Article

Economic valuation of protected areas: Overview of Chapada Dos Guimarães National Park in Mato Grosso, Brazil

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Abstract

The Protected Areas (PAs) are protected areas that follow the guidelines of the National System of Conservation Units (SNUC) responsible for safeguarding the Brazilian natural heritage, which in addition to preserving part of the biome of a certain place, provide environmental services that are fundamental to nature and the human population. This paper aims to demonstrate the importance of economically valuing protected areas, such as the Chapada dos Guimarães National Park in Mato Grosso State. The methodology is based on bibliographical and documentary review. The Mato Grosso Protected Areas are important spaces for protecting biodiversity, especially since they protect significant parts of three important biomes. One of these PAs is the Chapada dos Guimarães National Park, which is an important space created by legislation for the protection of the environment, especially the Cerrado biome. However, they may face threats that endanger their purpose. In this way, the economic valuation of these areas assists in decision making regarding environmental protection policies, demonstrating the importance of investments to create and maintain PAs at the expense of other policies. It concludes that protected areas meet the objectives for which they were created, but they suffer threats that may endanger their purpose. Therefore, valuing these areas would demonstrate the importance they have both to the environment and to the population and would help in public policies for their maintenance.

Keywords biodiversity; conservation; economic value; Mato Grosso; protected areas.

1 Introduction

The increasing degradation of natural resources is of great concern, which raises a quest for solutions that can minimize this problem. One of the well-known ways of preserving nature is the implementation of protected areas, since they are capable of securing part of the local biodiversity and provide various environmental services (Cunha, 2014; Baig, 2013; Fournier and Sanou, 2013).

Protected areas promote socio-economic benefits through the environmental services they provide, including support, regulatory, supply and cultural services. It is possible to translate them into economic values to quantitatively explain the significant role that these natural areas have if they are protected (Silva, 2015).

The creation of Protected Areas (PAs) over the past two decades has meant that protected areas have jumped from 37 million to 167 million hectares between federal lands and marines, posing a challenge to their management as the need for resources increases. This implies channeling these resources to basic protection and implementation activities, to the detriment of the final actions to consolidate public use and other economic uses of protected areas (Icmbio, 2018).

According to Brasil (2000), among the protected areas there are national, state and municipal parks that are designed as integral protection conservation units, whose main objective is the conservation of nature, which includes scientific research, education and environmental interpretation, recreation and ecological tourism, developed according to the norms established in its management plan.

The state of Mato Grosso, being a place with big biological diversity, counts on several protected areas by legislation, among them the Chapada dos Guimarães National Park, which was created with the objective of protecting the ecosystems of Savanas and semi-deciduous forests , archaeological sites and historical monuments. As well as the headwaters of the rivers, that makes up the basins of the Upper Paraguay and Amazon. However, it has been enduring threats that put it at risk, such as deforestation, burning and industrial mining (Isa, 2018).

In the face of these threats, there is a warning about the need to guarantee and direct public policies consistent with the management of environmental assets such as protected areas. This suggests that the determination of economic values to the existing natural resources and the functions they play in promoting social welfare is essential (Sousa and Mota, 2006).

The environmental economic valuation applied as an environmental management tool can contribute to the economic potential of the natural resources from protected areas and may indicate an economic contribution to be destined to the implementation and maintenance of the protected areas, with can meet the management priorities consolidated by the National System of Conservation Units (SNUC) (Camphora and May, 2006).

In view of the above, this paper aims to demonstrate the importance of the environmental economic valuation of protected areas, such as the Chapada dos Guimarães National Park, in the Mato Grosso state, Brazil.

2 Results and Discussion

Brazil leads the list of 17 mega diverse countries, the nations with the highest number of animal and plant species. According to estimates by the United Nations, the country holds 15% to 20% of the earth's biological diversity. In addition, on the global scale, it has the largest number of endemic species, that is, of plants and animals that only occur in the national territory, which serves as an indicator of the uniqueness of these genetic resources. It also houses the largest expanse of tropical forests on the planet. The variety of climates, reliefs and vegetation is reflected in the richness of biomes and in the exuberance of the country's biological diversity and the value associated with this heritage. The creation and effective implementation of federal, state and municipal protected areas (PAs) is one of the most important strategies for protecting the genetic heritage, the environmental services and the ecosystems that shelter them (Neto, 2012).

The protected areas (PAs) are important spaces created through legislation for the protection of the environment and their valuation can contribute to social perception about the need to created measures related to conservation of the benefits provided by these areas. Collaborating to one of the goals of the Sustainable

Development Goals (ODS) 2015 which consists precisely in "strengthening efforts to protect and safeguard the cultural and natural heritage of the world".

According to Law 9.985/2000, PAs are territorial spaces and their environmental resources, including jurisdictional waters, established by the public power, for conservation purposes, under a special administration regime to which adequate protection guarantees apply. PAs can be federal, state and municipal and are divided into two groups, with specific characteristics: Integral Protection Units, where only the indirect use of their natural attributes are permitted and Sustainable Use Units with the permission of the sustainable use of the portion of their natural resources (Brasil, 2000).

Through the creation of PA, several services can be assured, according to MEA (2003): support services: those that are needed to produce all other environmental services such as soil formation and nutrient cycling, for example; supply services: goods or products extracted from ecosystems such as food, water and wood. There are also regulatory services: these are the benefits that the regulation of ecosystem processes promotes, such as regulation of floods, droughts, climate and diseases; cultural services: these are the non-material benefits promoted by ecosystems, such as recreation, education, spiritual value and religious value.

Protected areas are important all over the world for a number of factors, such as the provision of water to important cities such as Rio de Janeiro, Tokyo and New York. Indeed, one-third of the world's one hundred largest cities depend on water supplied from forests located in Pas with significantly lower cost compared to other forms of supply (such as treatment and decontamination systems for effluent-receiving watercourses of human activities). In New York, the cost of preserving water sources in the Catskills basin, which supplies water for human consumption in the metropolis, is $ 1 to $ 1.5 billion. Supply from a treatment system would cost between $ 6 and $ 8 billion, plus $ 300 to $ 500 million per year for system operation (Neto, 2012).

The state of Mato Grosso has great biological diversity, because it is composed of three large biomes: the Cerrado, the Amazon Forest and the Pantanal. However these areas are threatened and attacked that endanger the ecological characteristics of the state. Among these threats, the most cited are agribusiness expansion, illegal occupation of public land, expansion of hydroelectric power plant construction, lack of consistent policies for consolidation of Pas. "[...] lack of structure of public agencies, gaps in legislation and, above all, how these areas are managed" (Irigaray et al., 2013). In this way, the creation and maintenance of PAs in the state is fundamental.

One of the main strategies for the conservation of biological diversity is the creation and maintenance of PAs, especially for the state of Mato Grosso that has three biomes with great diversity among them. However, in recent years, deforestation in the state is still high, and with it the environment is suppressed mainly because of agribusiness (Greenpeace, 2017).

The lack of an environmental policy aimed at resolving the serious land problems in the state has led to increasing degradation and loss of regional biodiversity within protected areas. This aspect, coupled with the lack of financial resources for the implementation and maintenance of the state protection areas for indirect use in Mato Grosso, has contributed to the lack of knowledge, lack of efficiency and lack of perspective in reaching, in the short term, the objectives for which were created (Dorval et al., 2012).

Despite this, the state of Mato Grosso has 69 protected areas at federal and state levels and is divided into several categories capable of protecting 3,443, 548.58 hectares of land (Table 1). In addition, the state still has protected municipal areas and indigenous lands that are important for the conservation of the state's biodiversity (Sema, 2018).

Table 1 Number of Protected Areas in Mato Grosso.

Protected areas	Quantity	Area/hectare
Environmental Preservation Area	7	1,113,773.36
Ecological Station	8	263,802
Park Road	5	21,951.75
Natural Monuments	1	258.09
Park	22	1,509,750
Wildlife Refuges	2	100,000
Biological Reserve	1	3,900
Ecological Reserve*	1	100,000
Extractive Reserve	1	138,092
Natural Heritage Private Reserve (NHPR)	21	192,021.39
Total	69	**3,443,548.58**

Source: Prepared from Sema (2018). PA awaiting recategorization to suit the National System of Conservation Units (SNUC).

Among the PAs in Mato Grosso, we can highlight the Chapada dos Guimarães National Park (PNCG), created on April 12, 1989 (Decree Law nº. 97,656), which is located in the municipalities of Cuiabá and Chapada dos Guimarães (Fig. 1). The boundary of the National Park is 26 kilometers from the urban area of Cuiabá and 6 kilometers from Chapada dos Guimarães, with access by highway MT-251, asphalt road that serves as a boundary and passes inside the PNCG, which has 326.30 km^2. It is located in the Cuiabá river basin, having in its area sources of tributaries of two important rivers: Coxipó river and Manso river (Icmbio, 2009).

The climate in the Chapada dos Guimarães National Park, according to the classification of Köppen, is included in the categories Aw (in the Depression Cuiabana) and Cw (in the Chapada). Both are characterized by the remarkable presence of a rainy season (October to March) and a drought (April to September). In the dry season cooler periods occur by the invasion of the polar mass on the continent, leading to abrupt drops of temperature. Average annual temperatures range from 25º C (in the *Baixada Cuiabana*) to 21.5º C (in the high tops of the Chapada dos Guimarães), and the maximum daily temperatures in the *Baixada Cuiabana* can exceed 38º C and the minimum temperatures in the top of the Chapada, fall to less than 5º C in the colder seasons. The average annual rainfall remains between 1650 and 2100 mm of rainfall, with relative humidity, from November to April, being less than 80% and, in the dry months, less than 60%. The presence of islands with microclimate on the slopes creates environmental conditions conducive to the survival of species other than those of the flat and low regions (Icmbio, 2009).

The PNCG region is part of the Cerrado, considered a biodiversity hotspot because it is a biome of rich biological diversity, but it is one of the most endangered tropical savannas in the world, suffering very high deforestation rates (Silva and Bates, 2002; Machado et al., 2004). The Cerrado has the lowest percentage of areas under full protection. The Biome presents 8.21% of its territory legally protected by protected areas. Of this total, 2.85% are PA of integral protection and 5.36% of PA of sustainable use. It shows the importance of creating Conservation Units in this biome (MMA, 2019).

In this way, the PNCG is able to preserve a sample of the biodiversity of this biome because national parks are designed as integral protection conservation units whose basic purpose is to preserve nature, with only the indirect use of their natural resources. In this use is included scientific research, environmental education and interpretation, recreation and ecological tourism activities developed in accordance with the norms established in its management plan (Brasil, 2000).
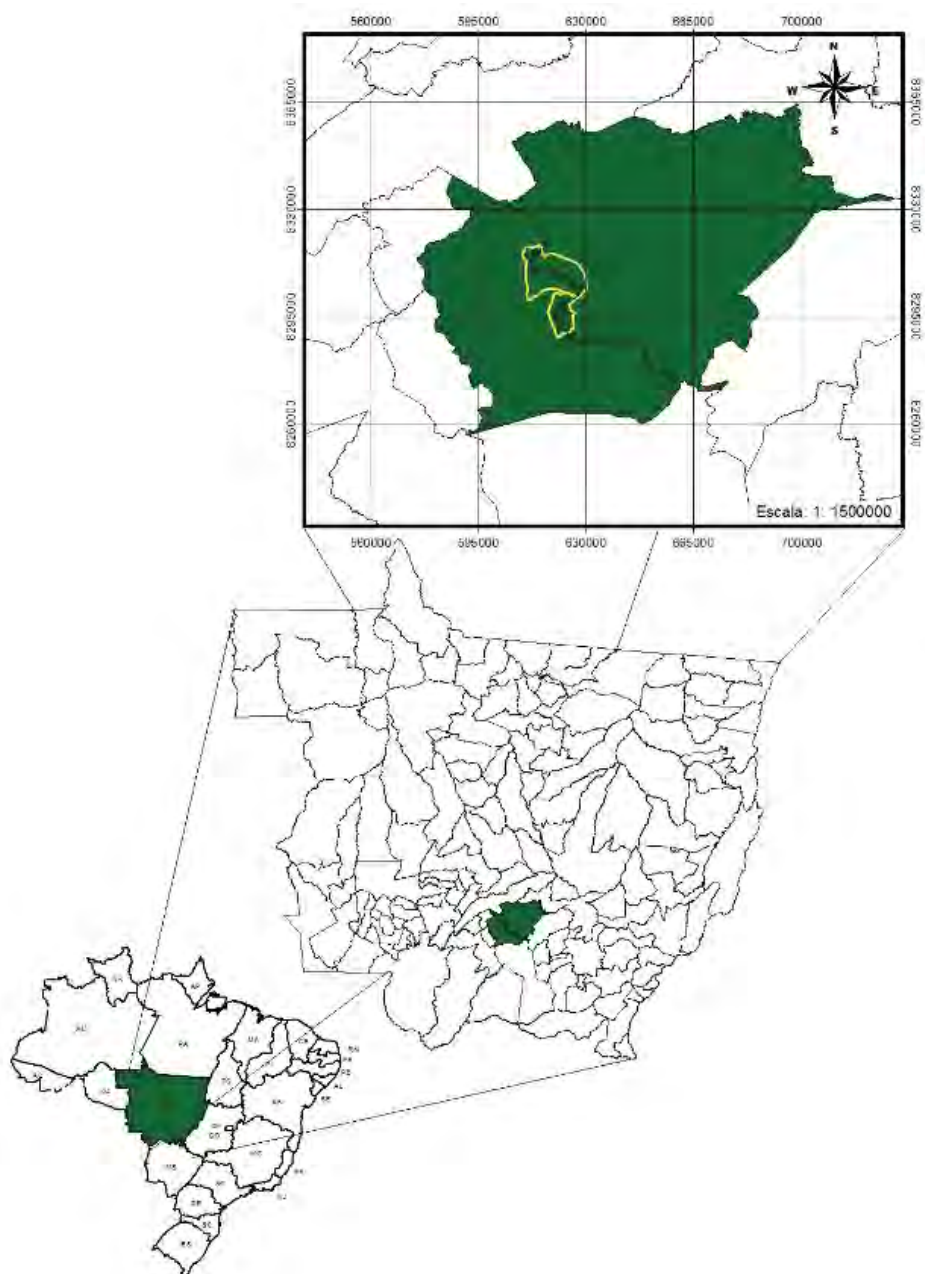
Fig. 1 Location of the Chapada dos Guimarães National Park – MT (Source: Machado-Neto et al (2017).

Famous internationally for its mystique and mysteries, the PNCG has protected its ecosystems of savannas and forests, numerous archaeological sites and historical monuments. It is a pilgrimage point for tourists who like to feel and get in touch with nature. The beautiful waterfalls and landscapes fill the eyes of visitors. Geodetic Center of Latin America, the National Park of Chapada dos Guimarães is the most central point of the continent. An unforgettable experience is right in the heart of Brazil (Secom, 2017).

In addition, the PNCG has significant financial results because tourists from all over the world visit it. In 2017, the PNCG received 172,839 visitors, who contributed to the region with almost R $ 30 million, generating 998 jobs resulting from this visitation. Therefore, it can be seen that the PNCG, as well as several other Brazilian protected areas, are important places not only for conservation but also to promote a sustainable economic development for the region (Souza and Simões, 2018).

Mato Grosso's main activity is agribusiness, which is responsible for much of the loss of habitats in the state. However, even with agribusiness being the main activity for the growth of the economy of the state, the income generated is private for a small part of the population, leaving the others the margin of this process. Thus, the creation and implementation of PAs in Mato Grosso, besides being responsible for protecting a significant portion of the biomes, could serve as an opportunity for economic development, since activities such as tourism, extractivism and sustainable exploitation can be encouraged for the purpose of generating economic returns for a larger portion of society.

However, even though it is an integral protection conservation unit, the PNCG suffers various threats, including fire, which can alter the structure and floristic composition and kill animals in the park, and these threats originate mainly from anthropic causes. The human occupation is also a threat, since several private properties are inserted in the limits of the park. The cutting of illegal timber, especially for the use of firewood, extraction of plant products by local residents and presence of livestock from neighboring properties that invade the park, which may have a direct impact on the vegetation. As well as messy tourism, waste disposal, and illegal fishing are also frequent threats to the purposes of the park, which is the preservation of its natural resources (Icmbio, 2009).

In addition, the region is experiencing several environmental problems every year, such as the disorderly urban growth of the city of Chapada dos Guimarães, which exerts great pressure on the park, suffering from the increase in the number of urban and rural properties in the region. Due to its great scenic beauty, the park has been the object of concern for its managers (Machado-Neto et al., 2018).

One of the main watercourses of the PNCG is the Coxipó River, which has its springs outside the park, near the urban area of the municipality of Chapada dos Guimarães, being vulnerable to threats such as silting, waste dumping and habitat fragmentation. In addition, the National Park is not valued as cultural and natural heritage, demonstrating the need for its environmental economic valuation (Icmbio, 2009).

The purpose of the PNCG is to protect the biodiversity present, such as semi-deciduous savannas and forests, numerous archaeological sites, historical monuments, headwaters of several rivers that make up the Upper Paraguay basin and the Amazon basin. And its maintenance will contribute to sustainable development as long as the park is valued consistently and concretely to avoid unsustainable economic decisions that could degrade the natural resources and services ecosystems generate (Fritsch, 2005). This is because contemporary society today faces something unthinkable a few years ago, a generalized crisis that, according to Rodrigues and Lumertz (2014), was motivated by the exhaustion of a growth model and the economies guided by unsustainable patterns of production and consumption, which ended proving harmful to the ecosystem.

In this sense, PAs can be considered as a preferred locus for studies related to environmental economic valuation, as they promote the conservation and sustainable use of biodiversity, provide directly and / or indirectly goods and services that contribute to social well-being, and generate economic contributions, an aspect little perceived by society and decision makers (Medeiros, 2011).

The services offered by ecosystems are fundamental to the well-being of human beings as they are essential elements of life, but since they do not have a defined market, their management is complex. According to Paiva (2010), if environmental resources continue to be considered free, that is, without price, they tend to be used and exploited until their degradation. In this way, valuation becomes an important point, because it will include environmental resources in the discussions of decision-making about its use.

As Young et al. (2015), in economic terms, valuation means estimating the variation in people's welfare due to changes in the quantity or quality of environmental goods and services, whether in appropriation for use or not. That is, imputation of value to environmental resources translates, therefore, into the best way to calculate the value in monetary units of the losses or gains of the society in face of the variation of the resource.

This can be done by means of valuation techniques, in order to differentiate each project and objective from the study to the technical analysis of the appropriate valuation.

Assigning value to environmental resources is one of the best ways to calculate the value in monetary units of the society's gains or losses in the face of resource variation (Young et al., 2015). In this sense, the economic valuation of environmental goods and services is a tool that serves as an aid in decision making regarding environmental protection policies. In this way, to avoid the loss of biodiversity, it is necessary to direct public policies aimed at this purpose.

According to Motta (1998), among developmental tools, along with the instruments of command and control, emanated from the public power, the economic instruments are increasingly emphasized, whose objective is to equitably distribute environmental costs, creating procedures whose main focus is equilibrium between the preservation of natural resources and economic growth. According to May (1995), economic growth and environmental preservation are often considered antagonistic objects. However, these aspects should not be understood as a contradiction.

However, environmental valuation is not always easy and there are several valuation methods that have been developed in the last decades. The report "The Economics of Ecosystems and Biodiversity" (TEEB, 2010) lists more than a dozen different methods, finding from the literature review that there is no single method for assessing all types of environmental services, there are methods that are more adequate for certain types of services, being inadequate for others (Cunha, 2014). There are also, according to Romero and Gonzalez (2012), more complex methods of analysis, with multi-criteria analyzes, which seek valuations also taking into account the socio-environmental conflicts that involve the use of the service under analysis.

Therefore, regardless of the methodology, the environmental economic valuation of a PA can contribute to the decision making, formulation and implementation of public policies responsive to protected natural areas. Creating and maintaining a PA is a major investment and demonstrating the economic value of the environmental goods and services that a PA provides and how they can contribute to social well-being is essential to justify the choice to invest in policies that are responsive to these areas to the detriment of other policies (Silva, 2015).

Inserted in this context, the PAs, as well as the PNCG, are important to ensure the conservation of natural ecosystems of ecological relevance and scenic beauty, enabling scientific research and the development of activities such as tourism that provide the closest contact of the population with nature and , through their valuation, public policies can be directed to ensure their maintenance.

3 Conclusions

PAs are created through legislation aimed at protecting the environment and ensuring support, supply, regulation and cultural services. Mato Grosso has several protected areas, including the National Park of Chapada dos Guimarães, in the municipalities of Chapada dos Guimarães and Cuiabá. The PNCG protects ecosystems of savannas and forests, numerous archaeological sites and historical monuments, besides serving as tourist point due to its beautiful landscapes. However, the PNCG suffers various threats, such as incidents of fire, cutting of illegal timber, extraction of its plant products; cattle invasion; messy tourism; waste disposal and illegal fishing.

Therefore, PAs generate environmental and social benefits resulting from their creation and the economic valuation of these areas assists in decision making on environmental protection policies. In this way, through the valuation it is possible to justify the reason for investing in policies responsive to these areas, aiming at the reduction of external threats and the creation and maintenance of PAs in different biomes, and not in other policies.

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