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PUBLIC POLICIES FOR BIODIVERSITY CONSERVATION IN THE STATE OF MATO GROSSO DO SUL - BRAZIL

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Abstract: As a proposal for the conservation of biodiversity, an environmental index was created, aiming to establish public policies for Mato Grosso do Sul aimed at Protected Surfaces (SPs), focusing mainly on the conditions in which the Conservation Units (UC) and Indigenous Land-(TI) of each municipality, with data collected in 2022. The UCs, TIs and Surface/Ha^{-1} /IBGE of the 79 municipalities in the State were used as indicators. Calculation formula: CCB= SAP/ SM*FC*AQAP; ICCBM=(CBM/CBE) *100; CCBM= (Sum of Conservation Coefficients - (CC) of the municipality's Protected Areas (PA); CCBE= (Sum of the CCs of the APs of all municipalities); CCB= Biodiversity CC; SAP = AP Surface; SM = Municipality Surface; FC= Correction Factor; AQAP= AP Quality Assessment. The highest rates were found in the municipalities of Jatei, Alcinópolis, Taquarussu, Bodoquena, Bonito and Naviraí; 33 were at High levels, 19 Medium and 26 Low, indicating 33% of municipalities need to institute public policies aimed at conserving biodiversity and expand protected surfaces depending on the biomes existing in the state.
Keywords: Public Policies, biodiversity, protected areas, indicators.

INTRODUCTION

Mato Grosso do Sul –MS, has a rich biodiversity, necessary for a healthy quality of life for the entire population. Therefore, this state has in its territory one of the greatest biodiversity in Brazil, being still insufficiently known, such as the Pantanal Biome (Oliveira et al., 2014), georeferenced in an area of 89,318 Km2(25.01% of the total area of the state).

To protect this invaluable heritage, and other Biomes, the MS allocates an area of 4,668,062.65ha-1 in protected areas (UCs), approximately 13% of the Mato Grosso do Sul Territory. There are 151 protected surfaces (Integral Protection and Sustainable Use) between parks (municipal, state and federal), RPPNs (state and federal); APAs (municipal, state and federal), natural monuments (municipal and state), park roads and indigenous lands of different ethnicities (SEMAC, 2011).

In turn, municipal, state and federal UCs cover almost exclusively APAs, areas around 3,174,471.46 ha^{-1}, 25,548.50 ha^{-1}, 713,370.43 ha^{-1} respectively; and smaller protected areas of Parks (mainly municipal and federal), RPPNs and natural monuments (SEMAC, 2011).

In recent years, there has been a great effort to create protected areas for both full protection and sustainable use, however, there is still little integration and coordination between the federal, state and municipal spheres in the management of these areas. The creation of the National Conservation Unit System - SNUC seeks to cover this gap (Imasul, 2014).

It is currently known that, for sustainable development, it is necessary to preserve the environment, which is necessary for the lives of all human beings and biota in general. This means, among other factors, conserving or making rational and responsible use of all biotic and abiotic factors (IBGE, 2010). However, it is necessary to define, use and validate indicators for the construction of environmental indices, as a reference for evaluating ecosystem processes and managing sustainable use.

This way, indicators are quantified information, of a scientific nature, easy to understand, used in decision-making processes at all levels of society, useful as tools for evaluating certain phenomena and presenting their trends and progress that change over time (MMA, 2012).

An index according to Gimènez (1998) is a dimensionless figure that results from the transformation of one or more indicators into a quality value, that is, it is a product of a mathematical manipulation of a group of indicators in relation to a desired value norm, obtaining a solid quality value.

Environmental indices can contribute to improving the functions of availability and demands of natural resources, composing a method to evaluate the performance of public policies aimed at the environment (IBGE, 2010).

They therefore constitute assessment instruments, which must be adapted to the environmental and socioeconomic realities of the federative entity, be it the State, the Planning Region or the Municipality in question; act as guiding mechanisms for strategies to reduce the pressure of demands and improve the efficiency and effectiveness of the use of natural resources, protecting the quality of the environment, in addition to maintaining safe and accessible stocks, with equality for all multiple uses and users (IBGE, 2010).

Finally, for its construction, indicators appropriate to the characteristics of the environment to which they refer must be used.

In the state of Mato Grosso do Sul - MS, the use of environmental indicators to construct indices is an unusual reality, and few states are immersed in this context in search of similar and positive tools regarding the development of environmental indices for all their municipalities, aiming to establish public policies for effective monitoring of its natural resources and especially existing biomes, thus ensuring their sustainability (Vieira et al., 2014).

Due to the urgency of preserving areas of great ecological relevance, conserving biodiversity, there is a pressing need to develop environmental indices based on consistent variables.

Therefore, the construction of environmental indices using appropriate indicators and parameters that allow the adequate assessment of government policies aimed at sustainability, especially in regions where natural resources are susceptible to all types of anthropization, is an emergency need.

The biodiversity conservation index proposed here will use protected surfaces as a variable. These express the size and distribution of territorial spaces that are under special protection status, called Conservation Units (SNUC) and Indigenous Lands. These spaces are intended to protect the environment, where the exploitation of natural resources is prohibited or controlled by specific legislation. Indigenous lands are those traditionally occupied by Indians, inhabited by them on a permanent basis, used for their productive activities, essential for the preservation of environmental resources necessary for their well-being and necessary for their physical and cultural reproduction, according to their uses, customs and traditions (Art. 231 of the Federal Constitution) (Semac, 2011).

The monitoring and management of protected surfaces are essential to avoid damage caused by the rampant anthropization that has occurred in recent decades through the use and occupation of land, requiring better monitoring.

Therefore, the Biodiversity Conservation Index of the State of Mato Grosso do Sul was born, a management tool, aiming to contribute to the improvement of the public management evaluation process and seeking, through indicators, to observe, monitor and monitor sustainable development of the respective municipalities, providing consistent information on the problem of reduced protected areas and the need to create or expand and establish protected areas in all municipalities.

Knowledge about indices prepared through consistent indicators, their limits and potential, can be of great use to public and private agents, academics, as well as institutions involved in defining priorities and promoting public policies, and in allocating resources. of the municipalities' budget, explained in their Multi-Year Plans - PPA. These, in turn, will be able to insert environmental indices for effective monitoring of biodiversity, as well as the sustainability of its impacting agents.

Thus, the need to build the state's Biodiversity Conservation Index became evident, using appropriate indicators, which as parameters allow for the adequate assessment of government policies aimed at developing activities in a sustainable manner in municipalities, considering ecocentric and anthropocentric factors.

Therefore, the objective of this study was to evaluate the protected areas (Conservation Units and Indigenous Lands) in all municipalities in the State of Mato Grosso do Sul, correlating data on protected surfaces and existing surfaces in each municipality in order to prepare the Index of Biodiversity Conservation and use it as a parameterizer for the preservation of areas of great ecological importance for the municipality and nearby areas, as well as promoting the creation of new protected areas.

MATERIAL AND METHODS

To choose the set of indicators aimed at municipalities, the methodology developed by IBGE (2010) was used, which has a regional scope and is based on the document prepared by the United Nations Sustainable Development Commission, Brundtland report (1987).

Two indicators were selected, using the Pressure-State-Response Model. They were constructed taking into consideration, the regional specificities of each municipality in the State, striving for representativeness to characterize the problem studied.

This model was developed by the Organization for Economic Cooperation and Development - OECD (1993), for the study of global environmental indicators and has been accepted and adopted internationally.

According to Alfaro & Oyague (1997), environmental indicators reflect the state of the environment and relate the pressures imposed by various economic activities on the quality of environmental components and the responses developed by society to combat such pressures.

After listing the indicators and studying them, the activity schedule for the entire construction process of the State Biodiversity Conservation Index - ICCB was drawn up.

Indicators that met the environmental needs of all municipalities were previously selected through data collection, with the main source being the Institute of the Environment of Mato Grosso do Sul - Imasul (2014), the State Secretariat for the Environment and Development Econômico (2015), IBGE (2010), Scandar Neto (2006), ONU (2005), using as a model, descriptive sheets of indicators (adapted) from the Ministry of the Environment (2012) and IBGE (2004; 2010).

Each form contained: a) definition of the indicator; b) description of its construction and the sources used; c) justifications and links with sustainable development; d) any methodological comments or aids to the interpretation of information.

This way, two indicators were selected: 1. Protected Surfaces (Conservation Units and Indigenous Land); 2. Total surface area of each municipality (Surface/Ha^{-1}/IBGE). Considering here, the ecocentric and anthropocentric factors for its evaluation. The first is directly related to the degree of naturalness, that is, the more preserved it is, the higher its quality. The second considers the reflection of the functions of the environment for human beings (Cendrero et al., 2002), which according to Scope (1995), is the relationship with the degree of fulfillment of three fundamental functions that the environment performs: sources of resources, waste sink and support/service provider.

After analyzing the two variables, it was possible to validate and prepare the ICCB for the 79 municipalities in the State.

The ICCB was prepared, with some adjustments, based on the law document established by the Government of Tocantins and the National Panel of Environmental Indicators - PNIA (MMA, 2012a). The two selected and validated indicators have all the desirable characteristics pre-listed, mainly scope and representativeness for preparing the ICCB, consolidated and compatible with monitoring which can be applied in any federative entity.

The following formula was used to calculate the Biodiversity Conservation Index:

$CCB = S_{AP}/SM*FC*AQ_{AP}$

$ICCB_M = (CB_M/CB_E) *100$

CCB_M = (Sum of the Conservation Coefficients of the municipality's Protected Areas)

CCB_E = (Sum of the Conservation Coefficients of Protected Areas calculated for all municipalities in the State)

CCB = Biodiversity Conservation Coefficient

S_{AP} = Surface of the Protected Area

SM = Surface of the Municipality

FC = Correction factor

AQ_{AP} = Quality Assessment of the Protected Area.

In addition to calculating the ICCB for each municipality, classification intervals were defined after studies for better interpretation of the data and results obtained from the protected surface condition. The proposed ranges were: Low = (0-0.1); Medium = (>0.1-0.5) and High = (>0.5). These intervals were established considering the results of the variables that make up the calculation formula: Protected Surface and Municipal Surface through the preparation of an evaluation table, considering the elements proposed for the index in the calculation formula.

RESULTS AND DISCUSSION

The great development experienced by many municipalities during the last decade has also promoted considerable growth in several sectors, such as agriculture and livestock and, concomitantly, land use and occupation. Anthropization is mainly related to the replacement of native areas by exotic pastures and cyclical crops.

The results of this study show that the municipalities that obtained lower rates have a territorial area with reduced or no protected surfaces. The geographical location suitable for agriculture, in many cases was responsible for decimating large areas, mainly in the Atlantic Forest Biome, according to data contained in the MS Geoenvironmental Notebook (Semac, 2011), leaving municipalities at the mercy only of their permanent protection areas - APP.

After studies with indicators of protected surfaces, it appears that large areas are covered in municipalities located entirely or partially in the pantanal biome, indicating progress in the preservation of areas of ecological interest, in the face of anthropization in recent years.

As for anthropization, data from Semac (2012) and Paranhos Filho et al. (2014), show that deforestation in the Pantanal biome was prominent throughout the last decade. There is a warning made by Oliveira et al. (2012) and Abdon et al. (2007), citing that deforestation in the Pantanal is increasing, with suppression carried out in areas of mountain ranges or capons, compromising shelters, nests and food for the Pantanal fauna. Silva et al., (2011), Calheiros & Oliveira (2010) and Calheiros et al, (2013), infer in their studies that, especially in the plateau surrounding the Pantanal plain, deforestation contributes to the degradation of ecosystems, compromising services ecosystem services provided by the Pantanal biome.

This strategic development relationship based on agribusiness has decimated large areas of ecological interest, as mentioned above. Faced with these problems, the State has encouraged the creation of protected surfaces for permanent protection and sustainable use (Semade, 2016), in addition to the legalization of indigenous lands with the federal government.

Analyzing the Biodiversity Conservation Index of municipalities in the State of MS - ICCB, composed of data on Protected Surfaces (Conservation Unit and Indigenous Lands) and Surface (Ha-1) of all Municipalities in MS, it is noted through the results contained in Table 01, and within a ranking following a scale from 1st to 6th place, the highest Index was obtained by the municipality of Jatei (11.912) followed by Alcinópolis (11.796), Taquarussu (8.2605), Bodoquena (8.0412), Bonito (6.1385) and Naviraí (6.1331). And the municipalities that had the lowest indices were: Anastácio (0.0011), Aparecida do Taboado (0.0015), Camapuã (0.0064), Brasilândia (0.0070), Bandeirantes (0.0126) and Sidrolândia (0.0154).

It can be seen that some municipalities have large areas of protected surfaces compared to the municipal area and some, no approved protected surface (Table 01) or low areas, as explained in the municipalities that had the worst rates.

These signals indicate that there are municipalities that need to observe the lack of protected areas, since some obtained a zero index (Table 01).

Municipalities with 0% levels need to be observed with critical eyes. Those that have large areas of fully protected surfaces or sustainable use need to be monitored.

The MS government, according to Semade (2016), has encouraged the creation of new protected surfaces, through the participation in the apportionment of the ecological ICMS (Ecological Goods Circulation Index) for all municipalities within this context. This way, many areas of ecological interest will reduce their anthropization, such as the Pantanal Biome, already mentioned by many researchers, addressing the problem of land use and occupation in these environments.

Its relevance is explained in the research by Abdon & Silva (2006) where they mention that the Pantanal is composed of humid areas occupying partial surfaces of nine municipalities in MS (Aquidauana, Bodoquena, Corumbá, Coxim, Ladário, Miranda, Sonora, Porto Murtinho and Rio Verde de Mato Grosso).

The biodiversity conservation indicator was suitable to be inserted in the context of the State, not only because it is an important variable, but also because it has a regional scope and also meets regional and local specificities. The data necessary for the analysis, which is the protected surface and the total surface of the municipality(ha^{-1}) are covered in all federative entities, in the proposed measurement units, thus obtaining positive results regarding the condition of biodiversity conservation, indicating the need for future monitoring in municipalities where changes are detected.

A favorable factor for the creation of protected surfaces and in particular conservation units in the State, is the richness and diversity of scenic beauty, encompassed by three biomes of high biological diversity in both the lithosphere and hydrosphere (SEMAC, 2012). Therefore, viable for

BIODIVERSITY CONSERVATION INDEX (PROTECTED AREAS) -STATE OF MS											
MUNICI-PALITIES	Área UC(ha^{-1})	**Sap**	**FC**	**P**	**Pquali**		**CCB**	**CCBI**	**ICCB**	**Índice**	**Class**
ÁGUA CLARA	1103107	0	0	0	0	0	0	0	0	**0**	**B**
ALCINOPÓLIS	439980	26849,6232	0,9	3	0,814	40,700	0,0549222	6,8707648	10,804	**11,7964**	**A**
		6021,3385	0,9	1	0,955	47,750	0,0123169	0,6004505	0,944		
		100	0,9	3	0,976	48,800	0,0002046	0,0305605	0,048		
AMAMBAI	420220	140978,606	0,05	0,5	0,751	37,550	0,0167744	0,3233262	0,508	**0,9748**	**A**
		2429,5454	0,45	1	0,868	43,400	0,0026017	0,1155164	0,182		
		404,7055	0,45	1	0,412	20,600	0,0004334	0,0093611	0,015		
		668,0796	0,45	1	0,698	34,900	0,0007154	0,0256838	0,040		
		56884,2065	0,05	0,5	0,843	42,150	0,0067684	0,1460279	0,230		
ANASTÁCIO	294920	3,369	0,9	3	0,433	21,650	0,0000103	0,0006986	0,001	**0,0011**	**B**
ANAURILÂNDIA	339554	0	0	0	0	0	0	0	0	**0**	**B**
ANGÉLICA	127300	25649,4603	0,05	0,5	0,388	19,400	0,0100744	0,1027590	0,162	**0,1616**	**M**
ANTONIO JOÃO	114375	0	0	0	0	0	0	0	0	**0,0000**	**B**
APARECIDA DO TABOADO	274960	15,7	0,70	1	0,465	23,250	0,0000400	0,0009693	0,002	**0,0015**	**B**
AQUIDAUANA	1695850	1592,8375	0,7	1	0,659	32,950	0,0006575	0,02232142	0,035	**0,8823**	**A**
		8452,1619	0,05	0,5	0,450	22,500	0,0002492	0,00292812	0,005		
		7647,2095	0,7	1,5	0,579	28,950	0,0031566	0,14180831	0,223		
		9619	0,7	1,5	0,313	15,650	0,0039705	0,09916217	0,156		
		5377,2754	0,45	1	0,522	26,100	0,0014269	0,03866844	0,061		
		6461,3459	0,45	1	0,433	21,650	0,0017145	0,03883437	0,061		
		8604,6858	0,9	2	0,456	22,800	0,0045666	0,21736872	0,342		
ARAL MOREIRA	165620	958,7993	0,45	1	0,407	20,350	0,0026051	0,0556193	0,087	**0,0875**	**B**
BANDEIRANTES	311600	152,993	0,7	1	0,448	22,400	0,0003437	0,0080424	0,01265	**0,0126**	**B**
BATAGUASSU	241500	113166,848	0,05	0,5	0,729	36,450	0,0234300	0,4387265	0,690	**0,6899**	**A**
BATAYPORÃ	182850	96929,75	0,05	0,5	0,5	25,000	0,0265053	0,3445684	0,542	**0,5418**	**A**
BELA VISTA	489540	150281,76	0,05	0,5	0,213	10,650	0,0153493	0,0894096	0,141	**0,3078**	**M**
		1999,188	0,7	1	0,529	26,450	0,0028587	0,0784704	0,123		
		1606,8533	0,45	1	0,357	17,850	0,0014771	0,0278427	0,044		
BODOQUENA	250720	12	0,7	1	0,627	31,350	0,0000335	0,0010838	0,002	**8,0412**	A
		19947,7099	0,9	3	0,456	22,800	0,0716055	5,1126350	8,039		
BONITO	493430	29312,2278	0,9	3	0,46	23,000	0,0534645	3,8494464	6,053	**6,1385**	A
		18,2754	0,9	1	0,541	27,050	0,0000333	0,0009350	0,001		
		273,6699	0,9	1	0,574	28,700	0,0004992	0,0148252	0,023		
		642	0,7	1	0,7	35,000	0,0009108	0,0327876	0,052		
		88	0,7	1	0,718	35,900	0,0001248	0,0046066	0,007		
		29,8494	0,7	1	0,5	25,000	0,0000423	0,0011010	0,002		
BRASILÂNDIA	580550	484	0,45	1	0,216	10,800	0,0003752	0,0044269	0,007	**0,0070**	B
CAARAPÓ	208970	3594,4154	0,45	1	0,614	30,700	0,0077403	0,2453670	0,3858	**0,3858**	M
CAMAPUÃ	620384	5440,7267	0,05	0,5	0,351	17,550	0,0004385	0,0040671	0,006	**0,0064**	B
CAMPO GRANDE	809600	66954	0,05	0,5	0,448	22,400	0,0041350	0,0483796	0,07607	**0,2155**	**M**
		3550	0,05	0,5	0,651	32,550	0,0002192	0,0036778	0,00578		
		35533	0,05	0,5	0,806	40,300	0,0021945	0,0453160	0,07126		
		100	0,9	3	0,858	42,900	0,0001112	0,0146406	0,02302		
		181,894	0,9	3	0,767	38,350	0,0002022	0,0238702	0,03753		
		50,11	0,7	1	0,529	26,450	0,0000433	0,0011893	0,00187		
CARACOL	293900	195485,217	0,05	0,5	0,689	34,450	0,0332571	0,5894820	0,927	**0,9270**	A
CASSILÂNDIA	365000	136629,583	0,05	0,5	0,498	24,900	0,0187164	0,2423771	0,381	**0,3811**	M
CHAPADÃO DO SUL	385069,3	350067,3727	0,05	0,5	0,840	42,000	0,0454551	0,9772849	1,537	**1,5368**	A

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CORGUINHO	264081	45055	0,05	0,5	0,210	10,500	0,0085305	0,0490505	0,07713	**0,1220**	**M**
		77,719	0,7	1	0,596	29,800	0,0002060	0,0063451	0,00998		
		81,75	0,7	1	0,639	31,950	0,0002167	0,0071401	0,01123		
		431,255	0,7	1	0,243	12,150	0,0011431	0,0150321	0,02364		
CORONEL SAPUCAIA	102890	88756,2365	0,05	0,5	0,845	42,250	0,0431316	0,9327212	1,467	**2,0503**	**A**
		1776,9594	0,45	1	0,673	33,650	0,0077717	0,2692899	0,423		
		9734,7482	0,05	0,5	0,841	42,050	0,0047307	0,1018274	0,160		
CORUMBÁ	6496490	69698,2923	0,9	2	0,544	27,200	0,0096557	0,54458412	0,856	**1,5903**	**A**
		862,7	0,7	1	0,613	30,650	0,0000930	0,00294207	0,005		
		13200	0,7	1,5	0,825	41,250	0,0014223	0,09013867	0,142		
		2000	0,7	1	0,439	21,950	0,0002155	0,00494575	0,008		
		13100	0,7	1,5	0,825	41,250	0,0014115	0,08945581	0,141		
		10984,7941	0,45	1	0,432	21,600	0,0007609	0,01719626	0,027		
		8729	0,7	1,5	0,493	24,650	0,0009406	0,03618782	0,057		
		8232	0,7	1,5	0,519	25,950	0,0008870	0,03585706	0,056		
		990	0,7	1	0,752	37,600	0,0001067	0,00411758	0,006		
		16530	0,7	1,5	0,493	24,650	0,0017811	0,06852842	0,108		
		13323,4386	0,7	1,5	0,785	39,250	0,0014356	0,08667478	0,136		
		21944	0,45	1	0,192	9,600	0,0015200	0,01611222	0,025		
		1298	0,9	2	0,79	39,500	0,0001798	0,01456543	0,023		
COSTA RICA	536258	3824,3703	0,9	3	0,967	48,350	0,0064184	0,9502482	1,494	**4,5555**	**A**
		6,3317	0,9	3	0,833	41,650	0,0000106	0,0013597	0,002		
		54,5941	0,9	3	0,993	49,650	0,0000916	0,0139224	0,022		
		169,92	0,7	1	0,507	25,350	0,0002218	0,0058445	0,009		
		455603,4	0,05	0,5	0,915	45,750	0,0424799	0,9929670	1,561		
		3719,3404	0,9	3	0,967	48,350	0,0062422	0,9241513	1,453		
		252,1948	0,7	1	0,500	25,000	0,0003292	0,0085592	0,013		
COXIM	641040	3105,0799	0,05	0,5	0,318	15,900	0,0002422	0,0020465	0,003	**0,0910**	**B**
		439,6605	0,05	0,5	0,331	16,550	0,0000343	0,0003009	0,000		
		3036,9957	0,7	1	0,315	15,750	0,0033163	0,0555484	0,087		
DEODÁPOLIS	83100	46458,9407	0,05	0,5	0,38	19,000	0,0279536	0,2795363	0,4396	**0,4396**	**M**
DOIS IRMÃOS DO BURITI	234460	1655,8381	0,05	0,5	0,527	26,350	0,0003531	0,0048289	0,00759	**1,9477**	**A**
		12550	0,7	1,5	0,39	19,500	0,0374691	1,15217414	1,81173		
		1598,9313	0,45	1	0,512	25,600	0,0030688	0,0816310	0,12836		
DOURADINA	28070	30	0,45	1	0,916	45,800	0,0004809	0,0225080	0,0354	**0,0354**	**B**
DOURADOS	408640	1733,8233	0,45	1	0,289	14,450	0,0019093	0,0294988	0,0464	**0,1071**	**M**
		1272,8035	0,45	1	0,531	26,550	0,0014016	0,0386149	0,0607		
ELDORADO	101810	3877,6849	0,7	1	0,362	18,100	0,0266612	0,5092294	0,801	**3,8808**	**A**
		3688,1852	0,7	1	0,362	18,100	0,0253583	0,4843437	0,762		
		16375,2746	0,05	0,5	0,556	27,800	0,0080421	0,1158059	0,182		
		1950,9806	0,45	1	0,619	30,950	0,0086233	0,2755154	0,433		
		3619,47	0,9	1	0,657	32,850	0,0319961	1,0830680	1,703		
FÁTIMA DO SUL	31500	30277,9385	0,05	0,5	0,315	15,750	0,0480602	0,4025043	0,6329	**0,6329**	**A**
FIGUEIRÃO	491484	5047	0,9	1	0,566	28,300	0,0092420	0,2707909	0,426	**0,4258**	**M**
GLÓRIA DE DOURADOS	49175	0	0	0	0	0	0	0	0	**0**	**B**
GUIA LOPES DA LAGUNA	121047	0	0	0	0	0	0	0	0	**0,0000**	**B**
IGUATEMI	294650	2,4200	0,90	1,0	0,770	38,500	0,00000739	0,0002920	0,0005	**0,6300**	**A**
		115783,6920	0,05	0,5	0,795	39,750	0,0196477	0,4003212	0,629		
INOCÊNCIA	577600	282049,612	0,05	0,5	0,876	43,800	0,0244157	0,5469106	0,860	**0,8600**	**A**
ITAPORÃ	132200	1740,7724	0,45	1	0,061	3,050	0,0059255	0,0239982	0,0377	**0,0377**	**B**

ITAQUIRAÍ	206220	98284,692	0,05	0,5	0,595	29,750	0,0238301	0,3663871	0,576	**0,8136**	A
		926,3391	0,9	1	0,727	36,350	0,0040428	0,1509984	0,237		
IVINHEMA	200980	48976,43	0,05	0,5	0,669	33,450	0,0121844	0,2098764	0,330	**0,3300**	M
JAPORÃ	45770	43121,1101	0,05	0,5	0,497	24,850	0,0471063	0,6088490	0,957	**1,5909**	A
		1648,8899	0,45	1	0,477	23,850	0,0162115	0,4028558	0,633		
JARAGUARI	291300	0	0	0	0	0	0	0	0	**0**	B
JARDIM	220170	4343,9678	0,9	3	0,459	22,950	0,0177571	1,2758445	2,006	**2,1488**	A
		487,6239	0,7	1	0,589	29,450	0,0015503	0,0472076	0,074		
		29,0348	0,7	1	0,76	38,000	0,0000923	0,0036002	0,006		
		307,5297	0,7	1	0,795	39,750	0,0009777	0,0398432	0,063		
JATEÍ	192800	42846,0575	0,9	1	0,725	36,250	0,2000075	7,4502805	11,7152	**11,9120**	A
		35117,0825	0,05	0,5	0,529	26,450	0,0091071	0,1249953	0,1965		
JUTI	161280	479,0728	0,45	1	0,277	13,850	0,0013367	0,0198500	0,031	**0,7188**	A
		95299,81	0,05	0,5	0,572	28,600	0,0295448	0,4372635	0,688		
LADÁRIO	34076,5	5420,5818	0,05	0,5	0,5	25,000	0,0079535	0,10339613	0,163	**0,1626**	M
LAGUNA CARAPÃ	173390	716,9316	0,45	1	0,531	26,550	0,0018607	0,0512611	0,081	**0,1858**	M
		777,5349	0,45	1	0,643	32,150	0,0020179	0,0668947	0,105		
MARACAJU	529880	607,37	0,7	1	0,511	25,550	0,0008024	0,0213029	0,0335	**0,0534**	B
		535,1047	0,45	1	0,536	26,800	0,0004544	0,0126334	0,0199		
MIRANDA	547870	119,497679	0,7	1	0,612	30,600	0,0001527	0,00482466	0,008	**0,4922**	M
		320,128916	0,7	1	0,612	30,600	0,0004090	0,01292506	0,020		
		2658	0,45	1	0,44	22,000	0,0021832	0,05021319	0,079		
		3000,2101	0,45	1	0,371	18,550	0,0024643	0,0481763	0,076		
		208,3702	0,45	1	0,472	23,600	0,0001711	0,00421023	0,007		
		4010,3674	0,7	1	0,732	36,600	0,0051239	0,19266043	0,303		
MUNDO NOVO	44200	20178,7692	0,05	0,5	0,612	30,600	0,0228267	0,3606613	0,567	**2,2123**	A
		11178,7692	0,05	0,5	0,59	29,500	0,0126457	0,1928464	0,303		
		1450,2198	0,9	1	0,558	27,900	0,0295294	0,8533986	1,342		
NAVIRAÍ	316520	16284,8512	0,9	1	0,717	35,850	0,0463047	1,7063285	2,683	**6,133**	A
		8	0,9	1	0,838	41,900	0,0000227	0,0009759	0,002		
		101792,245	0,05	0,5	0,683	34,150	0,0160799	0,2826044	0,444		
		9512,4694	0,9	1	0,854	42,700	0,0270480	1,1819962	1,859		
		6585,688	0,9	1	0,751	37,550	0,0187259	0,7218831	1,135		
		112,236	0,7	1	0,5	25,000	0,0002482	0,0064536	0,010		
NIOAQUE	392380	3029,3529	0,45	1	0,556	27,800	0,0034742	0,1000571	0,157	**0,1573**	M
NOVA ALVORADA DO SUL	401900	68376	0,05	0,5	0,621	31,050	0,0085066	0,1363182	0,21435	**0,3548**	M
		46406	0,05	0,5	0,599	29,950	0,0057733	0,0893422	0,14049		
NOVA ANDRADINA	477580	979,43	0,7	1	0,485	24,250	0,0014356	0,0362482	0,057	**0,1781**	M
		27926,02	0,05	0,5	0,681	34,050	0,0029237	0,0512379	0,081		
		475,05	0,7	1	0,721	36,050	0,0006963	0,0257976	0,041		
NOVO HORIZONTE	84910	49320,17	0,05	0,5	0,353	17,650	0,0290426	0,2708224	0,426	**0,4259**	M
PARANAÍBA	540300	88754	0,05	0,5	0,577	28,850	0,0082134	0,1225850	0,193	**0,1928**	M
PARANHOS	130210	116897,952	0,05	0,5	0,694	34,700	0,0448882	0,8012551	1,260	**2,5888**	A
		13,9181	0,9	1	0,725	36,250	0,0000962	0,0035835	0,006		
		2609,094	0,45	1	0,386	19,300	0,0090169	0,1830433	0,288		
		2118,2325	0,45	1	0,401	20,050	0,0073205	0,1540969	0,242		
		8584,7213	0,45	1	0,320	16,000	0,0296684	0,5043631	0,793		
PEDRO GOMES	365117	0	0	0	0	0	0	0	0	**0**	B
PONTA PORÃ	532860	777,2021	0,45	1	0,204	10,200	0,0006563	0,0073511	0,012	**0,0696**	B
		19617,4183	0,05	0,5	0,782	39,100	0,0018408	0,0369074	0,058		

PORTO MURTINHO	1773480	376591,78	0,45	1	0,191	9,550	0,0955558	1,0081137	1,585	**2,5350**	A
		16414,5856	0,9	3	0,461	23,050	0,0083300	0,6010111	0,945		
		51	0,9	3	0,741	37,050	0,0000259	0,0029544	0,005		
RIBAS DO RIO PARDO	1730810	500,6145	0,7	1	0,553	27,650	0,0002025	0,0058006	0,00912	**0,5526**	A
		644929,4	0,05	0,5	0,722	36,100	0,0186308	0,3456022	0,54344		
RIO BRILHANTE	398752	0	0	0	0	0	0	0	0,0000	**0**	**B**
RIO NEGRO	180766	0	0	0	0	0	0	0	0	**0**	**B**
RIO VERDE DE MT	815220	1743,9138	0,05	0,5	0,34	17,000	0,0001070	0,0009626	0,002	**0,0294**	**B**
		18825,4671	0,05	0,5	0,595	29,750	0,0011546	0,0177524	0,028		
ROCHEDO	156064	0	0	0	0	0	0	0	0	**0**	**B**
SANTA RITA DO PARDO	614161	0	0	0	0	0	0	0	0	**0**	**B**
SÃO GABRIEL DO OESTE	385440	7816,1943	0,05	0,5	0,373	18,650	0,0010139	0,0099619	0,016	**0,0157**	**B**
SELVÍRIA	325865	0	0	0	0	0	0	0	0	**0**	**B**
SETE QUEDAS	82590	81618,9359	0,05	0,5	0,59	29,500	0,0494121	0,7535348	1,185	**1,5044**	A
		19,301	0,9	1	0,75	37,500	0,0002103	0,0080976	0,013		
		971,0641	0,7	1	0,454	22,700	0,0082304	0,1950594	0,307		
SIDROLÂNDIA	528640	491,2378	0,45	1	0,436	21,800	0,0004182	0,0095341	0,01499	**0,0154**	**B**
		9,7428	0,45	1	0,612	30,600	0,0000083	0,0002621	0,00041		
SONORA	407570	4759,9854	0,9	1	0,612	25,550	0,0105110	0,2790683	0,439	**2,4874**	A
		7913,52	0,9	3	0,511	23,850	0,0174747	1,3027397	2,048		
TACURU	178530	2342,0155	0,45	1	0,413	20,650	0,0059032	0,1278053	0,201	**1,8292**	A
		174265,341	0,05	0,5	0,722	36,100	0,0488056	0,9053442	1,424		
		1922,6435	0,45	1	0,517	25,850	0,0048462	0,1301201	0,205		
TAQUARUSSU	105350	89897,8587	0,05	0,5	0,761	38,050	0,0426663	0,8330592	1,310	**8,2605**	A
		14214,2413	0,9	1	0,708	35,400	0,1214316	4,4201096	6,950		
TERENOS	284120	200	0,7	1	0,334	16,700	0,0004927	0,0087217	0,01371	**0,8572**	A
		50,0198	0,7	1	0,455	22,750	0,0001232	0,0029269	0,00460		
		44012,5054	0,05	0,5	0,546	27,300	0,0077454	0,1095975	0,17234		
		57090,7757	0,05	0,5	0,57	28,500	0,0100469	0,1481925	0,23302		
		3611,5119	0,9	1	0,462	23,100	0,0114401	0,2757064	0,43353		
TRÊS LAGOAS	1020680	3300	0,90	1	0,495	24,750	0,0029098	0,0749280	0,118	**0,1178**	**M**
VICENTINA	31000	24937,3809	0,05	0,5	0,343	17,150	0,0402216	0,3650109	0,5740	**0,5740**	A
TOTAL			10,85					63,5951036			

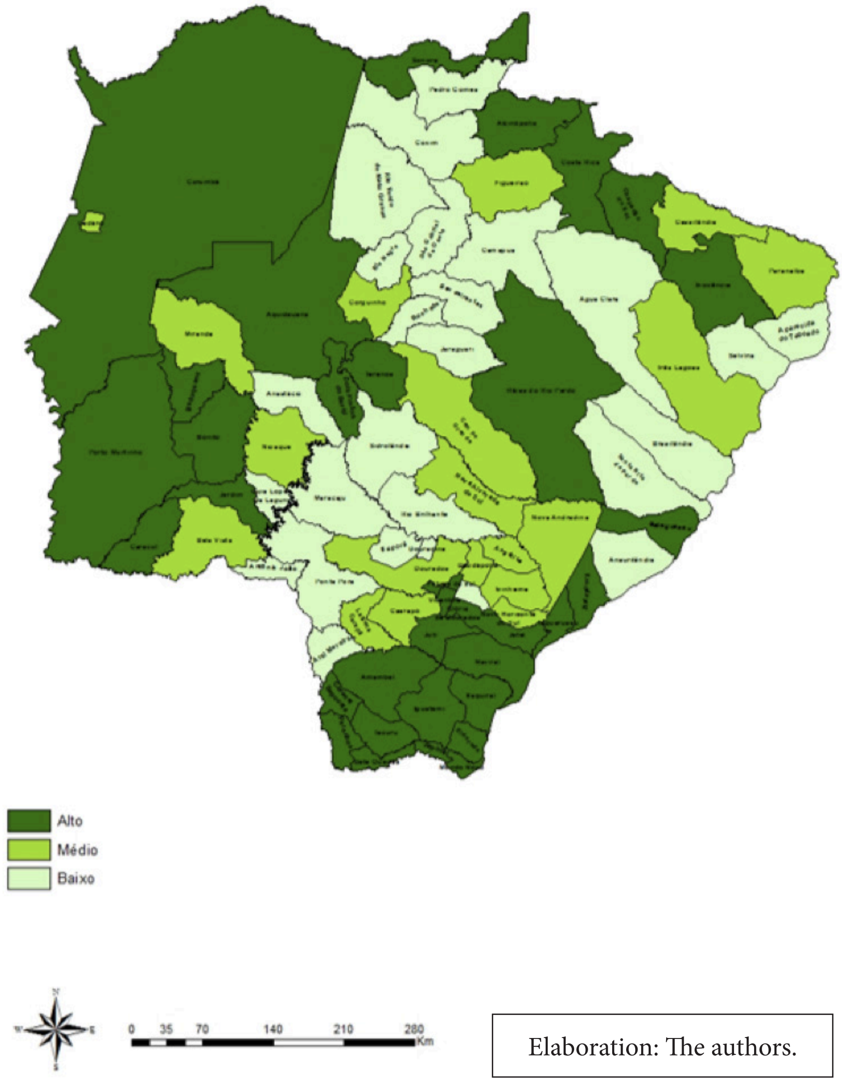
1°	**2°**	**3°**	**4°**	**5°**	**6°**

B= 0-0,133	**M = >0,1 –0,219**	**A=>0,226**

Table 1. Biodiversity Conservation Index of Municipalities in the State of Mato Grosso do Sul. Campo Grande /MS - Brazil, 2023

SAP = Protected Area Surface; FC = Correction Factor; P= Weight; Pquali = Protected Area Quality Assessment; CCB = Biodiversity Conservation Coefficient; ICCB= Biodiversity Conservation Index.

SOURCE: Prepared by the authors (2023).



Elaboration: The authors.

FIGURE 1. Classification of the Biodiversity Conservation Index of Municipalities in the State of Mato Grosso do Sul.

contemplative tourism, composed of special geological and geomorphological formations, and the maintenance of areas of ecological interest, such as the Pantanal Biome (SEMAC, 2011), one of the richest ecosystems in biodiversity in Brazil (Paranhos Filho et al., 2014).

Regarding the classification of Biodiversity Conservation Indices for the municipalities of MS, following the pre-established intervals of high (>0.5), medium (0.1-0.5) and low (0-0.1) condition of the protected surface, it is noted through this study that 33 of these were in high condition levels, 19 in medium condition levels and 26 were in low biodiversity conservation conditions levels (Figure 1). It appears that 33% of the State's municipalities are in low biodiversity conservation condition and less than 50% are in high conservation condition.

This means that municipalities, especially those with low levels of biodiversity conservation, contribute with smaller proportions of protected surface or do not have one, compared to the existing area and directly contribute to the absence of protected vegetation areas, thus serving as a warning to public environmental managers, as there are no or limited protected surfaces to play the ecological role that the municipality needs. It is also reinforced by the above, that the State, in addition to some municipalities having reduced values of protected surfaces (Table 1), twelve of them, are absent.

Much has been done, but in the face of *hot spots*, which are areas of great importance for biodiversity, places that are home to a large number of species or endemic species (MMA, 2012b), present in the State, monitoring these variables is essential, and ICCB is a promising tool.

The creation of new protected surfaces integrates a set of preventive measures to ensure the conservation of biota and the formation of biodiversity corridors between vegetation formations present in the state, in addition to ensuring greater environmental sustainability as a result of avoiding the loss of biodiversity by isolated fragments.

Therefore, it is necessary to emphasize that the MS, as previously mentioned, is covered by three biomes with very rich biodiversity in both the lithosphere and hydrosphere. Its municipalities have high natural scenic beauty that is highly vulnerable to human disturbance, as observed in Bonito and Jardim, in addition to having special geological formations, such as the Pantanal plain. These are environments that require preservation and protection, whether integral or sustainable use.

This way, based on the results obtained in this study, public managers will be able to insert Biodiversity Conservation Indices for effective monitoring of protected surfaces. It will then serve as an indication of the municipalities that are in alert conditions, so that managers can make decisions regarding which paths to follow and what appropriate measures to take, to prevent, correct and compensate for the rampant anthropization, which has occurred in recent decades, mainly in environments vulnerable, thus ensuring the maintenance of biota, reconciling development with sustainability.

CONCLUSIONS

Of all the municipalities analyzed, 33 (thirty-three) municipalities presented high biodiversity conservation indexes; 19 (nineteen) municipalities presented average levels of biodiversity conservation and 26 (twenty-six) municipalities presented low levels of biodiversity conservation.

- The data reports that there are municipalities needing to create protected surfaces, since in some of these, these areas are small or non-existent.

- Municipalities, with low levels of biodiversity conservation conditions, contribute with smaller proportions of protected surface or do not have them, thus contributing to the absence of protected vegetation areas, serving as a warning to public environmental managers, since they do not exist or protected surfaces are reduced to play the ecological role that the municipality needs.

- The municipalities that presented the best indexes within a ranking following the scale of first to sixth placed were: 1st) Jateí (11.9120); 2nd) Alcinópolis, (11.7964); 3rd) Taquarussu (8.2605); 4th) Bodoquena (8.0412); 5th) Bonito (6.1385); 6th) Naviraí (6.1330).

- The municipalities with the lowest rates were: Anastácio (0.0011), Aparecida do Taboado (0.0015), Camapuã (0.0064), Brasilândia (0.0070), Bandeirantes (0.0126) and Sidrolândia (0.0154).

- Twelve municipalities have a zero index.

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