Cattle farmer preferences and sustainable intensification: A Discrete Choice Experiment in the Colombian Amazon

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Introduction

- **Extensive cattle farming** causes environmental damages in the Colombian Amazon.
    - One of the main causes for **deforestation**
    - Land degradation, greenhouse gas emissions, biodiversity loss, amongst others

- **Sustainable intensification of the cattle sector** on the national policy agenda.

- Past and ongoing endeavors to introduce sustainable production practices (e.g., silvopastoral systems) have had limited success.

- **Adoption rates** remain at a **low level**.

Source: adapted from IGAC (1999)
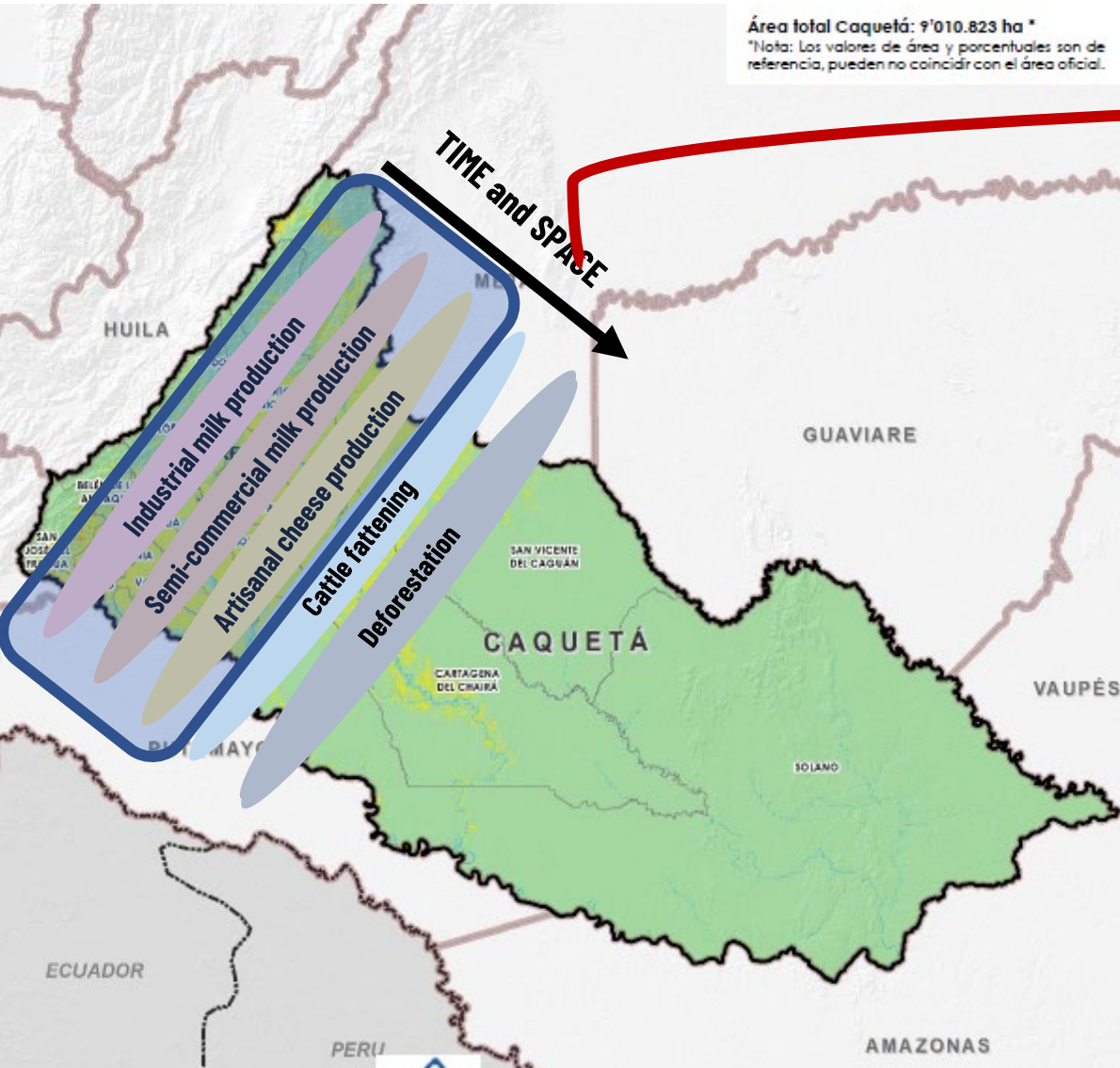
Research objective and questions

Overall research objective: To improve the understanding of factors that influence the adoption of sustainably intensified cattle husbandry systems in the Colombian Amazon.

DCE research objective: To improve the understanding of the idiosyncratic, socioeconomic and environmental conditions that contribute to building preferences of farmers for contrasting cattle-husbandry land use systems.

DCE research questions:

1. Do environmental and socio-economic factors influence farmers' preferences for land use systems?

2. Do farmers' preferences for investing into different land use options differ between individual farmers?

3. Does the size, composition and structure of personal information exchange networks (link to SNA), among other idiosyncratic variables, explain preference heterogeneity?

Study region

Área total Caquetá: 9'010.823 ha *
*Nota: Los valores de área y porcentuales son de referencia, pueden no coincidir con el área oficial.

TIME and SPACE

Industrial milk production
Semi-commercial milk production
Artisanal cheese production
Cattle fattening
Deforestation

Enabling environment and socioeconmic gradient

Land prices

Infrastructure

Services and inputs

Projects

State presence

Access to labour

Illicit crops

Presence of armed groups

Informality

Poverty

PIEDMONT

Industrial milk production
- Milk farmers selling to Nestlé or formal cheese processors
- Low-to medium technological level

Semi-commercial milk production
- Cattle farmers with access to milk route
- Low technological level

Artisanal cheese production
- Cattle farmers without access to the milk route
- Low technological level

Cattle fattening
- Investors, actors with other income sources (?)
- Low technological level

Deforestation
- Colonos (settlers)
- Deforest, plant and harvest subsistence crops (maize, cassava)

DEFORESTATION FRONTIER

Elaboró UPRA 2017, con base en IDEAM. 2013. Mapa nacional de cobertura de la tierra, imágenes 2010 - 2012, escala 1:100.000 versión 1.0.

Agricultura	0,1%	Forestal de producción	0,0%
Áreas de pastoreo	18,1%	Superficies de agua	1,0%

IDEAM

CGIAR
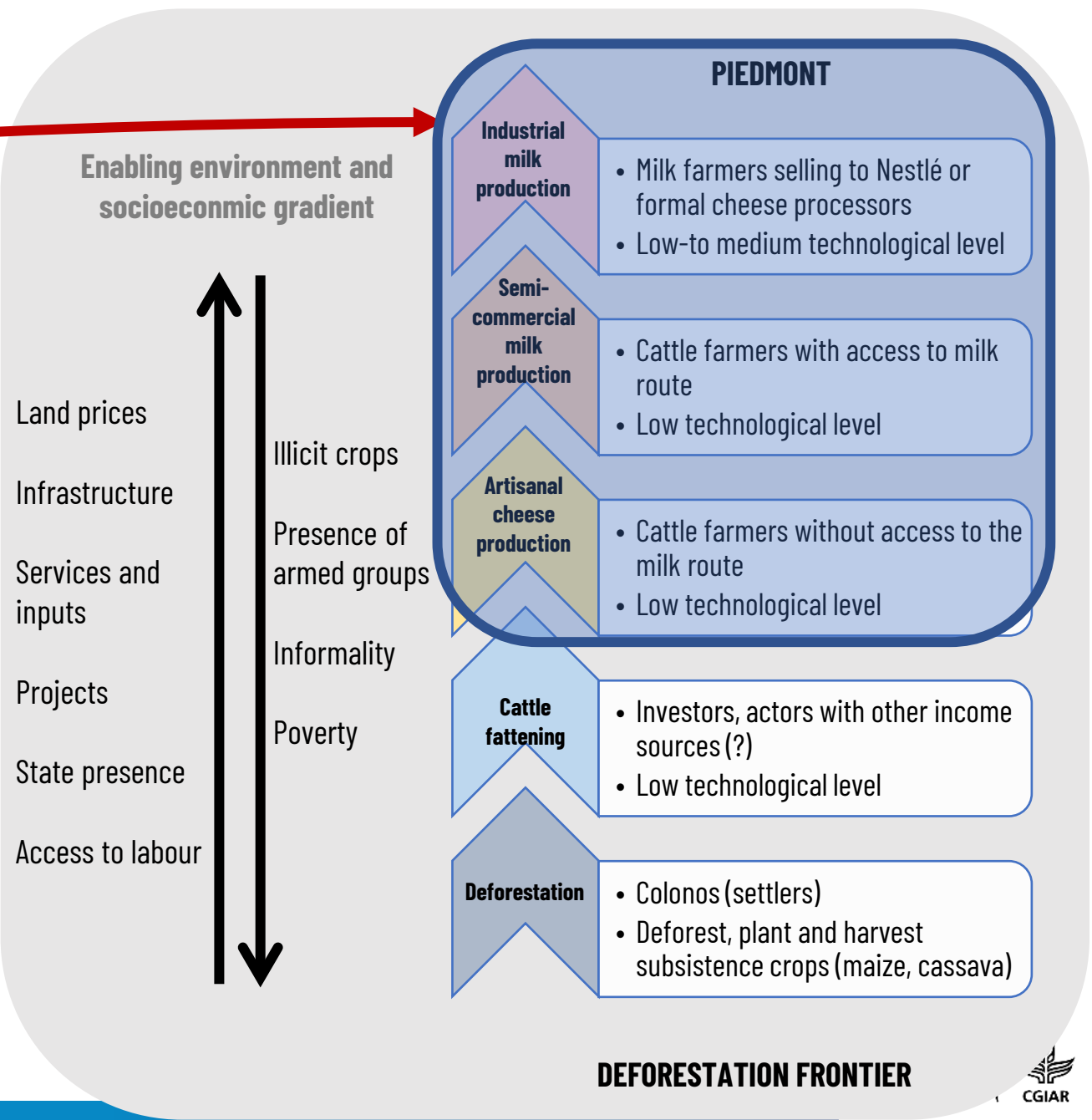
Source: map adjusted from Ministerio de Agricultura y Desarrollo Rural (2014)

Discrete choice experiments – Overview

- Stated preference method

- DC models predict the probability that an individual chooses an option among a set of alternatives.

- Choice probabilities modelled as a function of the underlying utilities of the alternatives available in a choice set.

- Interviewees are faced with several choice sets and asked to choose within each set the alternative (hypothetical scenario) that yields them the highest utility.

Please choose the alternative that gives you the greatest satisfaction:

	Policy A	Policy B	No Policy
Bee-friendly pest control	✔	✘	✘
Improving native bee habitat	✘	✔	✘
Native bee husbandry	✘	✔	✘
Changes in native bee population (%)	+50%	0%	-50%
Policy implementation costs (THB) ฿	500	500	0
I choose:	Policy A ○	Policy B ○	No Policy ○

Example choice card from Narjes and Lippert (2016)

DCE design

Hypothetic Government program to promote food security in Caquetá

- Government purchases **10 ha plots of** unused **extensive grassland** for cattle husbandry in Caquetá.

- **Farmers can participate** in the program and get access to the plots of land for cattle husbandry.

- Farmers have to **co-invest** → savings or loans.

- Farmers can choose between **3 alternatives**:

A1: Extensive cattle husbandry	**A2**: Silvopastoral systems (SSP)	**A3**: Don´t participate

- ✓ Gov. investment: COP 100 MM
- ✓ Stocking density: 0.5 - 1 livestock units/ha

- ✓ Gov. investment: COP 150 MM
- ✓ Higher farmer co-investment
- ✓ Stocking density: 3-4 livestock units/per ha

- ✓ Farmers don´t participate and keep their money (co-investment share)

Alliance
Bioversity & CIAT

CGIAR
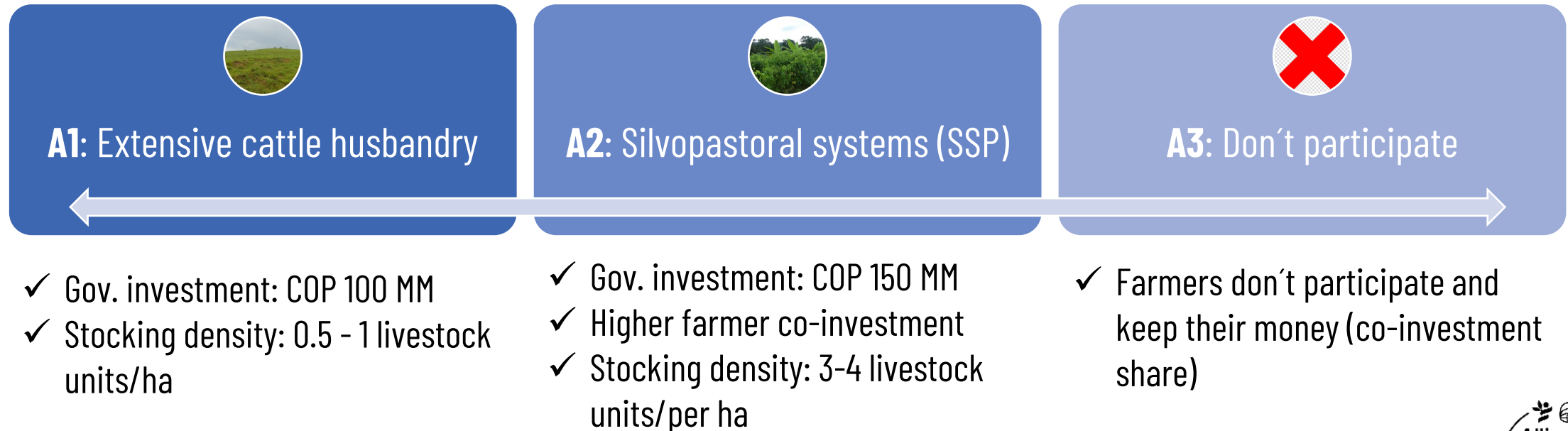
DCE attributes

Road infrastructure	Land use security	Access to information	Climate conditions	Co-investment (COP MM)
Farm cut off from main roads for: • > 60 days/year • > 30 days/year • 0 days	No risk of forced displacement for at least the next: • 3 years • 6 years • 9 years	• TA through extension officers; • Regular exchange with other program participants (farmer organisations)	Occurrence of prolonged dry season (5 months): • 1 in 10 years • 3 in 10 years • 5 in 10 years	Opt out • 0 Extensive systems • 10 • 20 SSP • 20 • 30

Expected results

- Farmers are willing to invest in SSPs.

- Road infrastructure, land use security and climate instability influence the willingness to invest in SSPs.

- Preference for SSPs is heterogenous:
  - Farmers with larger and more diverse personal information exchange networks have a stronger preference for SSPs.

- Policy makers should direct resources to improving infrastructre and social stability for increased adoption uptake.

- Increasing farmers´ awareness for the resilience potential of SSPs will increase adoption rates

Thanks!

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Sources

- Centro Nacional de Memoria Histórica – 2017. La tierra no basta. Colonización, baldíos, conflicto y organizaciones sociales en el Caquetá. Bogotá, Colombia.

- Departamento Administrativo Nacional de Estadística (DANE) – 2018. Población – Censo Nacional de y Vivienda.

- Gobernación del Caquetá - 2017. Historia del Caquetá. https://www.caqueta.gov.co/departamento/historia-del-caqueta, retrieved on 02.02.2022.

- Instituto Geográfico Agustín Codazzi (IGAC) – 1999. Mapas Nacionales - Mapa Oficial Político Administrativo. https://geoportal.igac.gov.co/contenido/mapas-nacionales, retrieved on 02.02.2022.

- Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM) – 2022. Atlás Climatológico de Colombia. http://atlas.ideam.gov.co/cclimatologicas/index.html, retrieved on 02.02.2022.

- Narjes, Manuel Ernesto & Lippert, Christian - 2016. Longan fruit farmers' demand for policies aimed at conserving native pollinating bees in Northern Thailand. Ecosystem Services, 18, 58-67.

- Torrijos, Rafael – 2021. Cifras de Contexto Ganadero Caquetá 2021. https://issuu.com/rafaeltorrijos/docs/contexto_2021, retrieved on 01.05.2022

- Torrijos, Rafael – 2022. Cifras de Contexto Ganadero Caquetá 2022. https://issuu.com/rafaeltorrijos/docs/contexto_2022_imp, retrieved on 01.05.2022.

- United States Agency for International Development (USAID) – 2017. Climate Risk Profile Colombia.

Annex

Choice modelling

- The utility U_{ij} that individual farmers i experience from each policy alternative j can be expressed as:

- V_ij= the linear sum of the marginal satisfactions β that they draw from the unit changes in the provision of the contextual attributes X_j

- Plus an unobserved random error ε_ij

$$U_{i\,sust\,intens} = \alpha + \beta_1 x_{INF_j} + \beta_2 x_{SEC_j} + \beta_3 x_{CLIM} + \beta_4 x_{INF\,ACC} + \beta_5 x_{INV} + \varepsilon_{ij}$$

$$U_{i\,extensive} = \beta_1 x_{INF_j} + \beta_2 x_{SEC_j} + \beta_{3ext} x_{CLIM} + \beta_4 x_{INF\,ACC} + \beta_5 x_{INV} + \varepsilon_{ij}$$

<u>Assumed choice rule</u>: in each choice set, the surveyed farmers will choose the program that, among the three available alternatives, yields them the highest utility

- The estimates of the taste coefficients β (marginal utilities) are those that maximize the likelihood of observing the modelled choice probabilities

- Preference heterogeneity can be modelled through simulation

- The willingness to invest for any context attribute → ratio of context attribute coefficient and investement attribute

Cattle sector Caquetá – Key facts and figures

- Department with 5th largest cattle herd (2,175,065 animals – 7 %)

- 14% of departmental area used for cattle husbandry

- Production system: dual purpose (88%), extensive, grass monoculture.

- Breeds: 7 colours, Brahman, Gyr

- 42% of farms: less than 50 cattle

- 68,2% of farms: less than 100 cattle

- 0.3% of farms: more than 1000 cattle

Cattle value chain map – Caquetá

Consumption / Retail / Wholesale / Processing / Aggregation / Primary production (left-side stages column)

Industrial milk channel

- Extraregional food industry
  - Industrial cold milk processors (160,000 l/day) N=1 (Nestlé)

Semi-commercial milk channel

- Regional households
  - Regional supermarkets, neighborhood stores
    - Semi-industrial milk processors (l/day?) N=20
- Extraregional households, restaurants
  - Extraregional supermarkets, neighborhood stores
    - Artisanal (informal) milk processors (l/day?) N=114

Raw milk channel

- Regional households
  - Intermediaries (cruderos) 15,000 l/day

Artisinal cheese channel

- Regional food industriy
- Extraregional food industriy
  - Intermediaries
    - 7,000 kg (?) of cheese/day
      - Double purpose cheese farms (837,000 l/day – 44%) N=?

Beef channel

- Regional households
  - Regional supermarkets, neighborhood stores
    - Regional slaughterhouses — 38,573 cattle (2020)
- Regional households
  - Extraregional supermarkets, neighborhood stores
    - Extraregional slaughterhouses — 378,851 cattle (2020)
      - Live animal traders
        - Cattle fattening farms

Primary production:
- Specialized milk farms (70,000 l/day – 4%; 8.6 l/cow/day) N=? No. 66,393 cattle
- Double purpose milk farms (950,000 l/day – 51%; 4.5 l/cow/day) N=? No. of cattle?
- Double purpose cheese farms (837,000 l/day – 44%) N=?
- Cattle fattening farms

Channel legend:
- Industrial milk channel
- Semi-commercial milk channel
- Raw milk channel
- Artisinal cheese channel
- Beef channel