

An Evaluation of the Outcomes of the
Calibration and Validation of the RUMINANT Model for Colombia,
A CCAFS-CIAT Project

Consultant: Msc. Kemly Camacho (PhD Candidate)

January-February, 2019

Livestock-Plus, CIAT



Acronyms:

AFOLU: Agriculture, Forestry and other land uses (*Agricultura, Silvicultura y otros usos de suelo*)

CIAT: International Center for Tropical Agriculture (*Centro Internacional de Agricultura Tropical*)

CIPAV: Center for Research in Sustainable Systems of Agricultural Production (*Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria*)

FEDEGAN: Livestock Federation (*Federación Ganadera*)

IDEAM:

NAMA: Nationally Appropriate Mitigation Measures (*Medidas de Mitigación Nacionalmente Apropriadas*)

NINO: NAMA Information Notes (*Notas de la información de la NAMA*)

I. Introduction

Colombia is a member of the United Nations Framework Convention on Climate Change (UNFCCC). Through the Colombian Low Carbon Development Strategy, Sectoral Action Plans have been developed based on a diagnosis of each sector. As an economic activity that produces significant greenhouse gas emissions, the livestock sector has been prioritized for mitigation action.

Livestock in Colombia occupies 38 million hectares and is estimated that 516,000 families make their living by this economic activity. About 80% of these producers are small producers, if measured by the number of heads. About 35% of the herd is double purpose (e.g. beef and dairy production), 39% is dedicated to breeding and 20% to fattening, only 6% is for dairy. Historically nearly all production has been based on forage, mostly naturalized forages, but also some improved and adjusted African species. There has been some balanced food utilization in specialized dairies, in others, they sometimes use some supplements. There is very little conversion to improved pastures (interview with Juan Carlos Gómez, Fedegan).

In Colombia, cattle farming represents 77% of the emissions coming from the AFOLU (Agriculture, Forestry and other land uses) sector and of these, 29% are due to enteric fermentation. There is a causal relationship between factors such as geographical area, types of cattle, types of producers, types of food and types of forages and their qualities and the production of methane gas emissions.

RUMINANT is an animal-level model and software tool originally developed as a tool for estimating ruminant emissions in Africa ([Herrero et al. 2008](#)). The quality of the diet is entered as an input, and the model indicates animal intake, nutrition and production as well as the amount of methane emissions. Measuring methane in the field is expensive and time consuming, so using RUMINANT is an attractive lower cost option.

With support from CCAFS Flagship 3, CIAT's Livestock-Plus Program calibrated and validated RUMINANT to adjust it to the types of livestock, food and nutritional qualities of Colombia, including the testing of forages that can provide improved nutrition, but lower emissions. The purpose of this work was to provide a tool to policy makers, technical assistance groups and producer associations in Colombia to better predict the impacts of improved forage on livestock nutrition and greenhouse gas emissions. To validate the model, measurement of emissions was conducted using a polytunnel, a laboratory and compared with the results of the simulation tool. The modeled and measured results show a good correlation, with an R^2 of 0.7.

CIAT and specifically Livestock-Plus work on the issue of sustainable livestock, food, greenhouse gas emissions and mitigation measures with various regional and national actors, including CIPAV, FEDEGAN, Sustainable Livestock Board, IDEAM and the Ministry of Agriculture and Rural Development, as well as with Ministry of Environment and Sustainable Development.

II. Outcome Harvesting.

Outcome harvesting methodology is an approach to assess the transformations (“outcomes”) that a program or project has produced, ie changes in the behavior of research users. To do this, I investigated the transformations in the physical and digital documentation and through interviews

with the different research users, the research leaders and other stakeholders (Annex 2). The transformations or outcomes are analyzed in light of the contribution of the program to mitigate climate change livestock impact due to enteric methane emissions. This process of documenting the achievements and transformations is the harvest phase (the result can be seen in Annex 1).

Subsequently, the results of the harvest phase are validated, by triangulating results from different sources. Results that cannot be validated are not included in the analysis.

Once the validated harvest is completed, outcomes are organized along a timeline (Figure 1) to demonstrate the relationship among outcomes and identify clusters of outcomes to better understand the kinds of transformation occurring. Subsequently, an outcome map is prepared to classify outcomes by their role in the impact pathway: entry point, milestone, behavior change, or institutional change (Figure 2).

Once this process is completed, the theory of change is constructed (Figure 3). This emerges from the harvest results and allows us to identify the change generated up to a specific moment by the program and the contribution to the project's development objectives.

III. Results of Outcome Harvesting

As can be seen in Figure 1, the harvesting process resulted in 18 outcomes that are located in the 2014-2018 timeline. These outcomes have been grouped to show where the main transformations have taken place as a result of CIAT's validation of the RUMINANT model for Colombia.

Three transformation areas can be identified:

- 1. Improved capacities and information** available to the livestock sector, particularly Fedegan, Colombia's national livestock producer organization: CIAT's research has made information available to and capacity of livestock producer organizations and their members to provide higher nutrition to livestock with lower GHG impacts.
- 2. Enhanced productivity of livestock** due to improved feed (pink highlights): CIAT's research has introduced to the livestock sector of new diets and combinations of grass varieties with trees and pastures that will contribute to mitigation impacts.
- 3. Climate change mitigation** (green highlights): CIAT's research has informed decisions on the mitigation measures of the livestock sector and the international policy commitments of Colombia to the UNFCCC Paris Agreement.

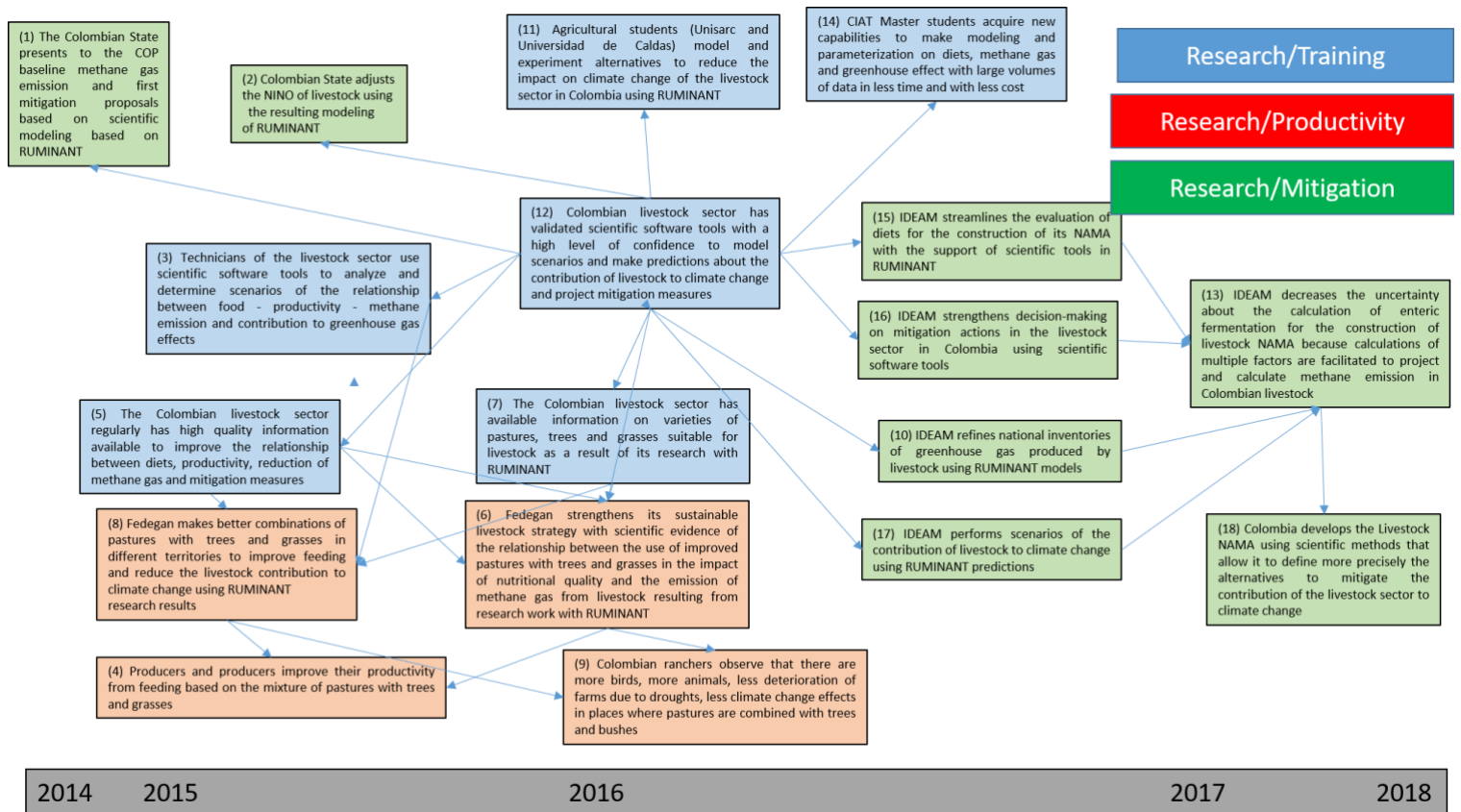


Figure 1: Line of Outcomes for RUMINANT to January 2019

The three areas of transformation identified show that the calibration and validation of the RUMINANT model in combination with engagement with stakeholders in the livestock sector and climate change policy makers has generated tangible impacts in the livestock sector and in the mitigation policy commitment of the Colombian government.

Outcome harvesting shows that the research done by Livestock-Plus at CIAT to calibrate and validate the RUMINANT model has contributed to improving the productivity of the livestock sector through demonstrating the beneficial impacts of improved forage on production, and to developing the Government of Colombia's Nationally Determined Contribution target and national mitigation strategy. This is demonstrated with by:

- a. Actors in the livestock sector (Fedegan and its committees) having more knowledge about enteric fermentation and its relationship with production practices and being able to discuss and identify sustainable livestock production practices based on multi-factor scenarios.
- c. The Government of Colombia improving its mitigation commitments in the bovine livestock sector by testing scenarios and scientific simulations that show how to achieve mitigation with less cost and less time.

According to the interviews, the main actors who noted changes in their behavior as a result of using the RUMINANT model for Colombian conditions were:

- **Fedegan:** Using RUMINANT to model nutritional inputs and greenhouse gas outputs has strengthened its sustainable livestock strategy. Fedegan shares information and data generated by working with the tool with its associated committees.
- **IDEAM:** Integrates RUMINANT with other instruments used to analyze the contribution of the Colombian livestock sector to climate change and mitigation measures.
- **Ministry of Agriculture and Rural Development:** Uses RUMINANT results to prepare together with other stakeholders of the Sustainable Livestock Table the commitments of the Colombian State with the mitigation of the sector's impact on climate change.
- **Sustainable Livestock Roundtable:** Integrates research results with RUMINANT into the sustainable livestock strategies of their members in Colombia.
- **Master's students at CIAT:** At least 5 CIAT students integrated RUMINANT as an analytical tools for their master's theses and contribute to the validation of the tool based on the corroboration of the correlation between field, laboratory and simulation.
- **Students from other universities:** At least 5 students integrated RUMINANT as part of their work tools in other territories (at coffee region, for example) and other species (milk for example) different from those that have already been worked on at CIAT.
- **Technicians of the livestock sector:** Integrate the results of the research with RUMINANT to work with trade associations and their associates.

Each of the three areas of impact is elaborated upon below:

1. Improved capacities and information: Livestock sector in Colombia has new knowledge about the feeding- enteric fermentation relationship, contribution to climate change and mitigation scenarios of bovine cattle.

The work of research and experimentation with RUMINANT has strengthened the information processes of the livestock sector and the formation of technical and specialized levels of human resources in the sector.

Updated and easily understandable information for the Colombian cattle livestock sector.

Cattle livestock sector improves the information and data that are based on scientific research and that are made available to students, technicians and guilds in an easy, understandable and updated way. The Livestock-Plus Program distributes this information generated through experimentation with RUMINANT through newsletters, websites and face-to-face workshops held with representatives of the sector, as well as presentations at the sustainable livestock table.

This is important because the information that is generated with the support of RUMINANT is used by the trade associations to in turn inform their livestock partners or to strengthen the programs that they themselves execute (for example CIPAV or Fedegan) mainly in sustainable livestock. For instance, Fedegan's sustainable livestock program at this moment covers 94,000 ha and 1,600 producers. These producers have been informed about RUMINANT results through Fedega's newsletters.

The availability of this information, which is easily accessed and accessed regularly, strengthens the potential for technical support and farmer actions related to nutritional improvement, methane gas reduction and mitigation of the greenhouse effect that are being worked on by different organizations that work in livestock.

Training of technicians and specialists in the livestock sector.

The livestock sector of Colombia has technicians with greater knowledge about the relationship between nutrition, generation of methane gas, productivity and greenhouse gas effect from the different modeling and experiments carried out with the support of RUMINANT.

Lifestock-Plus has generated training workshops based on the results of research results involving technicians from the livestock sector and students from various Colombian universities such as UNISARC and the University of Caldas. This has allowed to strengthen the installed capacity in the public and private sector.

Likewise, at least 5 students from different specialties (veterinary, climate change or agricultural) who complete their master's degree at CIAT validated RUMINANT and strengthen knowledge about the relationship between nutrition and methane gas emissions, as well as experimentation with different varieties of pastures combined with trees and grasses.

RUMINANT speeds up the research and exploration process due to the possibility of working with large amounts of data and the possibility of exploring with different factors with transparency in processing. The students in turn have been testing the robustness of RUMINANT and its limitations with their research processes. For instance, Research Associates at CIAT, Alejandro Ruden and Jesús Martínez working with Ngoni Chirinda and Jacobo Arango.

RUMINANT's contribution to this transformation area: The work with RUMINANT has contributed to this transformation by generating reliable and robust information and data that enable technicians to stay abreast of recent options for improving nutrition while also achieving mitigation. The tool has been integrated into the training processes of technicians and specialists, which enables more transparency and understanding of the tool and enables trainees to modify factors to conduct scenario experiments.

2. Enhanced productivity of livestock: The sustainable livestock sector has strengthened its production strategies by integrating better pasture varieties with trees and grasses based on the results generated by RUMINANT.

The tool has been used to improve nutrition in livestock production systems and strengthen sustainable livestock programs of other agencies such as Fedegan and CIPAV. The exact numbers of farm operations affected or livestock are not known and difficult to estimate.

Respondents indicated that there is increasing use of the combination of pasture varieties with trees and grasses in some areas, using the results presented by RUMINANT that inform the sustainable livestock programs of the livestock guilds. These new nutritional practices in the productive process strengthen productivity, livestock health and the transformation of livestock farms.

RUMINANT has contributed to this transformation by sharing results through bulletins, web, workshops and training processes as indicated above. The livestock sector appropriates this shared knowledge and applies it in its own programs in the livestock sector.

RUMINANT's contribution to this transformation: The search for nutrition that produces less methane gas emissions to reduce the contribution of the livestock sector to climate change has generated findings related to nutrition and sustainable livestock management. These have been used by institutions of the livestock sector to improve the production process and its results according to individuals from Fedegan.

3. Climate change mitigation: The Colombian livestock sector has scientific tools to generate mitigation scenarios of the contribution of enteric fermentation to climate change from large volumes of data with multifactor analysis at low cost and using less time.

The Livestock Bureau, Vice-Ministry of Livestock and IDEAM used RUMINANT to establish the mitigation commitments of the livestock sector of Colombia based on scientific results with experimental evidence and this gives them strength and security to develop the national goals.

Research supported by use of RUMINANT reduces the uncertainty about enteric fermentation calculations, and as a result the greenhouse gas inventory is more accurate and the scenarios that are worked with multiple data are more reliable. The use of RUMINANT helped support generating base lines of methane emissions from the livestock sector, which had not previously been established. The commitment of the Livestock NAMA of Colombia is prepared with more solid foundations as the contribution to the mitigation for climate change in this country.

The calibration and validation of RUMINANT contributed modeling, scenarios, experimentation with varieties of pastures, grasses and trees for use by the National Government and other public institutions. It has allowed working with large volumes of data, modifying factors to build mitigation options and evaluating animal diets. This has helped Colombia design its NDC in more precise ways.

RUMINANT's contribution to this transformation: RUMINANT allows IDEAM and the Sustainable Livestock Roundtable to experiment with and create multiple scenarios, managing large volumes of data with a high degree of reliability, facts that were demonstrated when comparing results in the field with the polytunnel, in the laboratory and with the software. Reliability levels were strong enough to use this software to calculate the Colombian nationally determined commitments (NDC) to climate change.

Figure 2 shows the outcomes according to their role in the impact pathway.

Development Objective: The livestock sector of Colombia adopts productive practices that reduce enteric fermentation as part of the mitigation measures established in the livestock NAMA of this country.

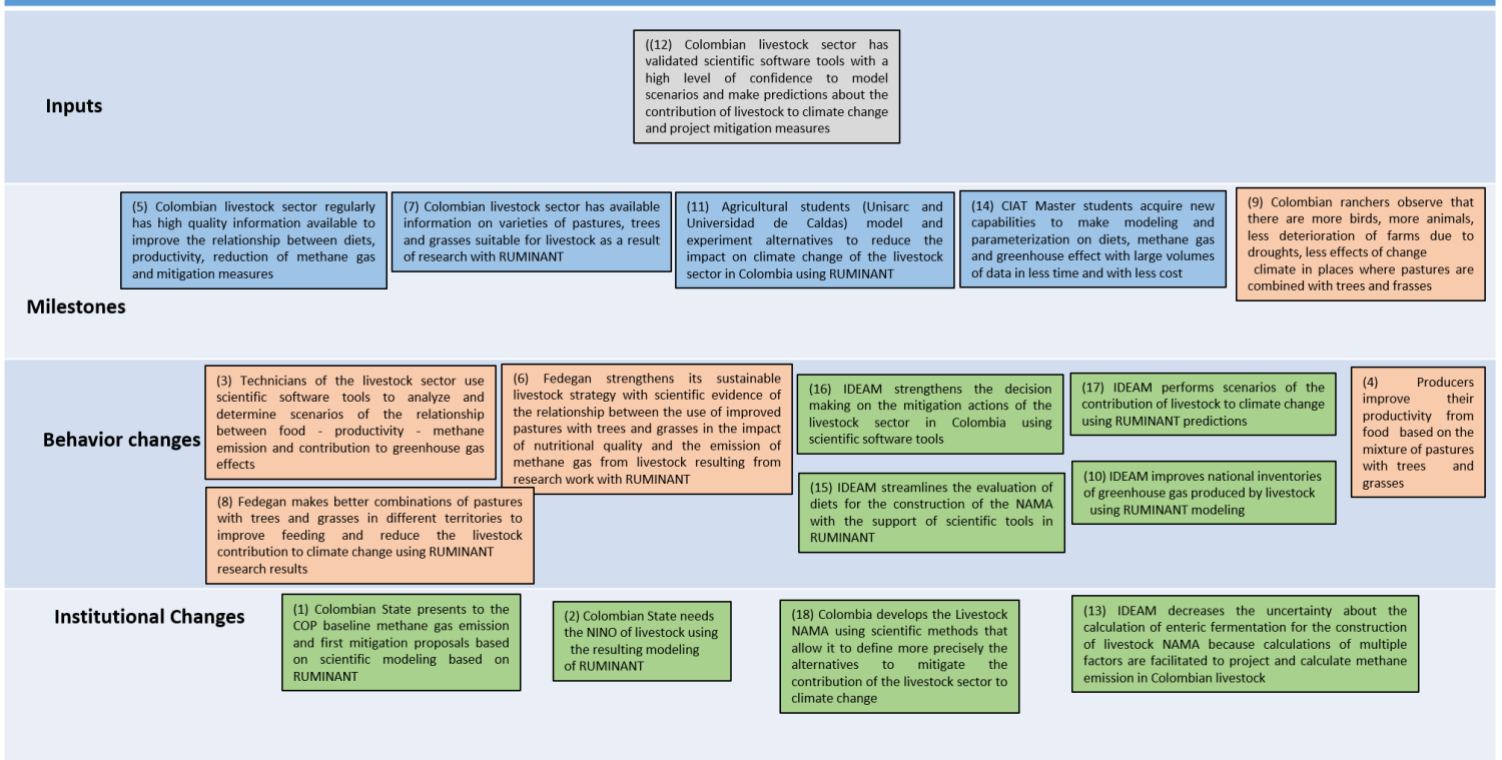


Figure 2: Outcomes harvesting map for RUMINANT to January 2019

As a point of entry to the outcomes harvesting, it is identified that the livestock sector - mainly the sustainable livestock table – as a result of the RUMINANT modeling in Colombia now has an automated tool that has shown a correlation with an R^2 of 0.7 between the results in the field and the results of the software to make predictions about the contribution from livestock to climate change and project mitigation measures.

In terms of the milestones, we can identify some aspects of transformation related to the availability of quality information that is understandable to diverse stakeholders, from the private sector to policy makers, and the possibility of developing skills in technicians and sector specialists using digitized tools to investigate and experiment with.

It also identifies as a milestone the transformation of livestock farms (mostly small producers integrated in Sustainable Livestock Program at Fedegan) to modify feeding in livestock by integrating pasture varieties with trees and grasses.

In relation to behavioral changes, the strengthening of sustainable livestock programs is can be attributed to the use of RUMINANT results and the strengthening of the use of scientific software. The strengthening of IDEAM’s capacities and the analysis of the contribution of the livestock sector to climate change is also included in changes in behavior, incorporating more precision in methane

gas inventories, creation of mitigation scenarios and the evaluation of diets that strengthens decision making using modeling with RUMINANT.

With regards to institutional changes, the use of RUMINANT findings is evident in the Sustainable Livestock Roundtable, the Vice-Ministry of Livestock and the IDEAM, who have developed the baselines and the livestock NAMA. These institutions have also adopted RUMINANT as one of their basic scientific tools for future analysis.

IV. Theory of change

The theory of change emerges from outcome harvesting, as it can be seen in Figure 3 that expresses the specific situation with which, at this moment the work done with RUMINANT at CIAT, is contributing, mainly from Livestock-Plus.

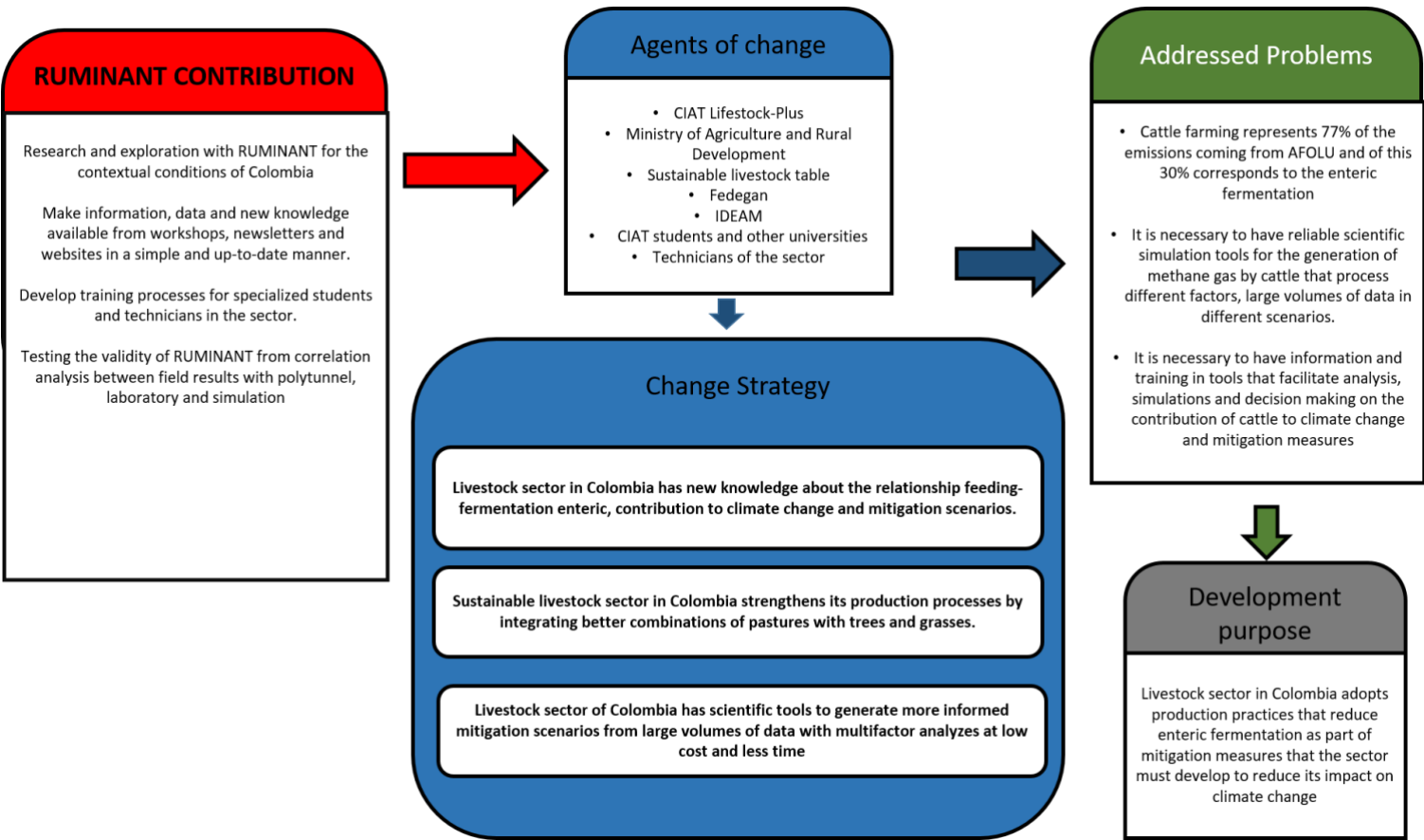


Figure 3: Emerging Theory of Change for RUMINANT to January 2019

According to the Theory of Change, RUMINANT is addressing mainly 3 key needs in the livestock sector:

- Quantifying the important contribution of enteric fermentation to the effects of in cattle farming on greenhouse gases in Colombia.
- Enabling the private (FEDEGAN) and public sector (IDEAM, MAG) to have scientific tools that can reliably simulate different scenarios in an agile way and at the lowest possible cost.
- Proving opportunities for information and training on mitigation measures in the livestock sector and their impacts on production processes, food and sustainability.

In addition, RUMINANT has supported

- The development of communication strategies to inform the livestock sector about the relationship between nutrition and enteric fermentation through accessible bulletins, easy to understand and updated information.
- Training opportunities on the subject of simulations on food, enteric fermentation, mitigation measures for both specialists and technicians in the sector.
- Investigating and exploring with RUMINANT to test it in several territories of the Colombian context, mainly with beef cattle and to a lesser extent with dairy cattle.
- Generating policy scenarios and to support decision-making.

The development objective that emerges with the Theory of Change can be identified as:

"The livestock sector of Colombia adopts productive practices that reduce enteric fermentation as part of the mitigation measures of the livestock NAMA of this country"

V. Recommendations:

RUMINANT is a valuable tool for the Colombian livestock sector. From the interviews conducted for this outcome harvesting, the following suggestions for improving and updating the tool have been compiled:

- a. Update its interface with the user
- b. Integrate a data visualization module for example of inventories, fodder, types of livestock or types of farms with a geo-referencing system.
- c. Assess the possibility of working with data generated from other sources (data science, open data, etc.)
- d. Make improvements from a workshop with the variety of RUMINANT users to jointly define the improvements.
- e. Develop a mobile application derived from RUMINANT that must be aimed to producers.

Anexo 1

Cosecha de Alcances Validada

25 de enero 2019

1.El Estado Colombiano presenta a la COP líneas base de emisión de gas metano y primeras propuestas potenciales de mitigación apoyándose en modelizaciones científicas basadas en RUMINANT – 2015

Contribución de RUMINANT: RUMINANT contribuye con el desarrollo de la modelización de las líneas base.

Importancia del alcance: Esto es importante porque por primera vez en Colombia se hacen líneas base para presentarlas a la COP.

2.Estado Colombiano precisa el NINO de ganadería utilizando las modelizaciones resultantes de RUMINANT – 2015

Contribución de RUMINANT: RUMINANT se utiliza para hacer las modelizaciones de diferentes escenarios de mitigación, especialmente relacionados con la emisión de gas metano y su contribución a efectos de gas invernadero.

Importancia del alcance: Esto es importante porque por primera vez se integra este tipo de simulaciones en la construcción del NINO

3.Técnicos de sector ganadero tienen nuevos conocimientos sobre herramientas científicas para hacer análisis y determinar escenarios de la relación entre alimentación – productividad – emisión de metano y contribución a efectos de gas invernadero – 2015

Contribución de RUMINANT: Lifestock-Plus desarrolla talleres con técnicos del sector mostrando los resultados de análisis con RUMINANT y enseñando el funcionamiento de la herramienta.

Importancia del alcance: Esto es importante porque se generan nuevas capacidades para el sector de ganadería.

4.Productores y productoras mejoran su productividad a partir de la alimentación basada en la mezcla de pasturas con árboles y gramíneas – 2015

Contribución de RUMINANT: RUMINANT genera datos sobre las ventajas de trabajar en la finca con mezcla de variedades de pasto, árboles y gramíneas y como esto favorece la productividad de la misma.

Importancia del alcance: Esto es importante porque además de mejorar la alimentación del hato y la productividad de la finca se estimulan estrategias sostenibles en el sector ganadero

5.Fedegan fortalece su estrategia de ganadería sostenible con evidencias científicas de la relación entre el uso de pastos mejorados con árboles y gramíneas en el impacto de la calidad nutricional y la emisión de gas metano de la ganadería resultantes de trabajos de investigación con RUMINANT - 2015

Contribución de RUMINANT: RUMINANT ofrece las evidencias científicas de la relación entre el cambio en la alimentación y reducción de la producción de gas metano

Importancia del alcance: Esto es importante porque se fortalece el programa de ganadería sostenible de Fedegan. Esta organización a su vez difunde entre sus asociados y se fortalecen las prácticas de mitigación del sector de ganadería.

6.El sector ganadero colombiano tiene a disposición regularmente información de alta calidad para mejorar la relación dietas, productividad, reducción de gas metano y medidas de mitigación – 2016

Contribución de RUMINANT: Livestock-Plus elabora boletines y blogs con información científica pero que es entendible para el productor. El contenido es de calidad, ameno y bien logrado.

Importancia del alcance: Esto es importante porque tanto productores como organizaciones e instituciones indican que se mantienen informados a partir de los boletines y el blog y que buscan esta información con regularidad en estos espacios.

7.El sector ganadero colombiano tiene a disposición información sobre variedades de pastos, árboles y gramíneas aptos para ganadería resultado de investigaciones con RUMINANT – 2016

Contribución de RUMINANT: Livestock-Plus elabora boletines y blogs con información científica pero que es entendible para el productor. El contenido de calidad, ameno y bien logrado.

Importancia del alcance: Esto es importante porque tanto productores como organizaciones e instituciones indican que se mantienen informados a partir de los boletines y el blog y que buscan esta información con regularidad en estos espacios.

8.Fedegan realiza mejores combinaciones de pasturas con árboles y gramíneas en diferentes territorios para mejorar la alimentación y reducir la contribución ganadera al cambio climático utilizando resultados de investigaciones RUMINANT – 2016

Contribución de RUMINANT: Livestock-Plus aporta al sector ganadero en la modelización de híbridos y variedades de pastos a partir del trabajo realizado con RUMINANT

Importancia del alcance: Esto es importante porque fortalece el Programa de Agricultura Sostenible de FEDEGAN y reduce la contribución ganadera al efecto de gas invernadero.

9. Los ganaderos colombianos observan que hay más aves, más animales, menos deterioro de fincas por sequías, menos efectos de cambio climático en los lugares donde se combina pasturas con árboles y arbustos – 2016

Contribución de RUMINANT: Livestock-Plus comparte información resultado de investigación y experimentación en informes técnicos muy útiles y desarrolla talleres sobre el tema. Además los datos se mantiene abiertos para uso común

Importancia del alcance: Eso es importante porque se van modificando las prácticas productivas ganaderas basadas en fincas con grandes extensiones de pasto que se demuestra que generan más emisión de gas metano.

10. IDEAM afina los inventarios nacionales de gas invernadero producido por ganadería utilizando modelaciones RUMINANT – 2016

Contribución de RUMINANT: Se capacita al personal de IDEAM para la utilización de RUMINANT como herramienta de modelización

Importancia del alcance: Esto es importante porque se comparte el conocimiento sobre RUMINANT para que sea utilizado en el sector público. También es importante porque se reducen los costos económicos y logísticos al poder modelizar con todos los animales y no uno por uno.

11. Estudiantes agropecuarios (Unisarc y Universidad de Caldas) modelan y experimentan alternativas para la reducción del impacto en cambio climático del sector de ganadería en Colombia utilizando RUMINANT – 2016

Contribución de RUMINANT: El Programa realiza capacitaciones a estudiantes del sector agropecuario y permite el ingreso a maestrías que trabajan con la herramienta.

Importancia del alcance: Esto es importante por un lado porque se prueba la solides de RUMINANT y por otro se genera una capacidad instalada de técnicos del sector ganadero que utilizan modelaciones automatizadas.

12. Sector ganadero colombiano dispone de una herramienta científica validada y con alto nivel de confianza útil para modelar escenarios y hacer predicciones sobre la contribución de la ganadería al cambio climático y proyectar medidas de mitigación – 2016

Contribución de RUMINANT: RUMINANT contribuye realizando experimentos e investigaciones con la herramienta basándose en el contexto colombiano.

Importancia del alcance: Esto es importante porque se cuenta con instrumentos científicos para apoyar las decisiones de producción, de mitigación y de compromisos desde el sector de ganadería y el Estado Colombiano.

13. IDEAM disminuye la incertidumbre sobre el cálculo de la fermentación entérica para la construcción de la NAMA ganadera porque se facilitan los cálculos de múltiples factores para proyectar y calcular la emisión de metano en la ganadería colombiana – 2016

Contribución de RUMINANT: Provee taller sobre RUMINANT en el que participan las instituciones públicas y de la mesa de ganadería de Colombia.

Importancia del alcance: Esto es importante porque reduce recursos y aspectos administrativos y logísticos

14. Estudiantes de maestría CIAT adquieren nuevas capacidades para hacer modelización y parametrización sobre dietas, gas metano y efecto invernadero con grandes volúmenes de datos en menos tiempo y con menos costo. – 2016

Contribución de RUMINANT: El modelo RUMINANT se hace cada vez más exacto a partir de diferentes trabajos, incluyendo los de investigaciones de maestrías y experimentación con politunel in vitro, inbio, etc

Importancia del alcance: Esto es importante porque el modelo se va validando y se van diversificando sus usos (producción, carne, leche, dietas, etc)

15. IDEAM agiliza la evaluación de dietas para la construcción de la NAMA con apoyo de herramientas científicas en RUMINANT – 2017

Contribución de RUMINANT: RUMINANT contribuye con la evaluación de dietas, ya que se puede analizar 500 a la vez y no hay que hacerlo una por una.

Importancia del alcance: El análisis de dietas no solamente apoya la construcción de la NAMA sino también apoya la productividad de la ganadería

16. El IDEAM fortalece la toma de decisiones sobre las acciones de mitigación del sector de ganadería en Colombia utilizando herramientas científicas – 2017

Contribución de RUMINANT: RUMINANT contribuye con la modelización de escenarios de mitigación

Importancia del alcance: Esto es importante porque las decisiones están mejor sustentadas por datos que son resultado de modelizaciones y escenarios.

17. IDEAM realiza escenarios de la contribución de la ganadería al cambio climático utilizando predicciones RUMINANT – 2017

Contribución de RUMINANT: Desarrolla talleres para aprender sobre la herramienta y las modelizaciones a técnicos del IDEAM. Acompaña la creación de escenarios.

Importancia del alcance: Simular escenarios permite que la toma de decisiones sobre los compromisos del sector ganadero colombiano con la reducción del impacto en cambio climático sea más precisa. El análisis de escenarios se hace menos costoso.

18. Colombia elabora la NAMA de Ganadería utilizando métodos científicos que le permiten definir con más precisión las alternativas para mitigar el aporte del sector ganadero al cambio climático – 2017

Contribución de RUMINANT: Desarrolla capacidades y acompaña en el uso de RUMINANT a técnicos que elaboran la NAMA.

Importancia del alcance: Compromisos del Estado Colombiano más precisos y más sustentados.

Anexo 2

Interviewees

Arango, Jacobo, Lifestock-Plus, CIAT, Colombia

Chacón, Mauricio, Ministerio de Ganadería, Costa Rica

Chará, Julian, CIPAV, Colombia

Chirinda, Ngoni, CIAT, Colombia

Gómez, Juan Carlos, FEDEGAN, Colombia

Martínez, Jesús, Research Associate CIAT, Colombia

Rudén, Alejandro, Research Associate, CIAT, Colombia

Serrano, Germán, Ministerio de Ganadería y Desarrollo Rural y Mesa de Ganadería Sostenible, Colombia

Solano, César, Universidad Técnica Nacional, Costa Rica

Torres, Felipe, IDEAM, Colombia