STUDIES AND MANAGEMENT OF NATIVE SAVANNAS OF COLOMBIA'S EASTERN PLAINS (LLANOS)

Georges Rippstein
Grassland Ecologist, CIAT/CIRAD-EMVT

1. GENERAL GOALS

Keep, improve, and, if necessary, regenerate the grazed ecosystem of Colombia's Eastern Plains (or Llanos), in the context of intensifying the introduction of new technologies, particularly forages and agropastoral systems (rice-pasture).

2. GEOGRAPHIC SITUATION

The Eastern Plains of Colombia are located between the Andes Mountains to the west, the Amazonian rain forest to the east and south, and Venezuela to the north. These pastures are called "tropophilous" savannas, treeless or "clean" savannas, intersected by gallery forests over a narrow band along rivers (Map 1).

Ten to twelve percent of this area is improved pasture grasses and some legumes, with the area in improved pastures increasing regularly (Map 2, Table 1).

3. PROBLEMS OF THE NATIVE PASTURES

These native pastures have low productivity (3-4 t DM/ha/yr) and fair quality due to very poor soils and species with bad palatability and low forage value.

Because of the importance of livestock and low stocking rates, as well as large native pasture areas and their poverty, it is essential to maintain or improve the use of these natural pastures and, if necessary, regenerate them, since all this area cannot become forages (especially in the Serranía and poorly drained Altillanura).

4. HYPOTHESES OF WORK

Normally, the climatic conditions of Colombia's Eastern Plains (rainfall, 2000 mm per year, with a rainy season of eight months or more; an annual mean temperature of 24°C; relative humidity of 80% in the rainy season and 50%-60% in the dry season; relatively well-drained soils) would lead to a physiognomic form of shrub savanna (and/or a tree savanna) or a forest.

However, clean savanna (or a very limited shrub savanna) and gallery forest can now be seen.

This physiognomy can be explained by natural conditions (fertility and hydric soil conditions), by the action of the pastures and, particularly, men and animals (deforestation, fire, forage).

Fire, regrowths → low productivity

5. STUDIES

In this context, our objectives will be to:

1. Increase the basic knowledge of the native savanna of Colombia's Eastern Plains:

   - Complete the inventory of flora (biodiversity).
   - Establish the typology of the savanna and bases for mapping (using satellite images).
   - Determine palatability, quality, and productivity of local species and pastoral value of savannas.

2. Better understand and explain the reasons for the present physiognomic form (fire climax) and the botanical composition of vegetation of these plains in order to avoid more degradation and, if possible, improve soil fertility, pasture productivity and quality.

3. Study productivity, quality and, in particular, the dynamics (or stability) of different types of vegetation managed with fire, rotation, rest and, stocking rate.

4. Propose new systems to manage native and improved pastures adapted to natural and improved conditions that will allow amelioration or at least stability (in a farming system). These systems will avoid pasture degradation (decrease of the best local and exotic species, erosion, etc.).

6. SOME RESULTS

6.1 Botany-biodiversity

Two different zones were already investigated in the Llanos: the flat area (Altillanura plana) and the more disturbed area (Serranía).

Biodiversity in Altillanura and Serranía

	Species	Family	Gram	Legumes
	- - - Frequency - - -			
Altillanura	158	43	45	23 Fab. Mimos. Caesalp.
Serranía	173	39	53	26
Different species	84		26	13

The native savanna is poor in different species (relative to Cerrados for example) but we have an important number of *Paspalum* (12) and *Panicum* (4). The vegetation is poor in good, productive legumes but quite rich in frequency.

6.2 Ecology and inventory

In the Carimagua region, we made a pilot study of vegetation ecology characterization and the inventory of the vegetation units

Twenty vegetation groups were identified. These twenty groups where reduced to eight ecological groups. Each group is characterized by characteristic species and edafic specifications. We have mapped this region. With the help of satellite images.

6.3 Classification and surface

Vegetation of the Llanos. According to management practices. SPOT Satellite Image. CNI ICA/CIAT window, Carimagua/Colombia:

. ***Dry season (March)***

	Vegetation classes and management practices	Surface (percentage)
1.	Recent burning (0-1 month), bare soil + ashes	1.06
2.	Recent burning (1-2 months), bare soil without ashes	1.20
3.	Savanna >5 months after burning. Clay soils	27.74
4.	Open savanna (soil visible: ant-hills) degraded and cultivated pastures overgrazed	20.47
5.	Savanna >5 months after burning. Sandy-limo-soils with *Schizachyrium hirtiflorum*	9.43
6.	Bare soils or recent ploughing	2.66
7.	Wet grassland (lowlands)	4.04
8.	Dry savannas (very old burning)	15.82
9.	Gallery forest	6.61
10.	Free water + rivers	0.26
	TOTAL	89.32
		10.68

. ***Rainy season (September)***

	Vegetation classes and management practices	Surface (percentage)
1.	Regrowth after burning during the dry season (dense chlorophyll savanna)	9.62
2.	Savanna ≥ 1 year after burning	34.73
3.	Savanna ≥ 1 year after burning (with more chlorophyll than 2).	17.40
4.	Dry savanna with important biomass (very old burning, >1 year)	11.17
5.	Open savanna, young savanna well grazed or degraded cultivated pastures (soil visible)	8.35
6.	Wet lowlands + subsidence zones of river and lake	1.61
7.	Young savanna, young or degraded cultivated pastures	1.08
8.	Bare soil or degraded cultivated pasture	1.78
9.	Gallery forest + lowlands near the rivers	10.48
10.	Free water (lake) + large rivers	0.70
	TOTAL	96.92
		3.08

In rainy season, some classes are different than in dry season (different management, content of chlorophyll, etc.). Two types of maps have to be made (one for each season).

6.4 Vegetation dynamics

The first results of management studies show that the timing of burning is very important for pasture value, botanical composition and dynamics of native savannas.

Stocking rate is less important, but very high stocking rate can increase the changes and the biodiversity of the native pastures over the long term.

If native pastures are mismanaged by over grazing or injudicious burning, their species composition changes and they are said to degrade. To understand how degradation as a process is related to trends in population dynamics, a long-term experiment on time and frequency of burning and grazing intensity on native savanna is being carried out at Carimagua.

Relative presence of some native savanna grasses after 10 years of burning at different times of the year, grazed at two stocking rates

Species	Low stocking rate (0.25 AU/ha)			High stocking rate (0.5 AU/ha)		
	Burning in:			Burning in:		
	Apr.	Aug.	Dec.	Apr.	Aug.	Dec.
Axonopus purpusii	0.0	45.1	6.2	0.6	62.0	10.4
Andropogon leucostachyus	2.6	5.3	11.9	1.3	3.5	7.1
Gymnopogon foliosus	34.8	0.3	0.0	48.7	0.0	0.0
Panicum versicolor	3.0	3.4	11.8	11.7	6.1	5.8
Trachypogon vestitus	38.0	19.5	51.5	12.1	3.3	3.7

6.5 Other studies

Dutch students are assisting with some preliminary studies of the vegetation in the undulating "serranía" savannas with the aim of relating the species composition to management practices and soil type.

A student from the University of Paris conducted a preliminary survey of soil macro-fauna under native pastures compared with gallery forest, improved pasture and several crops. Compared with the gallery forest, the savanna had lower diversity and numbers of macro-fauna. An old *Brachiaria decumbens*/Kudzu pasture maintained the diversity and dramatically increased the populations of earthworms. In contrast, crops of rice, and especially cassava, almost eliminated macro-fauna.

7. FUTURE STUDIES

The inventory of the native vegetation of the Serranía and poorly drained Altillanura will be the next step in the ecological studies over the next two years.