THE GLOBAL PARTNERSHIP ON FOREST LANDSCAPE RESTORATION

BONN CHALLENGE 2011

Assessing the incentives for Forest Landscape Restoration in Rwanda

CBD Workshop, Belize
01/May/2014

WORLD RESOURCES INSTITUTE

IUCN

Rwanda background information

- 90% of the nearly 12 million person population are engaged in subsistence agriculture
- Secure property rights and most land is privately owned
- Known for its hilly countryside and biodiversity
- Wood is the primary energy source



Rwanda's Vision 2020

- Government development program based on 6 Pillars to transform Rwanda into a middle-income country:
  - Good governance
  - An efficient state
  - Skilled human capital
  - A vibrant private sector
  - A world-class physical infrastructure
  - Modern agriculture and livestock

Our involvement in Rwanda

- Invited by government to conduct a Restoration Opportunity Assessment linked to national priorities:
  - Identify environmental challenges
  - Suggest potential interventions
  - Estimate geographic scope and costs & benefits
  - Assess institutional barriers
- How would this contribute to national priorities outlined in Vision 2020?

Environmental challenges and goals of Rwanda

- Low biodiversity eucalyptus woodlots & little remaining primary forest
- High rates of erosion reduce hydroelectric efficiency and reduce water quality
- Agricultural productivity is poor and below potential
- Poverty is high and vigorous private sector is missing

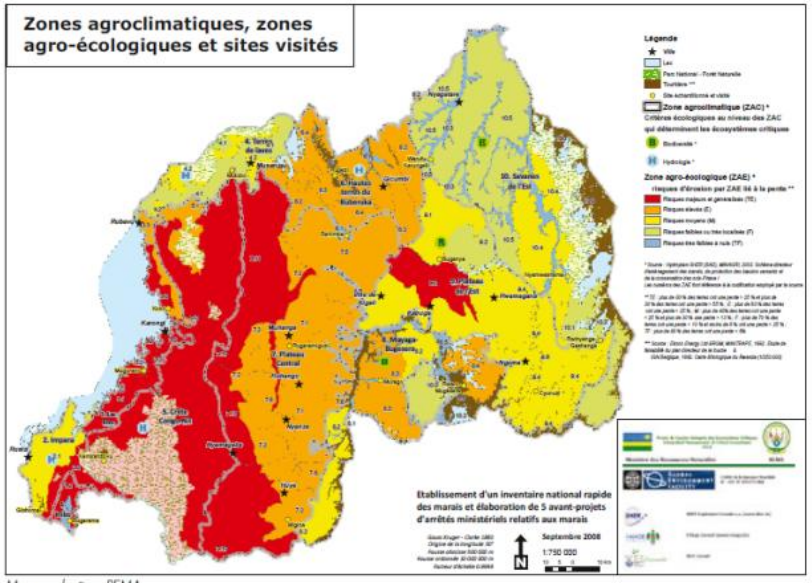
Forest	Energy	Water	Food
Increase forest cover to 30%	*Electricity to 70%*	*100% access to clean water*	*Agri production to 2600 kcal/day*

Economy

Poverty level to 20%
Per capita GDP to US$1,240

Our approach combines information with knowledge to create viable solutions

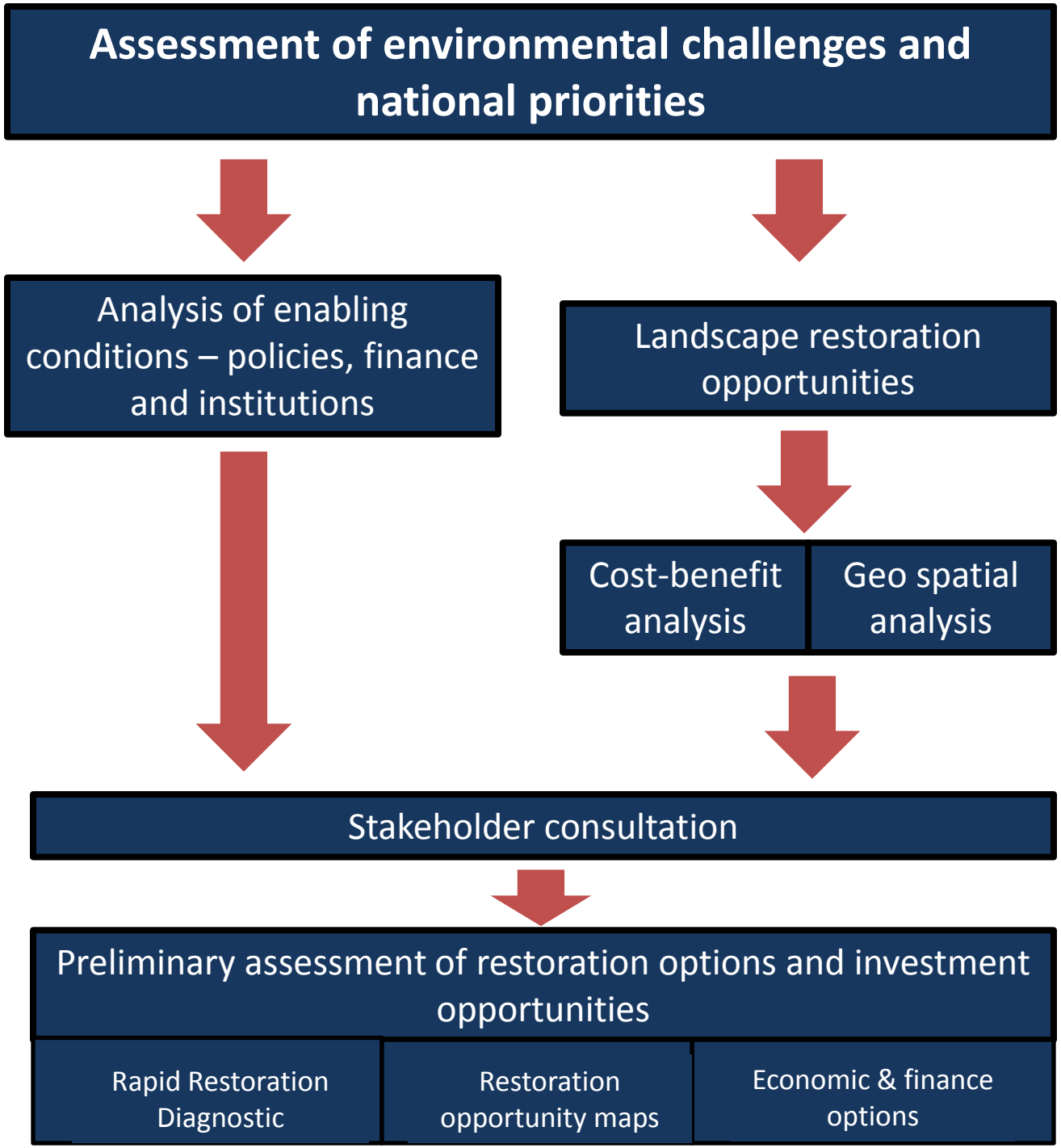
Figure 4: Agro-climatic zones and risk of soil erosion



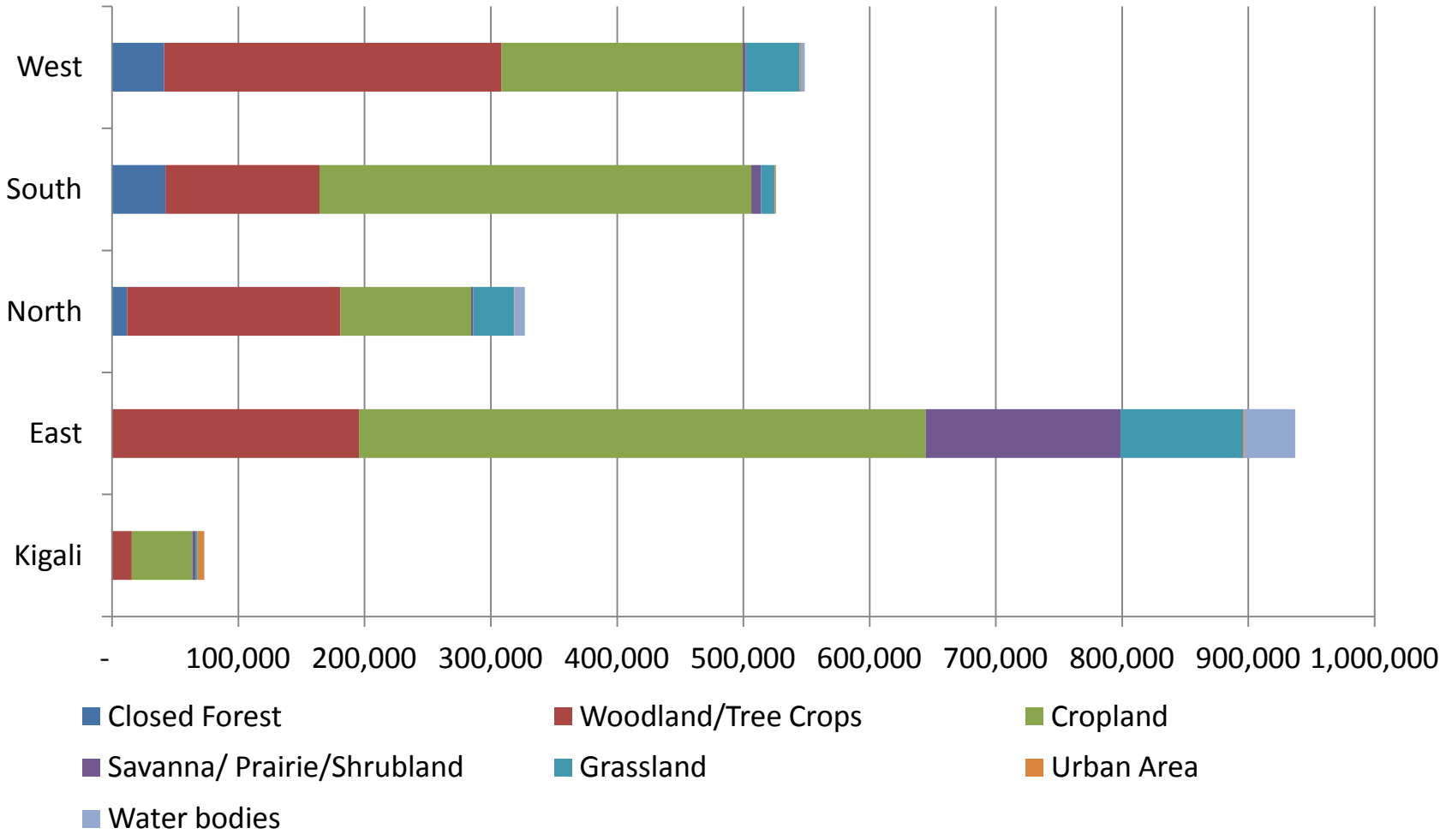
Map production: REMA

Best knowledge

Best science


Assessment of environmental challenges and national priorities
Analysis of enabling conditions – policies, finance and institutions
Landscape restoration opportunities
Cost-benefit analysis
Geo spatial analysis
Stakeholder consultation
Preliminary assessment of restoration options and investment opportunities
Rapid Restoration Diagnostic
Restoration opportunity maps
Economic & finance options

Land use (ha) – Rwanda



Restoration is a change in land use

- We consider three main degraded land uses
  - Agriculture
  - Woodlots and plantations
  - Deforested land (non-ag)
- Based on these land uses, we consider five (5) broad restoration interventions to restore degraded land:
  - Agriculture → Agroforestry
  - Agriculture → Secondary forest
  - Poorly managed woodlots and plantations → Well managed
  - Poorly managed woodlots → Secondary forest
  - Deforested land → Secondary forest

Integrated landscape approach

Natural Forest

Protective Forest

Woodlots

Agroforestry: Flat land

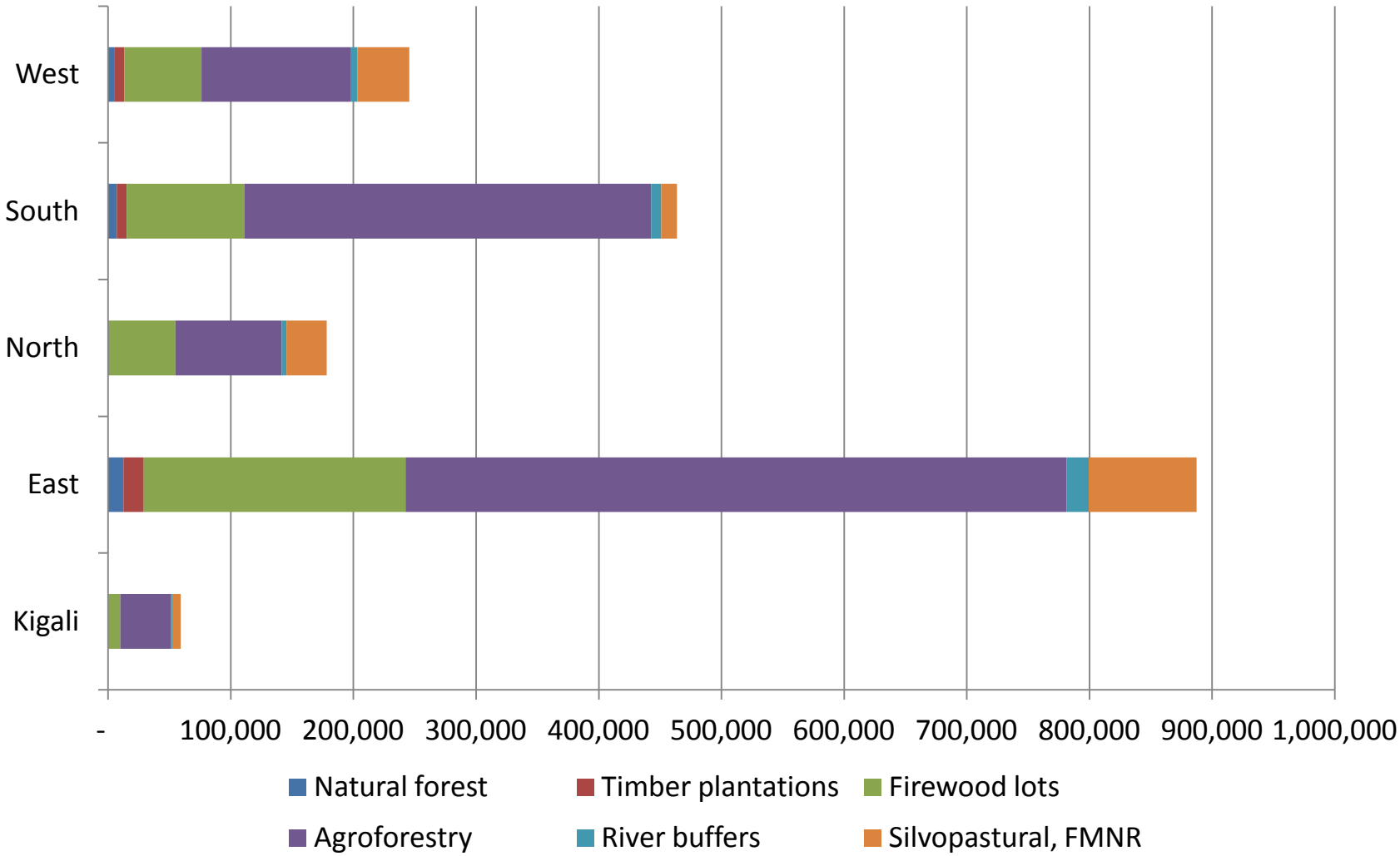
Agroforestry: Sloping land

Forest	Energy	Water	Food
Increase forest cover to 30%	*Electricity to 35%*	*100% access to clean water*	*Agri production to 2200 kcal/ day*

Economy

Poverty level to 20%
Per capita GDP to US$1,240

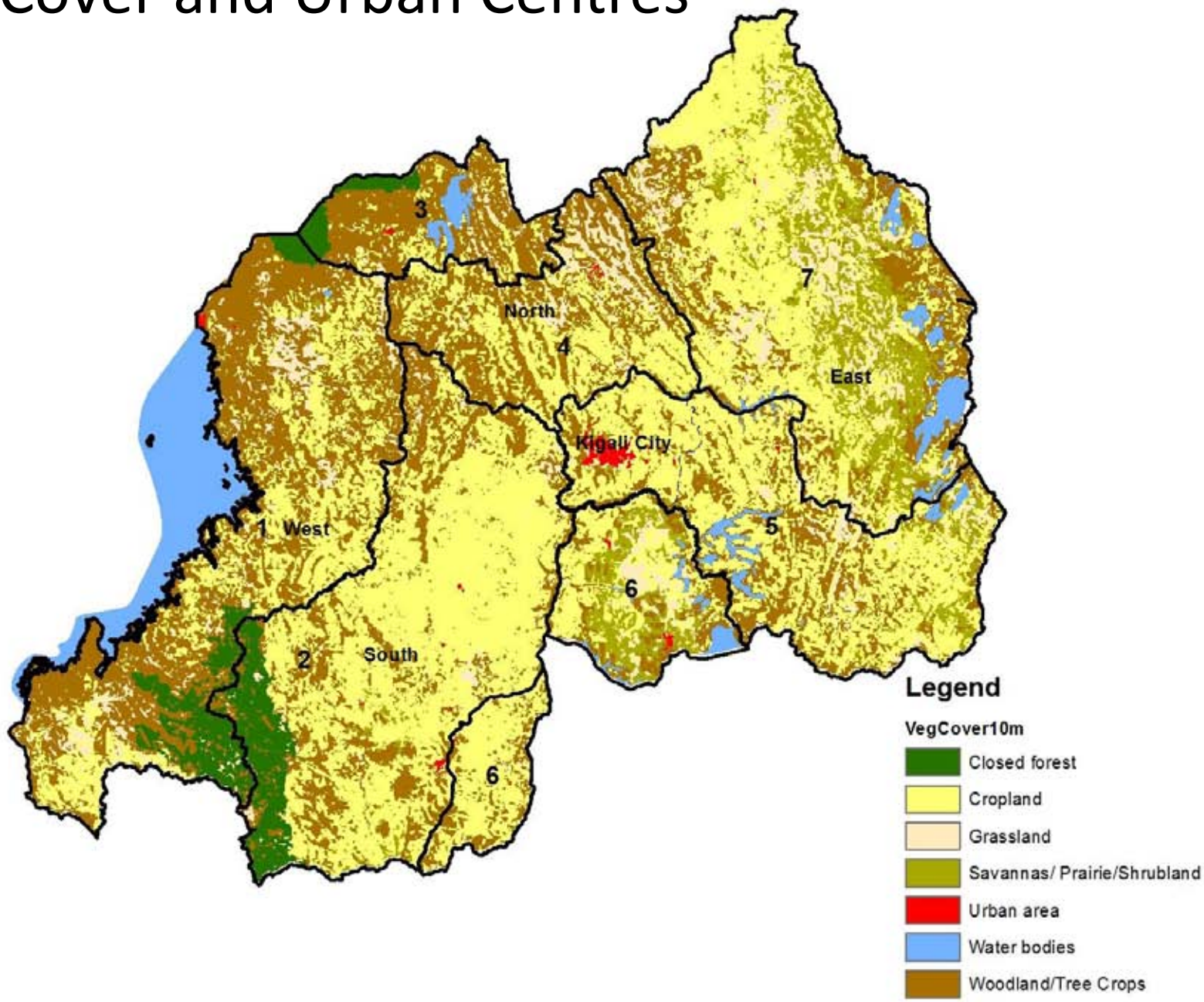
Interventions (ha) – Rwanda



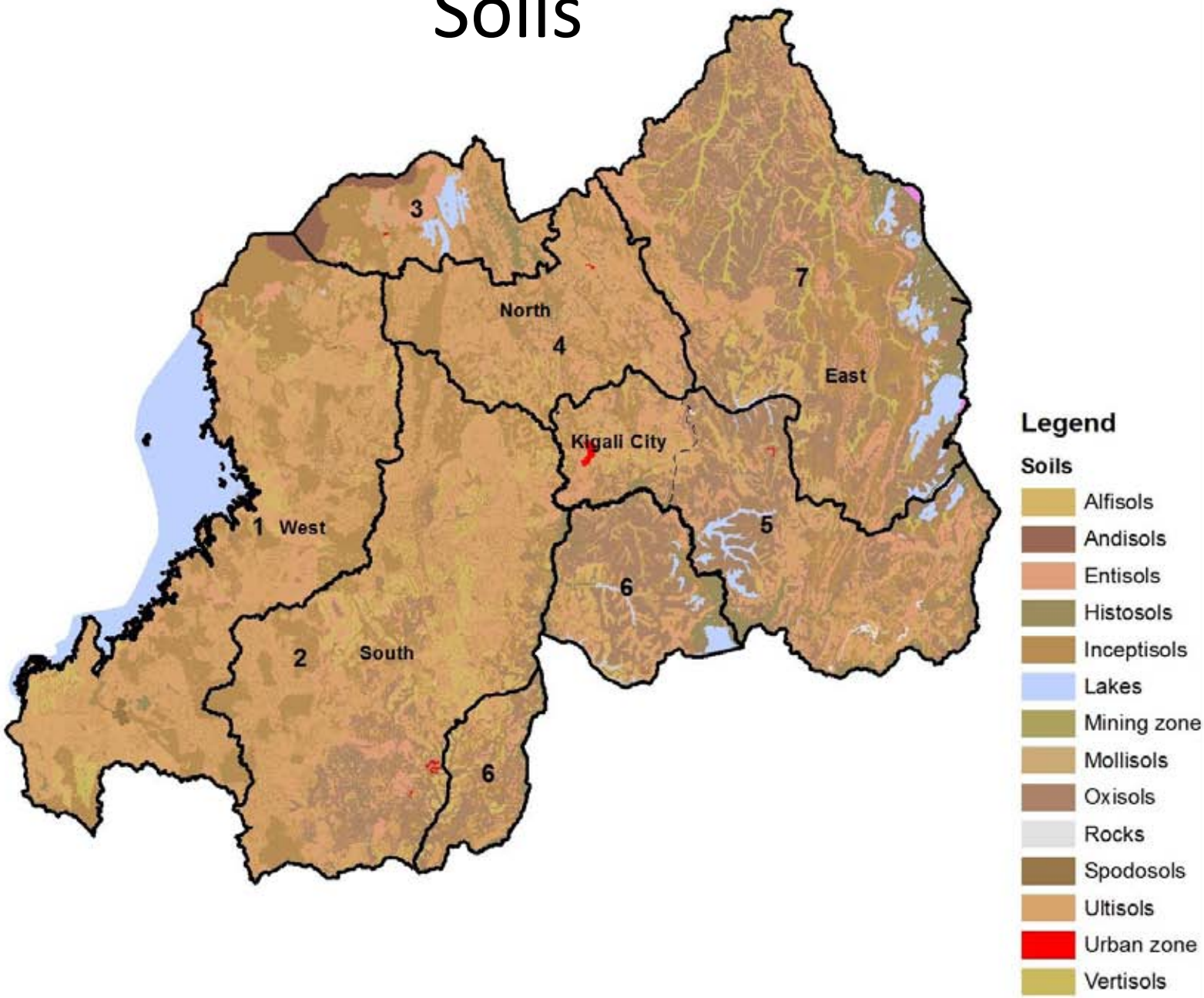
Can the interventions be implemented at scale?

- To examine this question we looked at:-
  - Land-use
  - Forest cover
  - Topography
  - Soils and erosion
  - Urban centres
  - River course and water bodies

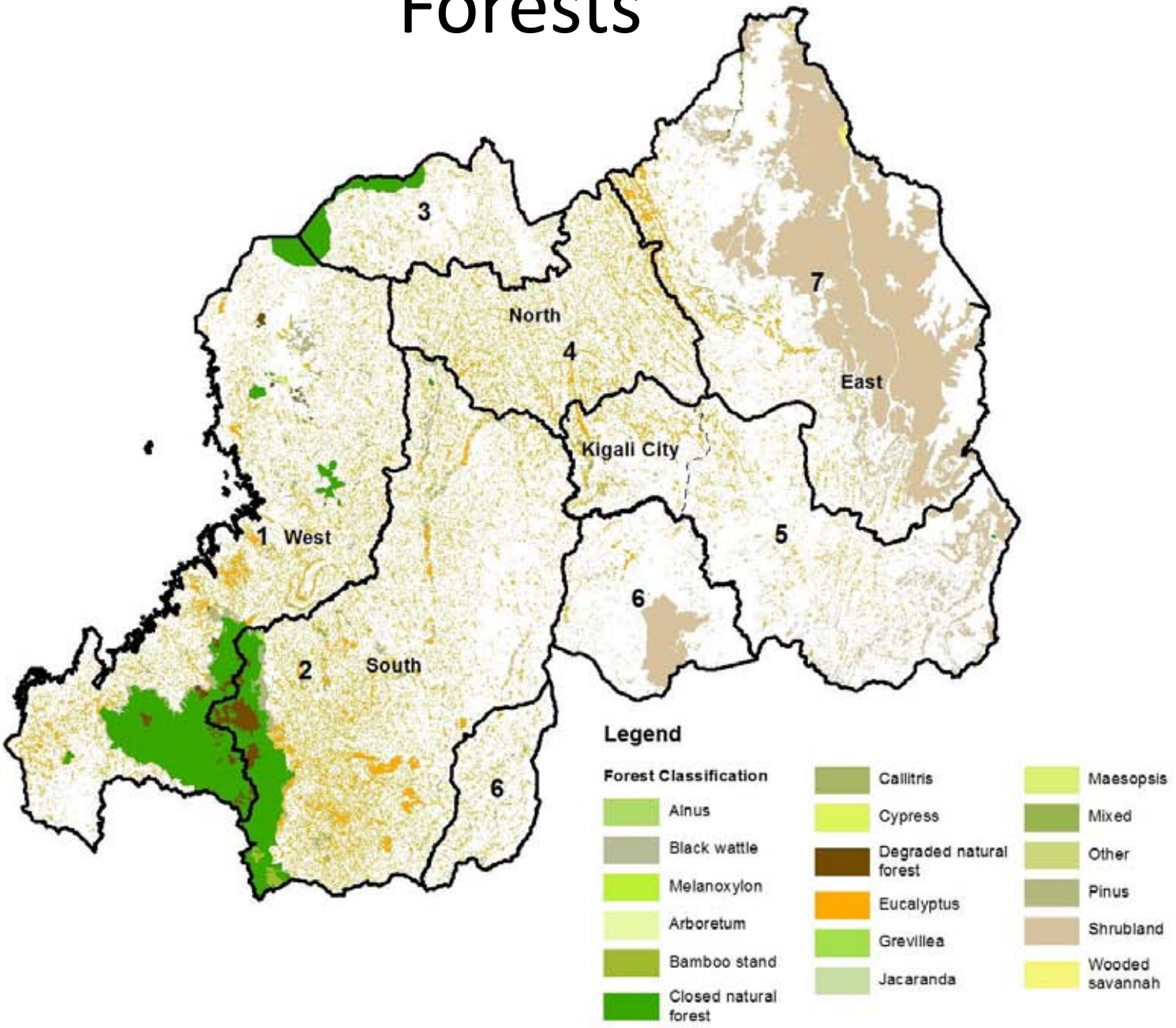
Land Cover and Urban Centres



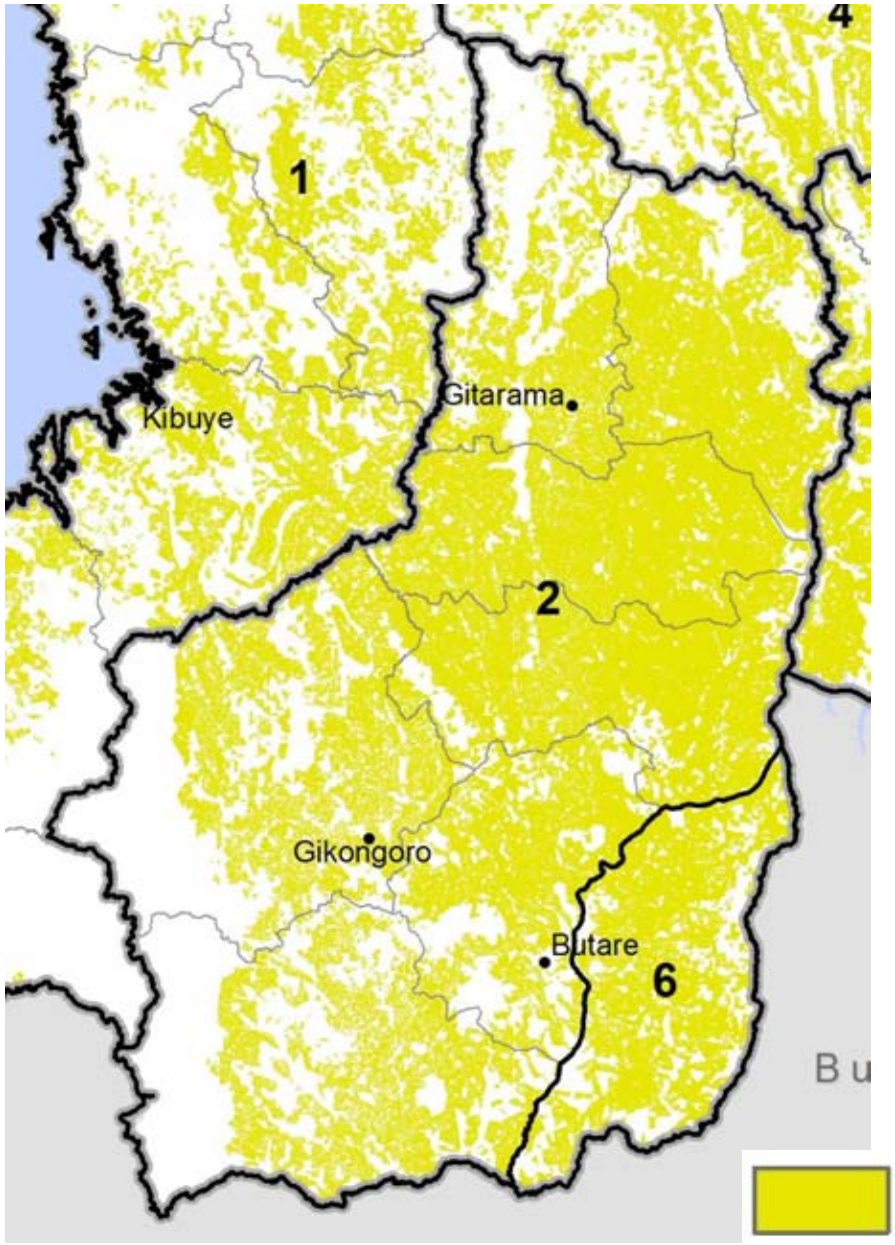
Soils


3
North
4
7
East
Kigali City
1 West
5
6
2 South
6
Legend
Soils
Alfisols
Andisols
Entisols
Histosols
Inceptisols
Lakes
Mining zone
Mollisols
Oxisols
Rocks
Spodosols
Ultisols
Urban zone
Vertisols

Forests


3
North
4
7
East
Kigali City
1 West
5
6
2 South
6
Legend
Forest Classification
Alnus
Black wattle
Melanoxylon
Arboretum
Bamboo stand
Closed natural forest
Callitris
Cypress
Degraded natural forest
Eucalyptus
Grevillea
Jacaranda
Maesopsis
Mixed
Other
Pinus
Shrubland
Wooded savannah

Example:-Expanded agroforestry in Southern Province

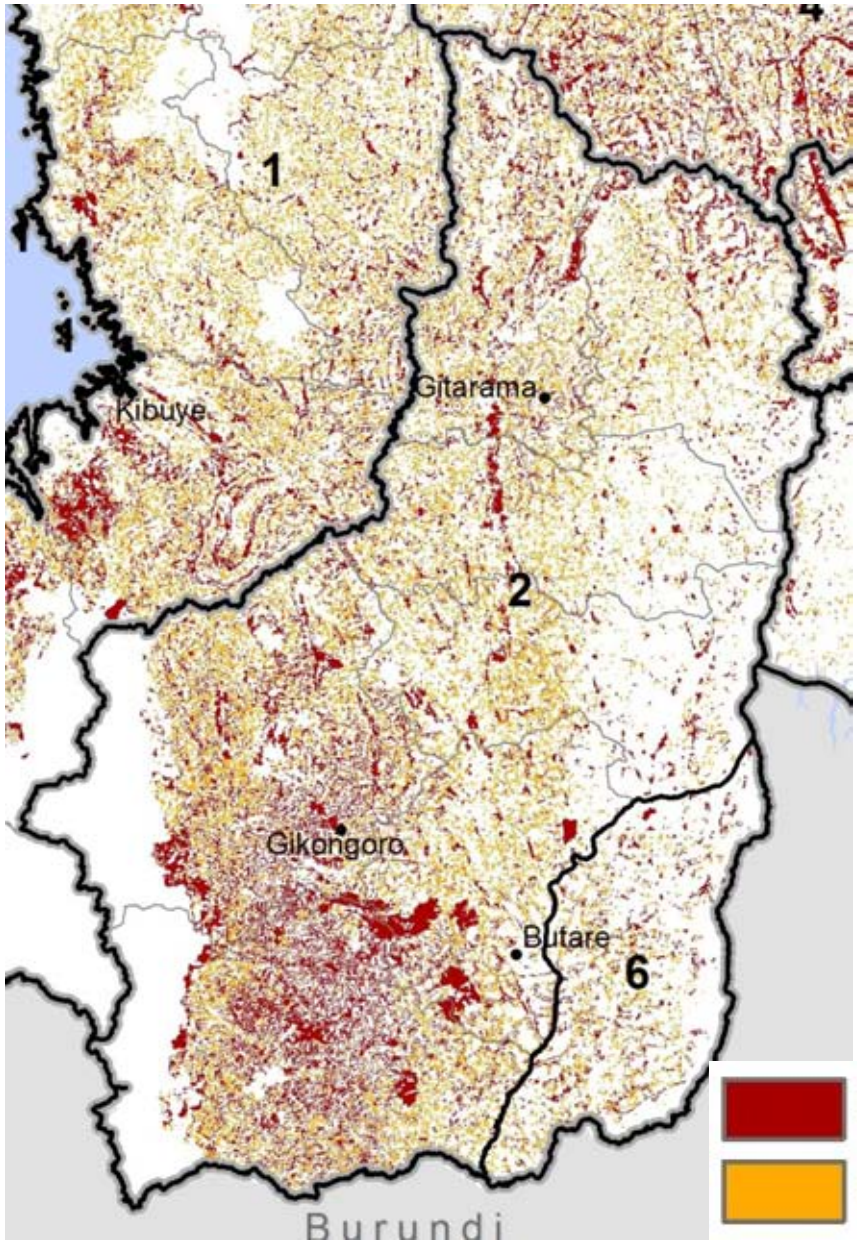


Land that is
- agricultural
- non-forested

District	Hectares	Percent
Gisagara	42,340	63%
Huye	33,627	58%
Kamonyi	44,265	67%
Muhanga	29,004	45%
Nyamagabe	43,760	40%
Nyanza	52,548	78%
Nyaruguru	33,719	33%
Ruhango	51,920	83%

Potential opportunity areas for new agroforestry

Example: Improved woodlot management in Southern Province



Land with Eucalyptus plots
- bigger than 2 ha
- smaller than than 2 ha

District	Hectares	Percent
Gisagara	6,545	10%
Huye	11,047	19%
Kamonyi	7,280	11%
Muhanga	10,799	17%
Nyamagabe	22,678	21%
Nyanza	6,228	9%
Nyaruguru	25,194	25%
Ruhango	6,573	11%

Eucalyptus plots more than 2 ha

Eucalyptus plots less than 2 ha

Economic analysis

Objective of analysis

The objective of the economic analysis is to address two questions:

(1) What policies can be used to encourage private landowners to restore degraded land?

(2) Which transitions store the most carbon for the largest benefit/lowest cost?

Methodology

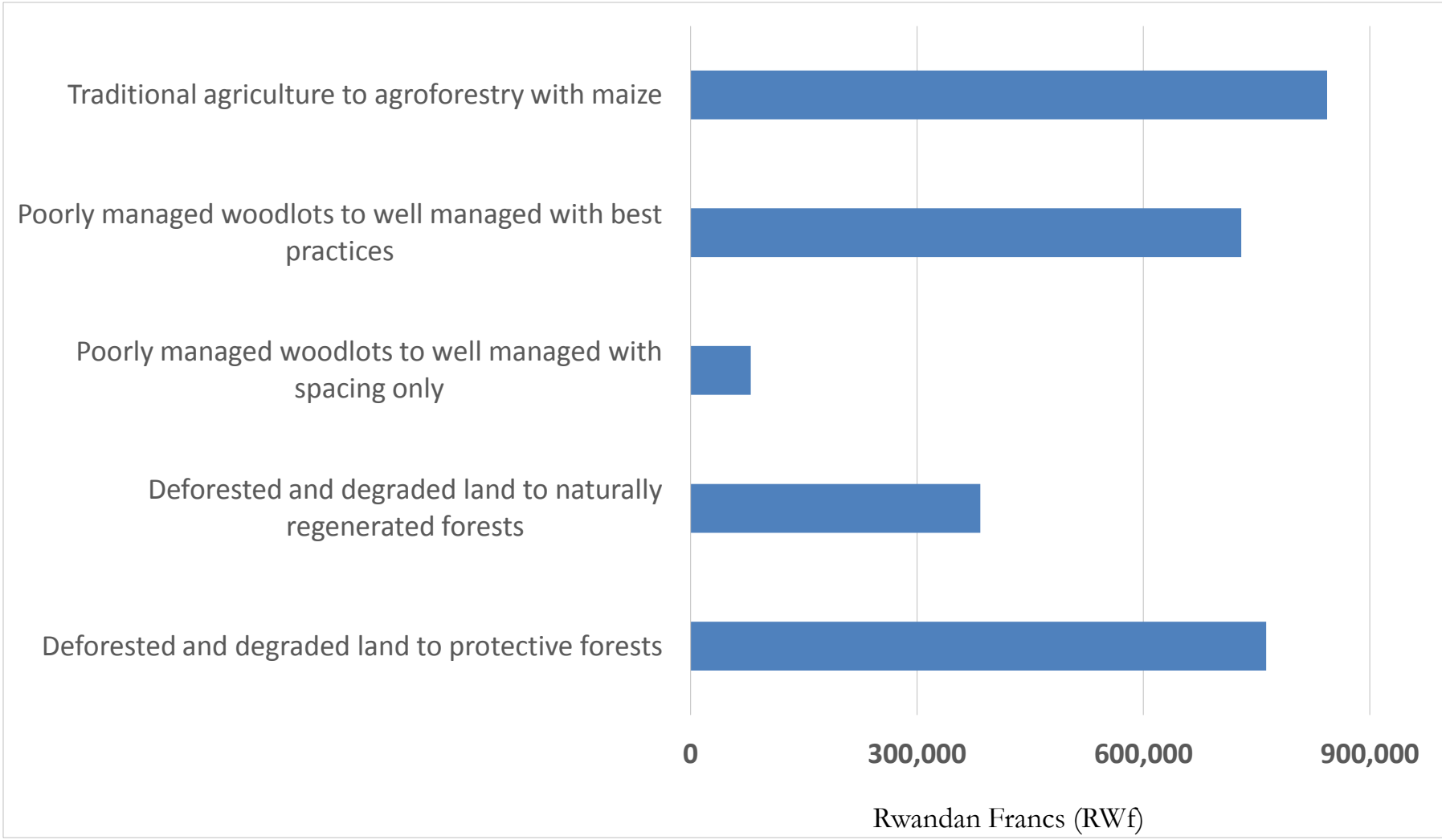
Benefit estimation

- For each land use, we use biological production functions to estimate fuelwood, timber, crops, prevented erosion, and carbon created by degraded and restored land uses
- Enterprise budgeting approach models benefits and costs of baseline and restoration intervention at the plot level
- Classify benefits as either accruing to the land owner (private benefits) or society (public benefits)

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

Costs of restoration transitions



Costs of restoration transitions

- Many of the costs are labor and are borne by landowners and managers
  - Site preparation, transport and plant seedlings, prune trees, manage weeds, and cut and harvest wood,
- The costs of learning new land management practice should also be taken into consideration
- The question is: given the costs, are the benefits large enough for anyone to do this willingly?

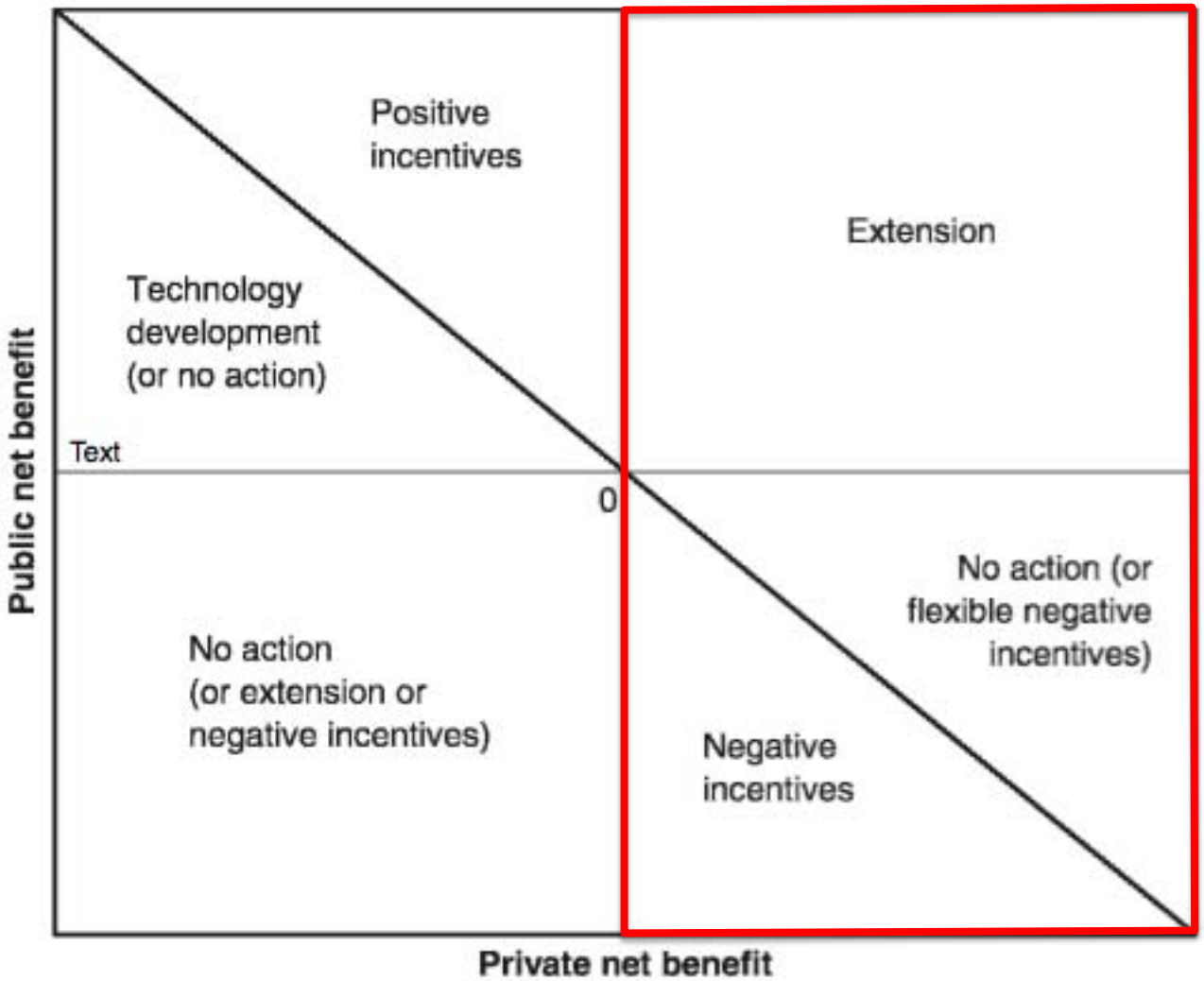
Policy analysis

- Restoring degraded land in Rwanda will require changes in land management on privately owned lands
- Private landowners investing in restoration reduces financial burden on national and sub-national agencies, improves efficiency, and maximizes chances for success
- Choice of policy mechanism should depend on the relative levels of private net benefits and public net benefits

Policy analysis

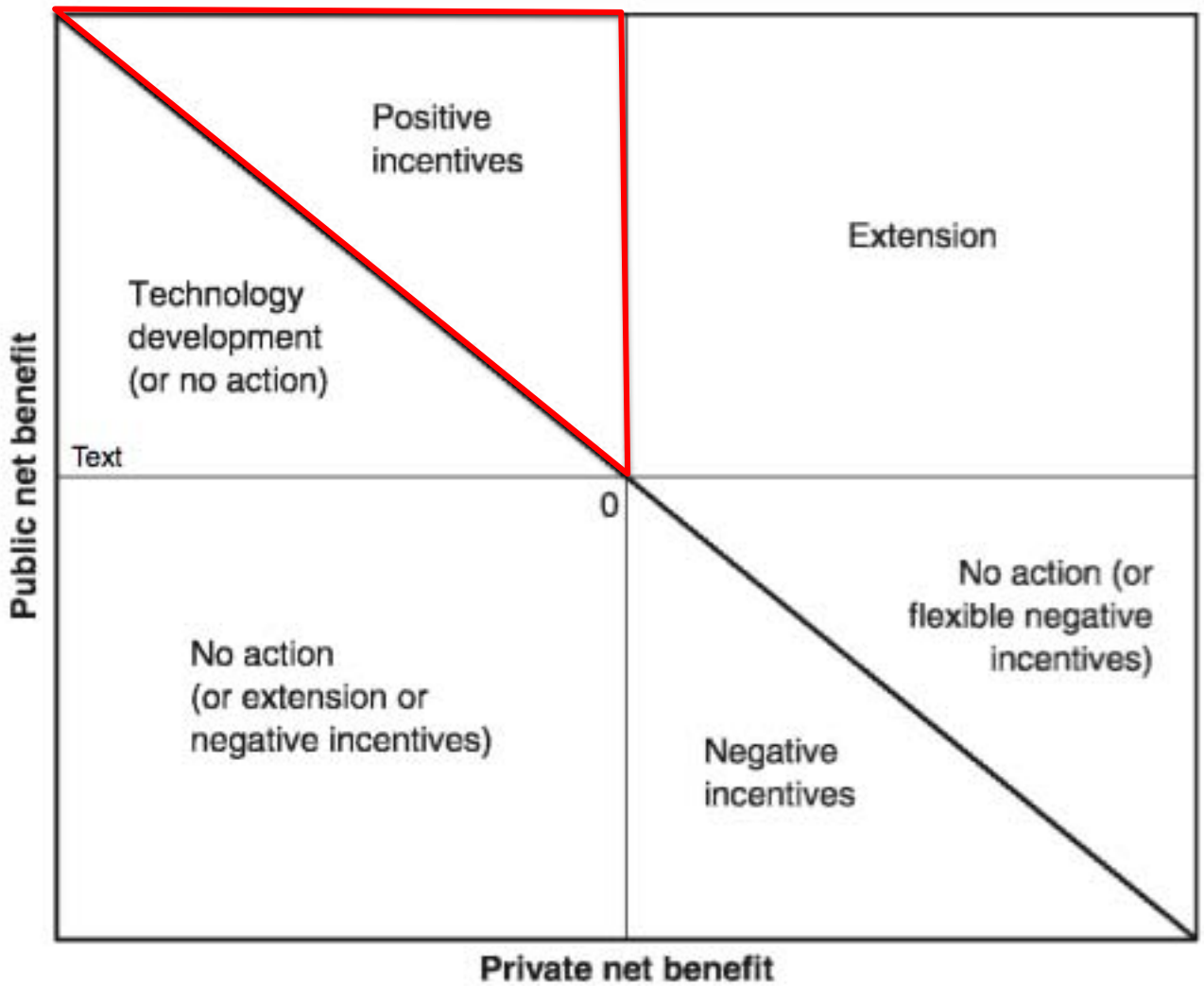
- Restoration programs use a range of mechanisms to influence land management and land use
  - Positive incentives (e.g. PES, subsidies)
  - Negative incentives (e.g. taxes, regulations)
  - Extension (outreach, communication, demonstration)
  - Technological development
  - No Action
- Landscapes are composed of many different land uses and generate a mix of public and private benefits
  - Landscape restoration will require a number of policies to encourage adoption.
- Whether or not landowners adopt restorative land uses depends on the whether policies create the proper incentives

Policy framework



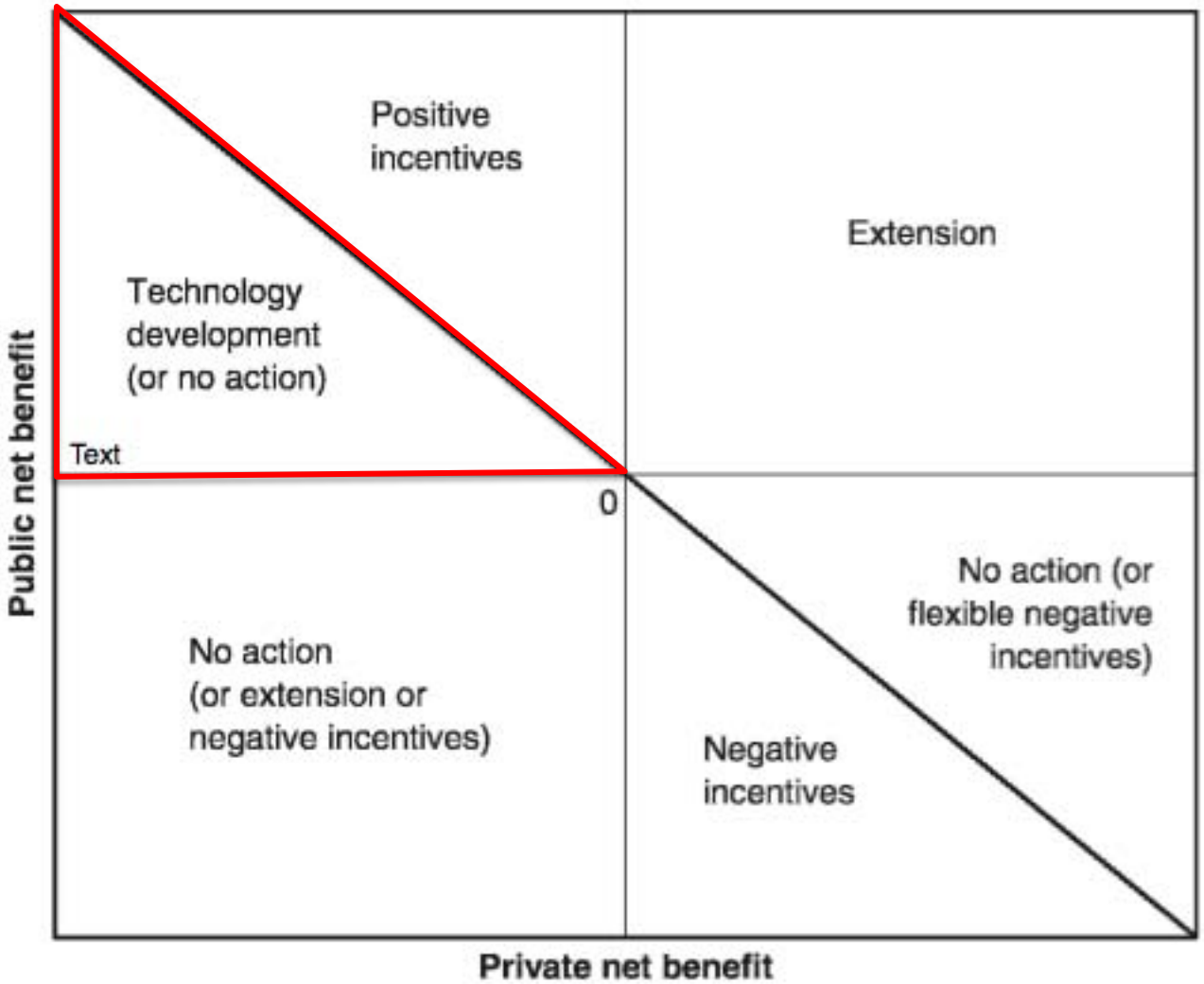
- Do not use positive incentives if land-holders would adopt land-use changes without those incentives

Policy framework



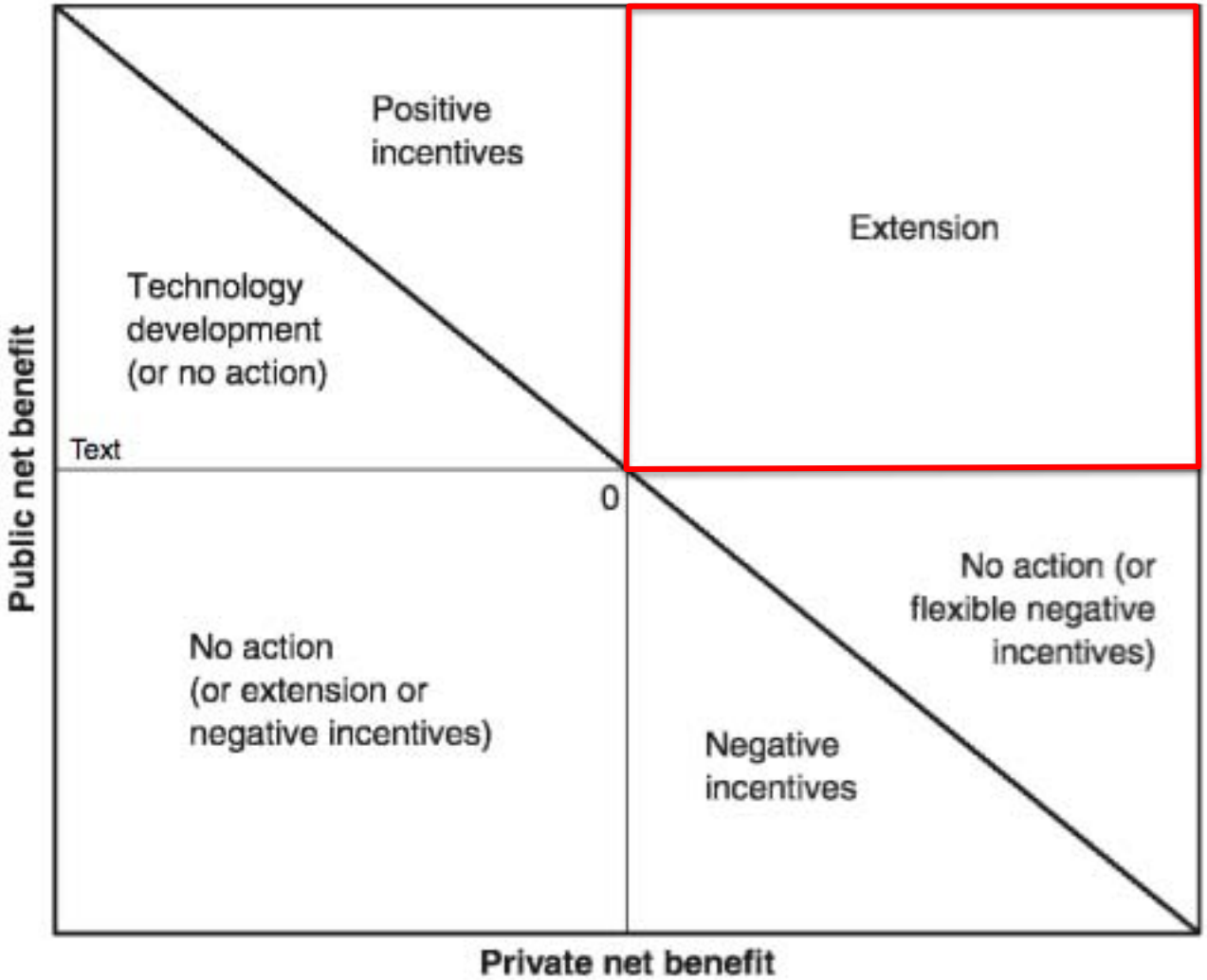
- Do not use positive incentives for land-use change unless public net benefits of change are positive

Policy framework



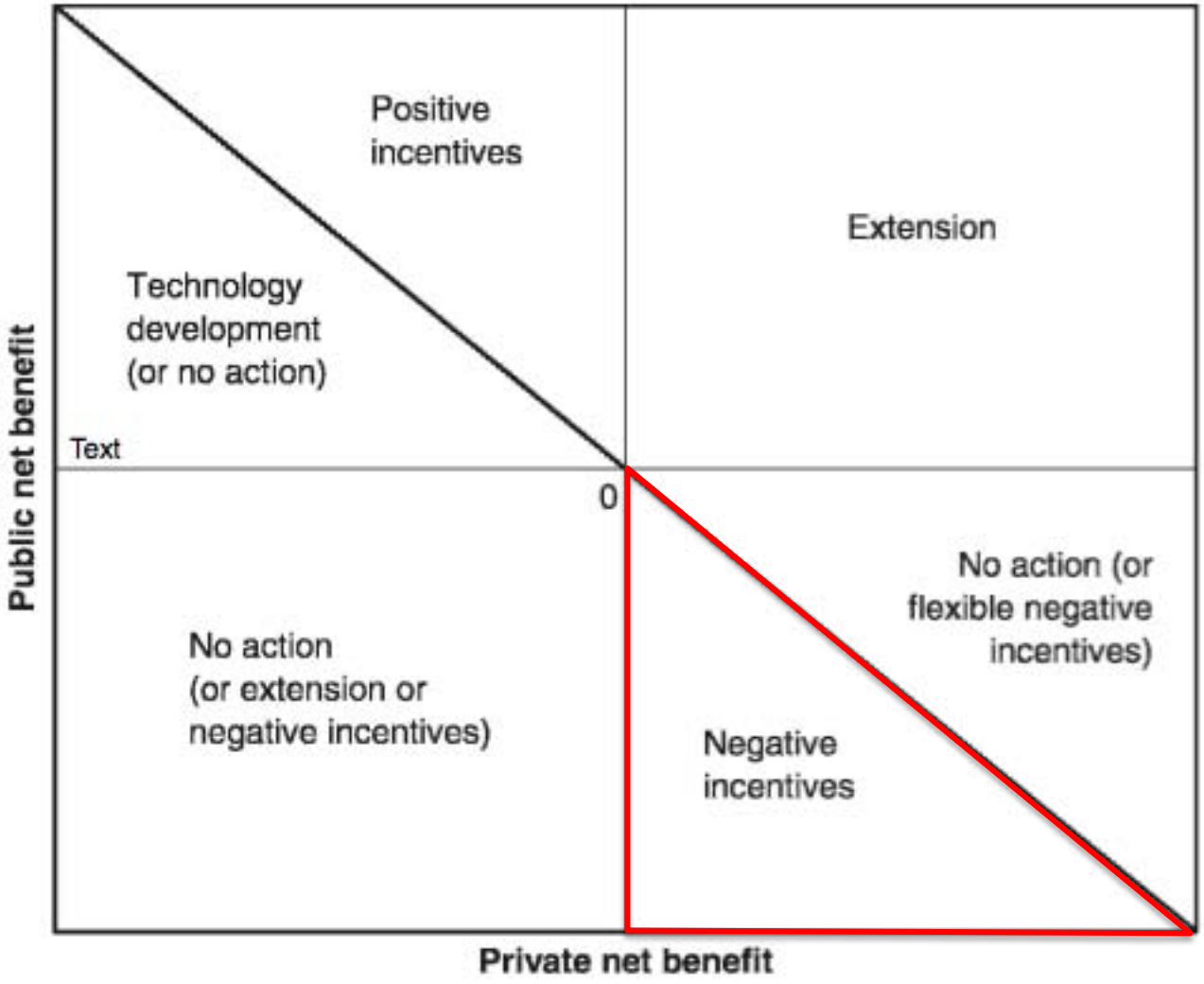
- If private net costs outweigh public net benefits consider technology development to create improved land management options that can be made adoptable (with or without positive incentives).
- Do not use positive incentives if private net costs outweigh public net benefits

Policy framework



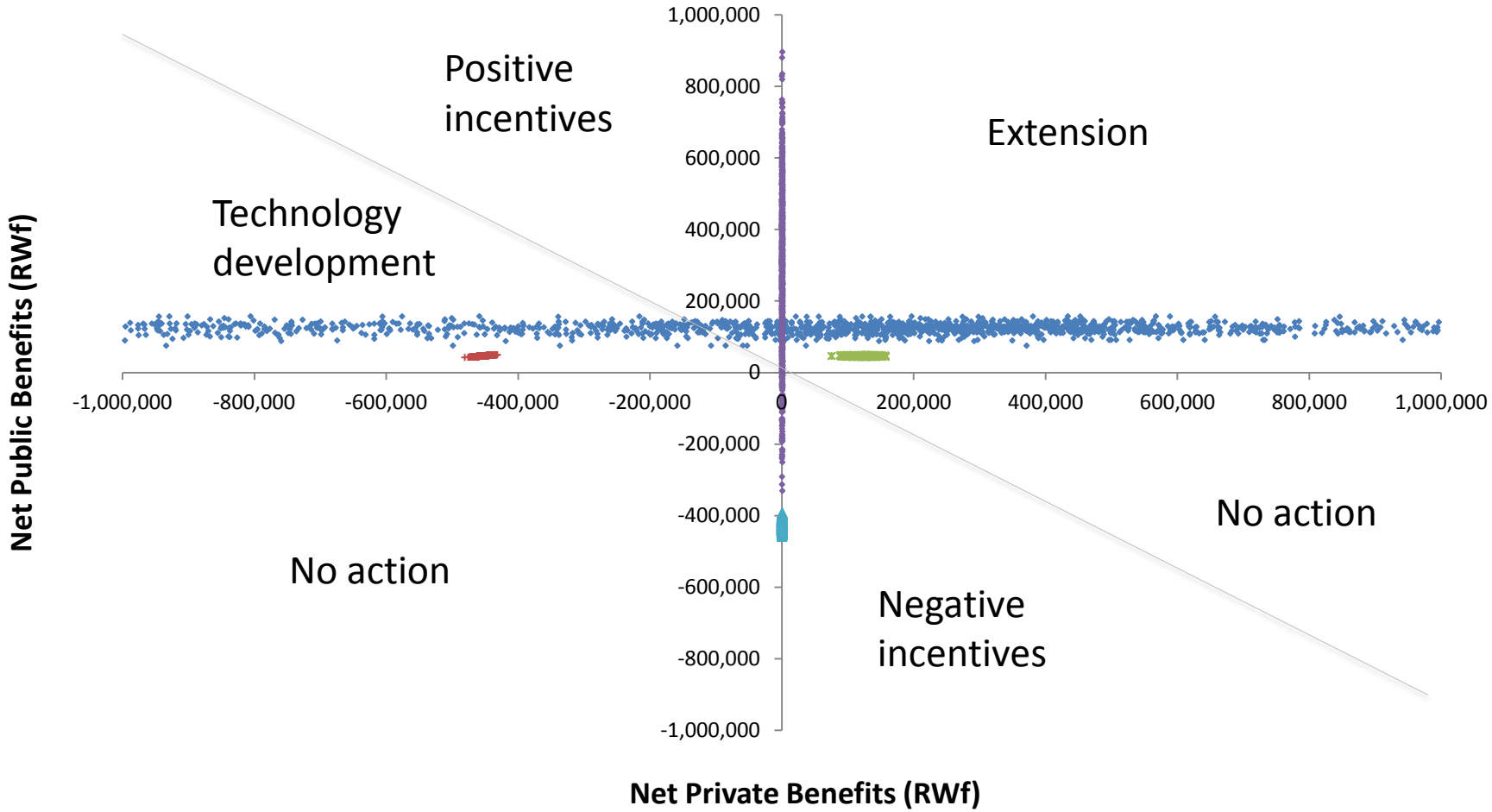
- Do not use extension unless the the practice is sufficiently attractive to landholders once extension ceases.
- Do not use extension where a change would generate negative net public benefits.

Policy framework



- If public net costs outweigh private net benefits use negative incentives to discourage uptake of the land use.

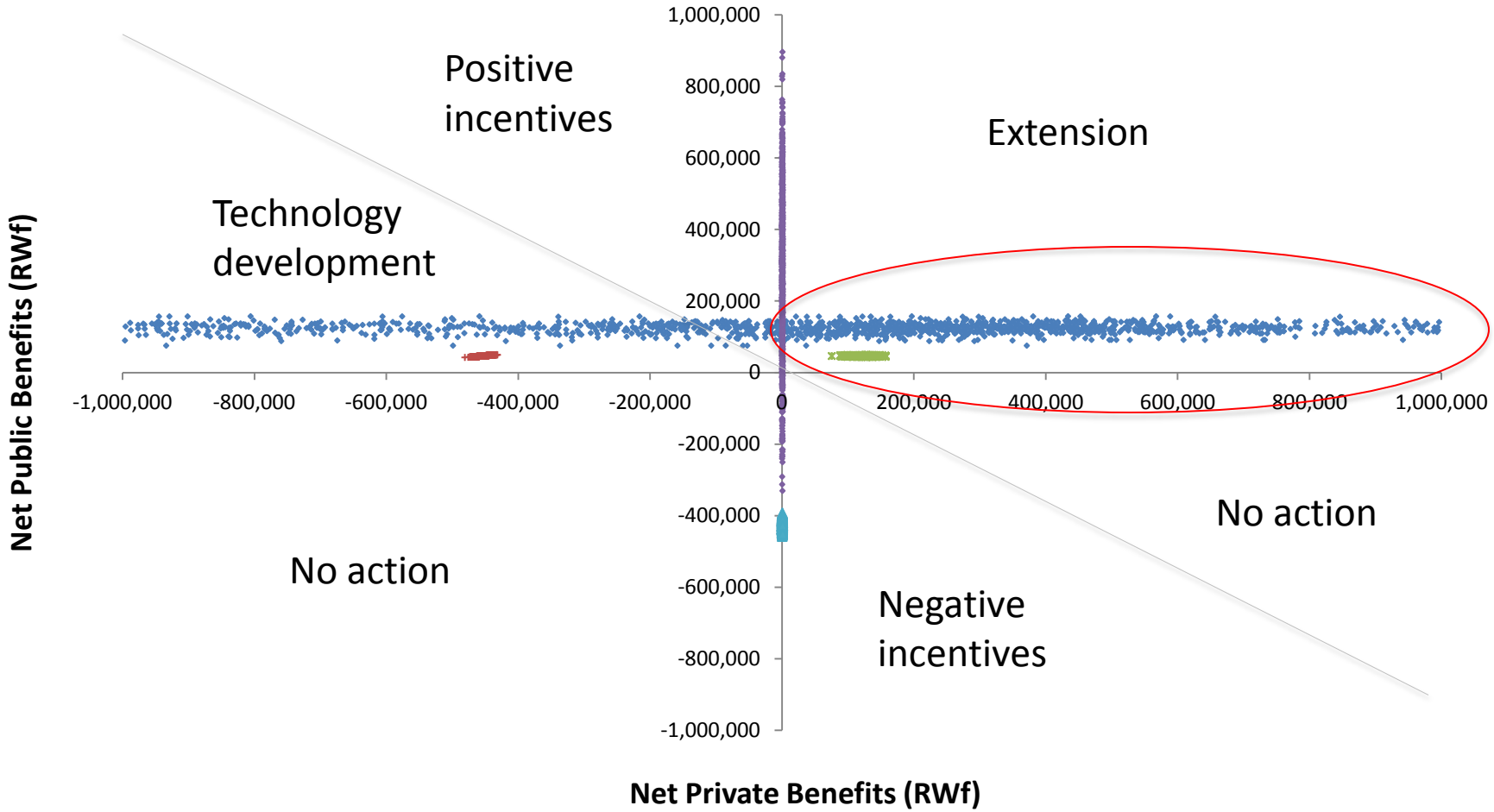
Policy analysis for restoration transitions on private land in Rwanda



Key

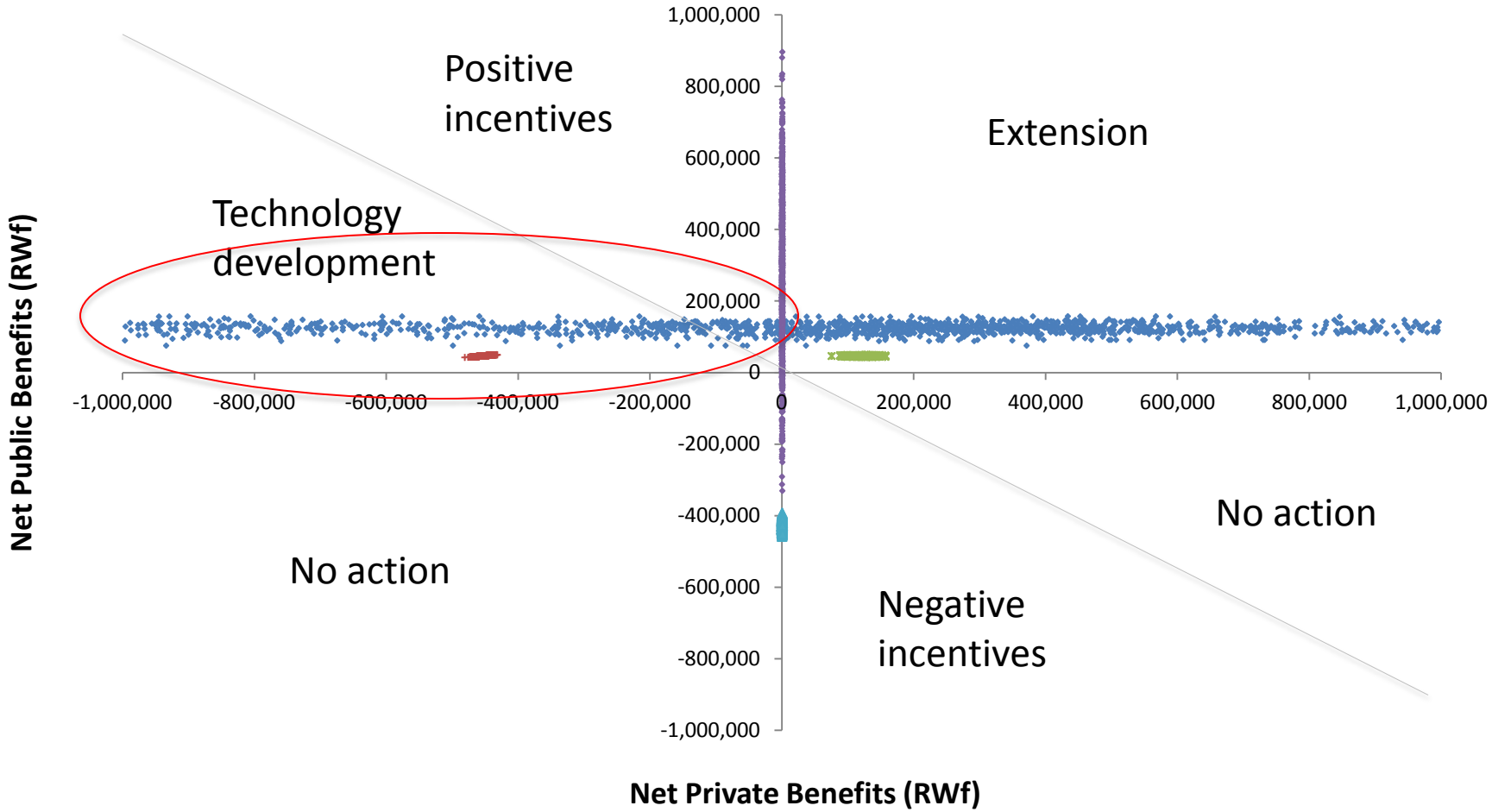
- Agriculture to agroforestry
- Deforested land to natural regeneration
- Poorly managed woodlots to well managed woodlots (SO)
- Poorly managed woodlots to well managed woodlots (BP)
- Deforested land to protective forests

Policy analysis for restoration transitions on private land in Rwanda



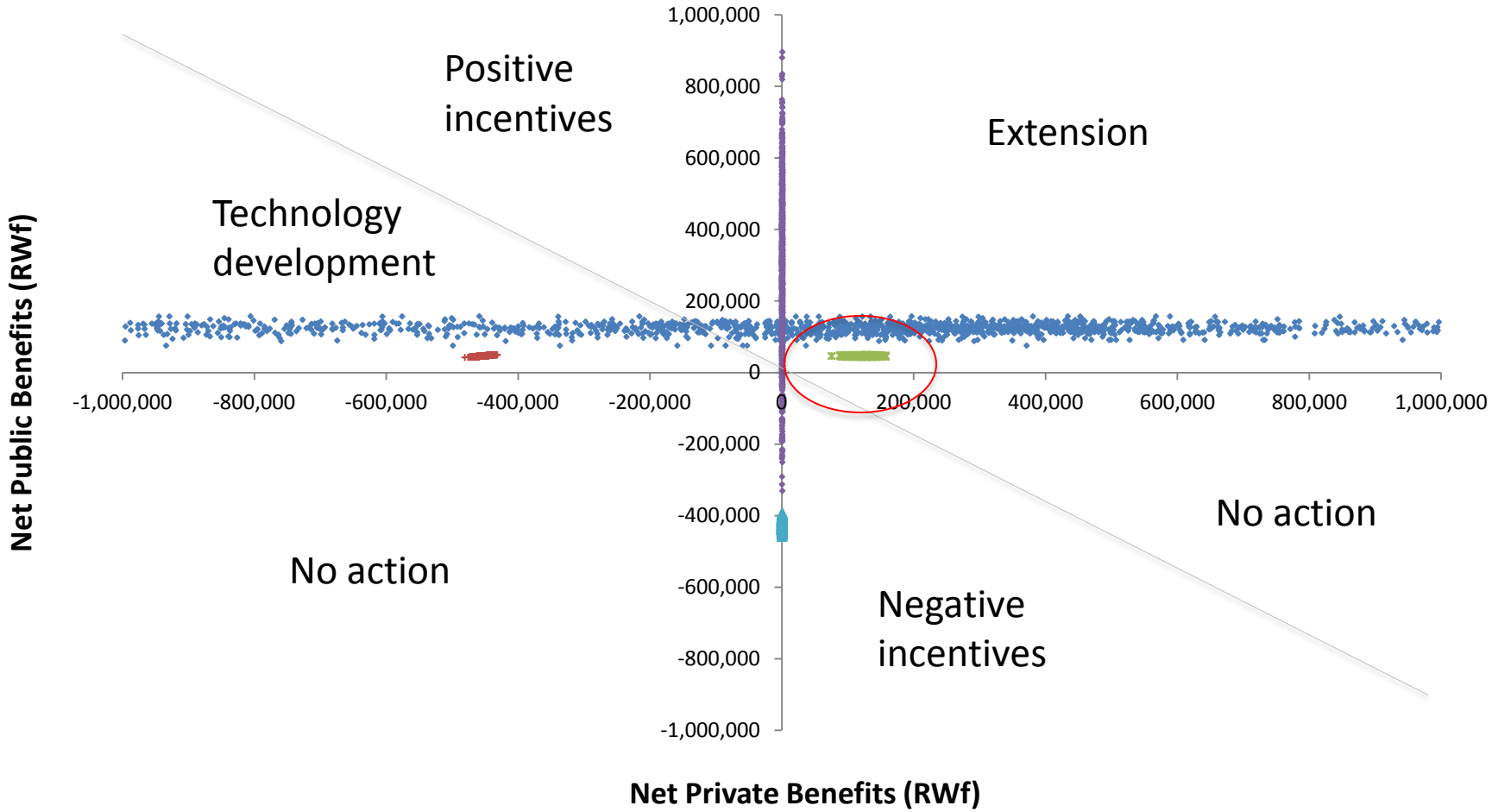
Agroforestry: On well-adapted sites, landowners may only need to be informed about the benefits of a specific agroforestry technology before they will adopt it.

Policy analysis for restoration transitions on private land in Rwanda



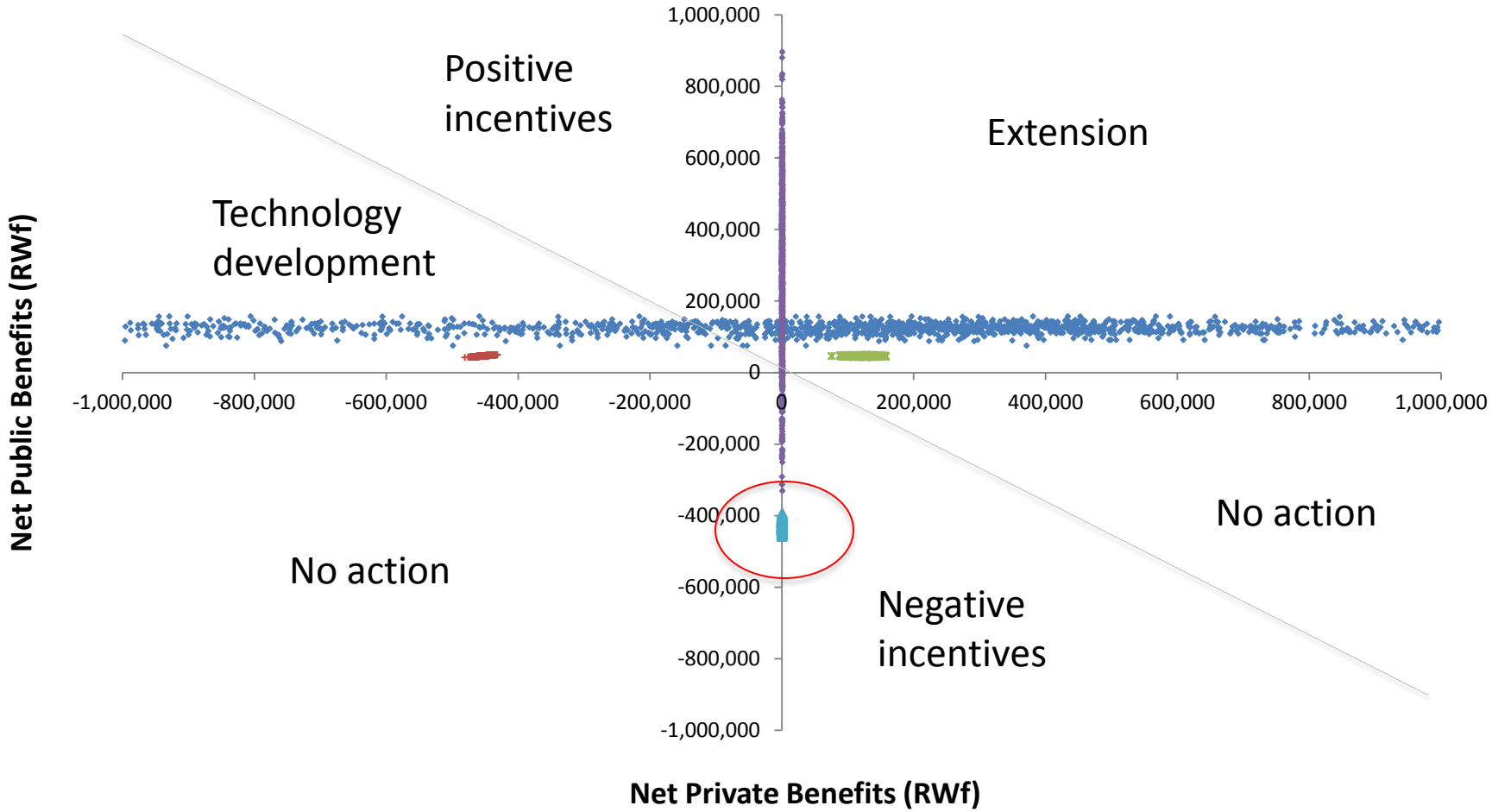
Agroforestry: Landowners who own land that is not well suited to specific agroforestry technologies will require technological development. The public benefits of the transition are too small to make positive incentive programs.

Policy analysis for restoration transitions on private land in Rwanda



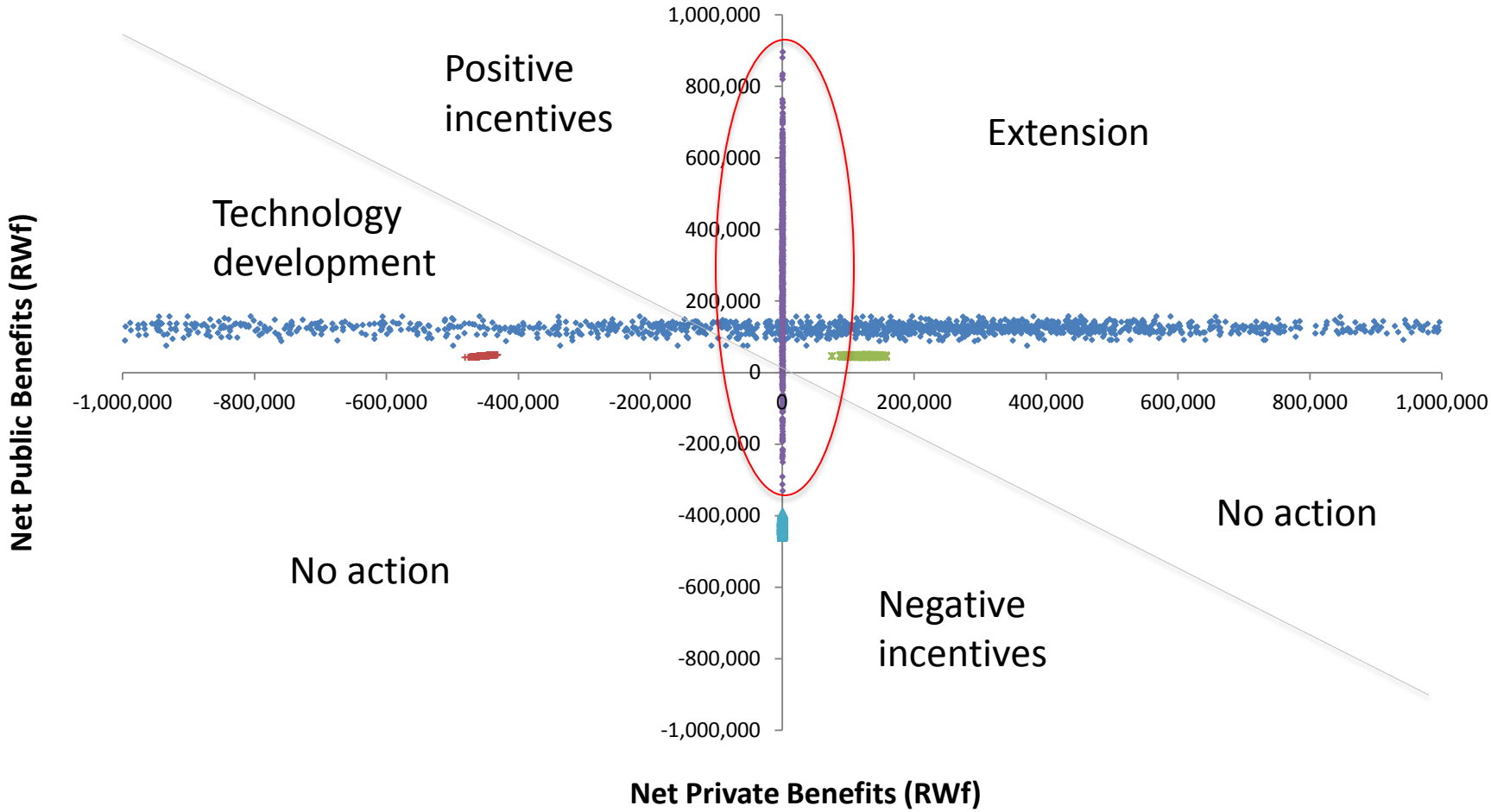
Woodlots: the private benefit of improving management is great enough that landowners would consider the transition if extension services were provided to promote the benefits and practices of improved management.

Policy analysis for restoration transitions on private land in Rwanda



Protective forests: our results suggest that protective forests are most effective when they are established in watersheds where erosion prevention services are highly valued. When the value of erosion prevention services is low, protective forests provide too few benefits relative to their cost.

Policy analysis for restoration transitions on private land in Rwanda

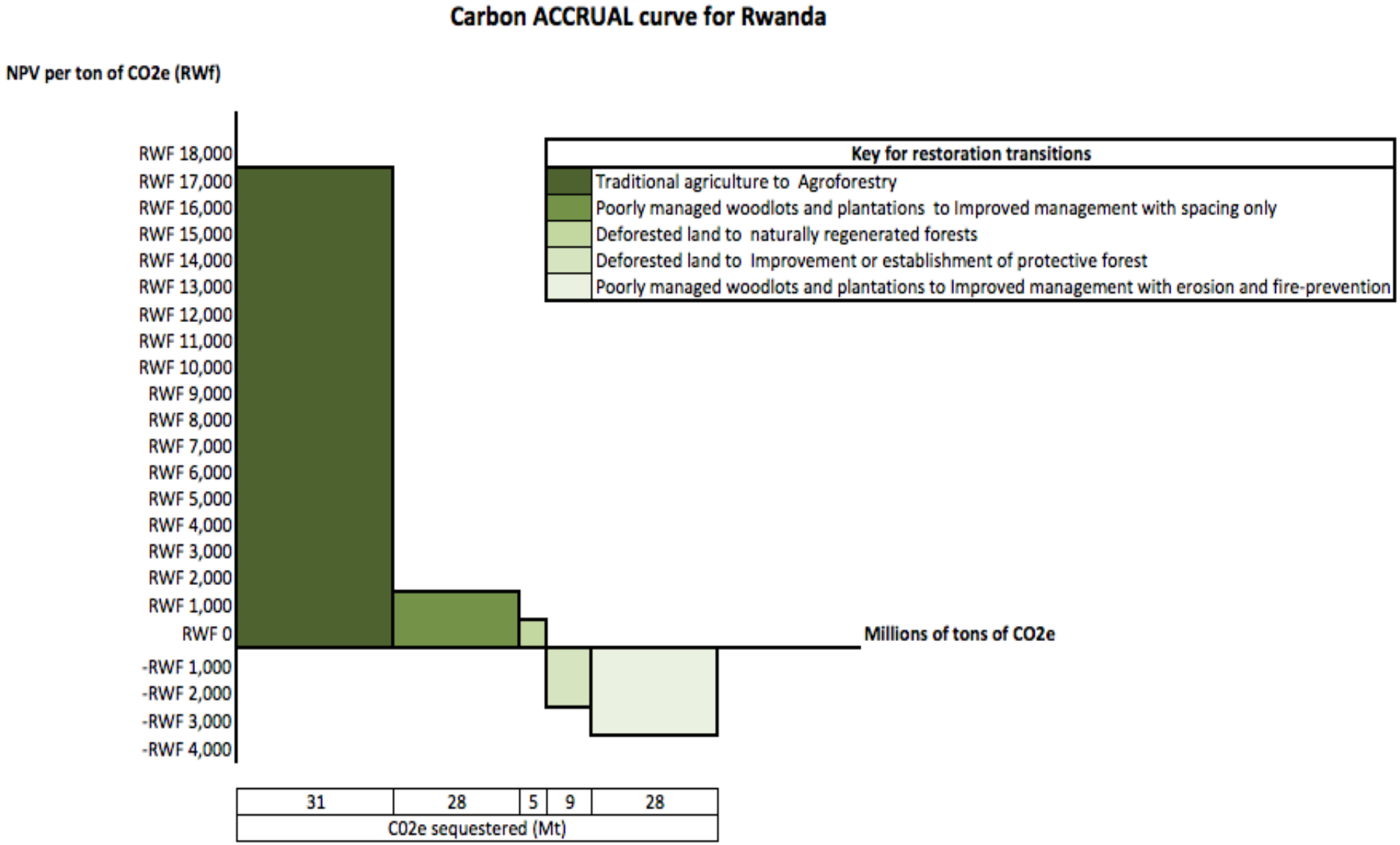


Natural regeneration: private landowners could be encouraged to restore deforested land with natural regeneration through the use of positive incentive schemes such as payments for ecosystem services. As we discuss below, the beneficiaries of restoration, such as power suppliers, tea producers, carbon emitters, eco-tourists and eco-tourism outfitters could finance the payments.

Carbon (REDD+ and Afforestation/Reforestation)

- Rwanda's Vision 2020 seeks to increase forest cover from 17% to 30% by 2020.
- As such, great efforts need to be made in order to reach this goal.
- This represents an important opportunity to restore degraded and deforested landscapes with the additional benefit of reducing emissions.

Carbon (REDD+ and Afforestation/Reforestation)



Carbon (REDD+ and Afforestation/Reforestation)

- Rwanda has the potential to reduce approximately 100 Mt of CO2e emissions through restoration transitions.
- Greatest potential is by using transitions that provide the largest private (i.e. livelihood) benefits.
- Transitions that produce more public benefits are less permanent means of storing carbon

Carbon (REDD+ and Afforestation/Reforestation)

- The main obstacle for financing restoration activities with carbon is the lack of demand in the carbon market
- For projects to be more successful there needs to be more clarity and simplicity regarding carbon credit ownership and revenue sharing

Conclusions

- There continues to be a lack of information available on and understanding of FLR among farmers particularly on native species and options
- Availability of quality tree seed and the production of planting stock that desire is currently a major limitation
- Significant gaps in knowledge and technical capacity that will need to be addressed
- Lack of emphasis on the potential role of the private sector, including opportunities and models for public-private finance

Strategic Recommendations

Stimulate Supply

1. Build capacity of Tree Seed Center
2. Stabilize and strengthen network of nurseries
3. Introduce 20% target for native species

Stimulate Demand

1. Economic case at district level
2. Campaign to highlight benefits
3. Increase extension to allow farmers to select species
4. Add performance targets for restoration

Increase Coordination

1. Convene stakeholders via Joint Sector Thematic Working Group
2. Increase linkages to public/private sectors and existing efforts

Value chain investments

- Rwanda as a country has an attractive country profile to investors.
- Most success in downstream investments in cash crop value chains such as coffee.
- The suggested value-chain investment opportunities focus on increasing forest cover and center around the reality of small holder land dynamics in the county.

Value chain investments: *Agriculture to Agroforestry*

Crops for Integrated Agroforestry Systems	Commercial Value Chain Partners
Apples, Apple Bananas, Bananas (with possible coffee intercropping[1])	Floris, Shekina, Freshpak International Ltd, Urwibutso Entreprise
Avocados[2]	Kigali Oil Company, Nakumatt Holdings, DD oil company, Rutemesha and Sons Fruits
Essential Oils – Geranium, Patchouli	Ikirezi Natural Products
Pyrethrum	SOPYRWA (Rwanda Pyrethrum Company)
Food crops that can grow in and around trees - Tree Tomatoes, Cassava, Taro, Chilles, and Passion Fruit	Shekina Enterprise, RChilles, Floris, Rwandaflora, Urwibutso, Nakumatt Holdings, multiple EU importers of passion fruit[3]
Shade trees for coffee or tea [4], honey production - Grevillea robusta	Rwacof Exports SARL, Campos, Misozi Coffee Company Ltd, RWASHOSCCO

- Private sector i roducer-end of agroforestry wi ation of investments tha tive return profile.
- One challenge esting in the transition from pe to a tree landscape is th o grow
- This can be ove ling agro-systems with di iles such as fast growing value- rees crops, or 2) by identifying " tments that have been operating for some time that can provide a better return profile.

[1] It is not clear whether intercropping with banana would qualify for certification as shaded.
[2] http://growafrica.com/wp-wp-content/uploads/2012/04/Rwanda_Avocado-Packaging-and-Export-Investment-Case.pdf
http://www.fao.org/docrep/009/a0142e/a0142e00.htm#TOC
[3] Has limited application to fruit tree varieties, but could support valued added shade grown systems

Value chain investments: Deforested land to protective forests

- Watersheds are, in many ways, the limiting factor for many of Rwanda's industries.
- The annual economic value of watershed protections services provided in Nyungwe National Park alone is nearly $118 million USD

- There are no large plantations that are in the position or capacity to offer high quality timber or timber products and thus the potential for investment. This would require investment on modern sawmills, wood based panel plans, timber treating plans, training and introduction of certification systems.

Economic analysis: Ag to Agroforestry

Net present value of Ag and agroforestry

The marginal value of agroforestry restoration is the difference between the net present value of agroforestry and traditional agriculture:

$$MAF_{k,c}(T) = AF_{k,c}(T) - AG_{k,c}(T) \qquad [1]$$

The net present value of the agroforestry system is represented by:

$$AF_{k,c}(T) = \sum_{t=0}^{T} \delta_t * (\underbrace{[AFE_t * Y_{t,k,c} * P_{k,c}]}_{\text{Crop revenue}} + \underbrace{W_{t,k,c} * Pw_{k,c}]}_{\text{Wood revenue}} - \underbrace{C_{t,k,c}}_{\text{Costs}}) \qquad [2]$$

and the net present value of traditional agriculture production is represented by:

$$AG_{k,c}(T) = \sum_{t=0}^{T} \delta_t * (\underbrace{[Y_{t,k,c} * P_{k,c}]}_{\text{Crop revenue}} - \underbrace{C_{t,k,c}}_{\text{Costs}}) \qquad [3]$$