Sustainable Cattle Ranching in Colombia
Pastures in South America

- 550 million hectares in Latin America (2007) 27% of area
- 38 million hectares in Colombia

Deforestation Hotspots in Colombia
310,345 ha-year$^{-1}$
1990-2010
Land use efficiency

- Average annual per hectare stocking rate: 0.59 animals

- Average annual per hectare productivity:
  - 19.9 kg of beef
  - 89.7 L of milk

- Minimum animal loads
- Low per animal and per hectare production indexes
- Meager contributions to rural employment

Los Santos province, Arco Seco region, Panama
Photo: Fernando Uribe

FAO, 2006
Growth of cattle herd in Colombia

Source: FAO - FEDEGAN

- 3.3% annual growth
- 0.3% annual growth
- 1.4% annual growth
Silvopastoral Systems - SPS

• Agroforestry arrangements that combine fodder plants, such as grasses and leguminous herbs, with shrubs and trees for animal nutrition and complementary uses.

Pezo & Ibrahim, 1998; Harvey 2004
Four silvopastoral systems

- Mixed fodder bank (cut-and-carry system)
- Live fences
- Scattered trees in pastureland
- Mixed fodder bank (cut-and-carry system)
Intensive silvopastoral system ISS

• A system that can be directly grazed by livestock. It combines:
  – **Fodder shrubs** planted at high densities (>10,000 plants ha⁻¹), intercropped with
  – highly-productive **pastures**, and
  – **500 timber trees** planted in east-west lines to minimize shading.
Daily weight gain (800 to 1000 g/animal/d)
Solorio et al 2011, México
Background

REGIONAL INTEGRATED SILVOPASTORAL APPROACHES TO ECOSYSTEM MANAGEMENT PROJECT 2003 – 2007
Colombia, Costa Rica, Nicaragua
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.
Regional Integrated Silvopastoral Approaches to Ecosystem Management Project

Land use change in Colombia

- Degraded pastures: 18
- Treeless native pastures: 9
- Treeless improved pastures: 17
- Native pastures with trees: 17
- Improved pastures with trees: 9
- Mixed fodder banks: 3
- Forests: 22.4
- Intensive silvopastoral systems: 1
- Others: 8

Pagiola et al., 2009
Land Use changes after project end

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>%</th>
<th>Previous Year</th>
<th>Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bosque maduro</td>
<td>107.4</td>
<td>107.4</td>
<td></td>
</tr>
<tr>
<td>Bosque secundario</td>
<td>13.0</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Bosque secundario intervenido</td>
<td>45.3</td>
<td>45.1</td>
<td></td>
</tr>
<tr>
<td>Sistema silvopastoril intensivo</td>
<td>130.3</td>
<td>140.8</td>
<td></td>
</tr>
<tr>
<td>Bosque ribereño</td>
<td>403.9</td>
<td>417.4</td>
<td></td>
</tr>
<tr>
<td>Sucesión secundaria temprana</td>
<td>44.7</td>
<td>62.9</td>
<td></td>
</tr>
<tr>
<td>Plantación diversificada de maderables</td>
<td>2.9</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Guadua</td>
<td>52.8</td>
<td>53.9</td>
<td></td>
</tr>
<tr>
<td>Pastura mejorada con alta densidad de...</td>
<td>239.8</td>
<td>229.1</td>
<td></td>
</tr>
<tr>
<td>Café bajo sombrío</td>
<td>33.8</td>
<td>20.9</td>
<td></td>
</tr>
<tr>
<td>Plantación en monocultivo de maderables</td>
<td>2.6</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Banco forrajero diversificado</td>
<td>3.7</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>CV multiestrato o Barrera rompevientos</td>
<td>94.0</td>
<td>94.1</td>
<td></td>
</tr>
<tr>
<td>Plantación diversificada de frutales</td>
<td>4.6</td>
<td>5.5</td>
<td></td>
</tr>
</tbody>
</table>
**INTEGRATED SILVOPASTORAL APPROACHES TO ECOSYSTEM MANAGEMENT**

*Bird Monitoring*

<table>
<thead>
<tr>
<th>Bird Category</th>
<th>Base Line</th>
<th>Year 5</th>
<th>% of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total richness</td>
<td>146</td>
<td>193</td>
<td>32,2%</td>
</tr>
<tr>
<td>Endangered species</td>
<td>6</td>
<td>7</td>
<td>16,7%</td>
</tr>
<tr>
<td>Forest dependant species</td>
<td>74</td>
<td>104</td>
<td>40,5%</td>
</tr>
<tr>
<td>Migratory birds</td>
<td>10</td>
<td>19</td>
<td>90,0%</td>
</tr>
</tbody>
</table>
Land use changes
Pinzacua Farm, Colombia

Baseline (2001) 2008
Mainstreaming Biodiversity in Sustainable Cattle ranching
Project Zones

1. Cesar river Valley
2. Lower Magdalena
3. Boyacá - Santander
4. Coffee Ecoregion
5. Orinoco foothills
# PROJECT GOALS

<table>
<thead>
<tr>
<th>Land Use</th>
<th>GEF Ha</th>
<th>ICF/DECC Ha</th>
<th>TOTAL Ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive Silvopastoral system</td>
<td>6,000</td>
<td>4,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Forests</td>
<td>5,000</td>
<td>945</td>
<td>5,945</td>
</tr>
<tr>
<td>Pastures with scattered trees</td>
<td>18,000</td>
<td>20,110</td>
<td>38,110</td>
</tr>
<tr>
<td>Recovery of degraded pastures</td>
<td>2,000</td>
<td>945</td>
<td>2,945</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31,000</td>
<td>26,000</td>
<td>57,000</td>
</tr>
</tbody>
</table>
**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.”
Objectives

- To include 3,000 small and medium-scale cattle farmers in five regions of Colombia.
- Adoption of environmentally-friendly production systems.
- Increase structural and functional connectivity in strategic ecosystems.
- Increase the provision of environmental services.
- Increase the productivity in participant farms.
Intensive silvopastoral system ISS
The key to successful ISS is the adequate selection of the species, particularly the fodder shrub that is the backbone of the system.

Two species have shown the best results:
• Mexican sunflower *Tithonia diversifolia* Helms
• and in particular *leucaena Leucaena leucocephala* (Lam.) de Wit
What is *intensive* about ISS?

Efficiency of biological processes:

- Photosynthesis & biomass production
- Nitrogen fixation
- Solubilization of soil phosphorus and other nutrients

The “inputs” of the system are the natural processes themselves.
<table>
<thead>
<tr>
<th>Year</th>
<th>Pasture</th>
<th>2011 iSS</th>
<th>Leucaena ha(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Pasture with star grass</td>
<td>10,000 Leucaena ha(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Fertilization</td>
<td>450-500 kg urea ha(^{-1}) year(^{-1})</td>
<td>Without fertilization</td>
<td></td>
</tr>
<tr>
<td>Stocking density (450kg ha(^{-1}))</td>
<td>3.5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Milk production</td>
<td>9000 l ha(^{-1}) yr(^{-1})</td>
<td>15,000 l ha(^{-1}) yr(^{-1})</td>
<td></td>
</tr>
</tbody>
</table>
January, 2006

August, 2006
First grazing

April 2006

January 2008

Biomass production

Animal body condition

Carrying capacity and productivity

1.2 large animals
1.7 L milk cow\(^{-1}\) day\(^{-1}\)

5.1 large animals
4.1 L milk cow\(^{-1}\) day\(^{-1}\)
Maximum and minimum in pastures with and without trees
During dry months of 2007 in the Caribbean Region of Colombia

Lopera, Cuartas y Murgueitio, 2008
Climatic Variability (2007-2013)
El Hatico Natural Reserve

Precipitación /año

- 2007: 909
- 2008: 1016
- 2009: 433
- 2010: 952
- 2011: 823
- 2012: 648
- 2013: 675

Rainfall
Liters per cow day$^{-1}$
### Productive parameters and GHG Balance under different scenarios in Colombia

<table>
<thead>
<tr>
<th>Plant Biomass; tons DM/ha/yr</th>
<th>Degraded Pasture</th>
<th>Improved Pasture</th>
<th>iSPS</th>
<th>iSPS + Timber trees*</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>19.2</td>
<td>28.0</td>
<td>28.0</td>
<td></td>
</tr>
</tbody>
</table>

| Stocking rate (GA/Ha)        | 0.85             | 2.34             | 3.00 | 3.00                |
| Kg de meat produced per ha-year (LW) | 77.6 | 341.6 | 711.8 | 711.8 |

Source: Naranjo et al. 2012
Surface required to produce 10,000 ton of meat (lw) per year in the dry region of Colombia

- Extensive pastures: 148,098
- Improved pastures: 54,795
- Intensive Silvopastures: 12,177
A win-win situation
The productive advantages that make SPS so attractive for landowners ultimately originate from the myriad environmental benefits they provide.
ISPS DRY CARIBBEAN ZONE. LA LUISA FARM. 14 months

Colombia
Silvopastoral systems as a landscape matrix at El Chaco Farm, Piedras, Tolima

- Riparian buffer and secondary forest
- Rice monoculture matrix
- Silvopastoral matrix
- Silvopastoral matrix
- Rice monoculture matrix
El Hatico

- Organic sugar cane crops
- Forest
- Intensive Silvopastoral Systems
- Bamboo
Sustainable Cattle Ranching in Colombia

FA1 - pilot project

What problems / opportunities does the component solve / respond to?
- Low productivity levels of cattle ranching
- Land use conflicts and natural resources degradation

What are the components proposed solutions to the problems / opportunities?
- Training and TA provision
- Provision of incentives to implement the systems (PES, Increased access to low cost credits, improved access to markets)

Who are the component’s clients, and how will the component market / ‘sell’ its services/products to them?
- Companies that benefit from buying better quality products.
- Government: Development of policies that promotes the sector productivity and reduces deforestation and other environmental problems
- Producer associations

What is the component’s added-value?
- Providing robust indicators of efficiency and environmental effects
- Support to multi-stakeholder engagement
- Link with a Programme on NAMAs within the GAA

What are the component’s key activities?
- Project preparation: methodology development, stakeholder engagement
- Project implementation: training, baseline assessment, scenario evaluation

What are the component’s estimated capital and resource requirements?
- 300kUSD for project preparation and initial measurements