Assessment of Restoration Potential and Country Readiness

Livingstone, Zambia
12th May, 2014

Global Partnership on Forest Landscape Restoration

It is a proactive network launched by the UK, IUCN and WWF at FAO COFO in 2003.

It unites more than 30 partners from governments, organizations, communities, and individuals, including UK, US, Germany, Netherlands, Norway, China, IUCN, WRI, FAO, World Bank, Tropenbos, IUFRO, UNFF, etc. that works to:

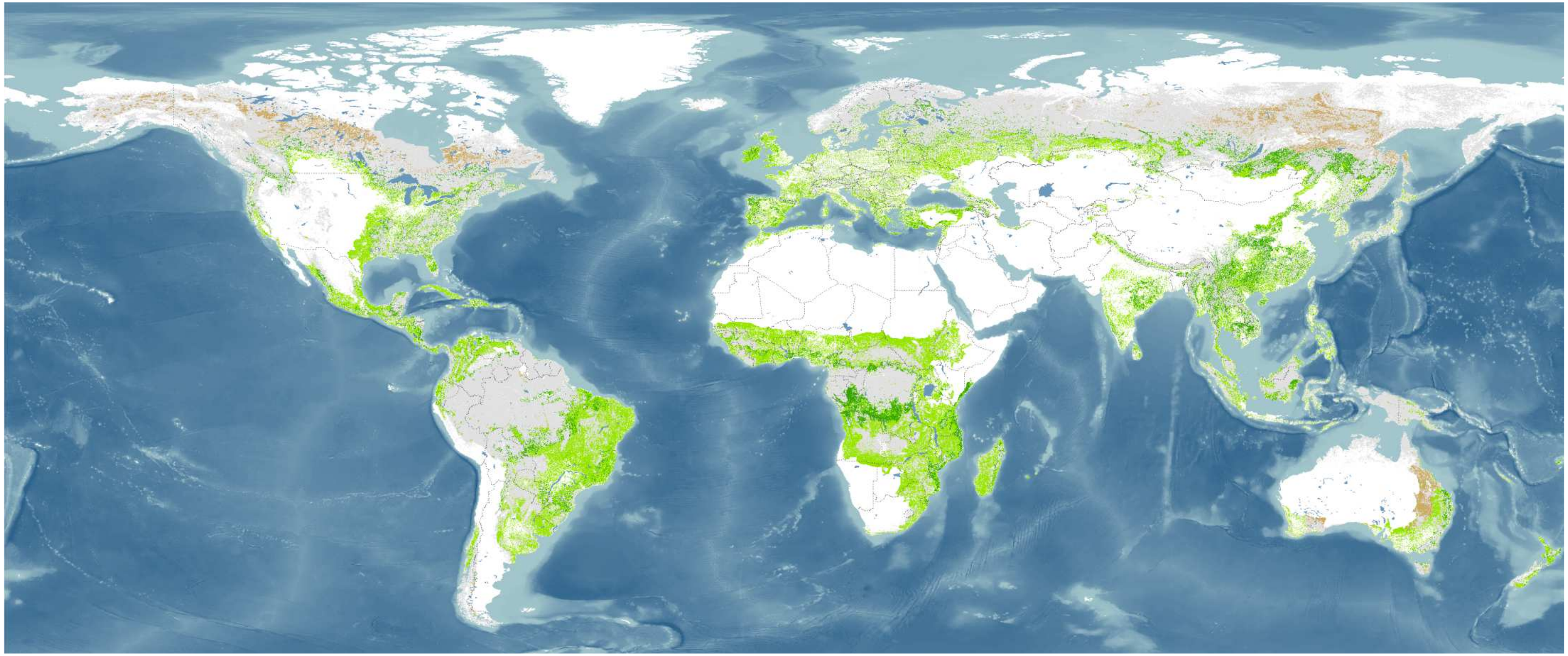
- Build support for forest landscape restoration with key decision makers, at the local and international level; and

- Provide information and tools to strengthen restoration efforts around the world.

http://www.forestlandscaperestoration.org/

THE GLOBAL PARTNERSHIP ON FOREST LANDSCAPE RESTORATION

Forest and Landscape Restoration Opportunity



FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

Wide-scale restoration

Mosaic restoration

Remote restoration

Current forest

THE GLOBAL PARTNERSHIP ON FOREST LANDSCAPE RESTORATION

WORLD RESOURCES INSTITUTE · South Dakota State University · IUCN · Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit · PROFOR · Forestry Commission

BONN CHALLENGE 2011

Launched in 2011

A global goal to restore **150 million hectares** of degraded and deforested lands by 2020

"Cooperative Initiative"

How will it work?

Governments, private enterprises, communities, NGOs or others who own or control or otherwise manage land …

Commit to initiate restoration (using a forest landscape restoration approach) over a specified number of hectares by 2020

The Bonn Challenge is an implementation vehicle for existing global commitments

United Nations
Framework Convention on
Climate Change

UNCCD
United Nations Convention
to Combat Desertification

WE CAN
END POVERTY
2015
MILLENNIUM
DEVELOPMENT
GOALS

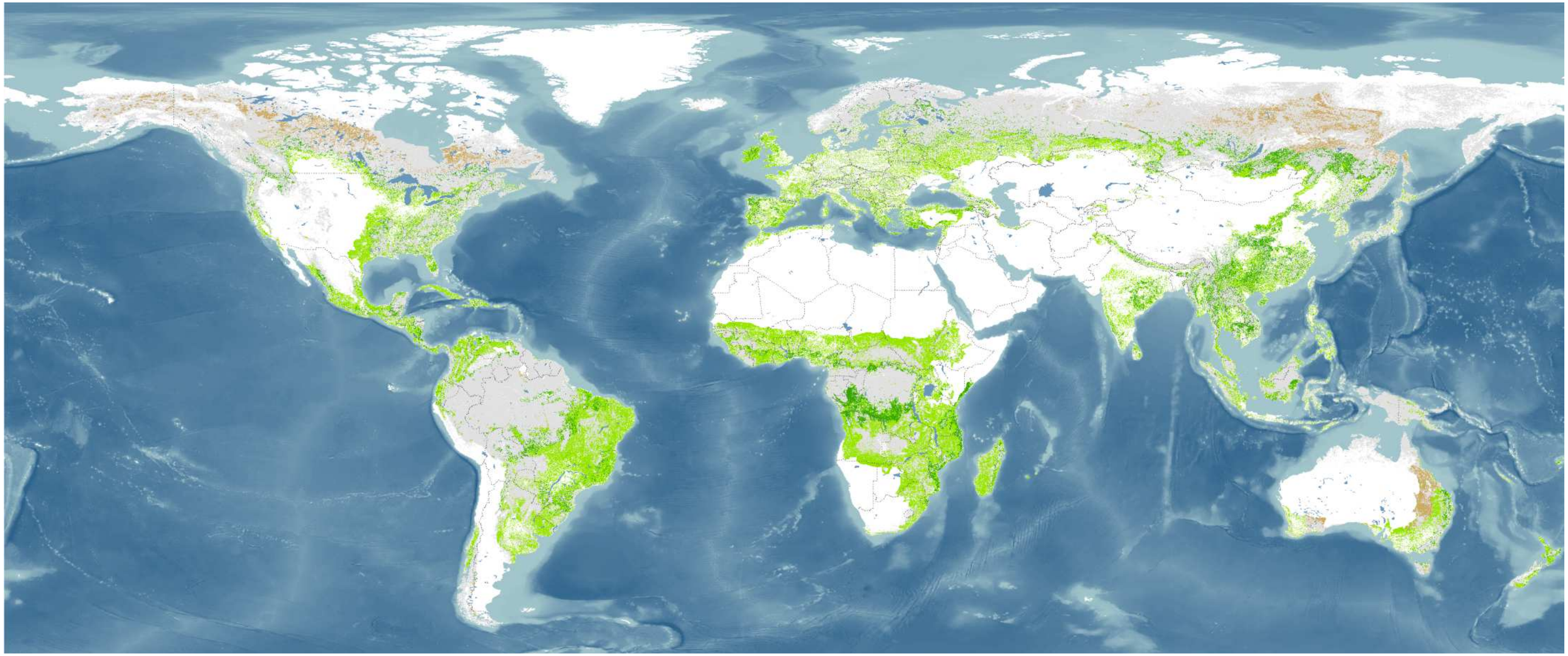
Pledges have been strong so far

Up to 20 million hectares in pledges have been announced:

- **US Forest Service**: 15 million ha
- **Rwanda**: 2 million hectares
- **Brazil Mata Atlantica Restoration Pact**: 1 million ha
- **El Salvador**: up to 1 million ha
- **Costa Rica**: up to1 million ha

With another 30 million hectares are in the pipeline as pre and potential pledges

Forest and Landscape Restoration Opportunity



FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

- Wide-scale restoration
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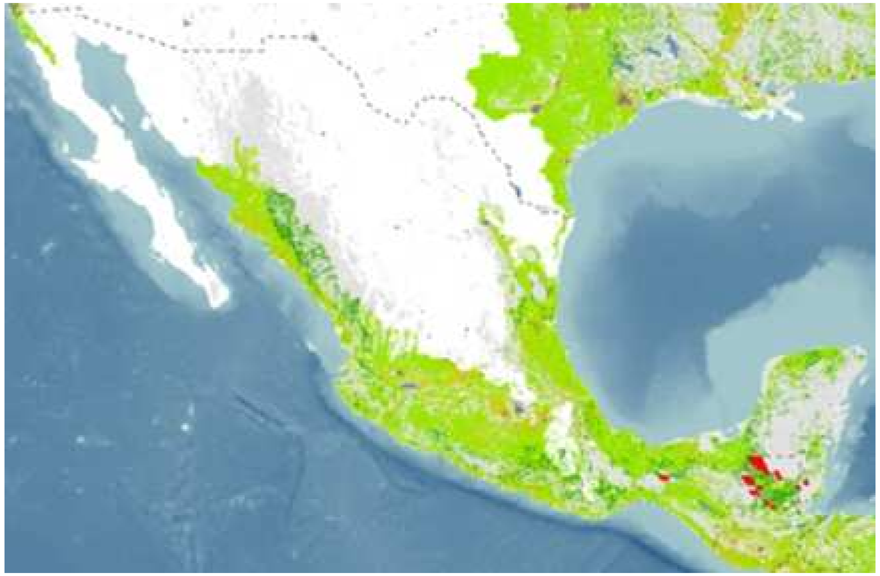
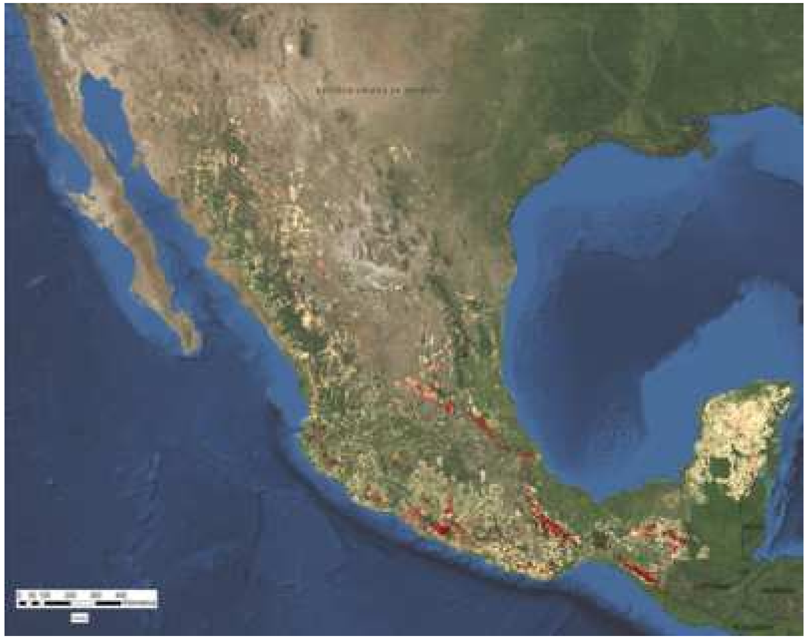
PROFOR

Forestry Commission

The challenge: to move from the global generic to national specifics





.... and to identify priority actions and priority landscapes

The goal is to frame sub/national programmes that offer workable and cost-effective strategies for landscapes like these

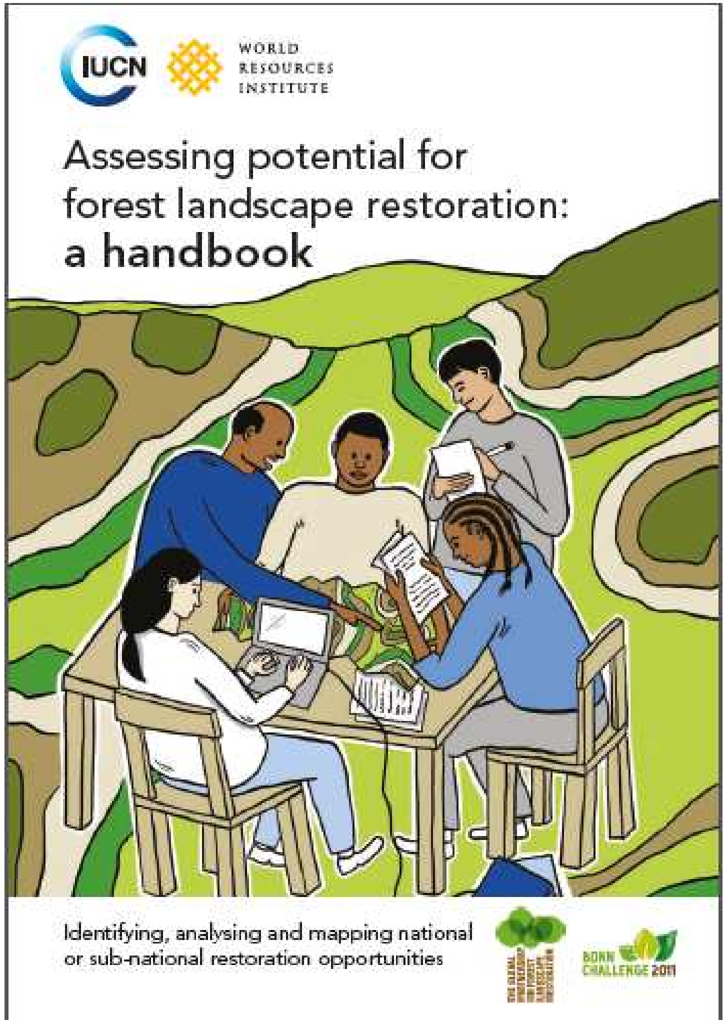
Rwanda’s deforested mountains hold tremendous potential for restoration that can improve lives

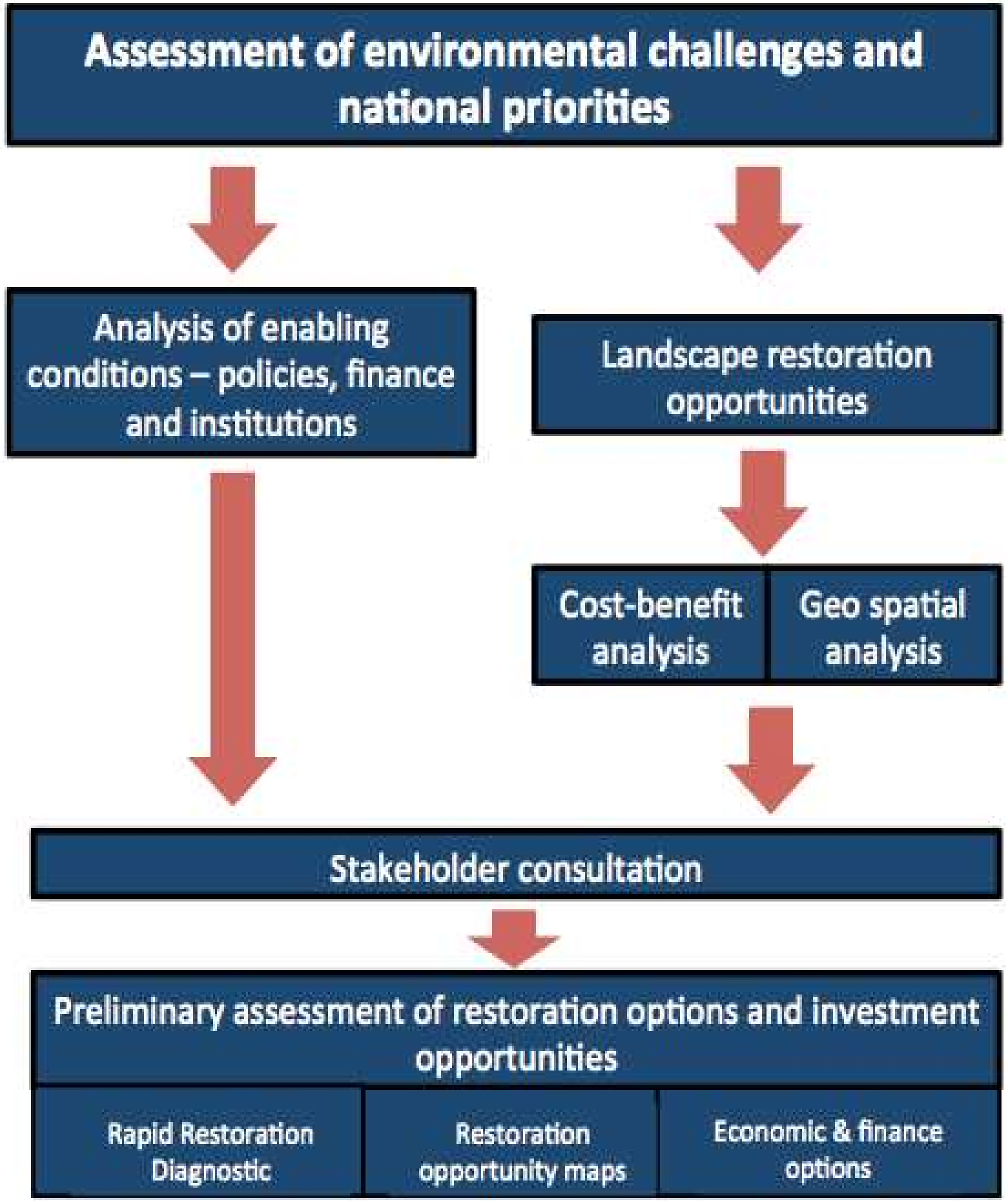
Primary challenges include

1. Lack of data: degraded lands and natural resources are opaque – if not invisible – as are the livelihoods of people who live there
   – Spatial and biophysical data needed
   – Economic and social data needed

2. Lack of coherence: in policy & programmes
   – Either institutional competition
   – Or (more likely) institutional myopia

Restoration Opportunities Assessment Methodology (ROAM)





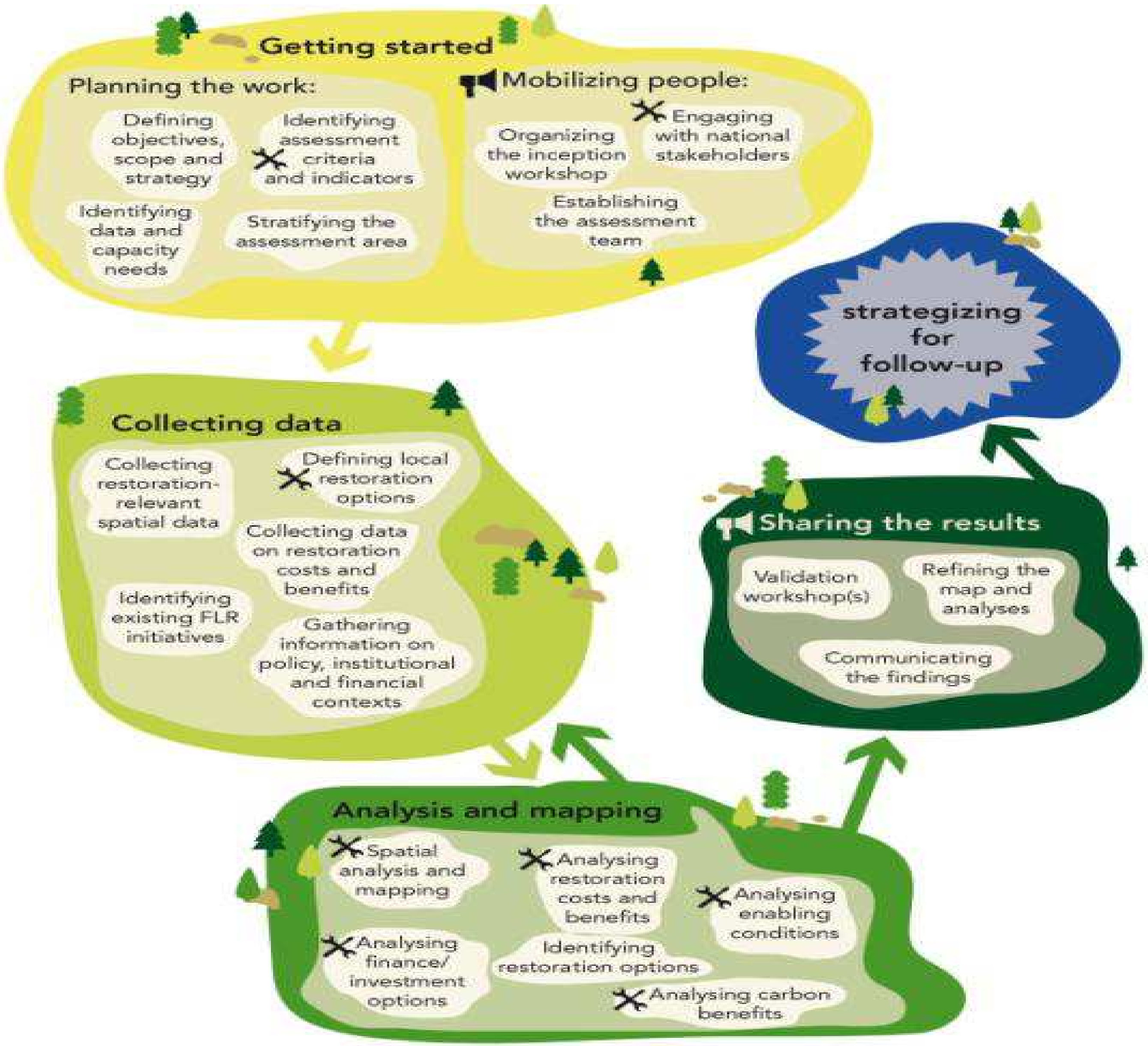
The purpose of ROAM is to

- Identify, analyze and map the overall potential and areas of opportunity for forest landscape restoration (FLR) on a national or sub-national level
- Support countries, organizations, communities and enterprises in defining and implementing pledges to the Bonn Challenge target to restore 150 million hectares worldwide by 2020
- Provide a basis for national policies like NAPAs, contribute to international programs like UN-REDD, and catalyze innovative financing

Components of ROAM

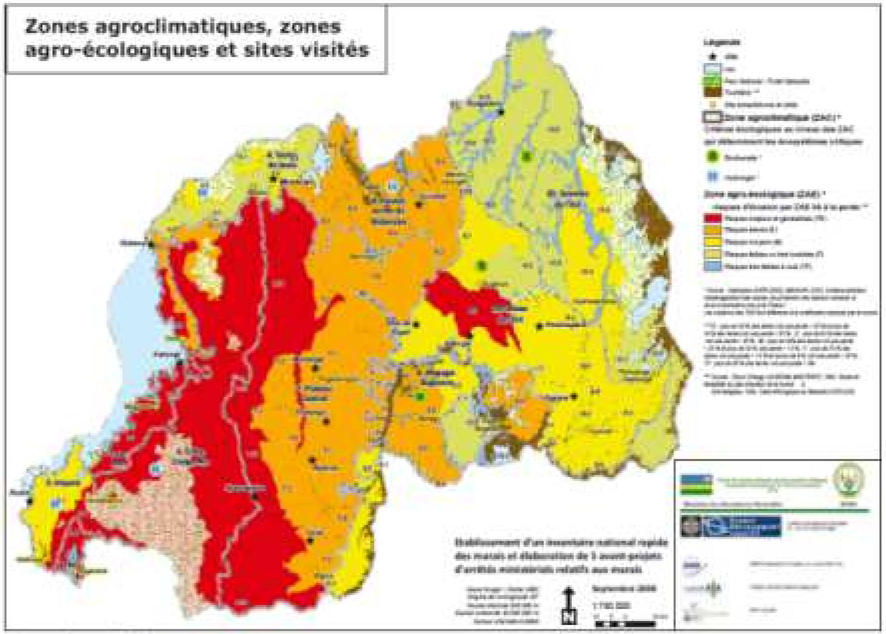
1. Mapping of Opportunities
2. Economic Valuation
3. Carbon benefits
4. Rapid Diagnostic of Success Factors
5. Finance and Investment options

The ROAM process



The Restoration Opportunities Assessment Methodology

Figure 4: Agro-climatic zones and risk of soil erosion

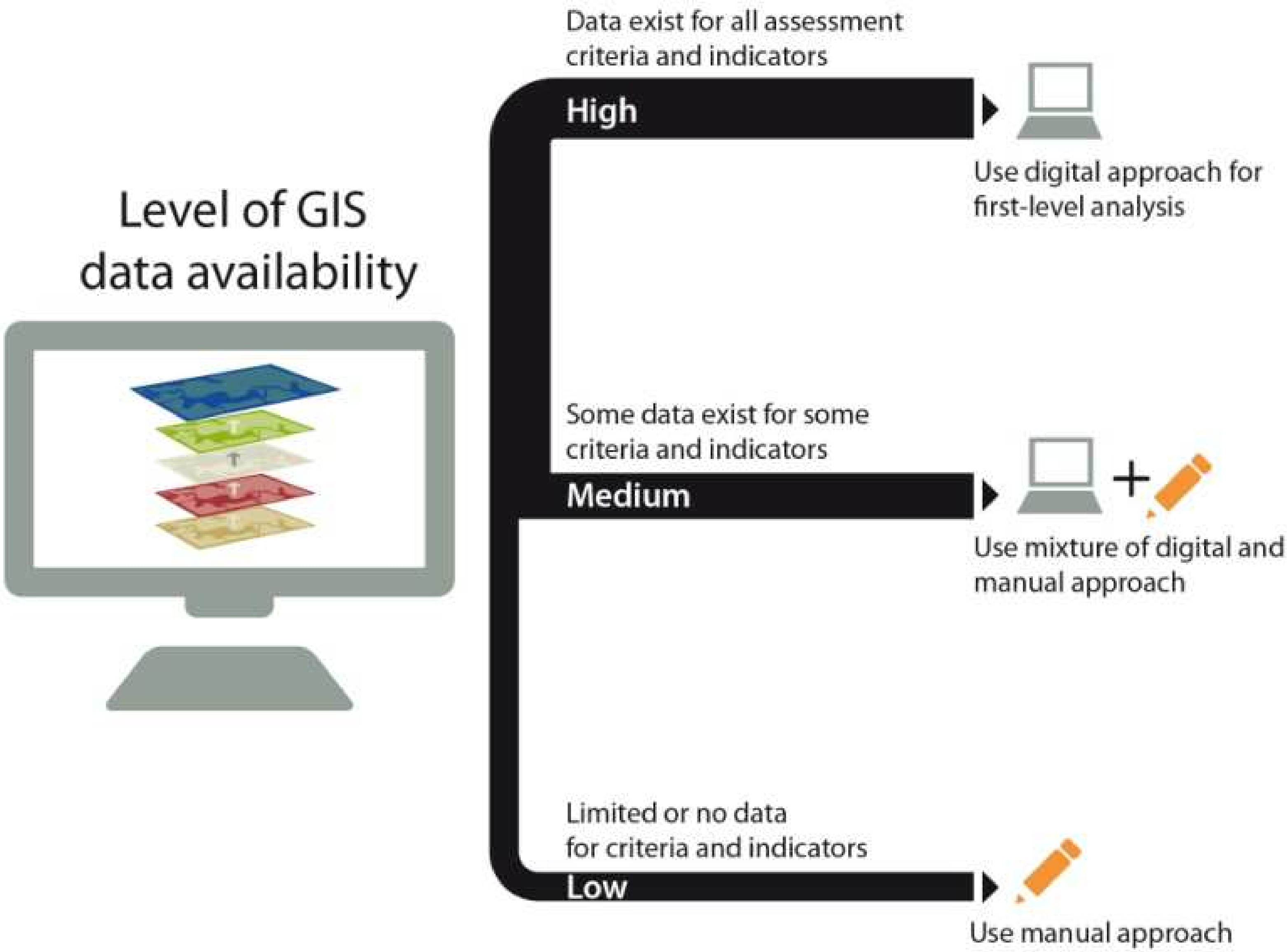


Map production: REMA

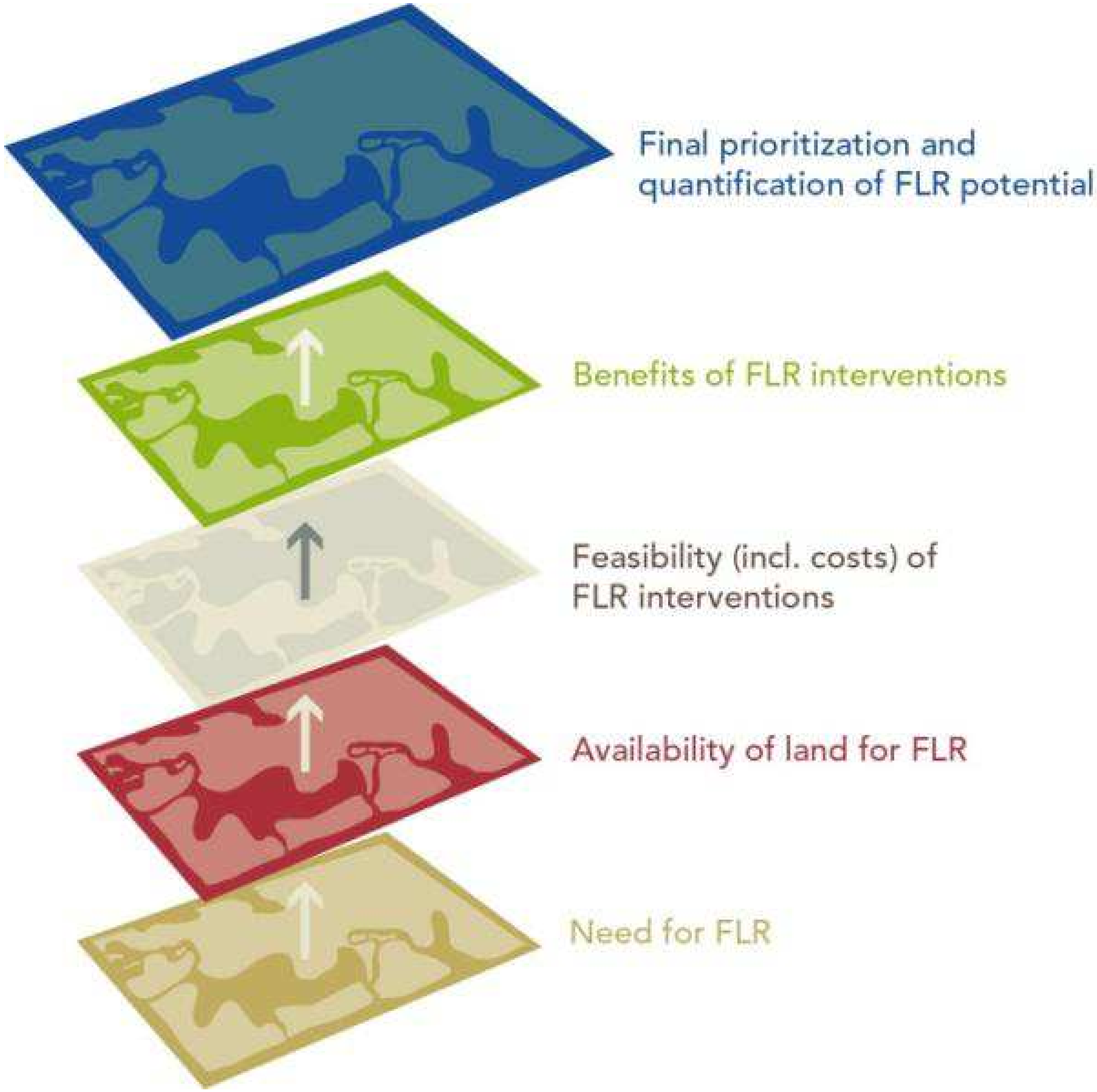
Best available science and data

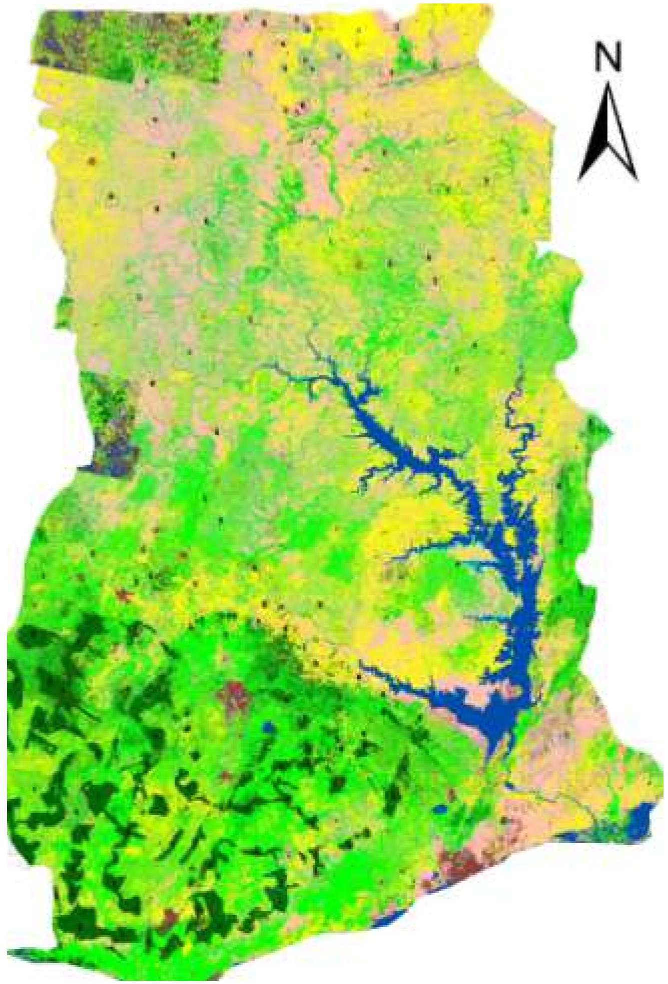
Best informed knowledge & insights

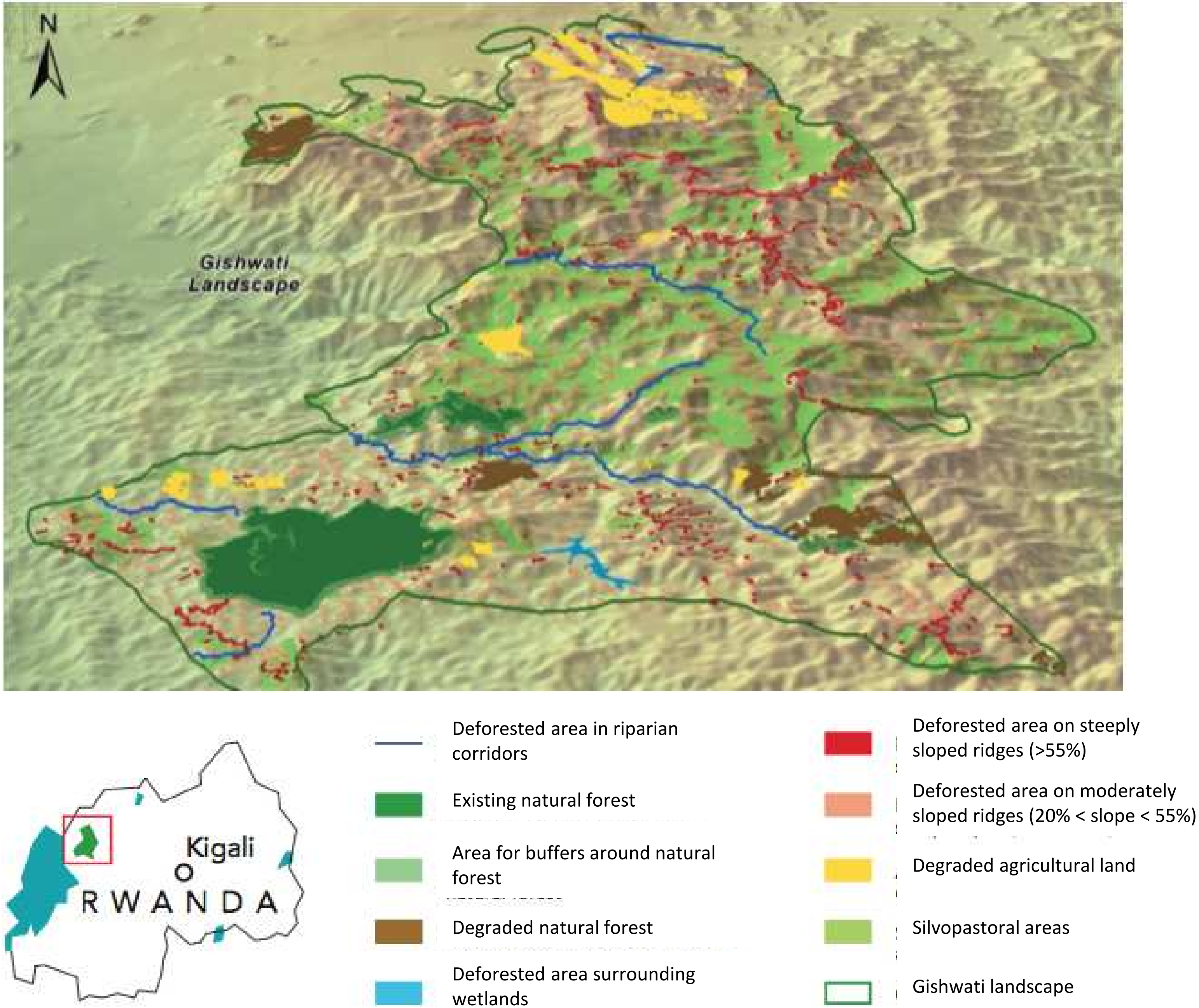
Spatial Analysis and Mapping



Analysis and Mapping






N
Gishwati Landscape
Kigali
RWANDA
Deforested area in riparian corridors
Existing natural forest
Area for buffers around natural forest
Degraded natural forest
Deforested area surrounding wetlands
Deforested area on steeply sloped ridges (>55%)
Deforested area on moderately sloped ridges (20% < slope < 55%)
Degraded agricultural land
Silvopastoral areas
Gishwati landscape

Quantifying and valuing benefits of forest landscape restoration

What does economics have to do with restoration?

- Globally, there are more than 2 billion hectares of degraded land.
- With this tremendous opportunity, deciding where, when, and how landscapes should be restored is important.
- The answers to these questions must be formed on the basis of restoration’s expected impacts on ecosystem goods and services.

How can economics help?

- An ROI framework is appropriate for serving the decision making processes at the country, regional, or local level.
- Framework assesses the ecosystem service and economic impacts of forest landscape restoration to help decision makers understand trade-offs.
- Carbon abatement curves show how much carbon each transition could capture and helps decision makers offset emissions by restoring landscapes as efficiently as possible.

Economic component of ROAM is meant to answer a few simple questions

- How much will restoration cost?
- Would money be better spent elsewhere?
- What policies can be used to encourage restoration?



To answer these questions effectively, analysis should:

- Capture a broad range of values
- Separate benefits into public and private
- Enable a fair comparison between other investment alternatives

Four steps in applying the ROI framework

1. *Identify degraded forest landscapes and their land uses:* Map landscapes in need of restoration as well as the characteristics of the landscapes.

2. *Identify restoration transitions:* Determine which restoration interventions could be used to restore each type of degraded land use.

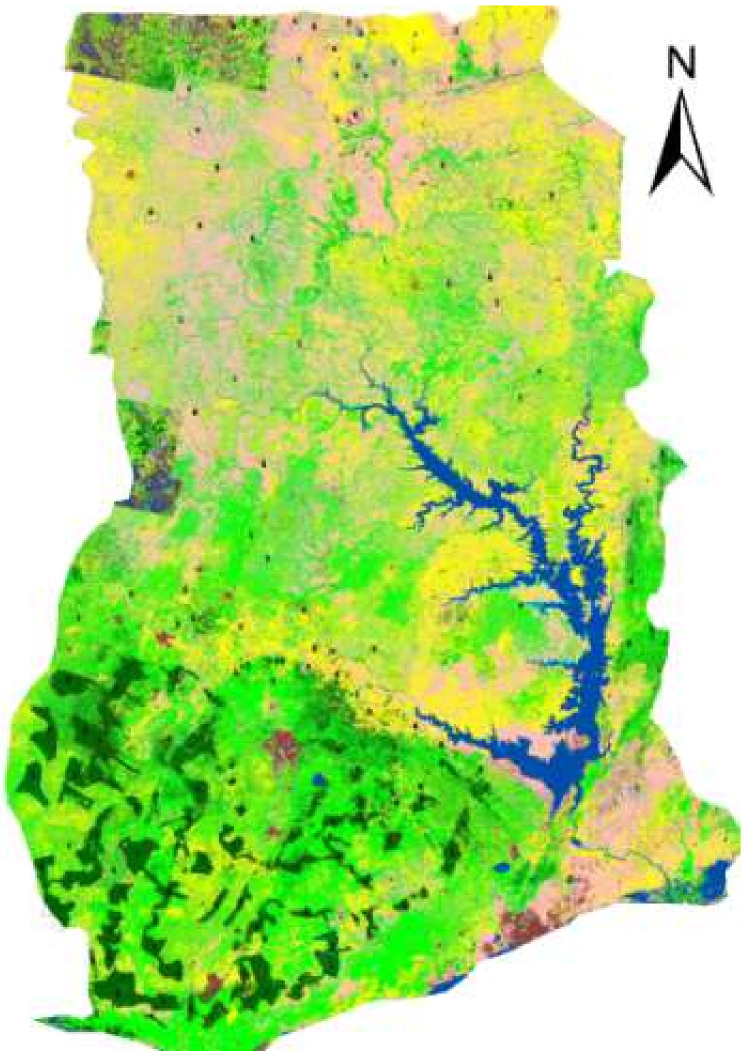
3. *Model and value the change in ecosystem goods and service production for each restoration transition*: Calculate the net change in ecosystem goods and service production.

4. *Conduct sensitivity and uncertainty analysis:* See how sensitive the cost-benefit results are to changes in key variables like prices, interest rates, and biological assumptions.

Step 1: Identify degraded forest landscapes and their land uses

- Map landscapes in need of restoration, as well as the characteristics of the landscapes.
- Degraded landscapes should be characterized in terms of current land uses and land cover, weather, socio-economic conditions, and other contextual information.

Geospatial analysis



- Geospatial analysis used to quantify areas of degraded land use that are also opportunity areas for forest and landscape restoration.

- Analysis based on geospatial datasets including elevation, slope, land cover, forest cover, water bodies, parks and reserves, and administrative areas.

- Five degraded categories: deforested land, agriculture, native forest, plantations, and farm fallow

Step 2: Identify restoration transitions

- Determine which restoration interventions could be used to restore each type of degraded land use.
  - For example, degraded agricultural land could be restored to agroforestry and
  - deforested land could be restored to secondary forests through natural regeneration.

Example of restoration transitions

Conventional agriculture →

Agroforestry

Poorly managed woodlots →

Well managed woodlots

Deforested land →

Naturally regenerated forests

Define restoration transition actions

- **Make relatively reliable estimates of the different technical specifications involved in each transition**

- **A Multistakeholder approach**

- Examples from Rwanda
  - **Conventional agriculture → Agroforestry**
    - Sale of crops is only source of revenue for agriculture
    - Agroforestry would add 300 additional trees/ha to agricultural land
    - Leaves from trees would be used as green manure, reducing fertilizer costs
    - Rotation interval for trees is 20 years
  - **Poorly managed woodlots → Well managed woodlots**
    - Poorly managed woodlots stock 1,100 trees per hectare
    - Well managed woodlots stock 1,600 trees per hectare
    - After 1 year, 15% of seedlings are replanted
    - After 4th year 250 trees/ha are removed for thinning

Step 2: Restoration transitions

1. Deforested land to tree planting
2. Degraded natural forest to naturally regenerated forest
3. Degraded forest plantation to improved plantation management
4. Degraded agriculture to agroforestry
5. Poor farm fallow to improved farm fallow

Step 3: Value change in ecosystem services

- Estimate economic returns of each restoration transition and identify areas where restoration would have a large, positive impact.

- Compare the value of ecosystem services gained through restoration with the costs of restoration.

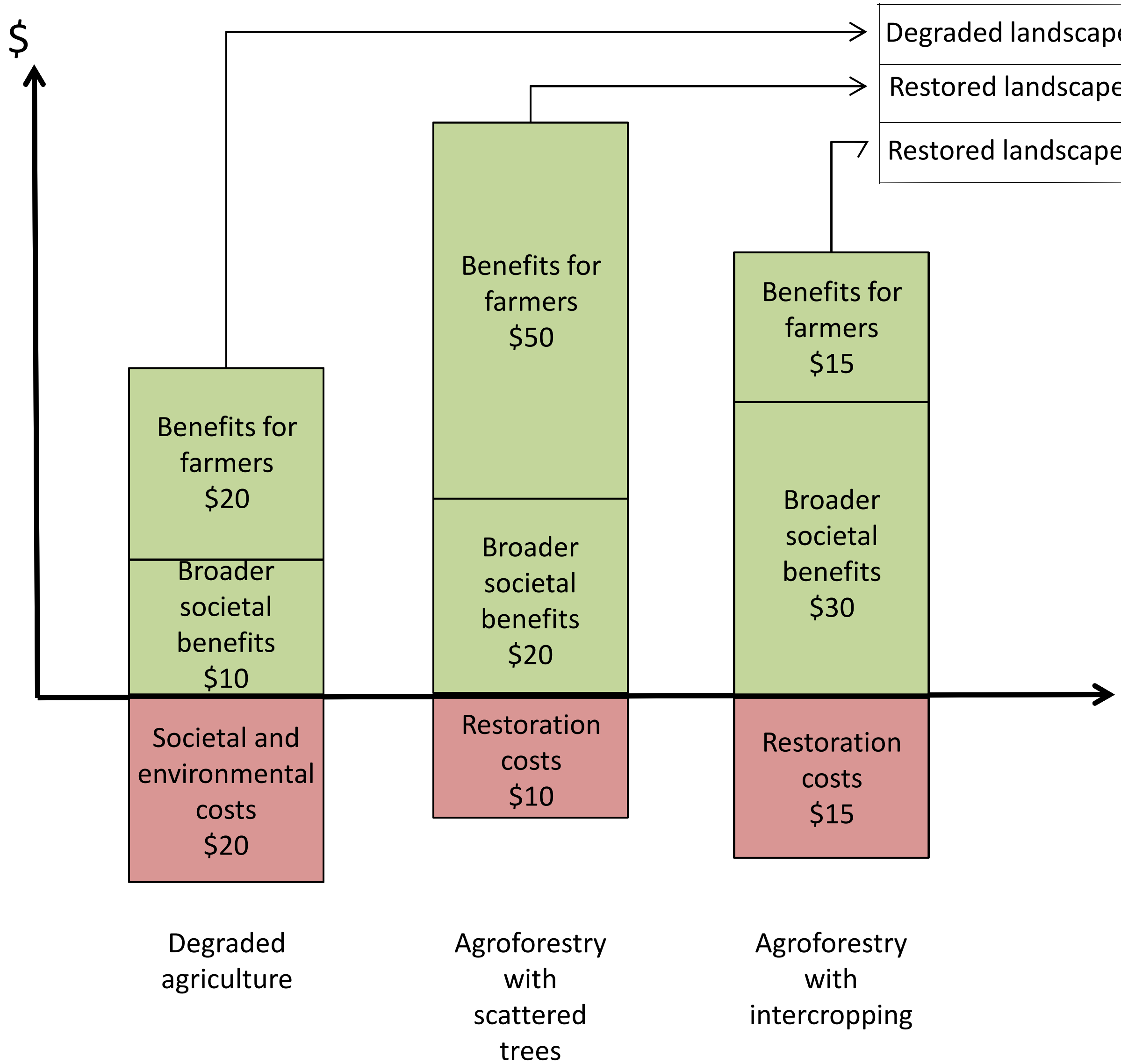
- The quantity of ecosystem services and their value can be estimated using a number of methods depending on how available biological and market data are.

- In data rich situations more accurate and advanced methods can be used, such as biological production functions.

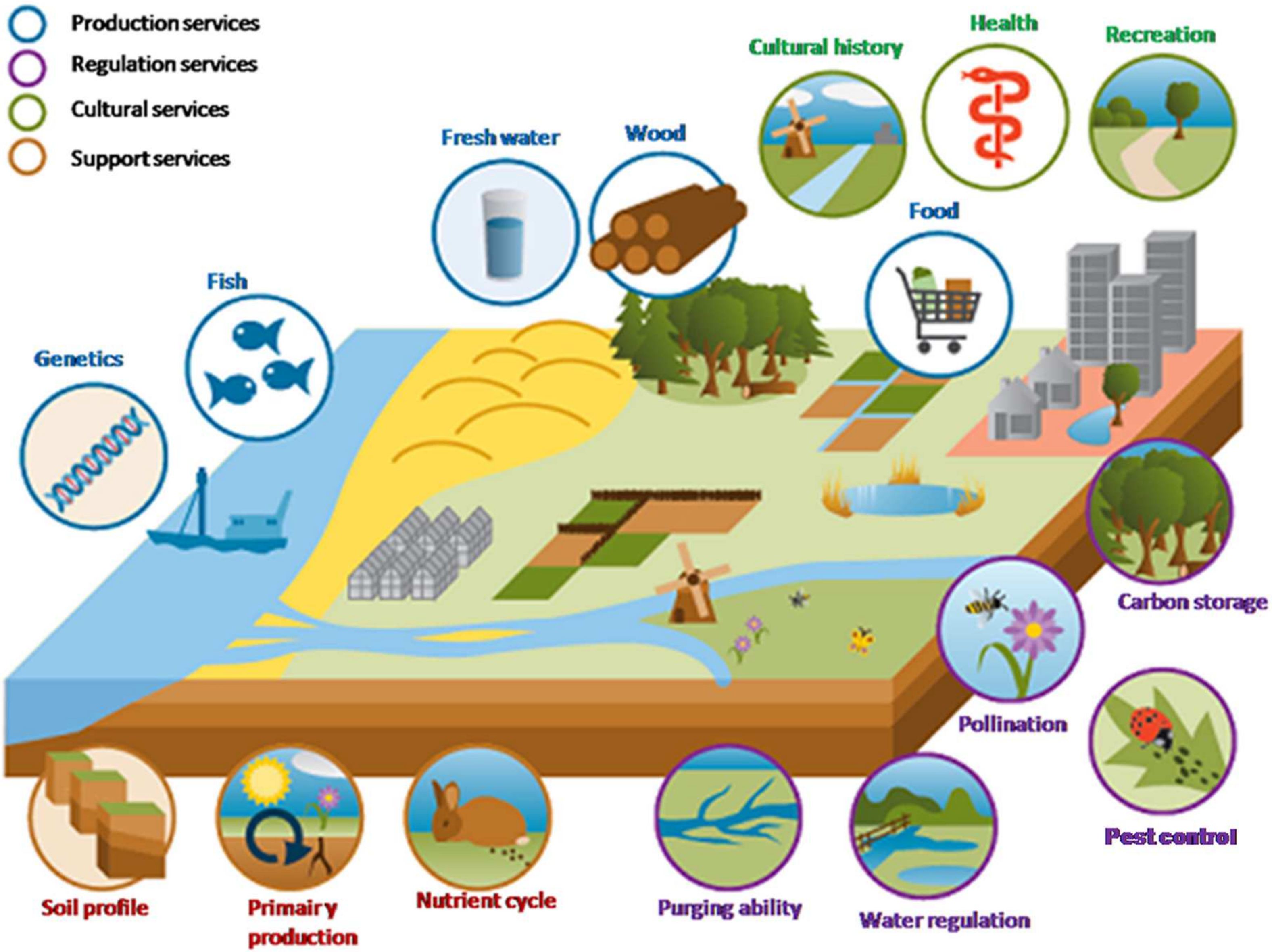
- In data poor situations benefit-transfer techniques can be used to construct look-up tables of land-use values.

Value of a restoration transition is a *marginal value*

	Benefits - costs	Net benefit	Marginal benefit
Degraded landscape	$30 - $20	$10	-
Restored landscape I	$70 - $10	$60	$50
Restored landscape II	$45 - $15	$30	$20



Typology of ecosystem goods and services



Source: https://publicwiki.deltares.nl

Selecting ecosystem goods and services to model

- There are many goods and services that can be modeled
- In many situations, these will be a few key *provisioning* and *regulating* services
- Aim to capture the most important ecosystem services/elements of a specific context – do not seek comprehensiveness at all cost
- To simplify the analysis choose goods and services that:
    - Are associated with key national goals, such as poverty reduction
    - Are easy to measure, have clear indicators and available data
    - Are easiest to communicate to key stakeholder groups
    - Have the highest economic values
    - Are likely to lead to changes that will improve the policy environment
    - Are most important across the entire protected area system
    - Are likely to lead to broad public support

Approaches to model ecosystem good and service production

- There are a number of approaches to model ecosystem good and service production:

  - **Look-up tables** - compiling a series of reference tables of secondary information on the costs and benefits of different restoration options.

  - **Ad hoc analysis**- Ad hoc analysis uses biological production functions, i.e. mathematical models of the processes by which ecosystem goods and services are thought to be produced, to model specific ecosystem goods and services.

  - **Generalizable ecosystem modeling tools** - Current tools range from simple spreadsheet models to complex software packages intended to enable replicable and quantifiable ecosystem services analyses.

Modeling ecosystem good and service production with Look-up tables

Restoration Opportunity Assessment Look-up Table					
	Ecosystem goods and services				
Land uses	Timber production (M3/ha/year)	Carbon storage (tons/ha/year)	Crop Production (tons/ha/year)	Livestock production (kgs/ha/year)	Erosion (tons/ha/year)
Degraded land uses	[1a]	[1b]	[1c]	[1d]	[1e]
1. Deforested land	0	0	0	0	14
2. Poorly managed woodlot	5	3	0	0	10
3. Degraded agriculture	0	0	0.8	15	18
Restoration interventions	[2a]	[2b]	[2c]	[2d]	[2e]
1. Natural regeneration	20	10	0	0	1
2. Well managed woodlot	12	6	24	0	7
3. Agroforestry	2	1	1.4	21	6

- Often, studies of FLR impacts will not be available in-country
- Part of exercise may require building scenarios reflecting likely impacts
- This can be done by compiling a series of reference tables of secondary information and stakeholder responses
- The table above shows the general template used in the Ghana assessment for recording the results of the analyses restoration impacts as reported by stakeholders

Modeling ecosystem good and service production with Ad hoc analysis

More precise impact estimates can be produced using mathematical models of biological production functions.

- Analysis uses empirically-estimated production functions to model the ecosystem service impacts of different restoration options

The following biological production functions were used to model timber production, erosion, crop yields, and carbon sequestration in Rwanda:

$$Timber_t = \{mai_t + \sum_{t=0}^{T-1} mai_t\} * (\frac{trees}{ha})$$

$$Erosion = R * K * L * S * C * P$$

$$Yield_i = (Precipitation^{\beta_1} * Area^{\beta_2})$$

$$Carbon\ (tons) = (above\ ground\ biomass + root\ biomass) * 0.49$$

- This approach is flexible because modeling of different services proceeds on an ad hoc basis.
- The largest limitation is finding appropriate data to solve the models.

Modeling ecosystem good and service production generalized ecosystem modeling tools

- There are a number of ecosystem service modeling tools available.
- Each tool has different intended uses, models different services, uses different analytical approaches, has unique data requirements and outputs, and requires varying amounts of time to run.
- The choice of tool depends on the context of the situation within which the tool is being applied.
- The table below provides a summary of four common tools.

Tool	Time requirements	Capacity for independent application	Level of development & documentation	Generalizability	Affordability, insights, integration with existing environmental assessment
InVest	Moderate to high, depending on data availability to support modeling	Yes	“Tier 1” models fully developed and documented	High, though limited by availability of underlying data	Spatially explicit ecosystem service tradeoff maps; currently relatively time consuming to parameterize
ARIES	High to develop new case studies, low for preexisting case studies	Yes, through web explorer or stand- alone software tool	Fully documented; case studies complete but global models and web tool under development	Low until global models are completed	Spatially explicit ecosystem service tradeoff, flow, and uncertainty maps; currently time consuming for new applications
Ecosystem Valuation Toolkit	Assumed to be relatively low	Yes	Under development	High, within limits of point transfer	Point transfer for “ballpark numbers,” building awareness of values
LUCI	Moderate; tool is designed for simplicity and transparency, ideally with stakeholder engagement	Yes, though website is under development and more detailed user guidance is presumably forthcoming	Initial documentation and case study complete; follow- up case studies in development	Relatively high; a stakeholder engagement process is intended to aid in “localizing” the data and models	Spatially explicit ecosystem service tradeoff maps; designed to be relatively intuitive to use and interpret

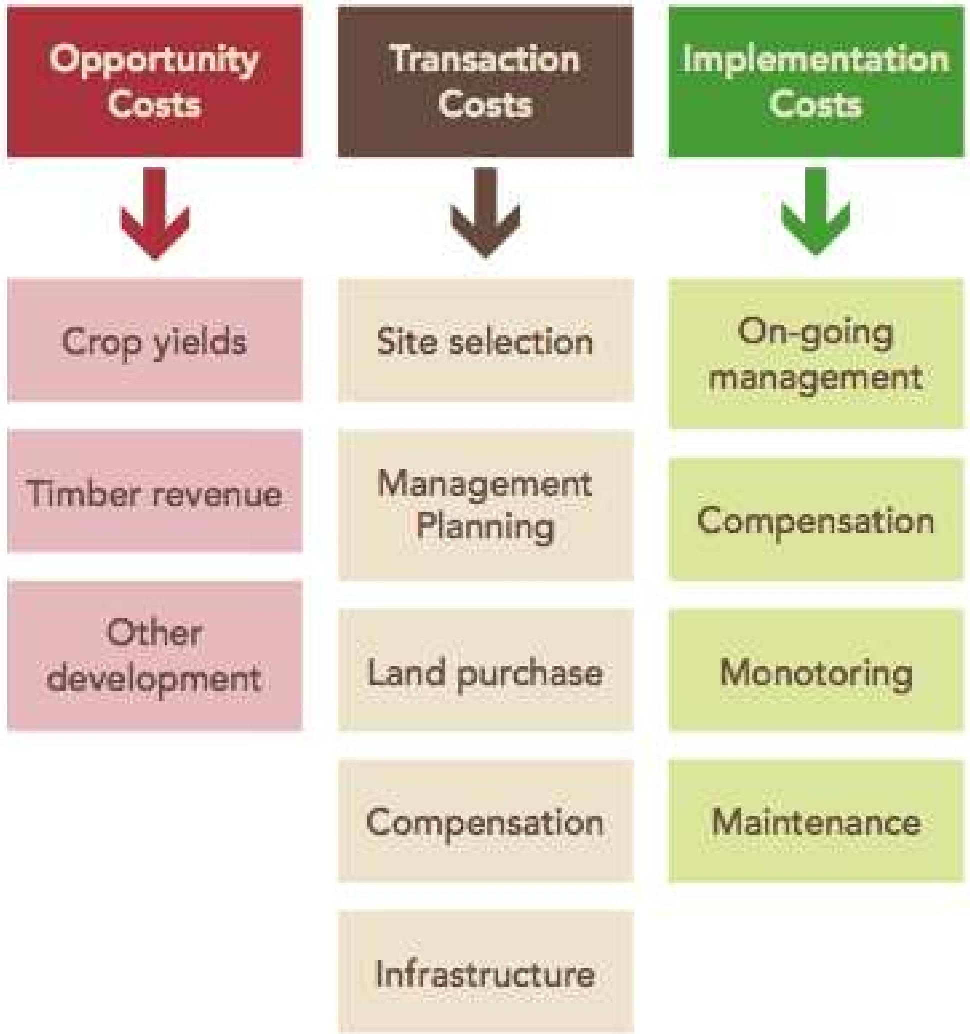
Source: Bagstad et al. 2013. A comparative assessment of decision-support tools for ecosystem services quantification and valuation. Ecosystem Services 5: 27-39.

What are the costs of restoration?

1.Implementation costs: represent investments in land, labor, and materials

2. Transaction costs: represent the cost for landowners and implementing agencies to identify viable land and negotiate over terms that ensure restoration meets both local and national priorities

3. Opportunity costs: Opportunity costs represent the tangible goods and services that were given up to make restoration possible.



Estimating the costs of each land use, restoration intervention, and restoration transition

- An annual site-level budgeting approach can be used to account for the *implementation and opportunity costs* of each land use and restoration intervention

Annual maize farm budget for Rwanda (1 hectare)				
Items	Unit	Quantity	Unit Price	Total cost (RWf)
Variable input costs				
Hired labor	Work days	22	1,000	22,000
Household labor	Work days	199	500	99,500
Seeds	Kg	40	93	3,720
Organic fertilizer	Kg	3,000	2	6,000
Capital costs			660	660
Fixed costs				
Small agricultural equipment			1,900	1,900
Discounted value of costs				2,932,635

- Approach records each activity and material input that is needed for each land use and restoration intervention on annualized, site-level basis.

Step 4: Conduct sensitivity and uncertainty analysis

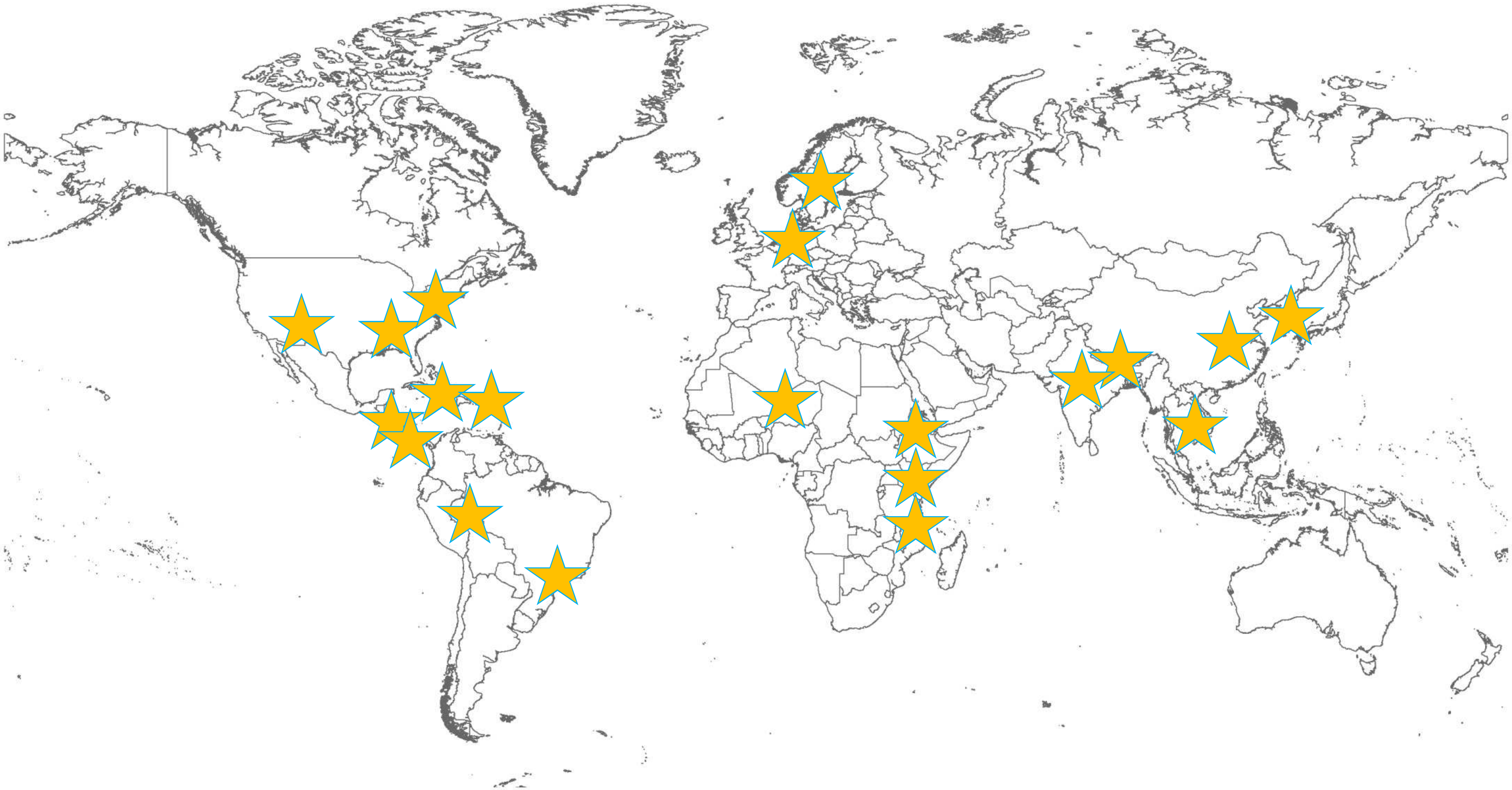
Monte Carlo Analysis

- Uncertainty over future ecological values makes it difficult to choose between options
- Monte Carlo explicitly accounts for uncertainty
- Output is a probability distribution that helps decision makers understand risks of different interventions


"Rapid Restoration Diagnostic"


Look back to look ahead

Case studies



South Korea

Before 1960

Impact

- Forest cover increased from 35% to 64% of country (1952-2007)
- Forest density increased 14x, population grew 2x, and economy grew 300x (1953-2007)

Motivate

- Land slides, flooding, wood shortages
- President Chung-hee made reforestation a national priority
- Big tree planting campaigns

After 2000

Enable

- ↓ demand for fuel wood (90% of energy in 1950, 5% by 1980)
- Urbanization
- Strong coordination between government levels

Implement

- Series of 10-year reforestation plans (1973-now) with targets, funds, extension, public outreach, and enforcement
- 460 well-paid nursery experts produced 500 million seedlings/year

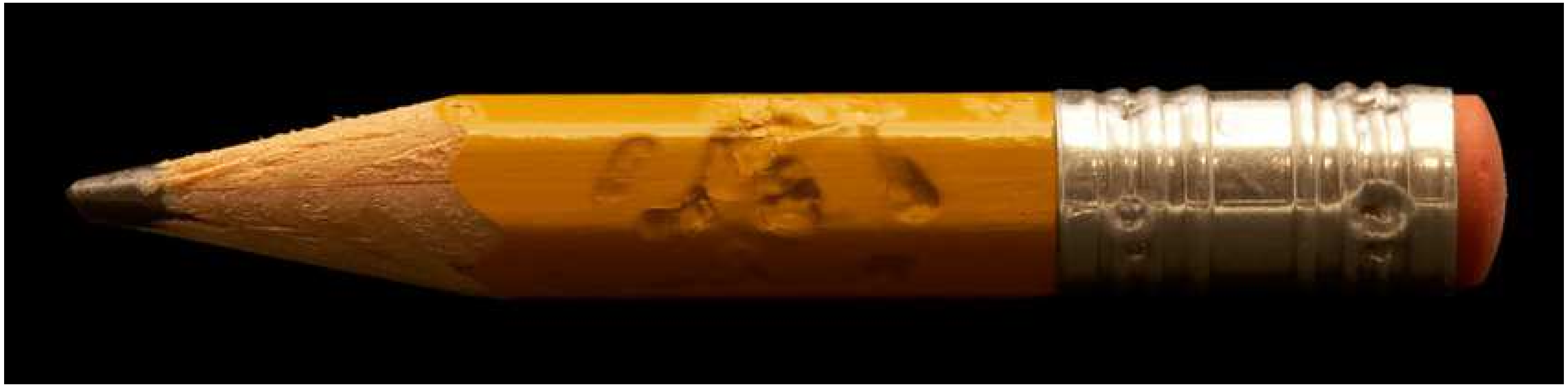
NIGER (ZINDER PROVINCE)

Impact	• 5 million hectares restored into agroforestry • Improved food security for 2.5 million people
Motivate	• Drought (1969-73) and famine (1984, 1988)
Enable	• Rural Code reformed to promise farmers “rights to benefits from trees” (1993)
Implement	• Regeneration “know how” spread by farmer to farmer

Theme	Feature	Key success factor	Response
Motivate	Benefits	• Restoration generates economic benefits	
		• Restoration generates social benefits	
		• Restoration generates environmental benefits	
	Awareness	• Benefits of restoration are publicly communicated	
		• Opportunities for restoration are identified	
	Crisis events	• Crisis events are leveraged	
	Legal requirements	• Law requiring restoration exists	
		• Law requiring restoration is broadly understood and enforced	
Enable	Ecological conditions	• Soil, water, climate, and fire conditions are suitable for restoration	
		• Plants and animals that can impede restoration are absent	
		• Native seeds, seedlings, or source populations are readily available	
	Market conditions	• Competing demands (e.g., food, fuel) for degraded forestlands are declining	
		• Value chains for products from restored area exists	
	Policy conditions	• Land and natural resource tenure are secure	
		• Policies affecting restoration are aligned and streamlined	
		• Restrictions on clearing remaining natural forests exist	
		• Forest clearing restrictions are enforced	
	Social conditions	• Local people are empowered to make decisions about restoration	
		• Local people are able to benefit from restoration	
	Institutional conditions	• Roles and responsibilities for restoration are clearly defined	
		• Effective institutional coordination is in place	
Implement	Leadership	• National and/or local restoration champions exist	
		• Sustained political commitment exists	
	Knowledge	• Restoration "know how" relevant to candidate landscapes exists	
		• Restoration "know how" transferred via peers or extension services	
	Technical design	• Restoration design is technically grounded and climate resilient	
	Finance and incentives	• Positive incentives and funds for restoration outweigh negative incentives	
		• Incentives and funds are readily accessible	

CAVEATS

- Factors are inter-related
- Not every case example has everything
- The more factors in place, the greater likelihood of success



Rapid Restoration Diagnostic: 3 Steps

1. **Select the scope.** Choose the “scope” or boundary within which to apply the Diagnostic. The selected scope will be the “candidate landscape.”

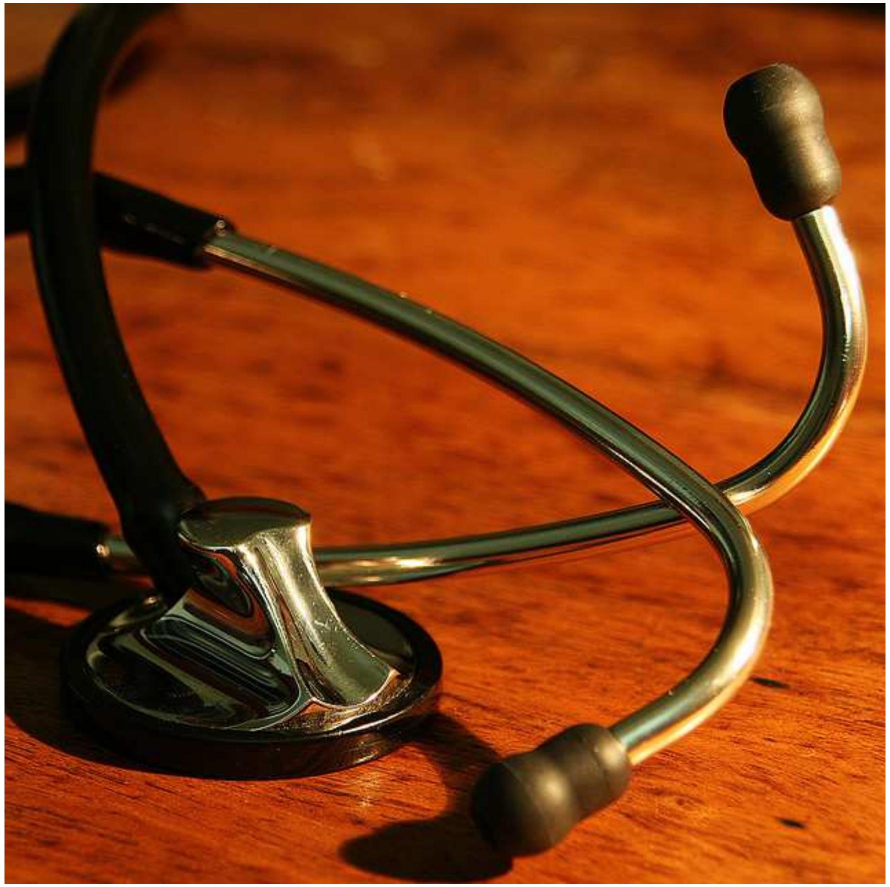
2. **Assess status of key success factors.** Systematically evaluate whether or not key success factors for forest landscape restoration are in place for the candidate landscape.

3. **Identify strategies to address missing factors.** Identify strategies to close gaps in those key success factors that are currently not in place or only partly in place in the candidate landscape.

1. Select the scope

- What geographical space?
  - Landscape (country, region, watershed, etc.)
- What time period?
  - Many decades
- What goals?
  - Food, biodiversity, timber, erosion, water, etc

2. Assess key success factors



Theme	Feature	Key success factor
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	Legal requirements	• Law requiring restoration exists
		• Law requiring restoration is broadly understood and enforced
Enable	Ecological conditions	• Soil, water, climate, and fire conditions are suitable for restoration
		• Plants and animals that can prohibit restoration are absent
		• Native seeds, seedlings, or source populations are readily available
	Market conditions	• Competing demands (e.g., food, fuel) for degraded forestlands are declining
		• Value chains for products from restored forests exists
	Policy conditions	• Land and natural resource tenure are secure
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		• Forest clearing restrictions are enforced
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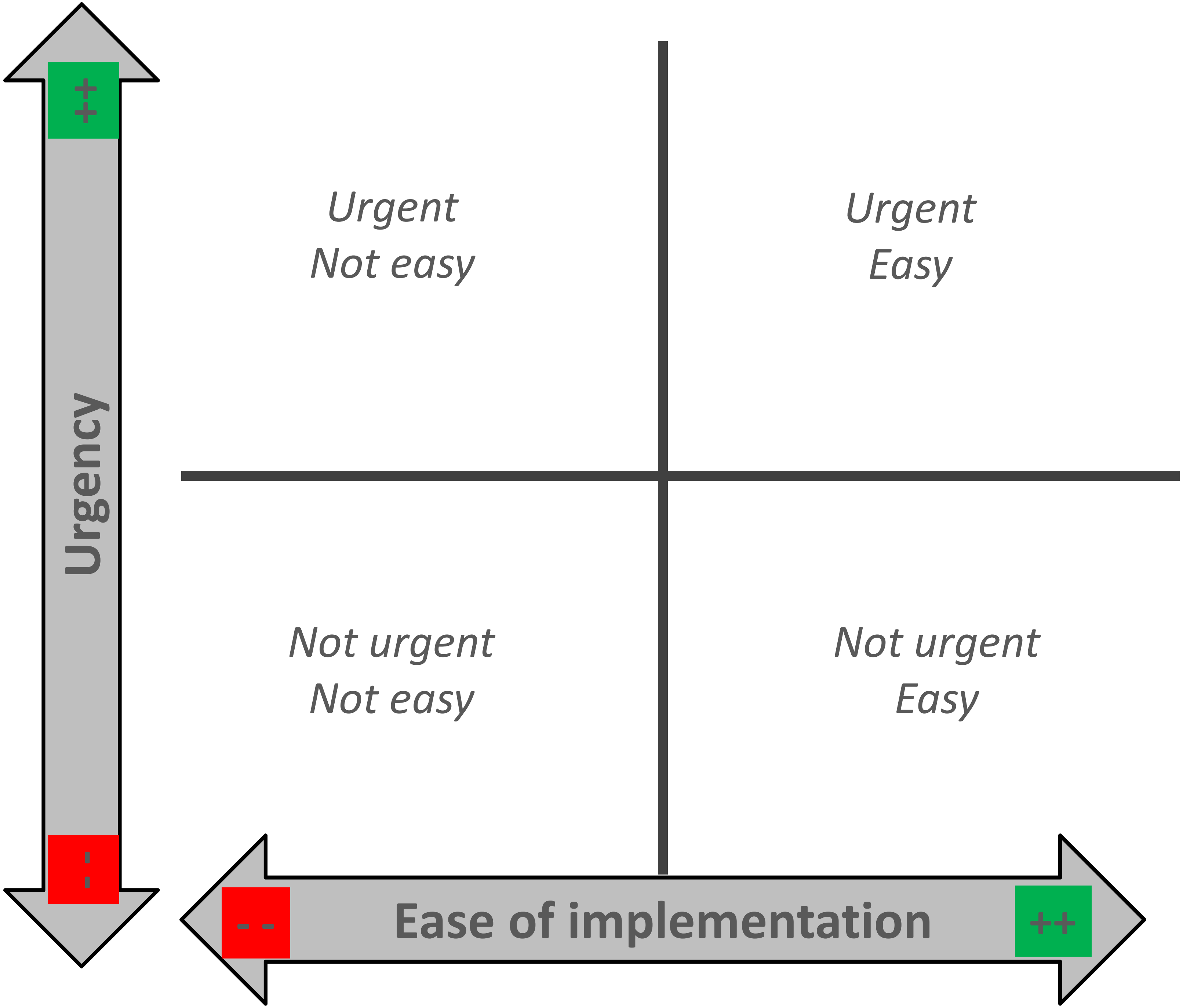
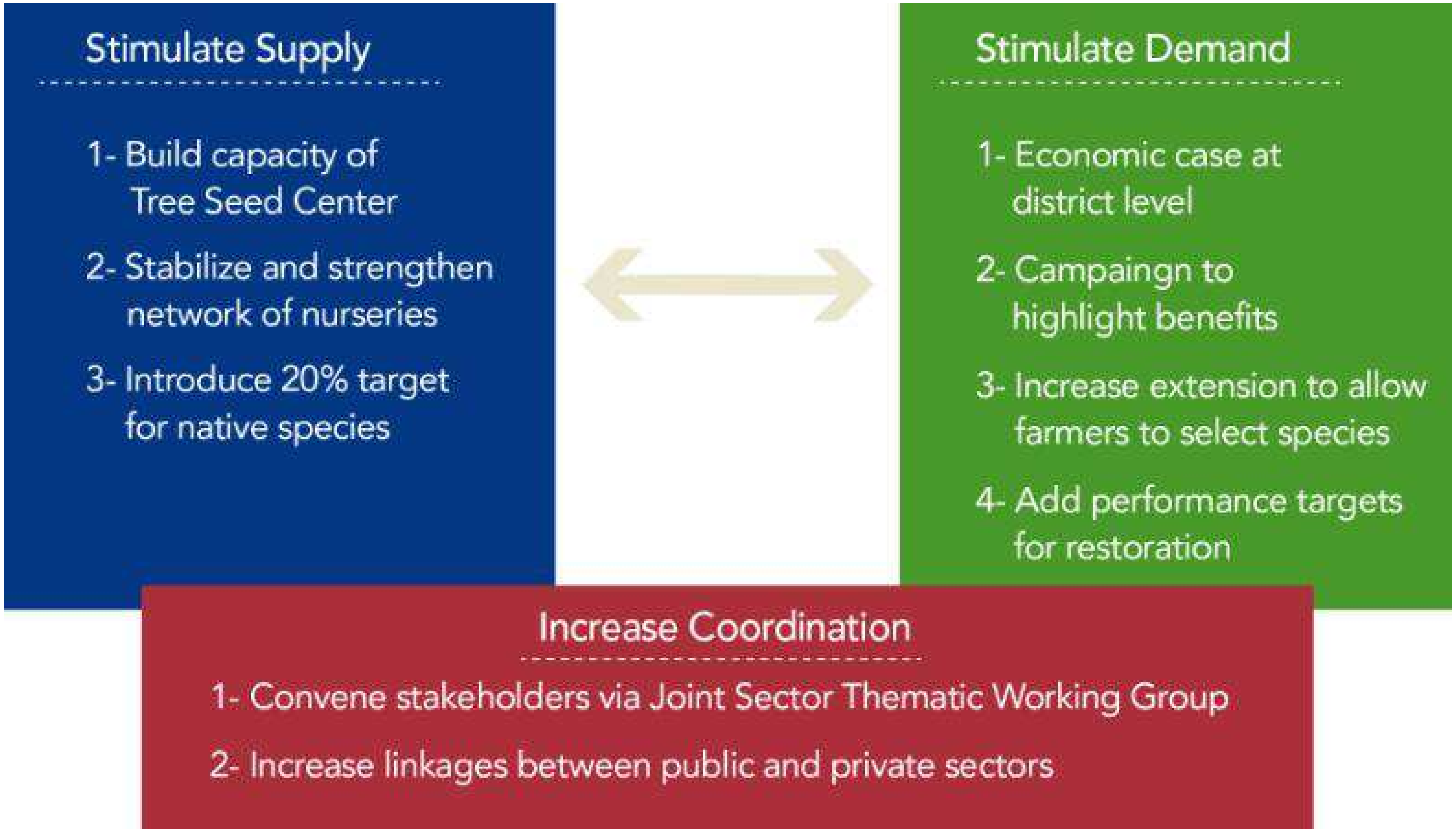
Implement	Leadership	• National and/or local restoration champions exist
		• Sustained political commitment exists
	Knowledge	• Restoration “know how” relevant to candidate landscapes exists
		• Restoration “know how” transferred via peers or extension services
	Technical design	• Restoration design is technically grounded and climate resilient
	Finance and incentives	• “Positive” incentives for restoration outweigh “negative” incentives
		• Incentives and funds are readily accessible
	Feedback	• Effective performance monitoring and evaluation system is in place
		• Early wins are communicated

3. Identify strategies to address missing factors



Urgency
++
- -
Urgent
Not easy
Urgent
Easy
Not urgent
Not easy
Not urgent
Easy
Ease of implementation
- -
++

IUCN/WRI Enabling Conditions Diagnostic e.g. Rwanda



Final step: strategizing for follow-up

Some examples of uptake and impacts of assessment findings so far include:

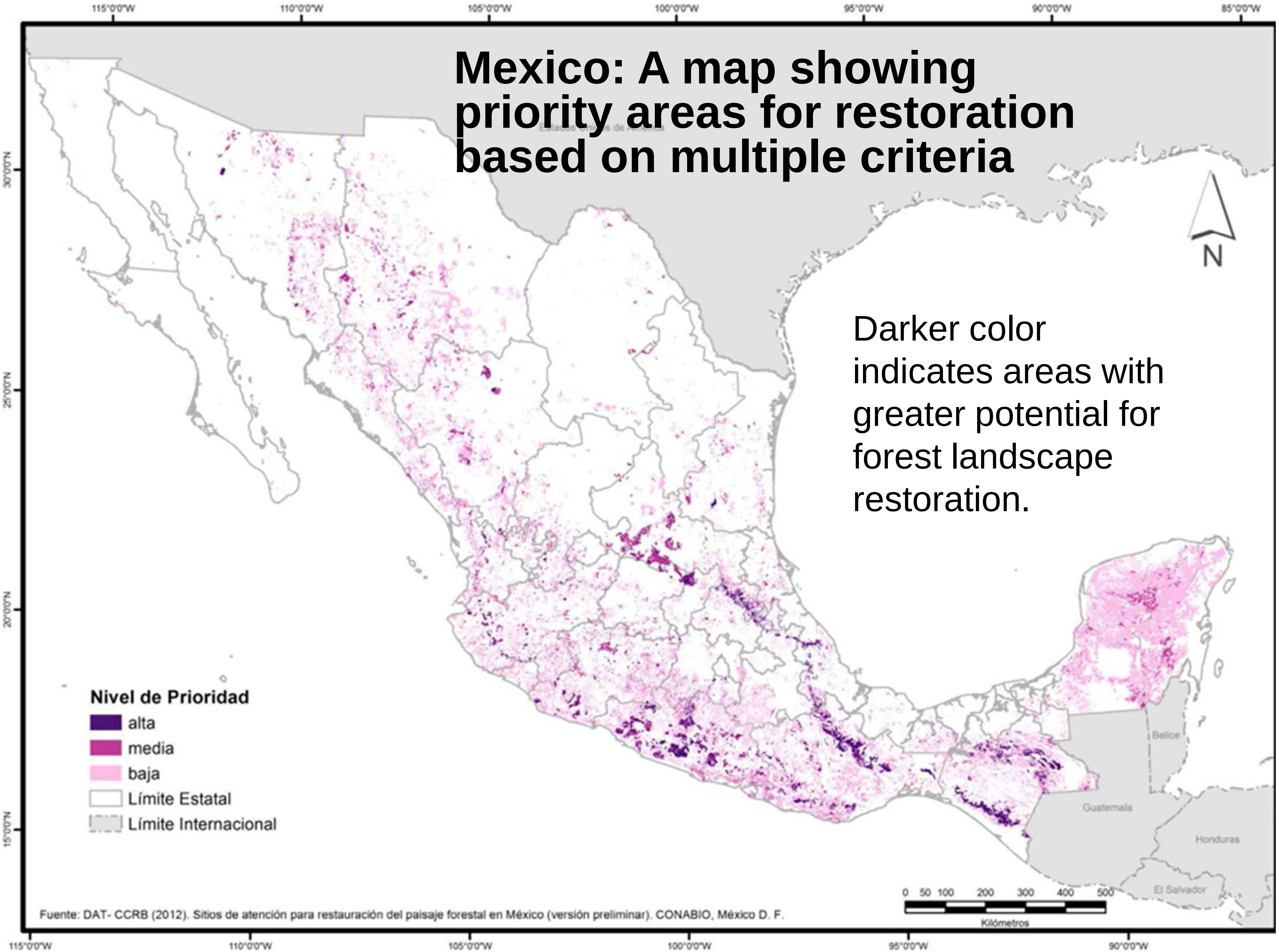
• Used as key source document in the design and submission of Ghana's investment plan for the Forest Investment Programme (FIP)

• Providing the basis of interagency development of a national strategy on FLR for Mexico and Guatemala

• Formed the basis of a Presidential/Cabinet briefing note and shaping the major GEF landscape restoration project in Rwanda

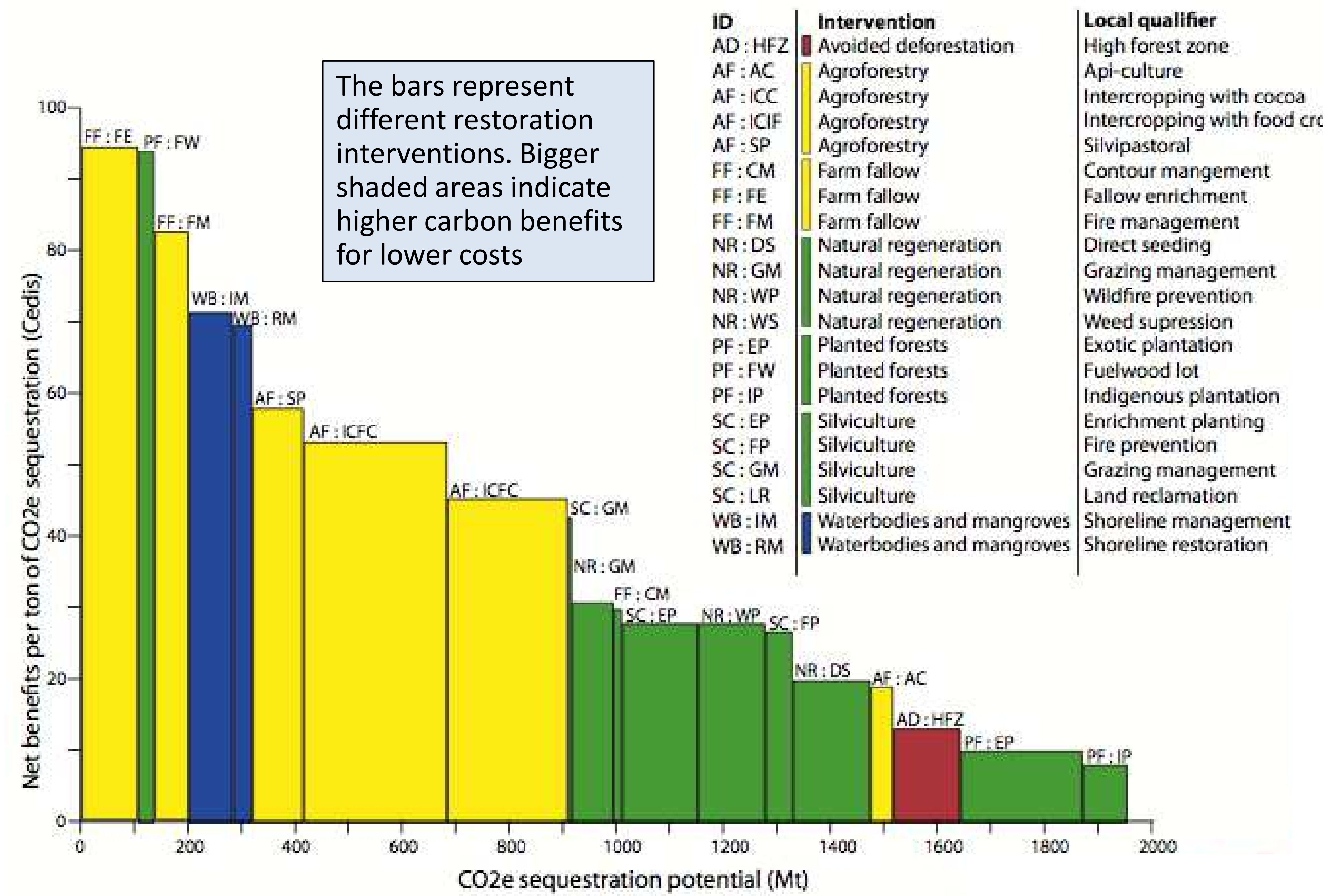
SOME EXAMPLES OF RESULTS

Mexico: A map showing priority areas for restoration based on multiple criteria



Darker color indicates areas with greater potential for forest landscape restoration.

Ghana: quantification of the potential of different landscape restoration interventions to sequester carbon



The bars represent different restoration interventions. Bigger shaded areas indicate higher carbon benefits for lower costs

ON-GOING IMPROVEMENT

Scoping of existing tools to value ecosystem services from FLR

Methodological approaches for accounting carbon stock enhancement at the landscape level

Framework to identify mobilize public and private investment to support FLR on the ground

Adaptation of FAO-PROFOR’s Forest Governance Framework

Other improvements from applying ROAM in other countries and regions

Q&A