



REPORT

**FUNCiTREE is a research cooperation project
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FUNCiTREE – Final conference presentations

Session II: Multiple functions underpinning ecosystem services in agro-pastoral landscapes

REFERENCE:

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

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COVER PICTURE:

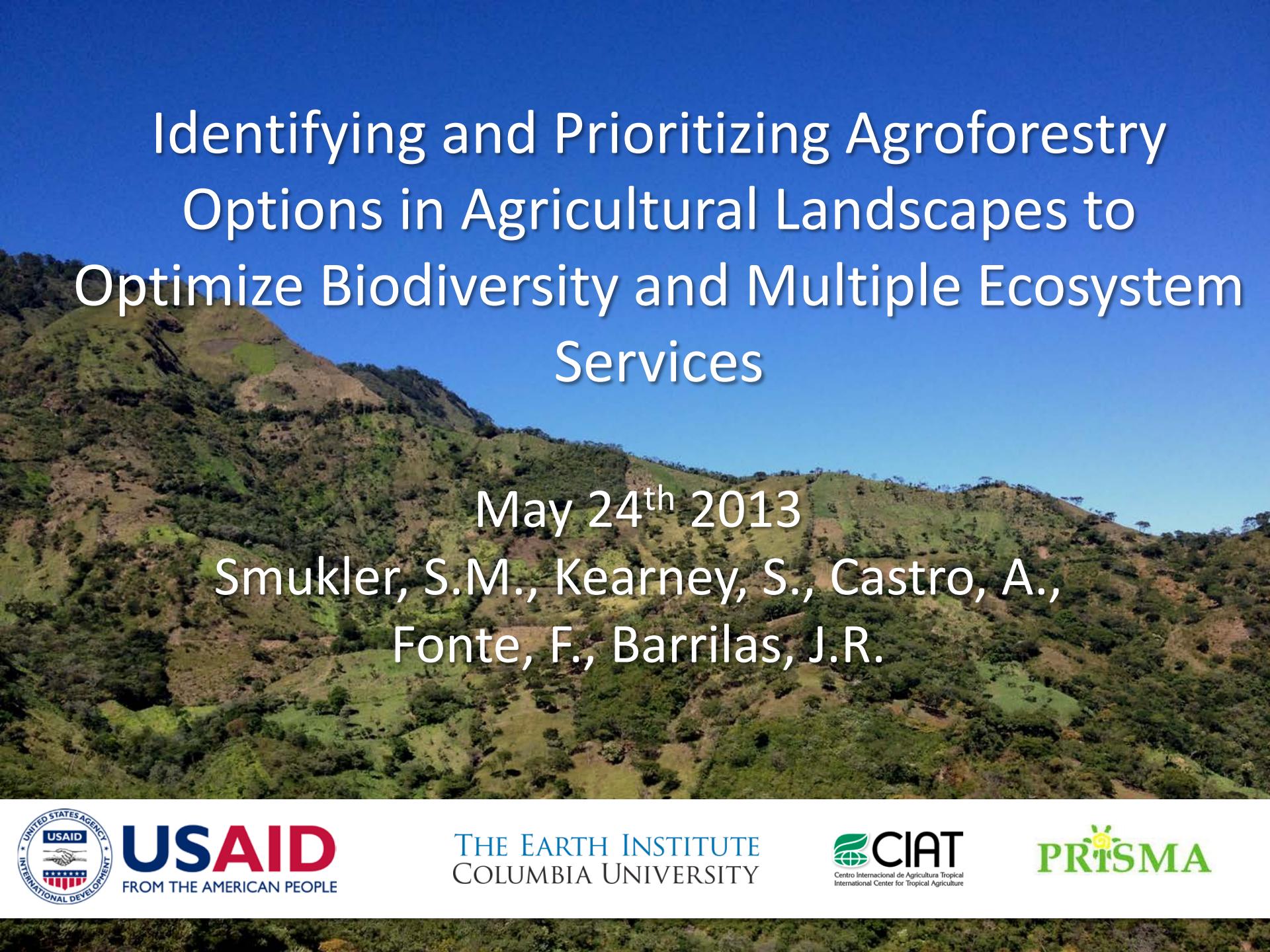
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KEYWORDS:

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

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Identifying and Prioritizing Agroforestry Options in Agricultural Landscapes to Optimize Biodiversity and Multiple Ecosystem Services

May 24th 2013

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 PRISMA



Outline

- Context - USAID project in El Salvador
- Methodology
- Some preliminary results
- Expected results

El Salvador

- 2nd most deforested country in Latin America after Haiti
- Since the 1960s, 85% deforested
- 14.4% forested
- 0.3% primary forest

(Photo: Edwin Garcia)

13 03 2013



Ministry of the Environment

- **Goal of the National Environment Policy 2012:**
 - Reverse environmental degradation and reduce vulnerability to climate change
- Goals of their National Program for Restoration of Ecosystems and Landscapes (PREP):
 - Improve watershed management
 - Retain and improve soil fertility
 - Protect critical ecosystems
 - Mitigate and adapt to climate change
- Preparing for REDD+





A photograph of a agricultural field. In the foreground, there is a dense crop of green corn plants. Behind the corn, several tall, thin trees with light-colored bark stand in a row. The sky is clear and blue.

Quesungual Slash and Mulch Agroforestry System (QSMAS)

Source: CIAT, 2006

Agroforestry (Quesungual) vs. Slash and Burn

100% more conservation of native vegetation at plot scale (14 species from 12 families)

Restoration of biodiversity at landscape level scale (50 species from 24 families)

Source: CIAT

Four times less global warming potential

Nicaragua: higher net income in the maize-bean system (83%)

Honduras:

Level of productivity in maize can be sustained with 40% less fertilizer

Higher productivity of maize (42%) and beans (38%)

Higher crop-water productivity in maize and beans (0.2 and 1.2 times, respectively)

Water holding capacity 20% higher

Ten times less nutrient losses (N, P, K)

Six times less soil losses through erosion



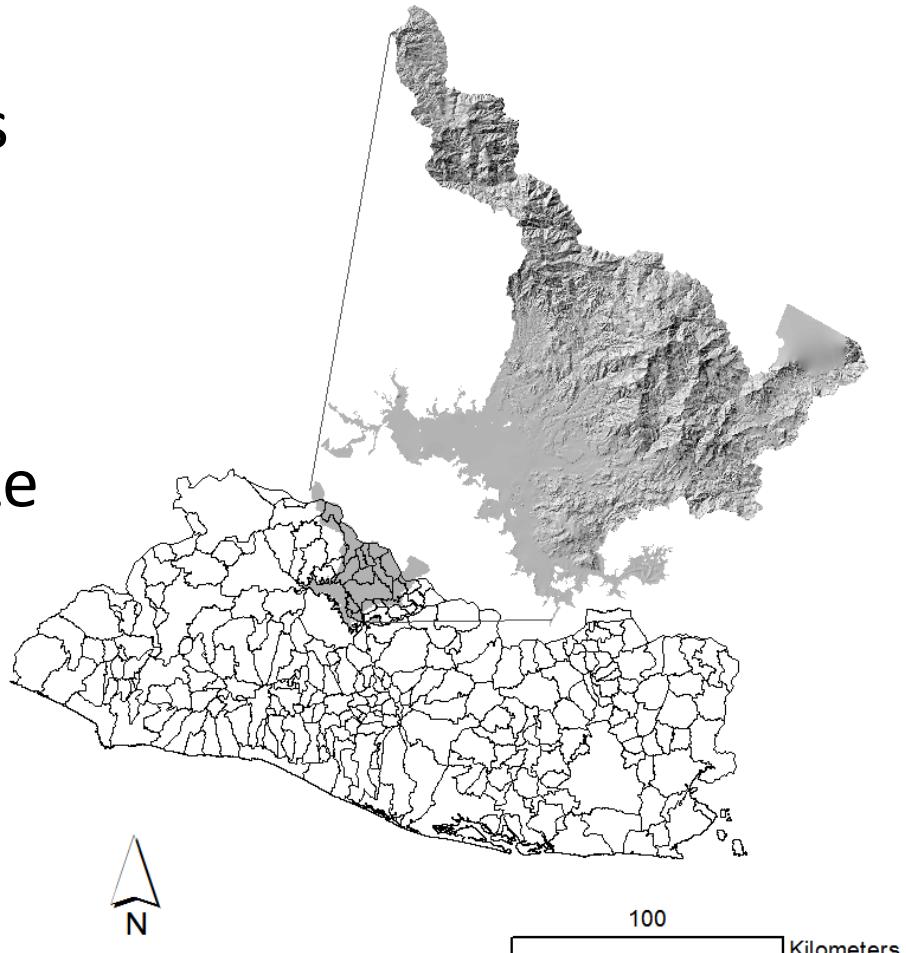
ABES Project

Agroforestry for Biodiversity and Ecosystem Services



USAID
FROM THE AMERICAN PEOPLE

- Working with farmers to develop an agroforestry strategy appropriate for steep hillsides that maximize farm income and protects natural resources
- 5 year collaboration
- Research-for-development



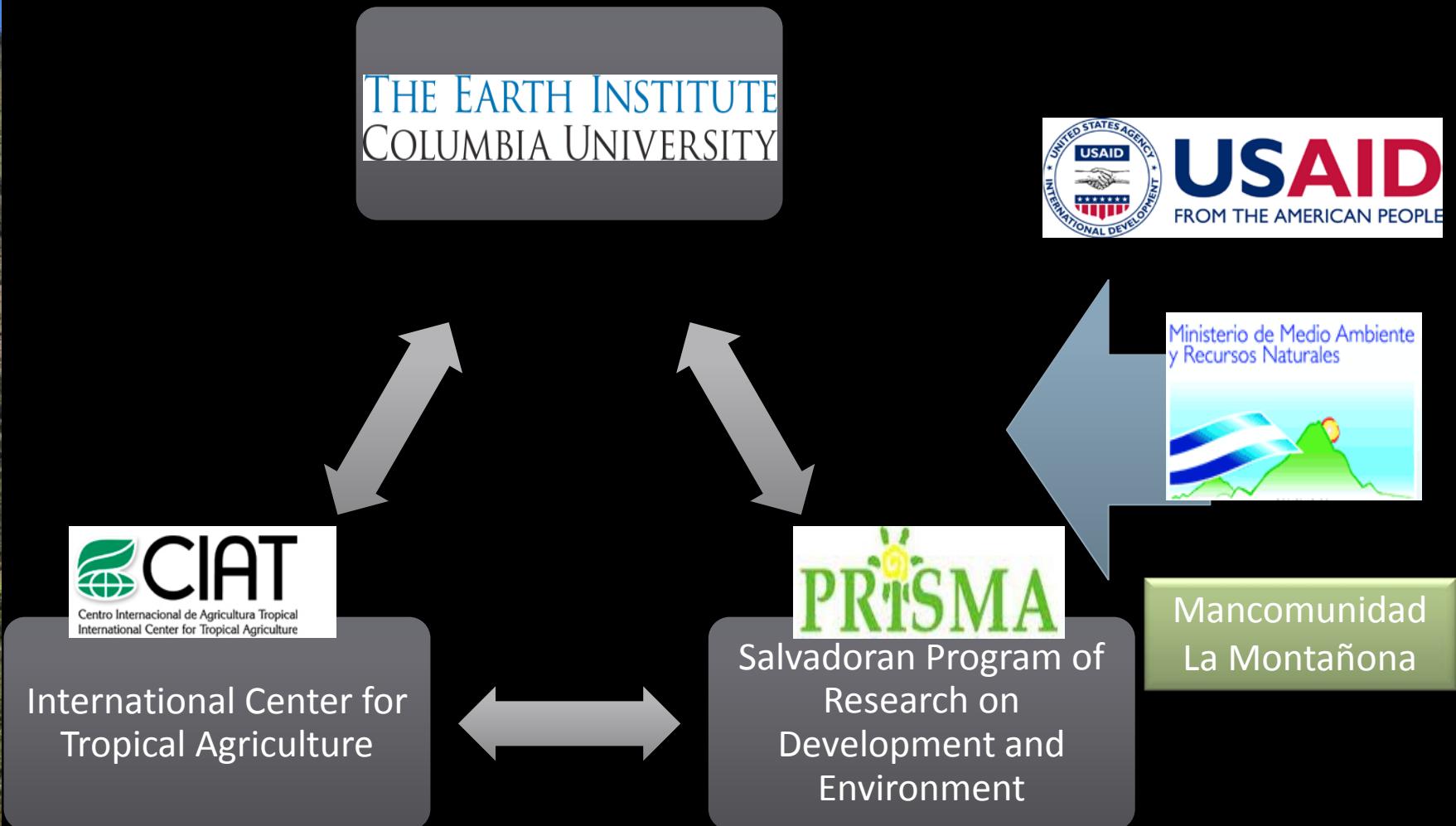
Montanona region, El
Salvador



Research Questions

- What are the limiting factors for adaptation to agroforestry? What are the strategies to overcome them?
- What is the potential for the agroforestry systems to increase farmer incomes compared to the alternatives?
- How will biodiversity and the availability of ecosystem services (eg carbon storage, erosion reduction) change with the adaptation to agroforestry?
- How much potential area could be agroforestry?
- How could changes in biodiversity and the availability of ecosystem services effect income?

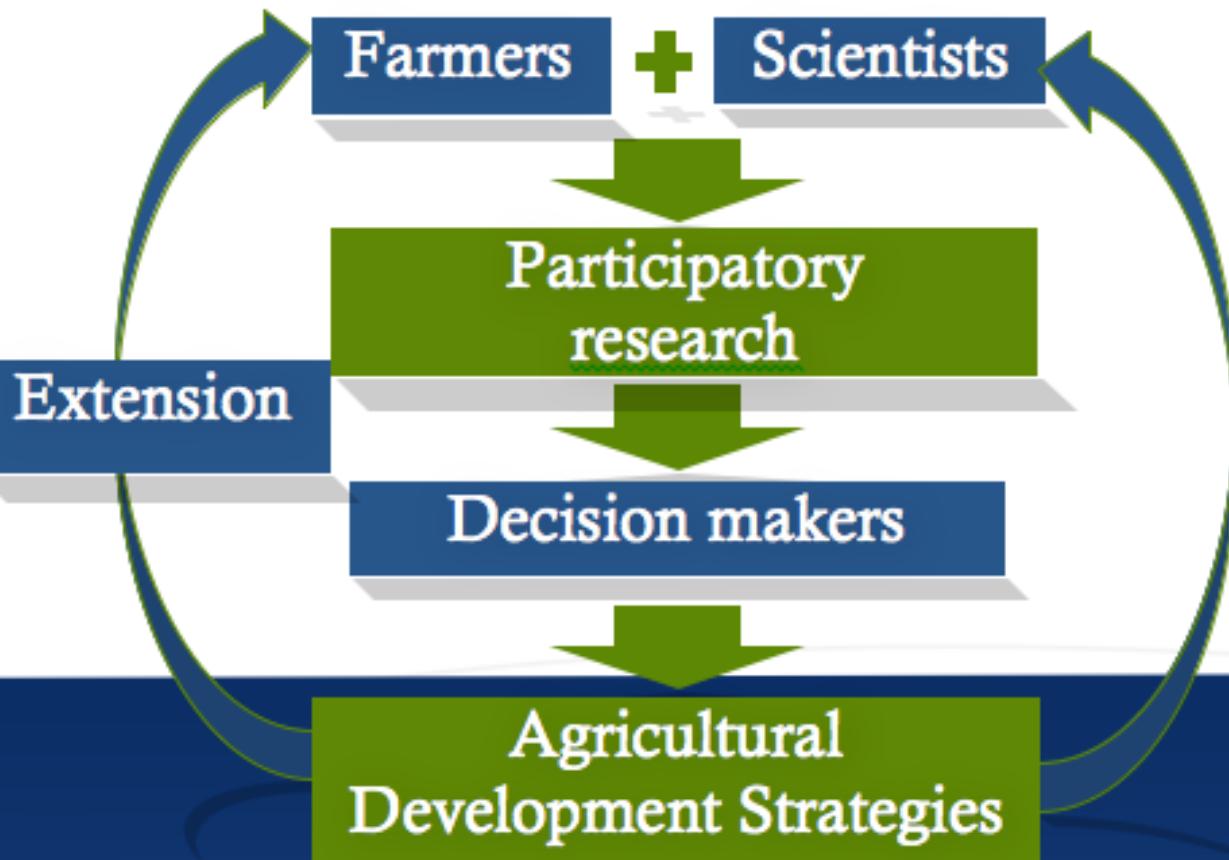
Project Collaboration



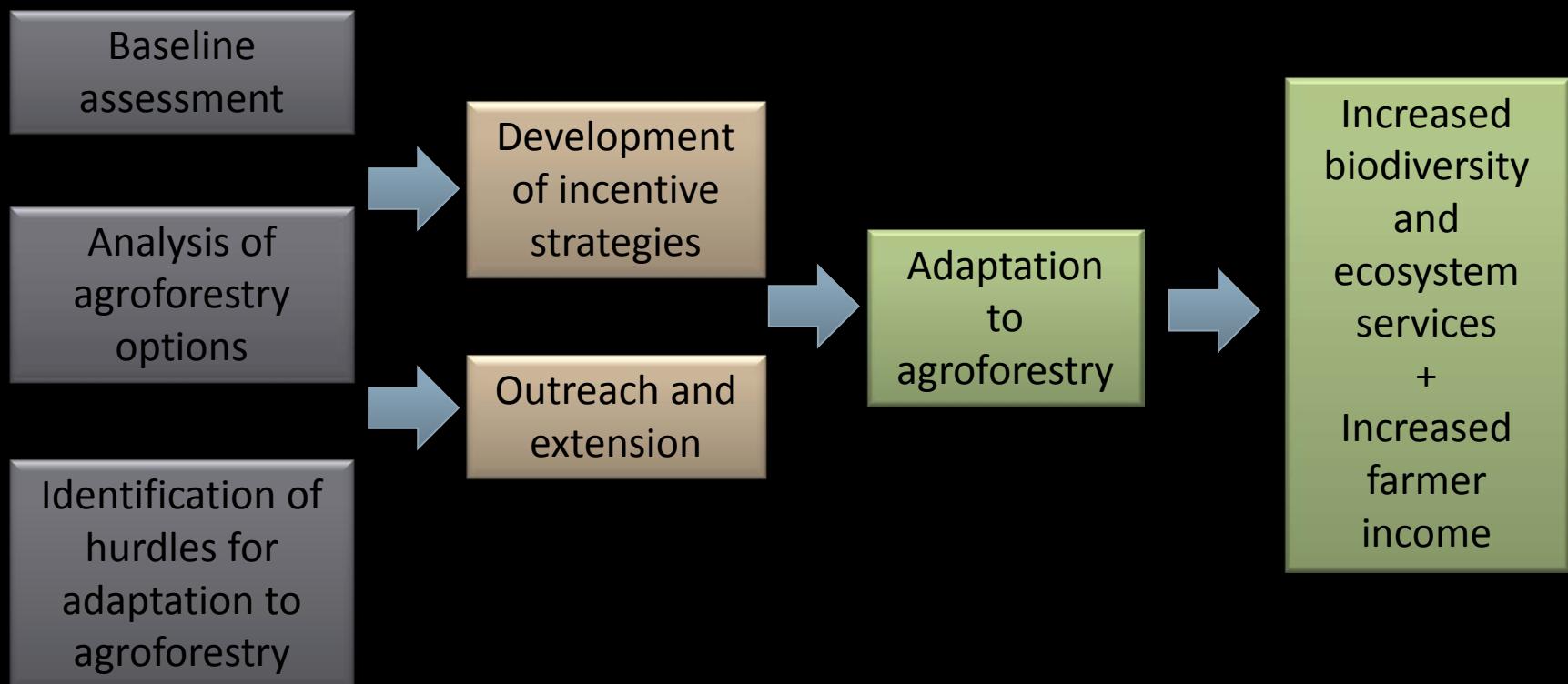


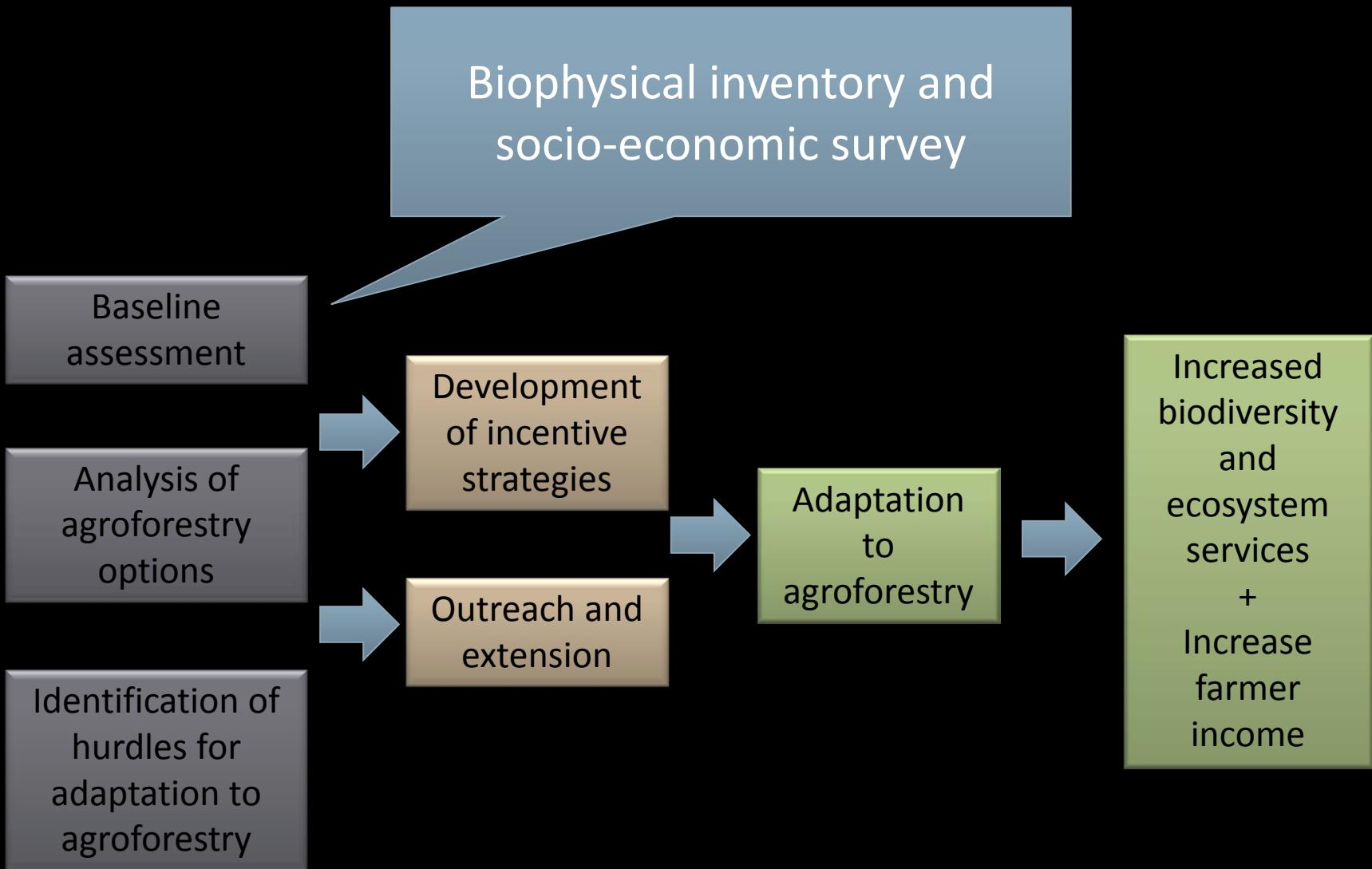
Methodology

Participatory Research



Agroforestry Research-for-Development Framework

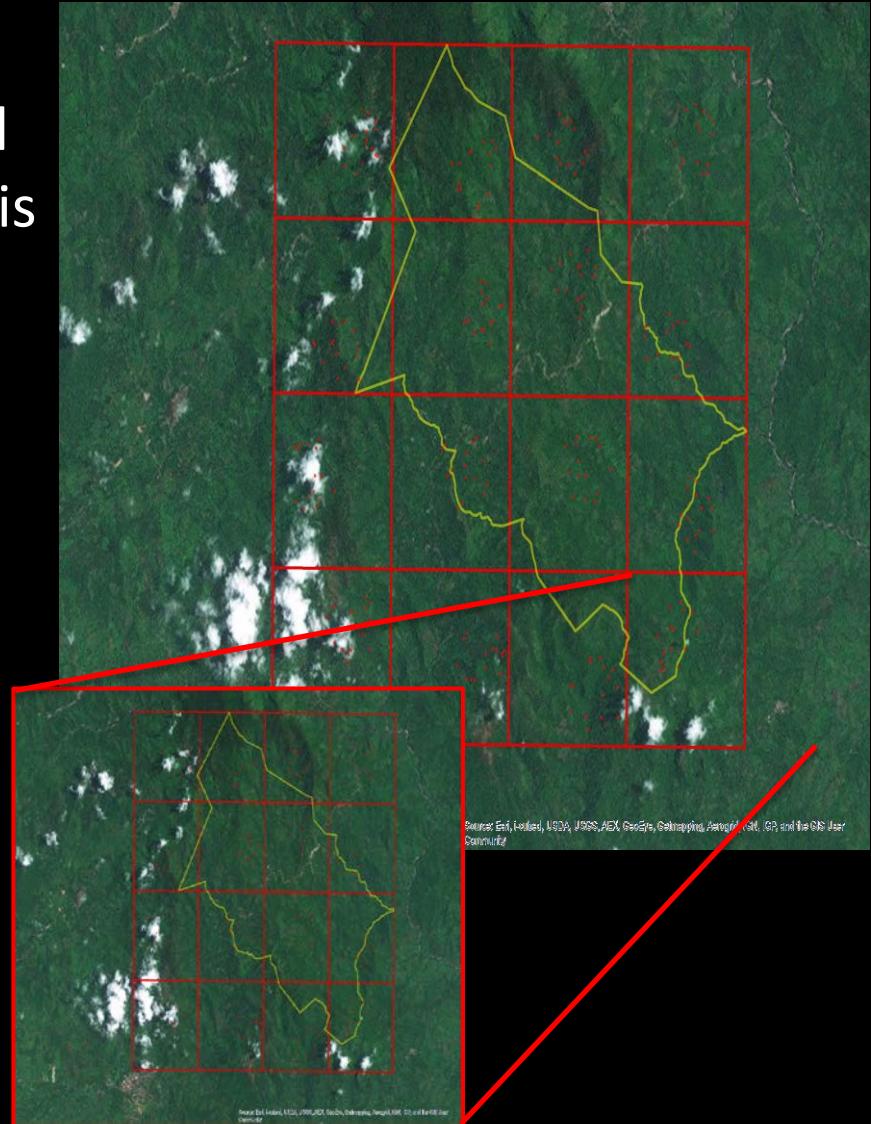




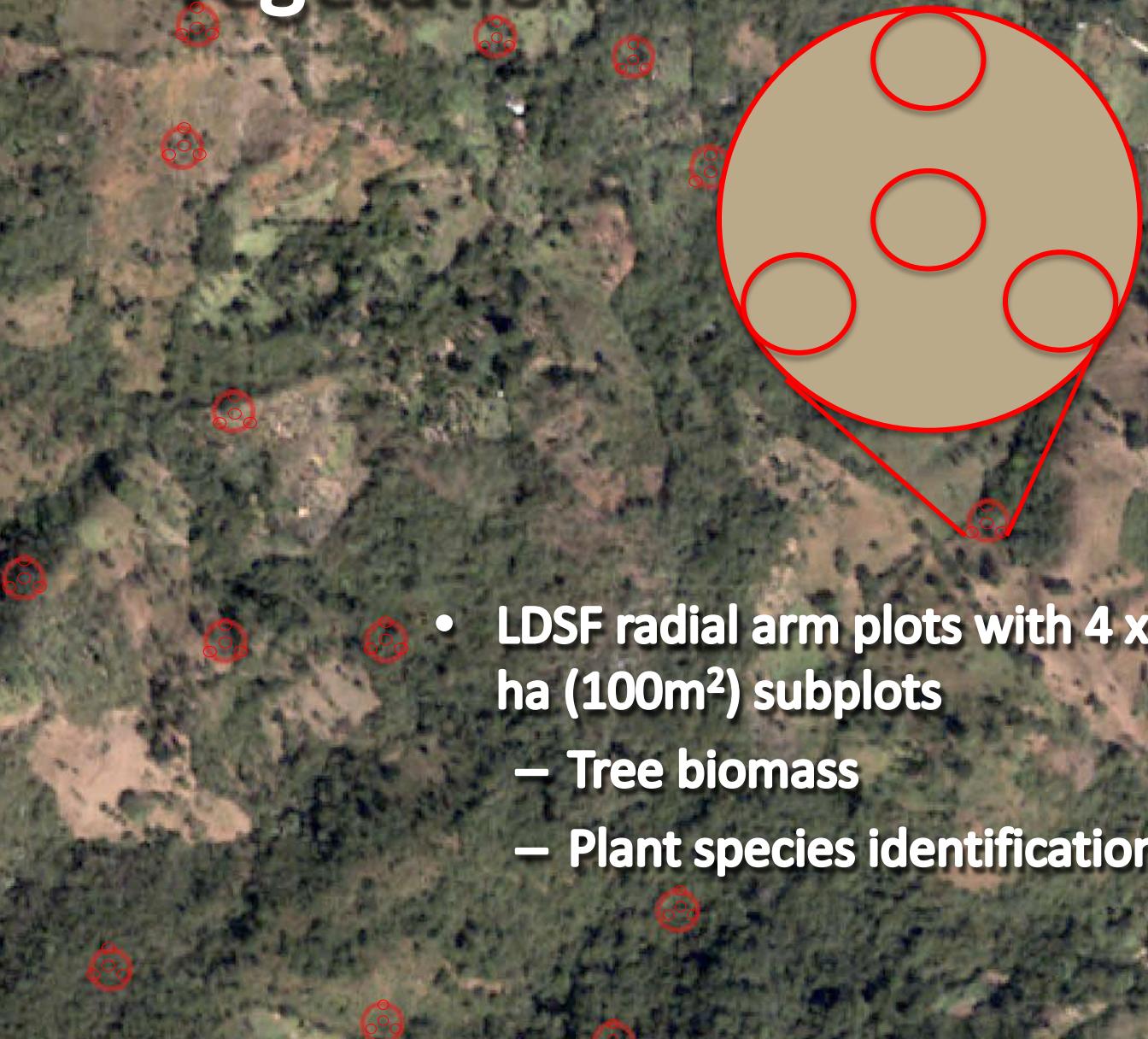
Linking field-based research and remote sensing

- Multiple-scale hierarchical data collection and analysis
- Based on The Land Degradation and Surveillance Framework (LDSF)
 - 160 x 0.1 ha plots
 - Field sampling – soils and vegetation
 - Quickbird high resolution imagery

(Walsh and Shepherd 2008)

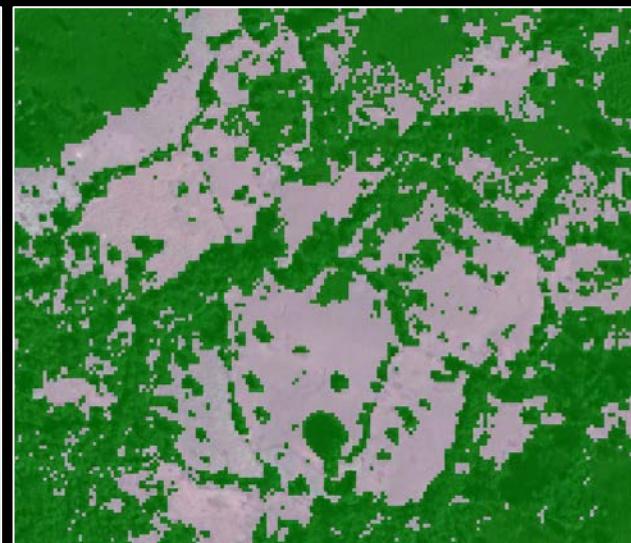
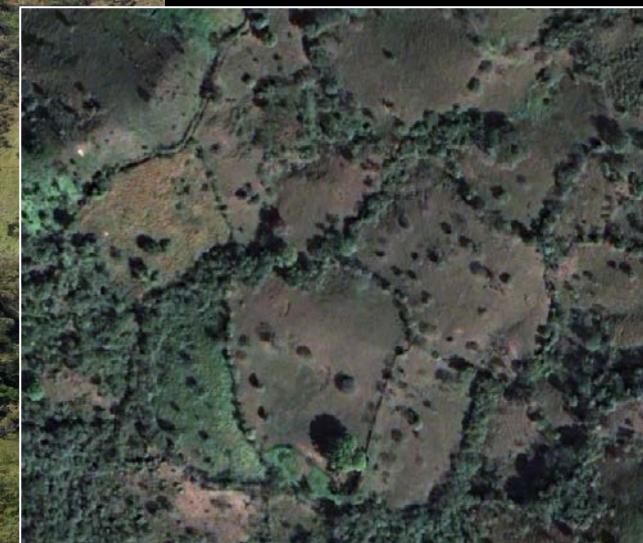


Landscape Inventory of Soil and Vegetation



Imagery Analysis

- Spectral mixing analysis (Small 2002)



High Resolution LULC Maps

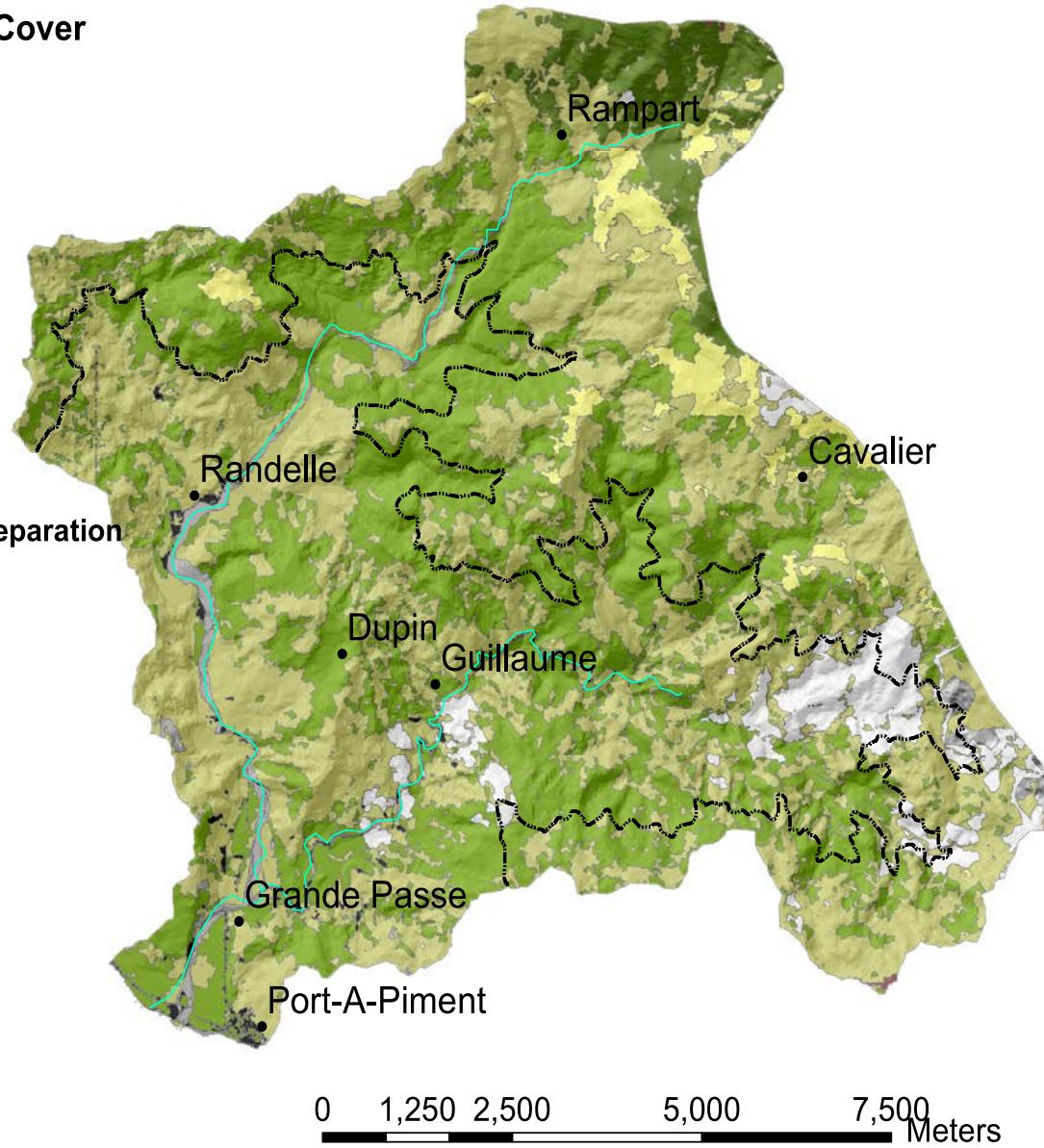
Land Use Land Cover

- Agriculture
- Agroforestry
- Barren land
- Clouds
- Forest
- Pastureland
- River bed
- Urban

— Watershed separation

— Rivers

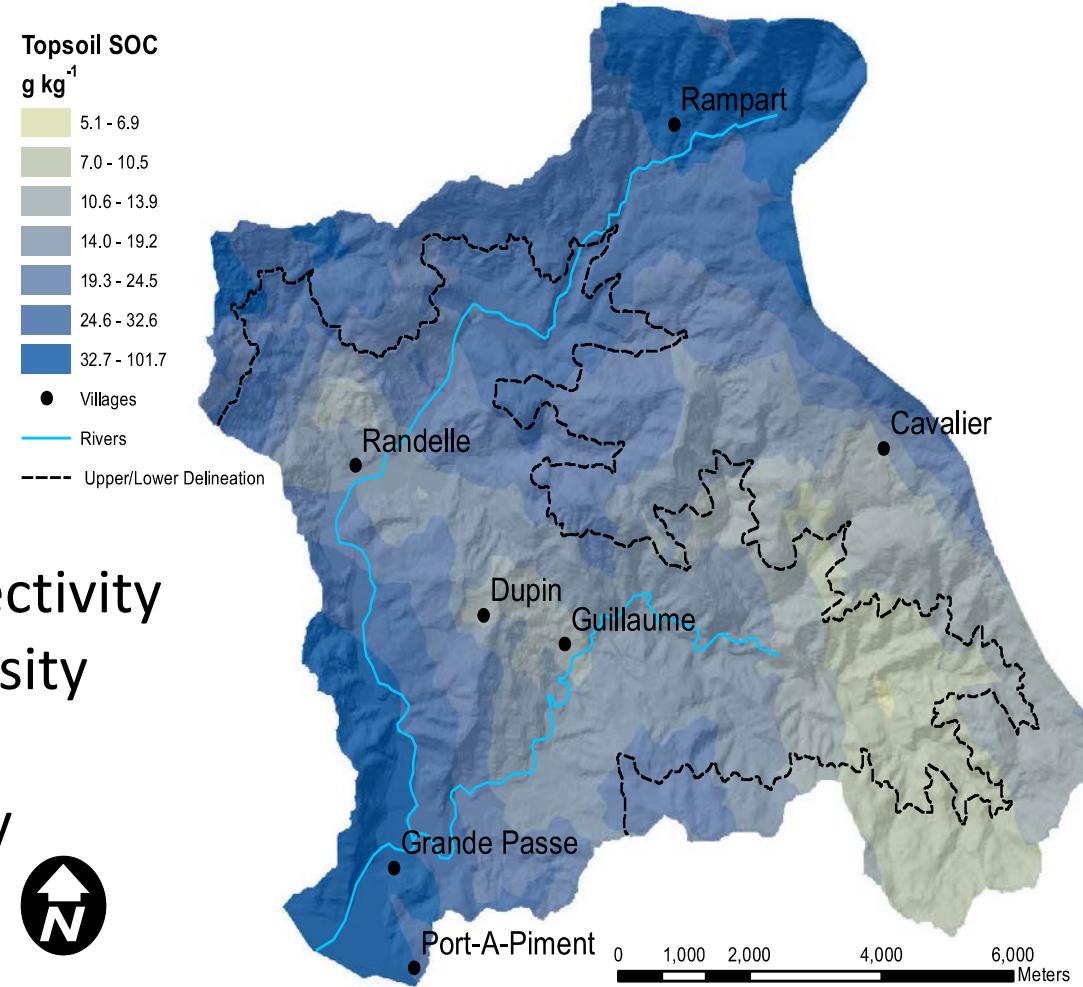
• Villages

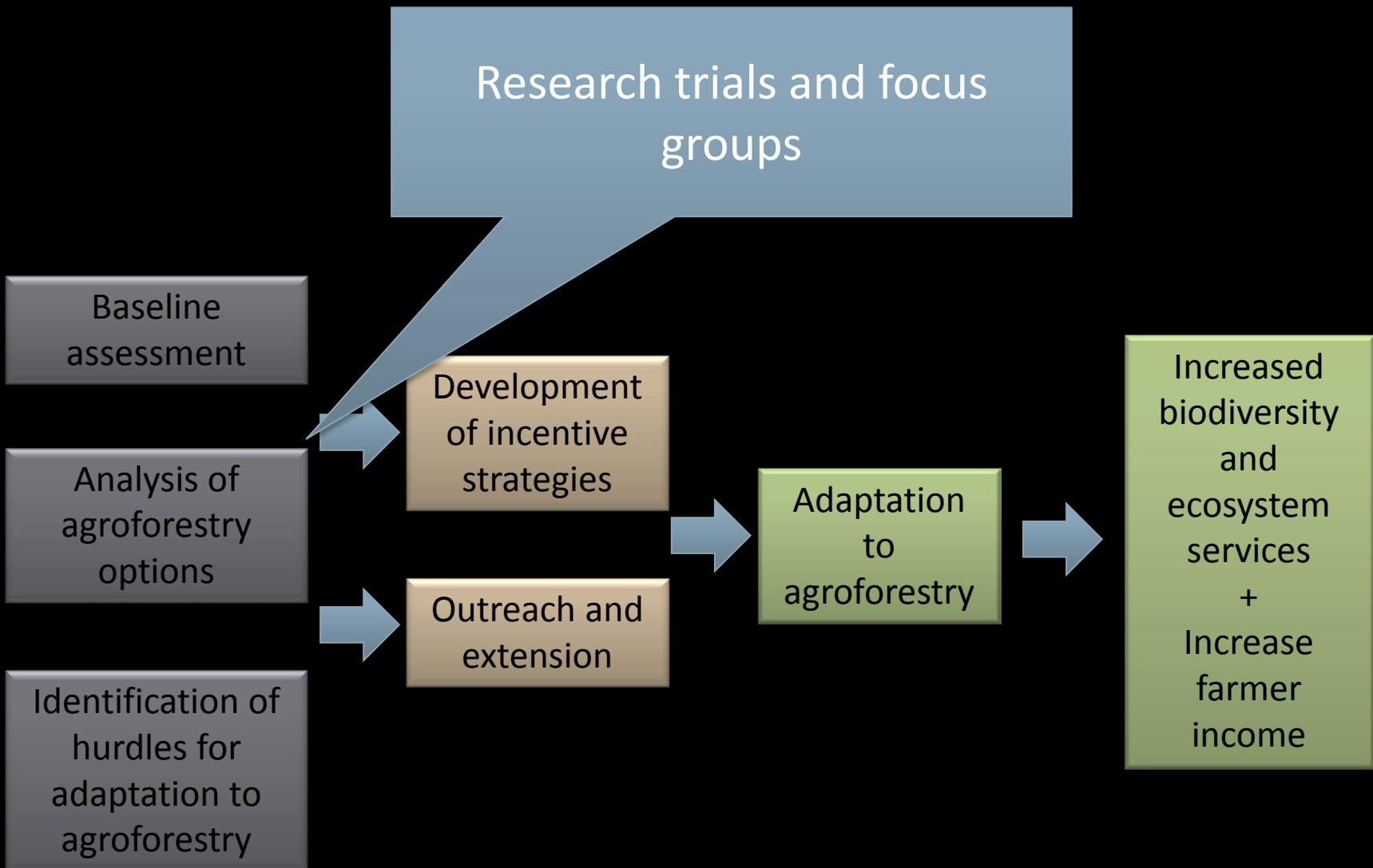


0 1,250 2,500 5,000 7,500 Meters

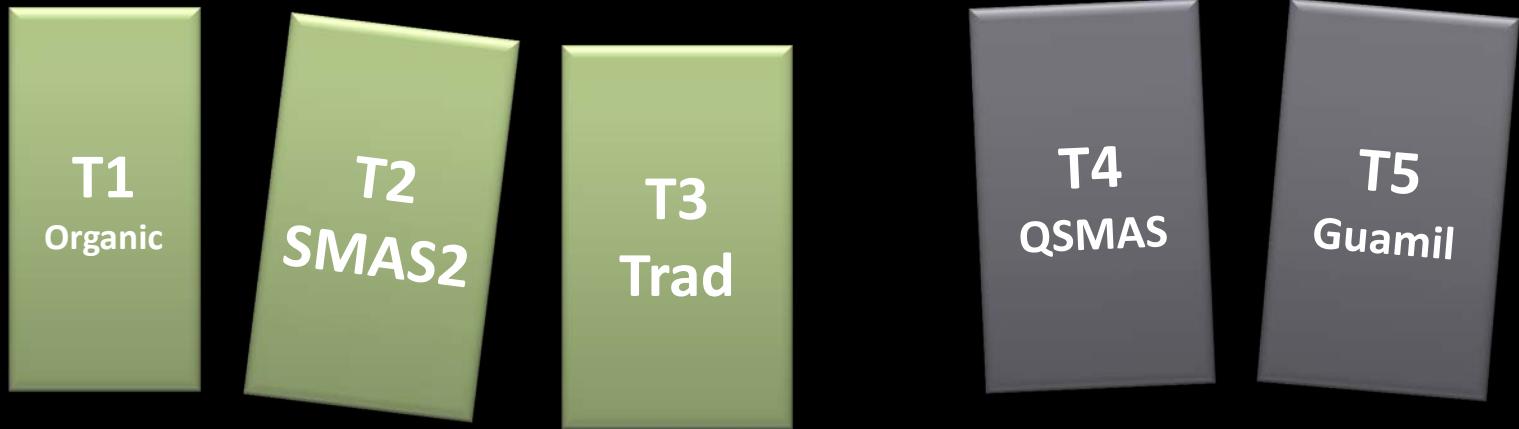
Landscape Biodiversity and Ecosystem Services

- Patch size and connectivity
- Tree and shrub diversity
- Erosion potential
- Fuelwood availability
- Carbon storage





Research /Demonstration Trials



Treatments

1. **Organic**
2. **SMAS2 – slash and mulch from no trees**
3. **Trad – traditional slash and burn cropping**
4. **SMAS1 – slash and mulch from regenerating forest**
5. **Guamil – regenerating forest (5-7 years old)**

Notas: T1 = 10 x 20 m

Research/Demonstration Plots



- Yield
- Erosion
- Carbon storage
- Soil, vegetation, avian, amphibian and reptile biodiversity

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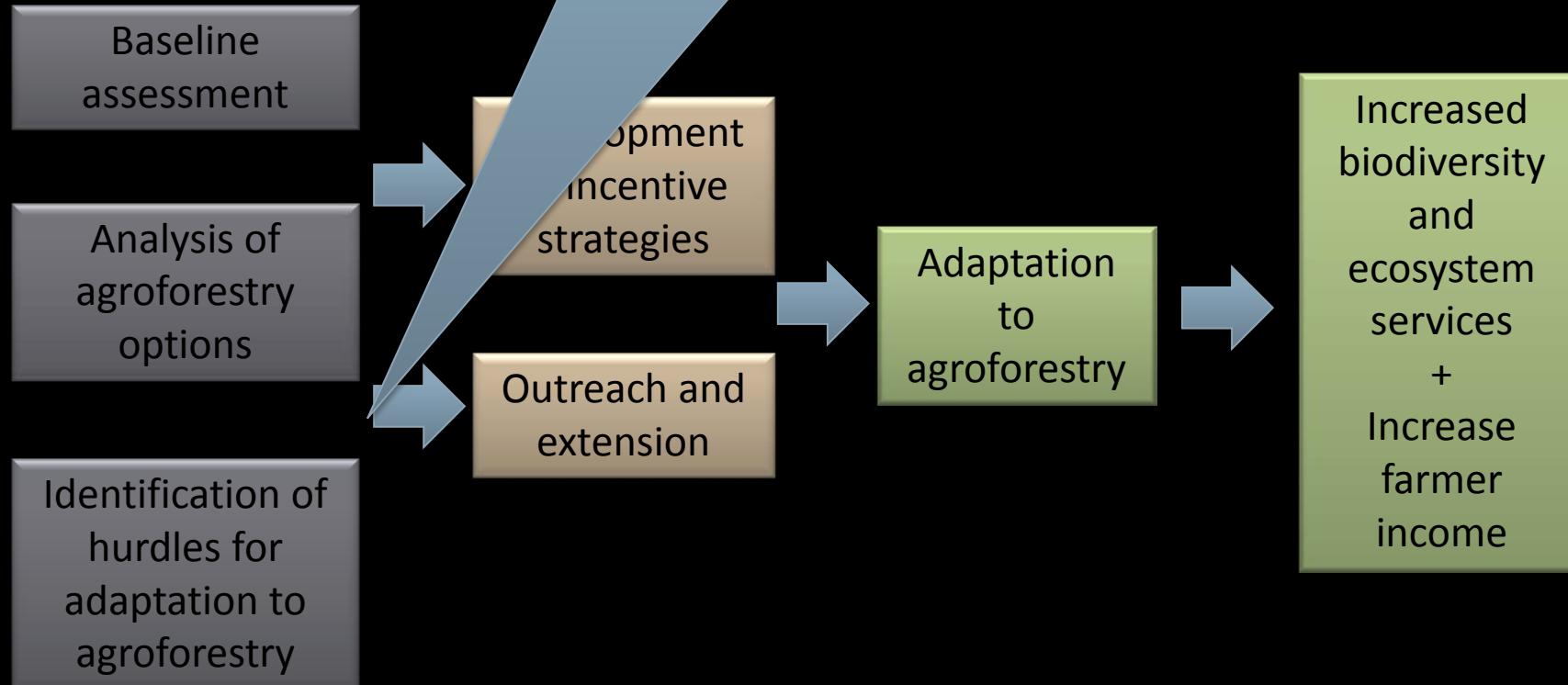
Focus Group Selection of Trees

(Photo: Edwin Garcia)

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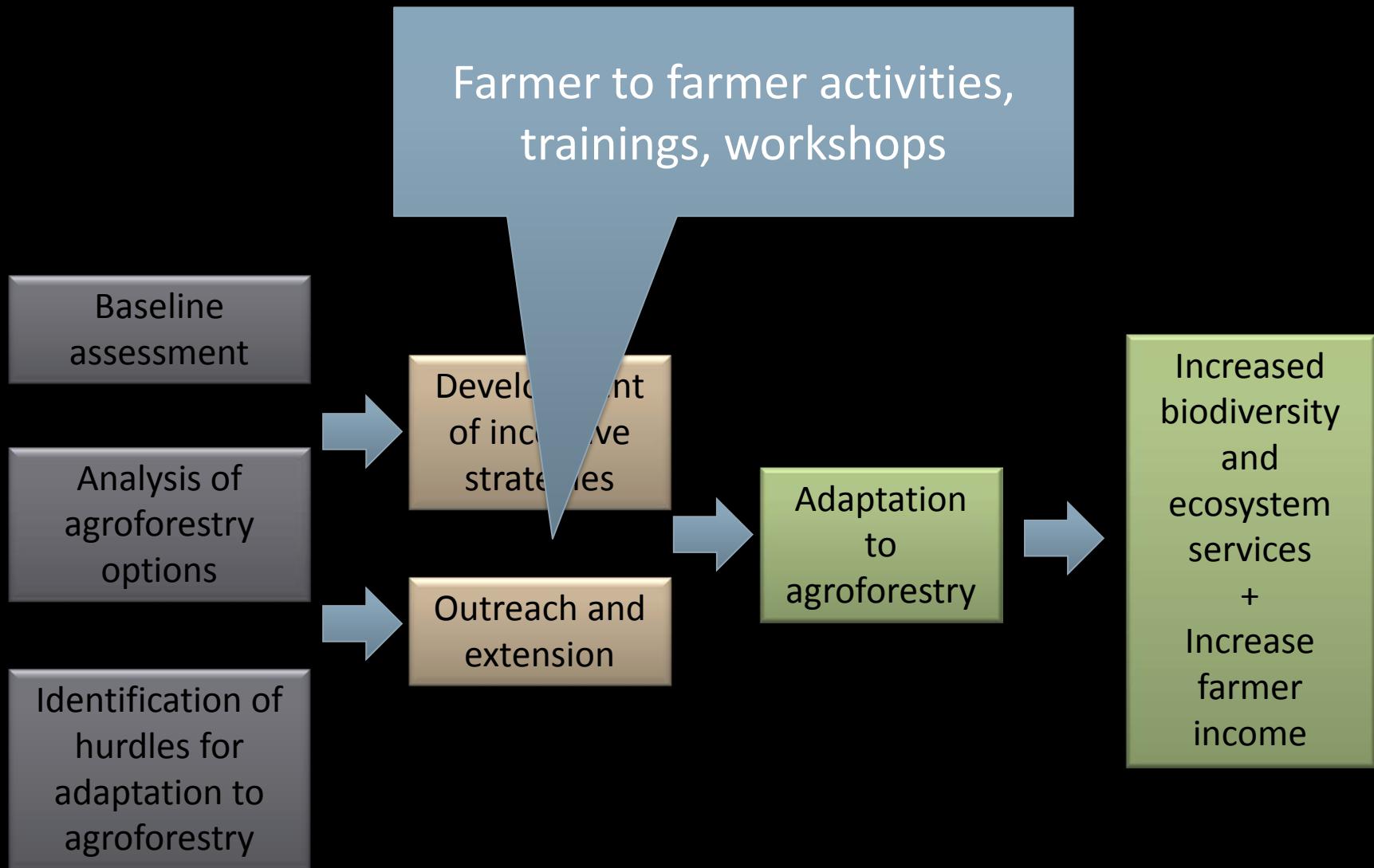
Farm economic analysis and participatory mapping



Participatory Landscape Resource Mapping



(Photo: PRISMA)



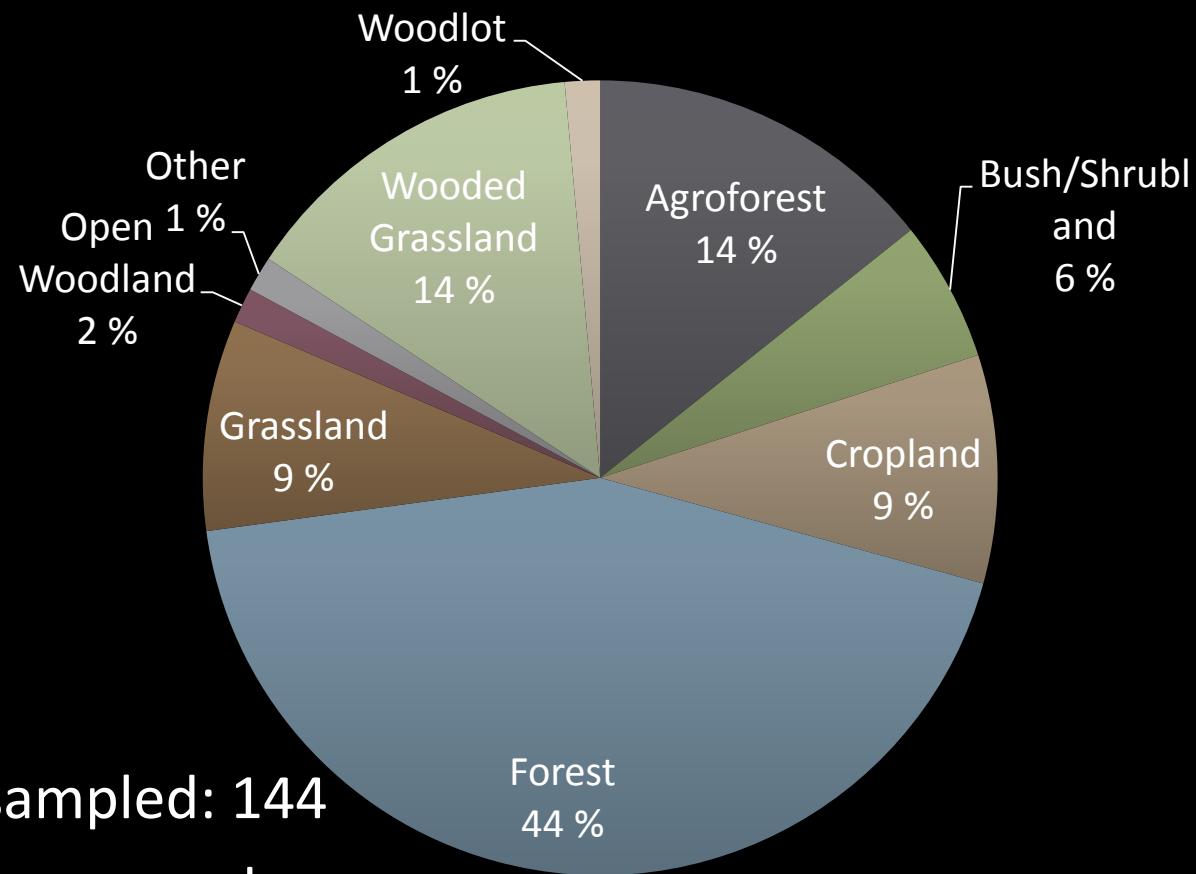
A photograph showing a group of approximately 15-20 men standing in a lush, green, overgrown field. They are dressed in casual clothing like t-shirts, jeans, and caps. Some have backpacks. In the background, there's a dense forest of tall trees under a clear sky.

Visit to Candelaria, Honduras October 2012



Preliminary Results

Landscape Baseline Assessment



- Number of sites sampled: 144
- 63% cultivated or managed
- 32% of cultivated/managed plots showed evidence of some impact from fire

Agroforestry Options

- Current practices
- SMAS 1 and 2
- Silvopastoral

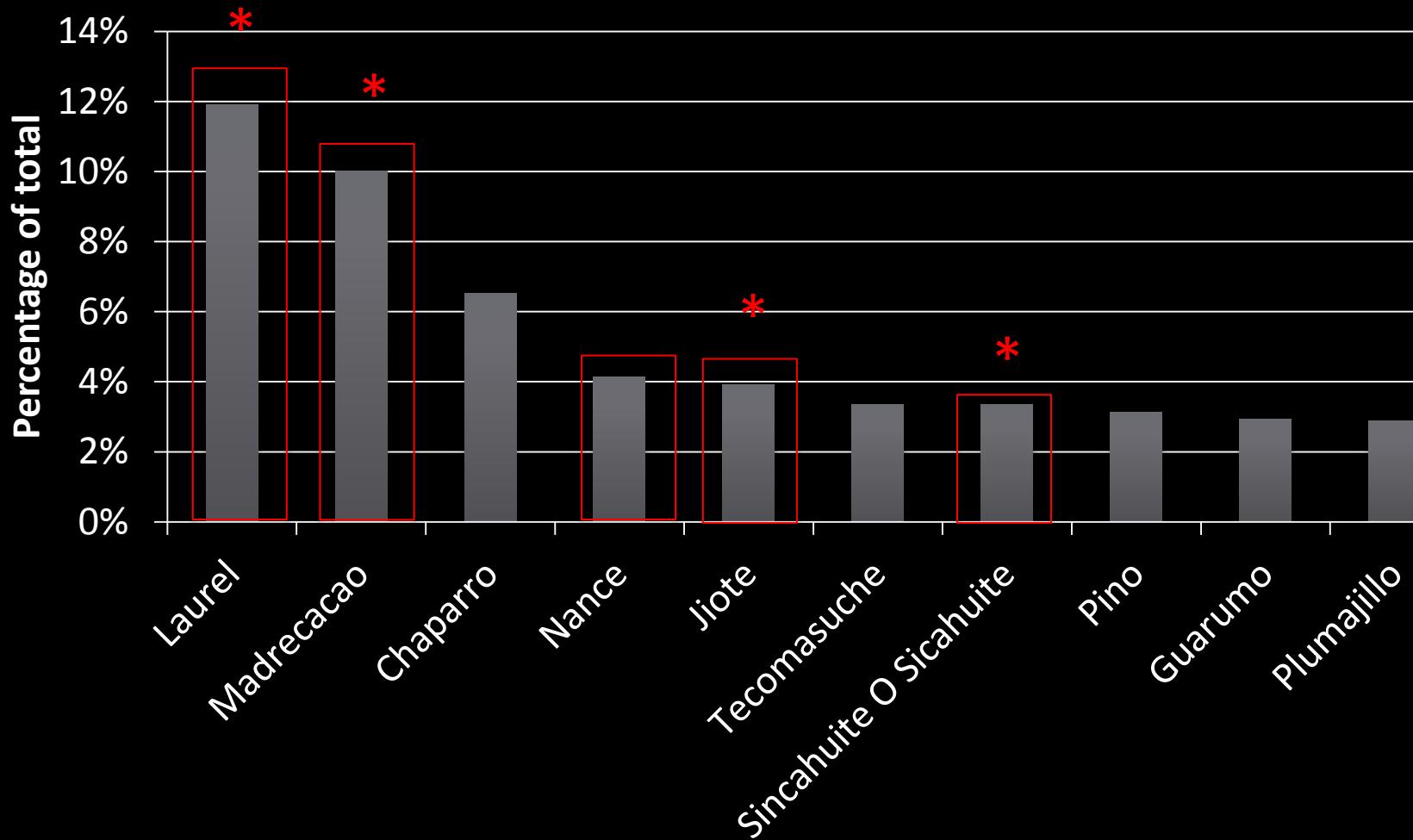


Producer Tree Preferences

No	Nombre Común	Nombre científico	Sub-familia	Principales usos en Las Vueltas	Otros usos
1	Madreado	<i>Gliricidia sepium</i>		Postes, Construcción y leña	forraje
2	Sicahuite	<i>Lysiloma acapulsence</i>	Mimosaceae	Postes, Construcción y leña	forraje
3	Guachipilin	<i>Diphysa Robinioides</i>	Paplionoideae	Postes, Construcción y leña	forraje
4	Jiote	<i>Bursera simaruba (L.) Sarg.</i>	Burseraceae	Estacas (brotones)	medicina y forraje. Madera blanda
5	Cedro	<i>Cedrela odorata L.</i>	Meliaceae	Construcción	
6	Cobano/Caoba	<i>Swietenia humilis</i>	Meliaceae	Construcción	
7	Nance	<i>Byrsonima crassifolia</i>	Malpighiaceae	Fruta, leña	
8	Copanchio	<i>Croton pseudoniveus Lundell</i>	Euphorbiaceae	Postes, Construcción y leña	
9	Laurel	<i>Cordia Alliodora</i>	Boaginaceae	Postes, Construcción y leña	
10	Aguacate	<i>Persea americana Mill.</i>	Lauraceae	Fruta, construcción y leña	
11	Mango	<i>Mangifera indica L.</i>	Anacardiaceae	Fruta, construcción y leña	
12	Naranja	<i>Citrus limetta Risso</i>	Rutaceae	Fruta y leña	
13	Marañon	<i>Anacardium Occidentale</i>	Anacardiaceae	Fruta y leña	
14	Quebracho	<i>Lysiloma acapulsence</i>	Mimosaceae	Postes, Construcción y leña	forraje
15	Nacuspilo	<i>Inga pavoniana G.Don</i>	Mimosaceae	Fruta, postes y leña	forraje

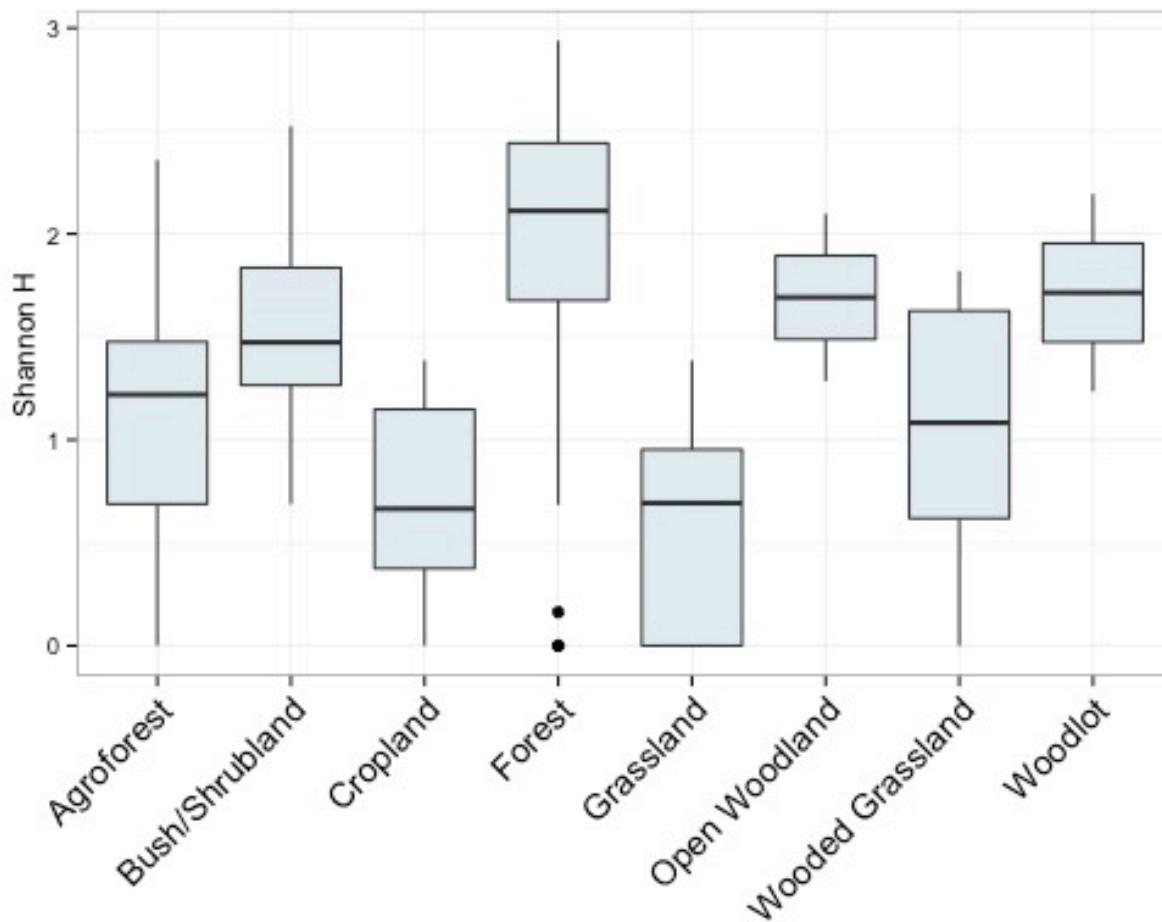
Tree Prevalence

10 most common species (52% of total)

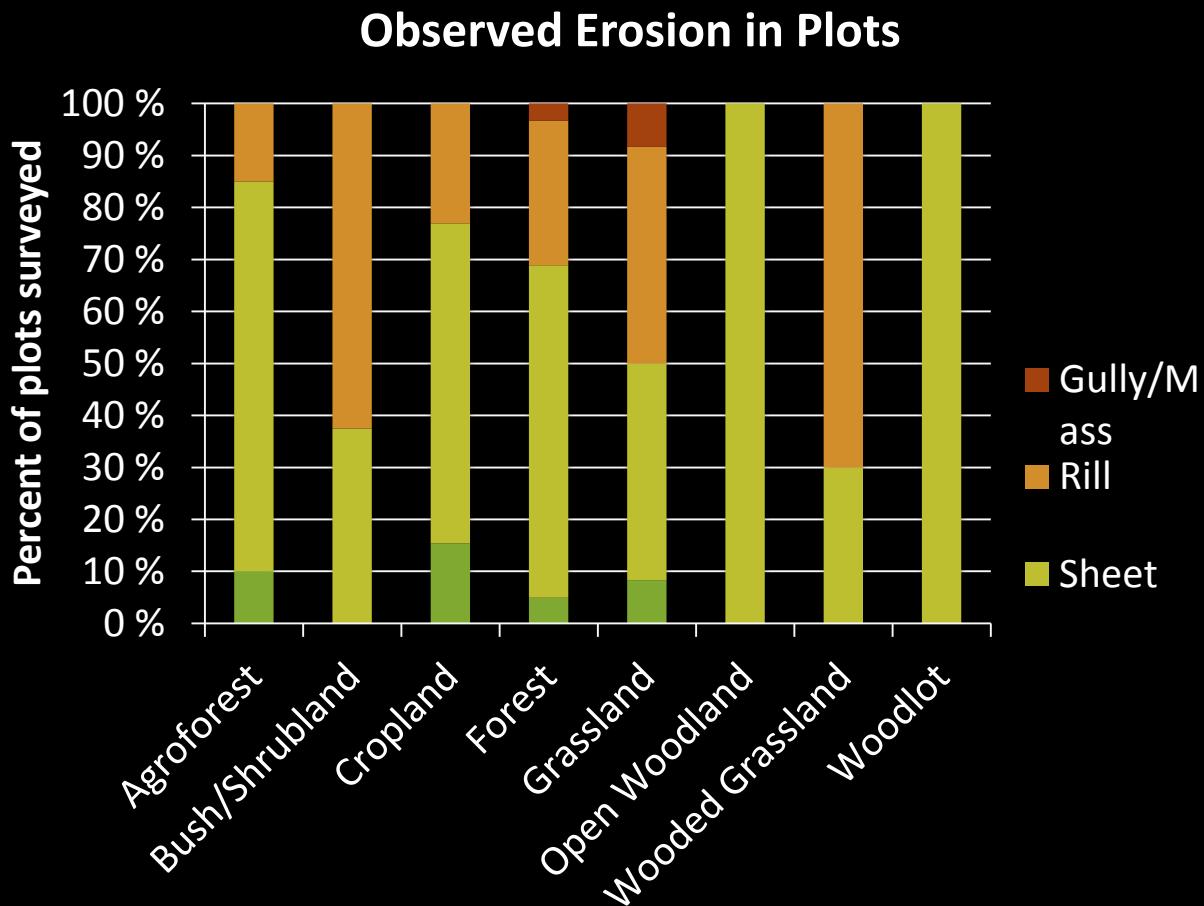


Tree and Shrub Diversity

Biodiversity Observed in BLA
(Shannon H Index)



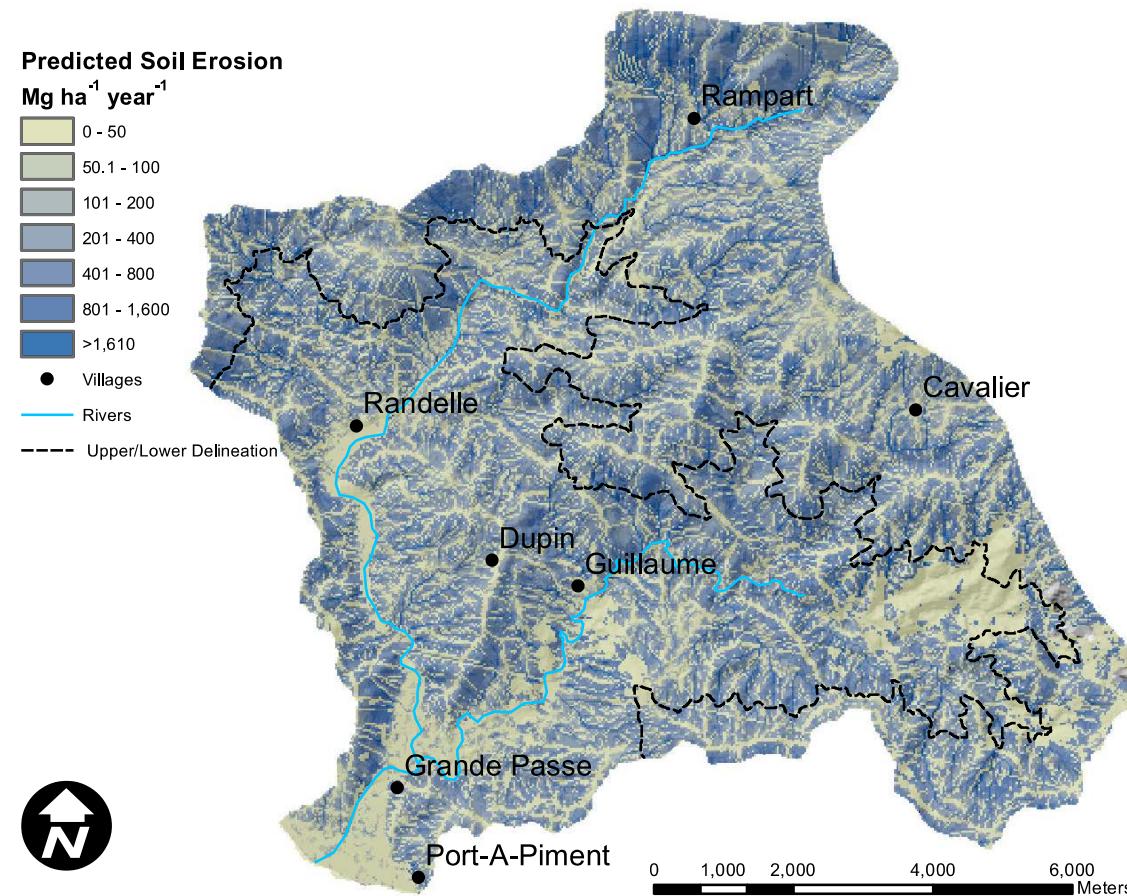
Erosion



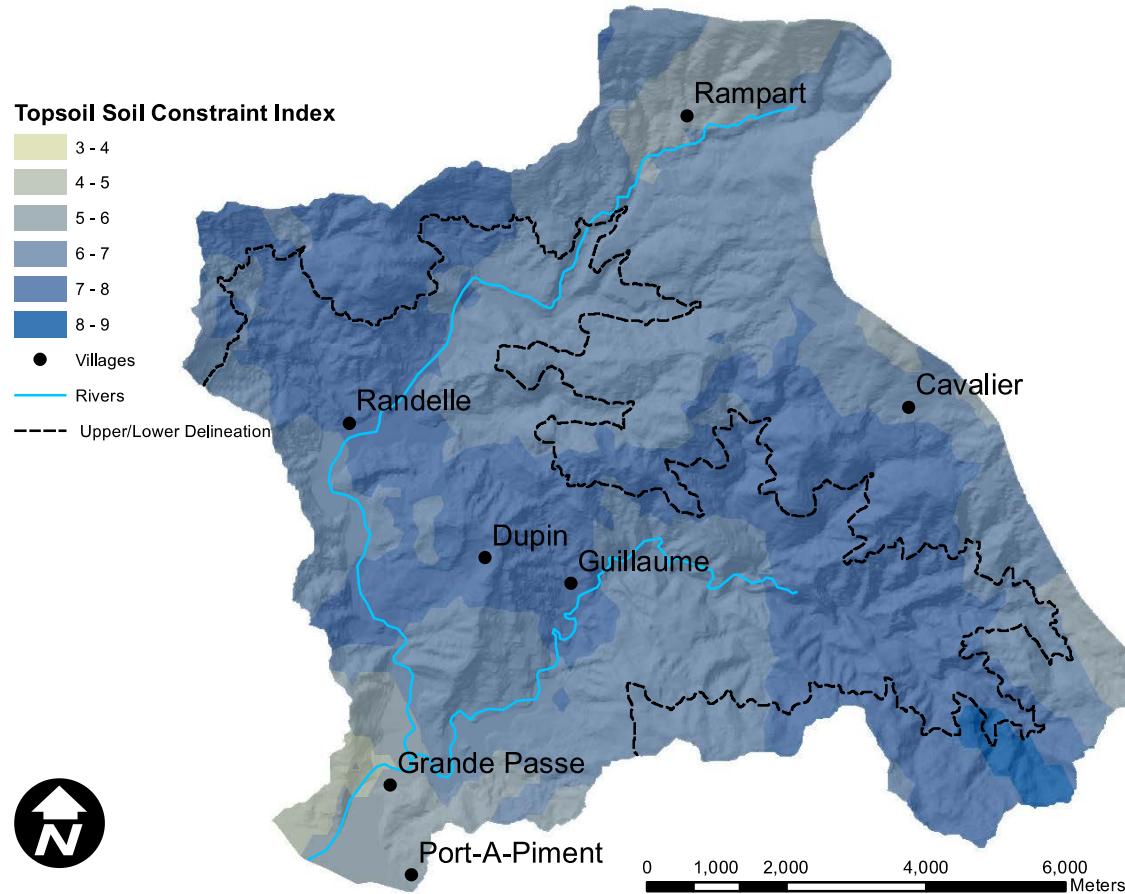


Expected Results

Predicted Soil Erosion



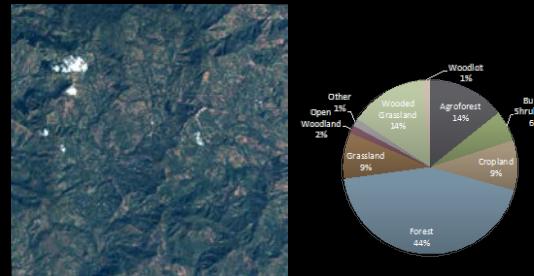
Soil Constraint Index



Landscape Scenarios

- Patch size and connectivity
- Tree and shrub diversity
- Erosion potential
- Fuelwood availability
- Carbon storage

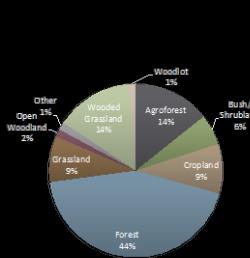
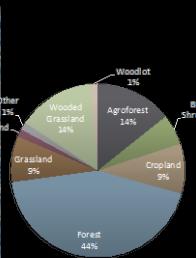
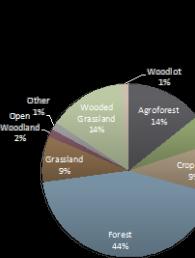
Baseline



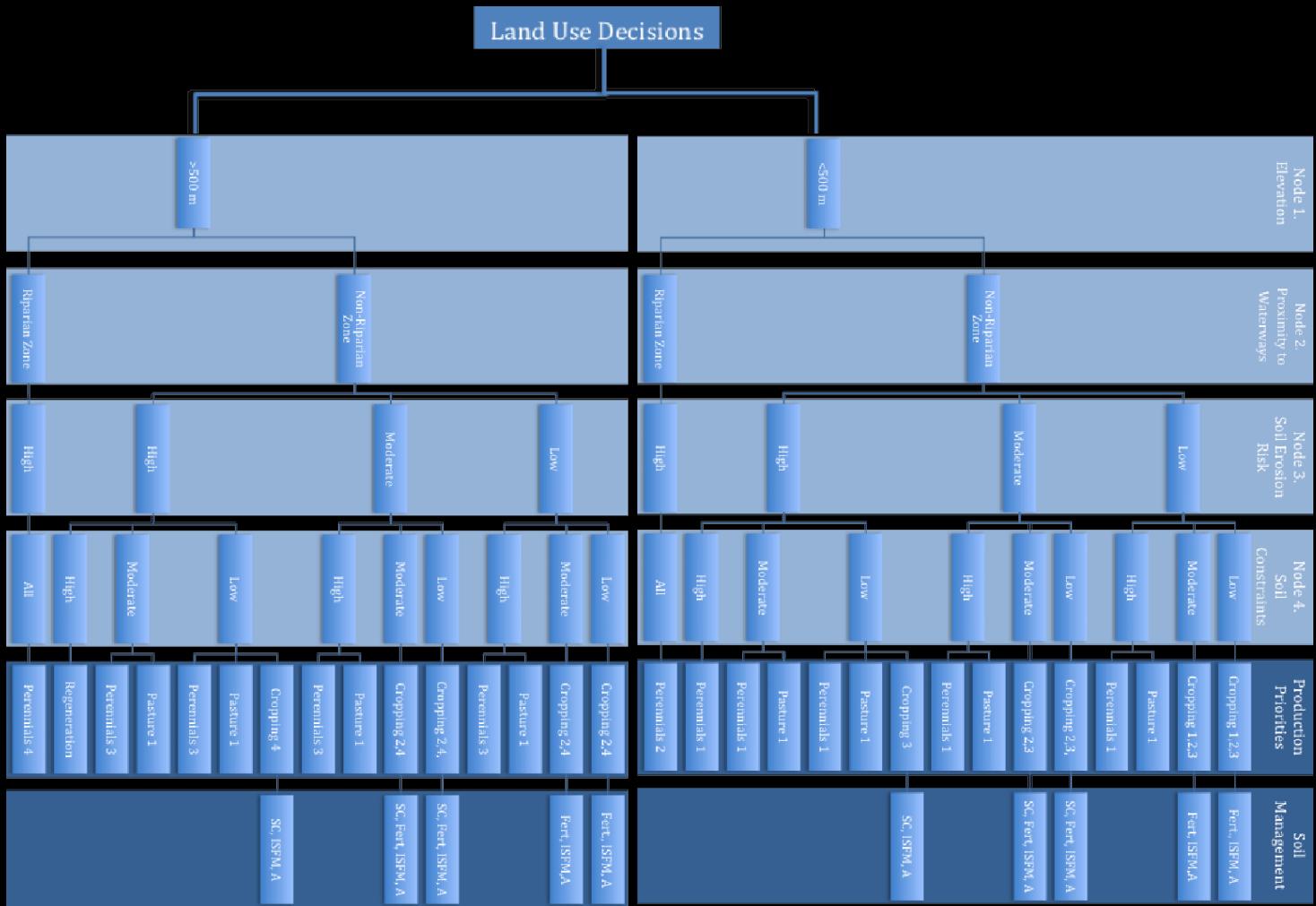
Business
as usual

Agroforestry

Reforestation



Land Management Decision Tree



Land Management Decision Tree





Made Possible By...

- CIAT
 - Aracely Castro
 - Steven Fonte
 - Kris Wyckhuys
- PRISMA
 - Neana Gómez
 - Wilfredo Moran
 - Elias Escobar
- Earth Institute
 - Rolando Barillas
 - Sean Kearney

A wide-angle photograph of a mountainous landscape at sunset. The sky is filled with dramatic, orange and yellow clouds, with the sun partially visible behind the mountains. In the foreground, there are dense, green, forested hills. The middle ground shows more mountain ridges, and the background features a range of mountains under the warm glow of the setting sun.

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