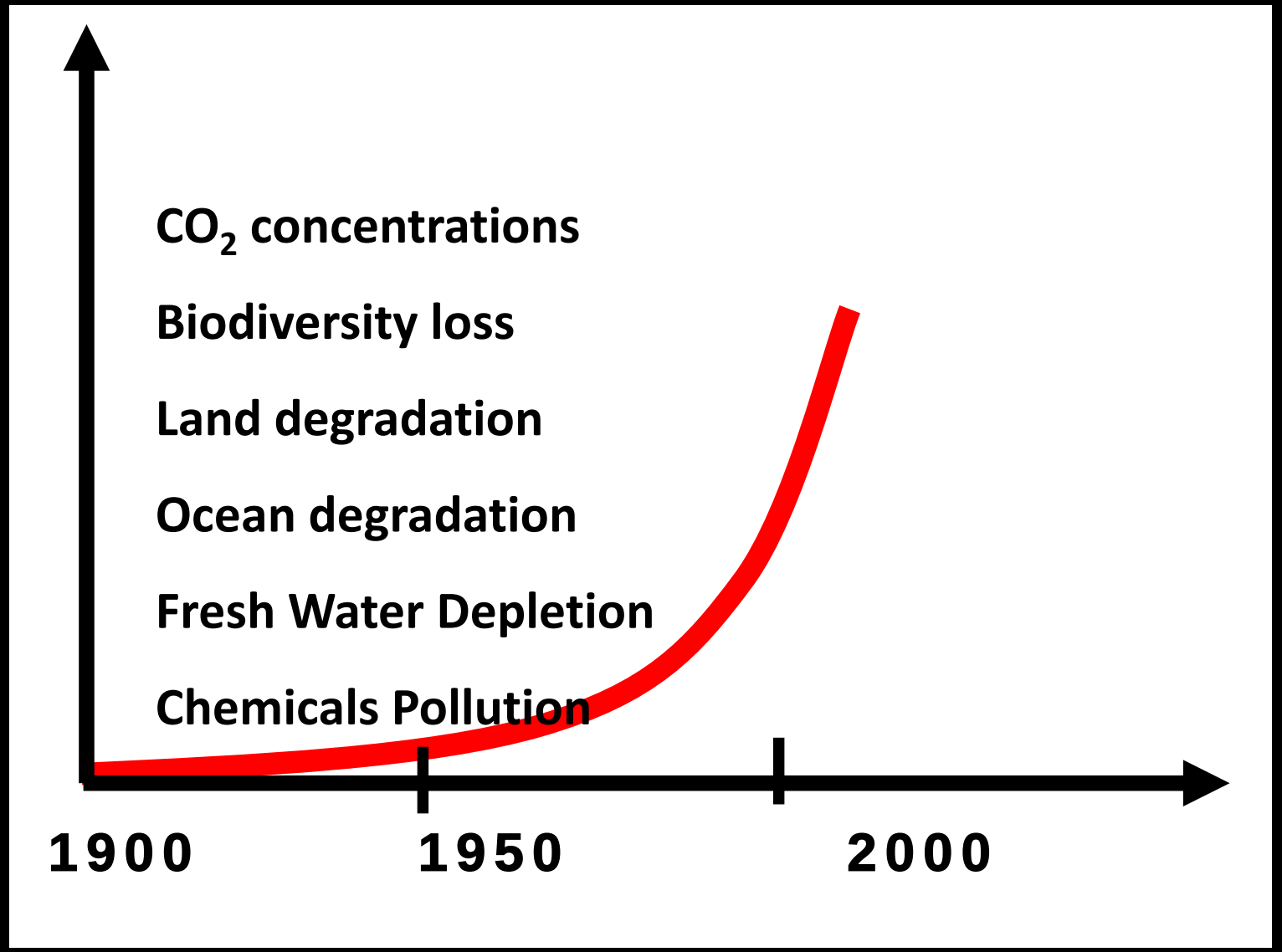
Module 1: Introduction

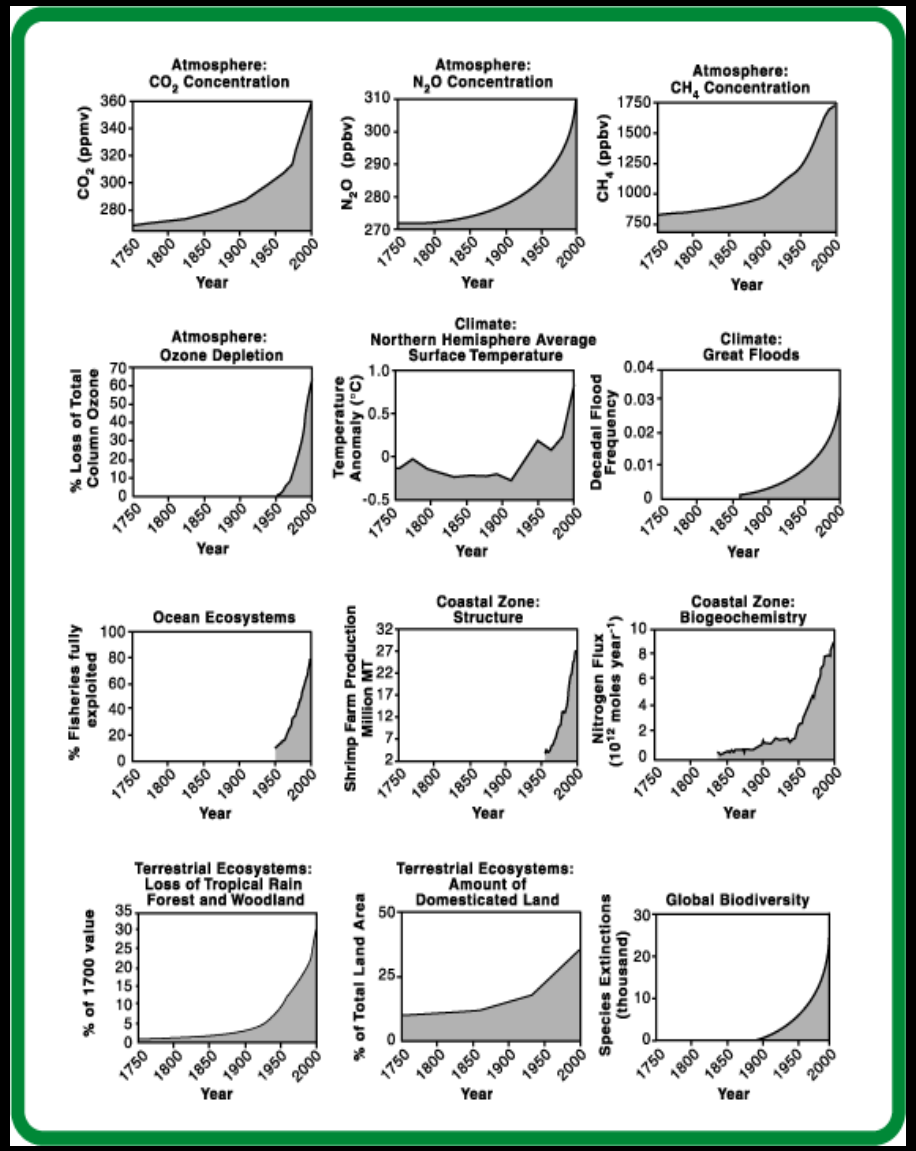
- Introduction to the participants and the session
- The state of the global environment including planetary boundaries
- Introduction to Global Environmental Facility, Conventions, IEO etc
- Linkages to the SDGs

Let’s get to know each other

- Briefly introduce yourself
- Your Name, Job description and Institution
- Why are you here?
- What are your expectations from this workshop?

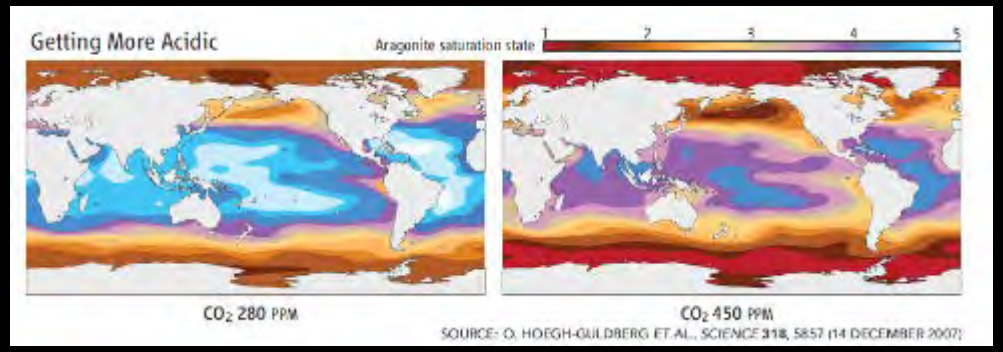
The State of Global Environment

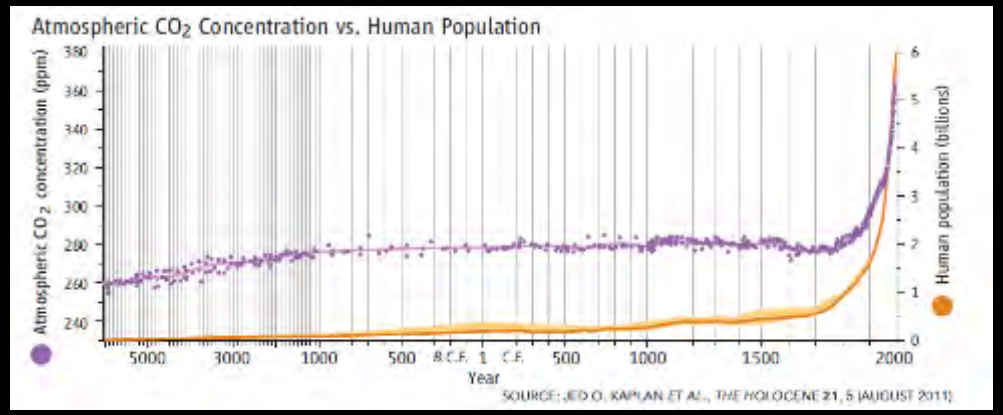


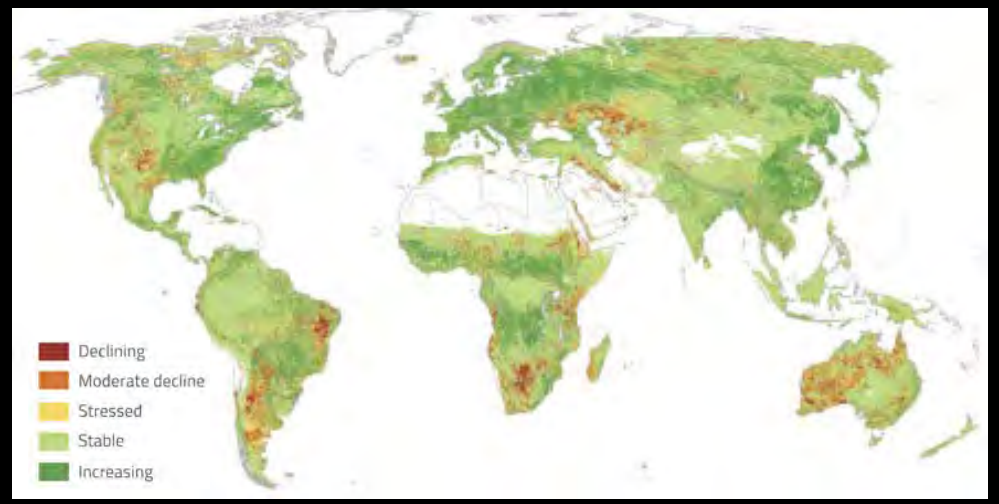


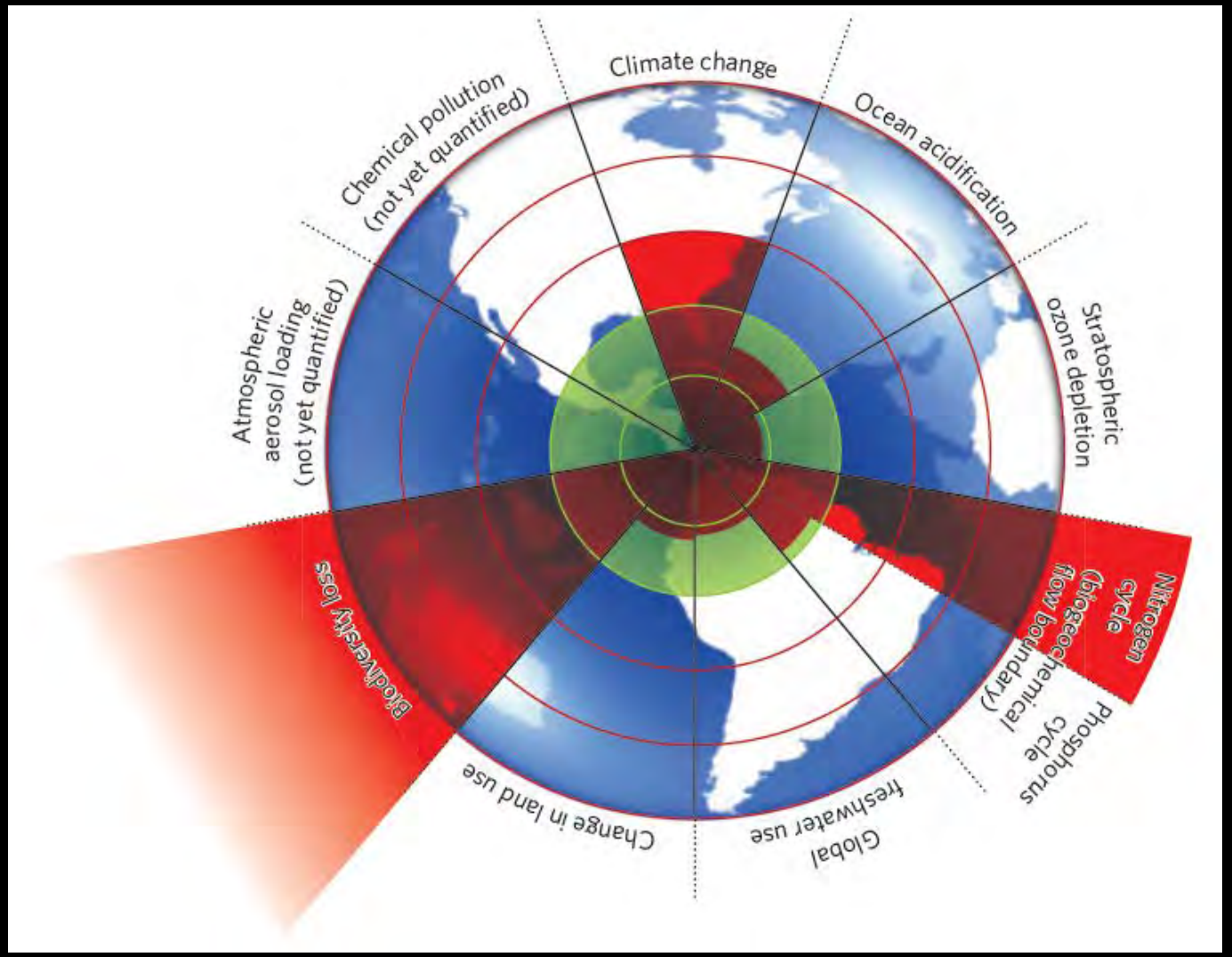
Source: SEI

Transgressing safe boundaries









Rockström et al. 2009 Nature, 461 (24): 472-475

United Nations Framework Convention on Climate Change

Convention on Biological Diversity

UNFF

United Nations Convention to Combat Desertification

UNEP MINAMATA CONVENTION ON MERCURY

Stockholm Convention on persistent organic pollutants (POPs)

gef

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

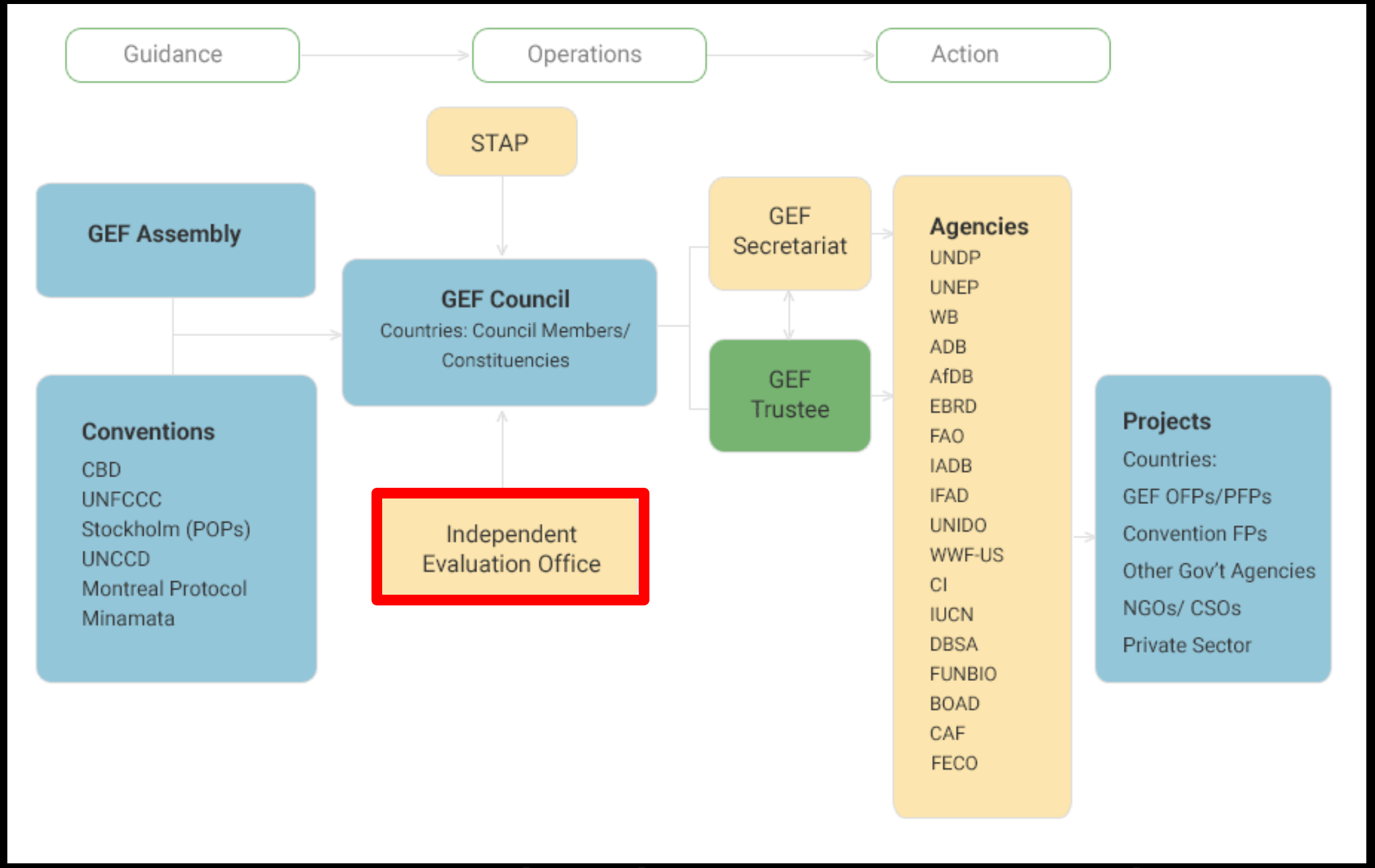
4,000 projects in 167 countries

18 implementing agencies

5 major environmental conventions

Established in 1992 | Innovator and Catalyst | Unique Partnership | Financial Mechanism

The Global Environment Facility



GEF: Institutional Framework

GEF Independent Evaluation Office

Mission

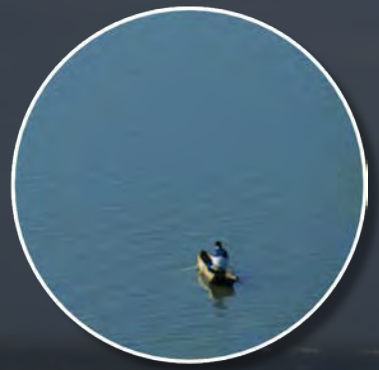
- To enhance global environmental benefits through excellence, independence, and partnership in evaluation

Functions

- Independent evaluation
- Setting of minimum standards (normative)
- Quality control (oversight)
- Knowledge sharing and dissemination

Thematic Areas(GEF Focal Areas)

International Waters



Land Degradation

Biodiversity

Cities

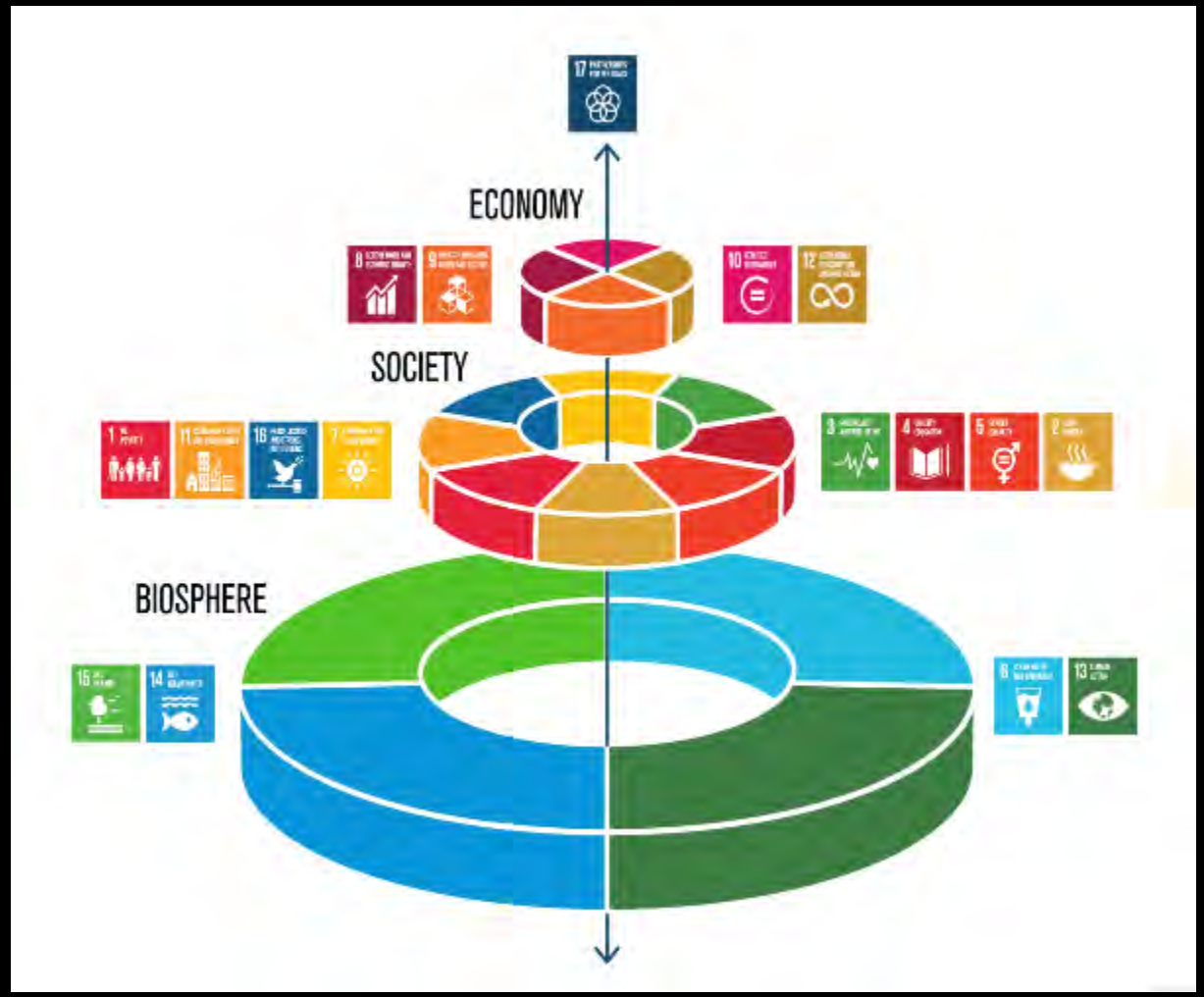
Chemical and Waste

Climate Change

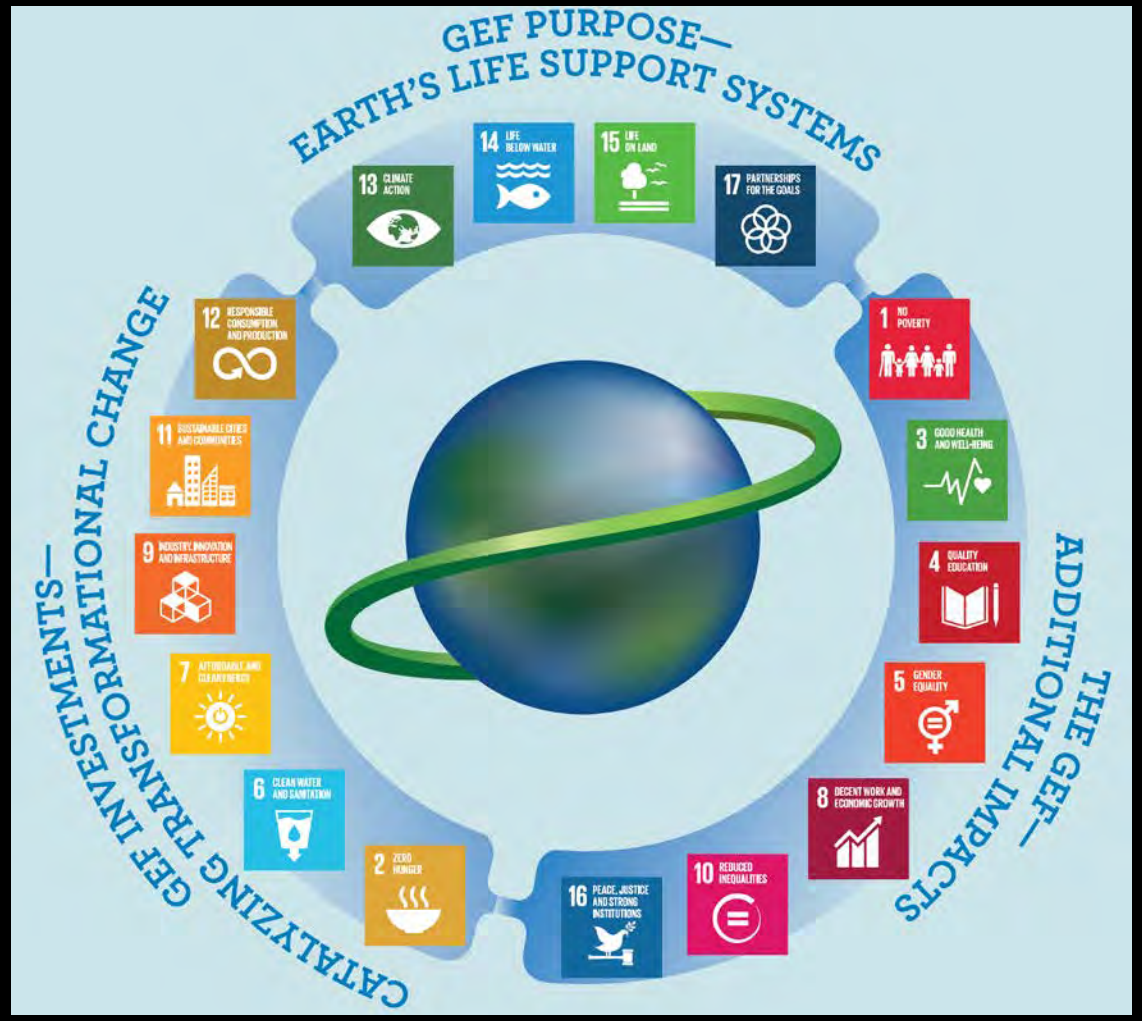
Commodities

Food Security

The GEF and the SDGs



Credit: Stockholm Resilience Center



Module 2: Sixth Comprehensive Evaluation of the GEF (OPS 6)

- Introduction to OPS6
- Overall approach
- Description of the studies, including focal areas & cross cutting issues and 29 briefs
- **Brainstorming** on Transformational change. What does it mean? How it can be assessed etc.?
- Transformational change

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Sixth Comprehensive Evaluation of the GEF (OPS6)

Outline

1 Objective, Quality Assurance, Methodology, Limitations
2 GEF Portfolio
3 Strategic Relevance
4 Performance and Impact
5 Focal Areas
6 Programmatic Approaches and Integrated Approach Pilots
7 Conclusions and Recommendations

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SECTION 1
Overview

OPS6 Overview

Objective

To provide solid evaluative evidence to inform the replenishment negotiations for **GEF-7**

Methodology

29 evaluations and studies

Mix of qualitative and quantitative approaches including geospatial analysis

Formative approaches to evaluate ongoing programs

Limitations

Limitations imposed by data and timing

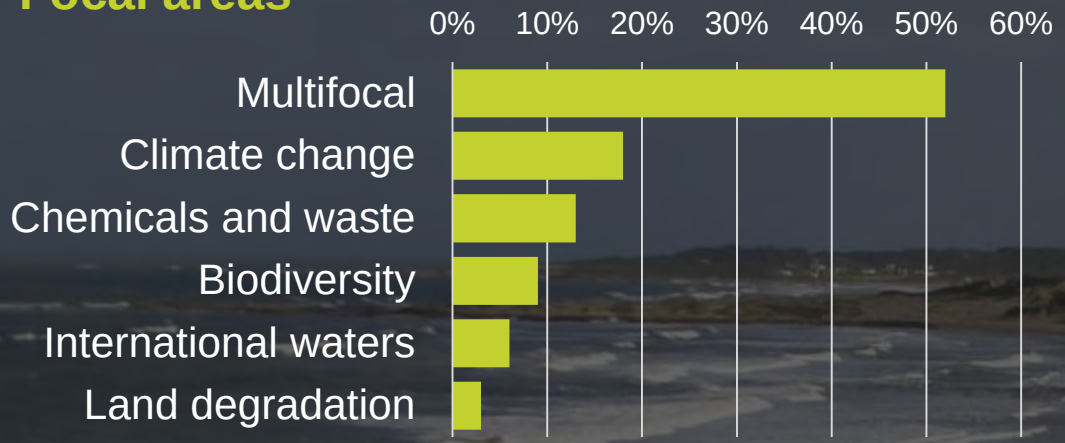
GEF-6 Overview

Portfolio (as of June 30, 2017)

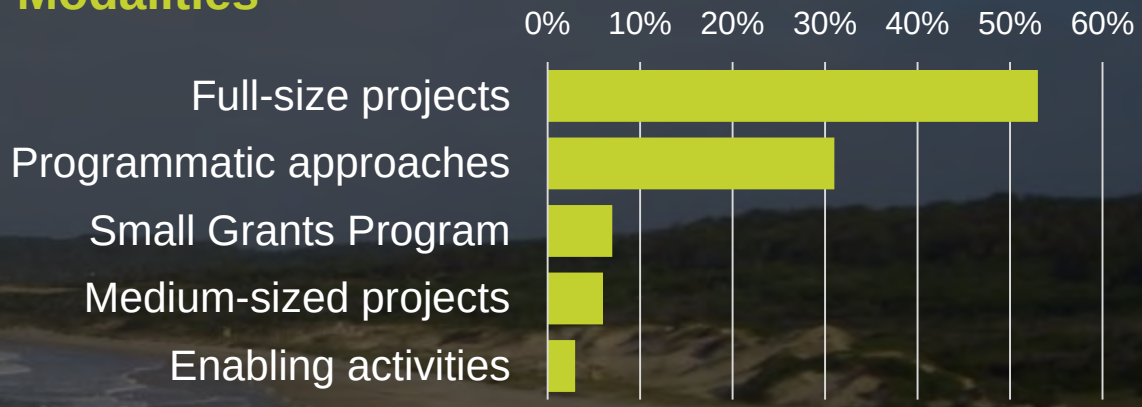
444 projects

$2.4 billion

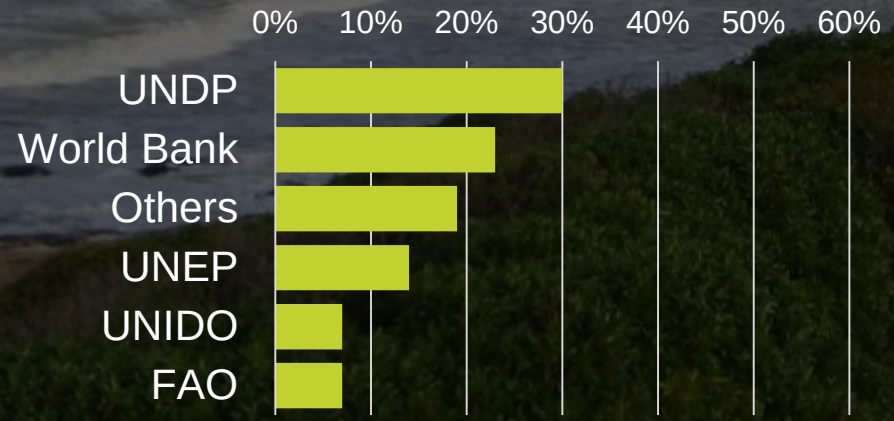
Focal areas



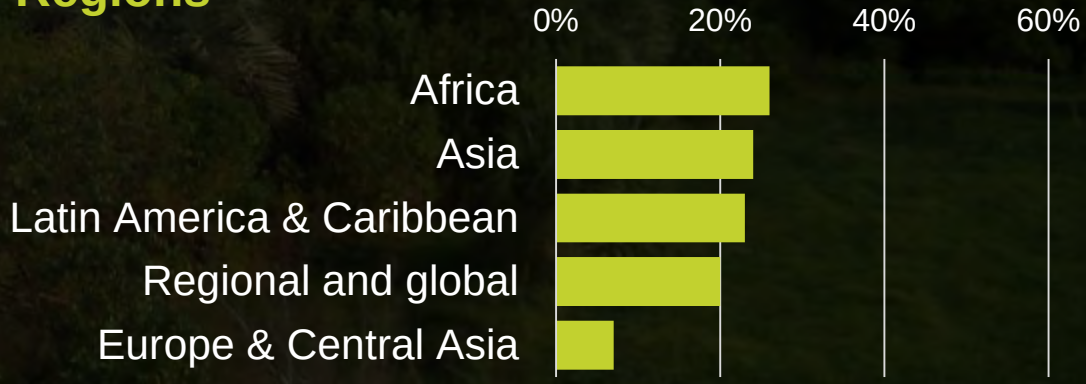
Modalities



Agencies



Regions



OPS6 Overview

Strategic relevance

Conventions. Main funding mechanism for:

Convention on Biological Diversity

STOCKHOLM CONVENTION

United Nations Framework Convention on Climate Change

United Nations Convention to Combat Desertification

UNEP MINAMATA CONVENTION ON MERCURY

Countries

More than **140** recipient countries

Support for **middle income countries** remains important

Support to **LDCs and SIDS** has increased

Also relevant to the

SUSTAINABLE DEVELOPMENT GOALS

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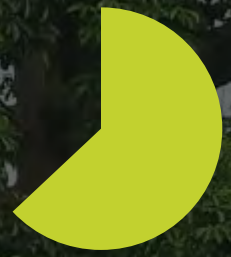
SECTION 2

Performance and Impact

Performance and Impact

79%

Satisfactory outcomes



63%

of projects have outcomes that are likely to be sustained

Drivers of good performance:

- Project design
- Quality of implementation and execution
- Materialized co-financing

- Performance and sustainability of outcomes > in middle income countries
- Institutional capacity challenges in Africa

FOCAL AREA STUDIES

Common findings

Relevant to conventions

Strong performance ratings on outcomes with limited variation

Sustainability of outcomes (Land degradation & Biodiversity)

M&E Design (International Waters and Chemicals)

M&E Implementation (International Waters, Chemicals and Multifocal)

Variation in private sector engagement

Transformational change

FOCAL AREA STUDIES

Biodiversity: Addresses specific drivers and pressures of biodiversity loss

Increase in the biodiversity **mainstreaming** portfolio with focus on reforms, and improved outcomes

Percent of forest loss in GEF supported protected areas was **half** that of protected areas not supported

Access to Benefits Sharing

Support to 100 countries in development **legislation** and discovery of “promising compounds”; project designs often “overpacked”

FOCAL AREA STUDIES

Climate change

Niche areas in changing landscape

Upstream approaches including policy reform to accelerate market development and create an enabling environment for investment

Risk sharing approaches

Piloting innovative technologies

Collaborating with other climate funds and MDBs to scale up investments

FOCAL AREA STUDIES

Climate change: Examples

China

Bosnia and Herzegovina

Mauritius

297 projects
1.37 billion

FOCAL AREA STUDIES

Climate change adaptation (LDCF/SCCF)

98%

of projects have a high to very high probability of delivering tangible adaptation benefits

- Highly relevant to UNFCCC COP guidance and the GEF Adaptation Strategy
- Agriculture, NRM and climate information systems / disaster risk management

75%

of completed projects received sustainability ratings in the likely range

- Resource availability: Constraint to actual scaling up

FOCAL AREA STUDIES

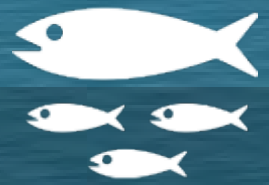
International waters

Support to multiple regional and global treaties

High level of contemporary relevance

Planetary boundaries and environmental tipping points

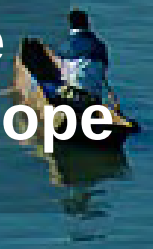
Significant emphasis on knowledge and learning



Dominance of marine and ocean investments

$$$

Decline of the funding envelope



FOCAL AREA STUDIES

International waters: Examples

Pacific Islands

GloBallast

Hai River Basin

FOCAL AREA STUDIES

Land degradation

Strategy

Shift towards **integrated landscape**

Shift from linkages towards land degradation **neutrality**

Climate risks, contextual factors, restoration

Portfolio

High level of effort in **Africa**

Addresses the local socioeconomic **drivers**

FOCAL AREA STUDIES

Land degradation

Gambia

Tanzania

Cuba

FOCAL AREA STUDIES

Chemicals and waste

Strong government ownership

Private sector commitment

Balancing hard outcomes metrics against relatively softer interventions

Promoting sector-wide approaches

FOCAL AREA STUDIES

Chemicals and waste

Georgia

China

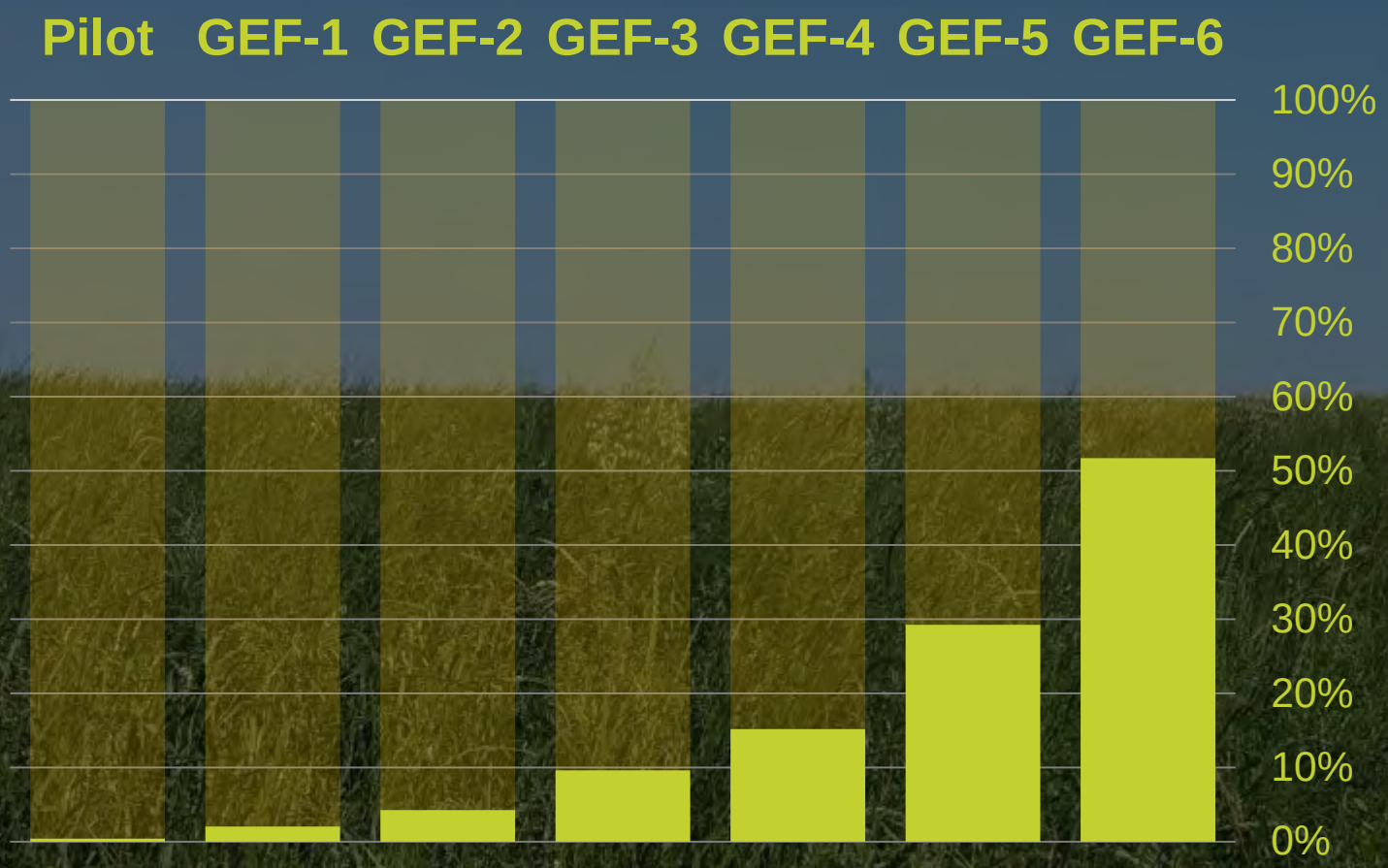
Mauritius

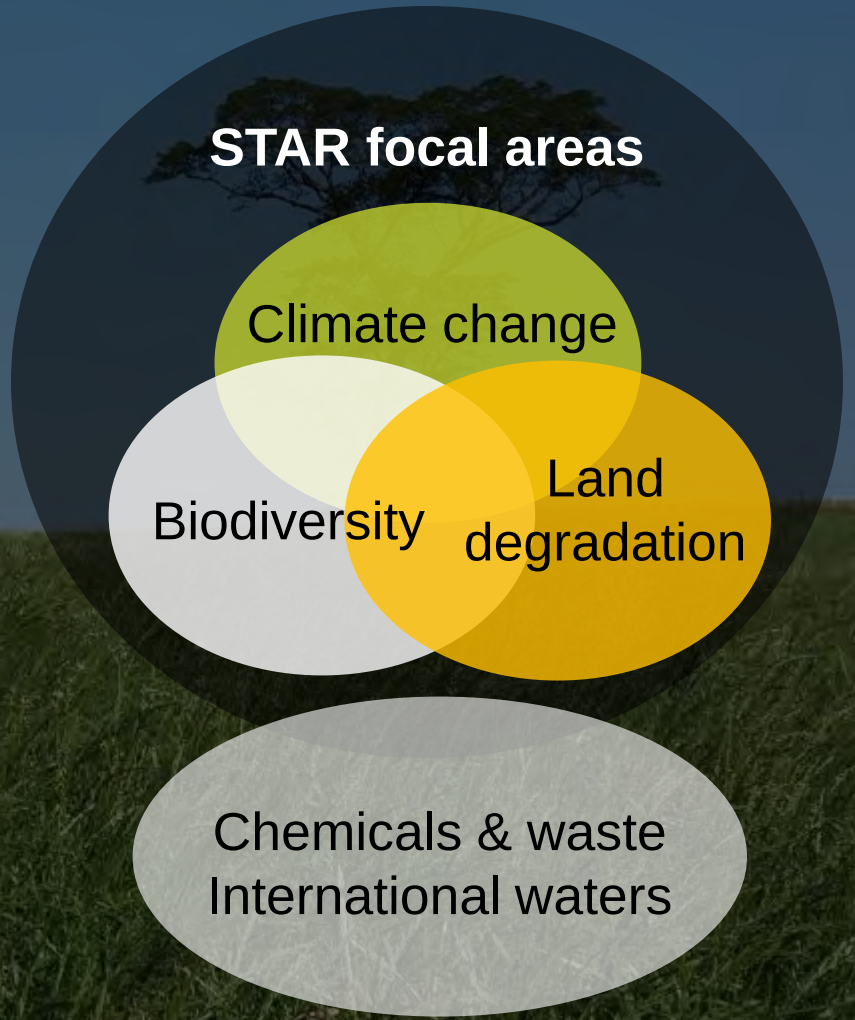
77% satisfactory outcomes
61% likely sustainable

FOCAL AREA STUDIES

Multifocal

Share of portfolio is growing





FOCAL AREA STUDIES

Multifocal

Majority of projects generated multiple benefits

Potential to enhance synergies and mitigate trade-offs

Institutional arrangements for sectoral integration

FOCAL AREA STUDIES

Multifocal

Enhancing synergies

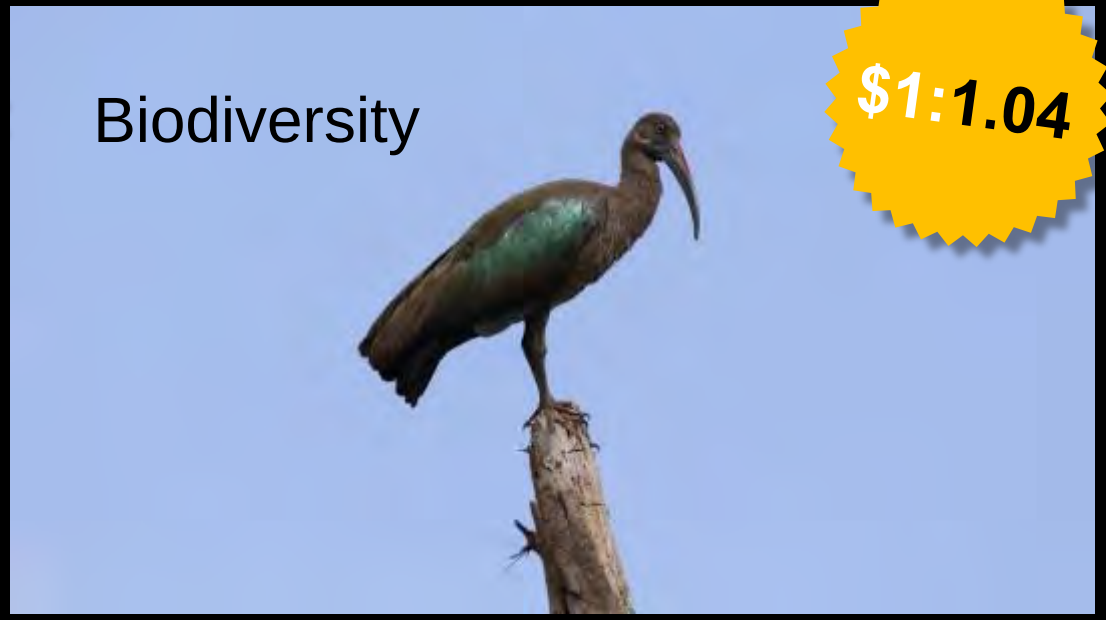
Mitigating trade-offs through value addition

Senegal

Brazil

China

Do GEF interventions yield positive returns on investment?



LAND DEGRADATION

Value for money: Factors

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

Vegetation productivity

forest loss and land fragmentation

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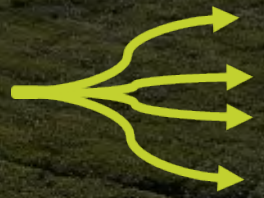
SECTION 3

Programmatic and Integrated Approach Pilots

PROGRAMMATIC APPROACHES

Findings

Program child projects perform slightly better than standalone projects



Outcome performance, cost effectiveness and efficiency decline with increased complexity

Coherence in project-program objectives has improved, but results focused on projects rather than programs

PROGRAMMATIC APPROACHES

Global Wildlife Program

- Relevant to biodiversity strategy
- Comprehensive theory of change addressing illegal wildlife trade
- Global coordination grant
- Simplified M&E framework

- Gaps in geographic and species coverage
- Structural limitations caused by funding mechanism
- Political will and corruption not explicitly addressed
- Minimal funding for demand reduction

INTEGRATED APPROACH PILOTS

Designed to build on **linkages** and **connections** across focal areas
Formative evaluation based on **30** child projects approved

Sustainable cities
Challenges to rapid urbanization in 28 cities

Commodities
Tropical Deforestation caused by soy, beef and palm oil in 4 producing countries

Food Security
Smallholder agriculture and food value chains in 12 African countries

INTEGRATED APPROACH PILOTS

Relevance

GEF has an important convening role

Countries/cities relevant to drivers of environmental degradation

Draw on comparative strength of the Agencies and think tanks

93%

of respondents agree that IAP child projects will address conventions at multiple levels

INTEGRATED APPROACH PILOTS

Design

Coherence in objectives between program and child projects

Emphasis on knowledge exchange

Designed for scale up, replication and market transformation

Gender and resilience addressed

Demonstration of program additionality

Specification and measurement of GEB Targets

Alignment between project and program outcome indicators

INTEGRATED APPROACH PILOTS

Process

Relevant selection of countries, cities and agencies but process varied

Set-aside funds provided incentives for countries

Agency, city and country selection process not always clear

Under estimate of time to design and launch a complex program

Limited private sector participation

INTEGRATED APPROACH PILOTS

Lessons

Design

- ✓ Demonstration of GEF additionality and comparative advantage
- ✓ Alignment of objectives between child projects and programs should translate into alignment of indicators
- ✓ Standardized measurements for GEB targets

Process

- ✓ Agency selection based on comparative advantage
- ✓ Transparency and clear criteria for agency and country selection
- ✓ Clarity on partnership arrangements

Monitoring progress

- ✓ Effectiveness of knowledge platforms
- ✓ Program and Project Outcomes

Comparative advantage

RELEVANCE

1. Serves multiple conventions and broad range of environmental issues
2. Strong Support to LDCs and SIDS

PERFORMANCE

3. Long history of good performance
4. Ability to address linkages and synergies between focal areas

TRANSFORMATIONAL

5. Ability to Create an enabling environment in countries through legal and regulatory reforms
6. Delivers innovative financial models and risk-sharing approaches

Recommendations

Strategic	Financial	Policies	Institutional
1. Strategic positioning 2. Transformational change 3. Integration based on additionality	4. Financial management 5. Private sector management	6. Gender equality 7. Safeguards and indigenous people	8. Operational governance 9. Systems for data, monitoring and knowledge

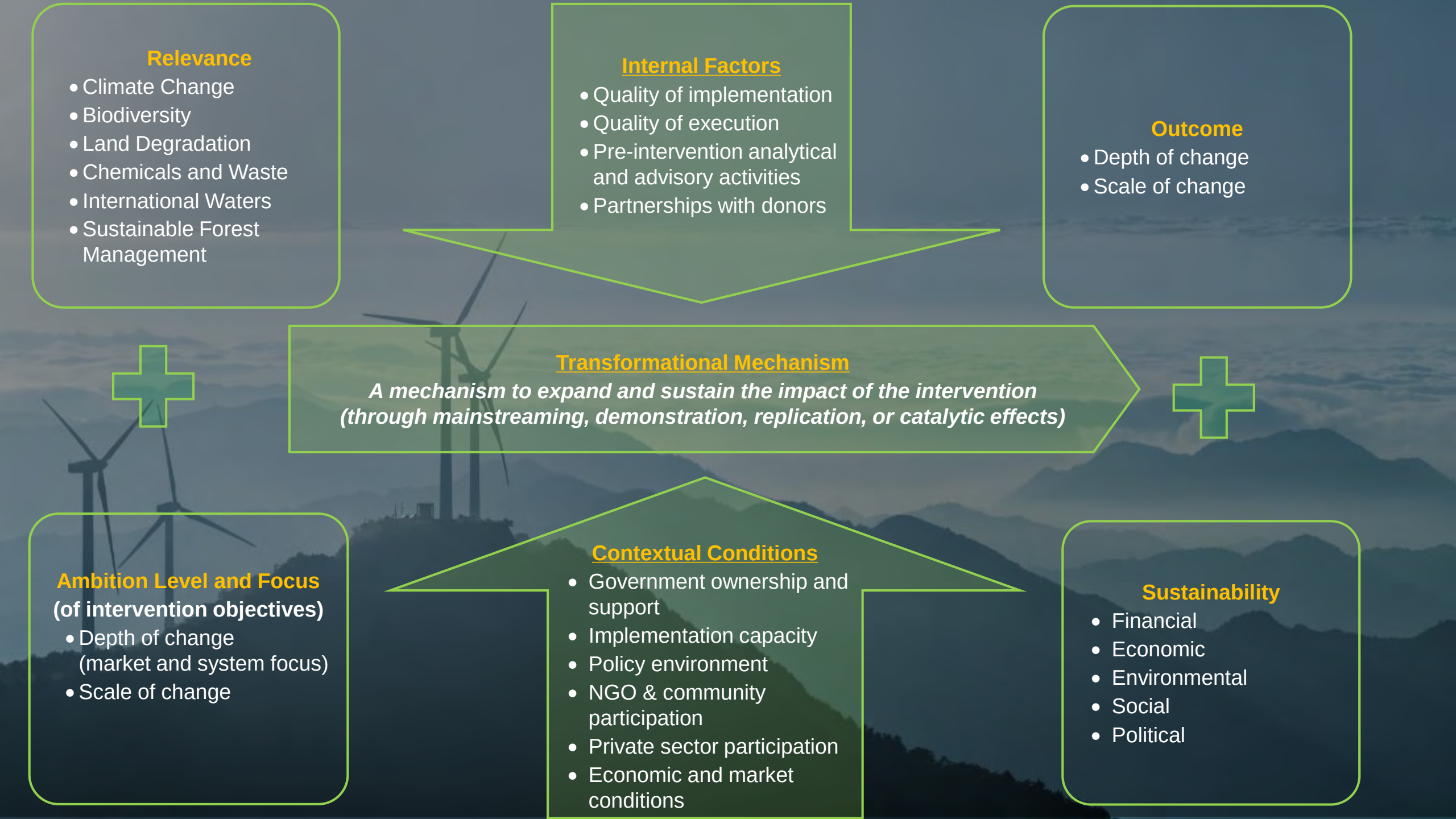
GEF's Support for Transformational Change

- **Brainstorming** on Transformational change.
- What does it mean?
- How it can be assessed etc.?

GEF's Support for Transformational Change

4 criteria:

- ✓ Relevance
- ✓ Depth of Change
- ✓ Scale of Change
- ✓ Sustainability

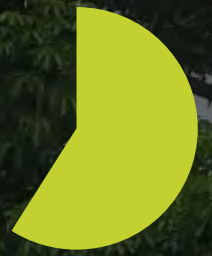

Relevance
• Climate Change
• Biodiversity
• Land Degradation
• Chemicals and Waste
• International Waters
• Sustainable Forest Management
Internal Factors
• Quality of implementation
• Quality of execution
• Pre-intervention analytical and advisory activities
• Partnerships with donors
Outcome
• Depth of change
• Scale of change
Transformational Mechanism
A mechanism to expand and sustain the impact of the intervention (through mainstreaming, demonstration, replication, or catalytic effects)
Ambition Level and Focus
(of intervention objectives)
• Depth of change (market and system focus)
• Scale of change
Contextual Conditions
• Government ownership and support
• Implementation capacity
• Policy environment
• NGO & community participation
• Private sector participation
• Economic and market conditions
Sustainability
• Financial
• Economic
• Environmental
• Social
• Political

PERFORMANCE AND IMPACT

Broader adoption and transformational change

61%

of projects achieved
broader adoption



59%

of projects achieved
environmental stress reduction

Mechanisms for broader adoption:

✚ Mainstreaming and replication
Scaling-up and market change

Success factors for transformational change:

- Clear ambition in designs
- Addressing market reforms through policies
- Mechanisms for financial sustainability
- Quality of implementation and execution
- May be achieved by projects of different size

EXAMPLES

Transformational Change

Uruguay

Wind power
2008: 0%
2016: 33%

Africa

1.3 mln – quality solar lanterns;

Private market transformed

Amazon

13.2 mln ha – strict protection
10.8 mln ha – sustainable use

China

Wind power
2005: 1.3 GW
2015: 129.3 GW

Namibia

98% PAs improved;

Doubled number of wild dogs, leopards, cheetahs, lions (2004–12)

156 projects - nominated and screened
30 cases (49 projects) – first review round
13 cases (29 projects) – second review round
8 cases (13 projects) - selected

Uruguay Wind Energy Program

2007–2011

GEF: USD 1 mln; UNDP: USD 35,000; National government: USD 53.7 mln

Result: Wind power - 2008: 0%; 2016: 33% of all electricity in the country

- ✓ Relevance: decreasing greenhouse gas emissions
- ✓ Depth of change: system and market-level (removing barriers to the wind energy market)
- ✓ Scale of change: national
- ✓ Sustainability: credible financial sustainability of investments; prices competitive with those of the fossil-fueled alternatives

Lighting Africa

2007–2013
GEF: USD 7.85 mln; co-financing: USD 14.09 mln

Result: about 1.3 mln households in remote off-grid areas of Africa purchased quality-certified solar lanterns at market prices

- ✓ Relevance: decreasing greenhouse gas emissions; increasing electricity access
- ✓ Depth of change: system and market-level
  (removing barriers to the markets for quality, affordable, clean, and safe off-grid lighting)
- ✓ Scale of change: multi-national
- ✓ Sustainability: self-sustaining market; people continue using and buying lamps; suppliers continue supplying; micro-financing available for end users

Amazon Protected Areas Program

2002–2008
GEF: USD 30 mln; co-financing: USD 55.38 mln

Result: Doubled the amount of Brazilian Amazon under "strict protection" from 12 mln ha in 2004 to over 25 mln ha in 2009. Added another 10 mln ha in "sustainable use".

- ✓ Relevance: conserving biodiversity of global importance in Brazil's Amazon Region
- ✓ Depth of change: system-level
  (expanding and consolidating the protected area systems in the region)
- ✓ Scale of change: regional
- ✓ Sustainability: endowment fund ($23.4 mln), however government contributions to PAs continue to be necessary

SUCCESS FACTORS FOR

Transformational change

- ✓ Clear ambition in design
- ✓ Addressing market reforms through policies
- ✓ Mechanisms for financial sustainability
- ✓ Quality of implementation and execution
- ✓ May be achieved by projects of different size

[Coffee Break] 11:00-11:20 am

Module 3: Results and methods

- [Group Work: Context-Question-Discussion-Approach-Result]
- Focal Area Studies with demonstration of methods
- Multiple Benefits, Trade-off and Synergies, Integrated approaches

Focal Area Studies with demonstration of methods

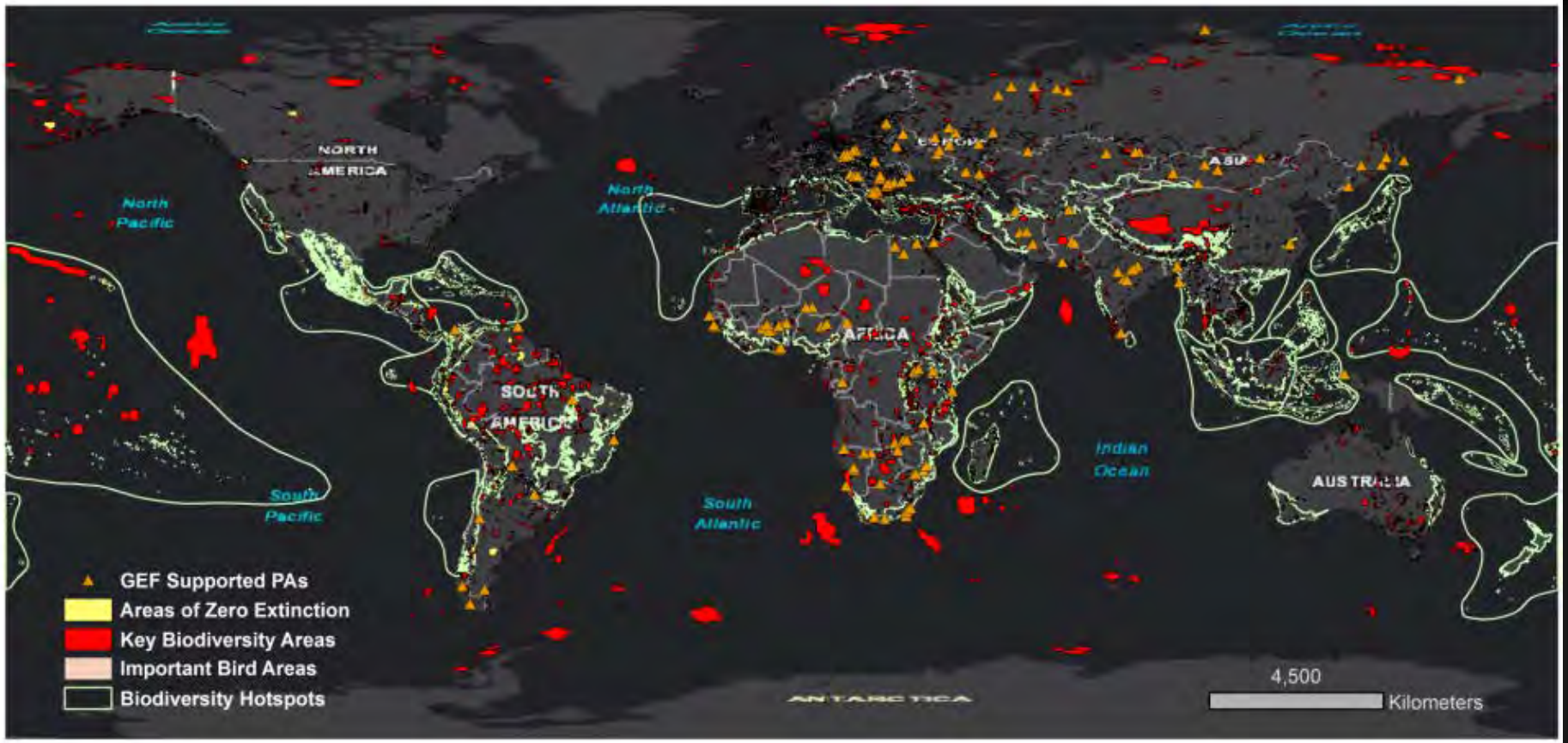
Anupam Anand

Questions we seek to answer through evaluation

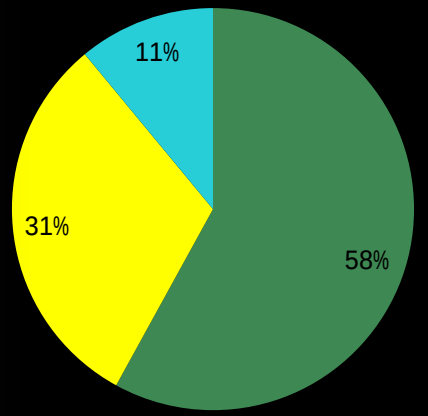
- Relevance of the intervention—is it in the right context?
- Trends in performance and impacts going far back in time…even if we didn't have baseline data?
- Attribution: Did the intervention make a difference? –counterfactuals
- Does the intervention deliver value for money?

Biodiversity

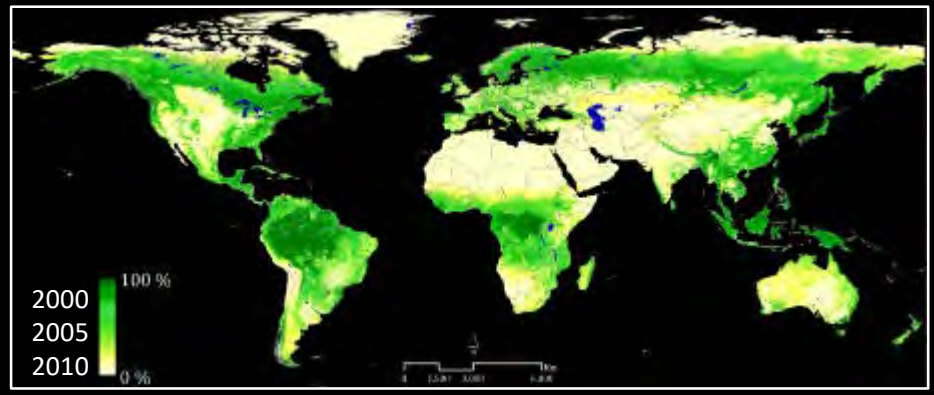
Biodiversity: Relevance



KEY BIODIVERSITY AREAS, highest scientific designation of global biodiversity significance

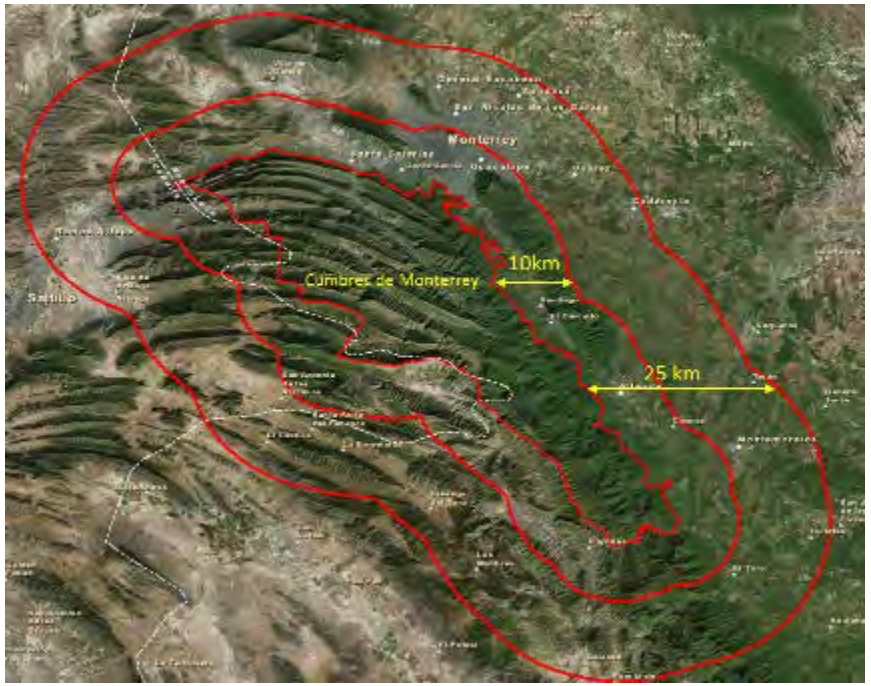


Study the impact of GEF support to 1292 global protected areas across 147 countries.

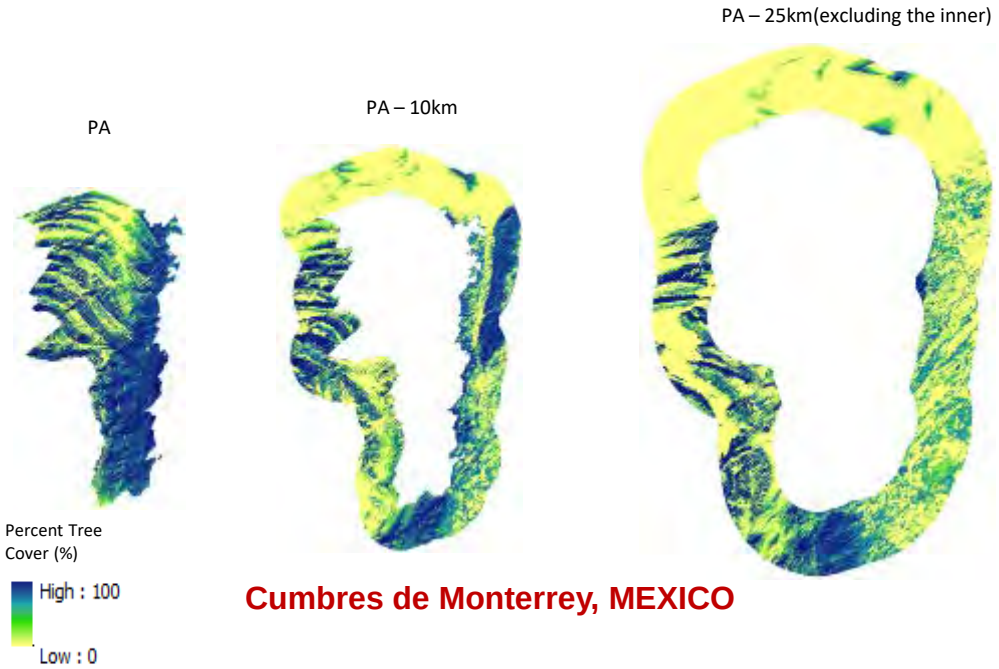


Hanssen et al., 2013, Sexton et al. 2013. *International Journal of Digital Earth* 6: 427-448; Kim et al. 2014. *Remote Sensing of Environment.*

Forest Cover Change Analysis

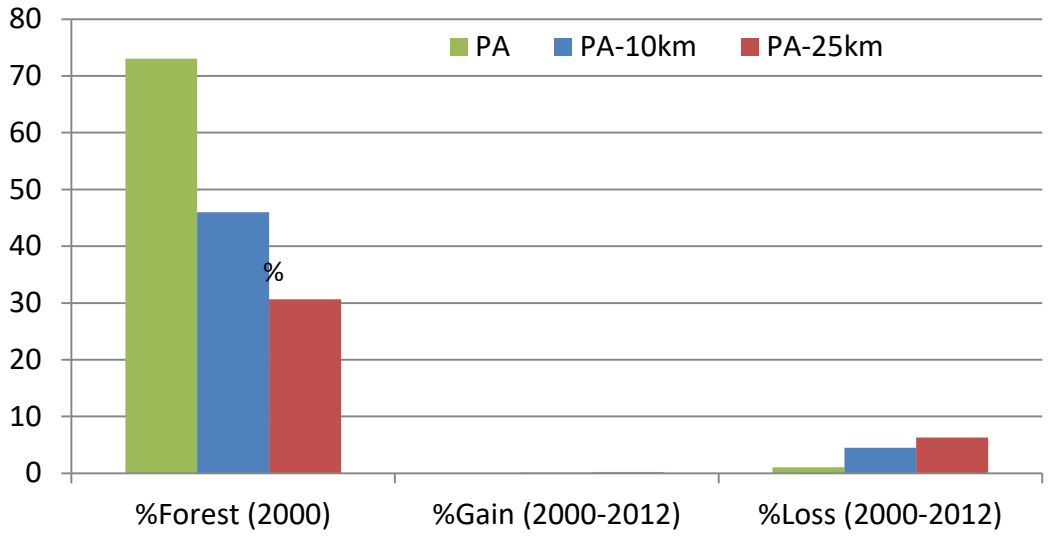


Percent Tree Cover (2000)

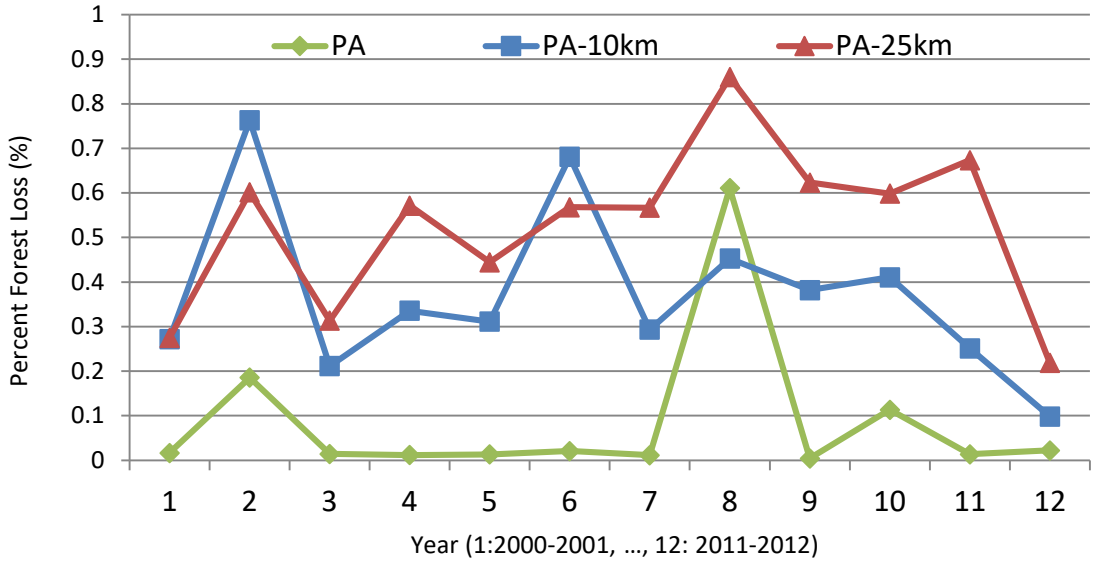


Cumbres de Monterrey, MEXICO

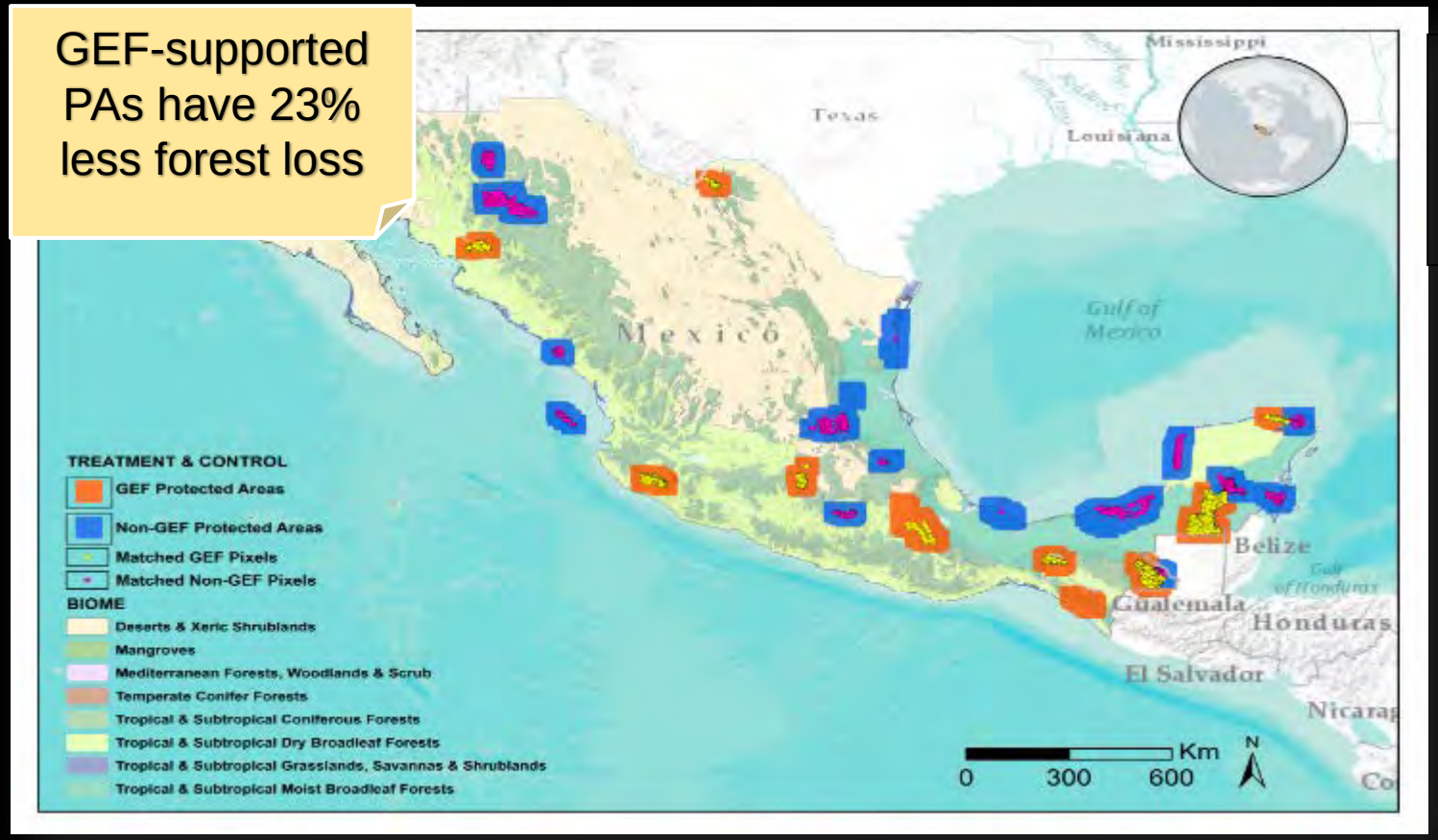
Decadal Forest Cover, Gain and Loss (2000 – 2012)

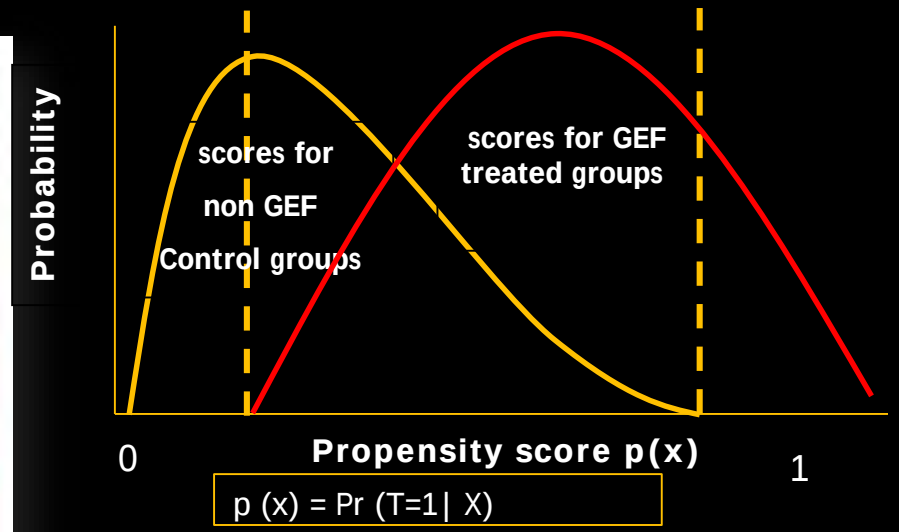


Yearly Percent of Forest Loss (2000 – 2012)



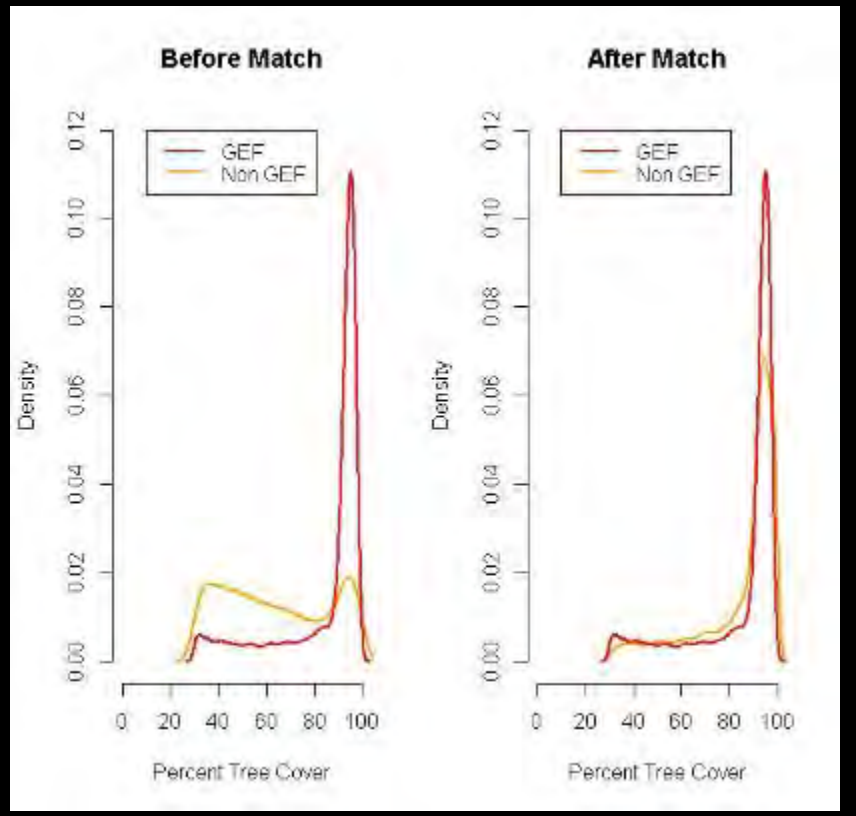
GEF-supported PAs have 23% less forest loss



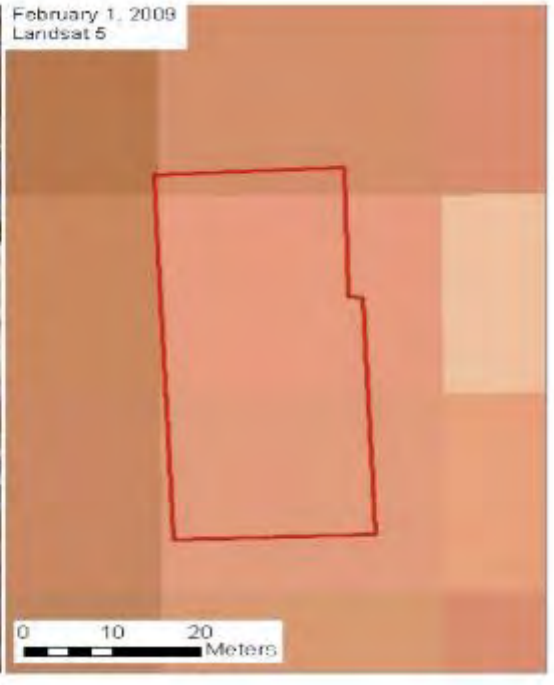


Attribution: Did the intervention cause the change?

Quasi-experimental evaluation design based on PSM



Identify the drivers



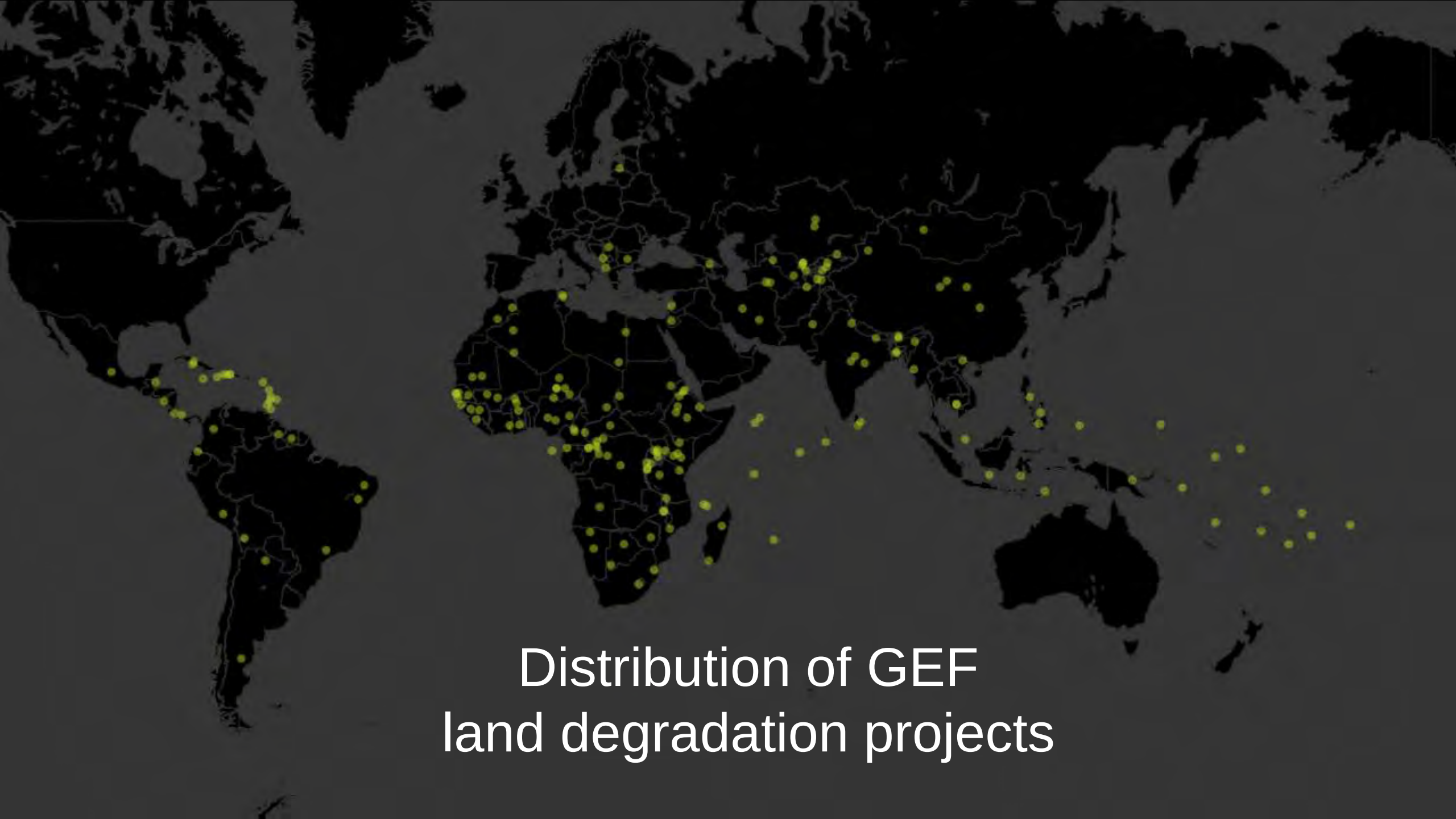
2.5 m

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

Biodiversity

- Indicators
  - Annual change in forest area and land under cultivation*: Satellite Data analysis
  - 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)

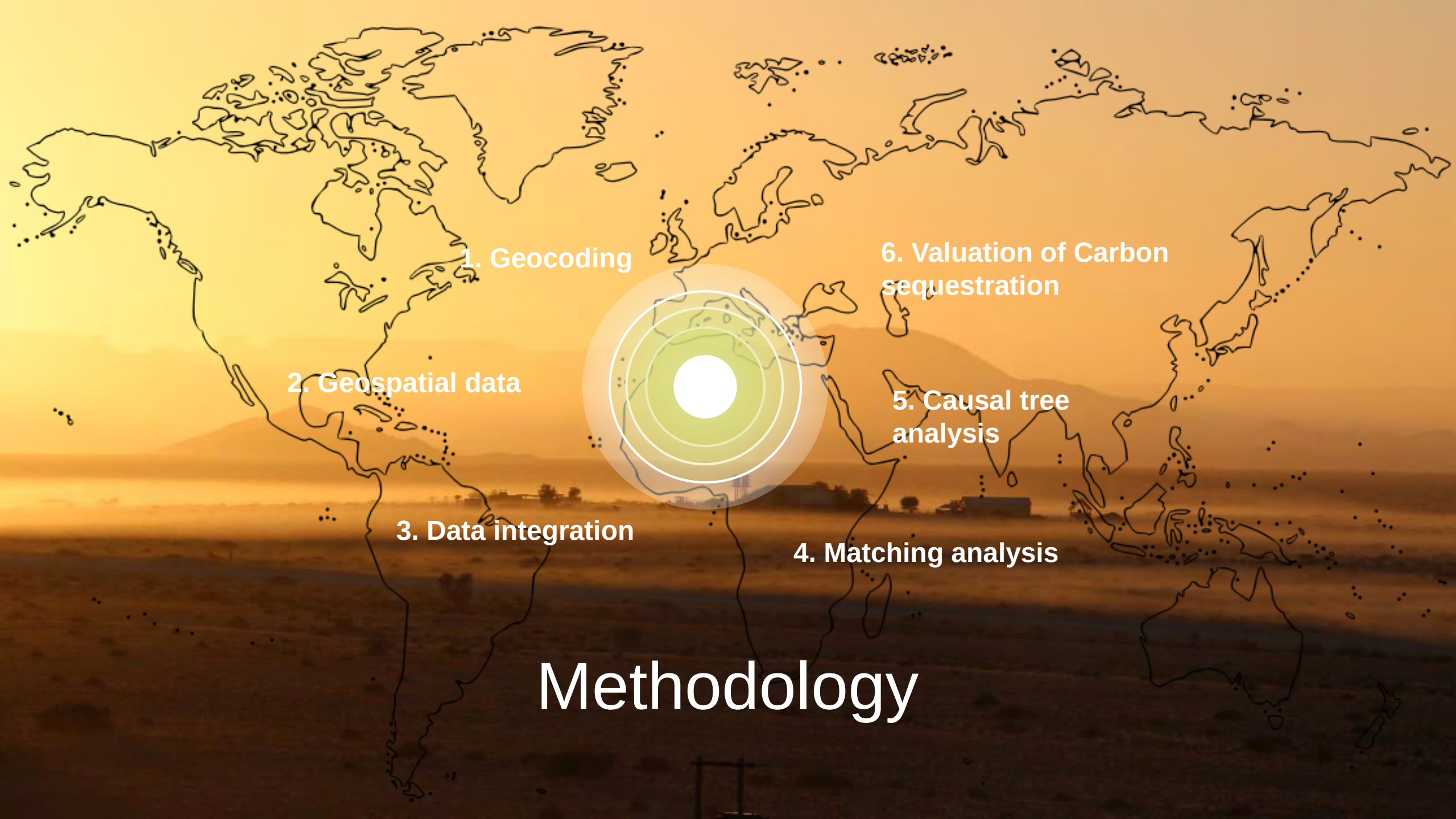


Distribution of GEF
land degradation projects

LAND DEGRADATION

Value for money analysis: 3 main objectives

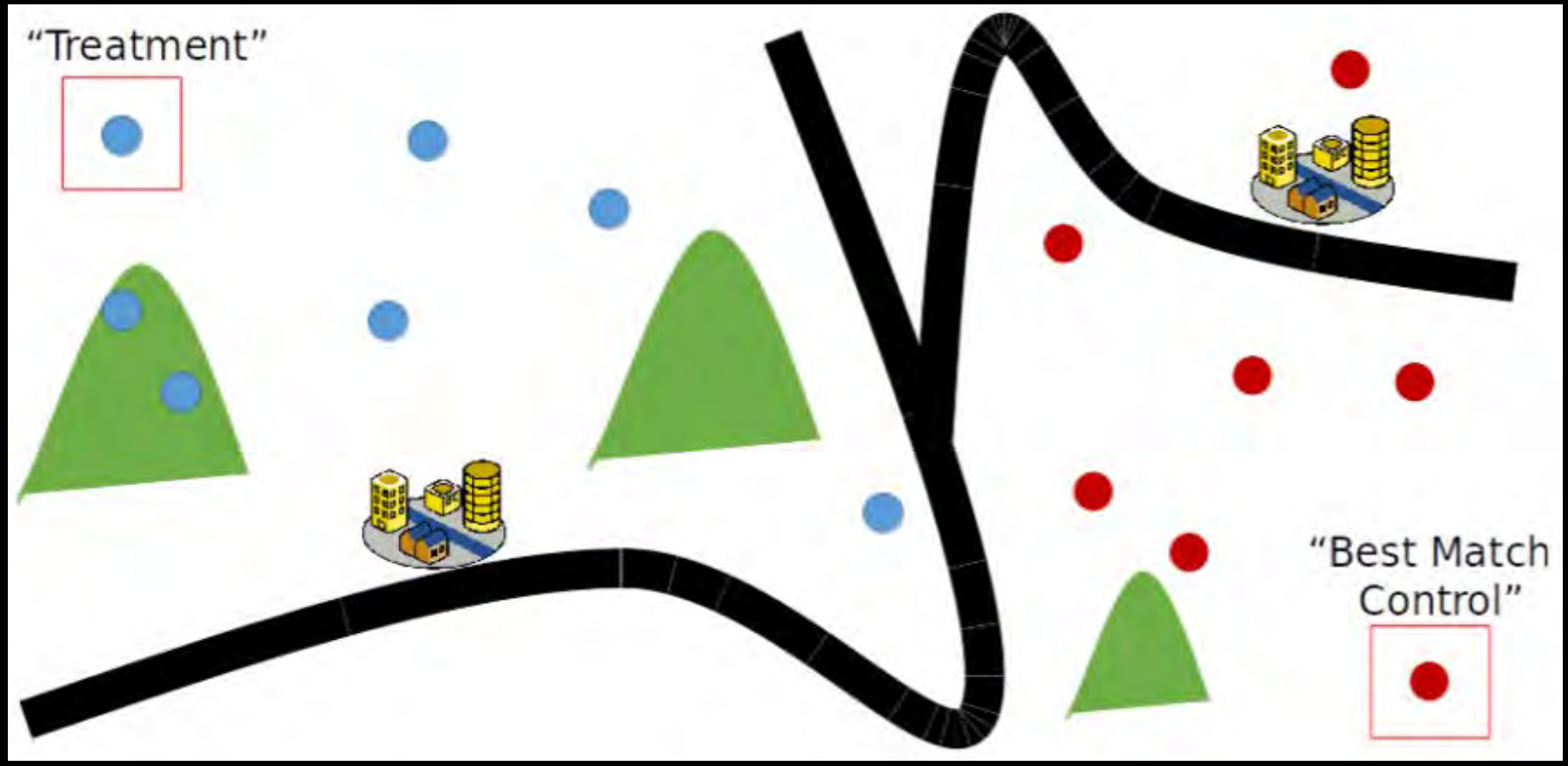
1. Impact of GEF land degradation interventions
2. Factors associated with the environmental outcomes
3. Value for money in terms of carbon sequestered



Methodology

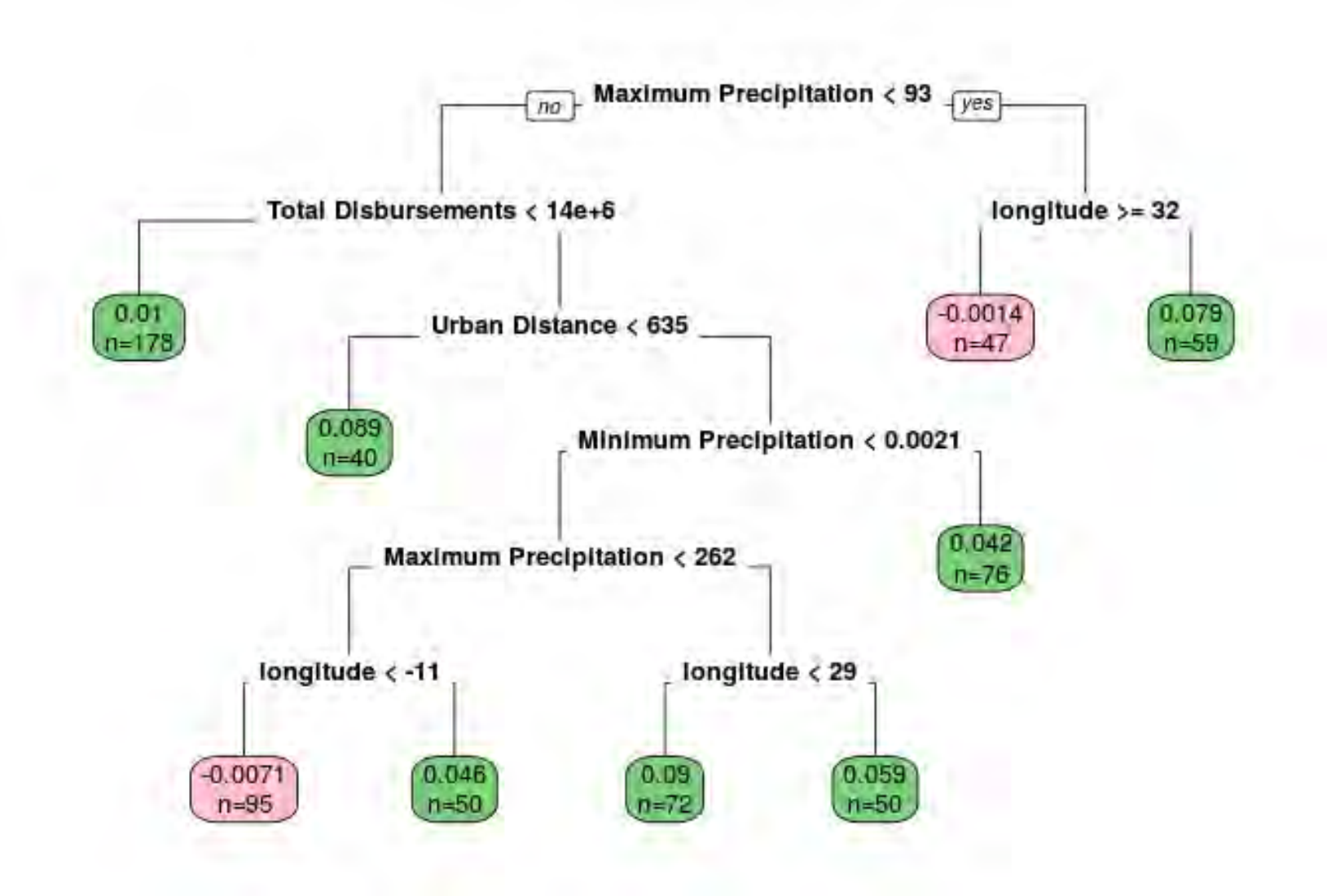
LAND DEGRADATION

Quasi-experimental method



LAND DEGRADATION

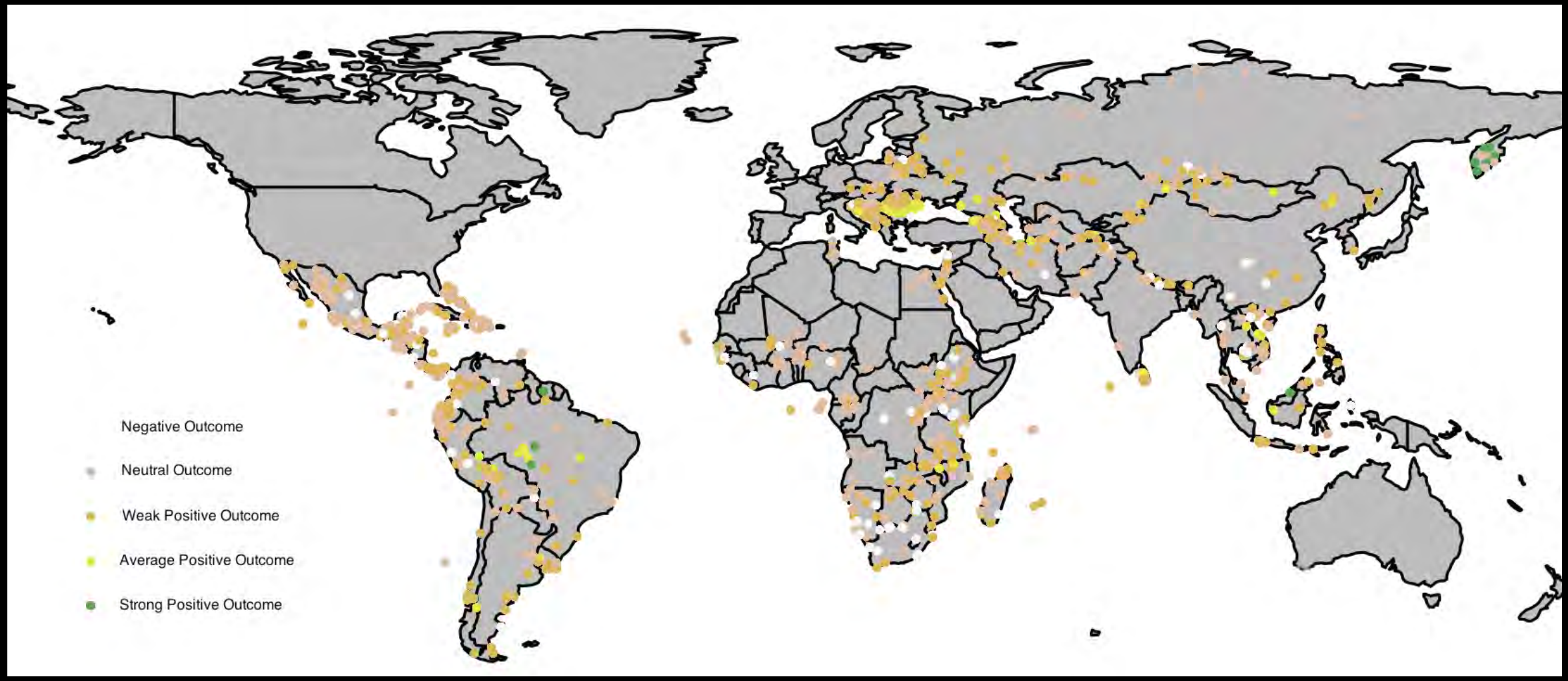
Machine learning and causal tree



LAND DEGRADATION

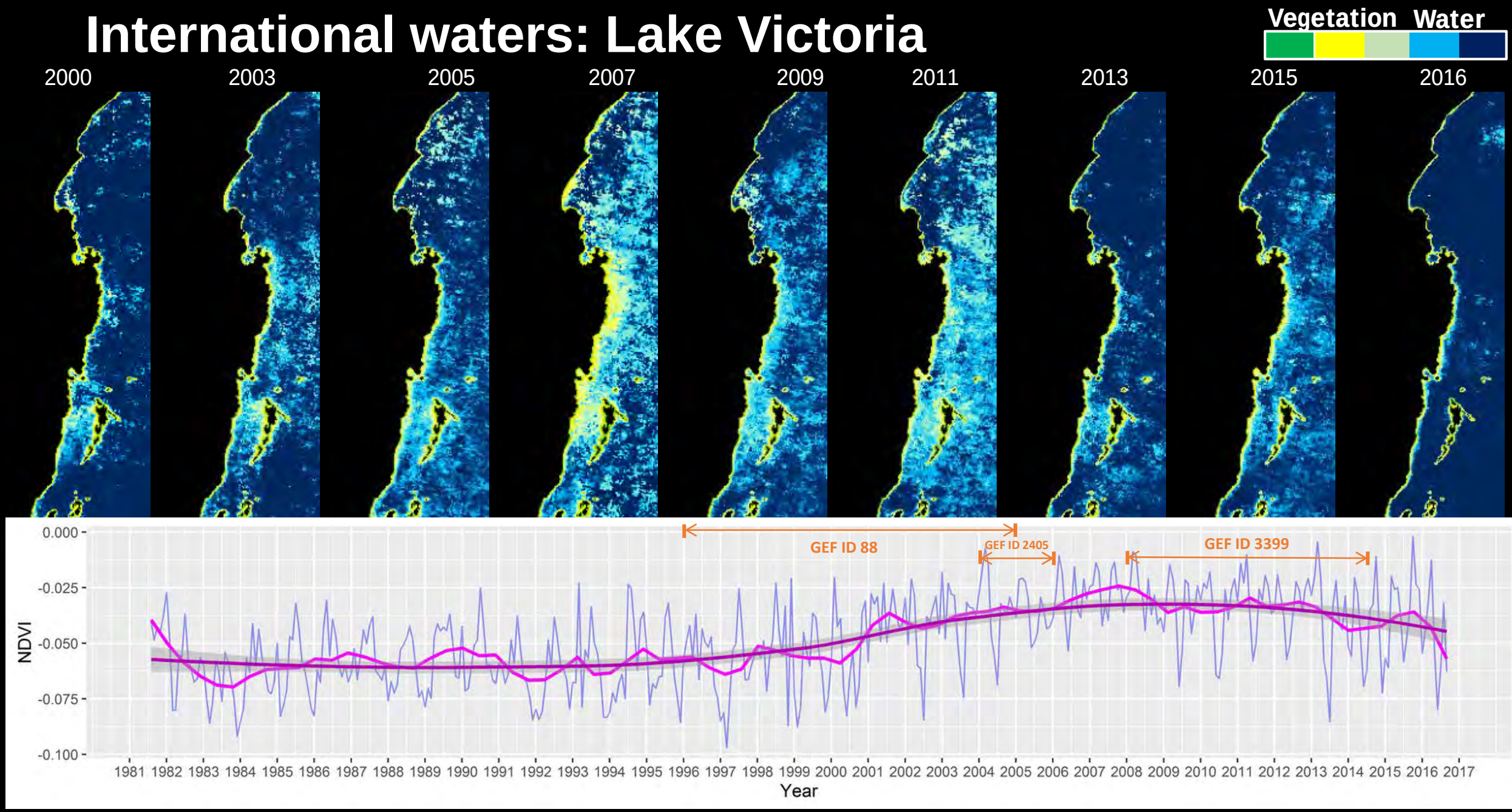
Bang for the buck

$1:1.08



DEMONSTRATING IMPACT

International waters: Lake Victoria



Ecological forecasting: Predicting the future

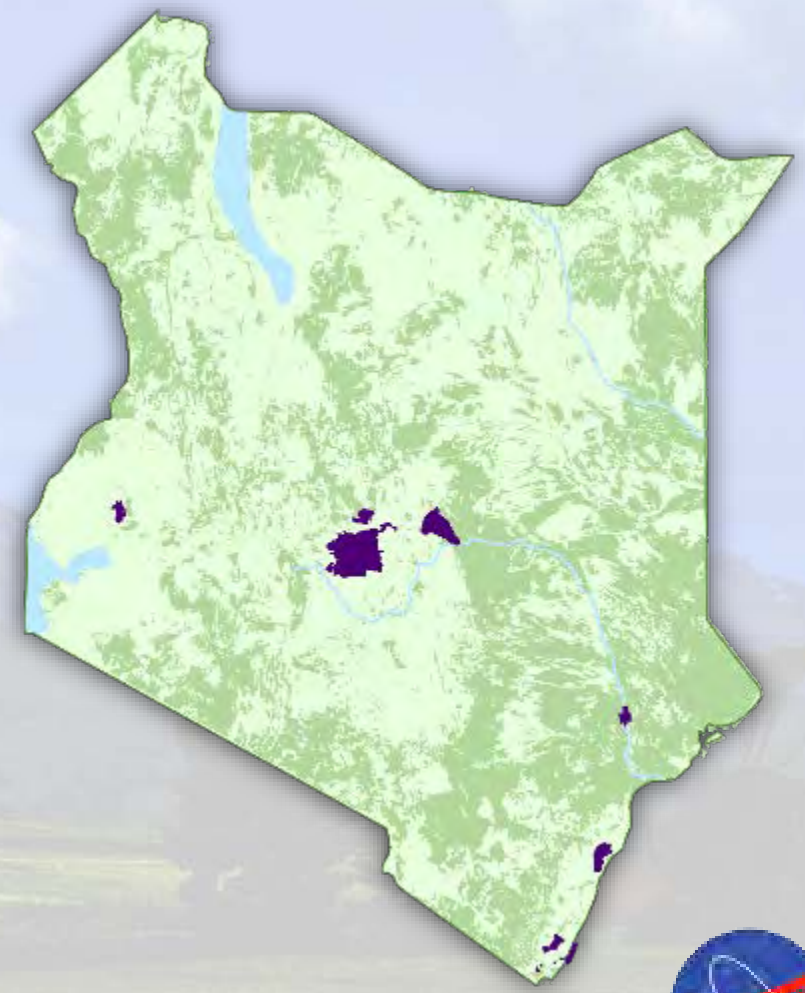
1. Estimating the impact
2. Project design
3. Scenario building

Kenya Ecological Forecasting

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

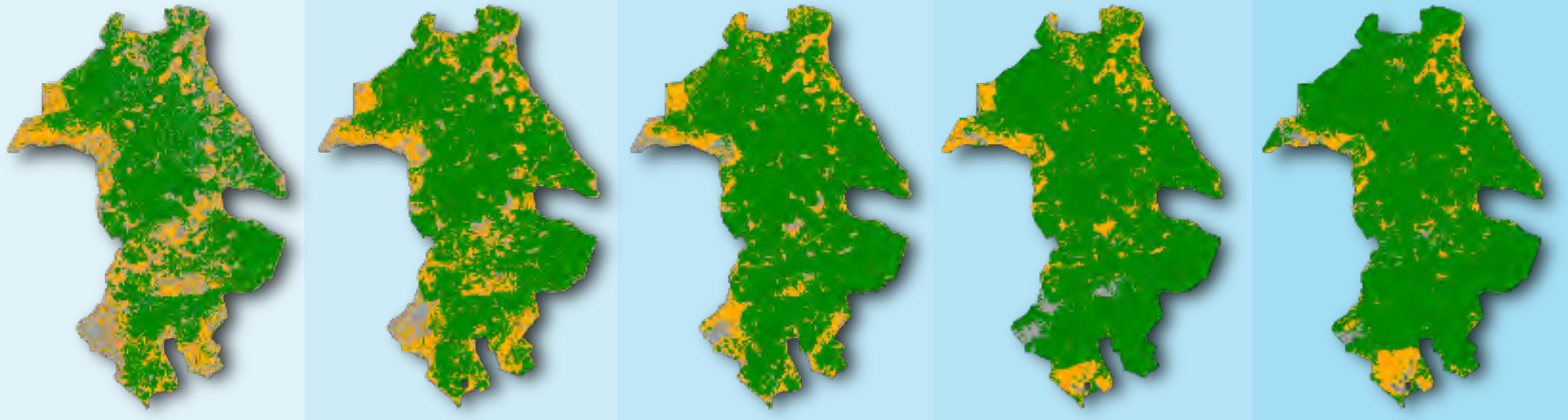
- Research collaboration between the Global Environment Facility’s Independent Evaluation Office (GEF-IEO) and NASA DEVELOP program

- Evaluated land cover and aboveground carbon stocks for 12 GEF protected areas in Kenya

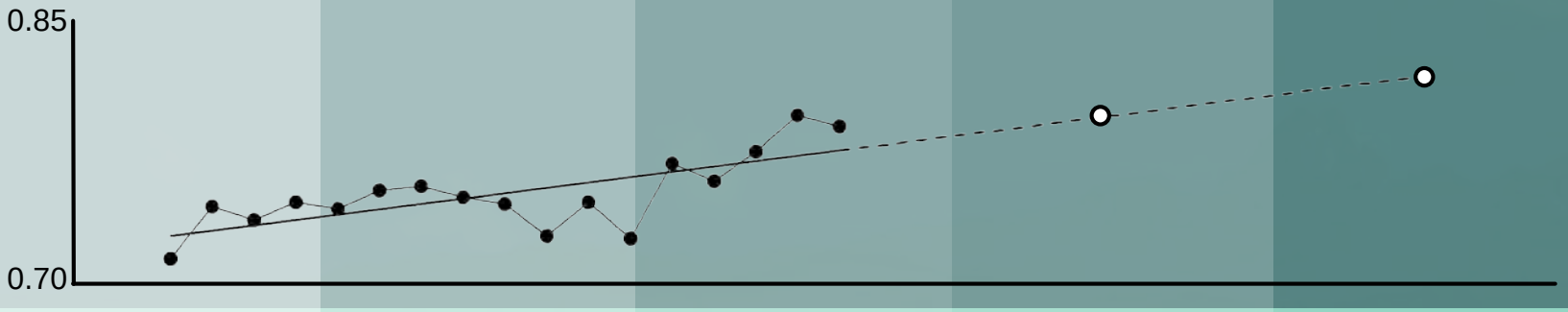


Land Cover Change

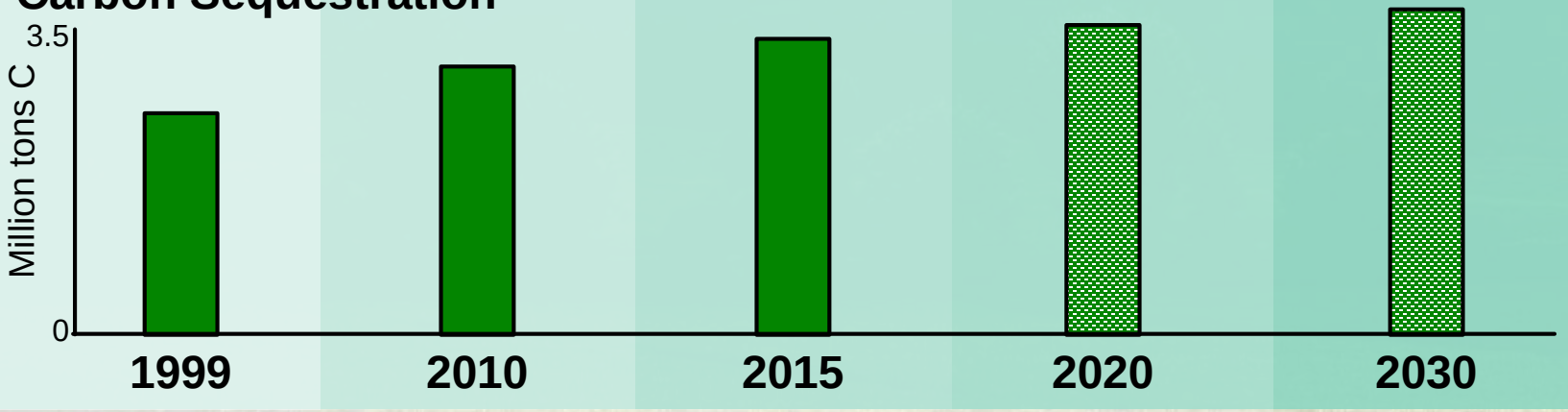
Forest Non-vegetated Shrub



NDVI

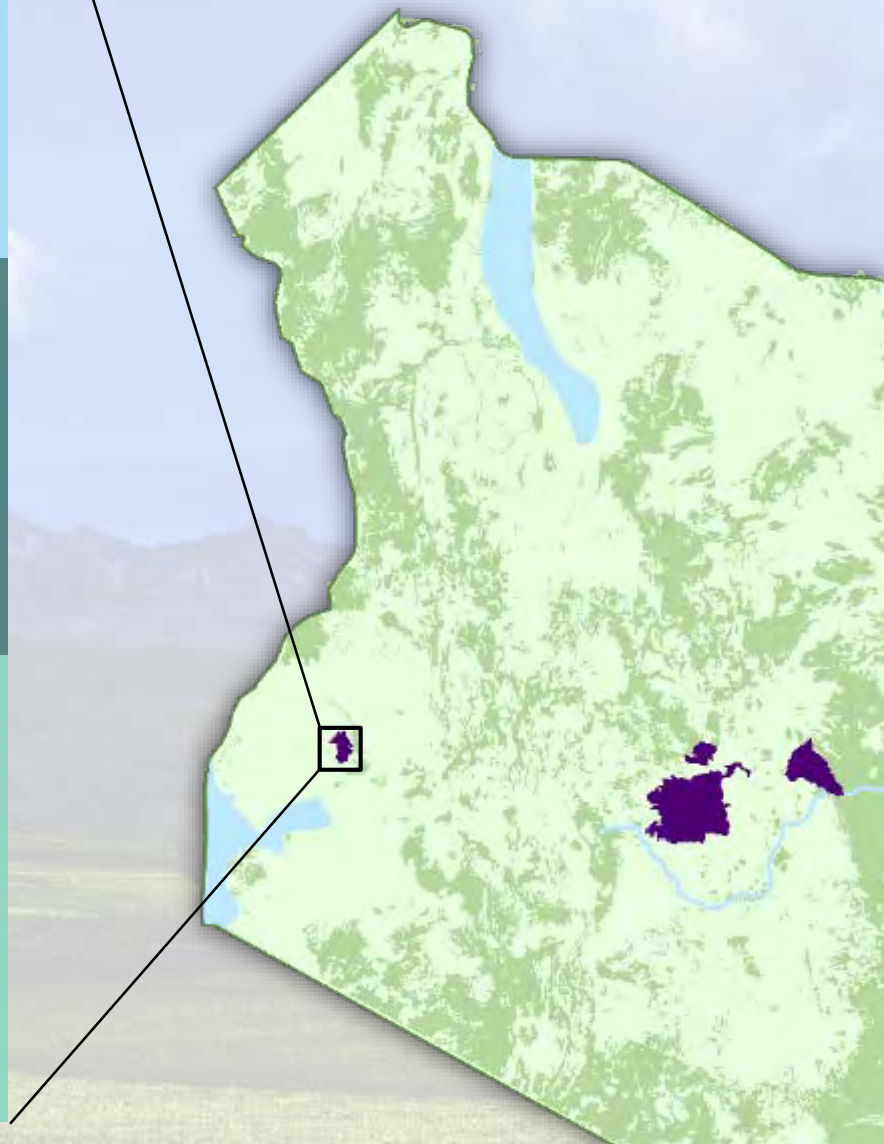


Carbon Sequestration



Case Study:

Kakamega Forest Reserve



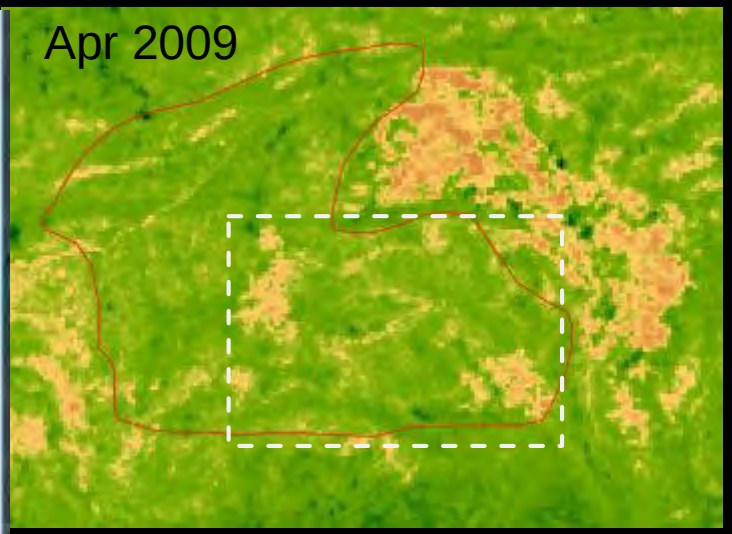
Triangulating Across Methods

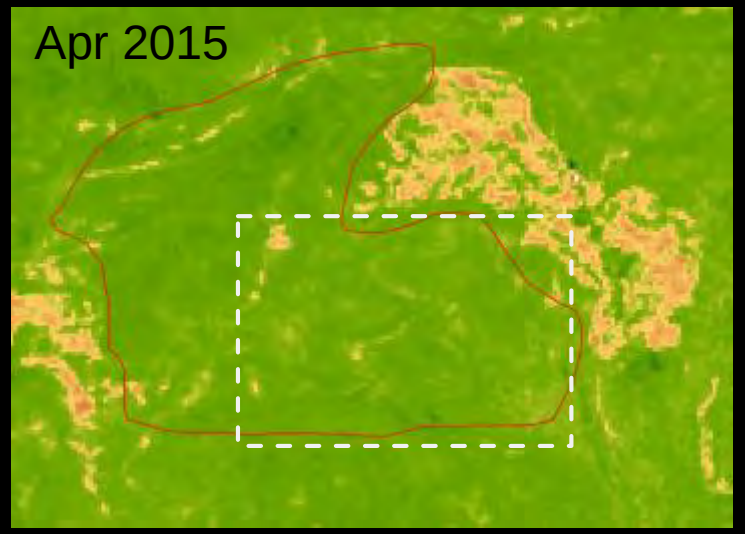
Beneficiary survey

Question	Response
Whats the current date and time	2016-09-18T13:27:00.000-06:30
Where is this interview taking place?	21.767220620007 78.66110602300134 488.3959563433855 24.0
Can I take a picture?	
Name of Interviewee(s)	Premlal anke
What is your role in the project?	beneficiary
Name of Organization	Jorpeni
Is the project creating any positive impact in the area/region/site?	yes
Did this project contribute to better land management ?	no_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?	no_a_moderate_
Did the project involve men and women equally?	yes
To what extent is the local community involved in the project?	no_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

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

Multiple Benefits, Trade-off and Synergies, Integrated approaches

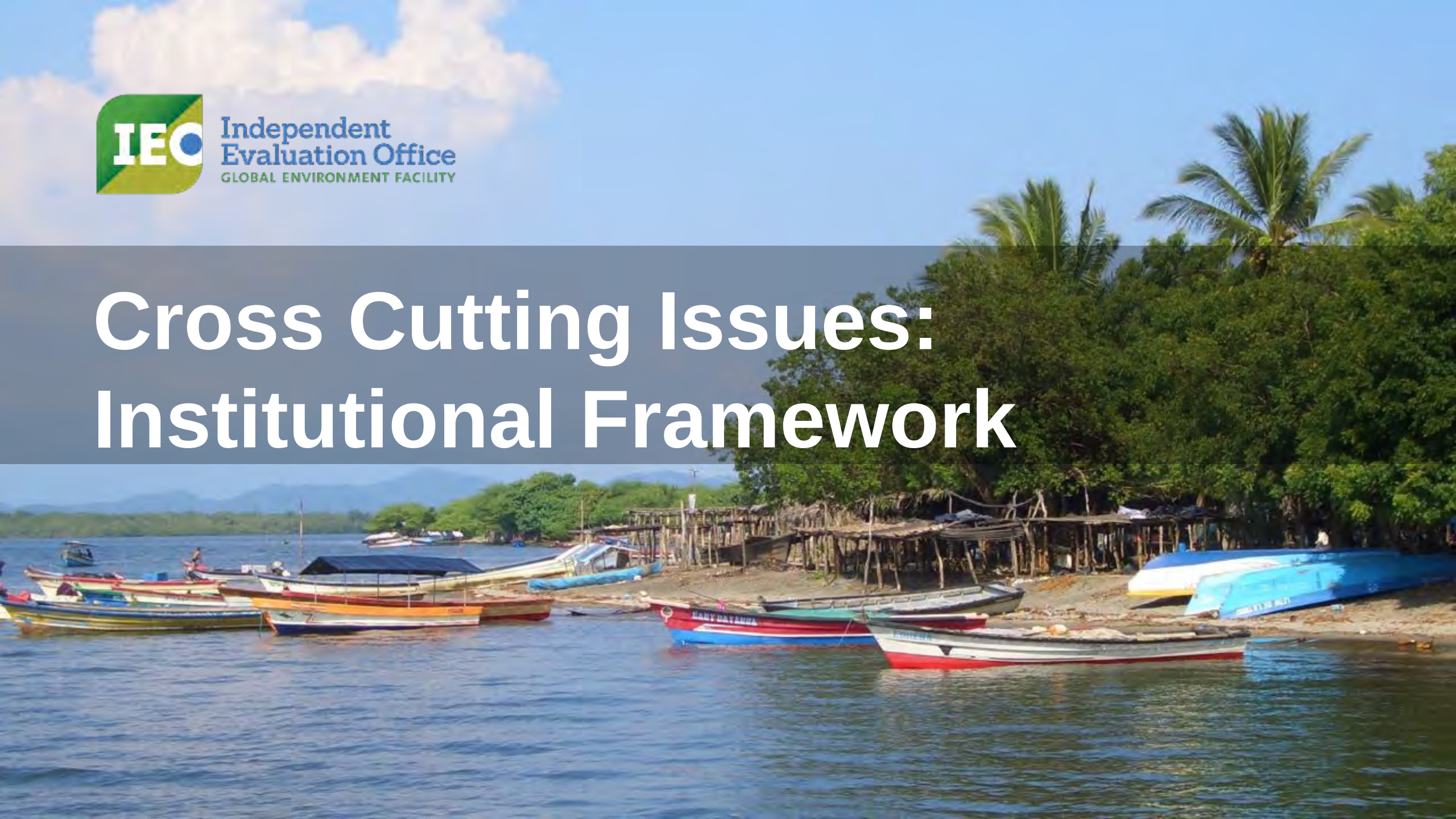
Jeneen Garcia

Module 4: Governance and Institutional issues

- Cross cutting issues (Gender, CSO,Ips, KM,Private Sector)

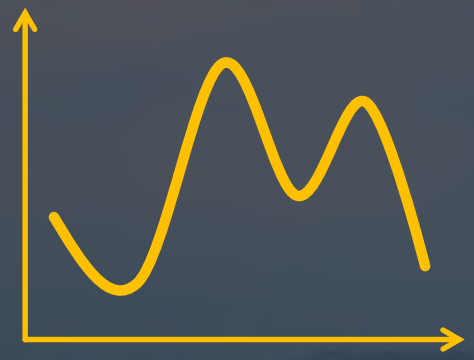
Independent Evaluation Office
GLOBAL ENVIRONMENT FACILITY

Cross Cutting Issues: Institutional Framework



INSTITUTIONAL FRAMEWORK

Financing



Exchange rate volatility

$£¥€

Donors have delivered on funding commitments

Fragmentation in donor funding

Ability to offer grants and non-grants appreciated

460 projects
$2,5 million in GEF investments

INSTITUTIONAL FRAMEWORK

Private sector

Not an area of comparative advantage

Operational restrictions constrain engagement

Climate change investments feature heavily

Needs to be seen as a partner, not only a source of funding

91 projects
$732.6 million in GEF investments

INSTITUTIONAL FRAMEWORK

Non-grant instrument

Greater diversity in use of NGI, beyond climate change

Technical assistance plays a significant role

Accessing NGI funds

In-house capital markets expertise

INSTITUTIONAL FRAMEWORK

Gender

Modest improvements

Gender analysis = higher gender ratings

Policy does not provide a clear framework

Gender Partnership is evolving into a platform to build a constituency

INSTITUTIONAL FRAMEWORK

Safeguard policies and indigenous people

Catalytic role in many GEF agencies

Gaps in the GEF Minimum Standards

Absence of guidance on safeguards reporting during project implementation

GEF projects that include indigenous peoples has increased substantially

Most agencies fully consistent with obligations under Minimum Standard 4:IP

UNDP SGP is primary modality for engagement with IPs

INSTITUTIONAL FRAMEWORK

PMIS, RBM, Knowledge management: PROGRESS OBSERVED

Project Management Information System

Data quality needs to keep up with partnership needs

Results-Based Management

Promotes accountability, limited learning

Knowledge Management

Used, and facilitates information sharing and, but access is limited

Module 5: The road ahead

- Addressing complexity
- Technological Innovations
- Open discussion, Q&A and concluding remark

Addressing complexity

Jeneen Garcia

Innovative Methods in M&E

Anupam Anand

BIG DATA?

- No fixed definition
- Data sets that are so large or complex that traditional data processing applications are inadequate
- Characterized by
  - Volume from various sources needing large storage
  - Velocity at which they are generated
  - Variety of unstructured formats needing additional processing
  - Value or meaning not immediately apparent

Adapted from Laney 2001, www.oracle.com and www.sas.com

The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data, with 1.9 million in the United States

Volume
SCALE OF DATA

40 ZETTABYTES
(43 TRILLION GIGABYTES)
of data will be created by 2020, an increase of 300 times from 2005

It's estimated that
2.5 QUINTILLION BYTES
(2.3 TRILLION GIGABYTES)
of data are created each day

6 BILLION PEOPLE
have cell phones

WORLD POPULATION: 7 BILLION

Most companies in the U.S. have at least
100 TERABYTES
(100,000 GIGABYTES)
of data stored

Variety
DIFFERENT FORMS OF DATA

As of 2011, the global size of data in healthcare was estimated to be
150 EXABYTES
(161 BILLION GIGABYTES)

By 2014, it's anticipated there will be
420 MILLION WEARABLE, WIRELESS HEALTH MONITORS

4 BILLION+ HOURS OF VIDEO
are watched on YouTube each month

30 BILLION PIECES OF CONTENT
are shared on Facebook every month

400 MILLION TWEETS
are sent per day by about 200 million monthly active users

Velocity
ANALYSIS OF STREAMING DATA

The New York Stock Exchange captures
1 TB OF TRADE INFORMATION
during each trading session

Modern cars have close to
100 SENSORS
that monitor items such as fuel level and tire pressure

By 2016, it is projected there will be
18.9 BILLION NETWORK CONNECTIONS
– almost 2.5 connections per person on earth

Veracity
UNCERTAINTY OF DATA

1 IN 3 BUSINESS LEADERS
don't trust the information they use to make decisions

in one survey were unsure of how much of their data was inaccurate

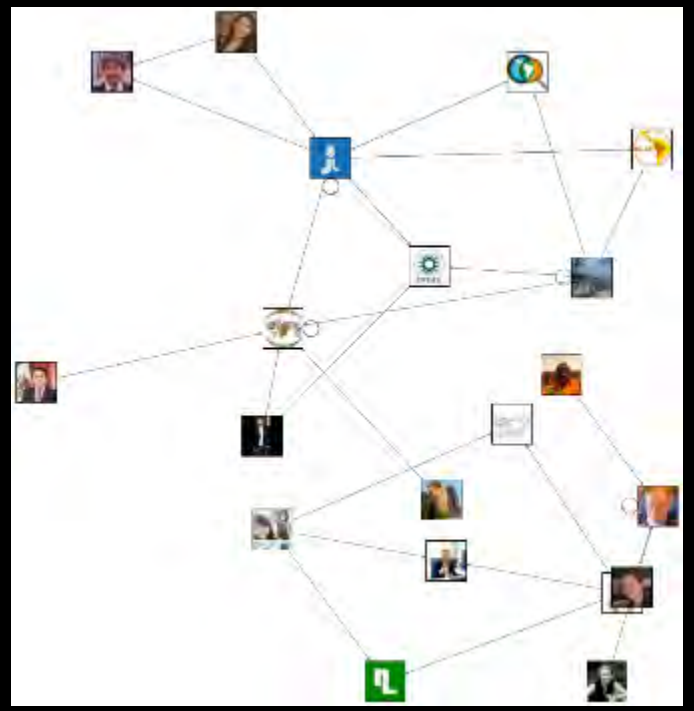
Poor data quality costs the US economy around
$3.1 TRILLION A YEAR

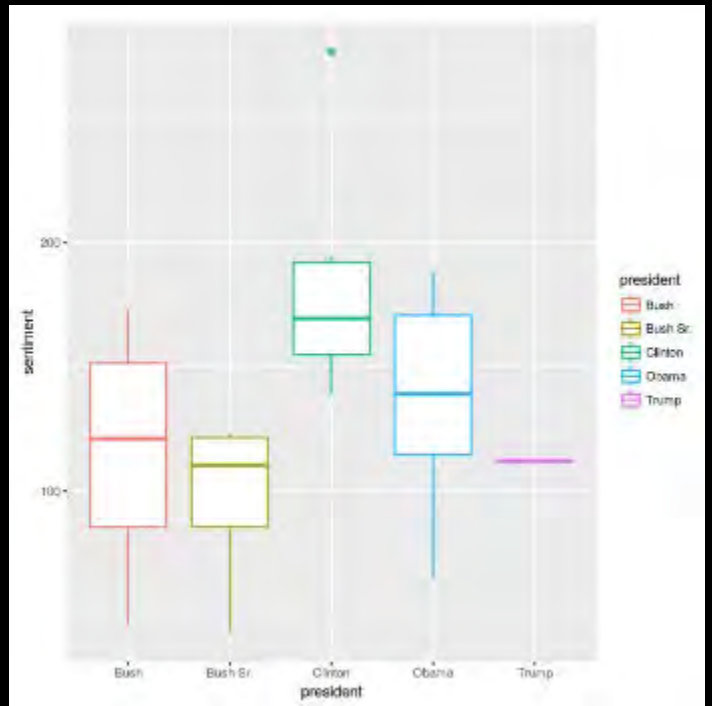
Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTEC, CAS

IBM

Social Media

- Crowdsourcing
- Network Analytics
- Text analytics
- Sentiment analysis





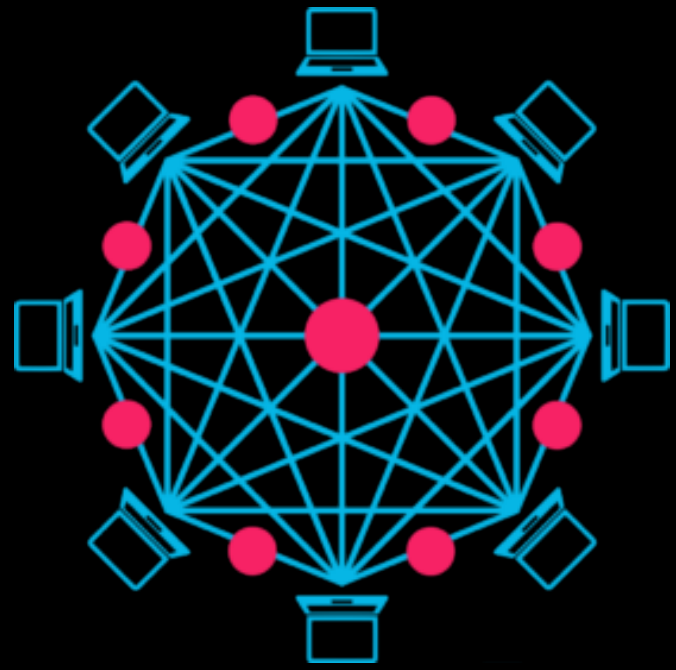
Internet of things(IoTs)

"Anything that can be connected, will be connected."

Open Source data, Blockchain

- Phenomenal increase in Open data and tools

- Blockchain technology will make data more secure and transparent



Geospatial Science

Tambopata National Reserve, Peru

- **1,400 active satellites**
- **Many more planned**
- **High resolution data available**

Application in Multiple Areas

SDGs and Earth Observation

Big data such as from satellite imagery and sensor networks make environment and development indicators increasingly measurable

Drones/UAVs

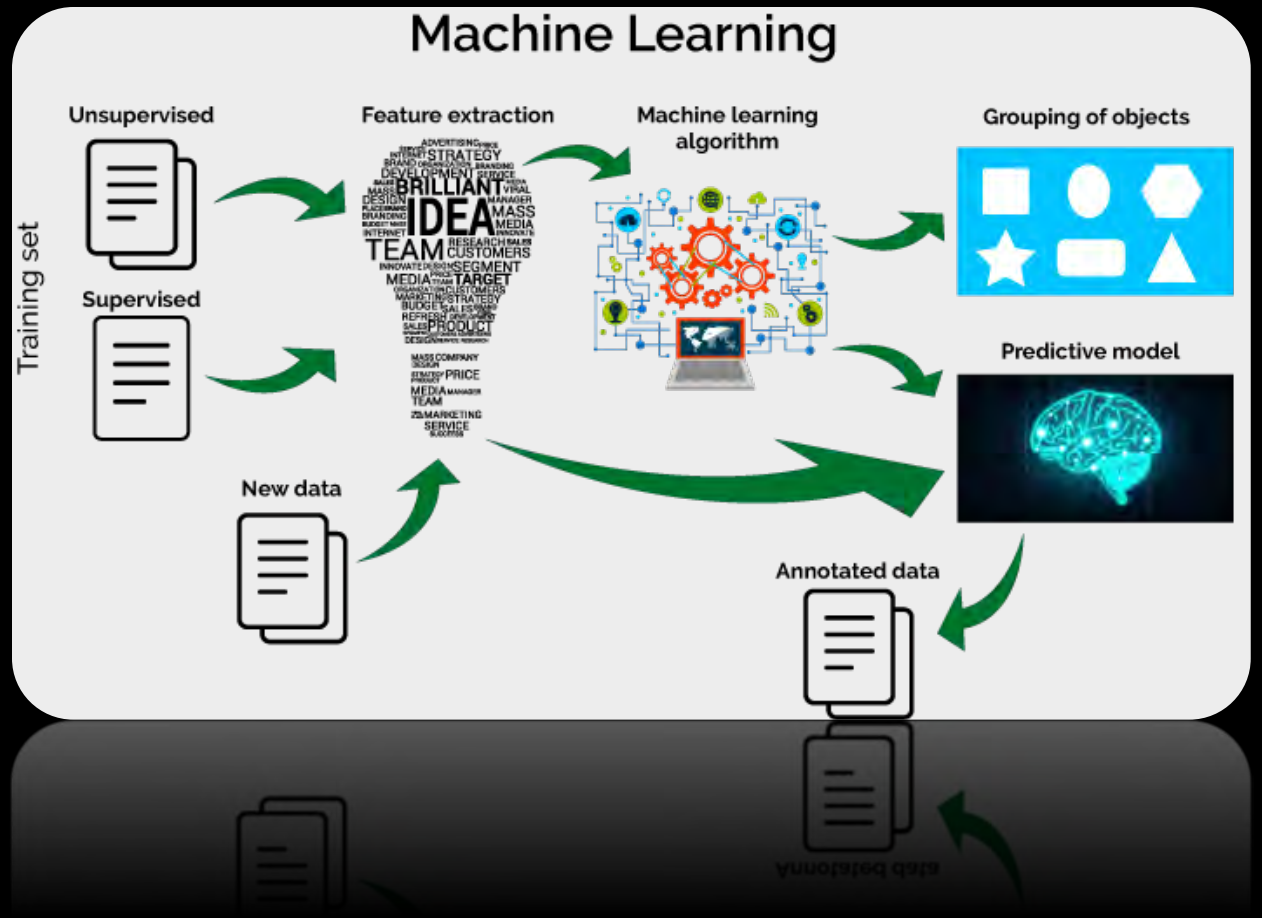
- For Rapid Assessments and baseline data

Application areas

- Payment for Ecosystem services(land productivity, biomass)
- Infrastructure projects
- Conflict area

Machine Learning, Artificial Intelligence

- Process all kinds of raw data faster
- Predictive analysis, likelihood of future outcome
- Pattern identification



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

Open Discussion


Thank you