

# Heterogeneity and vulnerability of livestock in forest plantations of Uruguay

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## SUMMARY

*In this paper we study the situation of livestock farmers related to the afforestation of the northwest region of Uruguay and suggest that their vulnerability has characteristics that vary according to characteristics of the modified ecosystem in which they operate and develop their resource endowments. We present an overview of mixed farming that includes trees and especially those that include cattle grazing. It is shown that the development of these systems has been associated with incentives from public policies, the demand for primary goods and the emergence of forms of agricultural organization that had not been present in the country. It presents various aspects of developments in the areas where forestry has shown great progress, justifying the need to elaborate on knowledge of the consequences of these changes. In particular, it proposes an approach that emphasizes the identification of interactions that we consider to be beneficial for both items. Briefly reviews some consequences that are manifested in changes in ecosystem services and the changes are associated with the original holding in the region: livestock. To analyze differences in vulnerability among farmers and in particular how this feature is affected by its connection with afforestation present a typology and the results of a series of interviews conducted archetypal representatives of the types we offer. Our study shows that differences exist between farmers associated with the afforestation that allow us to propose that will be affected differentially by changes that occur and the desirability of developing differential offers training and include consideration of public policy proposals that improve their situation. In particular, the valuation of environmental services throughout the silvopastoral systems can result in improved income from these new players in our national agriculture.*

## INTRODUCTION

Uruguay is a country with a strong farming tradition, which historically has been devoted to the production of beef and sheep extensively. The national economy has always been based mainly on livestock which brings almost 50.000 establishments, what occupy 13.2 million hectares (80% of agricultural area) (MGAP-DIEA).

Forest development in Uruguay has gone through 4 stages:

- Introduction - From nineteenth century to 1964 species and afforestation in the coast.
- Promotion 1964-1987 - 1st Forestry Law which resulted in 27,000 ha planted in total.
- Expansion-1987 - 2005 - 2nd law of Forestry whose result reached 766,000 ha planted with the support of planting subsidies, tax exemptions and credits
- Review and new strategies for 2005 to date - supports removal and adjustment of environmental and tax policies. Currently there are nearly 1 million acres planted.

Plantations are mainly carried out by large companies and are distributed in 3 major areas, with different agro-ecological (climate and soil) that determine different models:

- In the west (W) of the country, plantations are destined for the production of cellulose by the two most widespread species of eucalyptus (*E. grandis* and *E. globulus*).
- The North (N) is primarily intended for sawn timber production through the production of pine, but also with an important supply of eucalyptus (*E. grandis*).
- The Southeast (SE) again focuses on the production of pulpwood through *E. globulus*.

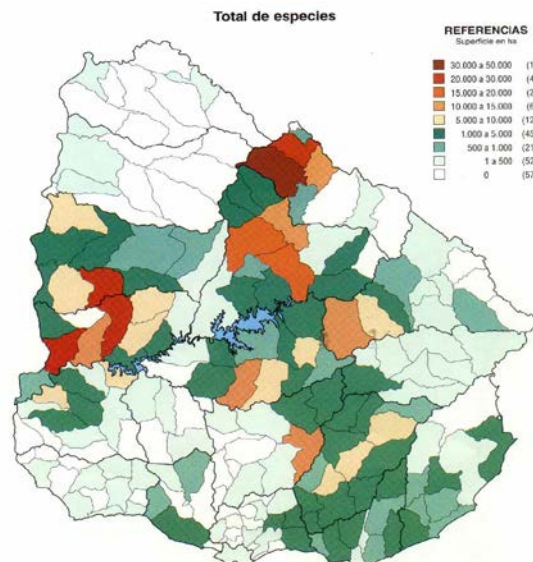


Figure1: Forest area by census tract, 3 major areas outlined

The presence of livestock in forest plantations is as old as forestry development itself. However, the rising price of land and the rental value and the very limited availability of grazing, provide far greater significance to grazing in forested air. Particularly in the Northeast (Tacuarembó and Rivera), until 5 or 6 years, the possibility of access to pasture to plantation forest was relatively simple and a very low cost relative to a field without trees. In recent years, the availability of grazing in forest plantations (like everywhere) has significantly dropped, both the price has increased considerably and the conditions of the contracts have been greatly adjusted (usually to the detriment of farmers).

Contrary to the above, the load capacity and therefore the productive potential of meat in forested areas of the region, decreased due to the growth of trees which limits (or resets) the production of pastures. The interactions between different components of these systems have been poorly studied in our country and all aspects of these new "Livestock Agroforestry Systems" (we call them: Livestock Systems in Forestry), with farmers who have adjusted and learned to manage their systems based on trial and error. Dealing with this issue from land use and / or from the stocking, using as unit the census section, police section, department or the region is very useful in spatial analysis and general. But it presents a very large level of aggregation, which fails to recognize the heterogeneity of situations among graziers plantations. In the forest region north of the country between 1996 and 2007 in round numbers, 400,000 ha of natural field (including in this category stubble) were replaced by 200,000 ha of forest plantations and 200,000 ha of improvements (adding all types of improvements). At the same time as stocking UG<sup>1</sup> in the study area has declined about 10%. View figure 2.)

<sup>1</sup> UG= requirements of a 380 Kg cow, including pregnancy and lactancy

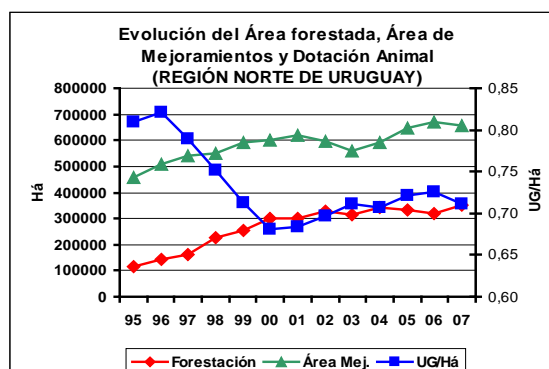


Figure 2: forested area, improvement pasture, stocking evolution between 96-07. (Ferreira and Gutierrez 2008 based DICOSE)

The chart above also indicates a certain stability in the number of animals in the region from 2000 onwards, we can link with the forest cycle peaking of competition involving the substitution of pasture by areas of trees (no pasture) surrounded by unplanted areas where pastures are maintained. The analysis of the stocking in the region, including the area of forest plantations, can lead to a slight inference that the change in farming is not very large, since there is a little less of livestock due to attenuation of the effect of decrease in the area of grazing by higher feed improvements.

In the case of Rivera in the same period, reducing the burden on the entire department (15%) is higher than the level of the forest region itself (10%), despite a significant increase in the area improved. The forest region of Rivera as the same authors, consisting of the 3 police stations bringing together more than 60% of the forested area of the department, has a great natural field replacement and improvements for forestry, entailing a reduction of the stocking.

This type of approach does not account for the profound changes that the expansion of forest plantations has been determined in northern Uruguay, especially in regions defined as "forest region". Nor can recognize as the producers have "adapted" to this new reality, if there are new farmers, whether there are changes in production systems or if there is interaction between forestry and livestock.

Apparently, the afforestation forced to intensify in livestock systems, but both subsystems (forestry and livestock) are completely independent, meaning that cows and trees do not have interactions with each other, ie for farmers there is not matter whether forestry, mining or any other cause determined by a decrease in grazing area.

## AGROFORESTRY IN URUGUAY

The Agroforestry is the deliberate association in a single unit of production, woody perennials with herbaceous crops and / or animals, in some form of spatial or chronological sequence, where there are positive economic and ecological interactions, achieving a sustained diversified production, and maintaining the productivity of resources (1990 Torquebiau cit by Polla 2006).

Grazing of forest plantations and forest shades are the main expressions of Agroforestry Systems in our country, although there are other experiences (systematic use of native forest grazing systems, with specific spatial arrangements, etc) its size and is now broadcasting very low. While forest plantations developed in Uruguay severely limit pasture production under / between the trees, the system includes an area that 30-40% of the plantation that has no trees due to soil constraints, roads, firebreaks, areas of environmental protection, etc.. Cattle use of these areas began with the same plantations as forest companies lease their fields to livestock producers sometimes before the actual planting. However, the increase in land prices in recent years has promoted a more intense exploitation of forest plantations and an increase in the rent costs.

There is discussion on the application of the concept of agroforestry systems (SAF) and more precisely to silvopastoral systems (SSP) for cattle exploitations developed in forest plantations. We believe that this discussion is a semantic and the effects of our work, in light of the above diversity of situations that may be considered SAF or SSP, we understand that grazing of forest plantations in Forestry

Livestock Systems call (SPF<sup>2</sup>) is the predominant expression occurring in our country and particularly in our study area.

This paper proposes that the great expansion of forest plantations in Rivera, according to a model mainly timber, determines a new modified environment, where livestock producers have adopted different strategies to adapt (Livestock Systems in Forestry) and their vulnerability is influenced by the characteristics of that ecosystem and resource endowments

Forest plantations in our country replaced ranching areas (where it is produced mainly meat and wool). Considering the low relative share of forests in land use (less than 5% of total area), at the national level does not seem a big change, but the effect is very evident in what we identify before and forest regions.

Traditionally, studies on the farm were targeted, limited to analysis of production processes at the mere physical and / or biological, from a partial, sectoral or single discipline (Malaquin 2009).

Meanwhile, studies of a territorial approach leaving the chains or agro industrial complexes allow a more comprehensive understanding of the changes that occur, so they can respond properly from public policy (infrastructure, logistics, technology, innovation and development , etc). However, do not account for the changes to the internal family-farm system, so far little is known about what happens to livestock producers who were or are in the areas planted.

From our perspective, the study of farming systems is to understand the relationships between man (farmer, his project, decisions), the animal stock and resources (feed, labor), within a certain context (ambient, market).

We study how a complex system control, which combines human decisions guided by a project and biological performances of animals and plants. This control is analyzed in the time scales of a financial year but also in the long term exploitation paths (Malaquin 2009)

Some producers have adapted to this new environment, adjusting and developing practical tools for the exploitation of livestock in it. These "new" ranchers who drives Livestock Systems in Forestry (SPF), have peculiarities that characterize them as a group and characteristics that distinguish a variety of situations related to their relationship with the land, its history / particular path and level resources they manages.

It is also important to recognize the weaknesses and risks that they identify in their systems, linked to their production systems, the relationship with the environment and contextual variables. From knowing these vulnerabilities, we can identify which are the main courses of action to minimize its possible effect on the different SPF and what are the levels at which one can act from the different sectors of society.

In particular we can understand in that area may action research institutions and extension, and the potential impact of their actions level.

## **METHODOLOGY**

We analyze secondary data sources and studies in our country about the interaction of livestock with afforestation, from a territorial approach (census tract, police section, department, region, etc). We use mainly official statistics of the Office of the Comptroller of livestock (DICOSE) of the Forestry Department (DGF) of the Research and Agricultural Economics (IDEA) and other public sources. We propose a typology based on aggregation centers, identified from self-knowledge and perform a series of interviews with representatives archetypal, emphasizing the vulnerabilities that they identify in their systems. The analysis of the collected data is done through content analysis, which is a research technique designed to make from the data, reproducible and valid inferences that can be applied in context. Considering the rates proposed in this paper, we identify individuals who could represent each one of them. This direct contact was established with growers through visits in the study area, raised the subject of study and scheduled an interview. We began interviewing 1 potential representative from each group, totalling 11 interviews at the end of the 7 types, was conducted between march and april 2011.

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<sup>2</sup> SPF= Sistemas Pecuarios en Forestación, in english Livestock Systems in Forestry

For types that are most frequently interviews were conducted with 3 producers. The interest in these groups apparently more often, the greater integration of livestock with afforestation (age of the farm, expectations and aspirations) as evidenced in interviews.

The sample was not probabilistic type, choosing the cases that might represent the population at some point. Although in the first 7 interviews (one of each) were all elements of analysis, that is no longer provided data or new insights, interviews were added to the groups that are most interest in this study.

## **HETEROGENEITY OF LIVESTOCK SYSTEMS IN FORESTRY (SPF): PROPOSED TYPOLOGY.**

From personal knowledge of the reference area, we can establish " agglomeration centers", ie certain types of producers preconceived share common characteristics and can differentiate themselves from others based on certain variables. This type is aggregative, empirical and open, so that new types can be added as it finds its existence. Thus, we can define some "types" of producers, enabling us to better understand the dynamics of farms.

We consider the land and livestock ownership as two major variables or principal, which can distinguish two large groups of farmers, foresters or silvopastoral (those identified with numbers 1 and 2). On the other hand, we consider the relative importance of each item within the herd, the relative contribution of forested area to livestock system and monetary origin of cattle (the identified capital letters: A, B, C and lowercase letters: a, b, according to the hierarchy level of the group).

Given these variables, we describe two groups, composed of 7 sub-systems including forestry and livestock components in the northeast of Uruguay and assign a descriptive name of its category.

1-The owner of the land and trees, is also the owner of livestock:

- A) Diversification forestry. They are forestry companies with a livestock component, which diversifies the original production is primarily forest. Consist of large plantations, where they also breed cattle.
- B) Diversification livestock. They are ranchers with forestry as a strategy of diversification, ie livestock producers who plant trees on designs and spatial arrangements, seeking to diversify their production. The original item considered by the owner's principal livestock, while afforestation provides a service to livestock and provides an extra income.

2-The owner of the earth and trees, is not the owner of livestock:

A) Ranchers with scaling strategy in forestry, they are livestock producers using forest plantation areas to increase their scale, according to the proportion of forested area used in the establishment, we distinguish two situations:

- a) Increase in complementary-scale, are farmers increasing their scale, but maintains its principal forage resources outside the forest plantation. Silvopastoral practice complements the livestock system.
- b) Increase of scale mainly, are farmers whose main forage resource is within forest plantations. The silvopastoral system is the largest part of the holding.

B) Livestock of opportunity- they are individual livestock producers, who do their operating exclusively in forest plantations in grazing regime. They find in plantations, the opportunity to develop a farm.

C) Associations of farmers of opportunity. They are associative forms of exploitation, grazing forested areas, as the source of capital distinguish chattel 2 subtypes:

- a) Association of breeders of opportunity, which comes from a self-propelled active more or less formal association of farmers. Are those farmers who are organized to use the opportunity of grazing on forest plantations.
- b) Investors Association of opportunity, using forest plantations in grazing regime / lease. Investors are usually extra-sectoral partnering to leverage the supply of grazing in plantations.

## VULNERABILITIES RECEIVED BY RESPONDENTS

Decision making on farms is given in an atmosphere of uncertainty, ie a situation of imperfect knowledge about the future, which is associated with the risk (Andrade and Laporta 2006). The risk refers to the imperfect knowledge about future outcomes, but with knowledge of the probabilities of possible outcomes and depends on the danger or threat, and vulnerability. We define risk as the probability of unexpected results as a consequence of decisions, omissions or actions of social groups (Andrade and Laporta 2006). So recognize the existence of uncertainties from the start, is what allows manage and therefore include it as an essential dimension of risk (Andrade et al, 2003). Content analysis of interviews, aims to provide knowledge, new intellections, a representation of facts and a practical guide for action (Kripendorff cited by Romero 2009). In this regard, based on analysis of interviews we identified common elements that respond to the context of exploitation, its system of decision (including aspirations, motivations and perspectives) or vulnerabilities.

The following table (figure 4) lists the vulnerabilities received by producers for each of the interviews.

Among the most repeated vulnerabilities are found in high care requirements and costs involved in animal health in these incorporations. They mentioned the increase in bicheras (especially navel) and other myiasis, the fungus from Eucalyptus, Tick and Parasite sadness as some of the main problems. Linked with this the forested lands are considered risky for the campaign to control FMD (by Livestock Services MCAP), which all movement in and out of them requires a health certification, vaccination as FMD.

It is also very common in the interviews, the identification of higher mortality in silvopastoral systems. The difficulty in achieving reproductive rates and / or production similar to the "clean field" is also mentioned as a vulnerability of these systems.

The rustling (cattle rustling), harvesting and forest management strategies are other vulnerabilities that recognize the interviewees.

The effect of planting on the water cycle, particularly its manifestation in the water source for livestock watering and progressive reduction in the supply of pasture are other vulnerabilities identified.

The organization of work as a vulnerability is linked to the difficulty in getting labor and increased labor required, as well as changes in the traditional handling of livestock.

The lack of knowledge and technology offer specific, it is considered a vulnerability, which has had to be addressed through trial and error with very high costs to the farmer.

Climate variability was seen by some respondents as a vulnerability though most understood the opposite, namely that the silvopastoral system is better adapted to climate variability so his vulnerability is lower.

VULNERABILIDADES/ENTREVISTADOS	1	2	3	4	5	6	7	8	9	10	11
	1 A	1 B	2 A a	2 Ab	2 Ab	2 Ab	2 B	2 B	2 B	2 Ca	2 Cb
1.SANIDAD DEL GANADO											
2.COSECHA SILVÍCOLA (TALA RASA)											
3.MANEJO SILVÍCOLA (PODA Y RALEO)											
4.MORTALIDAD											
5.INDICADORES PRODUCTIVOS											
6.ABIGEATO											
7.FUENTES DE AGUA DE ABREVADERO											
8.CICLO PASTURAS/ARBOLES											
9.FALTA DE CONOCIMIENTOS ESPECÍFICOS											
10.ORGANIZACIÓN Del TRABAJO											
11.VARIABILIDAD CLIMÁTICA											

Figure 4. Vulnerabilities perceived by each respondent.

## CONCLUSIONS

The dynamics of substitution of cattle for afforestation in the study area occurred in the first decade of forest expansion (1987-1997), but then was a kind of recolonization livestock at least partially (because trees reduced the carrying capacity) of the same areas.

According to sources, in Rivera some 200 grazing livestock producers planted 160,000 ha. While we found a forestry company that has its own SPF (Diversification forest type 1 A), some farmers that included afforestation (Diversification livestock 1 B), very few associative enterprises both capital and livestock (types 2 and Ca 2 Cb) we can say that the vast majority are increasing the scale Ranchers or Cattlemen's chance (types 2 A and 2 B).

The attitude of the forestry companies to ranchers, changed after the last crisis in United States (even persistent: Grazing lease/ceased, to be a low income relative with the advantage of controlling grazing (reduced risk of fire), to be a source of liquidity and profitability.

With the current price relationships, the value of the services it provides to livestock afforestation in the SPF (60 U \$ / ha for grazing +100 U \$ / ha for control of undergrowth and pastures), is of similar magnitude to forest production itself (90 to 160 U / ha).

According to the manifestations of most respondents, the current prices of grazing on forest plantations, questions the viability of the SPF, taking into account the vulnerabilities expressed that in many cases involve extra costs or commitments to address them productive.

Given the above information (and FUCREA IPA), the values of capital income at farm level (69 to 98 U \$ /ha) can hardly meet these rent values in systems with incremental costs.

This argument is contradicted by an ongoing demand for grazing, we believe that larger scale events affecting the dynamics of the sale and lease of land where grazing forest plantation is only a part. Besides the services mentioned, farmers could fulfil function of interest for afforestation, for example health alert or rangers, provided they are trained for this purpose (and receive remuneration).

Livestock farming has much to contribute to the forestry model established from the SPF, but it is necessary to recognize and address the vulnerabilities, many of which involve solving tensions between the parties. Grazing improves the environmental conditions of the forest (the effect on runoff decreases and increases biodiversity), meanwhile the forest can reduce the metabolic cost of animals and improve the GHG balance of the system.

On the other hand, the asymmetry of the relationship between foresters and farmers conspire against the consolidation of sustainable system, in this area public policies could collaborate for a better articulation.

The SPF is a new type, it is necessary to recognize and study in the same way they have defined and studied farming systems, agricultural livestock, agricultural dairy, etc.

Some of them could support sustainable rural develop life, particularly those of family kind (SPF fam), promote the settlement of families based on farms that use large areas of forest enterprises.

Public policies should be directed from the vision of the territory, as a better strategy to address vulnerabilities presented by the current rurality, where meet two agricultures (companies-families) with different speeds and dimensions, who should be developed together.

The SPF have specific vulnerabilities, within which the lack of organization is a major (although not perceived by the farmers), so that a change in attitude could be the starting point for greater bargaining power to alleviate some of them.

Recent changes in public policies in the forestry sector (reorientation and adjustment), as well as forecasts on climate (increased precipitation and extreme events); we suggest that the SPF will be facilitated though hardly promoted. In other words these contextual factors (climate and policy) are expected to be favorable to lift vulnerabilities, but not important determinants of changes.

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