



**MAN AND THE BIOSPHERE SERIES**

Series Editor J.N.R. Jeffers

**VOLUME 12**

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**THE WORLD'S SAVANNAS**

Economic Driving Forces, Ecological Constraints and  
Policy Options for Sustainable Land Use

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PUBLISHED BY



PARIS

AND



**The Parthenon Publishing Group**

International Publishers in Science, Technology & Education

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## CHAPTER 12

### LAND USE IN VENEZUELA

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#### SUMMARY

The availability of soil moisture during the dry season and the low-level nutrient status of the soil are the two main ecological constraints limiting natural and agricultural productivity within the Orinoco savannas of Venezuela.

Contrary to the perception expressed in some studies, the agricultural frontier is not expanding in the Venezuelan savannas. Instead, agriculture is still largely underdeveloped and marginal, and the savannas remain essentially uncolonised. The main land use is extensive cattle-raising under low-input management. Transformation into land suitable for crop production can only be achieved with considerable investment in infrastructure, roads, machinery and large subsidies. Crop production is technically possible but in most areas not consistent with national economic interest. The general low productivity of seasonal savanna systems needs to be recognised. In the last 30 years national agriculture, despite many government subsidies, programmes and substantial investment, has not been able to compete with imports.

A strategy of use based on extensive cattle-raising, coupled to technically based improvement of the quality of native pastures and the remodelling of the trading system, would allow productivity to improve without major environmental risks. Tourism and recreation, as well as the development of ecologically sound industries to exploit native animal populations, could also help to increase productivity and would be self-sustainable.

#### INTRODUCTION

Venezuela has nearly 300,000 sq km of savanna lands, which represent almost one third of the national territory. Most of this is located in the

Orinoco Llanos region in the central part of the country. Although there is an important amount of ecological information on the Venezuelan savannas (Sarmiento 1983, 1984; Acevedo and Silva 1985), studies on savanna land use are restricted to some areas. There is a lack of research linking the ecological and economical aspects of land use with a more general approach.

In this chapter, we present a preliminary view of savanna land use in Venezuela, and try to emphasise similarities and differences with the rest of the country. The influence of ecological constraints and government policies in the last three decades is then examined. The analysis is restricted by the lack of specific information on savanna lands, since official statistics refer to administrative units (States), not savanna land units. The statistics are scarce and have been further reduced during the last decade. Most of the information presented is based on the Anuario Estadístico de Venezuela and on the National Censi of 1961 and 1971.

Since this is a preliminary view, we concentrate on two representative areas within the Orinoco savannas: (1) the Mesas Region, located in the States of Anzoategui and Monagas in the eastern part of the country, and (2) the Llanos of Apure Region, which comprises most of the State of Apure in the south of Venezuela (see Figure 12.1). We selected these two areas because they present extended and continuous savanna vegetation, comprising a gradient of ecological conditions, from drier and well-drained seasonal savannas to wetter, periodically drenched hyper-seasonal savannas. Furthermore, a very important oil extractive industry is located in the Eastern Mesas Region.

These two areas cover nearly 80,000 sq km, about one-third of the total savanna area in the Orinoco Llanos and almost one-tenth of the national territory. In 1982, the total population of the three States, Anzoategui, Monagas and Apure, was 1,366,499 people. This is equivalent to 8.7 per cent of the total national population; 80 per cent of the people live in cities. The main cities of the Eastern Mesas are Maturin, El Tigre, El Tigrito and Barrancas. In Apure, the main cities are San Fernando, Achaguas, Mantecal and Elorza.

## **THE ORINOCO SAVANNAS**

### **Geomorphology**

The Orinoco Llanos are located in a large geosyncline, limited by the Guiana Shield to the south, the Andean Cordillera to the west and the



**Figure 12.1** The Orinoco Llanos Region of Venezuela (dashes) and the location of the two study areas, Apure and the eastern mesas of Monagas and Anzoategui (dotted)

Caribbean Cordillera to the north, and comprise around 500,000 sq km of quaternary sediments. Pleistocene tectonics raised some areas, isolating them from further depositions and exposing them to erosive processes (Mesas Region). Other areas were depressed and progressively covered by more recent sediments.

### **Climate and soils**

In contrast to the diversity of landscapes due to a variable geomorphology, the Orinoco Llanos have a homogeneous, macrothermic and isothermic climate. Annual mean temperatures are 24–28°C. Biotic activities are never limited by low temperatures. The region is wet, with annual rainfall varying from 900 mm in the Mesa de Guanipa in the Eastern Mesas to 1800 mm in the Andean piedmont. Rain is very seasonal, with a wet season from May to November, followed by a dry period with no rains. All savanna soils can be considered as homogeneously dystrophic as a result of their

origin and the intense leaching (Sarmiento 1983). The availability of soil moisture during the dry season and the low-level nutrient status of the soil are the two main ecological constraints that limit natural and agricultural productivity in this region.

The accumulation of dry biomass in the grass layer makes possible the annual occurrence of fires during the dry season. Fire removes the standing biomass, promotes the growth of native grasses (Silva et al. 1990, 1991), and reduces tree growth (San José and Fariñas 1983; Fariñas and San José 1985). Most of these fires are man-induced.

In the Mesas Region, seasonal savannas are located on the raised flat lands, locally known as mesas, from the lower Pleistocene age. These have been fragmented and dissected, and present a flat or gently rolling topography. The annual rainfall, between 900 and 1000 mm, is the lowest of any savanna in the Llanos Region. Soil erosion is important in both hydric and eolic forms. Soils are oxisols and ultisols, very poor in nutrients, with good drainage and a deep water-table (COPLANARH 1974). They are never flooded and after the rains they dry rapidly. Standing crop figures for these savannas are in the range of 300–700 g/m<sup>2</sup> (Sarmiento 1984).

The savannas from the State of Apure are on alluvial overflow plains and on eolian plains (Sarmiento et al. 1971). The former date from late Pleistocene to early holocene. The overflow of rivers has modelled the landscape, giving rise to a network of physiographic units such as pediments, deposition and drainage basins, with fine sediments (silt and clays). Most soils are alfisols or inceptisols, and vertisols are found at the bottom of the topographic catenas (Comerma and Luque 1971; MARNR 1982). The eolian plains are considered to be remnants of a former arid morphogenesis from the Würm glaciation. They are characterised by extensive dune fields superimposed on larger areas of loess-like material, partly covered by younger alluvia. Soils are very sandy (psamments), but topography may create restrictions to drainage.

In the Apure savannas, soils are also poor in nutrients, but alluvial soils are nutritionally better than those from the mesas. Standing crops in those savannas ranges from 700–800 g/m<sup>2</sup> (Sarmiento 1984).

Physiognomy is very similar in both regions: open savannas and grasslands are predominant. In hyperseasonal savannas, trees are restricted to better-drained river banks or dunes. In the better-drained, seasonal savannas, trees are restricted to areas where the water-table is reachable.

### **Flora and fauna**

Both regions have similar flora. Common tree species are: *Curatella americana*, *Bowdichia virgilioides*, *Byrsonima crassifolia* and *Casearia syl-*

*vestris*. The grass layer is dominated by species from the genera *Trachypogon*, *Andropogon*, *Axonopus*, *Paspalum*, *Leptocoryphium*, *Sporobolus*, and *Elyonurus*, and by sedges from the genera *Bulbostylis*, *Cyperus*, *Dichromena*, *Eleocharis*, *Fymbristilis*, *Scleria* and *Rynchospora*.

Within the Orinoco savannas there are two large national parks. One (Aguaro-Guariquito), was created in 1974 and is located in the State of Guarico, out of the study area. It is the second largest in the country and covers 560,000 ha (MARNR 1978). The other, Santos Luzardo, was created in 1988 and is located in the State of Apure. It covers 384,368 ha. Both parks have a very diverse wild fauna, especially birds. They lack any infrastructure for tourism or educational purposes, and even road access is difficult during the rainy season. The potential for fauna-based ecotourism is great, however.

Although low population density, remoteness and lack of access protect the biota and the ecosystems in these savannas, many vertebrate species have experienced heavy pressure from hunting and poaching. Of all the vertebrates, 94 species are reported as needing special protection. Of these, 11 are listed as highly endangered. The most well known of these include the cats (*Panthera onca* and *Felis pardalis*), the jabirú (*Jabiru mycteria*), the scarlet and the red-bellied macaws (*Ara macao* and *A. manilata*) and the Orinoco's caiman (*Crocodylus intermedius*) (MARNR-BIOMA 1991). These, and other animal species, are already under protection.

## People

Two main aboriginal groups are found in the area of study (Mérida 1966). The first group are found in the Mesas of Anzoategui and are known as the *Cariñas*. This small group of people are almost totally integrated to Spanish culture and live as peasants. The second group live in the Apure and are known as the *Yaruros*. Despite the intense pressure from Creole settlers, the *Yaruros* still maintain some traditional aboriginal land-use practices. Both groups are much endangered, not only because of cultural pressures, but also because of disease and direct attack from Creole settlers.

## SAVANNA LAND AGRICULTURE

### Savanna land use

In the three States under study, a high proportion of the land is covered by native grasslands and is used mainly for extensive cattle-raising with traditional, very simple management techniques. Only a small fraction of

**Table 12.1** Land use as a percentage of total land devoted to crops or introduced pastures, savanna rangelands and other (including fallow lands, forests, swamps, etc.)

	State		
	Monagas	Anzoategui	Apure
Agriculture			
Crops	10	7	2
Improved pastures	16	16	4
Savanna	47	38	72
Other	27	39	22

Source: National Census of 1971

the land is used for agriculture, including cultivated pastures. Agriculture is least developed in the State of Apure (see Table 12.1).

Until very recently, most of the ranches did not have any fencing. Extensive cattle-raising is conducted on native, low-nutrition grasslands, with little technical input. Maximum carrying capacity is only 0.5 animal units per ha. Savannas are seasonally grazed, and in hyperseasonal savannas the herd is moved toward better-drained areas during the peak of the rainy season. At the beginning of the dry season, cattle are sold to intermediaries who move them to ranches in the piedmont. There, the animals are fed on cultivated pastures for a few months before sale to meat industries.

Use of modern agricultural technology is very limited. For crops, like cotton, there is a very moderate technical support (irrigation, fertilisers, pesticides). Farming has low-profit margins, partly because of government policies controlling the market prices of agricultural produce and partly because most of the income generated goes to the intermediaries and only in a small degree to the producers (CENDES 1975). Furthermore, an important fraction of the profits, rather than being used to improve savanna productivity is diverted to other activities. As a result, these ranches exhibit a general situation of low productivity and progressive decapitalisation (Martinez 1975).

### **Savanna land tenure**

The pattern of land use described above conforms with a system of ownership characterised by very extensive ranches (see Table 12.2), most

*Land use in Venezuela*

**Table 12.2** Distribution of land by size of holding

Size ha	<i>Apure</i>		<i>Monagas</i>		<i>Anzoategui</i>	
	<i>n</i>	ha	<i>n</i>	ha	<i>n</i>	ha
<1	649	276	306	150	651	324
1-19.9	7490	37,311	11,659	65,523	10,937	47,203
20-99.9	1729	54,939	1841	68,835	1885	74,695
100-499.9	383	79,390	57	119,020	1144	270,330
500-2499.9	290	321,058	243	239,835	781	784,495
>2499.9	412	3,729,305	74	388,131	151	758,411
Total	11,062	4,729,305	14,774	881,494	15,843	1,949,458

Source: National Census of 1971

**Table 12.3** Distribution of land tenure by area. Source: National Census of 1971

	<i>Anzoategui</i>	<i>Monagas</i>	<i>Apure</i>
Owned (%)	85	83	83
Rented (%)	2	3	1
Occupied (%)	12	12	15
Other (%)	1	1	1
Total area (ha)	1,949,458	881,494	4,222,309

of which (80 per cent) are privately owned (see Table 12.3). Both the tenure system and the type of use have been predominant since colonial times (Rodriguez Mirabal 1987) and, despite the agrarian reform of 1961, have not been changed.

As shown in Table 12.2, in the State of Monagas only 2 per cent of the farms are larger than 500 ha, but they represent 71 per cent of the total area. In Anzoategui and Apure, 6 per cent of the farms are larger than 500 ha, but they represent 80 per cent of the total area in the former and 96 per cent in the latter. Note that these statistics are for the whole of each State; the concentration is even higher in the savanna lands since small farms are more abundant in the forested mountains. Size and type of land use are closely related. A high proportion of farms below 20 ha used exclusively for crop production, whereas almost all farms larger than 500 ha are devoted entirely to the production of cattle.

Concentration of land property has been considered one of the major obstacles to agricultural development within the country. Since large farms are mostly devoted to extensive cattle-raising, crop producers are restricted to small farms. Some people consider this decreases the efficiency of crop production as large landowners are not prepared to subdivide their land and sell part of it to farmers. As a result they are forced to rent the land

they use in a way that increases management costs and risks and also makes it more difficult to obtain credit. The incentive to improve or maintain the land is less under such arrangements (Orta 1974b).

### **The agrarian reform**

The land tenure system, characterised by very large landed estates (*latifundios*), is considered one of the great obstacles to the formation of agricultural capital and to technological innovation (Orta 1974b). The Agrarian reform was approved as a law in 1961, as a demonstration of the political decision of the ruling democracy to transform the rural system. The goals were to bring about a more equitable distribution of land ownership by breaking up large estates and giving the rural population a significant role in social and economic development and in political affairs. It was anticipated that this initiative would provide 300,000 rural families with 10 ha of land in property and raise the living standard of rural workers. The technical and financial assistance to facilitate this was also to be provided.

In implementation, however, the programme was very different and, after the first decade of enforcement, the programme was progressively abandoned. The reasons for failure were complex but relate largely to difficulty in breaking up large estates. Instead of doing this, most of the land allocated was public land with little production potential. Less than 10 per cent of all the land provided to the peasants came from privately-owned land. Thus, the major estates remained untouched. Furthermore, only a third of the proposed number of families received land, and of those 50 per cent received lots of 5 ha or less. Only 20 per cent received financial support.

The lack of technical and financial aid, and the limited area of agricultural land allocated to each peasant, made it very difficult to accumulate and consolidate working capital. A chronic debt problem resulted and to clear these debts families were forced to sell their land and migrate to the cities in search of jobs. Ironically, this land was then purchased by large estate owners with the result that land ownership became more concentrated and more public land entered into private ownership. The outcome of agrarian reform was the exact opposite of what was intended.

### **Traditional crops**

The main crop in the Orinoco savannas is corn. Other traditional crops are beans, manioc and cotton. A significant fraction of agricultural production is for the national markets and the agro-industry, only a small

**Table 12.4** Percentage of agricultural produce consumed on the farm. Source: National Census of 1971

<i>Proportion of produce consumed on the farm</i>	<i>State</i>		
	<i>Anzoategui (%)</i>	<i>Monagas (%)</i>	<i>Apure (%)</i>
All	5	1	2
Major portion	22	7	19
Minor portion	54	71	67
None	19	20	12

fraction being consumed on the farms (see Table 12.4).

During the past 3 decades, traditional crops have shown important fluctuations, both in harvested surface and production. Despite increasing needs traditional crop production either stagnated or declined. This picture contrasts with an apparent growth of agricultural production in the country, which parallels population growth from 1968 to 1980. Most of the production increase has been in rice, sorghum, eggs, poultry, fruits, pork, meat, milk and vegetables. These items are cultivated in the central and western parts of Venezuela, on lands from dry and wet forests, and in fertile valleys from the mountains and the Llanos regions.

One remarkable case is cotton, which almost doubled in harvested land during the early 1970s to decrease to very low levels subsequently (see Figure 12.2). From being a very important crop in the State of Anzoategui, it declined considerably during the 1970s to reach the low levels of Monagas and Apure.

Bread made of corn is an important element in the diet of Venezuelan people. Corn is also used to produce cooking oil. Corn production, however, has shown very wide fluctuations, both nationally and within the Orinoco savannas (see Figure 12.3). In contrast, corn imports have increased from very low levels in 1969 to a level that is two times higher than national production (see Figure 12.4). Competition from imported wheat has been an additional problem for corn producers. In 1951, 65 per cent of cereal consumption was provided by corn and 28 per cent by imported wheat. In 1984, the share of corn had declined to 37 per cent of the total, and that of wheat had increased to 50 per cent (Hernandez and Merz 1986).

Therefore, despite direct and indirect subsidies to agriculture, traditional crops have shown stagnation or deterioration during the last 30 years. There is no apparent direct relationship between Venezuelan agricultural production and market prices, and other factors, such as certificated seed supply, storage capacity, marketing assurance, technical assistance and competition with internationally produced substitutes like wheat, may be playing an important role (Kastner et al. 1983).

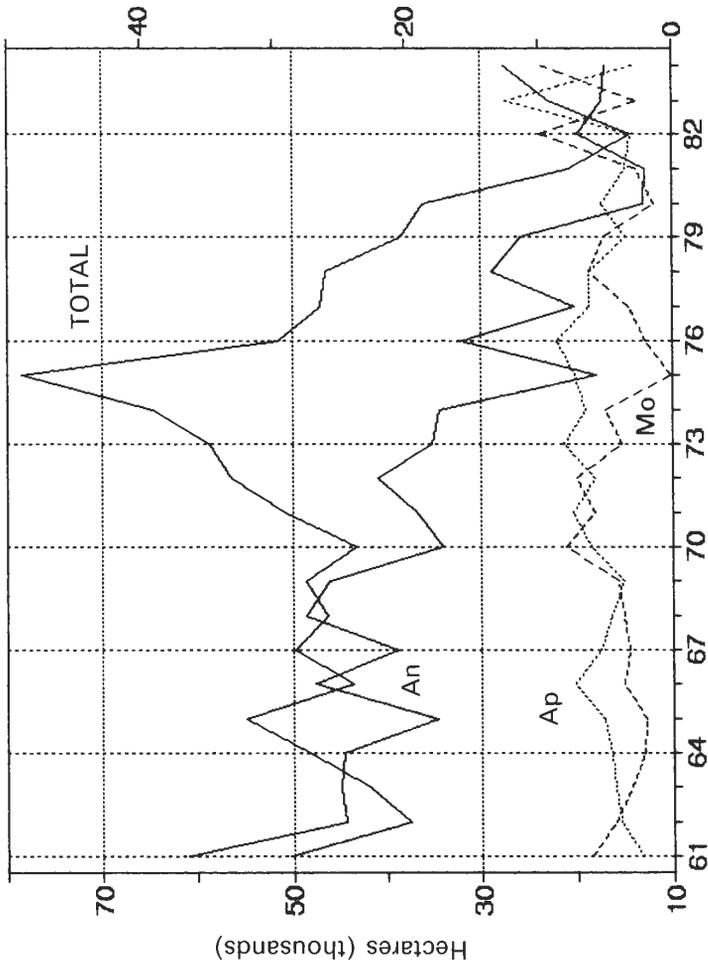


Figure 12.2 Harvested surface for cotton during the period 1961–1983, for the country (total) on the left vertical axis, and for each of the three States, Anzoategui (An), Monagas (Mo) and Apure (Ap), on the right vertical axis

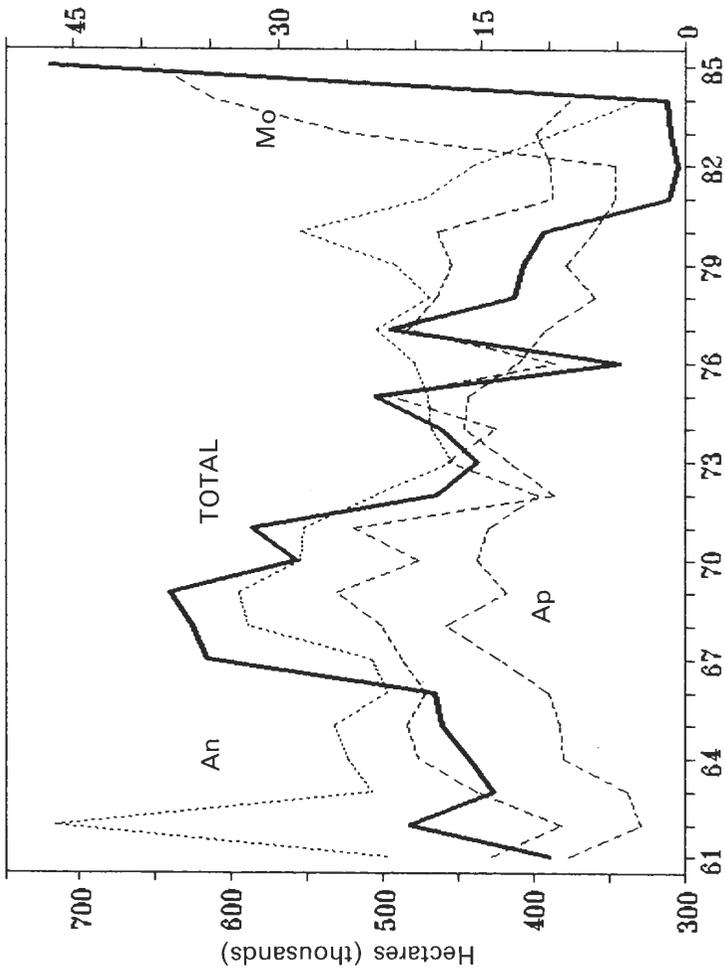


Figure 12.3 Harvested surface for corn during the period 1961-1985, for the country (total) on the left vertical axis, and for each of the three States, Anzoategui (An), Monagas (Mo) and Apure (Ap), in the right vertical axis

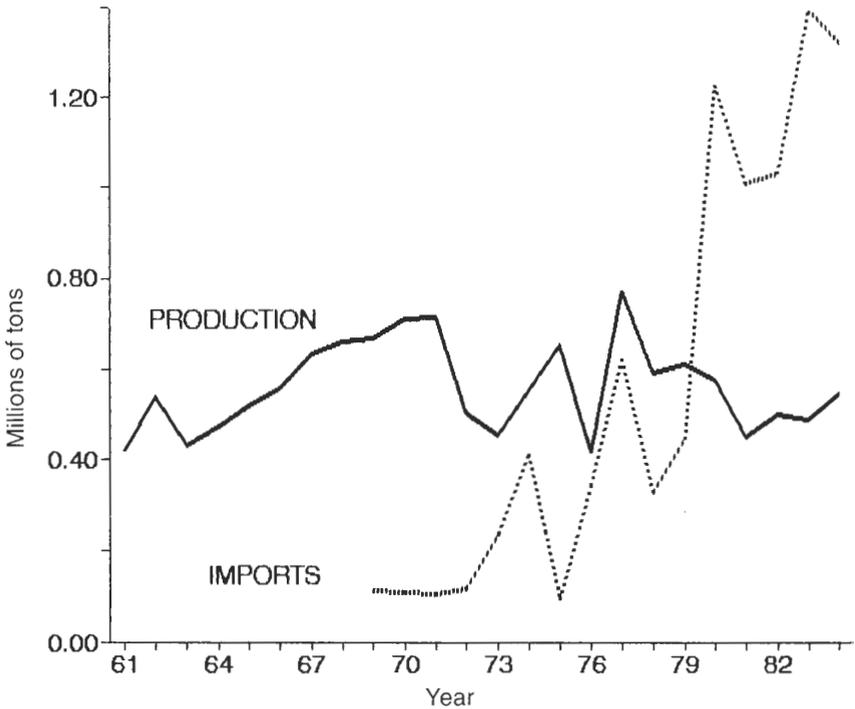


Figure 12.4 National production and imports of corn from 1961 to 1984 in millions of tons

### RECENT AGRICULTURE IN SAVANNA LANDS

In addition to the support for traditional crop production, government policies have sought to introduce new crops that are adapted to local conditions, as well as other economic programmes to enhance the productivity of savanna lands.

#### The peanut plan

One example of this approach has been the peanut programme targeted to Mesa Guanipa within the savannas of the State of Anzoategui. The introduction of this crop was facilitated by a concessional loan programme designed to help retired employees from the oil companies, store owners and young professionals from the main towns (El Tigre, El Tigríto) to become farmers. The programme included cooperation with agro-industry and technical assistance to improve production as well as trading. A

cooking oil factory, and several organisations for technical assistance and trade, were established (CENDES 1975).

Peanut production under this programme makes intensive use of irrigation, fertilisers, pesticides and machinery in a way that permits farmers to grow two crops per year. Nevertheless, the cooking oil industry finds it cheaper to import peanut oil. As a result, producers have only been able to persist because they continually receive government subsidies.

### **Sorghum**

Sorghum was introduced in the savannas of the Mesas Region as well as in the deciduous forests of the Central Llanos Region during the early 1970s. The harvested surface increased considerably during the 1970 decade, both nationally and in the Mesas, but for 1984 the latter had declined to less than 20 per cent of the 1980's peak.

### **Pine plantations**

Another programme was the pine plantations in the southern mesas of the State of Monagas, sponsored by the Central Venezuelan Government's Corporation of the Guayana Region. It was initiated in 1968, with the goal of sowing 140,000 ha with Caribbean pines at a rate of 10,000 ha per year for the paper industry. By 1985, the programme was to provide two-thirds of national paper needs, by means of a paper factory to be installed in the area, in partnership with an international consortium.

The plantations have developed well, reaching nearly 70 per cent of their goals. However, the paper mill has not been installed and it does not seem to have any priority within the current plans of the Central Venezuelan Government. Meanwhile, the pines are used for lumber and resins, in small-scale operations. The huge investment provided for the plantations is now at risk due to the delay and expected cancellation of the plans to build the factory.

### **Flood plain management**

Another government programme was started in the early 1970s to improve the carrying capacity of the flood plains savannas in the State of Apure. A system of dikes, to control the flooding and to keep a reservoir of water for the dry season, was constructed on an experimental basis. Several research programmes followed the changes in floristic composition, nutrient

dynamics and ecological status of the lands affected, as well as animal production (Gil Beroes 1976; Lopez-Hernandez et al. 1983; Berrade and Tejos 1984; Tejos 1984). The results showed a significant increase in the contribution of several nutritious species (*Leersia hexandra*, *Hymenachne amplexicaulis*, etc), higher animal production and changes in the carrying capacity from 6 to 1.5 ha per animal unit. However, the programme has been practically abandoned as a result of political changes and, apart from the results mentioned above, no evaluation has been made of the social and economic implications of the programme.

## **MARGINALITY OF SAVANNA AGRICULTURE**

Savanna lands in Venezuela, like those found in most other parts of the world, are of limited production potential. Under Spanish rule, the economy was orientated to crop production for international markets, and the country was not structured as a geographical and social entity. Instead, each independent region was connected to international trade by a city port. Whilst the Andean region experienced important economic prosperity, first from wheat agriculture and later from coffee plantations, the growth of the Barinas region was promoted by tobacco exports and the Central region prospered due to the cocoa plantations in the Coastal Cordillera, the Orinoco Llanos, and especially the savannas, remained socially and economically depressed. This stage lasted until the crisis of the agro-export economy, during the worldwide depression of the 1930s.

Both the nutritional conditions of the soils and the strong seasonality in water availability are important natural constraints on the development of sustained agriculture in these savannas. Crop productivity is consequently low and any increase can only be achieved with large subsidies and considerable investment in infrastructure of roads, machinery and capital improvements.

Savanna lands have, therefore, remained marginal to the agricultural development of the country, which is taking place instead in those regions with higher natural productive potential, such as the western piedmont of the Llanos Region with dry and mixed forests presently being replaced by annual crops. This marginal condition of savanna lands is not new. It originated in colonial times, and there is evidence that it is now increasing as a consequence of the advance of the agricultural frontier in other regions.

During the last 2 centuries (agro-exporting period), these savannas contained most of the national herd and were the major providers of meat and milk, based on extensive, semi-pastoral techniques. During the last 30 years, the agricultural frontier has advanced and replaced very extensive forests in the piedmont and the southern Maracaibo (Zulia) regions. These

**Table 12.5** Changes in the size of the cattle herds in the three States of the study area, in the whole country, and in the State of Zulia for comparison ( $\times 1000$ )

	1937	1950	1961	1971	1984
Apure	954.7	1154.3	1315.7	1283.6	1782.4
Anzoategui	352.7	432.1	387.1	436.1	524.6
Monagas	136.0	278.9	196.2	302.8	363.6
Zulia	289.1	502.4	908.8	1792.8	2645.5
Venezuela	4303.5	5768.8	6440.7	8549.3	11,843.6

Source: Anuario Estadístico Agropecuario

replacement systems have become stable as grasslands with introduced pastures, connected to livestock industrial development. As a result, national needs for these foods are provided in a substantial proportion by these new agricultural regions. As an example of these tendencies, the contribution of the State of Zulia to the national cattle herd has increased very rapidly, whereas those of the states of Apure, Anzoategui and Monagas have only increased moderately since 1935 (see Table 12.5).

The existence of numerous oil wells in the Mesas Region has not had any positive impact upon local economies nor upon agricultural development. On the contrary, this has further contributed to the abandonment of rural areas.

In summary, and contrary to the perception of some studies (Cochrane et al. 1985), the agricultural frontier is not expanding in the Venezuelan savannas. Instead, agriculture is still largely underdeveloped and marginal in both poorly drained and well drained savannas of the Orinoco Llanos, and they remain essentially uncolonised.

## **THE FRAMEWORK OF VENEZUELAN AGRICULTURE**

The lack of precise information, the complex web of policies and programmes, and the lack of coincidence between the proposed goals and the achievements make analysis of recent Venezuelan agricultural history very difficult. On the other hand, this paper is not intended to clarify the causes of the present conditions of Venezuelan agriculture. Instead, we will highlight a few main aspects of its development.

During the last three decades, around 20 per cent of oil revenue has been directed towards the agricultural sector, as part of a strategy to reduce food imports by promoting the development of a food industry based on national agricultural production. This strategy has required the development of a large and complex set of institutions to channel public and private

investments, including banks (Banco Agrícola y Pecuario, Banco de Desarrollo Agrícola), national corporations (Corporación de Mercadeo Agrícola), regional corporations (Corpo Andes, CorpoLlanos, etc). Furthermore, major investments have been made to develop the infrastructure needed for modern agriculture, such as irrigation systems, electrification of rural areas, roads and telephone systems, etc.

Besides the inefficiency of investment in agriculture, especially major projects like irrigation systems, the agricultural sector has not been able to consolidate its assets and has tended to divert profits towards other sectors, instead of reinvesting in its own development (Orta 1974a).

### **The policy of subsidies**

The six previous democratic administrations have maintained a constant policy of direct and indirect subsidies for agriculture. Among the former, the prices of fertilisers and pesticides have been maintained much lower than in the international market, via direct government subsidy of the petrochemical industry. This has induced the use and abuse of these chemicals, creating serious pollution problems in some regions with intensive crop agriculture.

Among the latter, the prolonged overvaluation of the national currency (bolivar), coupled with significant quantities of foreign currency from oil exports, has made possible the importation of agricultural machinery and other insumes at reduced prices. This overvaluation, however, has made Venezuelan products much less competitive in the international markets, and reduced agricultural exports to minimal proportions during the last 30 years. Furthermore, currency overvaluation has encouraged the importation of cheaper foodstuffs which has been an additional deterrent to agricultural production.

Since the discovery of oil at the beginning of this century, imports have been a dominant element in the Venezuelan economy. During the 1960s, Venezuela imported 25 per cent of the total food consumption. In the 1970s, this proportion increased to 70 per cent (Pinto Cohen 1984). In a very optimistic view of the recent history of agriculture in Venezuela, Kastner et al. (1983) blame cereals for the high importation levels and show that most of the imports go to the food industries. This has occurred despite a national strategy that has aimed to replace imports with locally produced products. Development of the agro-industry has not increased agricultural production. Instead, using national subsidies (oil money), they have imported unprocessed agricultural products, taken over crop storage and trading arrangements, and ruined rural producers. This has been possible because the agro-industrial sector is closely tied to large financial corporations and

to the commercial sector, operates as a monopoly and has considerable political influence. Also, the agro-industry has been developed using technology purchased from developed countries, which is unsuitable for the quality of national agricultural production (Kastner et al. 1983).

Following the recipes of the International Monetary Fund (IMF) and the World Bank, the present administration has changed from a strategy of subsidising agriculture to one aimed at transforming agriculture into an industry that will be able to compete on the international market.

## **DISCUSSION AND CONCLUSIONS**

The data presented show that savannas in the area considered in this paper are little used, characterised by extensive cattle-raising with limited managerial input and very low productivity. Crop agriculture, both of traditional as well as introduced crops, remains insignificant as a form of land use. Without subsidies little or no agricultural production would occur within the Orinoco savannas.

Venezuelan savannas are marginal to agricultural development and consequently prone to environmental damage. A strategy of use based on extensive cattle-raising, coupled to technically based improvement of the quality of native pastures and the remodelling of the trading system, allow this situation to improve without major environmental risks. This strategy could also play an important role in developing a livestock production system that can continue to compete on international markets. Other economic activities such as tourism and recreation, as well as the exploitation of native animal populations, and the continued extraction of oil reserves, would help to develop these areas. Further increase of savanna crop agriculture, with the replacement of native vegetation by agricultural fields, and the intensive use of fertilisers and pesticides, however, will undoubtedly create major environmental disturbances in this extended region. This will affect not only the vegetation and the soils, but also and especially the fauna and the aboriginal groups of people. The former has several endemic taxa which are already endangered. The latter represent very peculiar savannic groups that persist only in the region of the Orinoco Llanos.

In both aspects of agricultural activities, livestock and crops, these savannas are of secondary importance when compared to other regions of the country, where agriculture has replaced more productive natural systems. Although ecological constraints to productivity limit the agricultural potential of these savannas, it seems clear that their present condition is more the result of complex social, economic and political processes that began with the European occupation of Venezuela five centuries ago.

Since the proportion of savanna land used for crop agriculture is small,

and the use of technical support is very moderate, there are no major environmental problems caused by crop production within the Venezuelan savannas. Since regulations for the use of fertilisers and pesticides are not enforced, however, savanna agriculture may be contributing to the pollution of the rivers in the Orinoco basin.

Pollution from the oil industry is local and does not represent any major problem. It has been suggested that annual burning may be a menace for the survival of endangered animal species (MARNR-BIOMA 1991). However, there is no evidence available to support this.

The development of Venezuelan agriculture does not seem to be different from many other tropical underdeveloped countries, despite the abundance of resources provided by oil exports. Technical solutions, such as pasture improvement with low investment technologies, can be found and are currently under scrutiny some have already been experienced successfully (Thomas et al. 1990). But beyond the technical problems it is the socio-political framework which is conditioning development. Pouring money into a system that cannot hope to ultimately compete on international markets is likely to be counter-productive and would only suppress opportunities for economic development elsewhere. Moreover, the experience so far suggests that the usual impact of attempts to improve the productivity of Venezuelan savannas is the further entrenchment of social inequities.

## ACKNOWLEDGEMENTS

We thank M. Pino and M.G. Silva for help with the sources. We are also grateful to M.D. Young and O. Solbrig for their suggestions with the first draft of the manuscript. This paper was partially funded by CONICIT grant S1-1968, and by CDCHT-ULA grant C-411-90.

## REFERENCES

- Azevedo, M.F. and Silva, J.F. (1985) Información ambiental y ecológica sobre los Llanos del río Orinoco. Serie de Informes Técnicos DGSP/OA/IT/MARNR. Ministerio del Ambiente y los Recursos Naturales, Caracas. Venezuela, 290 pp.
- Berrade, F. and Tejos, R. (1984) Productividad primaria aerea neta en diferentes unidades fisiográficas del módulo "Fernando Corrales", Apure, Venezuela. *Revista UNELLEZ de Ciencia y Tecnología* (Barinas, Venezuela) 2:17-34.
- CENDES (1975) Estudio de prediagnóstico para el plan maestro de ordenamiento territorial del área de la faja petrolífera del Orinoco. Fase I: Prediagnóstico de la Sub-área Anzoátegui-Monagallo. Centro de Estudios del Desarrollo, Universidad Central de Venezuela, Caracas, 549pp.
- Cochrane, T.T., Azevedo, de L.G., Thomas, D., Madeira Netto, J., Adamoli, J. and Verdesio, J.J. (1985) Land use and productive potential of American savannas. In: J.C. Tohill and J.J. Mott (eds), *Ecology and management of the world's savannas*. Australian Academy of Sciences, Canberra, pp. 114-24.

- Comerma, J. and Luque, O. (1971) Los principales suelos y paisajes del Estado Apure. *Agronomía Tropical*, 21:379-96.
- COPLANARH (1974) Estudio geomorfológico de los llanos orientales, regiones 7 y 8. Comisión del Plan Nacional de Aprovechamiento de los Recursos Hidráulicos (Coplanarh), Venezuela. Publicación No. 38, 164 pp.
- Fariñas, M.R. and San José, J.J. (1985) Cambios en el estrato herbáceo de una parcela protegida del fuego y el pastoreo durante 23 años. *Acta Científica Venezolana*, 36:199-200.
- Gil Beroes, R.A. (1976) Producción y manejo de pastos en las sabanas inundables del Alto Apure. *Boletín de la Sociedad Venezolana de Ciencias Naturales*, 32:103-14.
- Hernandez, J.L. and Merz, G. (1986) Los cereales en el patrón de consumo de transición, posibilidades de cambio en los próximos años. *Cuadernos del CENDES*, 6:97-123.
- Kastner, G., Austin, J. and Tello, M.T. (1983) La Venezuela agrícola, mitos y realidades. Ediciones IESA, Caracas, Venezuela, 73 pp.
- Lopez-Hernandez, D., Niño, M., Garcia, L. and Carrion N. (1983) Annual budgets of some elements in a flooded savanna (Módulo Experimental, Mantecal, Venezuela). *Ecological Bulletin* (Stockholm), 35:541-45.
- MARNR (1978) Parques Nacionales y Monumentos Naturales de Venezuela. Instituto Nacional de Parques, Ministerio del Ambiente y los Recursos Naturales Renovables, Caracas, 192pp.
- MARNR (1982) Estudio agrológico gran visión del Estado Apure. Serie Informes Tecnicos. DGSHIA/IT/110. Ministerio del Ambiente y los Recursos Naturales Renovables, Caracas, Venezuela, 140pp.
- MARNR-BIOMA (1991) Plan de Ordenación y Manejo del Parque Nacional Santos Luzardo. Tomo I. Ministerio del Ambiente y los Recursos Naturales Renovables, Caracas, Venezuela, 350pp.
- Martínez, M. (1975) Diagnóstico técnico-económico de las explotaciones ganaderas del Estado Monagas. Ministerio de Agricultura y Cría. Proyecto MAC-FAO VEN 17. Maturín, Venezuela, 80pp.
- Mérida, J.M. (1966) La cuestión indígena en Venezuela. *Cuadernos de la Corporación Venezolana de Fomento*, 3:49-67.
- Orta, C.S. (1974a) Impacto de los ingresos petroleros sobre el crecimiento del sector agrícola. Facultad de Ciencias Económicas y Sociales, Universidad Central de Venezuela, Caracas, Venezuela, 67pp.
- Orta, C.S. (1974b) Los obstáculos al crecimiento autosostenido de la agricultura venezolana. In D.F. Maza Zavala, (ed) *Venezuela, crecimiento sin desarrollo*. Ediciones Nuestro Tiempo, Mexico, D.F. pp. 201-37.
- Pinto Cohen, G. (1984) La Agricultura: revisión de una leyenda negra. In M. Naim, and R. Piñango (eds) *El caso Venezuela: una ilusión de armonía*. Ediciones IESA, Caracas, Venezuela, pp. 500-35.
- Rodríguez Mirabal, A.G. (1987) La formación del latifundio ganadero en los Llanos de Apure: 1750-1800. *Academia Nacional de la Historia*. Caracas, Venezuela, 371pp.
- San José, J.J. and Fariñas, M.R. (1983) Changes in tree density and species composition in a protected Trachypogon savanna, Venezuela. *Ecology*, 64:447-53.
- Sarmiento, G. (1983) The savannas of tropical America. In: F. Bourliere (ed) *Tropical savannas*. Elsevier, Amsterdam, pp. 245-88.
- Sarmiento, G. (1984) The ecology of neotropical savannas. Harvard University Press, 235 pp.
- Sarmiento, G., Monasterio, M. and Silva, J.F. (1971) Reconocimiento ecológico de los Llanos Occidentales. IV. El oeste del Estado Apure. *Acta Científica Venezolana*, 22:170-80.
- Silva, J.F., Raventos, J. and Caswell, H. (1990) Fire and fire exclusion effects on the growth and survival of two savanna grasses. *Acta Oecologica*, 11:783-800.
- Silva, J.F., Raventos, J., Caswell, H. and Trevisan, M.C. (1991) Population responses to fire in a tropical savanna grass: A matrix population approach. *Journal of Ecology*, 79, 345-56.
- Tejos, R. (1984) Efecto de la altura de la inundación sobre los cambios de vegetación de la sabana modulada "El Rosero", Apure, Venezuela. *Revista UNELLEZ de Ciencia y Tecnología* (Barinas, Venezuela) 2:57-68.