



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

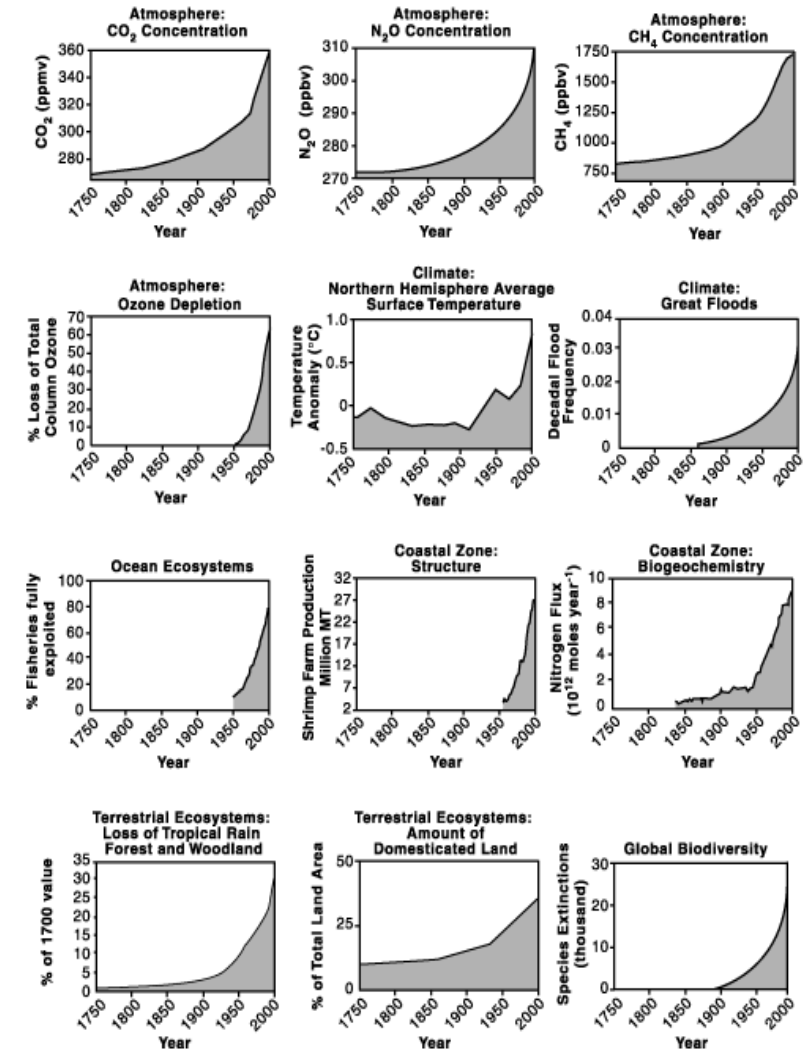
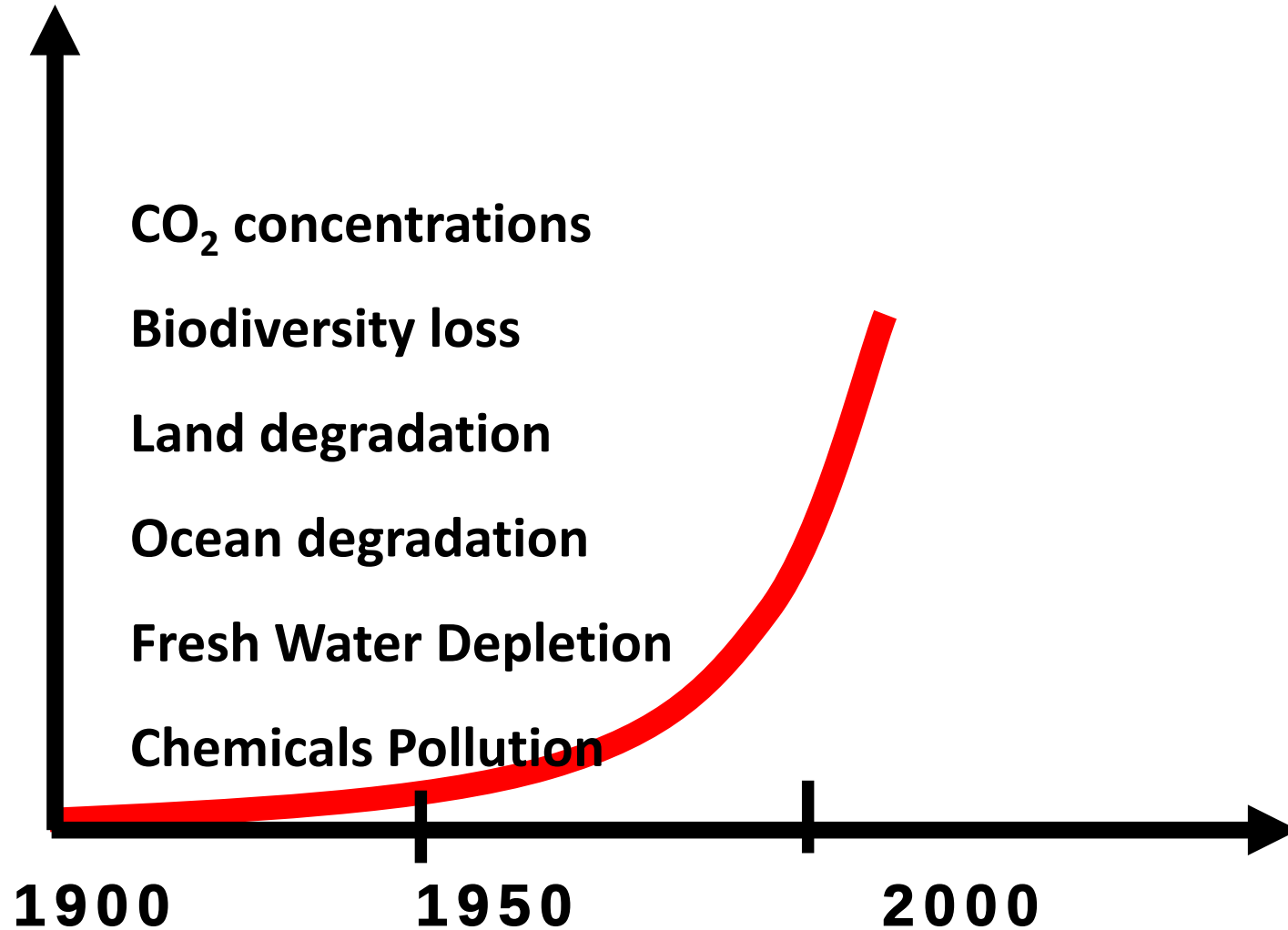
- Introduction to the participants and the session
- The state of the global environment including planetary boundaries
- Introduction to Global Environmental Facility, Conventions, IEO etc
- Linkages to the SDGs

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?

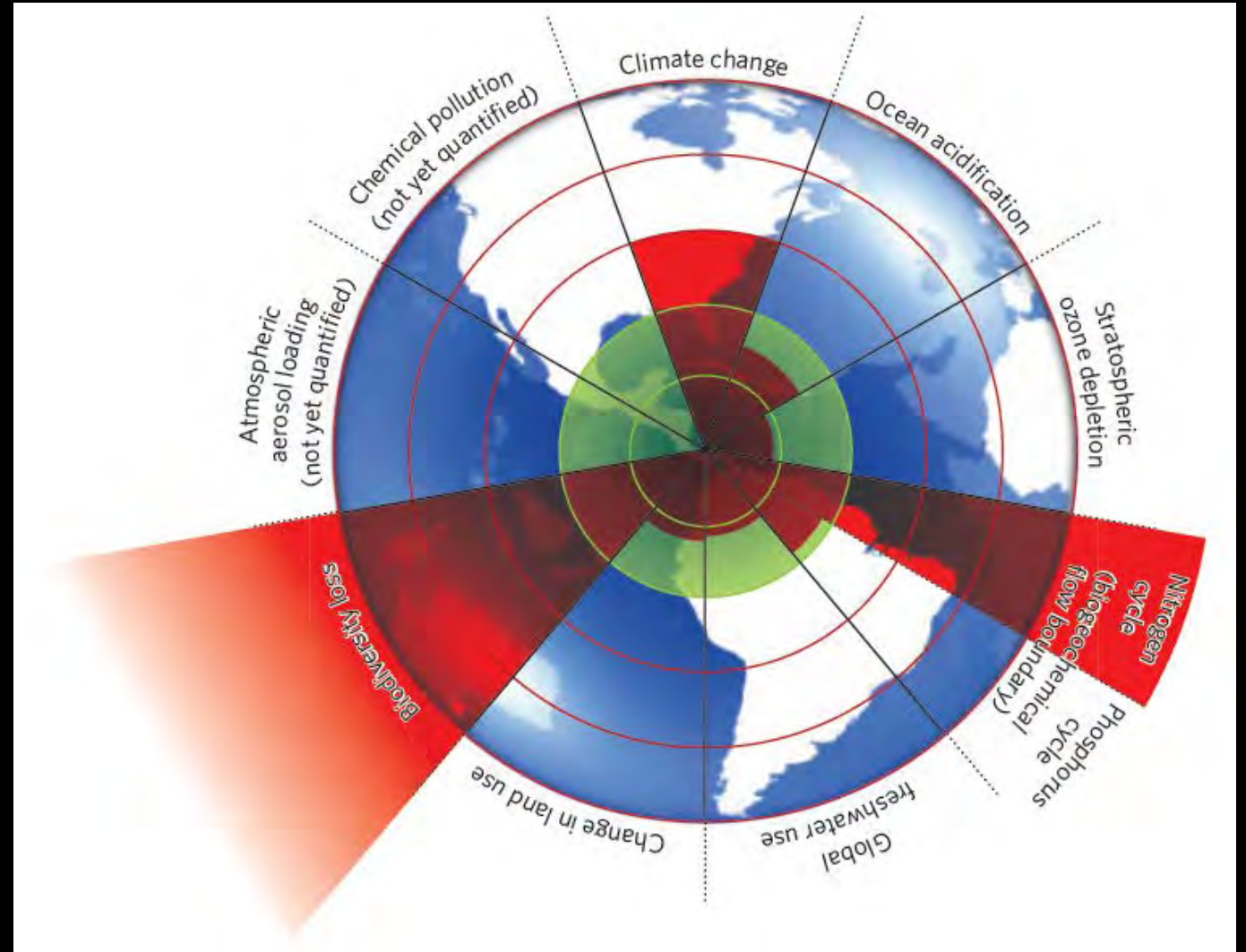
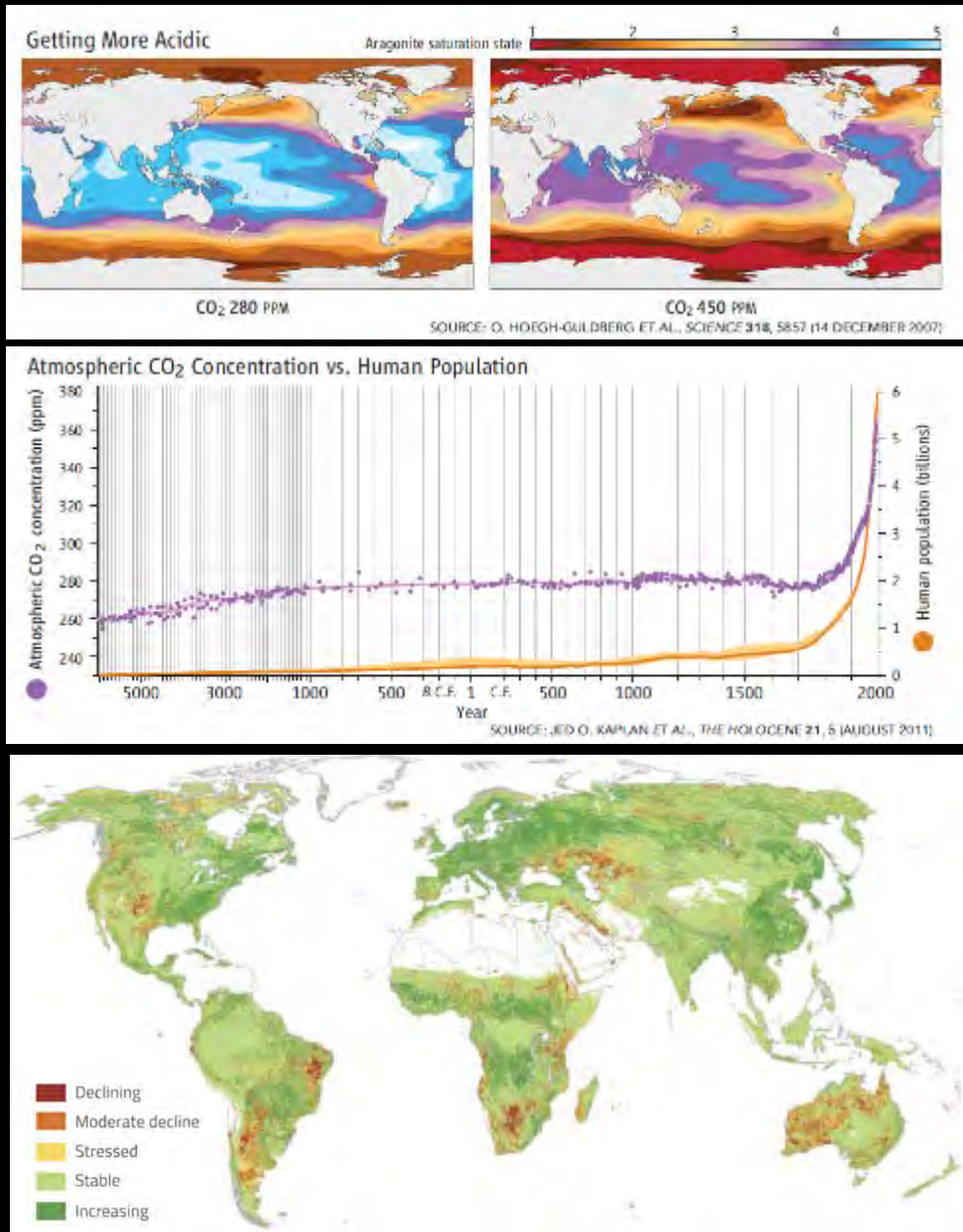


The State of Global Environment



Source: SEI

Transgressing safe boundaries





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**

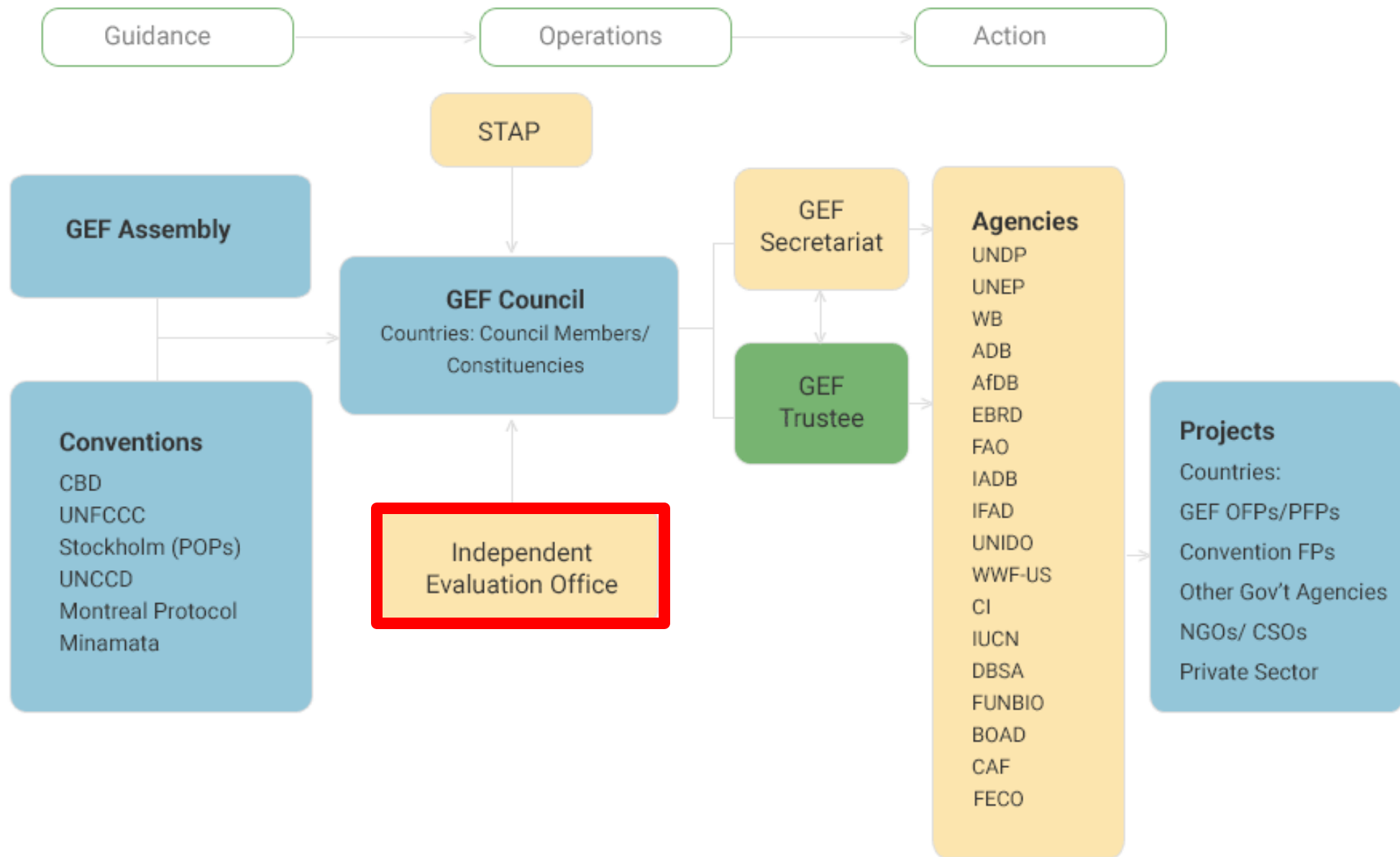
Established in 1992

Innovator and Catalyst

Unique Partnership

Financial Mechanism

The Global Environment Facility



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)

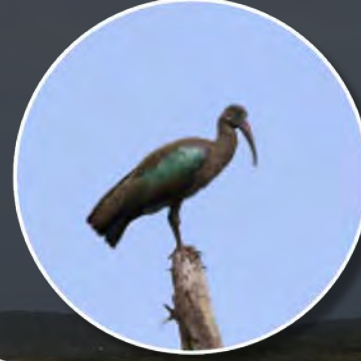
International Waters



Land Degradation



Biodiversity



Cities



Chemical and Waste



Climate Change

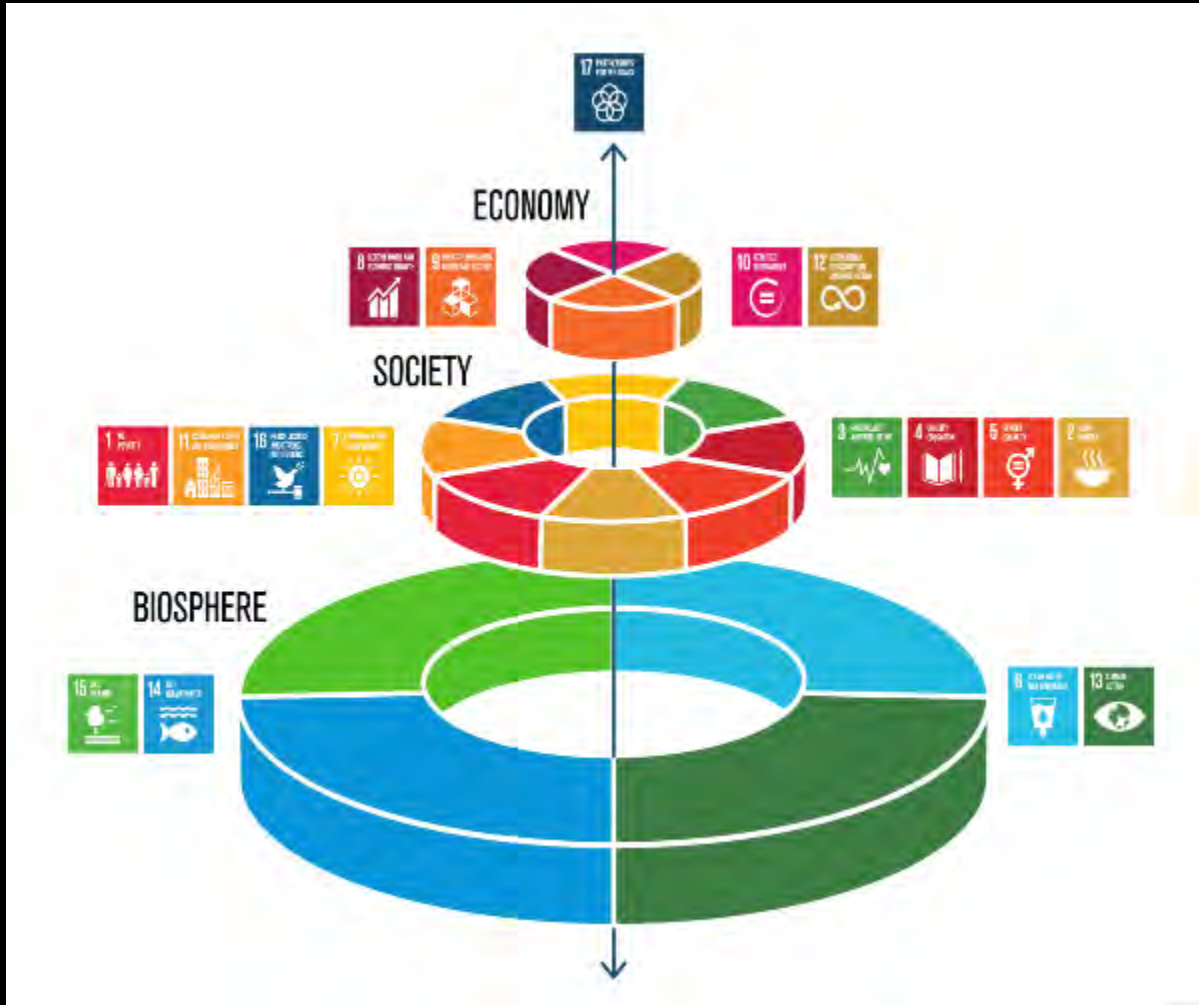


Commodities



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

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

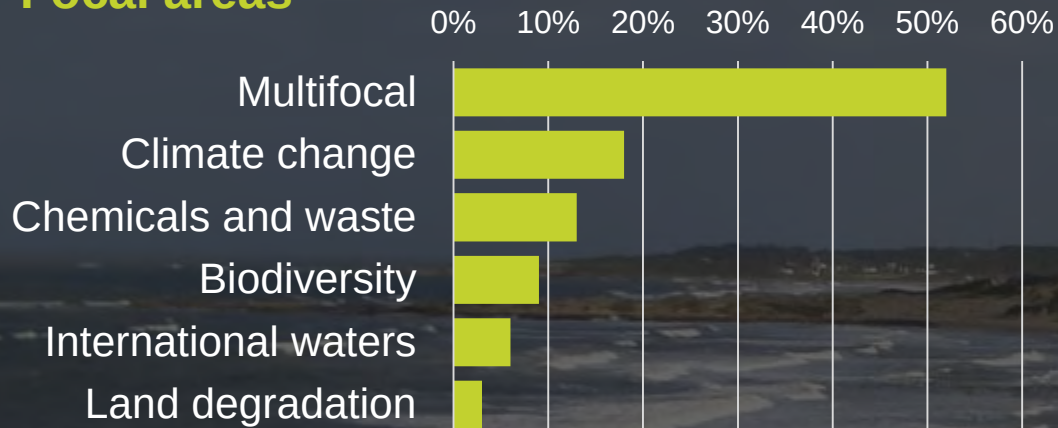
**Limitations
imposed by
data and
timing**

444 projects
\$2.4 billion

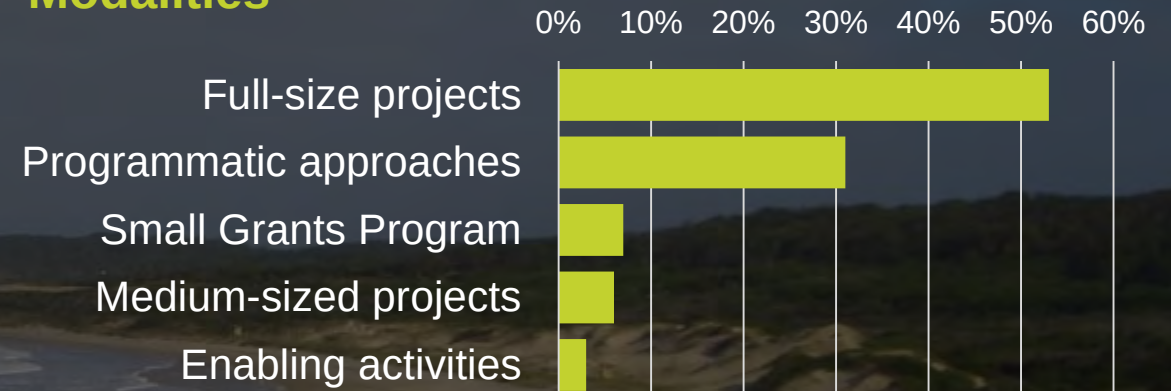
GEF-6 Overview

Portfolio (as of June 30, 2017)

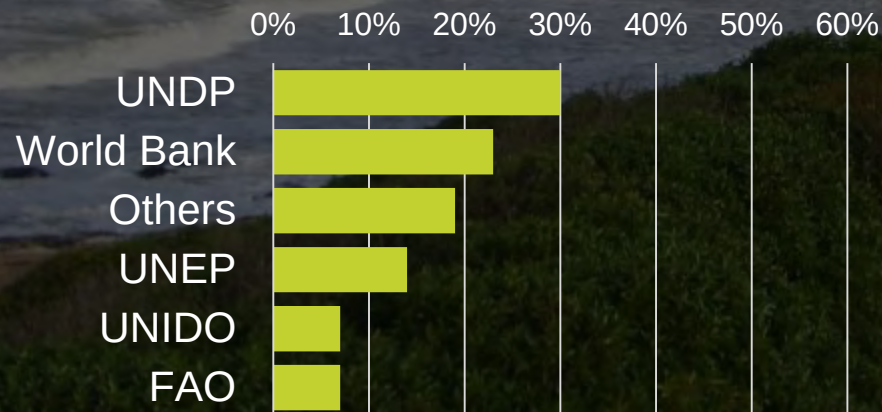
Focal areas



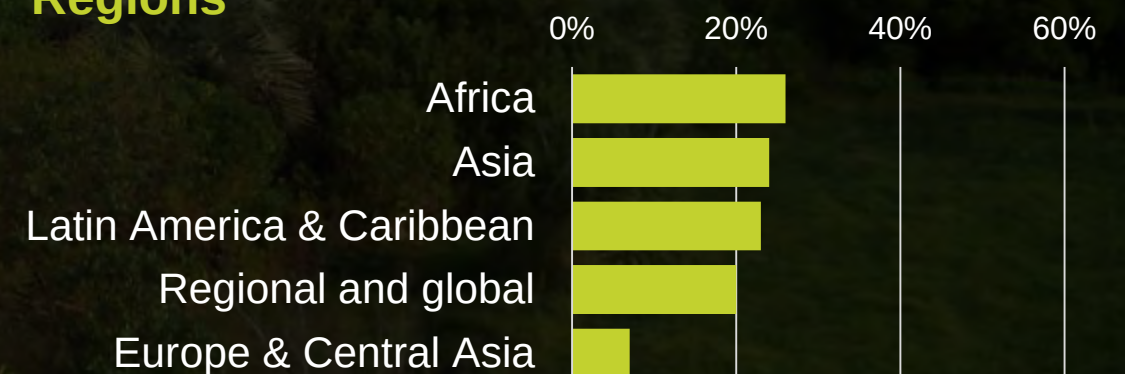
Modalities



Agencies



Regions



OPS6 Overview

Strategic relevance

Conventions. Main funding mechanism for:



Also relevant to the



Countries

More than
140
recipient
countries

Support for
middle
income
countries
remains
important

Support to
**LDCs and
SIDS**
has increased



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SECTION 2

Performance and Impact

Performance and Impact



Satisfactory outcomes



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

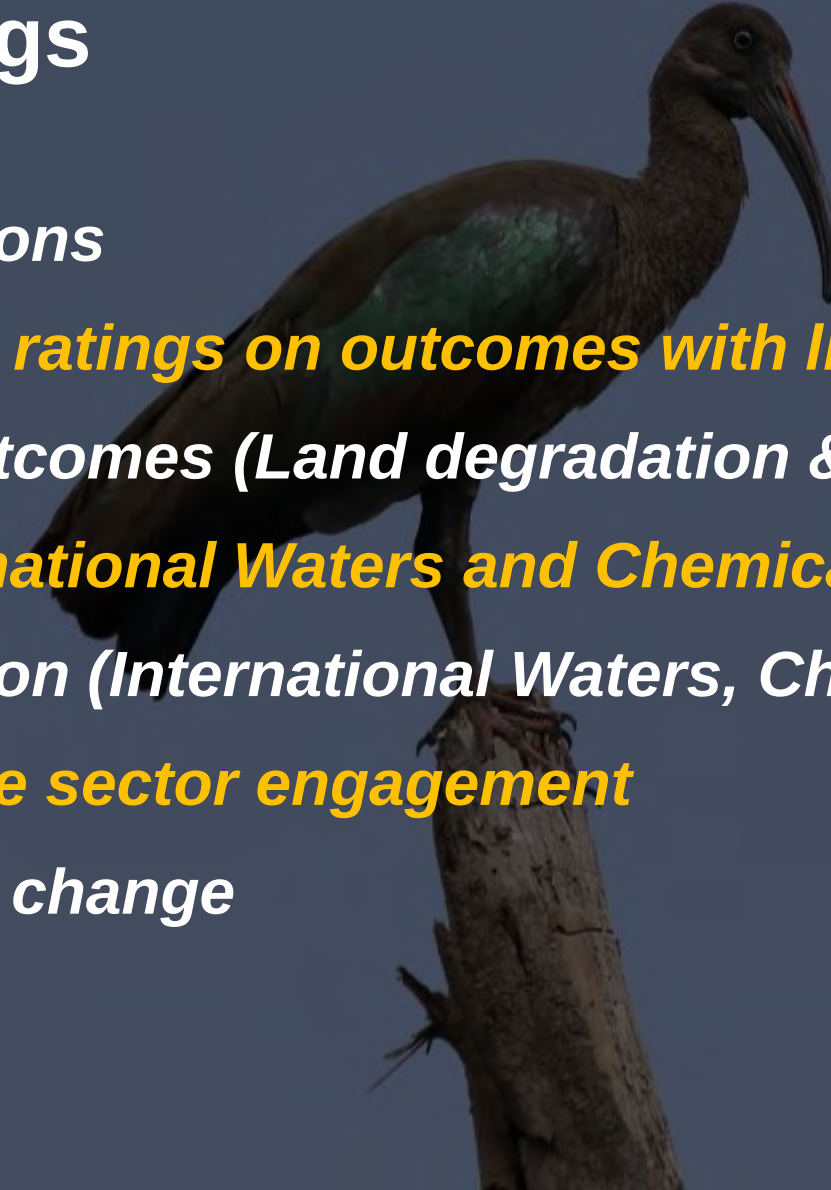
Sustainability of outcomes (Land degradation & Biodiversity)

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)



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



of completed projects received sustainability ratings in the likely range

- Resource availability:
Constraint to actual scaling up

FOCAL AREA STUDIES

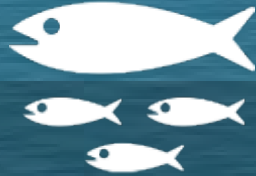
International waters

**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



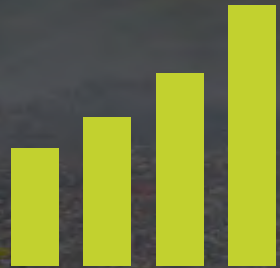
Cuba

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

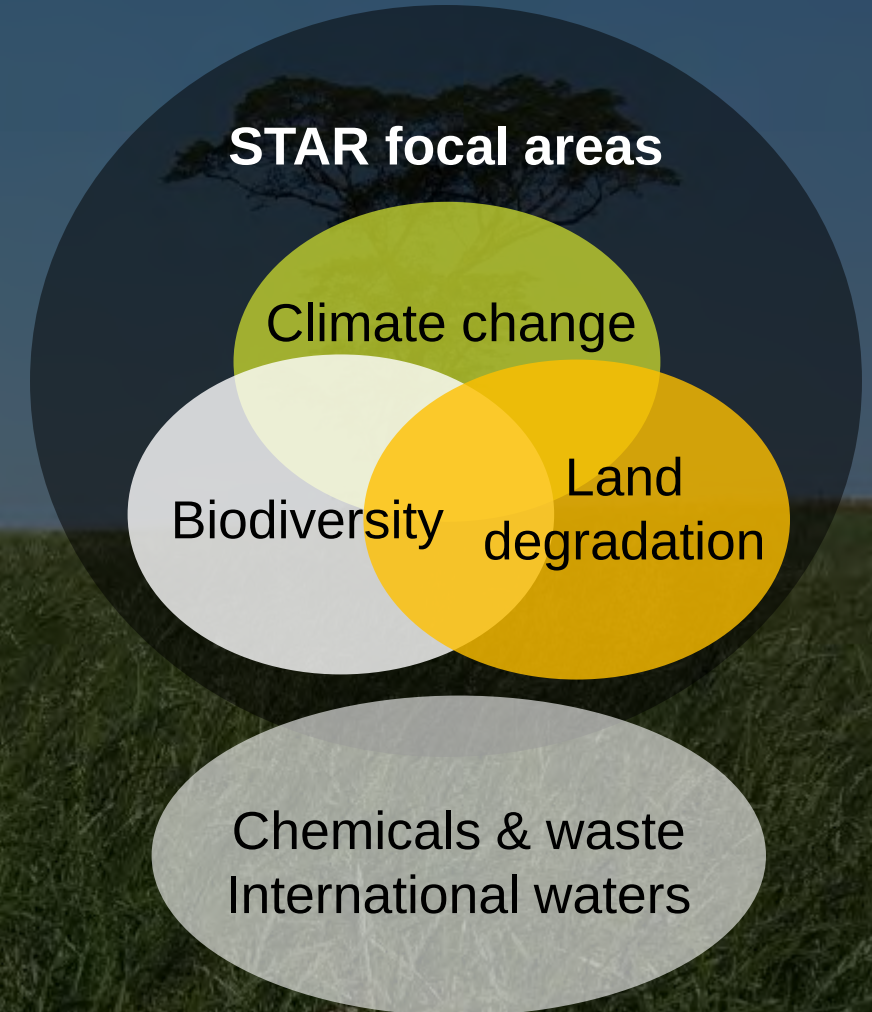
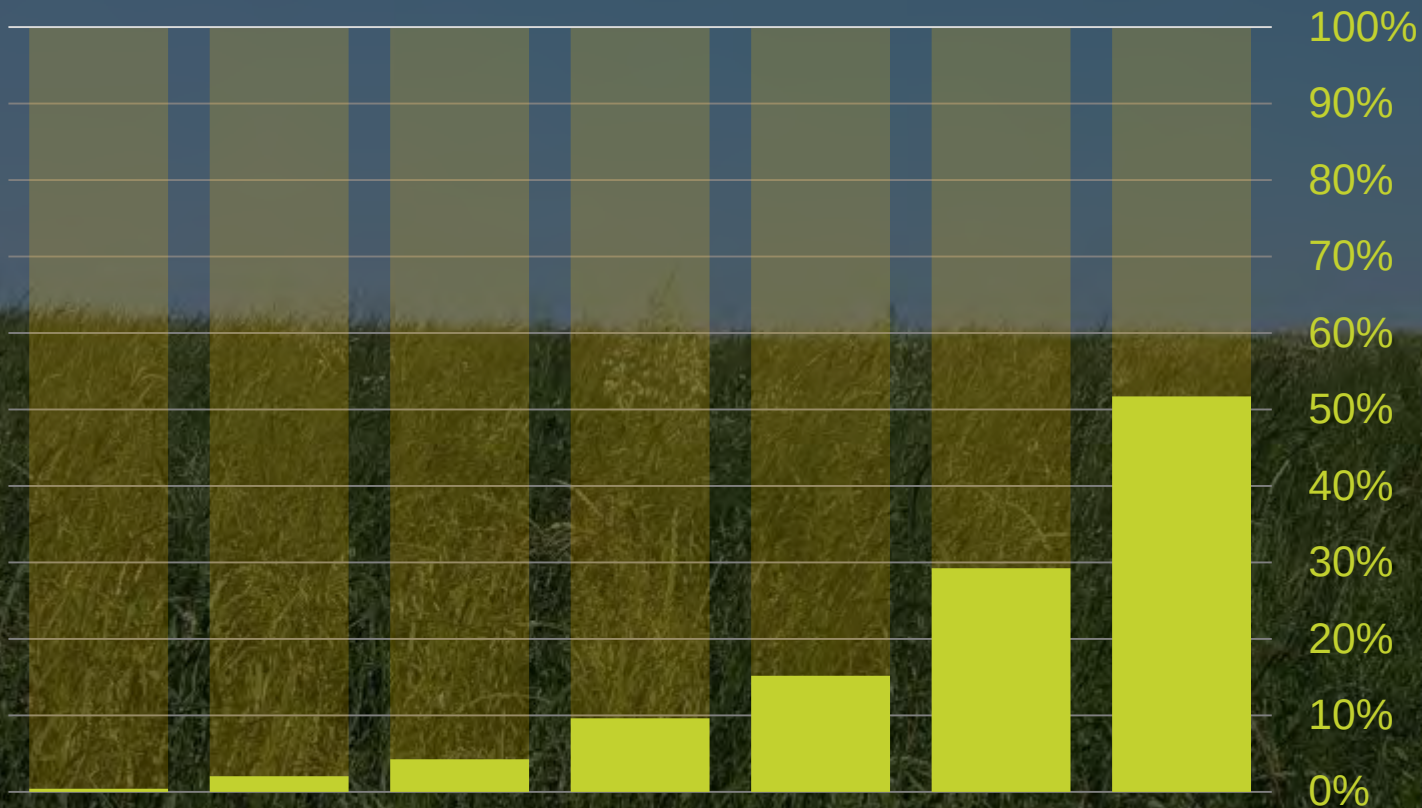
77% satisfactory outcomes
61% likely sustainable

FOCAL AREA STUDIES

Multifocal

Share of portfolio is growing

Pilot GEF-1 GEF-2 GEF-3 GEF-4 GEF-5 GEF-6



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



Senegal



Brazil

Mitigating trade-offs through value addition



China

Do GEF interventions yield positive **returns on investment?**

Land degradation

\$1:1.08

**43.52
tC/ha**

Biodiversity

\$1:1.04



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

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

1. Strategic positioning
2. Transformational change
3. Integration based on additionality

Financial

4. Financial management
5. Private sector management

Policies

6. Gender equality
7. Safeguards and indigenous people

Institutional

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.?



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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



of projects achieved
broader adoption

Mechanisms for broader adoption:

- +** Mainstreaming and replication
- Scaling-up and market change



of projects achieved
environmental stress reduction

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

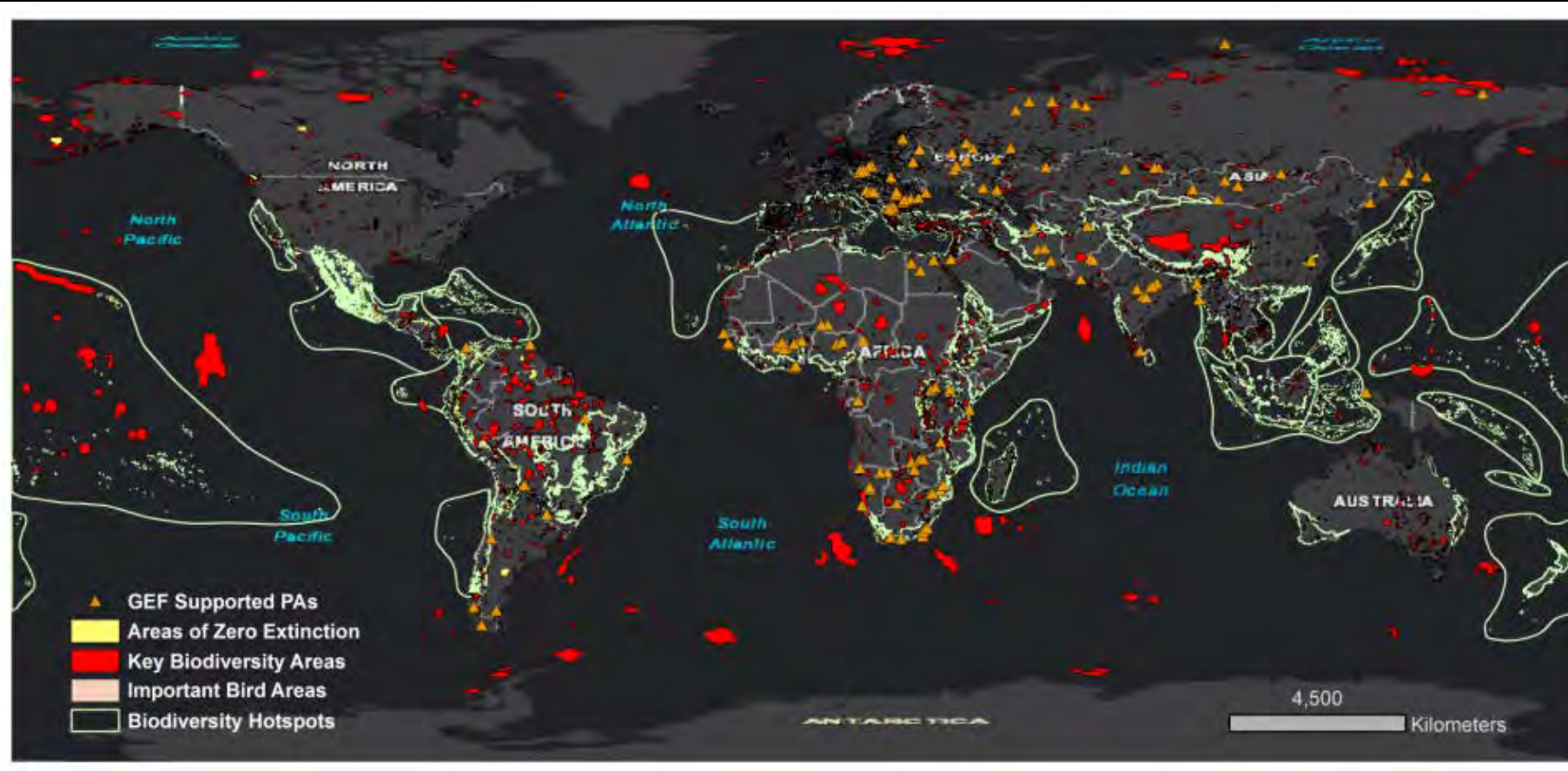
Questions we seek to answer through evaluation

- **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**?

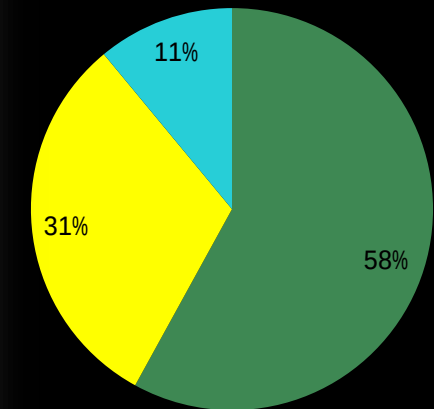
Biodiversity



Biodiversity: Relevance

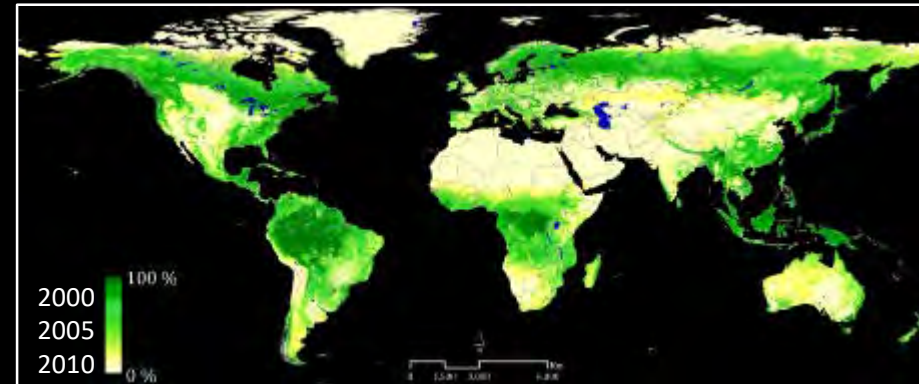


KEY BIODIVERSITY AREAS, highest scientific designation of global biodiversity significance



■ KBA ■ International Designation ■ National Importance

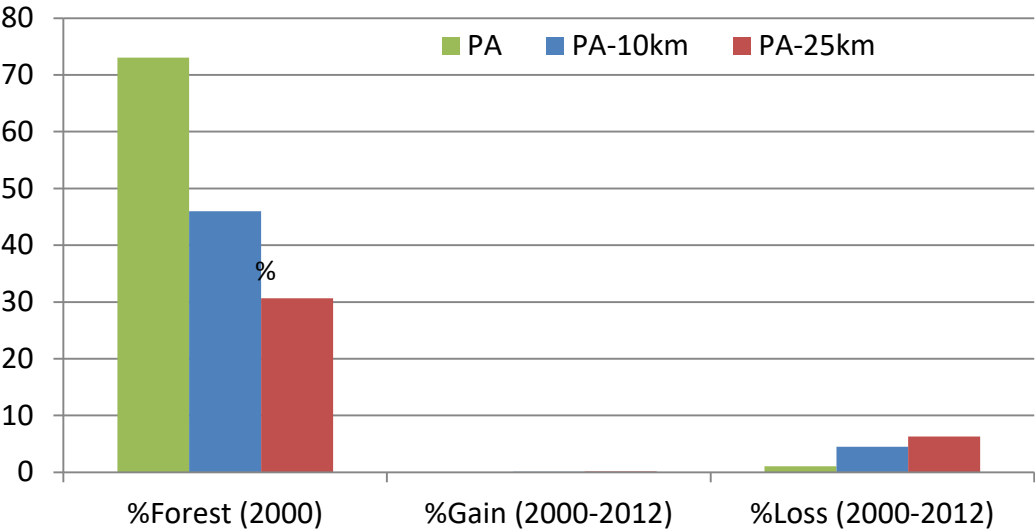
Study the impact of GEF support to 1292 global protected areas across 147 countries.



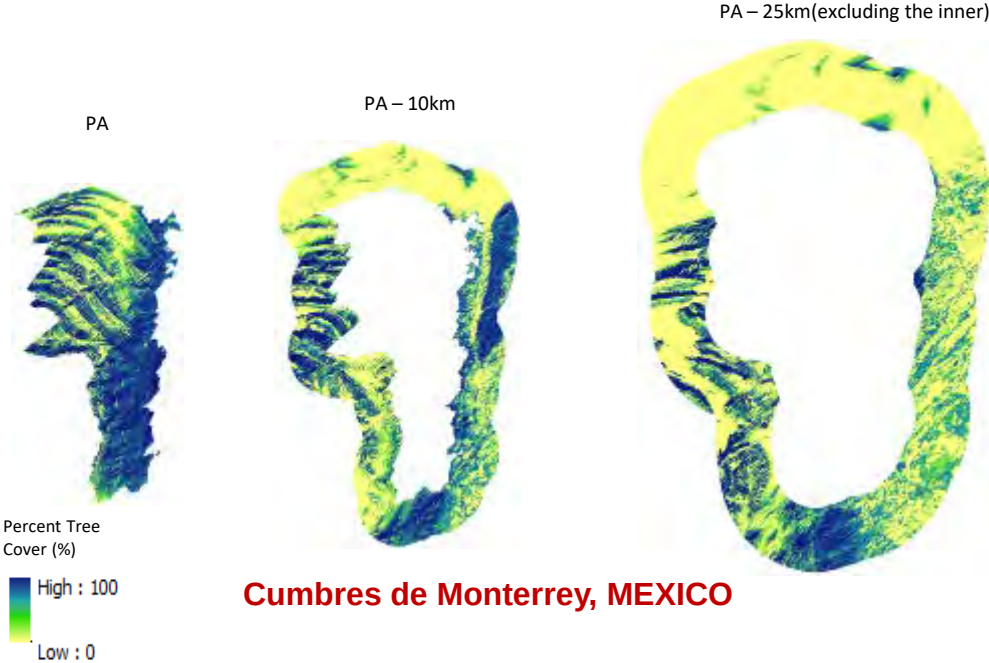
Forest Cover Change Analysis



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

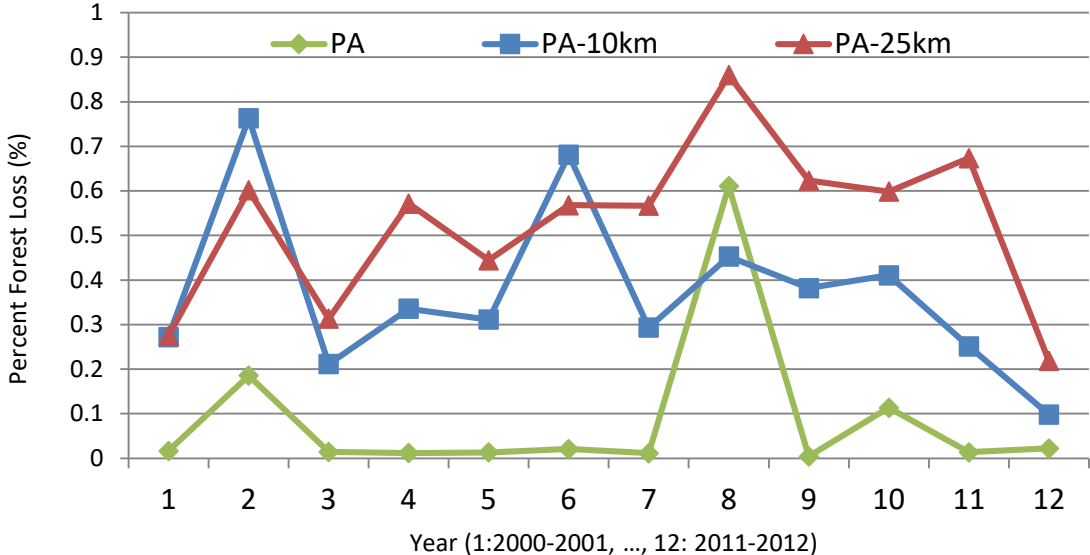


Percent Tree Cover (2000)

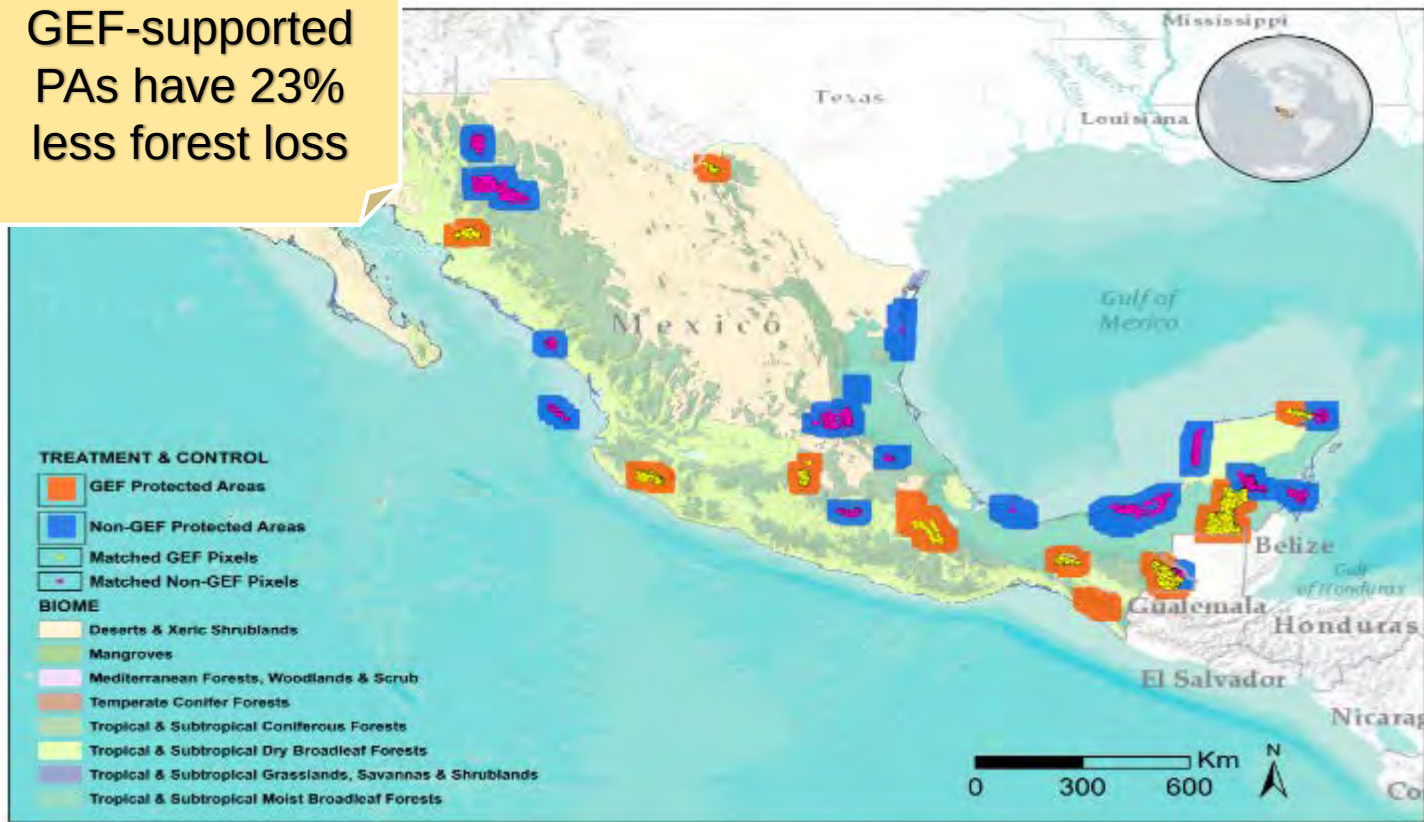


Cumbres de Monterrey, MEXICO

Yearly Percent of Forest Loss (2000 – 2012)



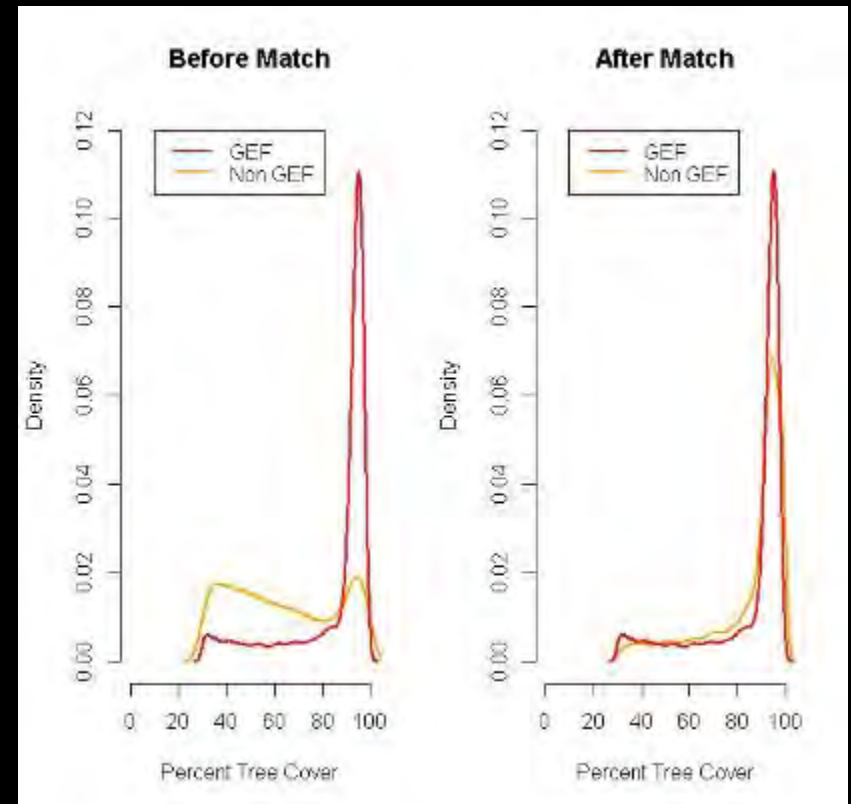
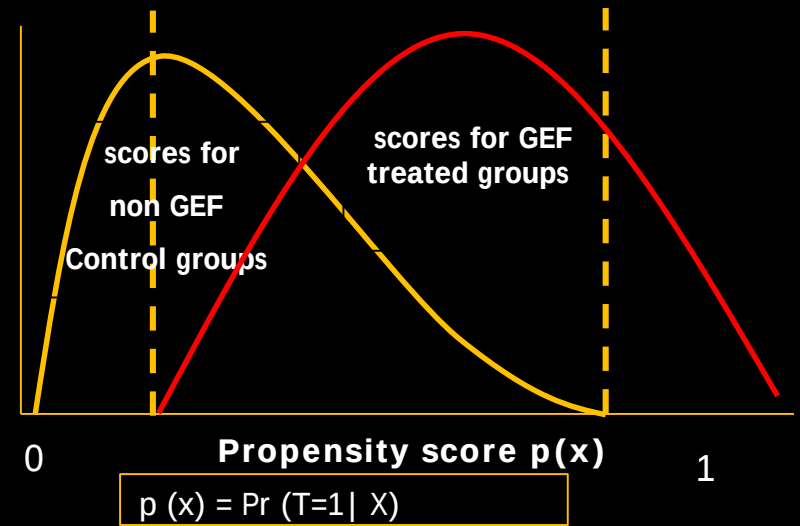
GEF-supported
PAs have 23%
less forest loss



Attribution: Did the intervention cause the change?

Quasi-experimental evaluation design based on PSM

Probability



Identify the drivers



2.5 m



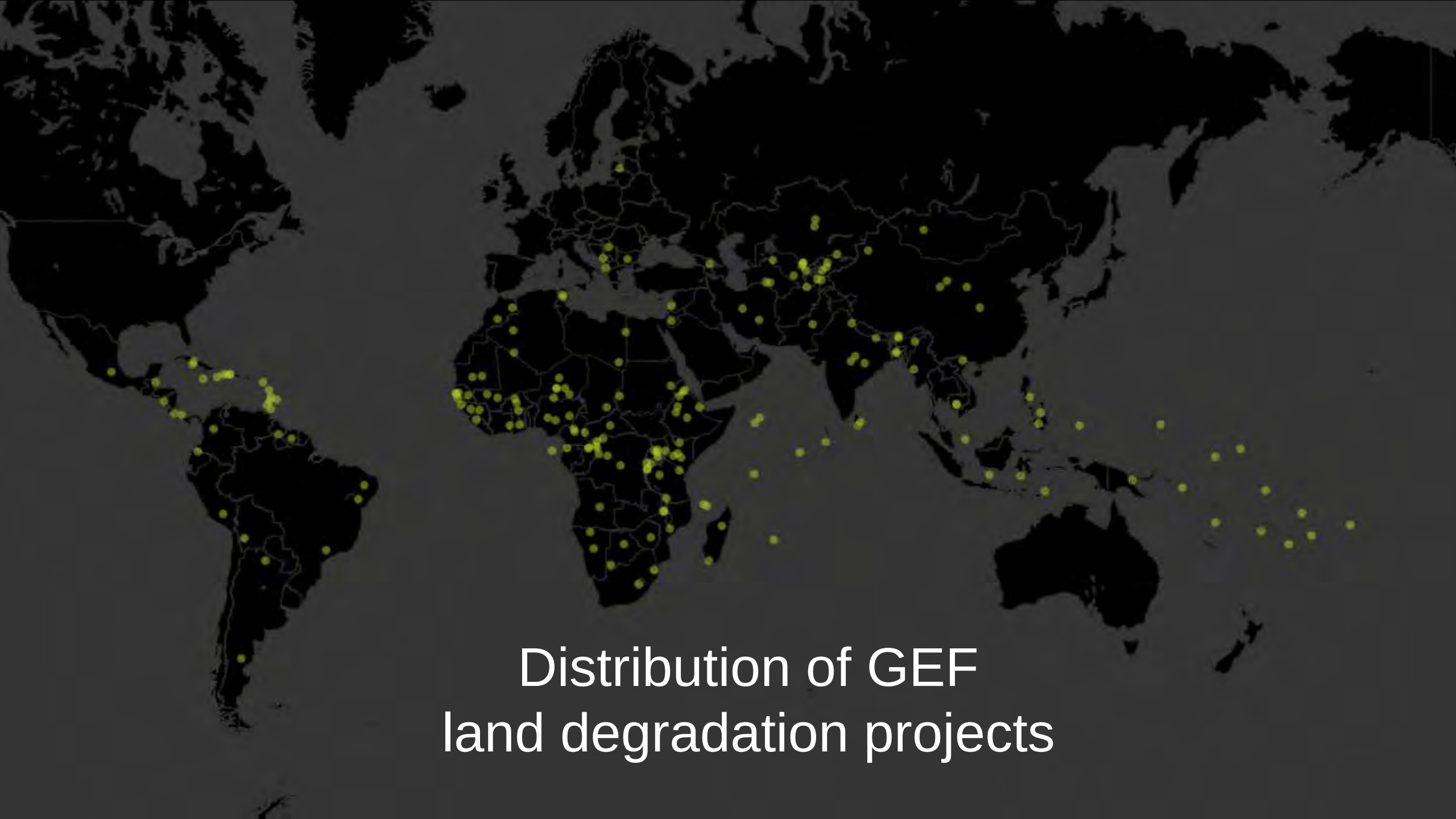
30 m zoomed in to 2.5 m

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

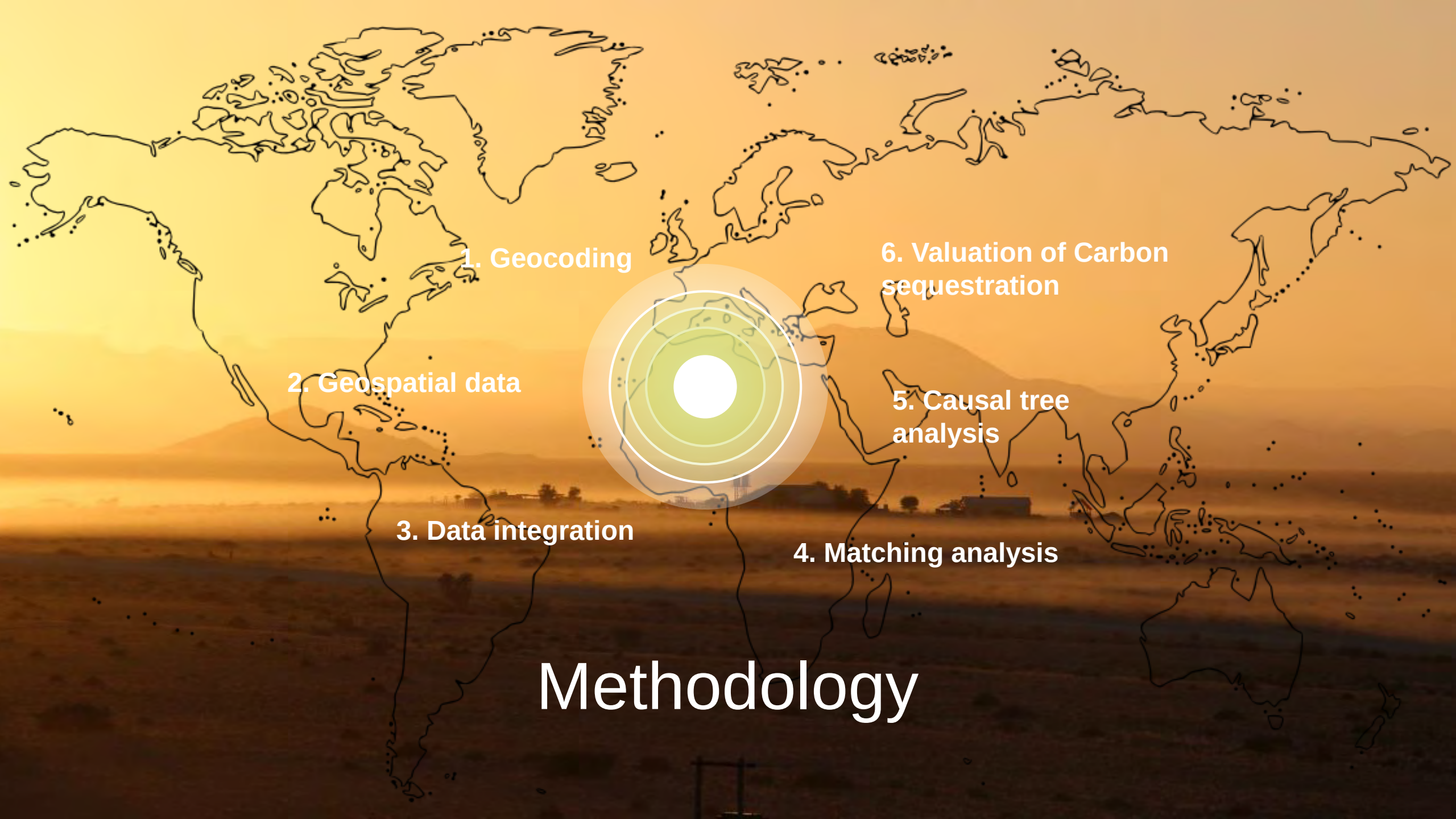
Impact of GEF land degradation interventions

2

Factors associated with the environmental outcomes

3

Value for money in terms of carbon sequestered



1. Geocoding

2. Geospatial data

3. Data integration

4. Matching analysis

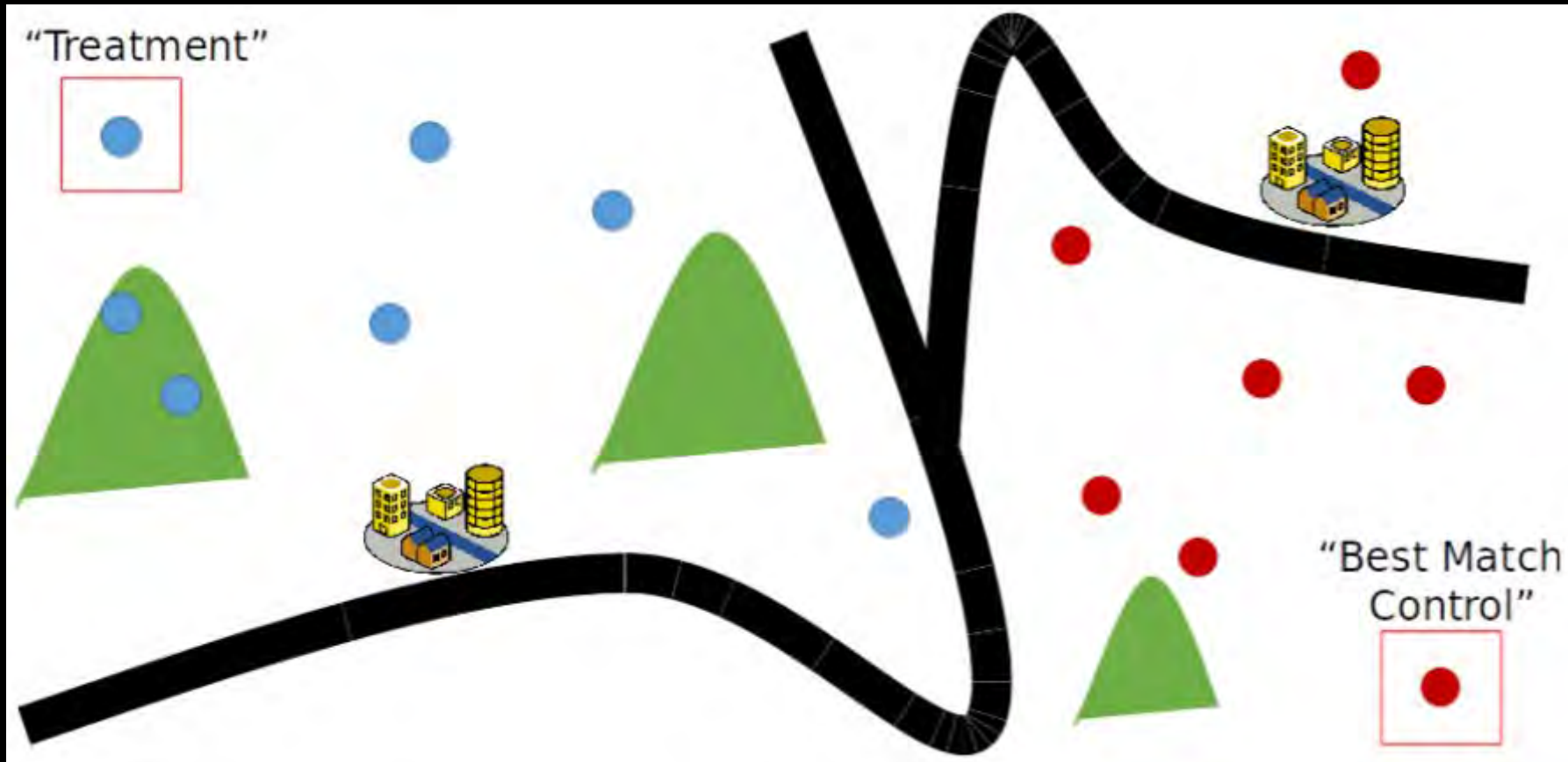
6. Valuation of Carbon
sequestration

5. Causal tree
analysis

Methodology

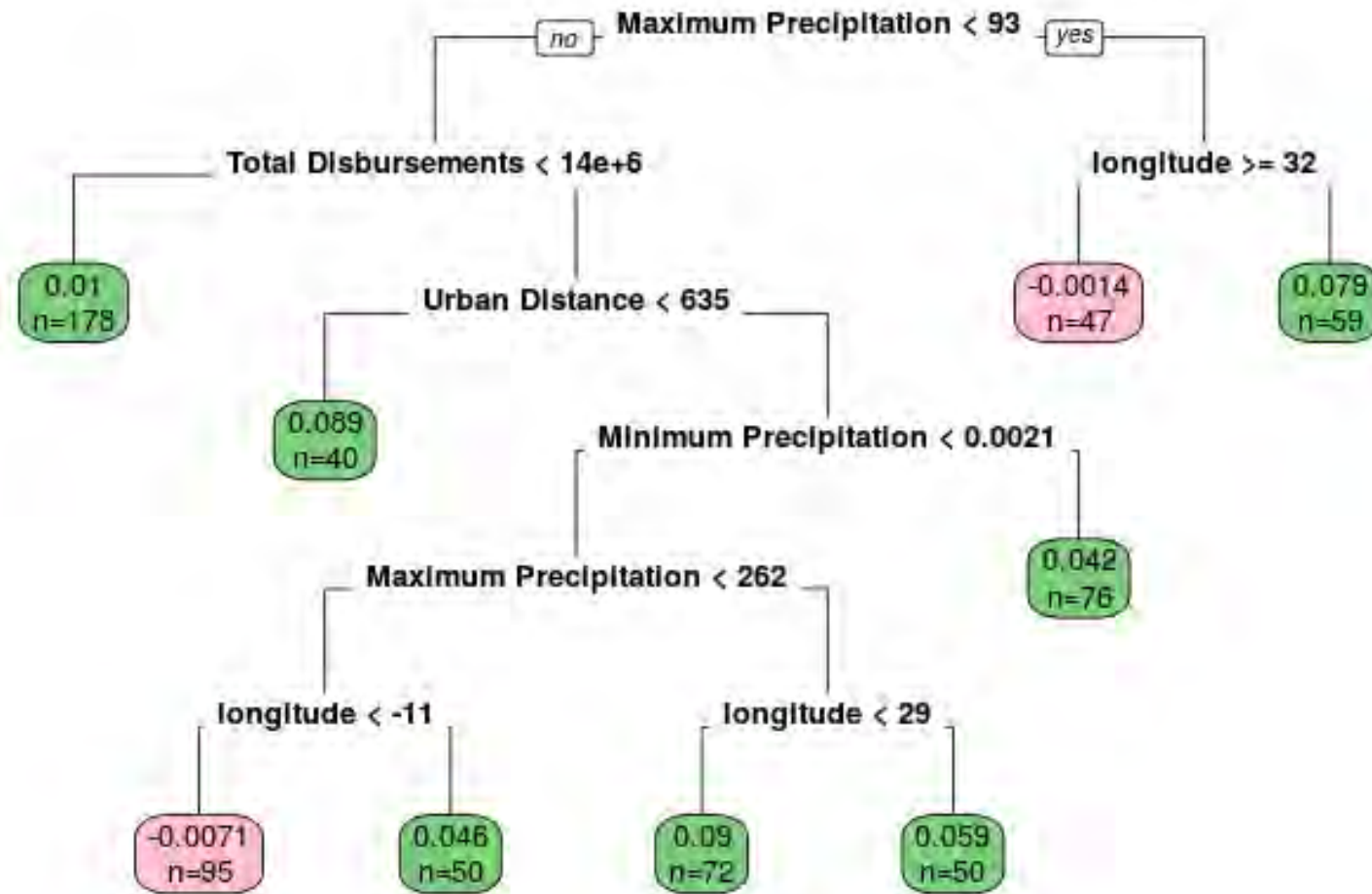
LAND DEGRADATION

Quasi-experimental method



LAND DEGRADATION

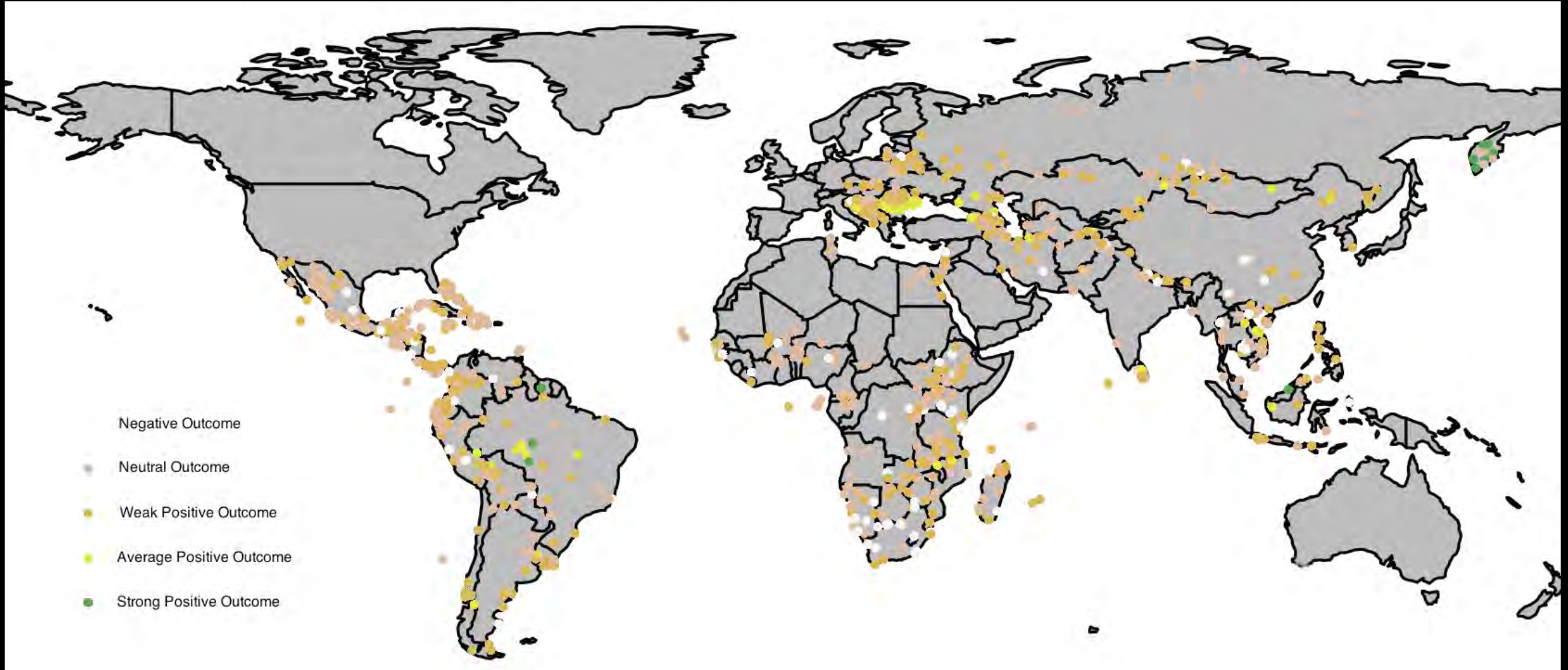
Machine learning and causal tree



LAND DEGRADATION

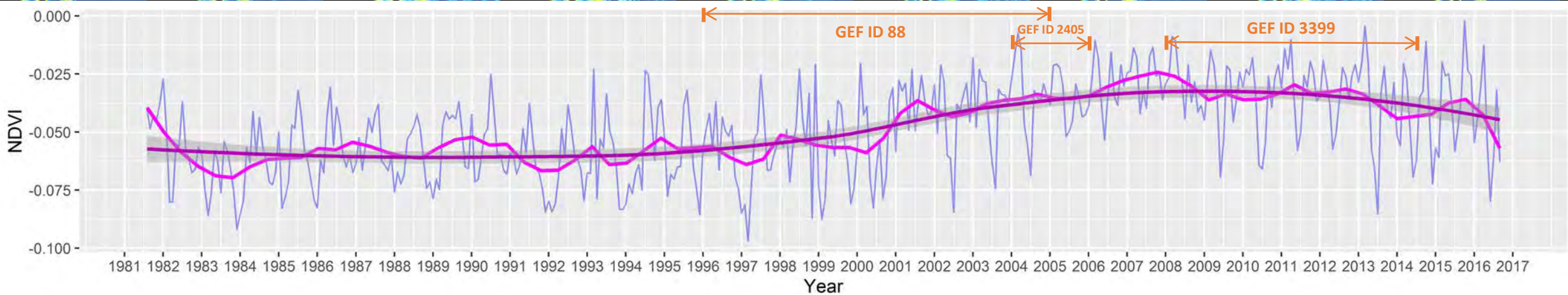
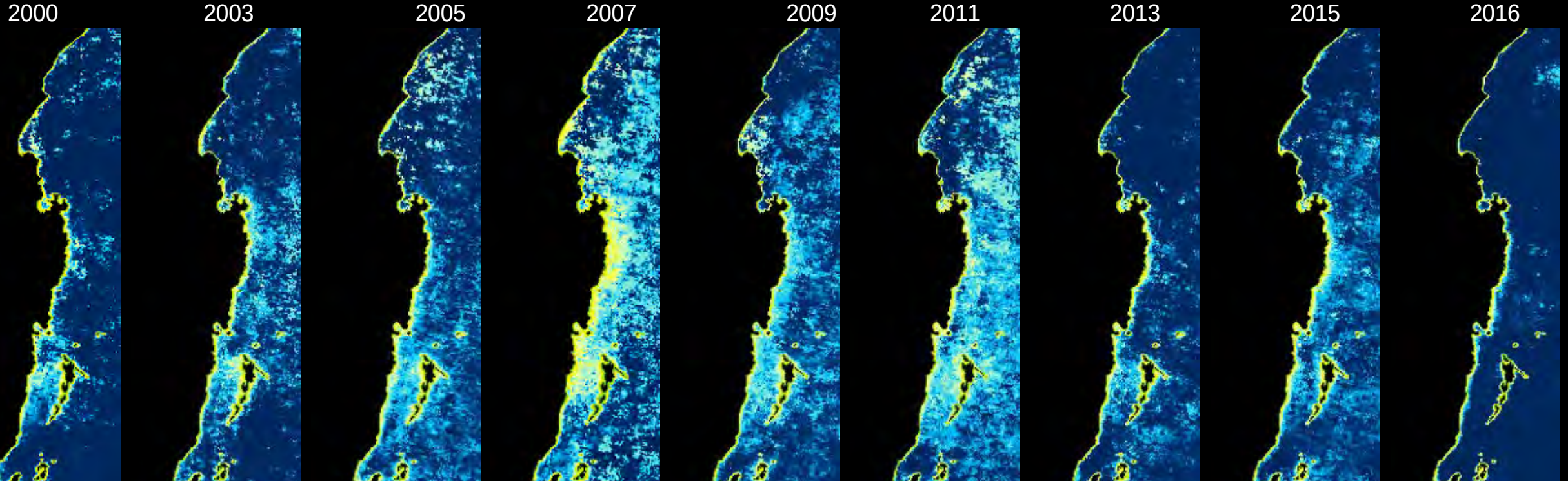
Bang for the buck

\$1:1.08



DEMONSTRATING IMPACT

International waters: Lake Victoria



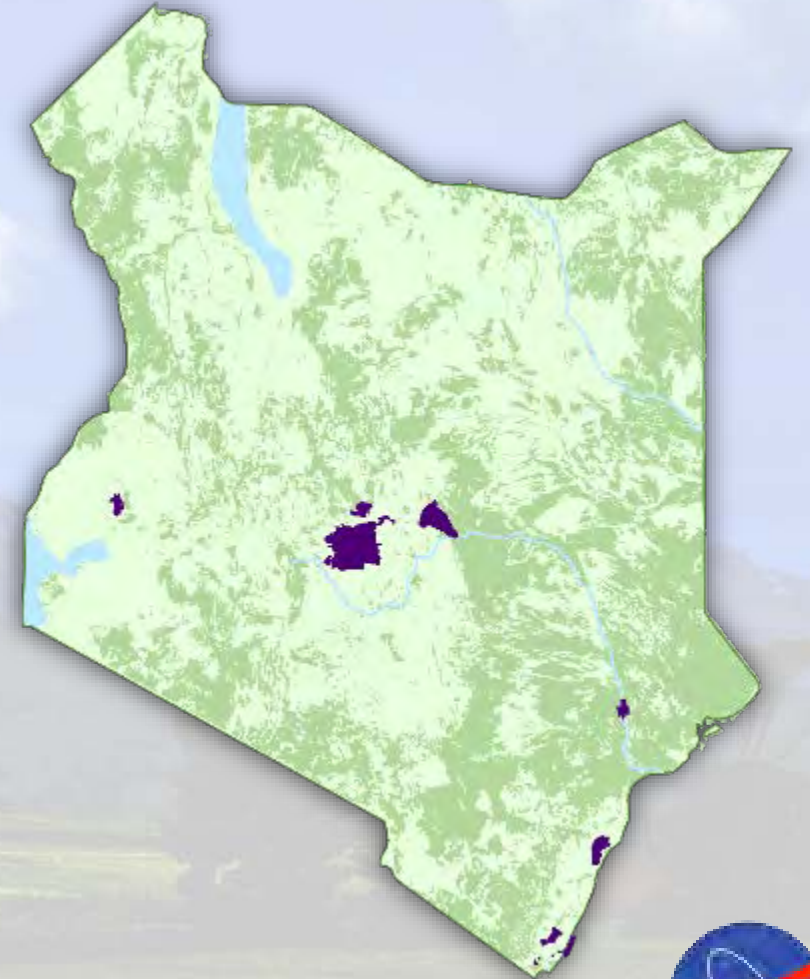
Ecological forecasting: Predicting the future

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

Kenya Ecological Forecasting

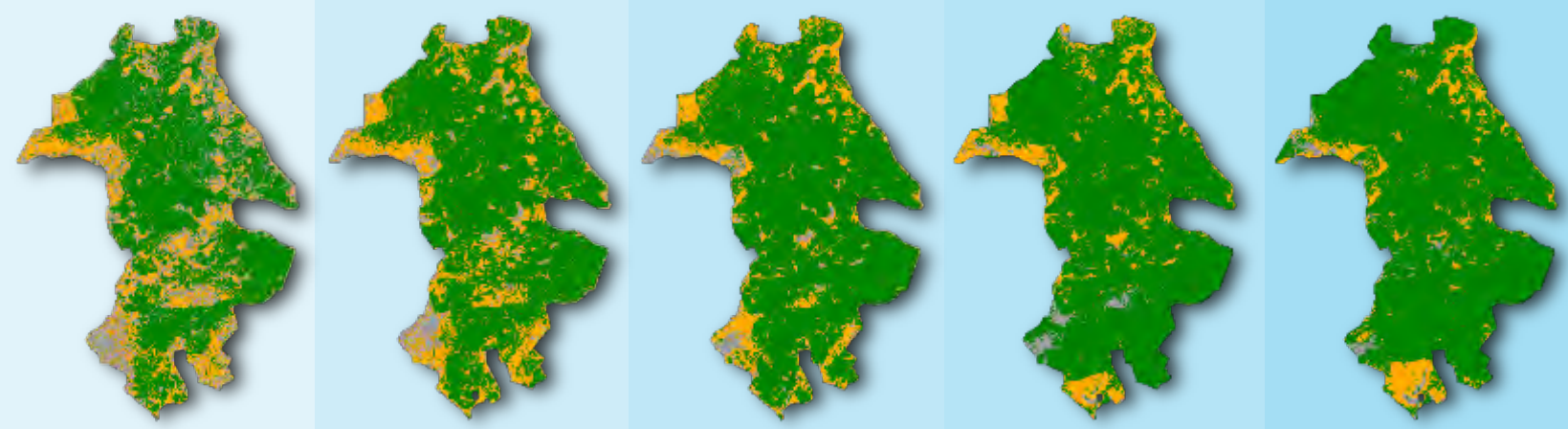
“Estimating Carbon Sequestration within Global Environment Facility (GEF) Funded Protected Areas in Kenya to Aid Future Policy”

- 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

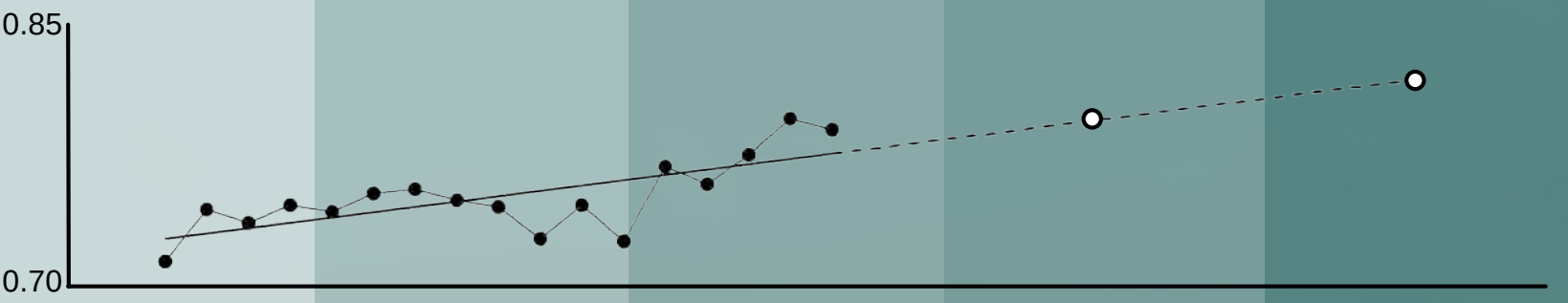


Land Cover Change

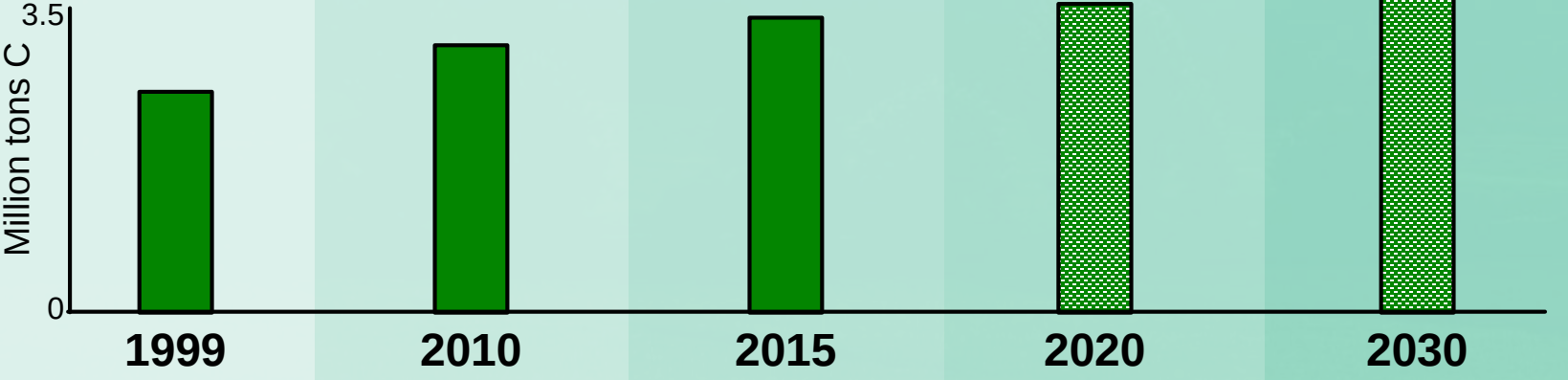
Forest Non-vegetated Shrub



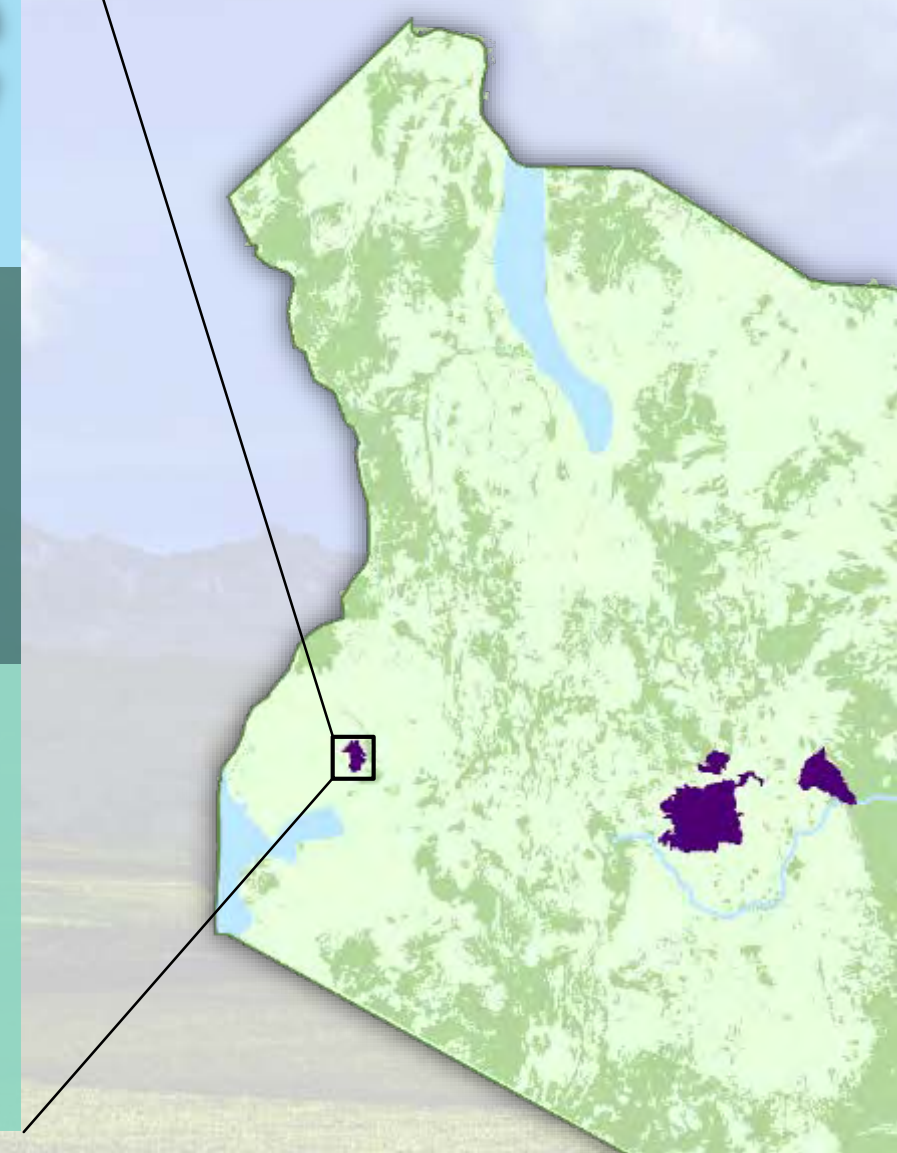
NDVI



Carbon Sequestration



Case Study: Kakamega Forest Reserve



Triangulating Across Methods

Beneficiary survey

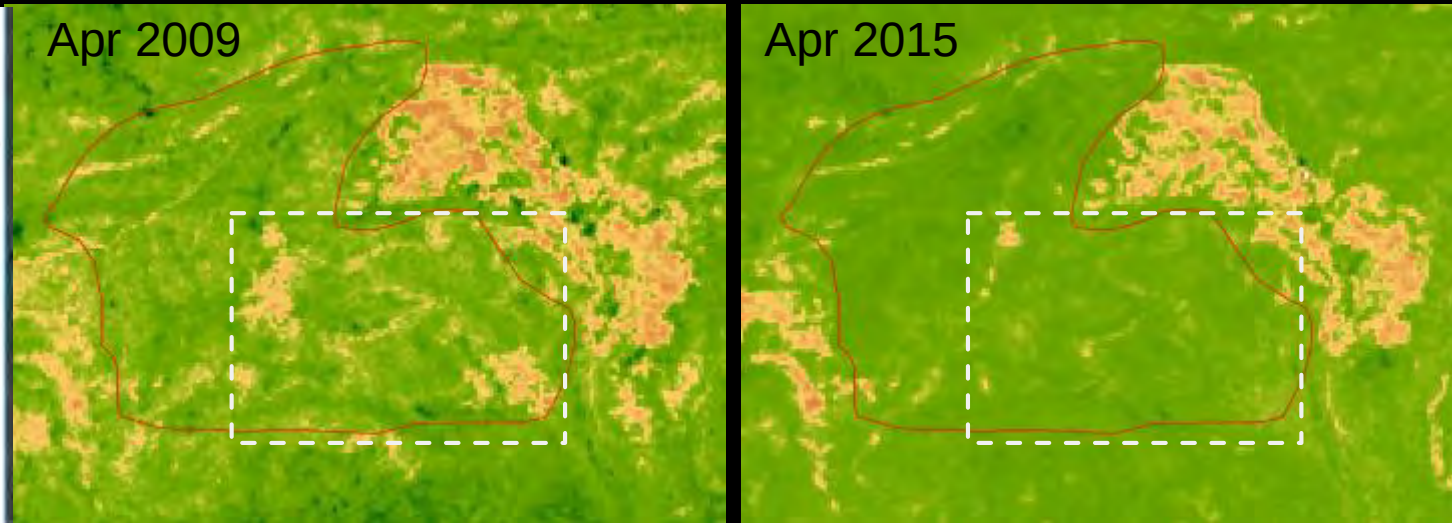


Question	Response
Whats the current date and time	2015-05-18T13:27:00.000+05:30
Where is this interview taking place?	21.76722165203057 78.66110502300134 488.3858563433855 24.0
Can I take a picture?	
Name of Interviewee(s)	Premalal anke
What is your role in the project?	beneficiary
Name of Organization	Dorben
Is the project creating any positive impact in the area/region/stre?	yes
Did this project contribute to better land management?	so_a_moderate_
Has the project increased productivity of rangelands? (Y/N)	yes
Has the project allowed for creating of new jobs and livelihoods?	yes
Do you believe project technicians listened to you and took your voice into account when planning or implementing the project?	so_a_moderate_
Did the project involve men and women equally?	yes
To what extent is the local community involved in the project?	so_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

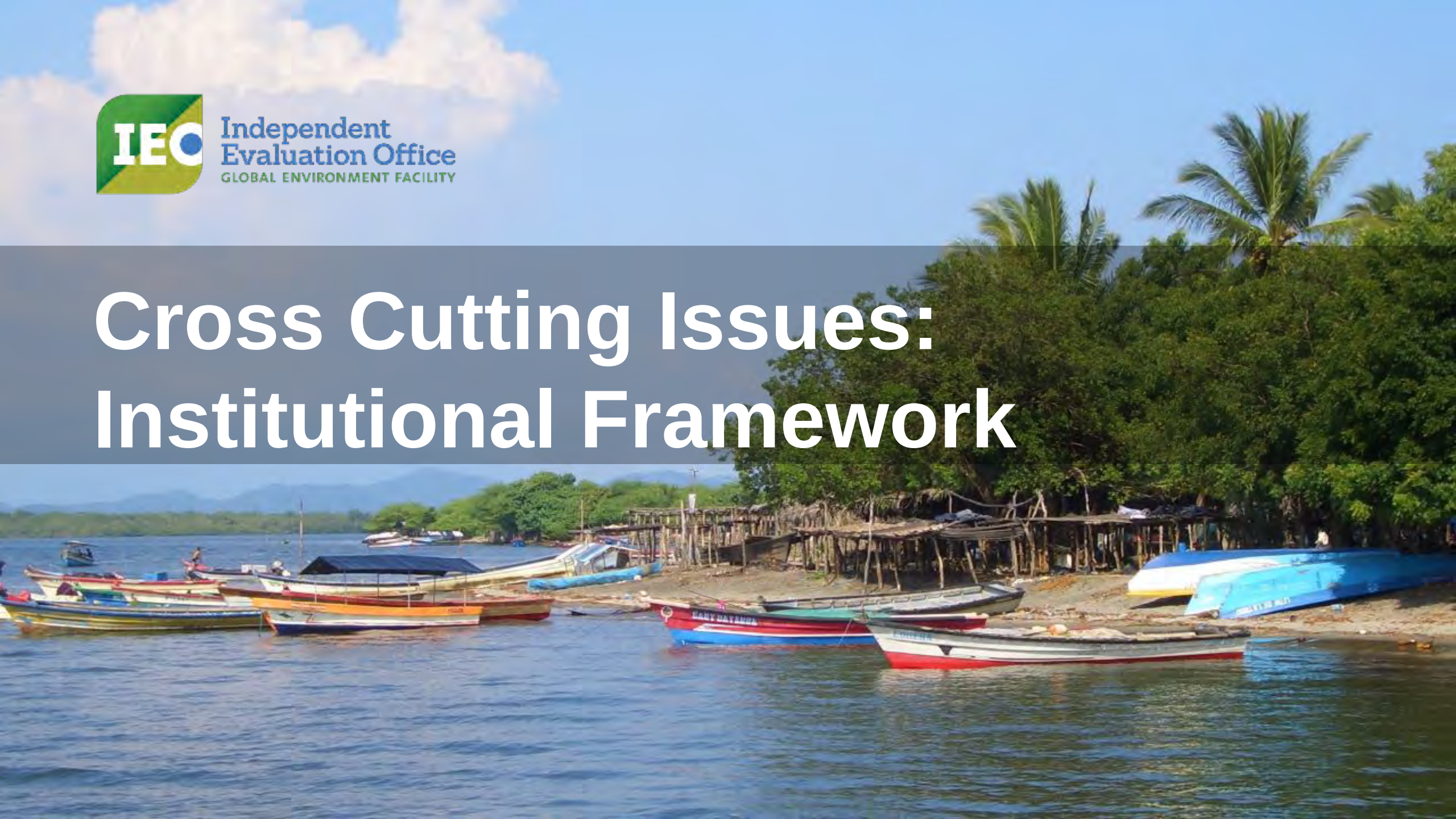
Module 4: Governance and Institutional issues

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



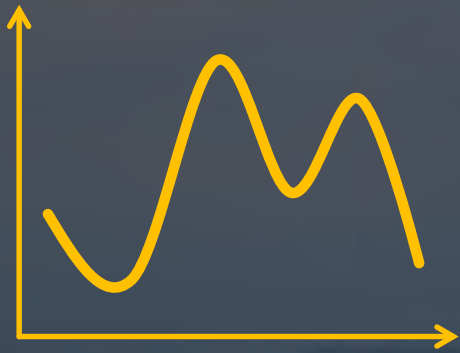
Independent
Evaluation Office
GLOBAL ENVIRONMENT FACILITY

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



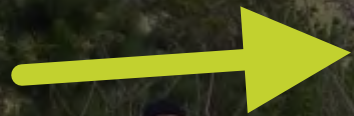
Accessing
NGI funds



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?

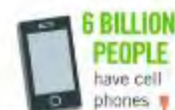
- No fixed definition
- Data sets that are so large or complex that traditional data processing applications are inadequate
- Characterized by
 - Volume from various sources needing large storage
 - Velocity at which they are generated
 - Variety of unstructured formats needing additional processing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

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

40 ZETTABYTES

(40 TRILLION GIGABYTES)

of data will be created by 2020, an increase of 300 times from 2005



6 BILLION PEOPLE have cell phones

WORLD POPULATION: 7 BILLION

Volume SCALE OF DATA

It's estimated that
2.5 QUINTILLION BYTES

(2.5 TRILLION GIGABYTES)
of data are created each day



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

The New York Stock Exchange captures

1 TB OF TRADE INFORMATION

during each trading session



By 2016, it is projected there will be

18.9 BILLION NETWORK CONNECTIONS

— almost 2.5 connections per person on earth



Velocity ANALYSIS OF STREAMING DATA

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



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



As of 2011, the global size of data in healthcare was estimated to be

150 EXABYTES
(161 BILLION GIGABYTES)



30 BILLION PIECES OF CONTENT
are shared on Facebook every month



Variety DIFFERENT FORMS OF DATA

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



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



1 IN 3 BUSINESS LEADERS

don't trust the information they use to make decisions



Poor data quality costs the US economy around

\$3.1 TRILLION A YEAR



27% OF RESPONDENTS

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

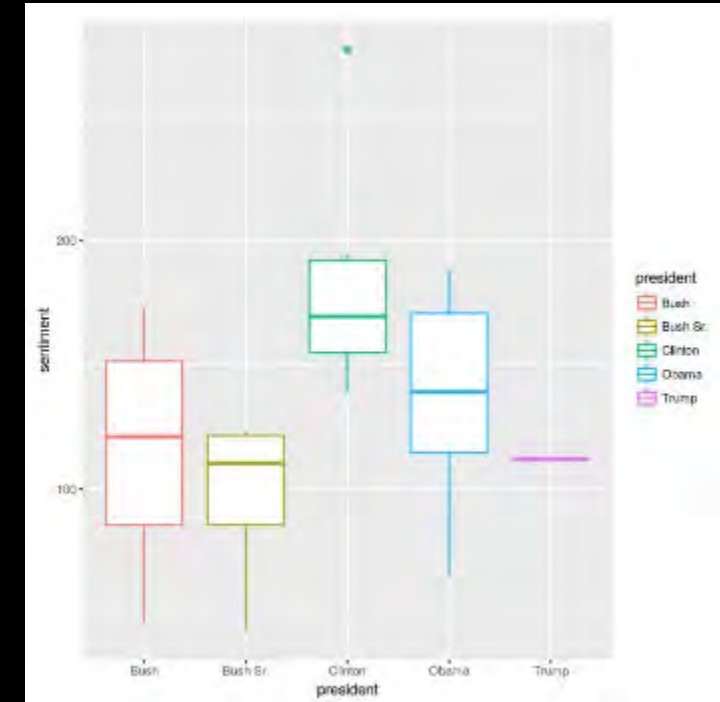
Veracity UNCERTAINTY OF DATA

Social Media

- Crowdsourcing
- Network Analytics
- Text analytics
- Sentiment analysis



#EvalGlobaLAC17



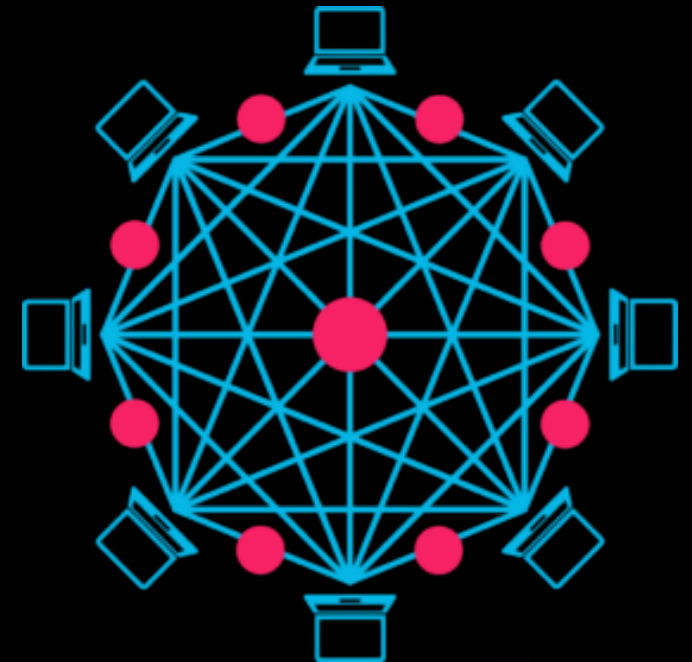
Internet of things(IoTs)



"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

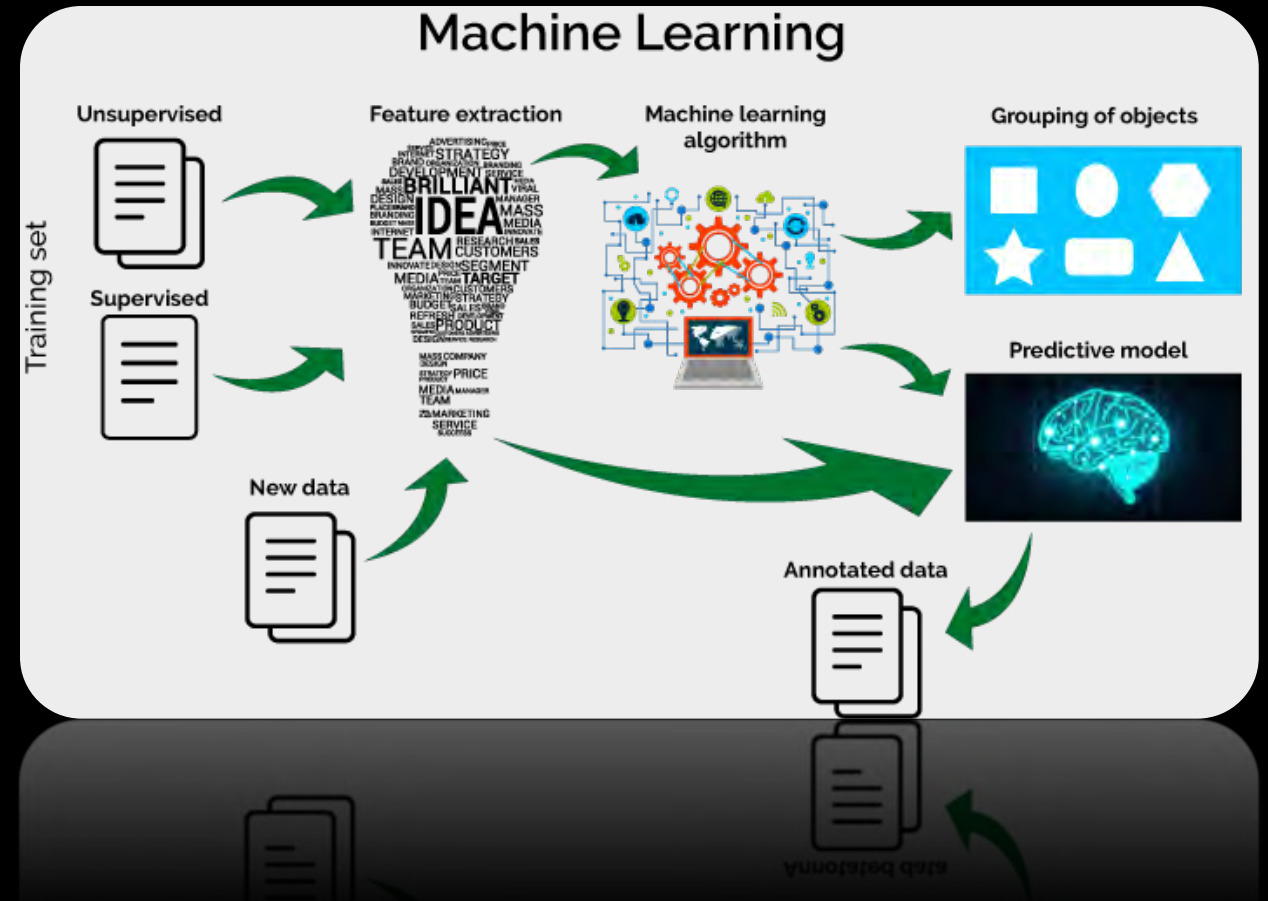
Application areas

- 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

A wide-angle landscape photograph. The foreground is a vast, flat field of green and yellow grass. To the left, a large, smooth sand dune rises. In the background, a range of mountains stretches across the horizon, with some peaks covered in snow. The sky is filled with heavy, dark, grey clouds, with some lighter patches where the sun might be breaking through.

Thank you