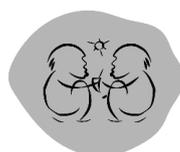
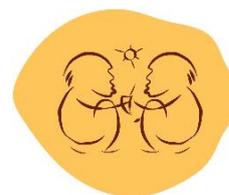


Social Relations and Environmental Research in the Pantanal of Mato Grosso do Sul:

When the Researcher must Be a Citizen *Ciência*¹

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(Capa)



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1. Introduction

Since ancient times, humans have left revealing accounts of their complex relationship with the environment. Lucretius, the Roman philosopher and poet, could find no common denominator between the reveries of human existence and the wonderful processes current in Nature (Epicuro *et al.*, 1985). The Industrial Revolution enhanced this impression even more, particularly amongst specialists who were devoted to investigations into the natural sciences. Examples of environmental imbalance have been growing at an alarming rate ever since. Localized research can add a certain dimension, and can even prick the conscience of citizens, reminding them of the fact that the very future of the human race is at risk. This is why, nowadays, such a sense of urgency and momentum surrounds the environmental issue, as well as the environmental ecological movement that was developed from it.

Within this process, the occasional investigation has also revealed problems of environmental imbalance within the Pantanal region. Universities and NGOs have been the principal parties carrying out research which delineates and circumscribes these

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problems, whilst demonstrating the heights that they have reached. The threat to bio-diversity is enormous. Preventative and corrective measures are called for on the part of the State. Appeals to political and business leadership in the region are constant. However, the sparse knowledge produced, together with fragmentary political pressures, still leaves a lot to be desired as far as results are concerned.

Another gap appears: few scientific efforts have been made to carry out a synthesis of the impacts that social conditions and relations have unleashed upon the bio-diversity of the southern Pantanal. This gap is also a result of an absence of pertinent inductions, as far as policies of scientific and technological research are concerned. It is true that even though they do not capture the historical nature of the imbalance suffered by the Pantanal over time, nevertheless, the rare studies already carried out can provide us with a good idea.

In the past, a rare exception in the search for the kind of synthesis we have been calling for, was the **PCBAP**: The Conservation Plan for the Alto-Paraguayan Basin (1997). Currently, two other efforts in this direction deserve note: one of them, sponsored by environmental entities such as WWF Brazil, SOS Mata Atlântica, Conservation International, Avina and Ecoa, has not yet officially published its results. The other one will be carried out soon through the Program called Biota-MS. This research will involve several research institutes of the State of Mato Grosso do Sul, and intends to “make an inventory and characterize the bio-diversity of the State of Mato Grosso do Sul, thus giving scientific support for its conservation, monitoring, and the assessment of economic potential and sustainable utilization” (Semac, s.d.). It still makes sense to mention the policies of the CNPq - 'National Council for the Development of Science and Technology', which, through its 'Integrated Ecological Program' (PIE - *Programa Integrado de Ecologia*), instituted the long-term 'Brazilian Program of Ecological Research' (PELD - *Programa Brasileiro de Pesquisas Ecológicas de Longa Duração*), which included the Pantanal as one of the regions in which the Program was implemented (Barbosa, 2001).

The most notable advances in our knowledge, from the various fields of scientific endeavour, make it increasingly desirable that efforts should be made to achieve the promised synthesis of all these initiatives. They involve an attempt to organize general blocks of reference-material, so as to facilitate our understanding of all the relevant questions posed by the very presence of humans.

We further emphasize that when the environment is understood to be an integral part of general social questions, common to all human beings, then the social sciences

also embrace and reinforce it as the object of research. Beyond merely politicizing the debate, social sciences help to alert researchers to the absolute necessity that, as citizens, they must influence both the debate as well as the political direction taken in relation to society as a whole. The social sciences show how capital has a modernizing action, and highlight its part in the destruction of the environment and the conditions of life on earth - an attitude which is the opposite of the dominant ideology that directly incriminates man in the abstract. With the influence of social sciences, the current work seeks to contribute to overcoming this lacuna. It also hopes to facilitate a political discussion that may remove obstacles to conservation and recuperation initiatives, within the Pantanal region of Mato Grosso do Sul.

2. The Presence of Man in the Pantanal of Mato Grosso do Sul: a Preliminary Historical Summary.

One of the largest flooded areas on the planet, the Pantanal has become emblematic throughout the world. Various factors point to this fact, starting with its strategic importance for the administration of hydro-electric resources, used by three different Nations: Brazil, Bolivia and Paraguay. It is considered a National Heritage Site by the Brazilian Constitution of 1988, and was declared a *Biospheric Reserve* by UNESCO in 2000 (Favero *et al.*, 2008). A vast silt plain, characterized by areas of perpetual flooding and regions with a rainfall that determines the annual flooding of parts of its surface, in Brazil the Pantanal occurs in the territories of Mato Grosso and Mato Grosso do Sul. Amongst its rivers, the most important is the River Paraguay; an axis fed by an intricate network of waterways. Navigable throughout most of its expanse, the River Paraguay, along with its tributaries, has been an important resource for human habitation since pre-Colombian times. Water systems have always conditioned man's historical choice of habitat.

The first tangible evidence of human impact on the region goes back to colonial times. Historical and anthropological records show that, up to the second third of the 18th Century, the River Paraguay Basin was basically nothing more than a vast open space, through which circulated 'Monções' (*Monções were river expeditions, setting out from the town of 'Itu', in Sao Paulo, to do business with the mines of Cuiabá between the 18th and beginning of the 19th centuries*), supplying products to Cuiabá. Within these western areas of Brazil, small nuclei of urban colonialists, en route to the Brazilian west, were formed exclusively around the location of the mines.

However, the presence of European colonialists was already being indirectly felt by the Pantanal region, which had become a mere way-station. Horses and cows, introduced by the Spanish in areas under their control, started to be exchanged with Indians of the Guaikuru Nation, or were simply stolen by them. The Guaikuru created their own herds, and became so adept at horse-riding that they earned themselves the nickname 'The Indian Horsemen'. Metals were also used in exchange. With the availability of the horse, in particular, the Guaikuru became better equipped in their settling of the Pantanal, increasing their sphere of activity. So, too, in their adaptation and incorporation of metals for use in armaments, the Guaikuru also increased their potential for war. Thus armed, they achieved an incontestable dominion over the region and were able to suppress other ethnic groups. Research attests to the fact that the Chamacoco were the principle victims of enslavement, imposed upon them by the more dominant tribe (Ribeiro, 1980).

In order to control areas where mines were situated and impose border limits, the Portuguese Authority began to construct military fortifications throughout the last decades of the 18th Century. Fort Coimbra (1775), on the river Paraguay, and Fort Príncipe da Beira (1776), on the Guaporé river, are two such examples of places erected with this in mind. But these forts also required certain establishments necessary for the re-stocking of goods and services, in particular those of foodstuffs. This is how there arose villages like Albuquerque and Corumbá (1778). Finally, rather than being merely a passing-point for waves of Portuguese 'monções' (see above), the Pantanal became a target for permanent occupation with the stationing of troops and the creation of colonies devoted to agriculture.

This profound transformation, linked to the elevation of the Guaikuru's level of civilization through the introduction and assimilation of the horse, cattle and metals, as well as the inauguration of Portuguese colonies, must have provoked tangible consequences in the way in which Man related to other species in the region; especially those species which, from their prior strongholds, threatened to attack the new livestock so recently introduced, or which disputed the native pastureland with them.

Occupation of the Pantanal region by the Portuguese, as well as dominions occupied by the Spanish, proved to be disastrous for the Guaikuru Nation. Since that time, confronted on two fronts, the Guaikuru saw their world reduced to the plains of the Pantanal. Their ability to enslave other ethnicities also diminished. Ever bellicose, the Guaikuru population continued to be decimated, a fact confirmed by the utter extinction of the Paiaguás, or 'Canoe Indians', who were one of the tribes of the Guaikuru

Nation (Moura, 1984; Carvalho, 1992). In the 1940s, according to a local periodical, the Kadiwéu tribe (another integrant of the Guaikuru) also came perilously close to extinction (Anuário de Corumbá, 1943). Confined to reserves around the area of Porto Murtinho, extinction was avoided, and by the second half of the 20th Century the Kadiweu population started to grow, despite the precarious conditions of their existence as reported by various travelers and researchers who visited them (Boggiani, 1945; Rivasseau, 1936; Ribeiro, 1980; Bertelli, 1987). Remaining native populations were gathered into reserves, and much of the Indian territory was rented out to farmers. The income derived from this became the main source of survival for natives, until the land was progressively removed from the farmers' control and returned to the Indians - a process which began in the 1990s and continues up to the present day (ISA, 2009).

One extremely important historical footnote was provided by the emergence of commercial centers - towns - on the margins of rivers within the Plata border region, shortly before the War of the Triple Alliance. In 1857, with the opening up of the River Plate Basin to commercial trade, European merchants as well as 'Platinos' (people from the Plata region) established towns such as Corumbá. Initially limited in their access to the Plata region's rivers, by the control exercised over them by Paraguay, restrictions were lifted after the war. Henceforth, trading stations multiplied. Establishments typical of the Pre-Industrial Age, and with a still non-existent regional banking network, these stores handled everything to do with exchange, including the financing of production and the transportation of goods. In short, they exercised absolute control over the local economy. Amongst the owners of these trade and exchange establishments were Portuguese, Spanish, Italians and Germans as well as local 'Platinos'.

While navigation of the region was predominantly via water, then the trading stations of the ports remained the center of the Mato Grosso economy (Alves, 2005). But the laying of the Brazilian northwest railway line, as well as the arrival of banks throughout the key urban centers of Mato Grosso do Sul, destroyed the power base of these mercantile establishments. In the 1930s, many proprietors started to set aside their mercantile activities and seek other ways to make money, above all through cattle-farming. Others accepted their new role as somewhat minor merchants, and some of them left the region altogether to try their luck further afield, in areas that still held out some promise of turning a profit (Corrêa *et al.*, 1985).

After the War of the Triple Alliance, Paraguay's fragile economic conditions brought the opportunity for a people, marked by diversity but retaining a predominantly Guarani ethnicity, to relocate to the south of Mato Grosso. From a cultural perspective,

these people's roots lay in the Jesuit Settlements, a point emphasized by their aptitude for harvesting Erva-Mate (*Ilex paraguariensis*) and their expertise in handling livestock.

These people breathed life into the Erva-Mate trade and, in so doing, they planted their own customs, values, habits and beliefs firmly into the soil of a region extending to an incredible five million hectares. The hub of Erva-Mate production was a farm called 'Campanário', in the municipality of Ponta Porã, upon which the 'Companhia Mate Larangeira' was based - a local enterprise which exercised a complete monopoly over the Erva-Mate trade. Between the end of the 19th Century and the first two decades of the 20th Century, the cultivation of Erva-Mate was the economic epicenter of Mato Grosso and the principle source of tax revenue for the State (Centeno, 2008). The economic influence of this cycle extended into the south of Mato Grosso, including the Pantanal, where the port town of Porto Murtinho, rising from the banks of the river Paraguay, provided the necessary outlet for exporting Erva-Mate to Argentina.

In the 1890s, the lands rented by the Mate Larangeira Company saw the arrival of the first contingent of immigrants - gauchos (people from Rio Grande do Sul) - escaping the often bloody internal political conflicts engulfing Rio Grande do Sul (Centeno, 2008). Traveling by horse and cart, they crossed the territories of Argentina and Paraguay and eventually installed themselves along the southern border with Mato Grosso. The fields were covered with native lemon grass (*capim limão*), typical of this rather hilly region, and were somewhat reminiscent of the 'coxilhas' (slightly hilly treeless plains), and proved to be ideal for raising cattle. The Company stimulated a reliance on cattle-raising amongst these immigrants, because it cheapened the value of the region's labor force. The 'Mate Larangeira Company' also insisted that the erva-mate extracted from the land where these immigrants had settled must only be traded with their affiliates according to the prices already set by the Company. Over time, the Gaucho immigrants turned into a formidable force in confrontation with the dominance held by the Mate Larangeira Company. This contest led to a decrease in cultivated land, which dropped to 1,815,905 hectares in 1916 followed by the termination of the land-leasing contracts, and consequently by a project of dividing up the Erva-Mate land into small farms to be donated to the immigrant communities living within them (Centeno, 2008).

Workers of Paraguayan origin, who had the same ethnic and cultural characteristics as those mentioned above, became the primary labor force in the fledgling cattle-farming industry of the Pantanal. This economic activity traced its origins back to the impoverished 'Bandeirantes' ('followers of the flag' - Portuguese

scouts and trail-blazers), who, since the beginning, had settled around the mines of northern Mato Grosso. The Bandeirantes themselves were descended from minor Portuguese nobility established in São Paulo. Families like the 'Barros' and 'Gomes da Silva', left the north and moved south, where they established centers for cattle-rearing in the district of Nhecolândia, in the municipality of Corumbá. As far as culture was concerned, the Bandeirantes maintained their aristocratic heritage and valued education (Barros, 1998). The second generation of pioneers could already boast the presence of doctors, vets and lawyers amongst their members. Throughout the 1890s, immigrants began to arrive, often broke and with only the small livestock units afforded them. Over the following years they concentrated on strengthening their herds. They rarely went to Corumbá, the nearest town. Their family ties strengthened through the solidarity of rural work. Collective efforts were common. Religious festivals, particularly those dedicated to the Holy Ghost, St. John and St. Sebastian, reinforced still further these collective bonds. Whenever they needed salt or any other basic commodity, they would slaughter a cow, make sun-dried meat (*charque*), and take it by boat to Corumbá where it would be used as exchange for goods sold through the trading stores (Alves, 2004). They felt increasingly exploited and plundered by the merchants, who continued to exercise a determining role in the regional economy, and who imposed an arbitrary and depreciating value upon sun-dried meat. This would later prove to be the catalyst which ignited latent conflicts and culminated in political disputes for control of Corumbá.

From the point of view of its general population, the ethnic demographic of the Pantanal in the south of Mato Grosso, by the first half of the 20th Century, basically looked as follows: a) indigenous locals, some in the process of becoming extinct; b) those of mixed race, but predominantly Guarani, who, in following the *erva-mate* trail, left Paraguay and relocated in large numbers to the farms of the Pantanal, after the end of the War of the Triple Alliance; c) a small contingent of Portuguese descendents who had originally performed the functions of administrators or commanders in the military outposts of the time - this group was later joined, during the Imperial period and the beginning of the Republic, by descendents of the former miners from the north of Mato Grosso, who had established cattle ranches around places such as Nhecolândia; d) In slightly lesser numbers, there were those European and Platino merchants, who, having lost undisputed control of the local economy through their Exchange Houses, located in the ports (with the exception of those who fled to Mato Grosso), either accepted their new position as somewhat smaller merchants, or diversified their economic activities in enterprises such as cattle-farming.

At a time when the grandeur of the Commercial Houses was on the wane, the population was further enhanced by the arrival of Arab and Japanese immigrants. The Arabs, who for thousands of years had been inextricably linked to commerce, transcended their initial roles as traveling salesmen and became the proprietors of the Commercial Houses. However, they never enjoyed quite the same level of dominance achieved earlier by the grandiose merchants of the ports. The Japanese flowed in via the Northwest Railways, coming from the large immigrant communities of the northwest of São Paulo. From the beginning, they dedicated themselves to the cultivation of vegetables, which until then had featured rarely in the diet of the local inhabitants. The descendants of both these colonies are found in immense numbers today, and their customs and habits remain unique and varied, even within the context the singular cultural characteristics of Mato Grosso do Sul. The epoch also saw an influx of Bolivians, concentrated in particular around the town of Corumbá, where they became a reserve labor force, needed by small businesses and by the service sector. Originally of indigenous origin from the Bolivian east, these immigrants are present today in ever scarcer numbers, located predominantly in the areas running between Corumbá and Campo Grande.

With the rise of President Vargas, government initiatives intensified the colonization of the south of Mato Grosso. Ideologically, the 'March West' cemented the creation of the territory known as 'Ponta Porã', and inaugurated the Federal Colony of Dourados. Also, under the pretext of nationalizing the frontier with Paraguay, scores of north-easterners emigrated to the south of the State (Centeno, 2008).

In the 1970s, a new migratory current, involving Gauchos and people from the States of Santa Catarina and Parana, spread out through the southern part of the State and overwhelmed the local population in and around the Federal Colony of Dourados. The newcomers started buying up land and merging together smaller plots of land into large farms, establishing agricultural bases suitable for their more advanced use of mechanization. But this migratory current went beyond previous limits and expanded well into the northern and eastern regions of Mato Grosso do Sul, giving rise to such urban communities as São Gabriel do Oeste and Chapadão do Sul.

Deforestation was virtually absolute in the regions where these southern immigrants settled. The land was stripped bare across extensive regions in the south, the north and in the east of the State. However, the kind of agriculture that they practiced, based on the plantation of soya and the intensive use of chemical supplements for the soil, as well as herbicides and pesticides, which had intensified in the 1980s,

slowed down in the early 1990s (PCBAP, 1997). In these places, a new movement of capital was focused on cattle-farming, which in turn served to deplete the local workforce.

This is the basic historical picture which makes the confused discussions of the supposed cultural identity of Mato Grosso do Sul more intelligible. These debates, though sporadic, have increased since 1977, with the recognition of Mato Grosso do Sul as a distinct entity within the Brazilian Federation. A Campo Grande newspaper of the period, used as its motivating axis the question: 'A Mato Grosso do Sul Culture?' (Grifo, 1979).

Due to the current environmental emergency, the question of culture has tended to be fused with considerations about the conservation and preservation of the environment. Social movements have used the threat to the environment as a pretext for their political demands, which also included the protection and preservation of local cultures. Without noticing the difference between culture and environment, they have been using the words preservation and conservation as politically progressive flagships.

The Guaikuru Cultural Movement, for example, as well as announcing the need to preserve the culture of the aforementioned indigenous ethnic group, also believed that people from the (then) newly formed state of Mato Grosso do Sul should turn to the Guaikuru in search of their own cultural roots (Spengler, 1996). Exponents of the ideology of the Pantanal farmers affirmed the existence of a specific 'Pantanal Culture'; some of them claiming that the preservation of this particular cultural tradition was also necessary (Medeiros, 2006). Nostalgically, they went in search of old utensils and other cultural artifacts produced by farm workers in the past, which they believed needed to be preserved. The dubious solution to all this was the reproduction of these old-fashioned utensils and artifacts by modern-day craftsmen and women, even though the landowners and the farm laborers in today's world are surrounded by industrialized products, similar to those offered in any modern market. These idealistic pretensions are mere fantasy and serve only to create anachronistic ideas of culture, which quickly degenerate into an inconsistent regionalism.

The formation of the State of Mato Grosso do Sul, as shown in this work, benefited from different cultural sources. What marks out a singular regional culture is not simply those characteristics contained in one cultural source and absent in another, but rather the dynamic fusion within a melting-pot which metamorphoses the whole cultural development of a region (Leite; Brito and Centeno, 2001). Native indigenous cultures were submerged beneath the predominating culture of the

bourgeoisie, and their products, which turned into merchandise, gained different uses. Indigenous ethnicities, both local ones and those that came from Paraguay and Bolivia, as well as the Portuguese, Spaniards, Italians, Arabs and Japanese, forged, through cultural exchange, the habits and values of Mato Grosso do Sul. Everyone living in these parts enjoys local treats such as *tereré* (cold mate-tea), Paraguayan *sopa* (a kind of savory sponge), *chipa*, barbecued meat, *saltenha*, Middle Eastern kibe, and Japanese noodles. Local musicians fused together influences from modern Brazilian pop (MPB) and local Platino rhythms. In the visual arts, primitive figurative works predominate, using as subjects Indians, people of mixed race, or animals of the Pantanal and the dense shrub lands around the frontier regions.

In conclusion, any regional peculiarity can only be interpreted as a singularity; something that is only revealed when taken as an expression of the whole. In any case, the culture of Mato Grosso do Sul is, above all, a bourgeois culture, because its progress has remained largely subordinate to the capitalist mode of production, employed by its merchants. Nevertheless, it is a unified cultural configuration, precisely because of the customs, traditions, and values of its inhabitants, together with the characteristics of the local terrain, all of which comes together in a singular and unique form.

3. The Impacts of Production on the Bio-diversity of the Pantanal: what the Academics and the Media Say.

The historical contextualization of social relations, within the Pantanal region of Mato Grosso do Sul, reveals some of the environmental pitfalls experienced by the region in our own times. The economic transformation of the plains, considered broadly as a collective vision of co-habitation, allows us to pinpoint how certain economic activities have profoundly affected the original bio-diversity.

We must bear in mind that scientific knowledge is still not sufficient to enable us to describe, in detail, precisely which transformations took place over the years. The first postgraduate (*stricto sensu*) courses in environmentalism were only introduced in Mato Grosso do Sul in the 1990s. Not until that time did scientific research become institutionally organized within academic circles. Recently, NGOs have also become conduits for research in the Pantanal.

Even though the damage done in the past can hardly be assessed, due to lack of information, we can nevertheless deduce a rough estimate of the sheer size of the disaster, which is indispensable if we are to rouse scientific endeavor from its apolitical

lethargy. Sometimes, at least, the scientific conscience does accept the idea that biodiversity is the relevant point of departure, because it is empirically most in evidence. With just one change of thought, the empirical is automatically realized. Henceforth, we must state that the departure point for recent research is an expression of how environmental reality has already been compromised by capital.

This point of departure brings with it the effects of destruction wrought upon the herb groves, the shrub lands (*quebrachais* - trees indigenous to the area), forests and pastureland native to the agricultural plateaus and river banks of the Pantanal, which, aside from being directly affected, also caused the sedimentation and pollution of their rivers. Also brought with it are the consequences of diminishing fish stocks as a result of over-fishing. The same departure-point also carries changes resulting from the practice of burning vegetation to produce charcoal. It also brings with it the effects on the general landscape caused by mining, which can reach devastating levels in the not too distant future if conservation measures are not introduced to monitor the extraction of iron and manganese around the Urucum Hills. Finally, it encompasses the disappearance of various animal species, and the risk of extinction to others caused by cattle-ranching companies.

Using the information from studies attained through the recent improvements in scientific research, carried out in the area, we will later in this work produce evidence to prove that capital is in large part responsible for this process.

The case of *erva-mate* (cf. above) is notorious. The herb groves around the southern frontier began to be rigorously farmed from the end of the 19th Century, after the War of the Triple Alliance (1864-1870). As a result of a company monopoly, methods of cutting the *mate* leaves were introduced that were harmful to the plant's conservation, thereby exhausting the plant and putting its development at risk. This kind of 'cutting' was not restricted to the leaves alone; whole branches were stripped away, which, in turn, reduced the speed at which the plant could recuperate (Centeno, 2008). It was not uncommon for the entire tree to be cut down. So much so, that in 1895 the State Government passed a decree banning the cutting down of *mate* trees, or cutting into the actual tree trunks (Corrêa Filho, 1925). The branches were used in the extraction process, to enable the laborer to scorch the herb and release the humidity, making sure not to lose the herb's color, or weaken it before it undergoes a slower and more thorough drying process. Locally, this process is known as '*sapeco*'. In the 1920s, a *tambora* was introduced: it was a cylindrical metal structure, either perforated or simply made out of barbed-wire. This drum was then placed on top of a

pile of bricks with the herb placed inside. Operators then rotated the entire structure over a furnace with the aid of a crank. This process, involving the use of the *tambora*-drum, allowed workers to cut tiny stems and twigs whilst avoiding using whole branches, thereby protecting the tree and enabling it to continue sprouting new shoots with greater ease. (Serejo, 1986). Despite all efforts, the destruction of native herb groves was not prevented; the conservation measures did not spread to all areas of the *mate*-herb production (Centeno, 2008), and by the middle of the 1920s, the widespread destruction of indigenous herb groves was already being recognized. An alert was also sounded regarding the 'sacrifice' of the local palm-tree known as *pindo*, whose leaves were used as cattle fodder (Corrêa-Filho, 1925). By the 1970s, during a phase of agricultural expansion, the destruction of the herb groves was complete.

The indigenous *quebracho* trees of the south-western regions were also decimated. The tree provided the raw material for tannin production, a substance used to cure or tan animal hides. The process of its harvest involved cutting down the tree completely. The tree trunks were transported via carts which were "pulled by two or three pairs of cows along pathways from the extraction points inside the jungle to the loading points, where tractors and lorries would take the trunks to the railway lines" (Steffan, 1960). The process was even more brutal than we have seen in the herb groves. The *quebracho* trees were hacked down and, according to one newspaper, "not one *quebracho* tree ever grew back to replace it." Without the slightest thought of replacing them, the *quebracho* trees were being completely wiped out (Corrêa and Corrêa, 2009).

The destruction was most in evidence around the Pantanal. On the high plains, beyond the limits of the Pantanal, the agricultural practices installed by southern migrants had caused profound transformations to both the environment and the natural landscape, from the 1970s onwards. In the north, even the protective vegetation around rivers was eradicated, contributing to the sedimentation of waterways throughout the Paraguay River basin, as well as filling them full of pesticides. Perhaps the most dramatic example of the damage caused by all this was the dissolution of the River Taquari: having lost its natural river bed, the water burst its banks and poured into the fields of the Pantanal, permanently submerging extensive areas around the region of Paiaguás, which had previously been used for cattle-rearing. The rivers of the plains are also subject to this inundation, when dykes along their banks suffer dissolution. The phenomenon of 'dissolution', which within certain parameters is quite natural, can nevertheless become intensified and cause disasters such as that of the river Taquari, as a result of the process of erosion unleashed in the surrounding areas of the high plains, from the 1970s

onwards. In fact, the changes to the general landscape are attributed to practises introduced by cattle-ranching companies, on account of the fact that “the obvious increase in sedimentation must be due to the erosive and aggressive processes, enacted by the cattle-rearing sector around the river Taquari basin...” which was determined by “the bringing down of underlying regional sediment deposits from the high plains, pertaining to the basin region of Alto Paraguay.” Clarifying still further; “Enormous parts of the surrounding sandstone regions of the high plains, used for rearing cattle and planting grains, have provoked the acceleration of this erosive process, which subsequently speeds up sediment deposits into the lower river basin.” (Mercante *et al.*, 2007)

There is general agreement that the bio-diversity encountered within the limits of the Pantanal plains is better preserved. However, it also depends on what happens on the high plains and on the slopes, and invasive problems occurring within the interior of the Pantanal plains can already be observed.

Cattle-farming, for example, is said to be an economic activity which has only a limited impact upon the bio-diversity of the Pantanal. This assumption is questioned by those who are familiar with the scientific evidence which suggests, on the contrary, that cattle-farming has had a profound impact on habitat and the formation of forests and savannahs, affecting the natural make-up and ecological configuration of the dense shrub lands, be it either via the introduction of alien foliage and grasses into the region, or by other practices related to the rearing of cattle (Harris *et al.*, 2005).

Even the average citizen sees the ongoing slaughter of certain species of animals, especially the wild cats, as a kind of assault against bio-diversity itself, whereas the farmers continue to justify their actions as being in legitimate defense of their herds. They launched campaigns in favor of the cattle-farming, portraying certain wild animals as a threat and calling for the complete eradication of certain species like the jaguar. A piece written by Marechal Rondon, aside from documenting his movements and contacts with communities during the laying of the telegraph lines in Mato Grosso, also relates in detail how the jaguar was hunted on farms across the Pantanal. This iconoclastic summary of the jaguar hunt is held up as testament to man's courage (Rondon, 1946). Other admirable stories are told concerning indigenous 'spear-throwers' and 'jaguar hunters'. These men, dedicated to a skill considered to be essential for the security of the cattle farms of the Brazilian bush land, populate the pages of Brazilian literature. This is the case with the central character in the story 'Meu Tio o Iauaretê' by Guimarães Rosa ('My Uncle the *Iauaretê*' - a name which literally means 'waterfall of

the jaguars', and is the term used to designate a native tribe of the Amazon) (Rosa, 1969). Since the 18th Century, explorers and chroniclers have left similar accounts to that written by Rondon and with the same sense of ethics. Not surprising, then, that this magnificent creature's population has dwindled in size, and is now on the list of species most threatened with extinction (Alho, 2008). At the same time, silence cloaks the question of jaguars, partly as a result of Brazil's hunting ban.

Also indicative of the effects of cattle-farming is the threat of extinction faced by the Blue *Arara* (giant macaw). The population of this psittacidae family of birds has been considerably reduced by the destruction of their natural habitat, and more specifically by the destruction of particular trees such as the *manduvi*, a tree ideal for use in building nests, as well as two palm trees which produce the nuts that are so integral to its diet - the *bocaiúva* and the *acuri* palm trees. Aside from this, they are also persecuted by those who trade in exotic birds, as well as being sought by some Indians for their feathers, which are used to make adornments (Guedes, 2004).

It seems that the much lauded harmonious co-existence between cattle farming and the environment, does not stand up to the results of scientific investigation. Indeed, it would seem that trend is to less and less harmony. Motivated by the possibility of increased profits, cattle-farmers have already launched new initiatives which further threaten the region's bio-diversity. The rearing of cattle is expanding towards the slopes around the great plains, replacing native pastures with foreign grasses. This process is starting to reverberate across the plains. With a view to increasing productivity within this fragile ecosystem, cattle farmers have already started to replace the native pastures of the mountain ranges and their surrounding woodlands, areas which are a natural refuge for animals. Technical information derived from EMBRAPA-Pantanal (the Brazilian Agency for Agricultural Research), having acknowledged that the "zoological indices were relatively low" in the region, attributed part of the responsibility for this fact to the "native pastures". They could be, "in the majority of cases, low in terms productivity and quality, except those which grow lower down in the middle-upland sections." The "economic pressure to increase productivity is prompting many farmers to introduce measures such as the introduction of foreign types of fodder." Using somewhat ambiguous language, which suggests a concern for the conservation of environmental conditions, EMBRAPA Pantanal falls back on its recommendation "to form pastures in the Pantanal out of *Brachiaria humidicola*, in medium and high lying fields, whilst maintaining areas of permanent conservation in the

low lying regions, as well as protecting the trees and the surrounding woodlands (Santos *et al.*, 2005).

The journalist Juliana Arini, having had privileged access to as yet unreleased mapping information, carried out by WWF-Brazil, SOS Mata Atlântica, Conservation International, Avina and Ecoa, affirms that “the increase in pastureland is one of the principle causes of deforestation in the Pantanal. In the past six years, 12000 square kilometers of new pastureland has been opened up in the region. This process is set to accelerate. Aside from the increase, the herds are being moved to less appropriate areas. Before, cattle-farming was concentrated around the lush native fields of the plains, a flooded part of the Pantanal. Now, the herds are taken up to higher ground where the natural vegetation was cut down to make way for pasture. Cattle are further pushed up by the encroachment of sugar cane, which is grown on the plains during the dry period.” (Arini, 2009)

Regarding the sugar-ethanol industry, questions multiply as its expansion speeds up. There are already proposals in place to expand the industry in the region, including within the plains of the Pantanal. This debate was reinforced by a legal bill, No. 6077/2009, proposed by the Federal Executive via the Ministry of the Environment, which rules over the agro-ecological 'zoning' (ZAE) of sugar cane, and regulates the expansion of sugar cane production in Brazil. Although their forecast is that production will double by 2017, the legal bill excluded the Pantanal and the Amazonian regions, which generated immediate outrage in the governments of Mato Grosso and Mato Grosso do Sul.

In the Pantanal, according to available data, there were already “five working refineries in the first semester of 2009. They have been there since before the *Conama* ('National Council for the Environment') passed a resolution in 1985 prohibiting such new enterprises in the area” (Portal Ecodebate, 2009a). However, a representative of the Secretary for Development of Mato Grosso do Sul, stated that there are already projects officially mapped-out for the construction of 31 new sugar-ethanol refineries (Portal Ecodebate, 2009b).

Amongst the consequences, aside from the cutting down of the protective foliage on river banks, the cultivation of sugar cane generates high levels of pollution, whether it be through the scorching process used in the sugar cane plantations, or the *vinhoto* ('a residual paste') which is a by-product of sugar-ethanol production and difficult to dispose of, putting both the soil and the region's rivers at risk.

Other risks accompanying these are even more imminent, although they remain little known and still scarcely targets for research. Such is the case with the infestation of the fly *mosca-de-estábulo* ('*Stomoxys calcitrans*'), especially in the southern region of Mato Grosso do Sul (EMBRAPA Gado de Corte, 2009). Similar to the domestic fly, this hematophagous insect provokes wounds in animals, including cattle, thereby facilitating the spread of disease. Sugar cane residues provide the perfect environment for their proliferation. As these parasites lay their eggs within an 11 kilometer radius, the close proximity of the refineries, in relation to the cattle ranches and the urban centers, may affect the health of both animals and humans living in the areas involved (MF Rural, 2009).

Research related to what is known as 'emerging or re-emerging infectious diseases, caused by pathogens both known and unknown, whose incidence has either increased over the last two decades or has a tendency to increase' has also flourished (Pignatti, 2003). This research has gained worldwide recognition since the beginning of the 1990s, and since the middle of the same decade in Brazil (Luna, 2002). It highlights the importance of environmental factors, involved both in the emergence and in the proliferation of diseases already present in the Pantanal, such as *dengue fever* and *leishmaniasis* (Dorval *et al.*, 2006; 2007; 2009; Galati, 2003; Oliveira *et al.*, 2006). It is beyond debate that "environmental changes, both on the macro and on the micro level, have an effect on the general pattern of distribution of infectious diseases. The links between economic development, environmental conditions and general health are very strong. This is due to the fact that human intervention creates favorable environmental conditions for various diseases to be easily transmitted" (Pignatti, 2003).

According to Arini (2009), in a study carried out by 'Coppe' ('Congregation of Postgraduate courses in Engineering'), at the Federal University of Rio de Janeiro, the effects of devastation over the last ten years are clearly in evidence; they are the result of mining practices and of the steel industry in the area around the Urucum hills, not far from Corumbá. This first resulted in the depletion of the amount of available water. In the region of 'Antonio Maria Coelho', two rivers practically dried up. It is worrying to think that by provision of the Brazilian Constitution, "mining concerns take precedence over any environmental decisions." Certain NGOs were able to buy time and have started talks with the mining companies. To fail in these talks would place an even higher burden upon the Urucum hills, already threatened with becoming a lunar landscape, as has happened in Minas Gerais (Arini, 2009).

The practice of burning native vegetation in the Pantanal is also intensifying as a result of charcoal production, which is used to fuel the pig iron industry. Two thirds of the charcoal produced is exported to *Minas Gerais*. Alcides Faria, leader of the NGO *Ecoa* in *Mato Grosso do Sul*, has an appropriate expression: “we are literally burning our bio-diversity” when there “are already alternative sources of combustion for the iron-ore industry, which are far more sustainable.” (Arini, 2009)

The “crisis in sustainable fishing” has also been a highly controversial and much debated topic over the past few years. The controversy is further exacerbated by the lack of reliable data, gathered from different sources, which makes it very difficult to ascertain exact levels of impact generated by fishing. Whilst trying not to take sides and exercise judgment on the predatory practices of fishing in the region, recent works have contributed to a descriptive synthesis regarding this controversy, which essentially opposes the arguments put forward by leading academics. Deeper questions persist. Thomaz Lipparelli, biologist and ex-State Superintendent for Fishing, dared to assert that fish stocks in the Paraguayan river basin are “disappearing”. Anyone who doubts this, he suggests, should talk directly to the local sport-fishing and the local river based communities, or to those who live on and around the rivers” (Benante, 2009). A response to this challenge appeared in the form of a declaration put forward by Astúrio Ferreira dos Santos, member of the 'Association of Amateur fishermen/women in Defence of the Environment' (ASPADAMA): “What we used to see in those rivers was incredible; as much in the Aquidauana river as in the Miranda and Coxim rivers - shoals of fish stretching for kilometers. Nowadays, you never see that. If you want to catch a fish these days, you've got to stay a long way from the cities, and even when you do catch something it's usually below average size. The larger fish, which are within the size range for fishing allowed by law, are already disappearing year by year” (Santos, 2009). For Santos, the complacency of the Fishing Law, which is on its way through the Executive/Legislative Assembly, threatens to further compromise fish stocks in the Pantanal.

Lipparelli also denounces the hijacking of discussions on the part of “those sectors involved” - powerful entities with “commercial interests”. If fishing is directly responsible for the falling fish stocks, then there are also opinions which touch upon another determining factor: the neglect of “fish habitats, or aquatic ecosystems” caused by the “degradation of protective trees and foliage along riverbanks”, as well as the “deforestation of the river basin” (Benante, 2009). In the face of such arguments, it is clear that a discussion is much needed regarding the depletion of fish stocks and

the capacity for Nature to replenish its resources in the Pantanal. Such a discussion must also take into account the fact that fish are a very important link within the food chain of the region's bio-diversity. As food for various species of fauna, certain types of fish (such as *pacu*), are also biologically responsible for the dispersal of seeds. The disappearance of these fish, therefore, could be connected with the disappearance of various other animal species, too.

Without wishing to exhaust the theme, these then are the array of threats weighing against the Pantanal's bio-diversity.

4. Scientific Activity and Citizenship rights Today

It is worth noting first and foremost the need for scientists to be engaged. Beyond their technical function, it is also necessary for scientists to exercise the rights of citizenship within a political orbit. With this in mind, it is worthwhile returning to a piece written by the educator Paulo Freire, which can be applied to any theme, including the question of bio-diversity:

“What we have to do is not merely define the concept of a given topic, or to take its contents as a 'given fact' and simply describe and explain them but, by contrast, we must have a committed attitude to the topic. This is the attitude of someone who doesn't merely wish to describe what happens, or how it happens, because, above all, he wants to transform reality from what is currently happening in such and such a way into that which comes to pass in a different way.” (Freire, 1976)

Such 'engagement' has clearly not been the behavior of scientific guides. Einstein presumed that the scientific community was ready to assume responsibility when he launched his intense political campaign against the growing “military-industrial complex of the USA.” Little by little, Einstein was isolated. Finally, finding himself utterly alone, he was defeated. Scientists in large part were silent in the face of environmental destruction, brought about by capital. The majority had spoken out against damage caused by man, but this politically timid behavior was nonetheless off target, because it failed to pronounce capital as being the social condition responsible for the whims that result in the pollution of the environment, and destroy conditions essential for the reproduction of life. We must, however, recognize that a scientist's training conspires against his political engagement. Scientific specialization of knowledge nearly always blinds us to the origin of each determinant that destroys the environment. They have wonderful intentions and issue moralistic, Ciceronian, tracts against some vague notion

of the “actions of Man”. However, we stress once more, it is not the actions of Man that are to be considered but rather a historical and social condition called 'capital'.

What is called 'political engagement' on the part of scientists, at least in our own time, has reached dramatic new levels:

“The destruction of the environment in the service of the blind interests of capital, has reached such proportions...that even if the entire process were to be reversed tomorrow, it would still require several decades in order to allow for significant changes which might neutralize the pernicious damage, sustained as a result of self-interested and self-serving capital, which causes reason to suffer in favor of immediate economic gratification, adopting 'the line of least resistance'. Furthermore, there are potentially lethal implications involved with messing around with the environment, through the imprudent use of 'bio-technology', 'cloning' and by uncontrolled genetically-modified food. All of which is dictated by enormous, greedy, Companies and their respective Governments. Such implications are tantamount to a new Pandora's Box.

As things currently stand, these are the dangers appearing on the horizon, and no one knows what additional dangers will be faced by our children because of the uncontrollable and destructive rationale of capital.” (Mészáros, p. 87)

Having said that, we recognize that the dangers posed by capital to the reproductive necessities of life are being confronted by NGOs whose political activity has been much more positive. We also recognize, as fairness dictates, that many scientists have increased their own participation. Nevertheless, in the face of the sheer magnitude of the threat, it is still a very small number. In Mato Grosso do Sul, political activity on the part of scientists has become an urgent matter of systematically creating inventories of the problems that are continuously and progressively compromising bio-diversity. As their interests are less contaminated by the machinations of capital, they are in a better position to achieve a more objective balance regarding the environmental problems experienced in the Pantanal. Thereby, they can fight on a political platform which includes: a) a definition of 'Public Policies': stressing pertinent measures for conservation, environmental protection, vigilance and the actual punishment of offenders; b) greater involvement in environmental concerns on the part of Universities; and, c) the formation of alliances with NGOs and with companies that are aware of the need to defend life in the region.

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