

## THE SUSTAINABLE USE OF NATURAL RESOURCES AND THE CONSERVATION OF THE PANTANAL WETLAND, BRAZIL

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### RESUMO

A beleza cênica, a fauna e flora exuberantes despertam interesse pela conservação do Pantanal. Contudo, a região está experimentando o desenvolvimento, em ritmo acelerado, dos mais diversos tipos de atividades sócio-econômicas, muitas das quais responsáveis por grandes alterações nos seus ambientes naturais. Neste trabalho, são discutidos alguns fatores que afetam os esforços para a conservação do Pantanal e chama atenção para a necessidade de um programa de manejo, cujas prioridades são o planejamento do uso e ocupação do solo da bacia, bem como ações para promover a diversificação dos meios de produção da planície a partir da utilização sustentada de seus recursos naturais.

### ABSTRACT

The scenic beauty and exuberant flora and fauna are the inspiration for the conservation of the Pantanal wetland. However the region is experiencing rapid development that involves diverse socio-economic activities, many of them responsible for considerable impacts on the Pantanal's natural habitats. In this paper we discuss some factors influencing conservation efforts, and stress the need for a management program that includes land-use planning and management on the high plains as well as the floodplains, and the promotion of a diversification of human production practices in the floodplains through the sustainable use of its natural resources.

## INTRODUCTION

The aim of this meeting is to discuss the current situation of the principal aquatic systems in Brazil; to evaluate the present state of knowledge; and to propose alternative policies for conservation and management. For the Pantanal, as for other Brazilian ecosystems, these are not easy tasks. A number of factors complicate the realization of development policies in the Pantanal. Here we discuss some of these factors.

1. Area of the Pantanal: It is necessary to consider the Pantanal as a combination of floodplains and high plains, or "planaltos", because most of the activities developed in the high plains will affect ecological processes in the floodplains (FIG. 1). According to BRAZIL (1974a), the region covers an area of 393,600 km<sup>2</sup>, comprising 140,000 km<sup>2</sup> of floodplains (36%) and 253,600 km<sup>2</sup> of high plains (64%). In some cases, legislation and development policies consider these areas as separate systems, resulting in inevitable problems with regard to the conservation of the floodplain.

2. Ecological characteristics of the region: The Pantanal is located in the center of the South American continent, being influenced by the Amazonian region to the north, the Cerrado savannas to the east, the Atlantic Meridional Forest to the southeast, and the Chaco savannas to the south (ADAMOLI, 1984). The theoretical basis for dealing with ecological problems in floodplains extends beyond the classical concepts of Limnology. The ecological processes that prevail involve not only aquatic and terrestrial areas but also transition zones between flooded and nonflooded systems (SIOLI, 1980).

3. Complex socio-economic status: The Pantanal is undergoing rapid development that involves a wide array of socio-economic activities. Agriculture, various industrial activities, and urbanization are of particular significance. The location and population growth of urban centers are related directly or indirectly to several conservation problems in the Pantanal. HOMEWOOD (1991) argued that the greatest environmental problem in Brazil today is pollution in the cities, and

the majority of urban centers in the Pantanal have developed along the floodplain periphery, on the margins of the main rivers that drain the region (FIG. 2). The urban population is growing at an alarming rate

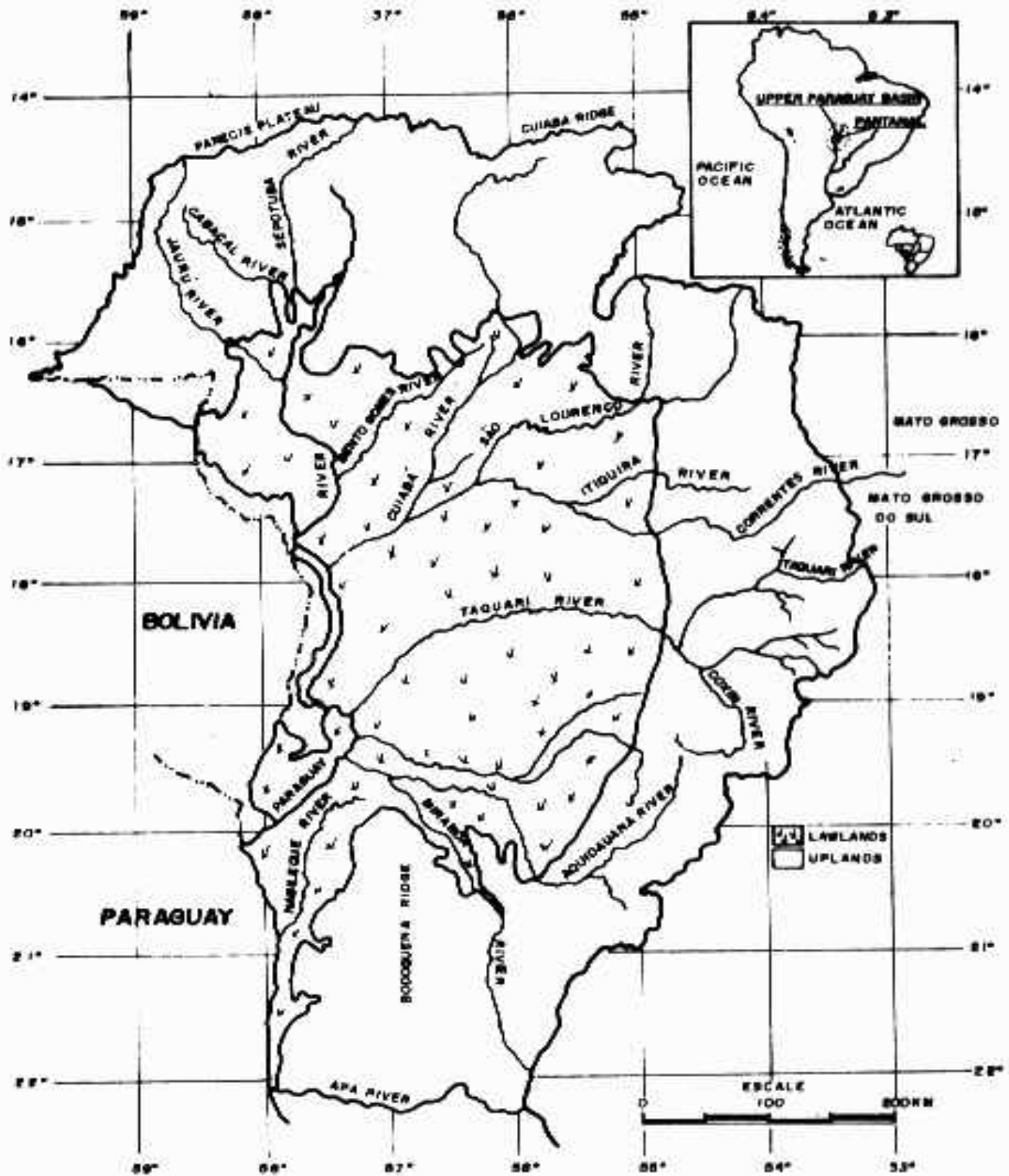


FIG. 1 - Map of the Pantanal, classified into lowlands and uplands.

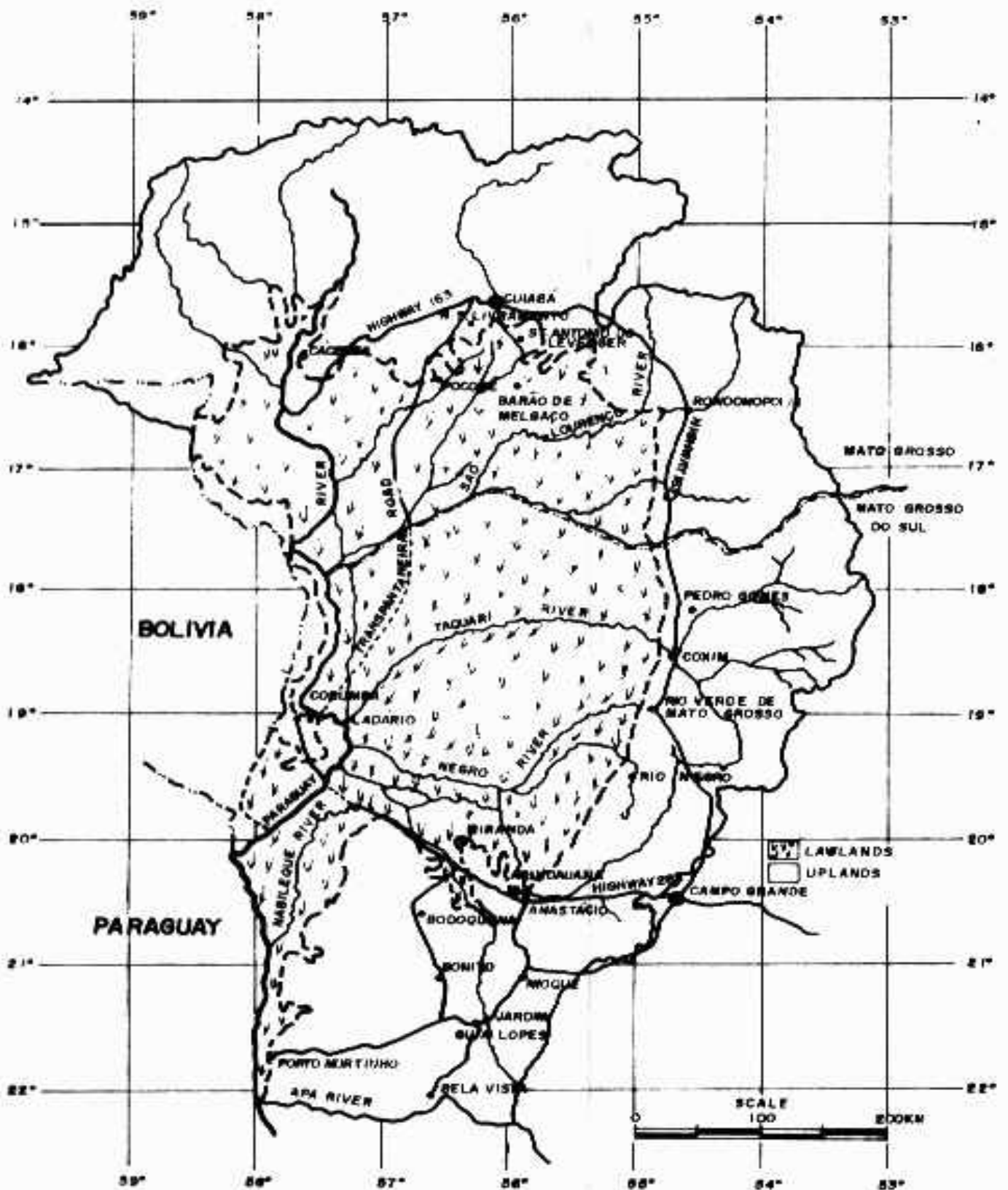


FIG. 2 – Map of the Pantanal, showing the main roads and the location of the cities around the borders of the floodplains.

(FIG. 3), and the cities lack basic services such as sewage treatment, schools, and land-use planning. Although most urban centers are in the uplands, they result in environmental problems in the nearby floodplain areas. Cattle pastures and deforestation are typical examples (FIG. 4 & 5), occurring especially in areas close to cities or in areas of easy access (along the roads); activities which are now showing signs of advancing into the interior of the floodplain.

4. Development strategies. Presently, the concept of development in Brazil is associated with the idea of "growth without limits", giving little consideration to the possibility of achieving an equilibrium between production and consumption. Large-scale development projects still exist, which lack adequate consideration or quantification of their long-term costs and benefits, although recently, such development plans are increasingly being substituted by programs of conservation and management. Management entails human interference in the ecosystem to achieve specific goals. The use of natural resources must be indefinitely sustainable, possible only through conservation policies, which should provide for the maintenance of diversity and genetic potential.

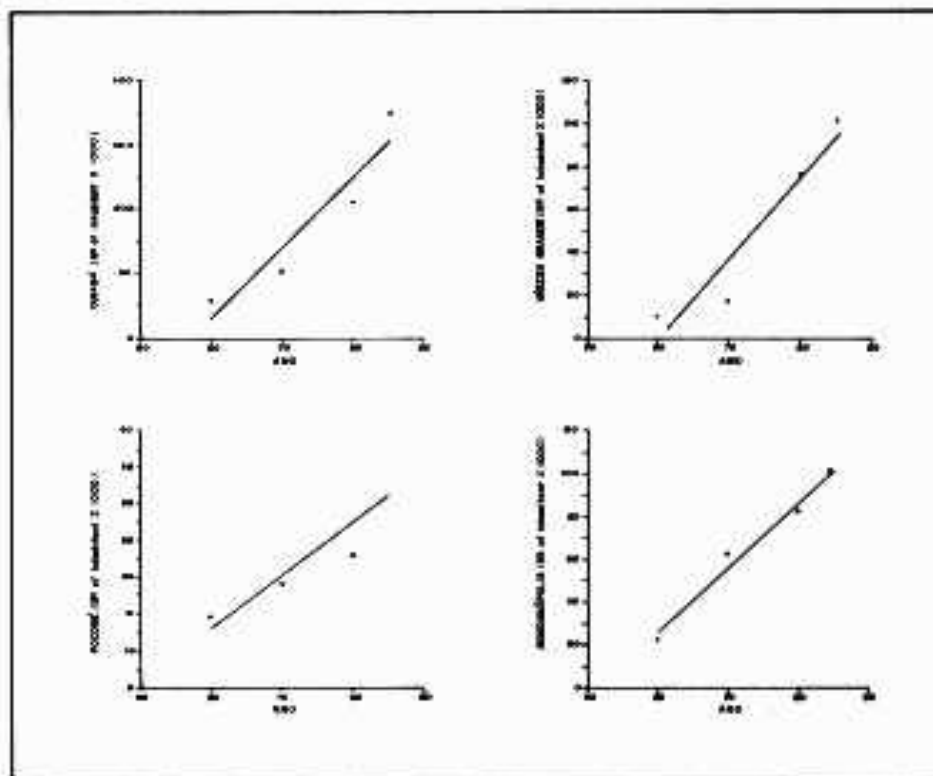


FIG. 3 — Population growth in four cities within the Pantanal (a. Cuiabá, b. Varzea Grande, c. Poconé and d. Rondonópolis), from 1960 to 1990.

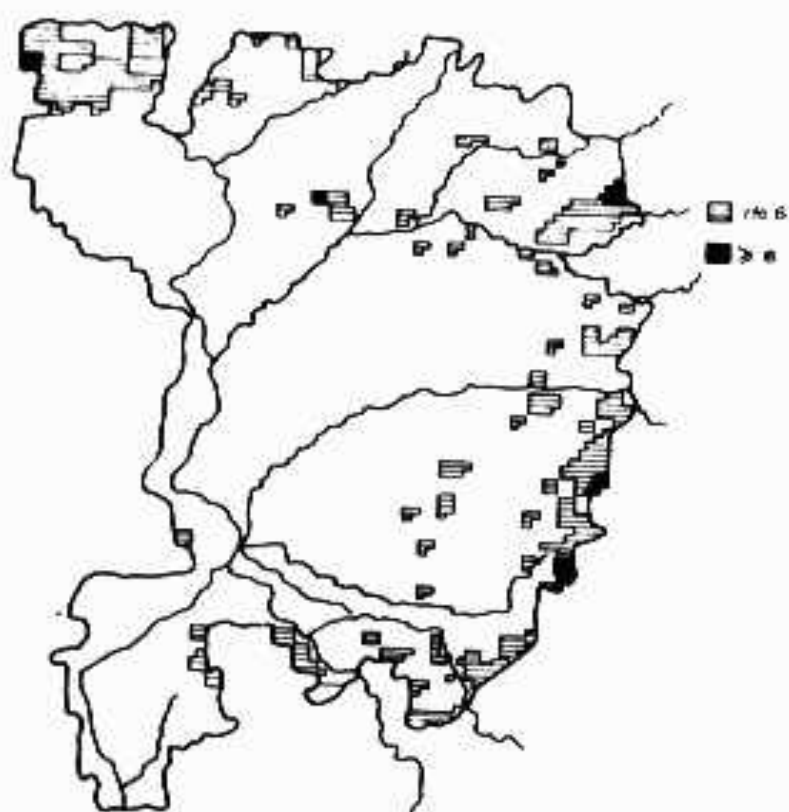


FIG. 4 – Intensity of introduced pastures observed by aerial survey during September-October, 1991. Intensity was measured as indices ranging from 1 to 10.

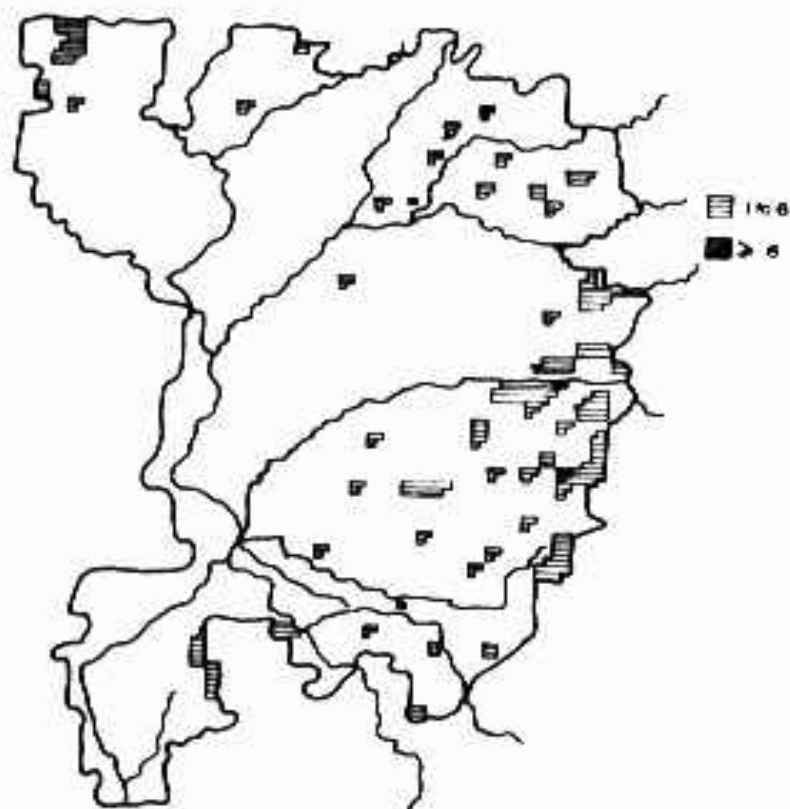


FIG. 5 – Intensity of deforestation observed by aerial survey during September-October, 1991. Intensity was measured as indices ranging from 1 to 10.

## FACTORS AFFECTING CONSERVATION EFFORTS

The Pantanal's scenic beauty and exuberant flora and fauna are the key factors inspiring interest in its conservation. Even in the 1950's, VALPASSO (1956) was pointing out the problems arising from deforestation and burning the Pantanal. More recently the most important activities which are damaging the floodplains are occurring in the uplands or near the floodplain borders: they include mining activities causing heavy metal pollution and soil degradation, agricultural activities involving the use of biocides and causing soil degradation, alcohol distilleries, industries, highway construction (ALHO et al, 1988), and as already mentioned the growth of cities along the floodplains margins. ALHO et al (1988) called attention to wildlife poaching as an important threat, although not presenting data on the trends in population sizes of hunted species. CAUGHLEY (1977), however, argued that few wild populations are declining because of hunting pressure. He suggested that habitat destruction is the major threat to wildlife. We consider that deforestation and replacement of natural vegetation in the floodplains (FIG. 4 & 5) may become a critical factor to wildlife conservation. In addition, two important development projects that appear likely to be approved are the "hidrovia" (waterway) on the Rio Paraguay and the establishment of an industrial district in Corumbá that will take advantage of natural gas to be supplied by a new pipeline from Bolivia.

MARES (1986), suggested that environmental problems of large magnitude could not be solved on a local scale and listed some factors that obstruct conservation efforts in South America. These are: lack of data, lack of people trained in areas related to conservation, lack of money, lack of coordinated planning over the long-term, weak economies, short-term strategies, and a general air of panic. These factors are relevant with regard to the Pantanal:

1. Lack of specialists: Lack of trained people is a generalized problem. At the moment it is vital that the few people and institutions working in the Pantanal function efficiently. In general, there is evidently little overall coordination of the efforts of the various institutions working in the region. While maintaining independent projects, it is important that institutions such as the municipal and state

secretaries, the state and federal universities, the Center for Agricultural Research in the Pantanal (CPAP/EMBRAPA) and non-governmental organizations coordinate and complement their research and conservation programs.

2. Lack of data: The lack of basic data is a problem due in part to the lack of specialists noted above. A data base assembled by CADAVID - GARCIA (1992) revealed an apparently large and diverse literature on the Pantanal, but 85% of contributions are in the form of abstracts or technical reports (TAB. 1). Although such information is scientifically valuable, little has been critically evaluated by the peer review processes such as those used specialized scientific journals, and many of them are generally unavailable to the scientific community.

TABLE 1 – Numbers of publications on different aspects of the Pantanal. (Modified from CADAVID-GARCIA, 1992)

Area	Type publication		
	Abstract and/or Technical Report	Scientific Journal	Thesis or Books
<b>PHYSICAL DESCRIPTION</b>			
Physiography, climate, geology	57	16	02
<b>MINERAL RESOURCES</b>			
Soils	14	02	01
<b>FLORA</b>			
Vegetation	104	19	02
Economic Botany	25	01	00
<b>FAUNA</b>			
Invertebrates	09	00	00
Vertebrates	70	12	02
Ictiology	43	03	01
Parasitology	02	01	00
<b>ECOLOGY</b>			
	10	00	00
<b>LIMNOLOGY/HYDROLOGY</b>			
	48	05	03
<b>CONSERVATION/IMPACTS</b>			
	27	01	00
<b>AGRICULTURE</b>			
	120	38	07
<b>ENERGY/TRANSPORT</b>			
	28	02	00
<b>SOCIAL-ECONOMY</b>			
	97	02	01
<b>EDUCATION</b>			
	15	00	00
<b>DEVELOPMENT/POLITICAL RESEARCHS</b>			
	30	00	00
<b>TOTAL</b>	<b>699(85%)</b>	<b>102(12%)</b>	<b>19(3%)</b>



3. **Lack of capital and weak economy:** Unlike Amazonia, where biological diversity is the outstanding feature, the Pantanal floodplain is notable more for the abundance of populations of a relatively limited fauna and flora. Despite this, animal husbandry, the principal economic activity on the floodplain, is not particularly profitable because of low production rates and the low levels of technology employed (CADAVID-GARCIA, 1986). The activities developed on the high plains surrounding the Pantanal are, on the other hand, quite lucrative, although many of them present the potential for environmental degradation and show little concern for the conservation of the floodplain.

4. **Strategies for short-term development and lack of long-term strategies:** During the 1970's, development planners presented suggestions for the construction of longitudinal and transverse highway systems traversing the floodplain, as well as projects for irrigation, dams, river channelization, flood control, and navigation (BRAZIL, 1974b). In the 1980's, such planning was increasingly replaced by an "ecological approach", despite the continuation of such practices as channel-dredging and the introduction of exotic species such as water buffalo (BRAZIL, SUDECO, 1986). By the end of the 1980's, ALHO et al (1988) called attention to the urgent need for a conservation and management program in the Pantanal, suggesting a series of economic activities that could be developed on the floodplains without damaging the natural habitats. Such a program still needs to be developed.

5. **Public opinion regarding the use of natural resources:** One of the main obstacles in the use of natural resources in the floodplain is the predominant feeling among the public that the resources will quickly become exhausted. Although it is important public opinion influences governmental decisions, in the specific case of the use of fauna on the floodplains, this has had a negative effect. Attempts to improve the land for cattle production include costly deforestation, burning, and replacement of native pasture with cultivated species, and the sustainable use of native rather than exotic species could provide additional economic incentives for the natural floodplain habitats, without running counter to ecological and conservationist principles.

## CONSERVATION AND THE SUSTAINABLE USE OF NATURAL RESOURCES

A program for conservation and management in the Pantanal should include two distinct strategies: (1) land-use planning and management on the high plains as well as on the floodplains, and (2) it should promote a diversification of the production activities on the floodplains, through the sustainable use of the existing natural resources. The general idea is based on the concept of "value-added conservation" (HINES et al, 1986). This states that sustained-yield wildlife management programs may generate a considerable revenue which may contribute to conservation research and habitat preservation or to encourage landowners to maintain their natural habitats (HINES & PERCIVAL, 1987). The concept is applicable to other activities that if well managed could bring benefit local inhabitants, while minimizing environmental degradation. These include tourism, apiculture, the use of native plants for medicinal and ornamental purposes, the sustainable harvest of forest resources, and the use of native pastures in order to increase livestock productivity. In addition, areas set aside for preservation and research would be extremely valuable genetic reserves and for educational activities.

The Pantanal is a huge natural laboratory. The maintenance of its integrity with respect to its structure and function is an essential requirement for any development option.

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