REPORT

FUNCiTREE is a research cooperation project funded by the EU 7FP – KBBE

FUNCiTREE – Final conference presentations

Session III: Policies to support sustainable natural resource use and the Ecosystem Services concept

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REFERENCE:
FUNCiTREE. Final Conference : «The role of functional diversity for ecosystem services in multi–functional agroforestry», Trondheim 23-25 May 2013

DATE : May 28th 2013

COVER PICTURE:
Graciela M. Rusch

KEYWORDS:
Plant functional traits, ecosystem services, ecological functions, Bayesian networks

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Payments for Environmental Services – from Theory to Practice ?

by

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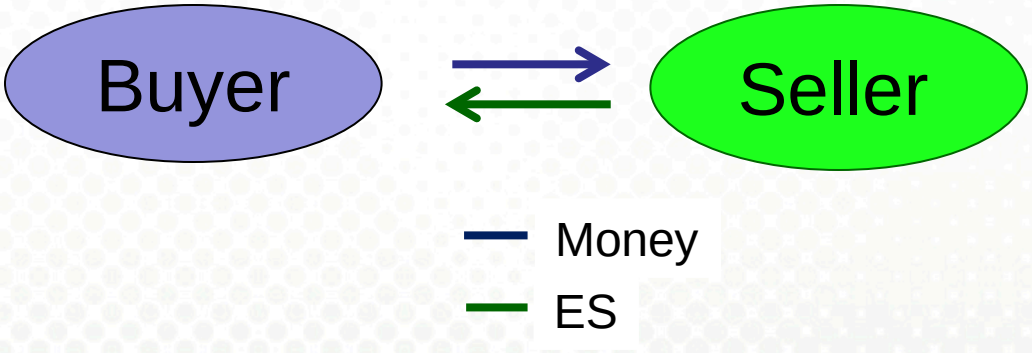
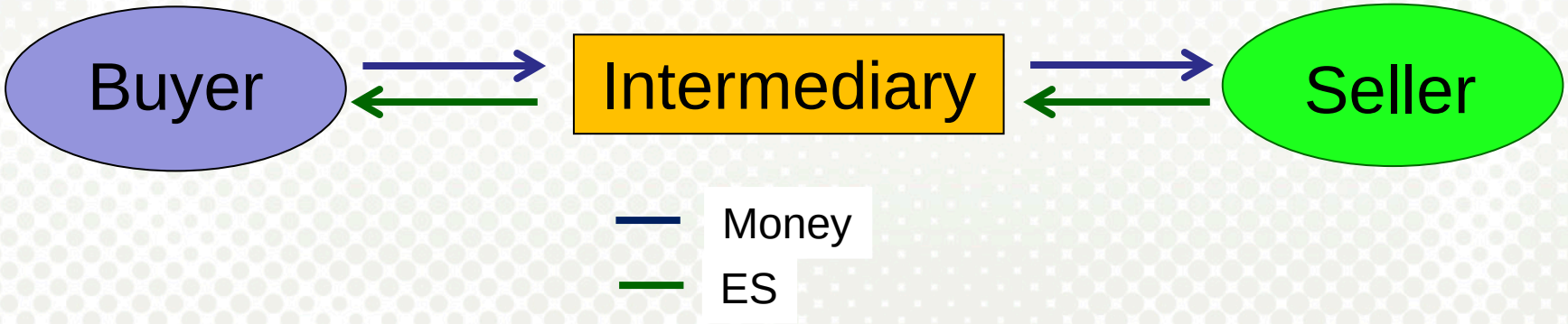
At FUNCiTREE final conference. 23-25 May 2013, Trondheim, Norway.

Introduction

- Payments for ecosystem services (PES) have over the last 10-20 years gained a quite strong position as a new way to ensure nature protection/sustainable delivery of (public) ecosystem services (ES) like biodiversity, water manage-ment, carbon sequestration etc.
- It is typically seen **as a market** for ES – e.g., Engel et al. (2008) – part of a neo-liberal agenda. An alternative to legal regulations
- As such it is seen as a way to **increase efficiency** in nature protection – e.g., Pagiola et al. (2008)
  - Values are more accurately measured
  - One avoids budget fights within governments
- The capacity markets have to create **more resources** is also emphasized

The market


Buyer
Seller
Money
ES


Buyer
Intermediary
Seller
Money
ES


Svendart.3dk.org


NYSE

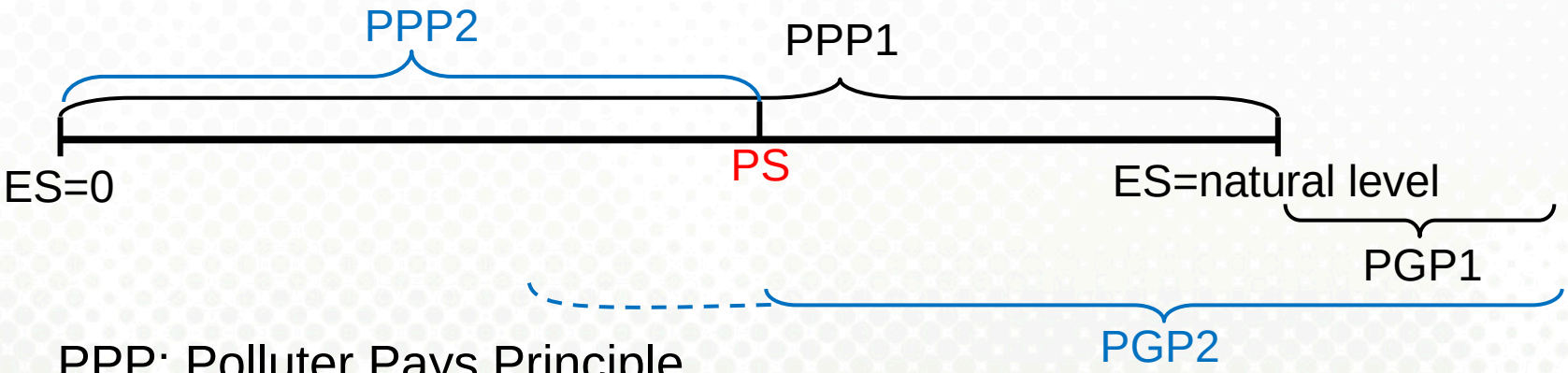
PES as a governance structure

- A governance structure includes two core elements
  - The **actors** involved – e.g., individuals, firms, public bodies
  - The **rules specifying the interactions** between actors – e.g., trade, command, reciprocity/cooperation
- Types of governance structures
  - Markets
  - Public management
  - Cooperatives/community organization
  - Hybrids
- PES: Private actors trading in markets?

The challenges for PES

- **Rights**
  - Paying demands deciding who should pay whom
- **Delimit the service**
  - How to delimit what to pay for? Nature as commodity vs. a process
- **Incentives**
  - Why should individual actors pay for ES? They are (very often) public goods?
- **Valuation**
  - Should/can (all) ES be measured in monetary terms?
- **Transaction costs**
  - Trading is in itself costly to organize

The rights issue



PPP: Polluter Pays Principle
PGP: Provider Gets Principle
PS: Present state

- Payments vs. subsidies vs. taxes
  - The issue of **fairness**
  - **PPP** implies taxes on disturbances
  - **PGP** implies payments/subsidies for 'producing' the service
  - In the latter case (payments vs. subsidies): Payments may sound much better than subsidies. But isn't it the same thing with a different name: Private payments vs. state payments?

Delimit the service

- We talk largely about eco**systems** – i.e., systems of species, matter and energy → difficult to define and delimit the ES
- There is a big difference between delimiting water for sale as:
  - Drinking water (in bottles)
  - Ground water
  - Precipitation etc.
- Forests as **timber** vs. forests as hosting **biodiversity**
- Payments are typically not for services, but for proxies like land of certain types/under certain management regimes


A.S. Thygesson

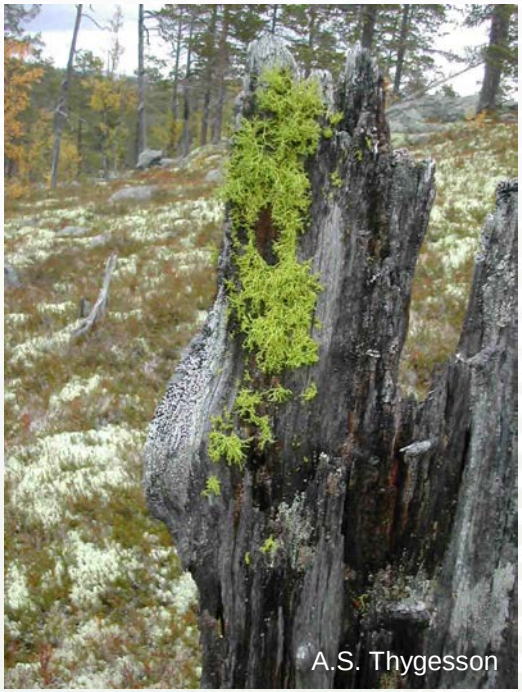

A.S. Thygesson

The incentives

- Three main challenges
  - Public goods → '**free riders**' or the '1/n problem'. Why pay if somebody else has already done so? Why pay if nobody else pays? → Does PES as market really attract more resources?
  - Payments may **change motivation** → no nature will be protected without somebody paying (?)
  - Incentives to **cheat** – the problem of control

Valuation

- Main challenges for economic valuation
  - **Complexity and knowledge**
  - **Ethical issues** – e.g., rights of species
  - **Public goods** – should decisions in this area be made on the basis **individual preferences** in the form of willingness to pay or on **arguments**?
  - **Willingness to pay** depends on **capacity to pay**



Transaction costs

- The theory of markets does not really take into account that trading is in itself costly – transaction costs
  - Define rights and delimiting the ES
  - Gather information
  - Make contracts
  - Control that contracts are complied with
- Wallis og North (1986): **Transaction costs are about the size of production costs** in modern economies....
- **Public authorities** can often organize payments much cheaper than **markets** – use the power they have to command – e.g., taxing
  - Ex: Already existing water fees are increased to protect forests upstream of a water reservoir

PES in practice

- **Rights** are with **land owners** (provider gets principle)
- Where land rights are not clarified → PES may result in **redistribution of** access to **land**
- Buyers and sellers must often be 'created'. **Intermediaries** are the dominant actors
- **Public authorities** are **the dominant** 'buyers' or 'intermediaries' in PES
  - At the **funding side**: Taxes or fees dominate
  - At the **buying side**: Public bodies may operate through trades – e.g., auctions and some non-auctioned contracts. This fraction has not been quantifiable, but seems to be rather low. Also difficult to draw the line between trade and non-trade arrangements here
- Why does public bodies dominate:
  - The **free rider problem**
  - **Transaction costs**

PES in practice (cont.)

Volumes of money in PES in 2009 (Milder et al. 2010)

- **Water services**
  - Total volume: 14.200 mill. USD
  - Part provided by public bodies: 99.9%
- **Landscape protection and recreation**
  - Total volume: 7.300 mill. USD
  - Part provided by public bodies: 70%
- **Biodiversity**
  - Total volume: 1.400 mill. USD
  - Part provided by public bodies: 99 %
- **Carbon-sequestering** – only land based activities
  - Total volume: 170 mill. USD
  - Part provided by public bodies: 8 %

(The size of the cap-and-trade carbon market was in 2011: 176 billion USD (World Bank 2012). This market is created by the cap set and the defined right to trade (command based))

PES in practice (cont.)

- In total, 90 % of PES resources are provided by public authorities (local and national) through taxes, fees etc. Regarding money coming voluntarily – 'private payments' – 9/10 is for private services (hunting, fishing, hiking etc.)
- Hence, only 1 % of the money for public aspects of ES comes from voluntary private payments
- The situation is pretty much the same in developing and developed countries.

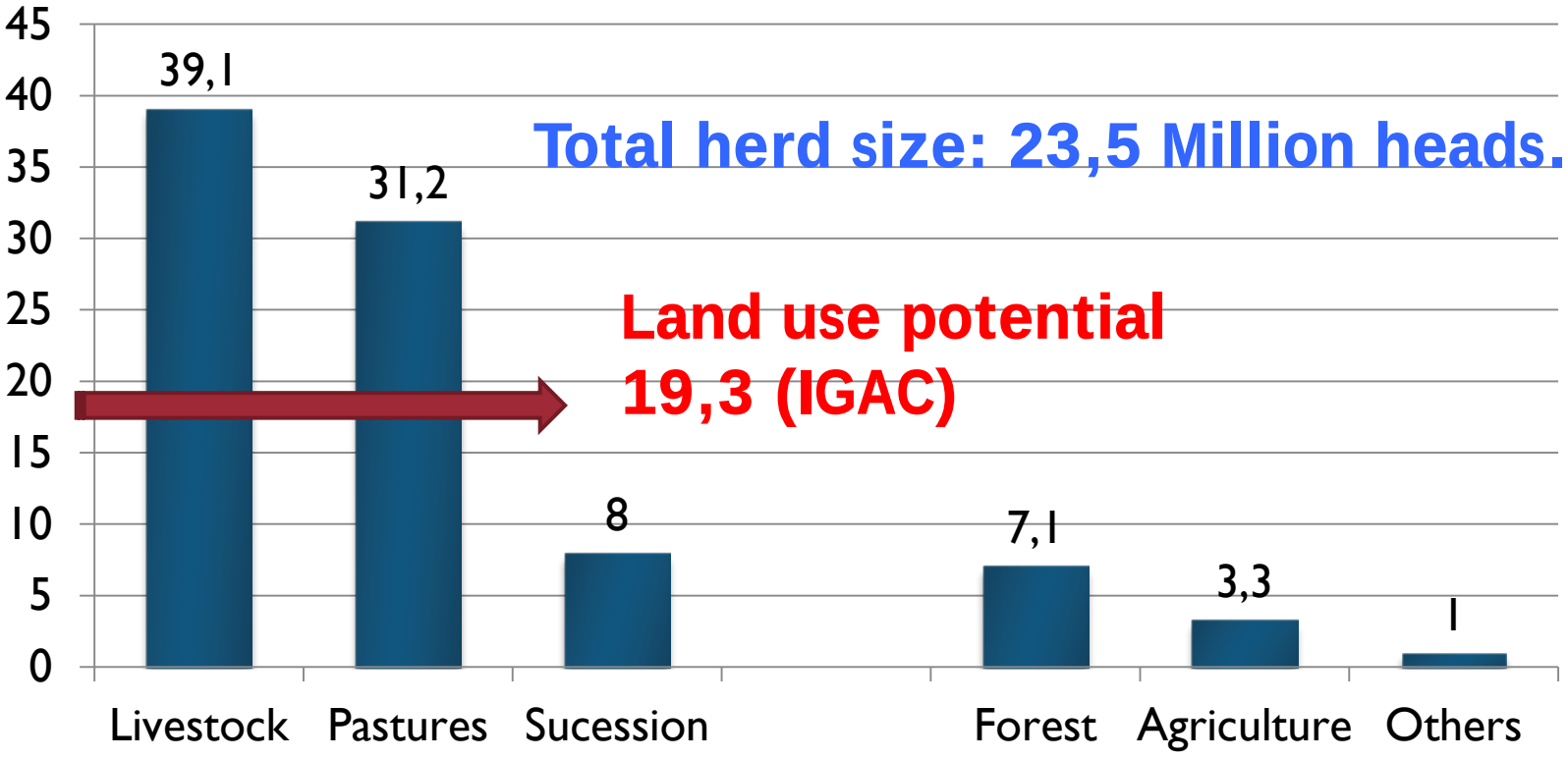
Conclusion

- While PES is very much 'marketed' as a 'turn to the market', most of PES is public subsidies
- Important reasons for this seems motivational (free rider issues) and cost related (transaction costs)
- There is, however, a big difference between the various ES where PES in carbon services is dominantly taking the form of trades – simpler commodity + less state engagement in carrying costs directly
- The PES ideology may still be a 'game changer' in that it shifts our thinking about nature towards one of exchanges and monetary valuation

Colombian experiences in PES and other incentives to mainstream biodiversity in sustainable cattle ranching

Antonio Solarte
Enrique Murgueitio

Land uses in Colombia in 2010 (Ha 10^{6})

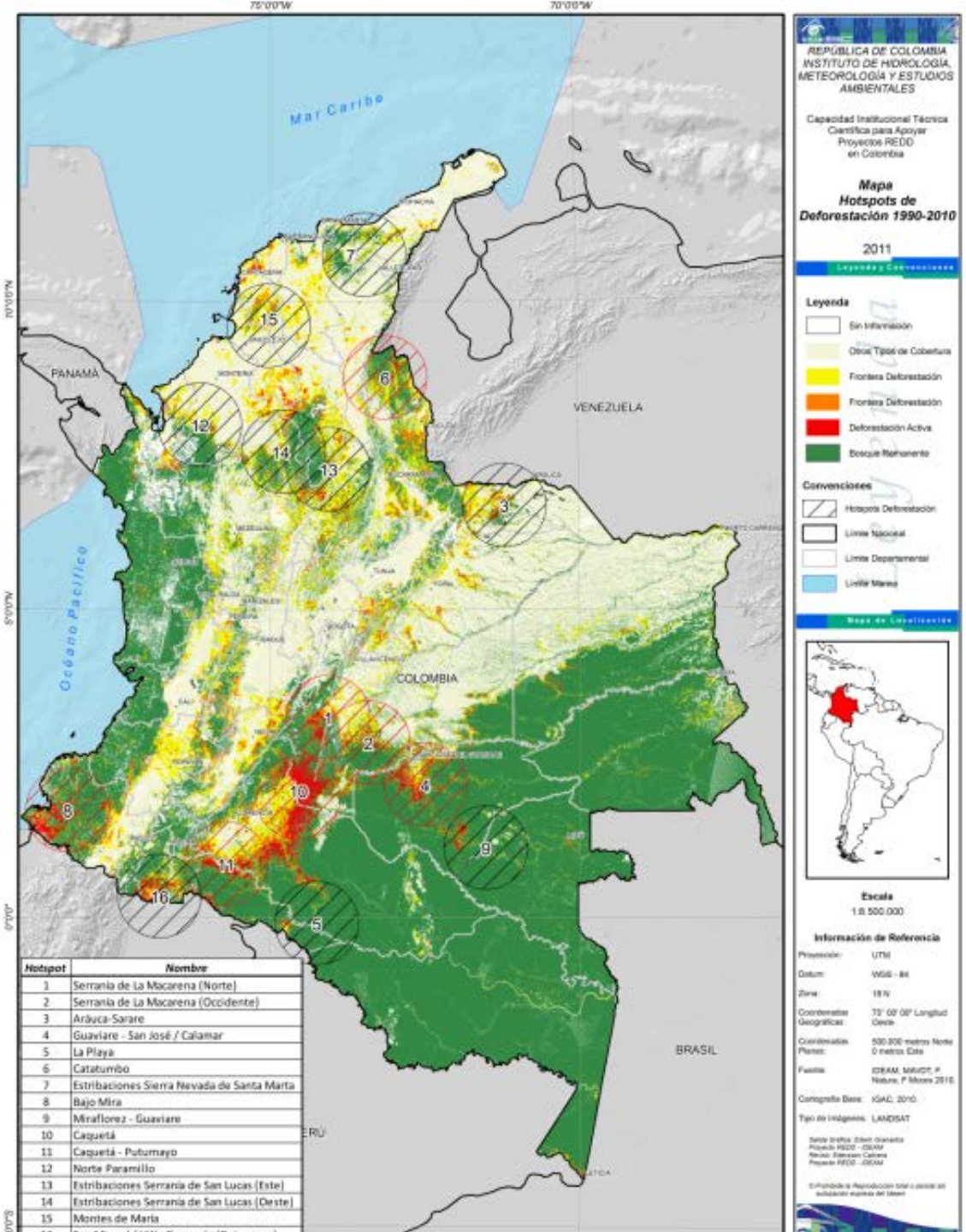


Source: DANE and Ministry of Agriculture 2010

Deforestation Hotspots in Colombia

310,345 ha-year^{-1}

1990-2010



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FEDEGAN - PLAN 2019

Goal to 2019:

- National herd size: 56 millions heads of cattle
- Cattle ranching area: 28 millions Hectares

This meas:

- **More than twice the cattle herd size**
- **releasing 10 Million Ha.** ¿ How to do it ?

Silvopastoral Systems

Barriers for adoption of silvopastoral systems.

- Socio-economics:
  - Financial capital required for establishments.
  - Waiting period for establishment the trees in pastures.

- Technical and operationals.
  - Lack of specialized technical assistance.
  - Availability of technical assistance from agricultural inputs business houses advising in the opposite direction
  - Increased complexity and risk.
  - Need for skilled labor to handle a more complex farming system.

- Deep cultural roots to the extensive traditional cattle ranching systems

Tools for scaling-up SPS

- Financial incentives
- Payment for Environmental Services (PES)
- Specialized technical assistance
- Innovation awards for farmers
- Market preferences

Rural Capitalization Incentive - RCI -

- Financial benefit given to a person or company that individually or collectively, issue a new investment project.
- It is aim to improve the competitiveness and sustainability of agricultural production and to reduce their risks.
- This incentive is a direct payment to the bank to reducing the capital of the credit given by the beneficiary to finance investment activities.
- For small producers access to relief capital up to 40% of the project value, while medium and large producers benefit from an exemption of up to 20% of the capital value.

Rubro de Inversión	*Unidad*	*Valor máximo por unidad (en pesos)*
OBRAS DE ADECUACIÓN		
Perforación Pozos Profundos **(1)**	Metro	681.045
Excavación o Movimiento de Tierra - Manual o Mecánico **(2)**	M^3	6.687
Construcción Gaviones y Espolones	M^3	185.740
Erradicación de cafetales envejecidos para reconversión productiva	Ha.	1.000.000
Recuperación física y química de los suelos de la Altillanura de la Orinoquía	Ha.	1.354.577
OBRAS DE INFRAESTRUCTURA		
Infraestructura de producción	M^2	185.740
Invernaderos	M^2	12.383
CULTIVOS DE TARDÍO RENDIMIENTO		
SISTEMA SILVOPASTORIL		
Con densidad de siembra de 7.000 especies forrajeras/Ha.	Ha.	2.070.124
Con exigencias de densidad de siembra en especies maderables	Ha.	3.477.800
Chontaduro	Ha.	4.950.000
Espárragos	Ha.	30.956.600
Fique	Ha.	4.272.011
Guanábana	Ha.	12.816.032
Guayaba	Ha.	8.482.108
Macadamia	Ha.	9.906.112
Mango	Ha.	9.000.000
Pitahaya	Ha.	19.812.224
Palma de Aceite	Ha.	6.934.278
Palma de Iraca	Ha.	6.129.407
Vid	Ha.	15.800.000
SISTEMA SILVOPASTORIL		
Con densidad de siembra de 7.000 especies forrajeras/Ha.	Ha.	2.070.124
Con exigencias de densidad de siembra en especies maderables	Ha.	3.477.800

Caquetá

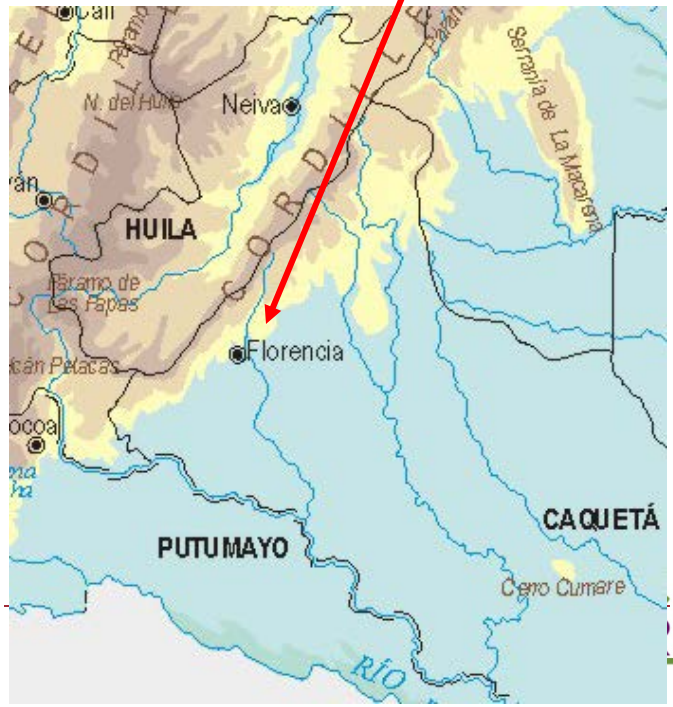
Eastern Andes - Amazon foothills

Rainfall > 3000 mm

CIPAV

Nestlé
Good Food, Good Life

Environmentally Sustainable Milk Project



"Environmentally Sustainable Milk" Project

Caquetá

Baseline situation: land degradation in a cattle ranching farm

Eastern Andes - Amazon foothills

Rainfall > 3000 mm

Nestlé de Colombia and CIPAV
Environmentally Sustainable Milk Project
(Leche Ambientalmente Sostenible)

- Credit: Soft loans < US $13,000; 8 year term and one year of grace (paying interest but not capital)
- Specialized technical assistance
- **Bonus price for "sustainable milk" > US $ 0.04 L^{-1}** (depending on the rate of progress in meeting the farm's goals).

To sustainably increase milk production and quality in the Amazon foothills (NESTLE's Caquetá dairy district) without increasing the land area used for grazing, through silvopastoral systems that promote the protection and restoration of forests, water and soil."

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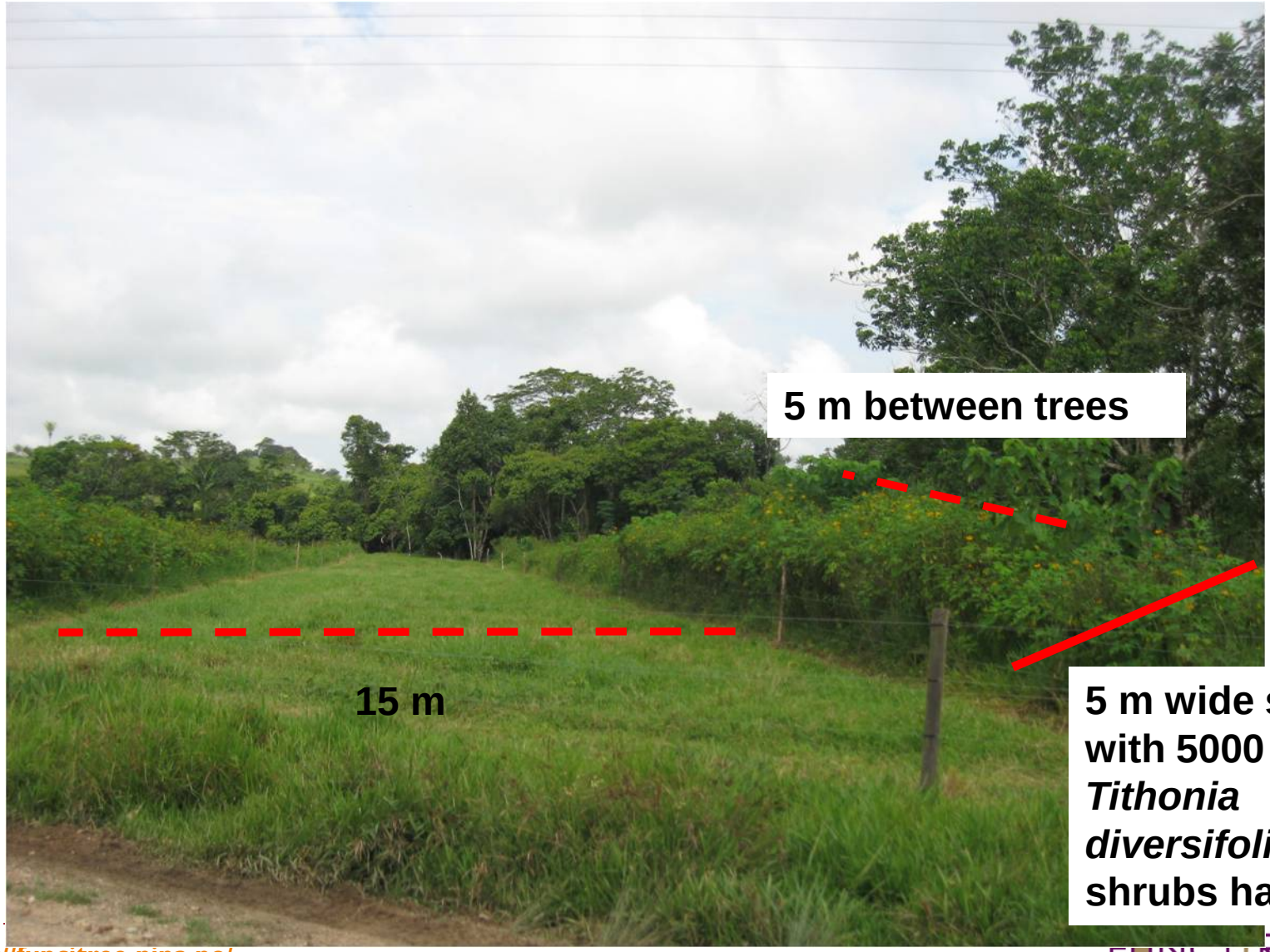
Intensive silvopastoral system



Milk production: 355 L ha^{-1} yr^{-1}

596 L ha^{-1} yr^{-1}

Buenos Aires Farm, San Juan del Doncello, Caquetá

Owned by: Hernán Grajales

- 100 trees ha^{-1} in lines each 20 m
- 5000 shrubs ha^{-1} in double strips at both sides of trees.
- 15 m wide pasture strips between shrub & tree strips (5 m)

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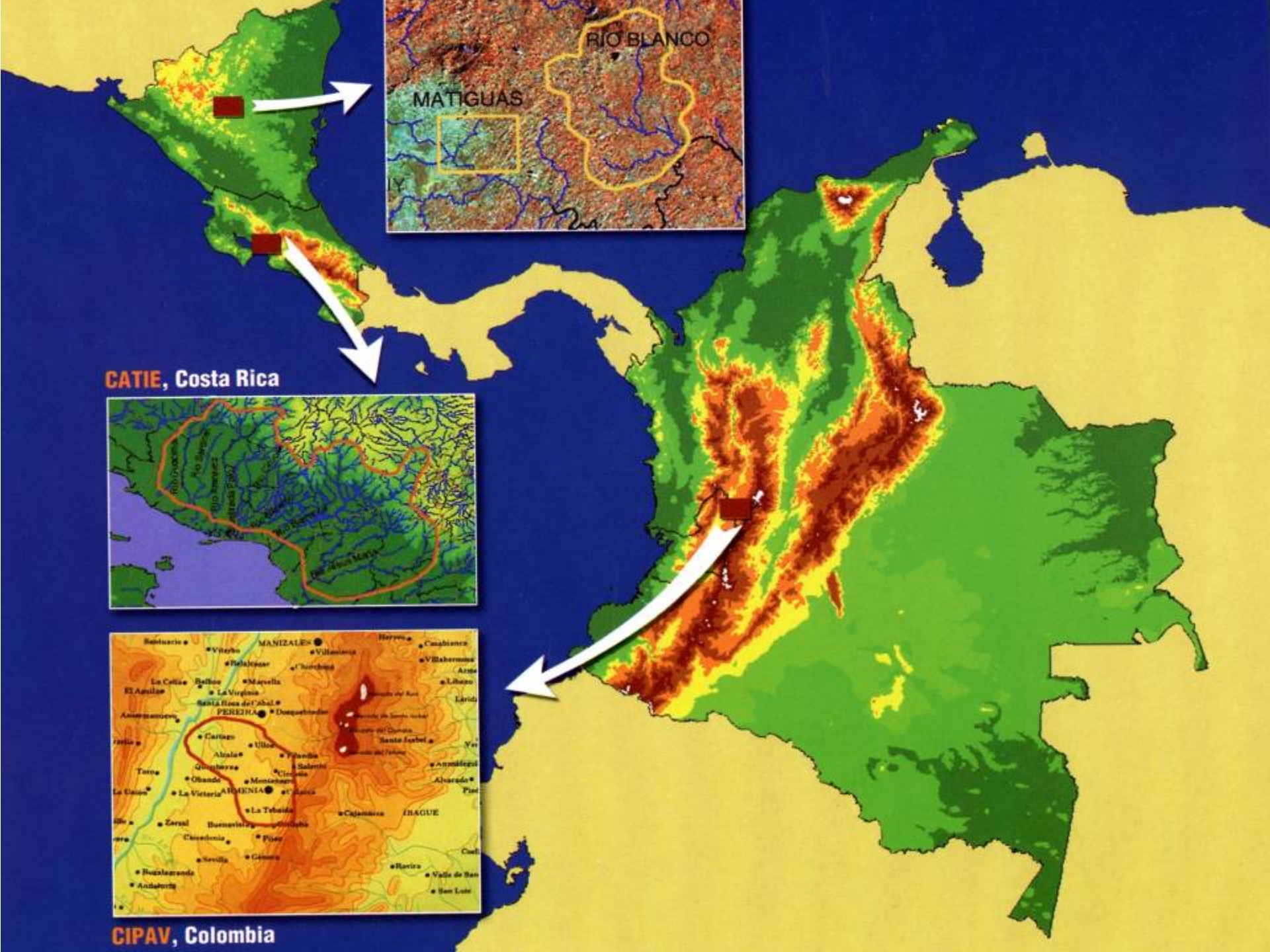
Regional Integrated Silvopastoral Approaches to Ecosystem Management (RISAEM) Project, 2002-2007

- Objective: evaluating the role of Payment for Environmental Services PES in the conversion of conventional cattle grazing systems into silvopastoral systems.
- In Colombia, the project contributed to the ecological rehabilitation of 3700 hectares at La Vieja river basin (Quindío and Valle del Cauca) through:
  - Transforming 78% of treeless pastures into silvopastoral systems
  - A 2040% increase in live fences
  - 140 hectares of intensive silvopastoral systems.

GEF Banco Mundial Nitlapan CRQ


RIO BLANCO
MATIGUAS
CATIE, Costa Rica
MANIZALES
PEREIRA
ARMENIA
IBAGUE
CIPAV, Colombia

Farm in the Project

	Colombia	Nicaragua	Costa Rica	Total
Group A (control)	29	30	28	87
Group B (PSA + TA)	50	77	74	201
Group C (PES)	25	30	31	86
Total	104	137	133	378

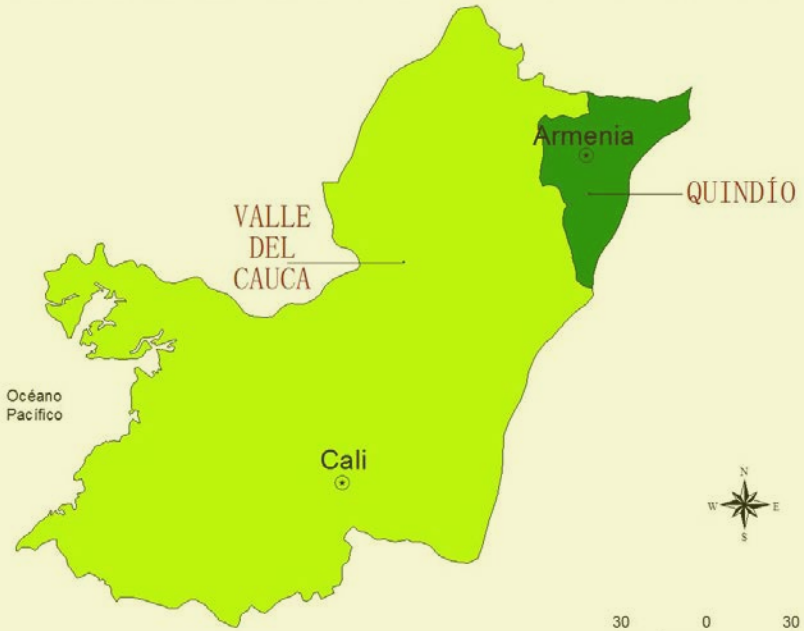
PSE – Payment for environmental services

TA – Technical Advisory

Research Site in Colombia

Colombia

Departaments



La Vieja River Basin

Área: 584 Km²

Altura: 900 – 1800 m

Zonas vida: bmh-PM y bh-PM

Fuente: Cipav

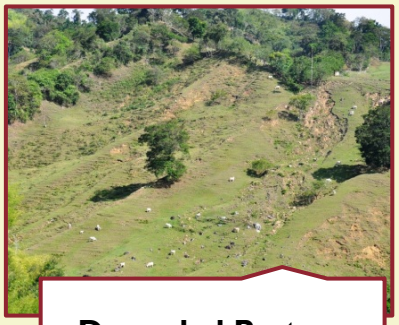
PES Index

It is an approach to estimate the amount of ES generated on a farm.
Used to monitor changes in IS and to define the amount of payment for the same.
28 Land Use areas were defined in the project in the three countries.

It is the combination (sum) of the points allocated for biodiversity and carbon sequestration, to each type of land use present on farms.

- Undesirable land uses = low score
- Land uses desirable = high score

28 Land Uses



Degraded Pasture

Improved Pastures - Tress

Natural pastures - Trees

Perennial Crops

Live fences

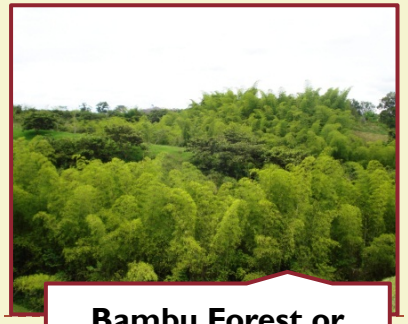
Fodder Bank

Wind Breaks

Improved Pasture + Tress

Riparian Forest

Intensive Silvopastoral System



Bambu Forest or plantation

Secoundary Forest

#	Tipo de Uso de la Tierra	Índice Carbono	Índice Biodiversidad	Índice Total
7	Past. nat. enriquecida c/ baja dens. de arboles	0,3	0,3	0,6
8	Cerca viva nueva o establecida c/ poda frecuente	0,3	0,3	0,6
9	Pastura mejor. enriquecida c/ baja dens. de árboles	0,3	0,4	0,7
10	Cultivo homogéneo de frutales (monocultivo)	0,3	0,4	0,7
11	Banco forrajero de gramíneas	0,3	0,5	0,8
12	Pastura mejorada c/ baja densidad de árboles	0,3	0,6	0,9
13	Banco forrajero con leñosas	0,4	0,5	0,9
14	Pastura natural c/ alta densidad de árboles	0,5	0,5	1,0
15	Policultivo de frutales	0,6	0,5	1,1
16	Cerca viva multiestrato o barrera rompe viento	0,6	0,5	1,1
17	Banco forrajero diversificado	0,6	0,6	1,2
18	Plantación de maderables en monocultivo	0,4	0,8	1,2
19	Cultivo de café con sombrío de árboles	0,6	0,7	1,3
20	Pastura mejorada c/ alta densidad de árboles [2]	0,6	0,7	1,3
21	Bosque o plantación de guadua o bambú	0,5	0,8	1,3
22	Plantación de maderables diversificada	0,7	0,7	1,4
23	Sucesión vegetal o tacotal	0,6	0,8	1,4
24	Bosque ripario o ribereño	0,8	0,7	1,5
25	Sistema silvopastoril intensivo	0,6	1,0	1,6
26	Bosque secundario intervenido	0,8	0,9	1,7
27	Bosque secundario	0,9	1,0	1,9
28	Bosque primario	1,0	1,0	2,0

#	Tipo de Uso de la Tierra	C	BD	Total
2	Pastura degradada	0	0	0

Índice según Pontecial para Fijar Carbono y Conservar Biodiversidad

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#	Tipo de Uso de la Tierra	Índice Carbono	Índice Biodiversidad	Índice Total
1	Cultivo de ciclo corto	0	0	0
2	Pastura degradada	0	0	0
3	Pastura natural sin árboles	0,1	0,1	0,2
4	Pastura mejorada sin árboles	0,1	0,4	0,5
5	Cultivo de semi-perennes	0,3	0,2	0,5
6	Pastura natural c/ baja densidad de árboles	0,3	0,3	0,6
7	Past. nat. enriquecida c/ baja dens. de árboles	0,3	0,3	0,6
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28	Bosque primario	1,0	1,0	2,0

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22	Plantación de maderables diversificada	0,7	0,7	1,4

#	Tipo de Uso de la Tierra	C	BD	Total
28	Bosque primario	1,0	1,0	2,0

Land Use Monitoring

Land Use change in the “coffee region” of Colombia

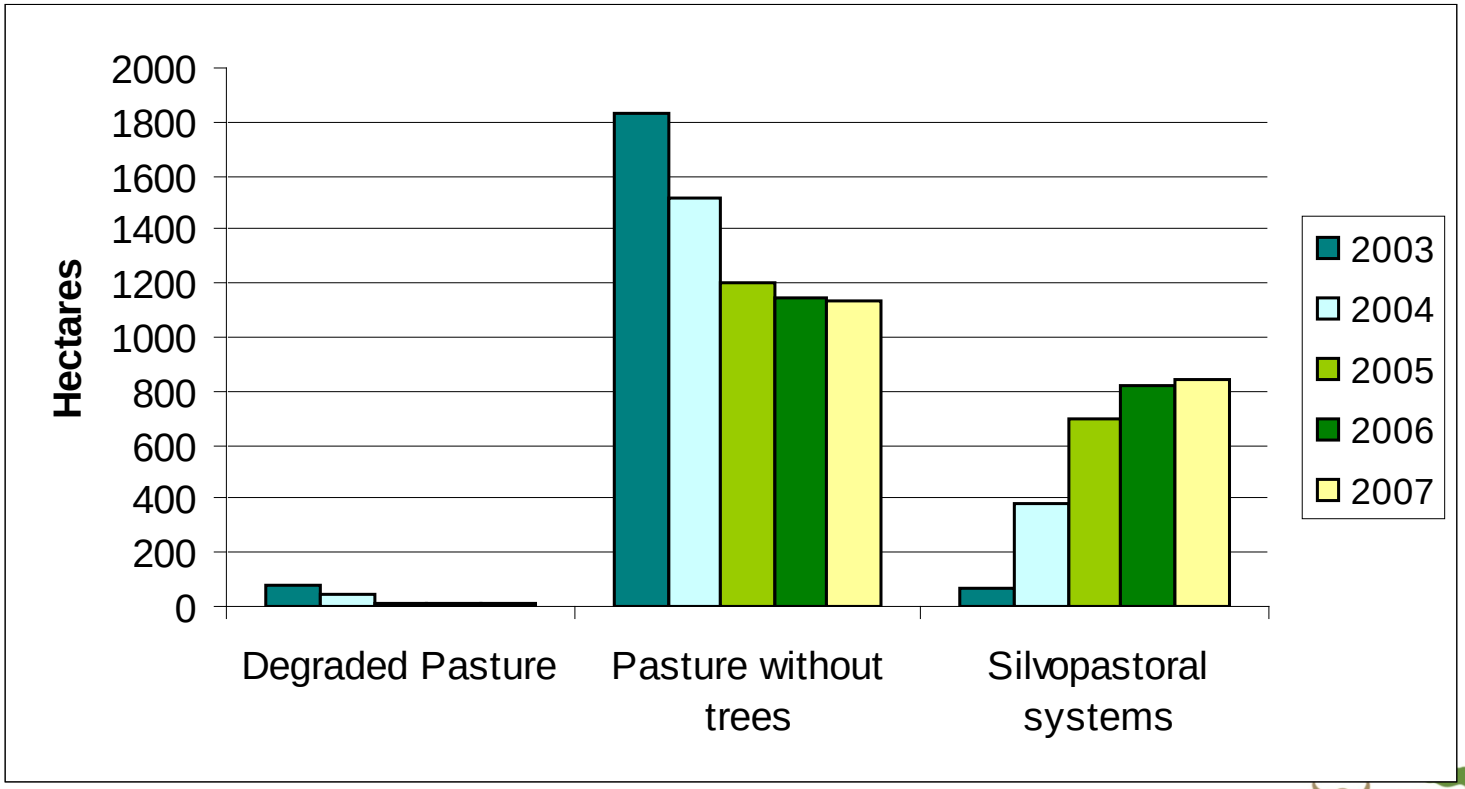
2003 - 2007

FINCA PINZACUÁ, 2003

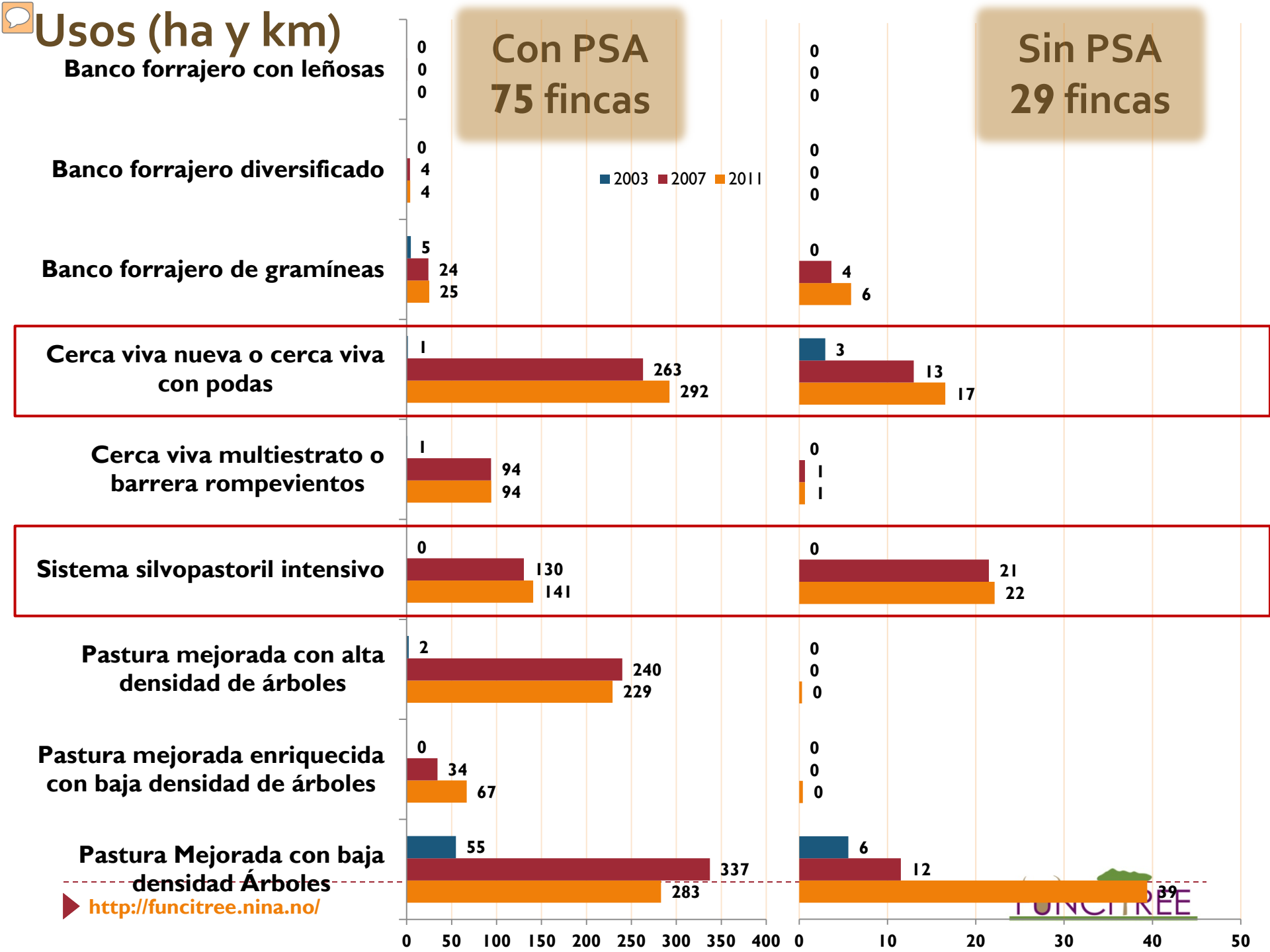
FINCA PINZACUÁ, 2007

Efecto del PSA sobre Cambios en el Uso del Suelo

Summary of the effect of the PES with Technical Assistance increasing forested areas and reducing treeless areas and degraded areas.
Rio La Vieja (Valle del Cauca and Quindio)



Usos (ha y km)



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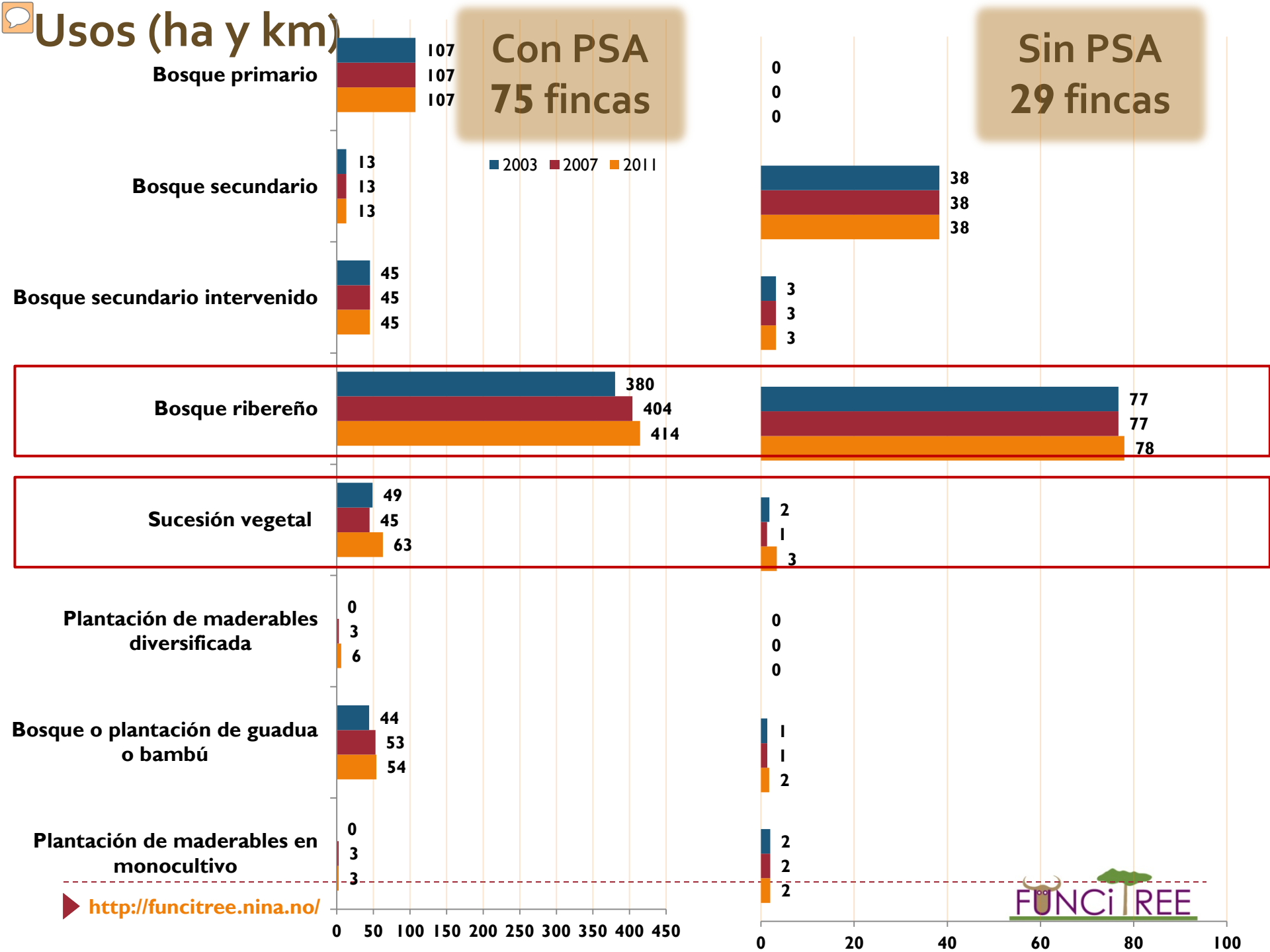
Usos (ha y km)



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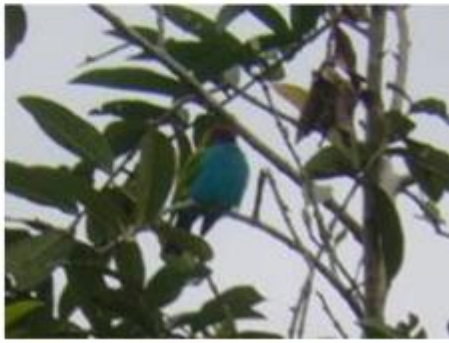
Effect of PES + TA

	Changes in the land use			
Treatments:	**PES 2 YEARS**		**PES 4 YEARS**	
Land uses:	**2003-2007**	**2007-2011**	**2003-2007**	**2007-2011**
Silvopastoral				
Pasture + trees	+		+	+
Fodder Banks			+	
Intensive Silvopastoral			+	
Live fences	+		+	+
Conservation /restauration				
Riparian Forest			+	+
Conservation Forest			+	
Undesirable land uses				
Degradaded Pasture			-	
Pasture - trees	-		-	





BIRD FAUNA IN CATTLE RANCHING

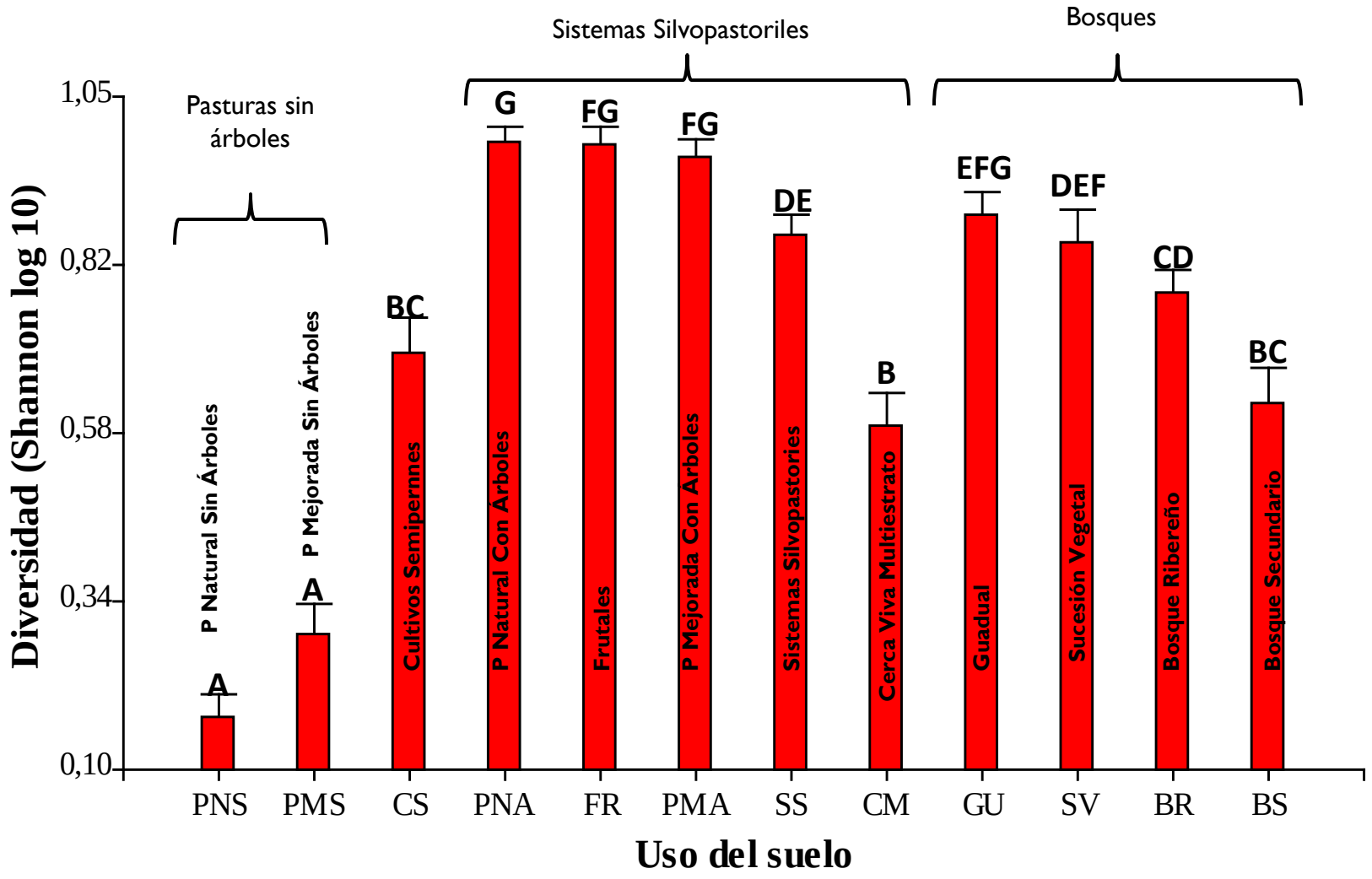




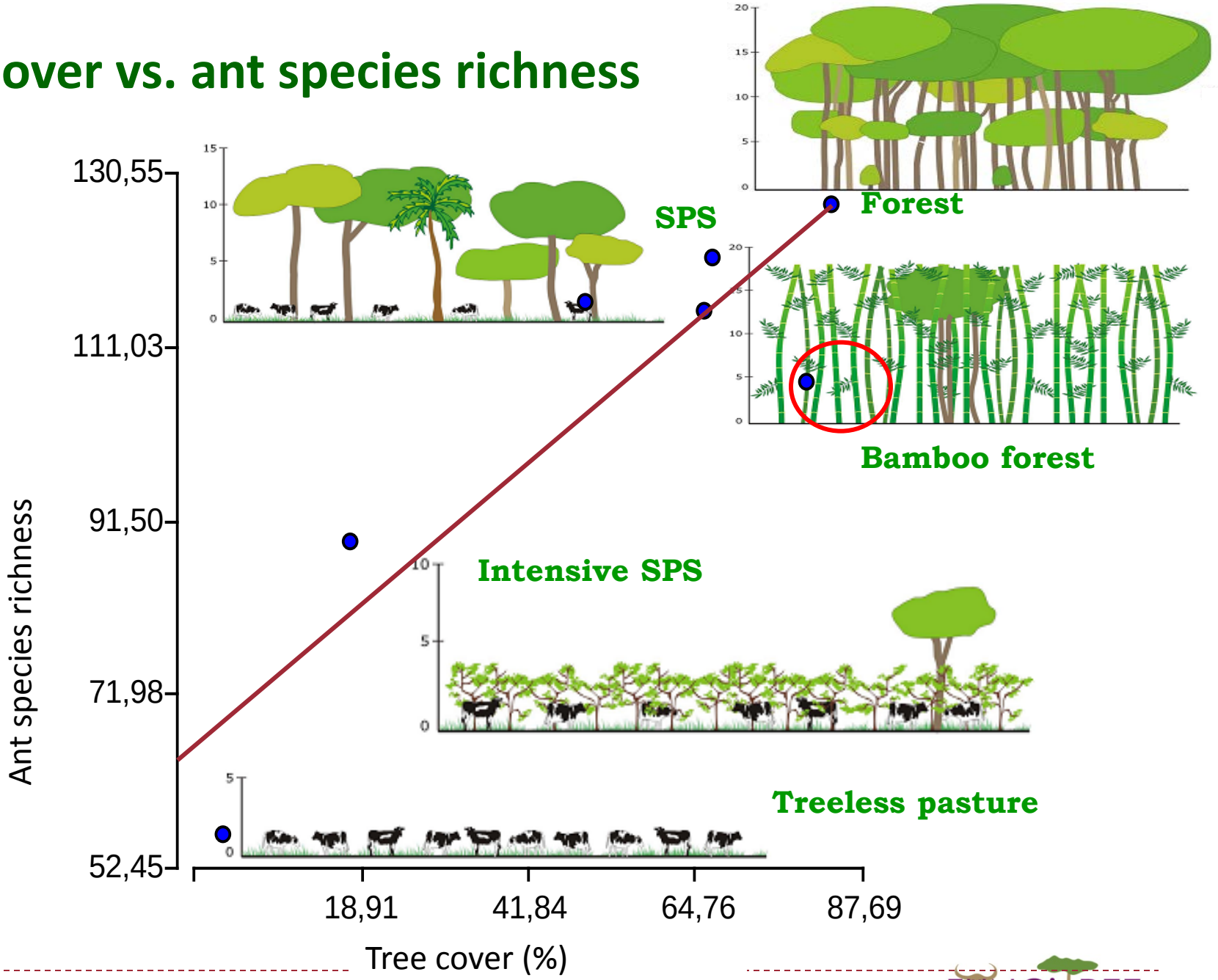

Bird Monitoring

Bird Category	Base Line	Year 5	% of change
Total richness	146	193	32,2%
Endangered species	6	7	16,7%
Forest dependant species	74	104	40,5%
Migratory birds	10	19	90,0%

Bird Monitotring



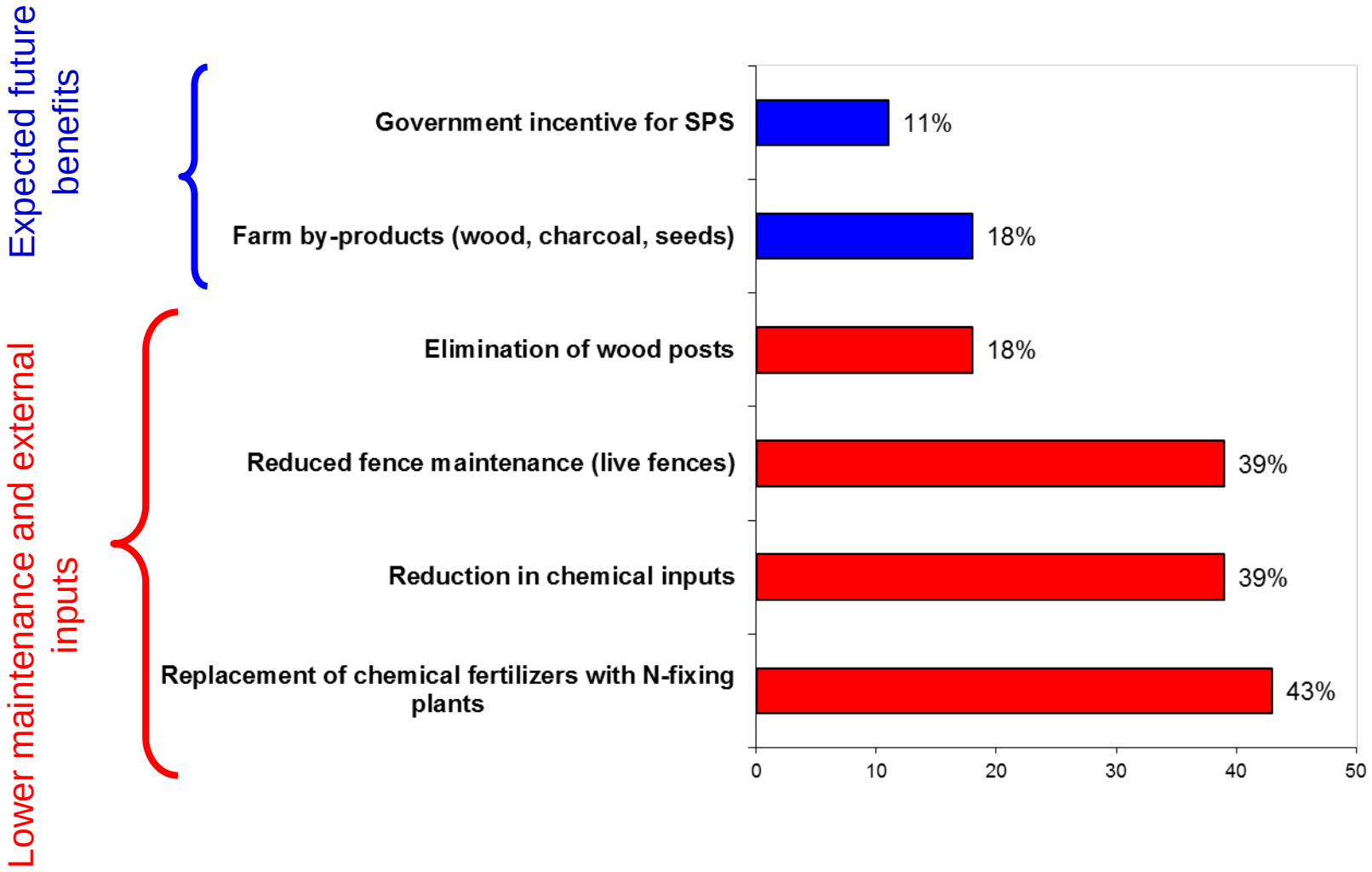
Tree cover vs. ant species richness



* Spearman ρ = 0.75, N=7, p<0.005

FUNCiTREE

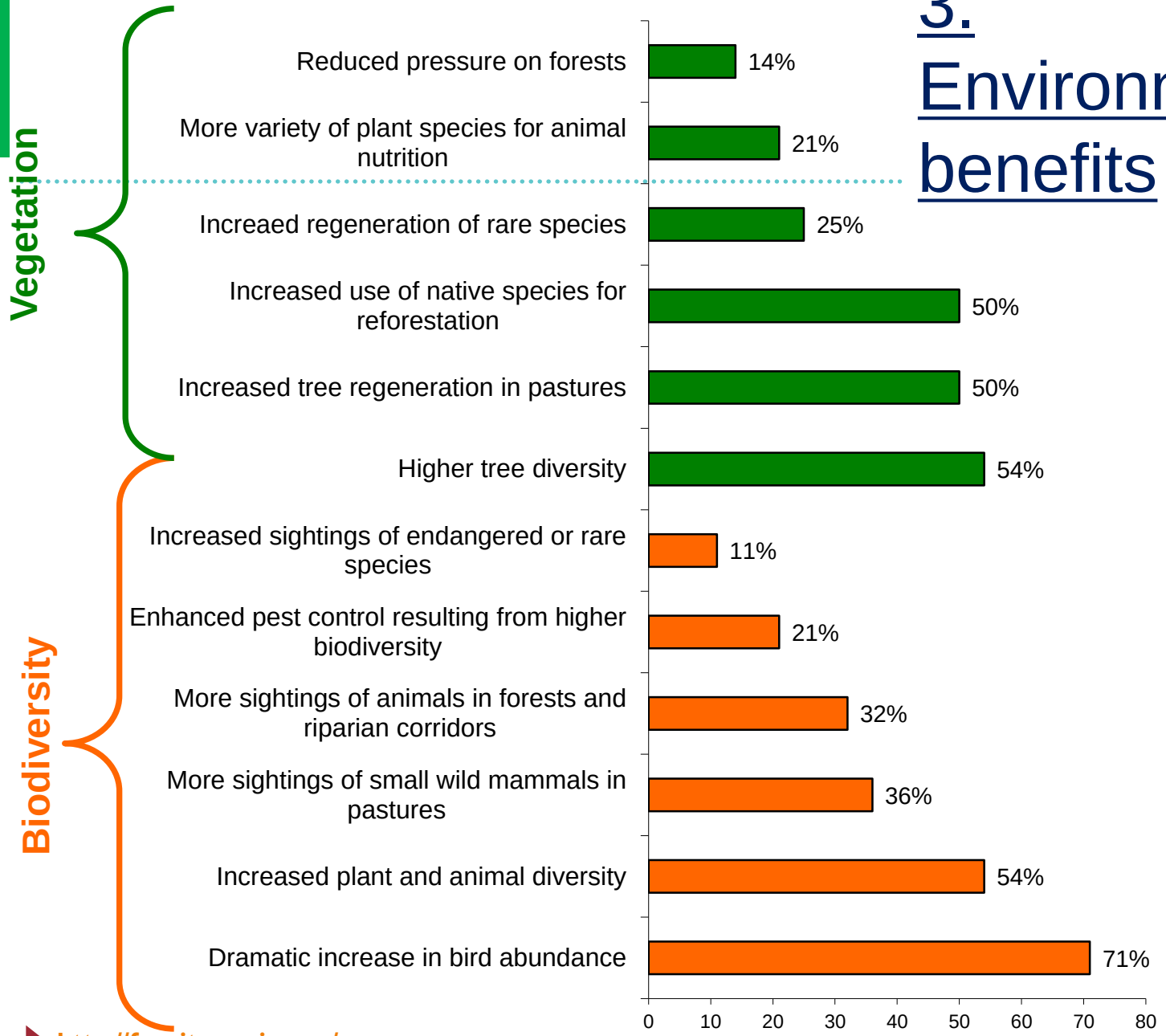
Farmers' perceptions on the benefits of the adopted silvopastoral systems



1. Economic benefits

Calle A, Montagnini & Zuluaga, 2009

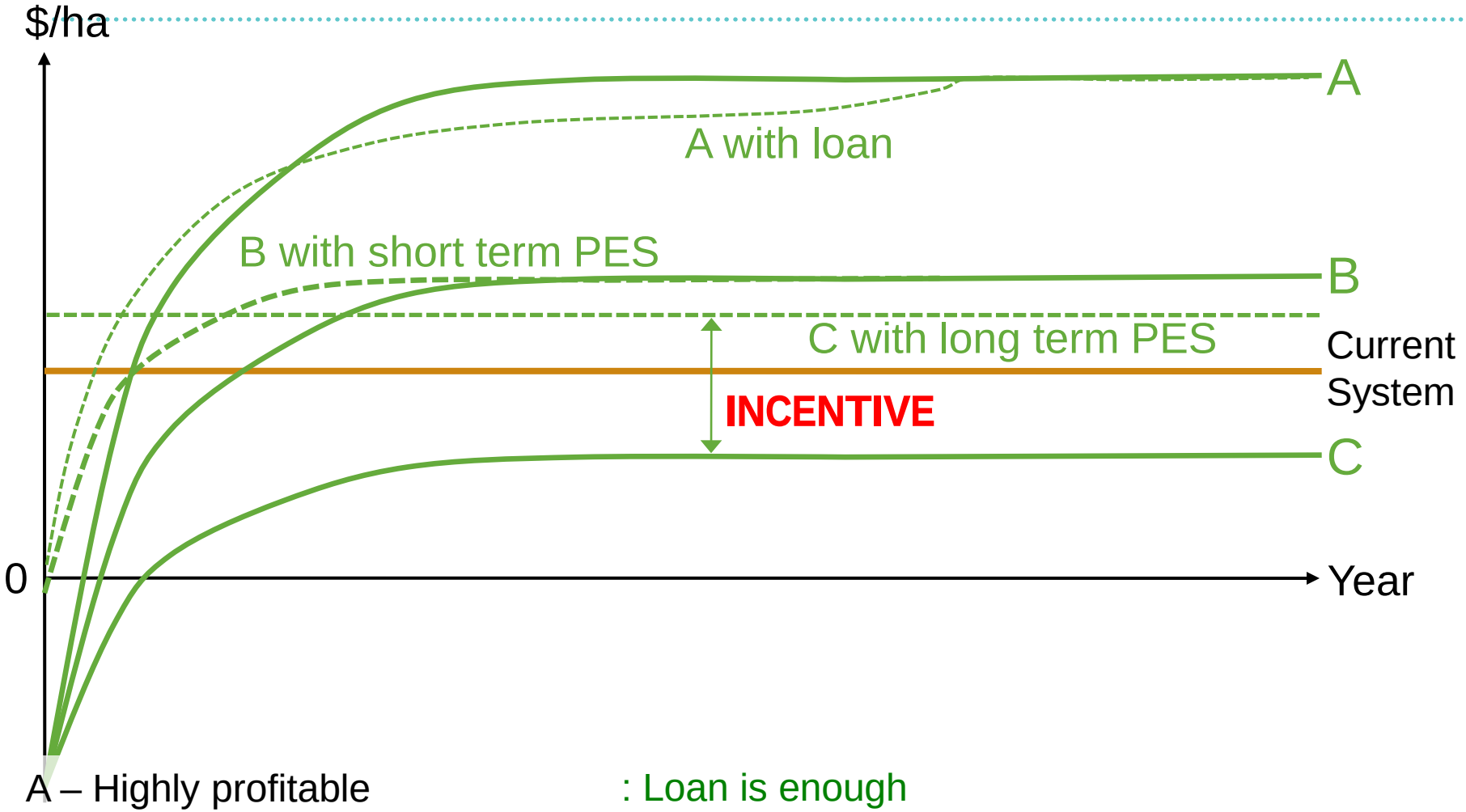
3. Environmental benefits



http://funcitree.nina.no/

Calle A, Montagnini & Zuluaga, 2009

How we can support good farming system?



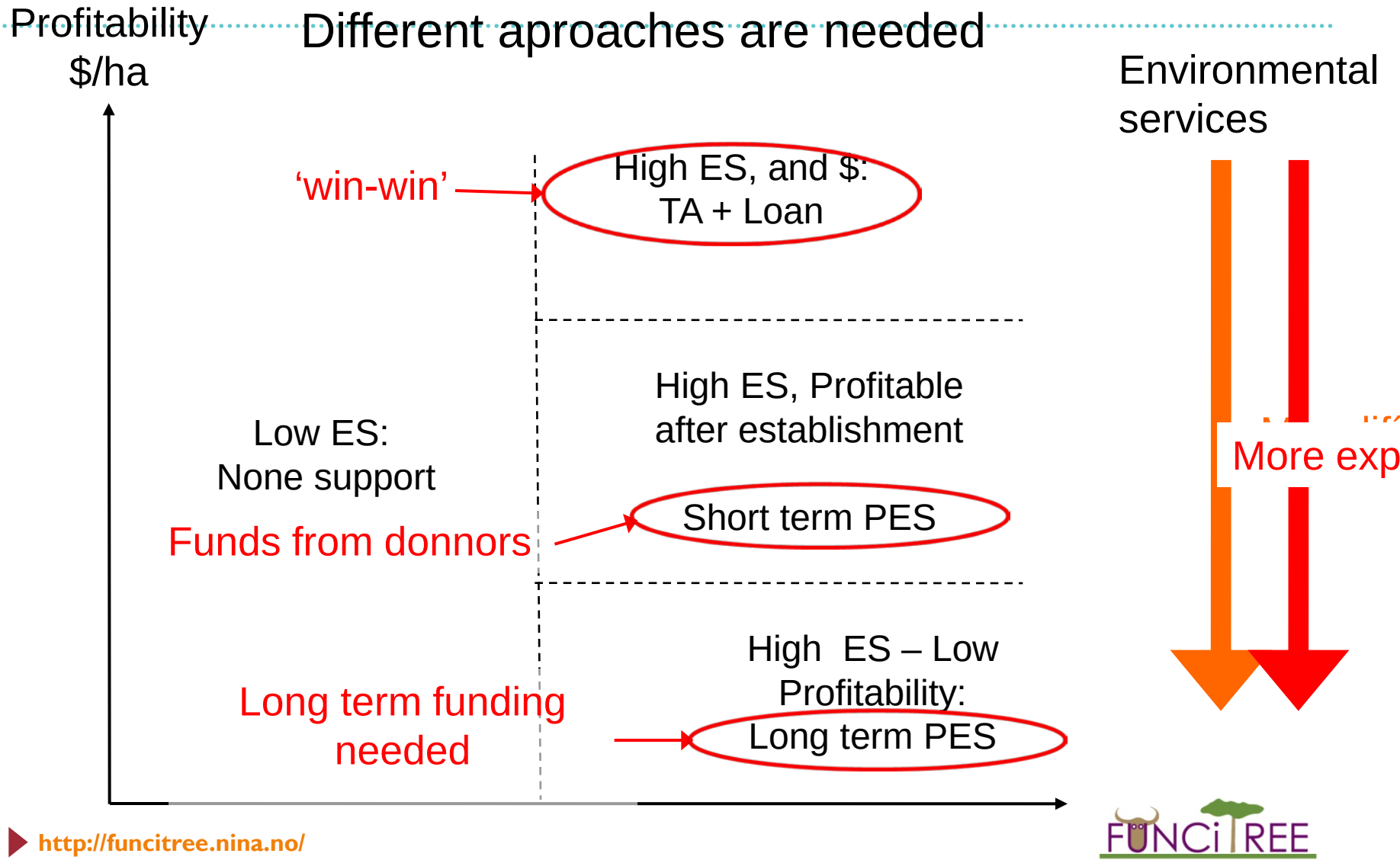
A – Highly profitable : Loan is enough

B – Profitable only after establishment : Short term PES

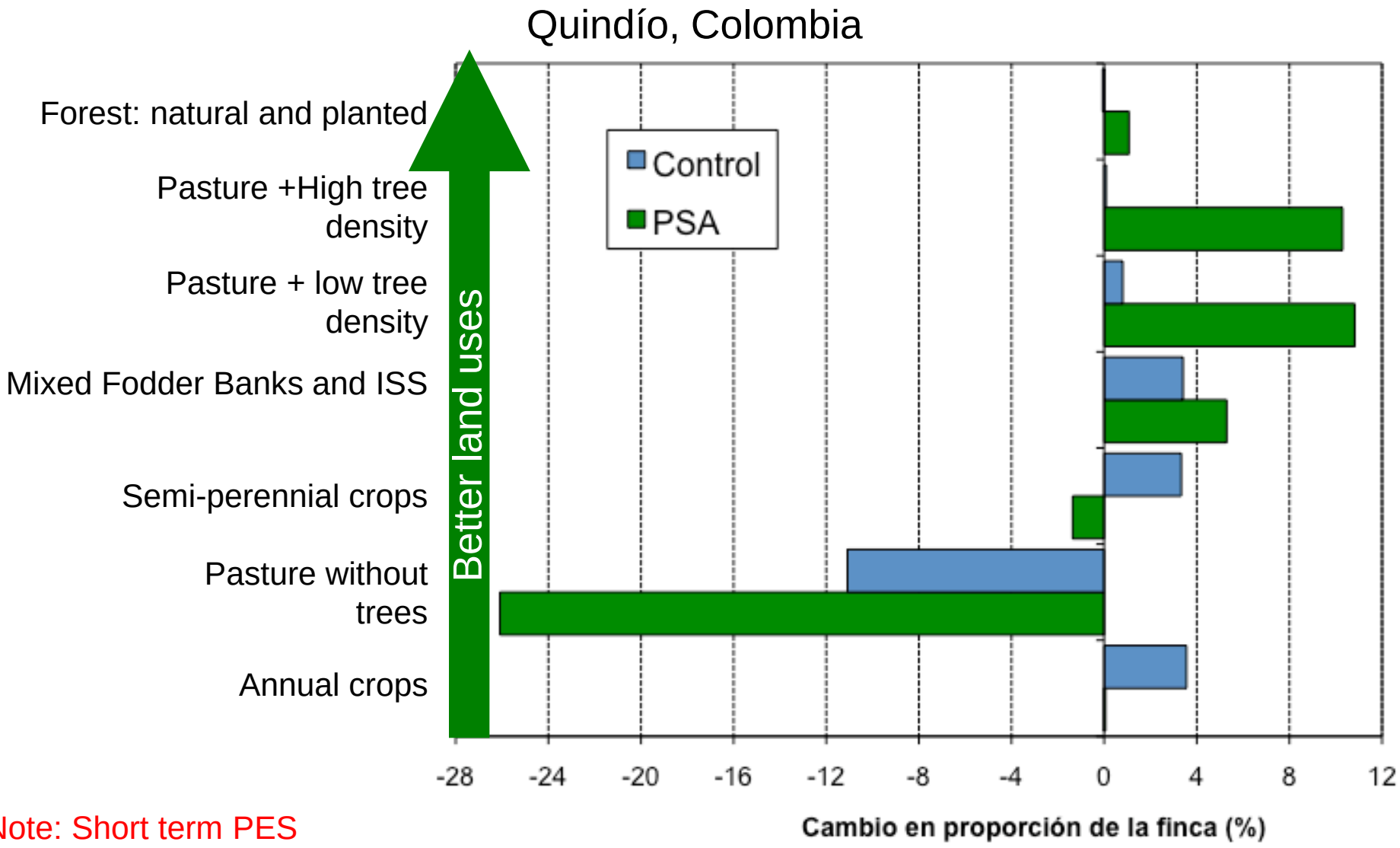
C – Low profitability : Long Term PES is mandatory

FUNCiTREE

How we can support good farming system?



Impact of PES in land use changes



Note: Short term PES

Fuente: Datos Proyecto Silvopastoril

Lessons learned from RISAEM Project

- Farmers respond to PES. The project induced substantial land use change.
- SPS generate significant benefits for biodiversity, carbon sequestration and water.
- Some SPS are highly profitable.
- The high profitability of some SPS means that they do not need PES but other incentives such as credit and technical assistance.

Mainstreaming Biodiversity into Sustainable Cattle Ranching Project

Ganadería Colombiana Sostenible

PROYECTO GANADERÍA COLOMBIANA SOSTENIBLE

GEF

FEDEGAN FNG

CIPAV

The Nature Conservancy. Protecting nature. Preserving life.

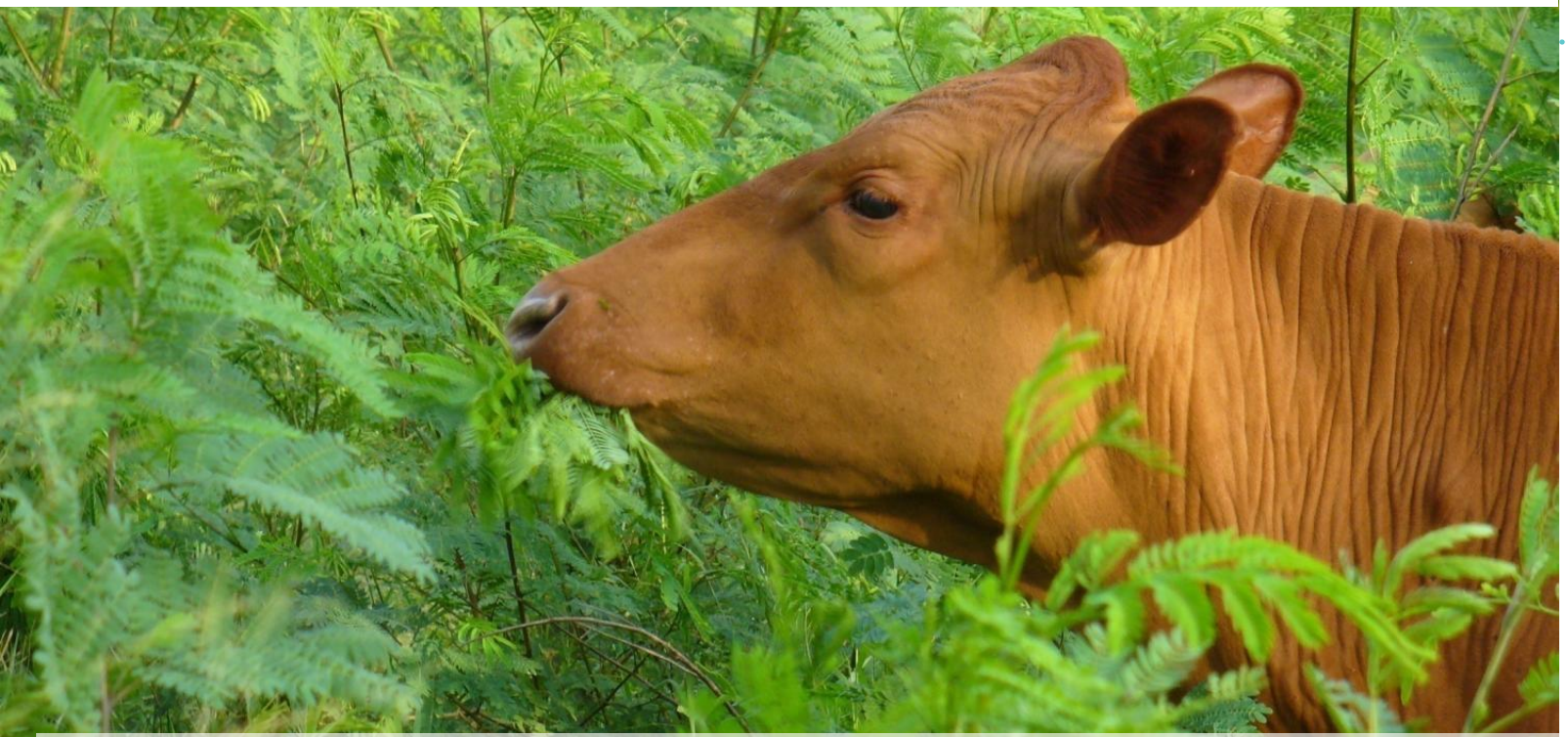
FINAGRO

Ministerio de Ambiente, Vivienda y Desarrollo Territorial

Ministerio de Agricultura y Desarrollo Rural

CATIE Solutions for environment and development / Soluciones para el ambiente y desarrollo

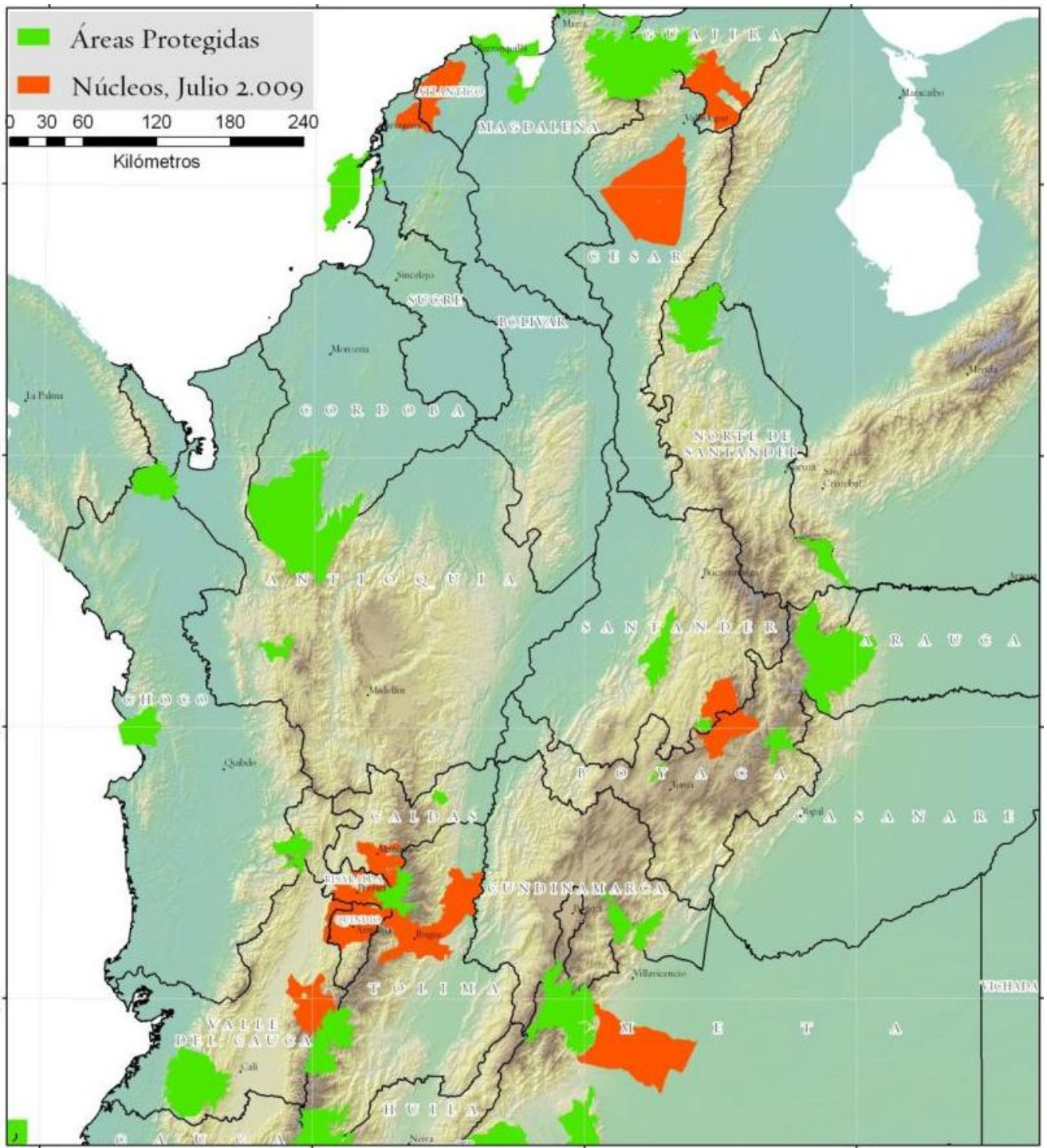
Mainstreaming biodiversity into sustainable cattle ranching Project



General objective

Inducing the adoption of biodiversity-friendly cattle ranching in areas with degraded pastures through different strategies, in order to: (1) create more suitable landscapes for biodiversity, water and soil, and (2) increase the income of farmers.

FUNCiTREE



Project areas

Protected areas

TNC Colombia, 2009

FUNCiTREE

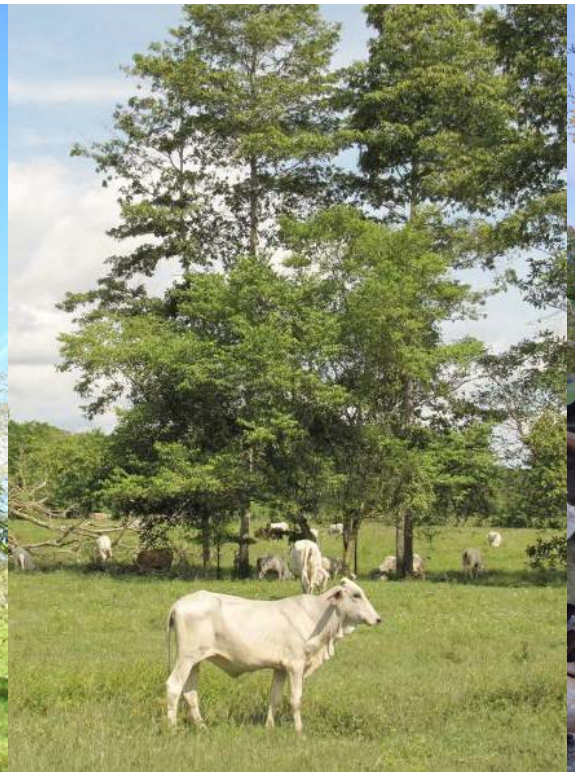
Project goals

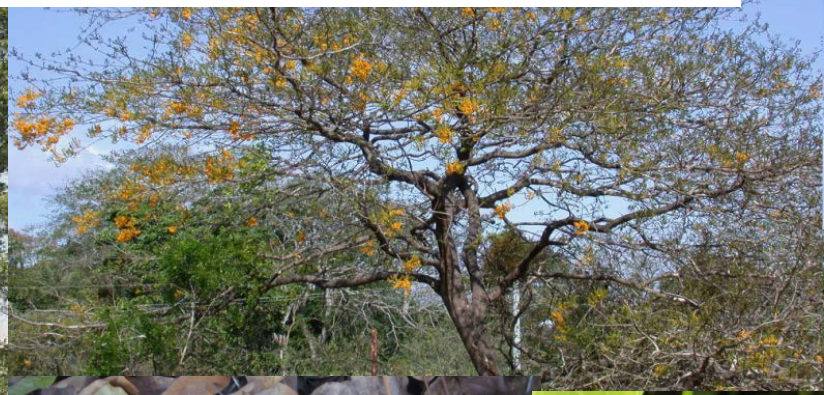
- 45,500 ha of pastures converted into biodiversity-friendly systems
  - 12,000 ha of intensive SPS
  - 31,500 ha of pastures with trees and live fences
  - 11,000 ha of pastures with scattered trees
  - 5,000 km of live fences
  - 2,000 ha of degraded land, recovered
- 5,000 ha of forests, conserved

FUNCiTREE

50 focal species

50 plant species of global conservation concern planted in farms

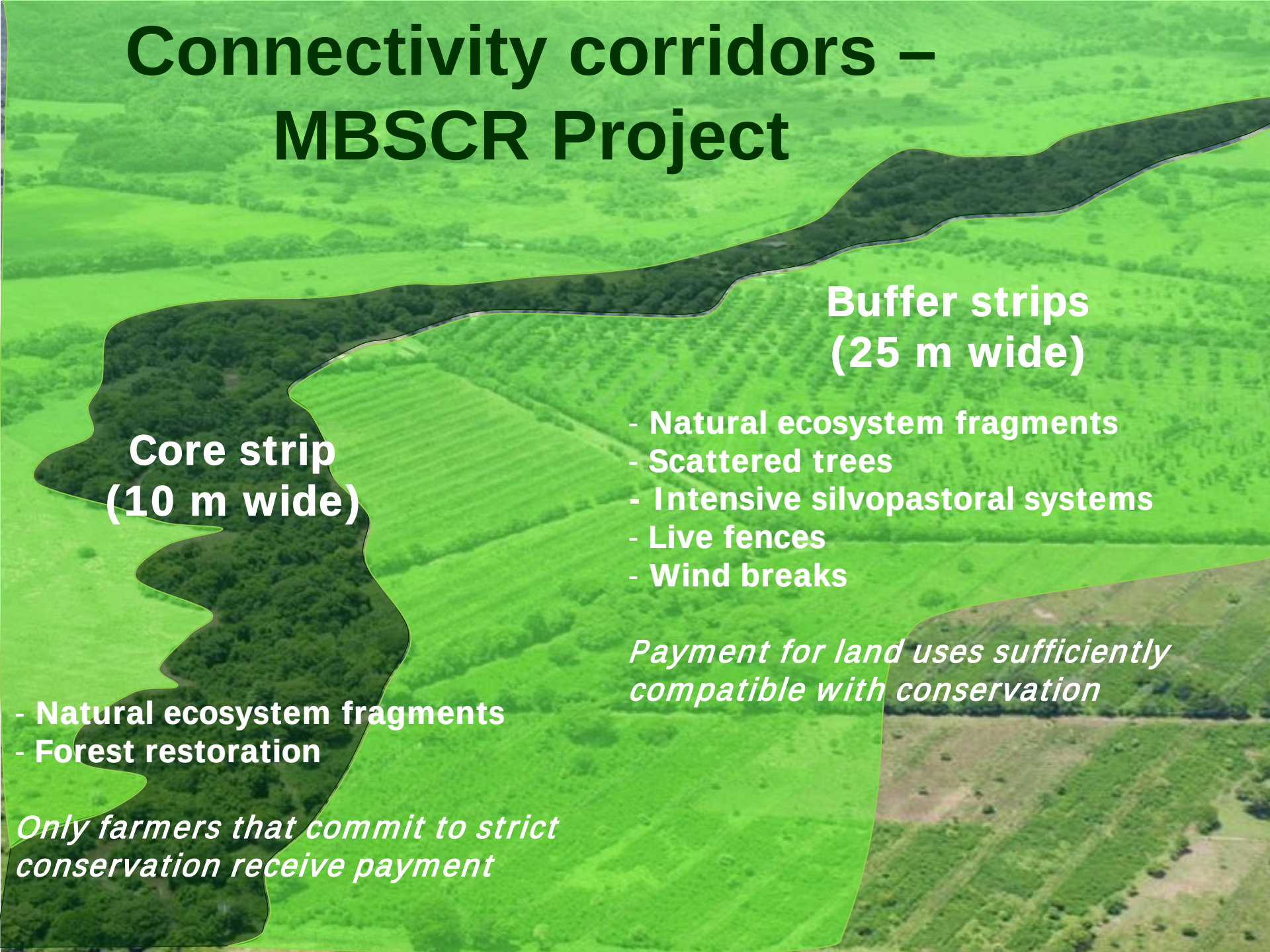




Project goal: connectivity corridors

- Project goal: 15,750 ha of connectivity corridors through a combination of secondary succession and enrichment planting.
- “Stretches of tree or shrub vegetation connecting fragments of natural ecosystems through riparian strips, pastures with high tree density, and other elements of the landscape.”

Connectivity corridors – MBSCR Project



Core strip (10 m wide)

- Natural ecosystem fragments
- Forest restoration

Only farmers that commit to strict conservation receive payment

Buffer strips (25 m wide)

- Natural ecosystem fragments
- Scattered trees
- Intensive silvopastoral systems
- Live fences
- Wind breaks

Payment for land uses sufficiently compatible with conservation

Compensation for small and medium farmers for land use changes

PES – Payment for Environmental Services

Treeless pastures in areas <u>unsuitable</u> for grazing; degraded areas

Conservation of native forests
Corridors
Riparian buffers
Protection of wetlands
Restoration of degraded areas

Technical assistance and access to credit

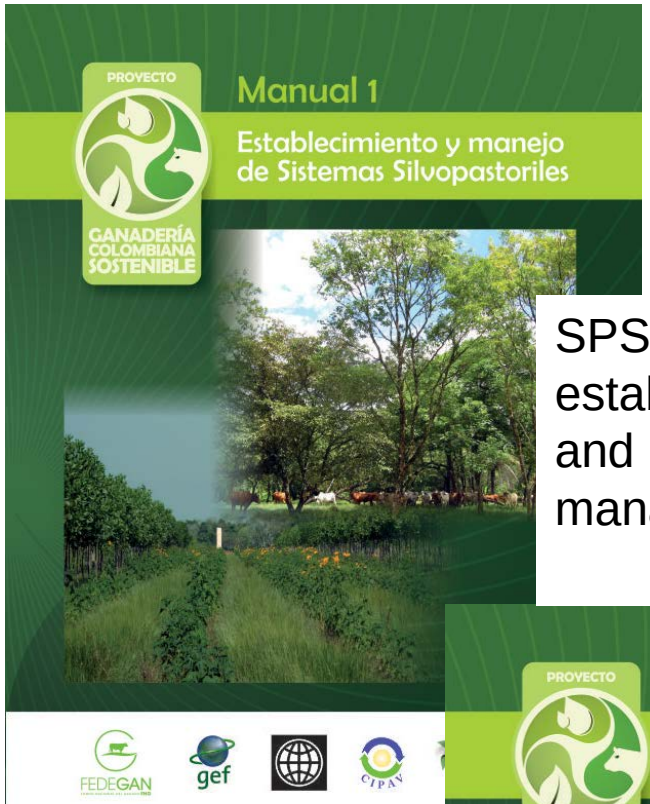
Treeless pastures in areas <u>suitable</u> for cattle grazing

Intensive silvopastoral systems with timber trees
Mixed fodder banks
SPS with rotational grazing and good management practices

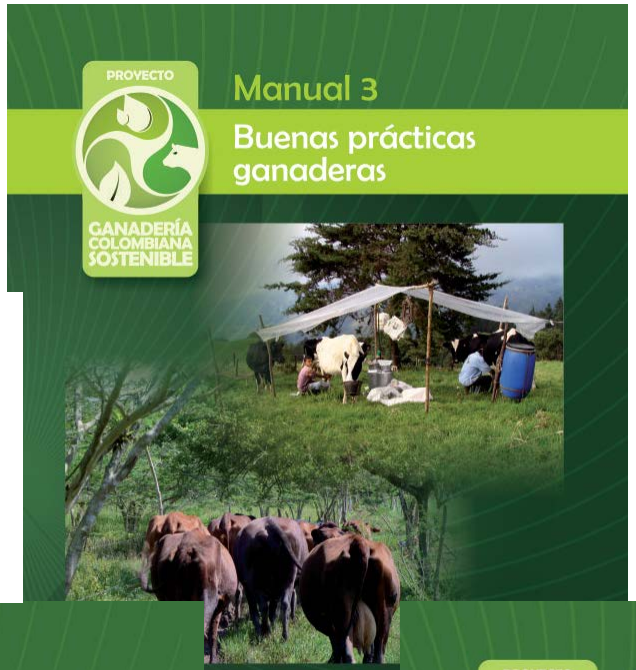
PES - Biodiversity and soil conservation scores for different land uses

Land use	Basic points	Additional points	
		In biological corridors	Focal species*
Mature forest	100	-	-
Secondary forest	95	-	-
Scattered trees and managed tree succession in pasturelands	70	10	10
Agroforestry systems (> 2 strata)	50	20	10
Live fences and windbreaks (Km)	10	5	5
Agriculture plots with plant cover >80%	10	-	10
Intensive SPS and mixed fodder banks	0	30	10
Seasonal crops and forest plantations	0	30	10
Degraded soil and degraded pasture	0	20	0

1 point = US$ 0,75 ha-1
SPS: Silvopastoral systems
* Species of global conservation concern according to official project list (TNC-CIPAV)

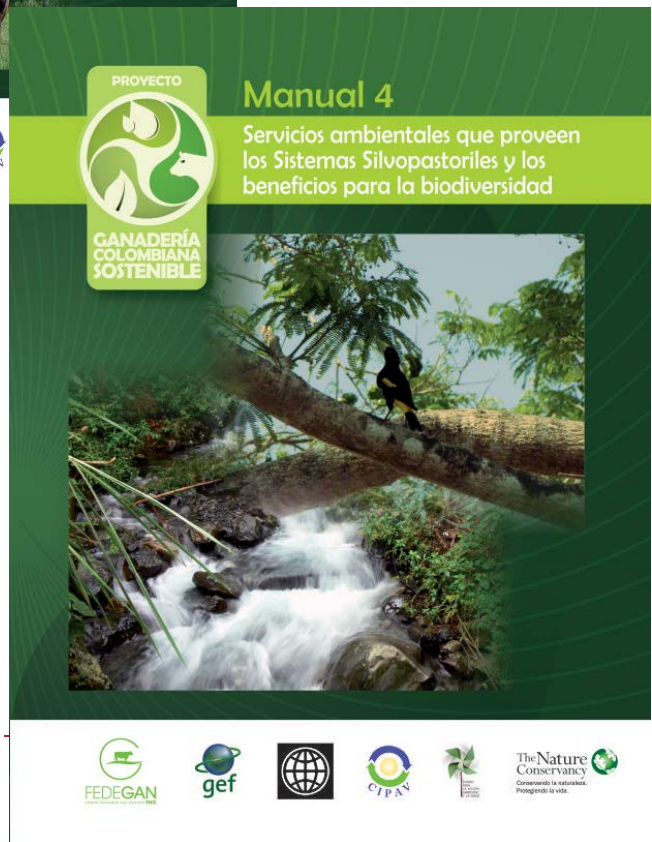


SPS establishment and management



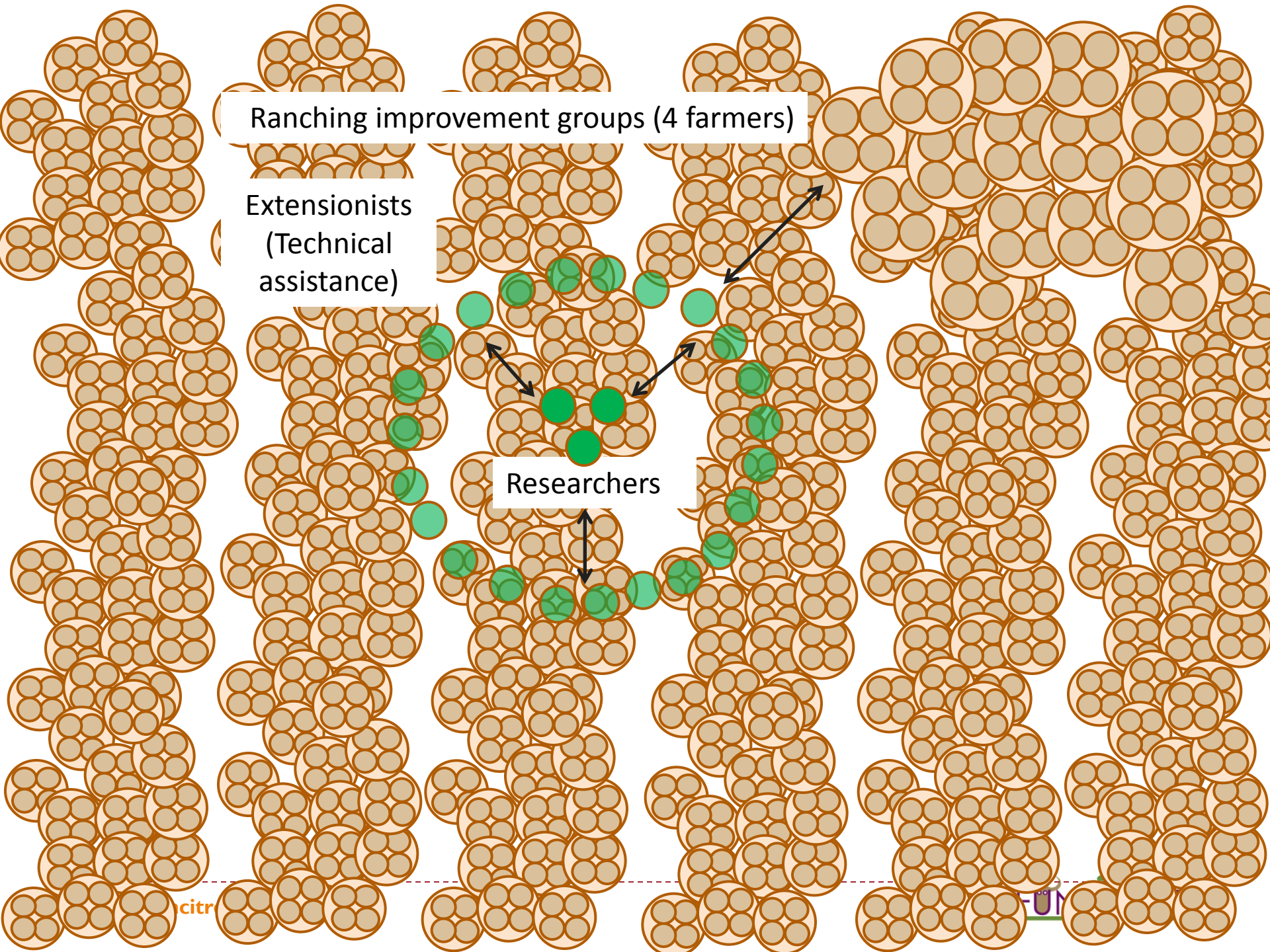
Good farming practices

Integrated pest management



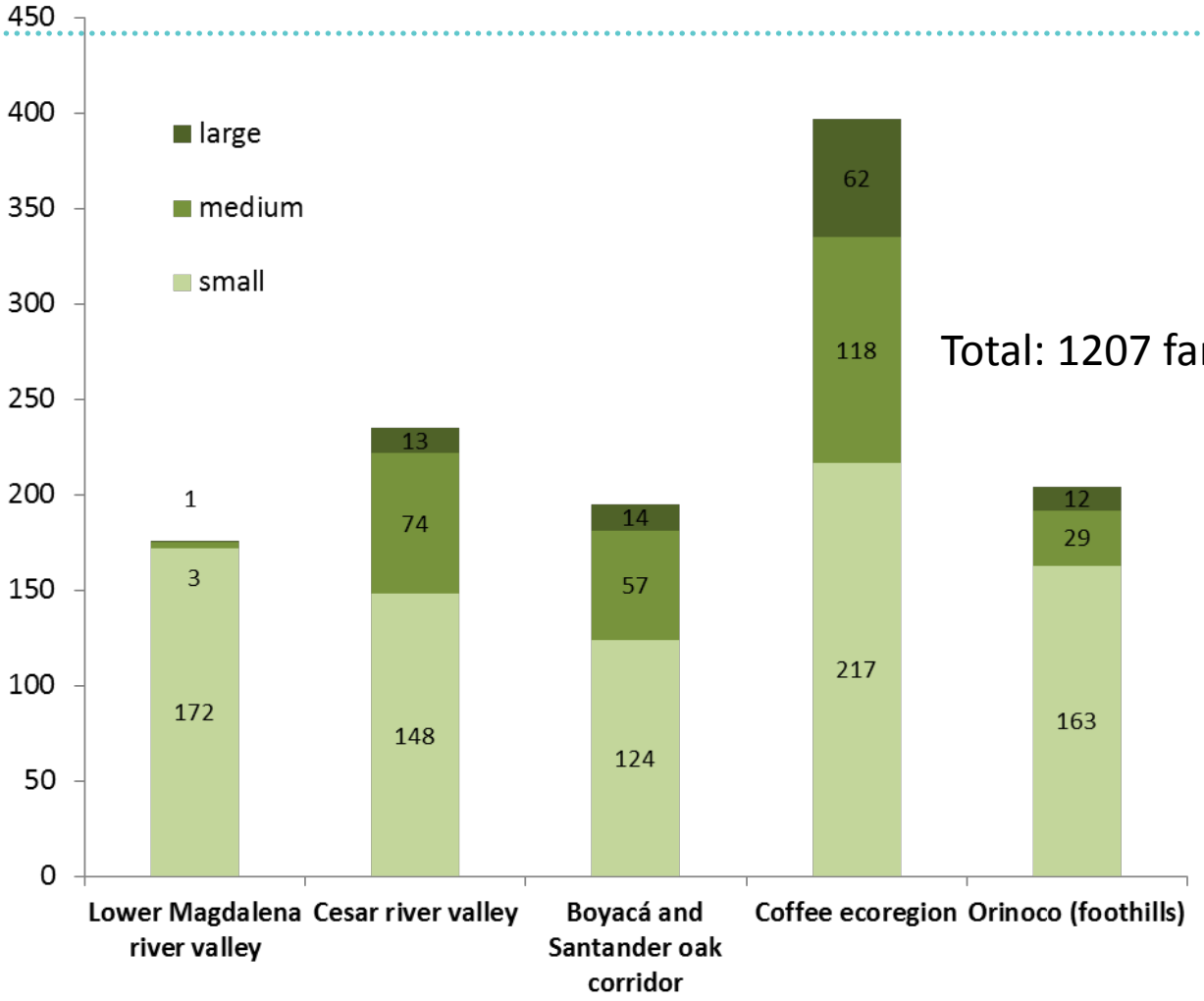
Environmental services & benefits of biodiversity

Training manuals


Ranching improvement groups (4 farmers)
Extensionists (Technical assistance)
Researchers

Farms enrolled in the Project after first call

Number of farms



Total: 1207 farms

Project region


Thanks!!!

UiO : Centre for Development and the Environment
University of Oslo

Learning from payments for environmental services: private sector, development cooperation and PES in campesino lands in Nicaragua.

Mariel Aguilar-Støen

Environmental governance

- The *practices* by way of which we construct and administer the exploitation of natural resources under neo-liberalization
- Engagements for the distribution of resources and the exercise of control and coordination (State and non-state actors)

Question

- How are the objectives, knowledge, technologies and practices of different actors negotiated in a PES project?
- Power asymmetries

Payment for Environmental Services

- Sugarcane industry CASUR (40%) (87 million m3)
- GIZ (German cooperation) (49%)
- Belén Municipality (10%) (0.6 million m3)
- Plantain producers (1%) (79 million m3)

- 87 *Campesino* families (US$ 30/Ha.)

ent


GRANADA
Ochomogo
Las Lajas
CARAZO
Escalante
Ñocarime
LAGO DE NICARAGUA
ALTAGRACIA
MOYOGALPA
Concepción 1610
Ometepe
El Astillero
BELEN
POTOSI
Esquipulas
San José
Balgüe
Nancimí
BUENOS AIRES
Las Salinas
TOLA
Maderas 1394
La Mohosa 477
SAN JORGE
Mérida
RIVAS
Pie del Gigante
La Virgen
Brito
La Zanata
SAN JUAN DEL SUR
Sapoá
Peñas Blancas
CARDENAS
OCEANO PACIFICO
Sábalos
La Flor
El Ostional
Colón
COSTA RICA
Bahía de Salinas


Honduras
Auasbila
Waspam
Bocay
Puerto Cabezas
La Rosita
Kukalaya
Quilali
Somoto
Prinzapolka
Somotitto
Esteli
Nicaragua
La Cruz de Rio Grande
Potosi
Matagalpa
Rio Blanca
Chinandega
Leon
Boaco
Puerto Sandino
San Benito
Santa Domingo
Laguna de Perlas
Managua
Bluefields
Lovago
Jinotepe
Granada
Caribbean Sea
Nueva Guinea
Rivas
Isla dé Ometepe
Punta Gorda
Pacific Ocean
Montelimar
San Carlos
San Juan del Norte
Costa Rica
Nicaragua Map - ©2006 Destination360


01/02/2011

The idea of PES

- Territorial planning

Why PES?

- Public-Private-Partnerships (GIZ/Gov/CASUR)
- Corporate Social Responsibility (CASUR)
- Decentralization (municipality)

Why be involved in PES?

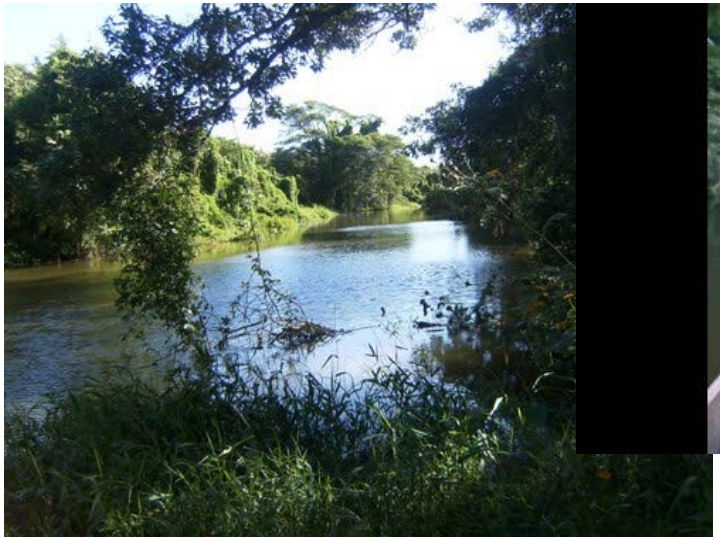
- Territorial planning/PPP/water (GIZ)
- CSR- the company's image/PPP
- Decentralization/local consultations
- cash income/access to water/water availability

Participatory exclusions

- «… on the one side CASUR is paying, but on the other side they are felling trees all over the place to plant more sugarcane…the lands around the marsh are going to be planted with sugarcane, that is why they [CASUR] are drying it and many [of us] are going to end up without being able of fishing…fishes or shellfishes or hunting armadillos… they are taking opportunities [for using the resources] from others… i think it would be better if they do not give incentives but that they do not fell trees or dry the marsh either…»

Woman 40 years old

Excluded/included natures



The economy of repair

- Expand sugarcane plantations in the lower part of the watershed and around the lake and marsh →clean energy (bioethanol, electricity)
- Reforestation and agro-forestry in the upper part of the watershed → environmental services

The economy of repair

- Sugarcane production → clean energy (and sugar)
- Campesino families → providers of environmental services

Conclusion

- Rrestructuring of rules and authority over NNRR
- Restructuring around ideas of markets
- Market only rhetorical device
- Expansion of sugarcane
- Spaces for participation

Boosting traditional management of Sahelian *Faidherbia* parks ?

Regis Peltier (CIRAD), B. Marquant (APT),
O. Palou Madi (IRAD), M. Ntoupka (IRAD) and Tapsou (IRAD)

http://funcitree.nina.no/

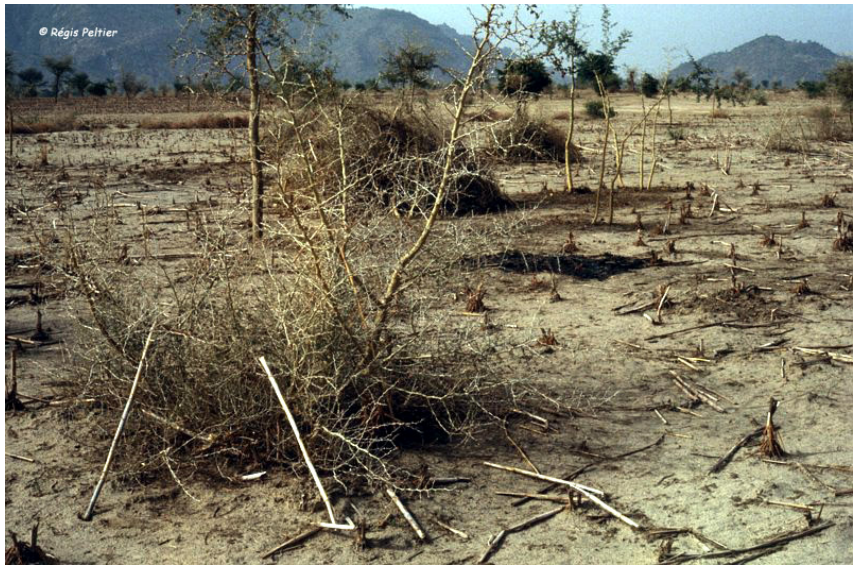
FUNCiTREE

Background:

Traits and functions of Apple-ring acacia (*Faidherbia albida (Del.) Chev*.), iconic species of sahelian agroforesters, are well known of agro-pastoralists farmers and scientists.

Traits include its deep taproot system reaching the water table on alluvial soils, the ability to fix atmospheric nitrogen and its inverted phenology, the leaves being present in the dry season and absent during the rainy season

An other trait of *Faidherbia albida* is his ability to vegetative propagation (root suckers) and to reject from stems and branches



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FUNCiTREE

Faidherbia albida positive impact on associated crops and its production of forage (leaves and fruit) and firewood are also **functions** widely recognized.

http://funcitree.nina.no/

FUNCiTREE

During the eighties, agricultural development companies had the leitmotif of **agricultural mechanization.**

To facilitate mechanical tillage, they wanted to **expel the tree out of the fields**, confining it on their periphery (live-hedges, windbreaks) or in line (alley-cropping).

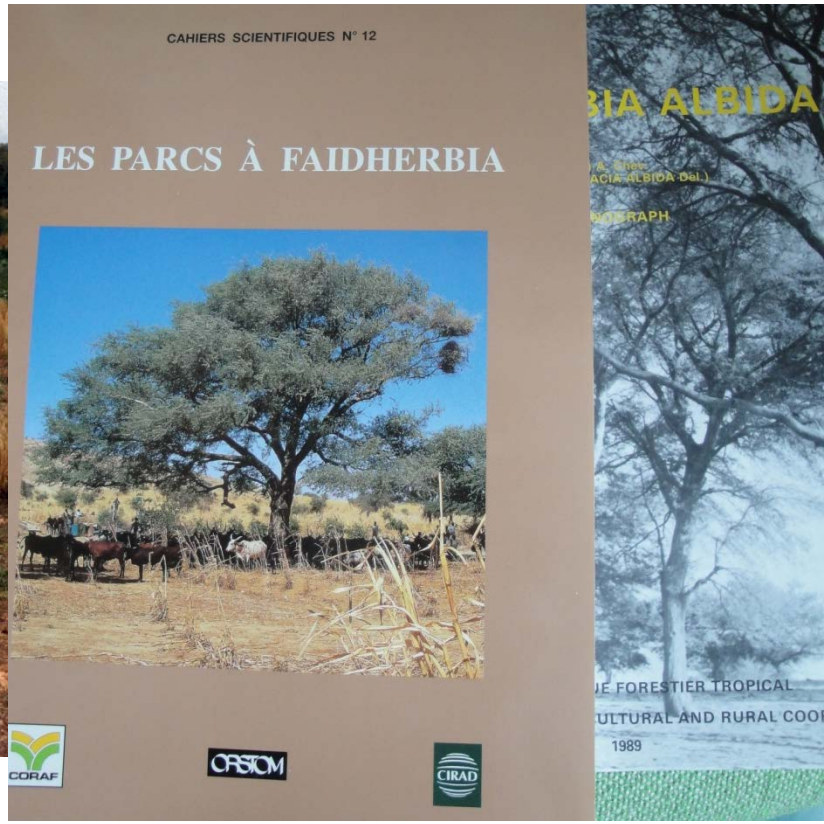
This is why the great traditional agroforestry trees have been only preserved in the home-gardens, cultivated with the hoe. These “modern lines agroforestry systems” were less effective than traditional parkland for the conservation of soil fertility, more workforce consumers, less compatible with traditional breeding. That is why **they have remained confined into research stations.**

http://funcitree.nina.no/

FUNCiTREE

This explains why, despite all their advantages , the area extension of *Faidherbia* agroforestry systems (parklands) was far below what it could be, despite the isolated actions of many extension services and NGOs

The northern Cameroon example shows that new researchs on crop productivity under *Faidherbia* helped changing the perception of this tree by services and operators of agricultural development, in the 1990s.



http://funcitree.nina.no/

FUNCiTREE

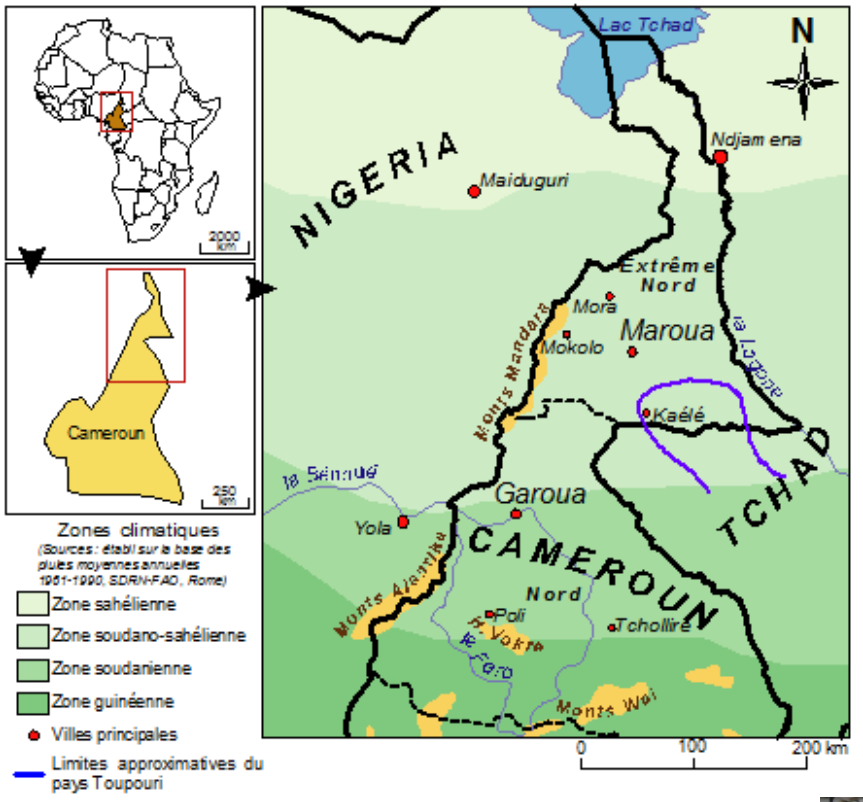
Then it was possible to "boost" the restoration of these parklands on a large scale, mobilizing public funding, associations and farmer organizations and subsidizing (even at a low level) Assisted Natural Regeneration (**ANR**).

http://funcitree.nina.no/

FUNCiTREE

Study Method:

Socio-economic surveys, trees inventories and pruning trials, were conducted in northern Cameroon, in 2012



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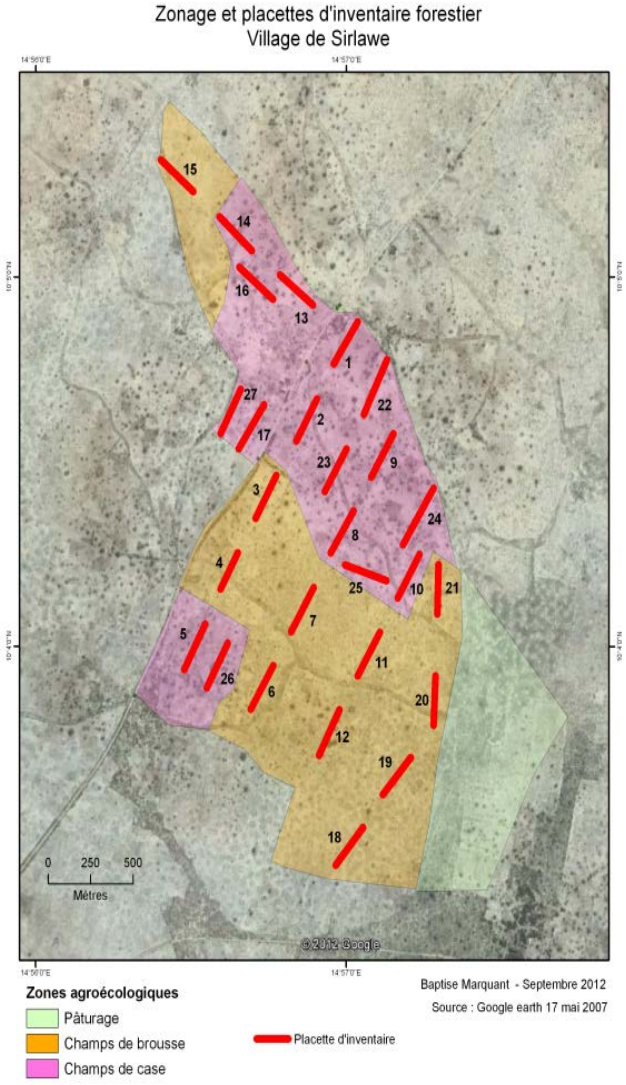
FUNCiTREE

Survey of Gane and Sirlawe landscape,by agroecological zones inventoried.



The measurements made during inventories are:
- DBH for all species;
- Height and floor projection for *Faidherbia* never been pruned;
- *Faidherbia* spruts number.

These data will be determined by agro-ecological zones and village
- *Faidherbia* densities relative to other trees;
- Structures and dynamics of *Faidherbia* stands;
- Coverage percentages of *Faidherbia*.

Some of these settings tree stands will be compared to those identified by ENGREF ten and twenty years ago.

Agroecological zones	Surface (ha)	N plots	Plots surface (ha)	Sampling rate (%)
"Home fields" Gane	259	11	1	4
"Bush fields" Gane	124	12	0.6	6
" Home fields " Sirlawe	177	16	1	9
" Bush fields " Sirlawe	231	11	1	5

Calculating the annual productivity of *Faidherbia* fuel-wood, obtained by pruning, at two village landscape

From 2004 to 2006, ENGREF conducted a first round of pruning of 60 *Faidherbia* in a range of the widest DBH. In 2012, it was decided to select from all databases of the trees pruned by ENGREF, 29 trees of various DBH.

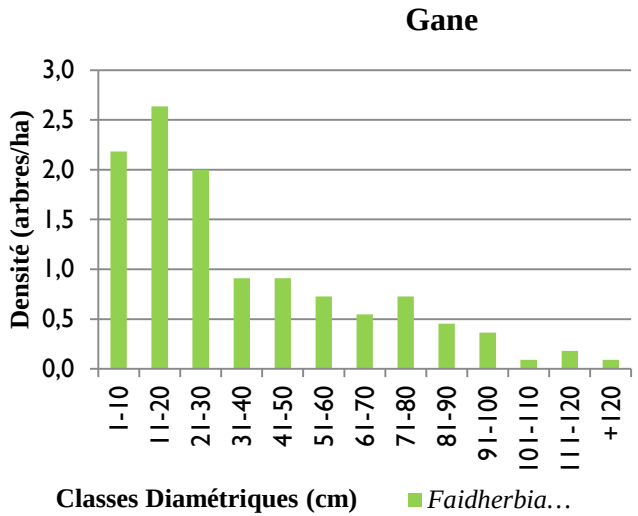
These trees have been pruned to new, 6 to 8 years later, and the wood has been weighed.

FUNCiTREE

Results of *Faidherbia* surveys in Gane

Year	2012 Home fields (N=11)	2003 Home fields (N=10)	2012 Bush fields (N=12)	2003 Bush fields (N=31)
Mean	11,9	6,9	27,6	19,9
Standard deviation	6,7	2,9	17,3	19,8
Standard deviation to the Mean	2,0	0,9	5,0	3,6
Student test (ddl = N-1)	1,8	1,8	1,8	1,7
Sampling error	3,6	1,7	9,0	6,0
Confidence interval 90%	[8,3;15,6]	[5,2;8,6]	[18,7;36,6]	[13,9;25,9]

Comparison of *Faidherbia* inventories, in the village of Gane, in numbers of trees / ha, between 2003 and 2012.

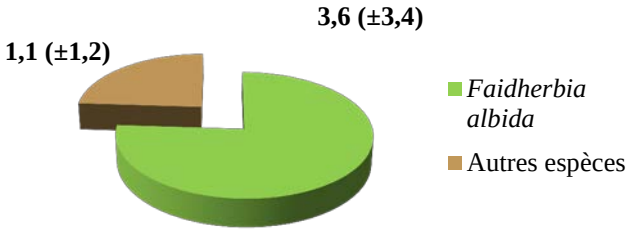


Diametric structures in stands of *Faidherbia albida*

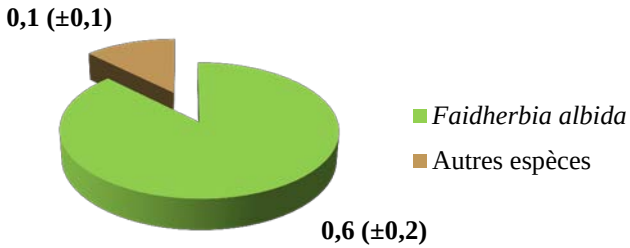
Results of *Faidherbia* surveys in Gane, species biodiversity

(Basal area of *Faidherbia* and others species in m²/ha)

Home fields



Bush fields



Discussion

Concerning the recovery of biomass between the two pruning, the results show a wide difference between the two villages. The recovery rate in the village of Sirlawe is 27% (± 10.7) and it is much more important for Gane: 127% (± 26). In the latter case, the pruned biomass was totally restored after seven to eight years. The difference can be explained by the height of the water table, the closer it is to the surface, the higher the rate of recovery.

Taking into account the results of forest inventories and the model of the annual productivity of pruned *Faidherbia* wood, it is possible to **calculate the amount of pruned wood on both village lands**.

Weighing bundles of firewood used by families surveyed have established an average daily household consumption per person for each of the two villages. The combination of these data allows us to show that the pruned *Faidherbia* wood ensures resource needs for firewood kitchen preparation of 1600 and 1,800 people, respectively Gane and Sirlawe, during 3 months, **a quarter of the annual needs**.

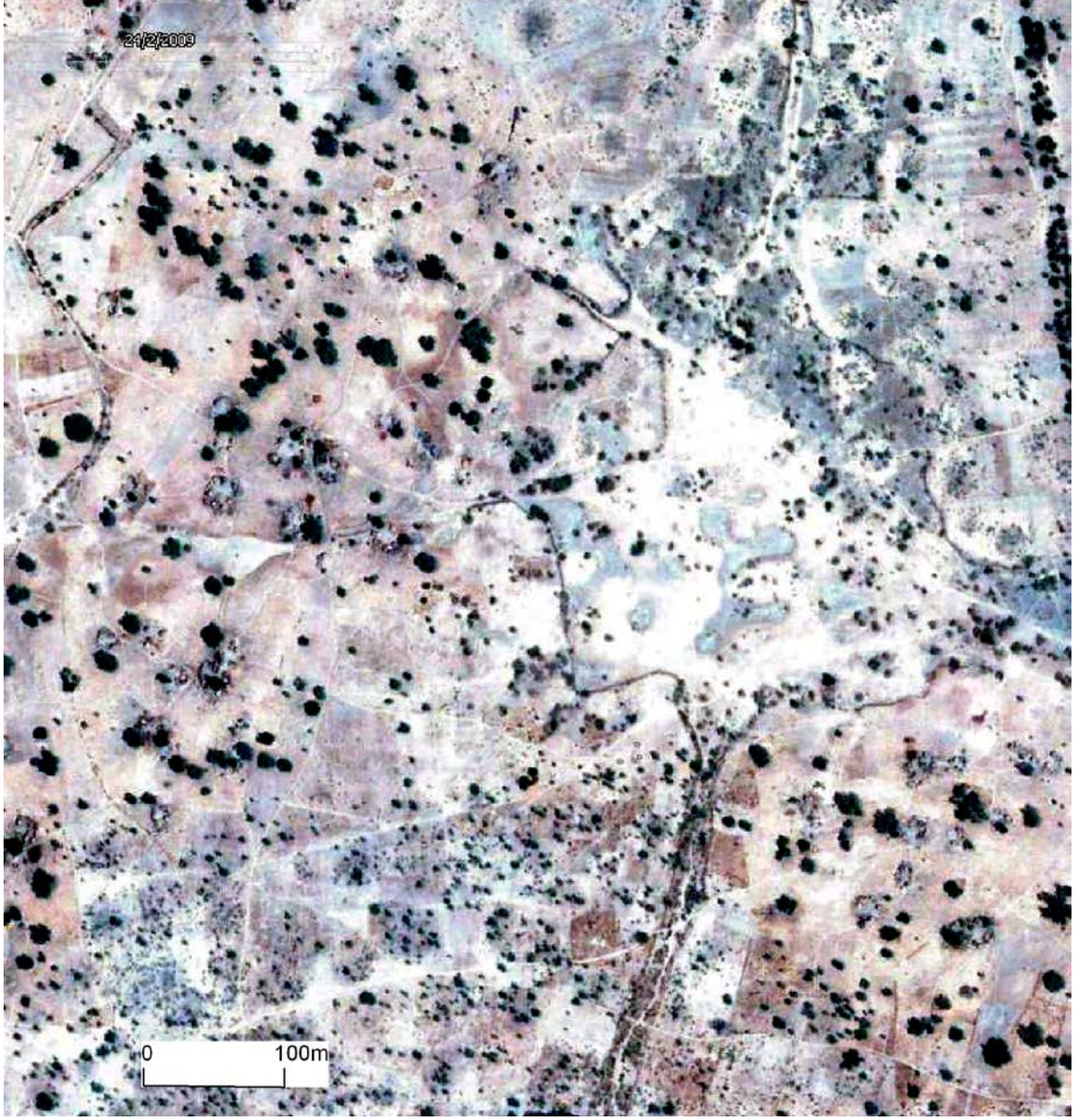
http://funcitree.nina.no/

FUNCiTREE

Conclusion

These studies on *Faidherbia albida* have helped Cameroonian farmers to keep more than

one million young trees



FUNCiTREE

But these studies have also helped to change the law in the sense of increasing the rights of peasants on the tree. This concern planted trees, often exotic, but also natural species kept and maintained by farmers, such as *Faidherbia,* shea-butter tree (*Vitellaria paradoxa)* and many other multipurpose species.

http://funcitree.nina.no/

FUNCiTREE

Thank you very much for attention and thank for the project Funcitree team

http://funcitree.nina.no/

FUNCiTREE

Functional Diversity:
An ecological framework for sustainable and adaptable agro-forestry systems in landscapes of semi-arid ecoregions.

Based on the principles of functional ecology, FUNCiTREE addresses the provision of multiple services of silvopastoral systems (SPS) in semi-arid regions in Africa and Central America. FUNCiTREE aims to provide farmers in the regions with a portfolio of regionally suitable tree species that are capable of providing multiple services. The project integrates theories and concepts from agroforestry and ecological science and will provide a scientifically based model for the design of modernized SPS.

NINA (Norway): The leading research center in Norway on applied ecology, emphasizing the interaction between human society, natural resources and biodiversity

CATIE (Costa Rica): A regional research and education centre about agricultural sustainability, environmental protection and poverty eradication

WUR (The Netherlands): Internationally leading university in agricultural Almeria has a focus on organism responses to drought, ecological interactions, biodiversity conservation, desertification, and soil science

CIRAD (France): Research on agro-ecosystems for international sustainable development, environmental, and climate research

CSIC (Spain): Research at the Arid Zones Research Station,

ISRA (Senegal): Priority areas relate to agronomic, animal and forest production, and rural economy

IER (Mali): The leading research centre in Mali on agriculture and agro-ecosystems.

www.funcitree.nina.no