Agricultural Synergies: Sustainable Intensification of Colombia's Livestock Sector

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Woodrow Wilson School, Princeton University
Cali, Colombia, October 2014
Agricultural Synergies Project

NORAD (Norway)

Princeton University

Agro-Forestry

Sustainable Livestock Intensification

Land Sparing/Sharing

Rwanda

Vietnam

Colombia
The Agricultural Synergies Project
Protecting forests and reducing greenhouse gas emissions while increasing food security

The importance of pastures:

• By 2050 production of livestock products up by 70% (WRI 2013)
• 50% of all agricultural emissions from livestock – land conversion & production
• 30% ice-free land area in livestock production, 30% of cropland for feed (Herrero, 2013), 50% of animal feed from grass (WRI 2013)

AND

• Cattle generates 6 TIMES more GHG emission per unit protein than chicken, pork & egg (WRI 2013)

Guess where?

How can we develop policy guidance that will increase production sustainably while conserving and/or restoring natural areas?
The Goal:

• Provide a way of sharing information about livestock systems all over the world
• Create a baseline of data of livestock production systems and the options for increasing production at the same time conserving natural areas and reducing greenhouse gas (GHG) emissions
• Work the process of “upscaling” – take information at the local level and aggregate it to have a regional or national vision for policy making.
Informing Public Policy: Gathering Information

1. Technical Information: Baseline Data of Production Systems, Geographically Specific, Emissions, and Productivity
   + Alternative Scenarios, Emissions, and Productivity

2. Where systems should be implemented: Geographic Analysis
   Socio-Economic and Bio-physical Barriers to Implementing Sustainable Intensification

3. Public Policy: Costs, Instruments, Paths to Implementation
Example: Colombia’s Livestock Sector

In 2011:
• 20 Million Head of Cattle TOTAL
• 900 Million Tons of Beef Produced
• 6.32 Million Liters of Milk Produced

Area of country in livestock (2010): 39.2 million hectares, 34% of total
• 81% of plots have less than 50 head of cattle; 44% less than 10
• National Goal (PEGA 2019): Reduce 10 million hectares, increase to 40 million head cattle \(\rightarrow\) from 0.6 to 1.5 head/ha

Source: FEDEGAN 2012 & CIPAV 2011
Our Approach

1. Classify Production Systems
   - Beef, Dairy, Dual
   - Regionally
   - Management & Output

2. Up-Scaling by System & Region
   - Land-area
   - Emissions
   - Production

3. Policy Targets by System & Region
   - Costs
   - Biophysical & socio-economic barriers
   - Instruments
   - Specific targets

Pasture Land-Cover, Production System & Region

Fuente: FEDEGAN/CIAT
Autor: J. Moran
Who We Work With

- CIPAV & CIAT – Equipo de trabajo de campo y procesamiento de datos
- FEDEGAN – Analisis de datos → Validar datos del campo y analisis cluster de los sistemas productivos y nivel de tecnología
- CORPOICA – Tecnicos para talleres con expertos, datos de estudios gris
- MADR – Formación de Política Publica – NAMA de Ganadería

Agricultural Synergies: Princeton University
Step 1. Creating Production Regions
Methodology

We are developing a webtool that can capture data from various production systems.

There are three sources of information:

1) Individual Farms: The project will visit 30 farms in 5 regions of the country (Dpto Cesar, Eje Cafetero, Cundinamarca, los Llanos, Valle de Patía).

2) Information from typical or representative farms at various productivity levels and production systems in various parts of the country (with regional experts).

3) Data from fieldwork already completed (published or unpublished).
Extent of Production Systems and Representative Farms

1. Start with a region
2. Percentage of farms, production, and/or area in each production system: dairy, fattening, calf operation, dual-purpose
3. Within each production system, percentage of different productivity levels – lower, medium, high productivity for example

Information from workshops with regional experts
Information from Livestock Producers Organization (FEDEGAN)

Designing our survey instrument
Expert workshop in Popayan
Clustering producers to match our focus group data with Fedegan

Grouping farm systems by land area and number of animals
The Webtool: SIDESS

The Agriculture Synergies Project
Improving Food Security Sustainably While Holding Down Greenhouse Gas Emissions

About the Project > General Description

AGRICULTURE SYNERGIES PROJECT:
Improving Food Security Sustainably While Holding Down Greenhouse Gas Emissions

The Agricultural Synergies Project is a collaborative effort of research institutions across the world to develop detailed guidance of ways developing countries can boost food production while reducing agricultural greenhouse gas emissions. This guidance will help countries to develop Nationally Appropriate Mitigation Plans (NAMAs), and international aid agencies to evaluate them. It will also help farmer groups, private companies, and non-profit organizations to identify the most promising synergies between increases in agricultural production and reduction in emissions. The initial efforts focus on three sets of guidance:

1. Sustainable intensification of ruminant livestock
2. Land sparing
3. Agroforestry.

The project will provide initial sets of guidance by the end of 2015.

The Norwegian Agency for Development Cooperation (NORAD) is providing primary funding, with additional funding provided by the research institutions.
On-Line Webtool SIDESS

Sustainable Intensification Decision Support System

SIDESS Tool > Map Browser

Instructions
Click on a country on target country.
Entering Data Into SIDESS

Sustainable Intensification Decision Support System

SIDESS Tool > Map Browser

Survey Date: 09/09/2014
Farm Name: Cerrodo Fattening Low Technology
Informant Name:
2nd Level Location:
3rd Level Location:
GPS Coordinates:
% out of Total: 70
Livestock Production Orientation: Fattening

Land Use

Components, Management & Performance

Socio-economics

Technical Assistance & Memberships

Household

Labor

Household Incomes

Barriers to Improvement

Strategies to Improve

New Member Type

Age

Education

Work At Farm

Monthly Cost

Update Cancel
## Sustainable Intensification Decision Support System

**Module**
- **Date**: 15/04/2014 12:00:00 a.m.
- **Farm Name**: Typical Beef farm
- **Informant Name**: Victor Aranda
- **GPS Coordinates**: N04 09 25.3 W073 25.24.7
- **% out of Total**: 25
- **Is Typical**: Yes
- **Livestock Production Orientation**: Beef

### Formulario de edición

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<th>Allocation Type</th>
<th>Source Type</th>
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</table>

### Herd Structure

<table>
<thead>
<tr>
<th>Breeds</th>
<th>Standard Features</th>
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</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

### Additional Information

- **Save**
Production Levels & Production Systems

Estimation of GHGs – CH4 and N2O
Croos RUMINANT & Local Emission Factors

Simulation of Data – Representative and Real Farms

Herd Modeling: HerdDinamics

Production (LWG)

Number of animals, sex, age over time

Available Forage

RESULTS:
1. GHG Estimation
2. Production Outputs
3. Economic modeling

Systems Include: Baseline Systems, Various technology levels, Improved Systems (i.e. Intensive Silvo-Pastoral)
Examples of Outputs – Full System Emissions

**Beef System - Caribe Seco - Conventional and with *L. leucocephala***

<table>
<thead>
<tr>
<th>Method</th>
<th>CO₂ eq/Kg of milk (ECM)</th>
<th>CO₂ eq/Kg of milk (FPCM)</th>
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<tbody>
<tr>
<td>Conventional</td>
<td>2.26</td>
<td>2.69</td>
</tr>
<tr>
<td>iSPS</td>
<td>1.83</td>
<td>2.21</td>
</tr>
</tbody>
</table>

**Dairy System – Eje Cafetero – Conventional and with *L. leucocephala***

<table>
<thead>
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</tbody>
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Fuente: J. Rivera, CIPAV
Example Scenarios: Herd Evolution

Inventario Consolidado

Fuente: C. Solano, IAP-SOFT
Example Emissions & Mitigation
Thank you!

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www.agriculturalsynergies.org
Colombia as an example
Examples of Outputs
Premise

• 2050 population projection 9.5 m (UN 2012)
• A growing middle class demands more meat and dairy
• 69% calorie gap between 2006 and 2050 proj. (WRI, 2013)

AND

• 40-50% of arable land in crop & pasture
• 13% of global GHG emissions from crop & livestock production – 50% of that from livestock
Necesidad de conocer los sistemas productivos– 5 regiones

Elaboración de encuestas

Productividad

Manejo

Social

Económico

Zonas representativas

Talleres regionales

Visitas a fincas

Información

Simulación

GEI

NAMA

Incremento de productividad

Dinámica económica

Costos

Ingresos

Alternativas de intensificación Sostenibles

Software
The Sustainability Factor: Intensive Silvo-pastoral Systems

- Colombia is a leader in developing intensive silvo-pastoral systems
- Impact: ↑Biodiversity; ↑Carbon storage; ↓Chemical inputs; ↑Dry matter w/ ↑Protein
- Two Pilot studies: 3.78 → 5.64 & 3.5 → 4.85 animals/ha without chemical inputs
- Increase of milk production 3.5 → 5.45 L/animal/day
- Better health of animals (shade, pest & parasite management)
- Cost: $2,400/ha

Source: CIPAV 2011
“..At its heart **Sustainable Intensification** is about producing more outputs with more efficient use of all inputs – on a durable basis – while reducing environmental damage and building resilience, natural capital and the flow of environmental services.”

(Montpellier Panel 2013; Royal Society 2009)
Geographic Analysis