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CONSERVATION AREAS, POVERTY AND SOCIAL INEQUALITY: AN EVALUATION USING SOCIOECONOMIC INDICATORS IN MINAS GERAIS, BRAZIL

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ABSTRACT: The objective of this study was to evaluate the possible correlations between the socioeconomic development indicators of the municipalities of Minas Gerais, Brazil, and the presence of both sustainable use and full protection conservation areas (CAs). The Human Development Index (HDI) and Gini Index (GI) values were compared between municipalities with and without CAs using the non-parametric Wilcoxon-Mann-Whitney test. The correlations between the HDI and GI of each municipality and its areas occupied by CAs were analyzed using the non-parametric Spearman correlation test. A total of 560 CAs were identified in the 853 municipalities of the state. The HDI values of municipalities with CAs were not significantly different from those of other areas, but significant differences were found in the GI values, which were higher in municipalities with CAs. No significant correlations were found between the HDI of municipalities and their areas occupied by CAs. However, significant correlations were found between the GI and areas occupied by CAs, suggesting that the CAs are associated with greater socioeconomic inequalities. Populations should be included in conservation efforts through programs that benefit these individuals, such as payment for environmental services and other conservation strategies.

ÁREAS DE CONSERVAÇÃO, POBREZA E DESIGUALDADE SOCIAL: AVALIAÇÃO UTILIZANDO INDICADORES SOCIOECONÔMICOS EM MINAS GERAIS, BRASIL

RESUMO: Neste estudo objetivou-se avaliar as possíveis correlações entre os indicadores de desenvolvimento socioeconômico dos municípios do estado de Minas Gerais, Brasil, e a presença de unidades de conservação (UC), tanto de uso sustentável como de proteção integral. Os valores de Índice de Desenvolvimento Humano (IDH) e Índice de Gini (IG) foram comparados entre os municípios com e sem UC pelo teste não paramétrico Wilcoxon-Mann-Whitney. Testaram-se as correlações entre IDH e IG de cada município e suas áreas ocupadas por UC através do teste não paramétrico de correlação de Spearman. Identificaram-se 560 UC nos 853 municípios do estado. Os municípios com UC não apresentaram IDH significativamente diferentes dos demais, mas encontraram-se diferenças significativas nos valores de IG, superiores nos municípios com UC. Não se encontraram correlações significativas entre os IDH dos municípios e suas áreas ocupadas por UC. Mas encontraram-se correlações significativas entre IG e as áreas ocupadas por UC, associando as UC a maiores desigualdades socioeconômicas. Deve-se incorporar as populações aos esforços de conservação por meio de programas que as beneficiem, em especial o pagamento por serviços ambientais, entre outras estratégias conservacionistas.

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INTRODUCTION

Natural protected areas are land or sea areas specifically dedicated to the protection and maintenance of biological diversity and associated natural and cultural resources that are managed through legal or other effective means (CHAPE et al., 2008). These areas include conservation areas (CAs), generically called parks. In the Brazilian CAs system, CAs are divided into two large groups: the first group is granted full protection and includes five types of CAs aimed at preservation; the second group is dedicated to sustainable use, with seven conservation function categories, and economic activities are allowed as long as the strict rules of each CA are observed (BRASIL, 2000).

Although the establishment of these areas is recognized as the most important biodiversity and natural resource conservation strategy (PERES, 1995; ADAM et al., 2004), critics claim that the establishment of CAs may inhibit local or regional development and lead to poverty in human populations by restricting access to subsistence natural resources and traditional sources of income, generating conflicts between these populations and those protecting the areas (BROCKINGTON, 2004; PRETTY; SMITH, 2004; ADAMS; HUTTON, 2007; McSHANE et al., 2011). Many populations depend on these resources for food, folk medicine, housing construction, and manufacturing of clothing and various tools (GIRALDI; HANAZAKA, 2010; BRITO; SENNA-VALLE, 2012).

In contrast, studies show that many protected areas promote income generation and stimulate regional and local development by promoting sustainable tourism programs and the creation of cooperatives, in addition to encouraging science and education (ADAM et al., 2010; CANAVIRE-BACARREZA; HANAUER, 2013) and reducing poverty (FERRARO et al., 2011). Thus, countries such as Costa Rica and Thailand have reduced poverty by combining protected areas with tourism, which has also reduced deforestation rates (ADAM et al., 2010). Likewise, Naughton-Treves et al. (2011), in a decadal study of Kibale National Park, Uganda, failed to link the park to poverty, but rather linked it to the generation of better quality of life for the surrounding population.

In Brazil, little is known about the effect of the creation and management of CAs on the socioeconomic development of a site or region. Silva & Garavello (2013) found that of 1,058 municipalities in the Cerrado biome, those with CAs had lower Human Development Index (HDI) values, and the municipalities with sustainable use CAs exhibited lower rates of development than

those with full protection CAs but with a more equal income distribution as demonstrated by the Gini Index (GI). The authors suggested that the lower HDIs of the municipalities with sustainable use CAs are a natural consequence of the presence of traditional populations with a production system geared to subsistence and not the market economy.

The state of Minas Gerais has an area of 587,000 km² that is divided into 853 municipalities with approximately 20 million inhabitants. These municipalities show high socioeconomic heterogeneity, with situations ranging from a depressed economy, poor infrastructure, and very low indicators of quality of life to those with economic dynamism and good life standards (SCOLFORO et al., 2008). The state is also home to 560 CAs covering 52,000 km² or 8.8% of its area. Thus, it represents an excellent opportunity to study the effect of CAs on socioeconomic development.

The objective of this study was to test the correlation between the socioeconomic development indicators of the municipalities of Minas Gerais, Brazil, and the presence of both sustainable use and full protection conservation areas.

MATERIALS AND METHODS

The Human Development Index (HDI) and Gini Index (GI) were used as socioeconomic development indicators of each municipality of the state of Minas Gerais. The HDI of a location is based on the life expectancy of its citizens at birth, access to education, and per capita income; it ranges from 0 to 1 and is considered high when it exceeds 0.8 and low when it is below 0.5 (NOORBAKHSH, 1998; NEUMAYER, 2001; UNDP, 2010). In Brazil, the index has been expanded to consider other variables such as housing, health, work, and vulnerability, with data obtained from demographic censuses (PNUD et al., 2013). The GI is a statistical measure of inequality used to indicate the degree of income concentration of a region. Treated as complementary to the HDI, it ranges from 0 (perfect income equality) to 1 (perfect income inequality and concentration) (FREIRE JUNIOR, 2010). The HDI and GI values of each municipality were obtained from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014), and the information on the existence of conservation areas (CAs) in each municipality, as well as their category and area, were obtained from the João Pinheiro Foundation, an institution associated with the Department of Planning and Management of Minas Gerais (FJP, 2015).

The HDI and GI values were compared between the municipalities with and without CAs using the non-parametric Wilcoxon-Mann-Whitney test (CHAKRABORTY; CHAUDHURI, 2015; FAY; PROSCHAN, 2010). The municipalities with and without sustainable use CAs and those with and without full protection CAs were also compared separately. The correlations between the development indices (HDI and GI) of each municipality and their areas occupied by CAs were analyzed using the non-parametric Spearman correlation test. Minitab 16 was used for the statistical analyses.

RESULTS

A total of 560 conservation areas (CAs) were identified in the 853 municipalities of Minas Gerais among municipal, state, and federal areas. Of these, 119 are fully protected and 441 are sustainable use CAs, covering 11,600 km² and 40,300 km² or 1.96% and 6.86% of the state, respectively.

The Wilcoxon-Mann-Whitney tests showed that the HDI of the 365 municipalities with CAs did not significantly differ from the HDI of the 487 municipalities without CAs ($p = 0.1440$), and no significant differences in the HDI were observed between the 300 municipalities with and the 487 municipalities without sustainable use CAs ($p = 0.1670$) or between the 134 municipalities with and the 487 municipalities without full protection CAs ($p = 0.0483$). In contrast, the test showed significant differences in the GI values between the municipalities with and without CAs ($p = 0.0001$) as well as those with and without sustainable use CAs ($p = 0.0003$) and with and without full protection CAs ($p = 0.0000$); the GI was higher in municipalities with CAs in the three cases. The HDI and GI values of the groups are shown in the box plots in Figure 1.

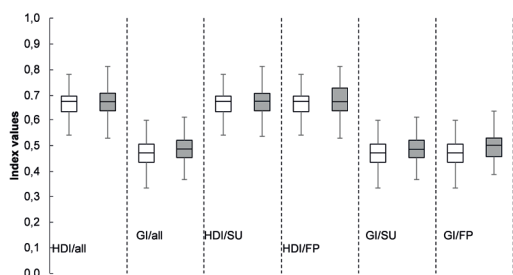


FIGURE 1 Box plots of the Human Development Index (HDI) and Gini Index (GI) values for all municipalities in Minas Gerais, Brazil, that do not have (empty box) or have (gray box) conservation areas and for those with and without sustainable use (SU) and full protection (FP) conservation areas.

FIGURA 1 Boxplots dos valores de Índice de Desenvolvimento Humano (HDI) e Índice de Gini (GI) para o total de municípios de Minas Gerais, Brasil, que não possuem unidades de conservação (box vazio) ou as possuem (box cinza) e entre os municípios com e sem unidades de conservação de uso sustentável (sust. use) e de proteção integral (preserv.).

The Spearman test indicated no significant correlations between the HDI values of the municipalities and their areas occupied by CAs ($r_s = -0.014$; $p > 0.05$; Figure 2A) or with their areas occupied by sustainable use CAs ($r_s = -0.006$; $p > 0.05$; Figure 2B) but did indicate a weak correlation with their areas occupied by full protection CAs ($r_s = 0.083$; $p < 0.05$; Figure 2C). For the GI, significant correlations were found with the total areas occupied by CAs as a whole ($r_s = 0.153$; $p < 0.05$; Figure 2D) and also with the sustainable use ($r_s = 0.127$; $p < 0.05$; Figure 2E) and full protection ($r_s = 0.143$; $p < 0.05$; Figure 2F) CAs.

DISCUSSION

The Human Development Index (HDI) values showed that the municipalities with conservation areas (CAs) in their territories do not generate worse living conditions for their populations than the municipalities without CAs, which is inconsistent with the findings of Silva & Garavello (2013). However, it cannot be stated that the CAs of Minas Gerais provide greater gains for the local populations, as shown by several studies (e.g., MEDEIROS et al., 2011; ADAM et al., 2010; FERRARO et al., 2011). It is important to recognize and draw attention to the fact that the HDI is a summary measurement; as such, it generalizes the different living conditions within each municipality and does not show how a smaller social group is affected by inhabiting the CA or its close surroundings. This is especially true regarding social groups that directly depend on biological resources for their survival, such as traditional populations (GIRALDI; HANAZAKI, 2010; BRITO; SENNA-VALLE, 2012).

In contrast, the Gini Index (GI) values indicated greater social inequalities in municipalities with CAs, corroborating the findings of Silva & Garavello (2013). These municipalities are in regions of Minas Gerais identified as dynamic and of high economic significance, such as the Central region, the South region, and the Triângulo Mineiro (CIRINO; GONZÁLEZ, 2011). Although the result does not prove causality in the correlation, it increases the importance of including populations in conservation efforts, as suggested by LIU et al. (2007; 2015). This represents a paradigm shift from the conservationist ideals of a sacred nature, kept untouched with no human presence (ORMSBY; BHAGWAT, 2010). Such efforts, which are increasingly common, provide alternative livelihoods to individuals, reducing the pressure on biodiversity and allowing sustainable use of natural resources through community-based conservation programs by combining biodiversity protection with the livelihoods of traditional populations (BERKES, 2004).

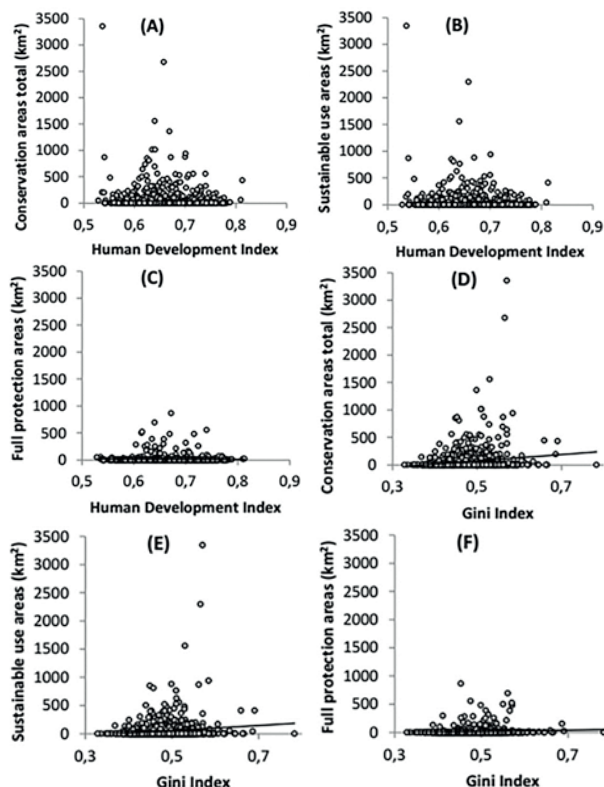


FIGURE 2 Relationship between the Human Development and Gini Indices of 853 municipalities of the state of Minas Gerais, Brazil, and the respective areas occupied by total, sustainable use, and full protection conservation areas.

FIGURA 2 Relação entre os Índices de Desenvolvimento Humano e de Gini de 853 municípios do estado de Minas Gerais, Brasil, e respectivas áreas ocupadas por unidades de conservação, tanto totais quanto por unidades de uso sustentável e de proteção integral separadamente.

One of the strategies commonly used to minimize this impact is payment for environmental services. Through economic incentives, local populations can reduce the extraction of resources and actively participate in conservation (ENGEL et al., 2008), and this strategy is considered a potential solution to the conflict between traditional populations and the protection of natural areas (MILLER et al., 2011). It becomes even more important to consider such programs where full protection areas exist that restrict the use of biological resources that are used as primary sources of subsistence (BROCKINGTON, 2004; PRETTY; SMITH, 2004; MCSHANE et al., 2011). Communities that receive some direct benefit for conservation tend to contribute to the protection of a resource, such as a protected area, so that the areas occupied by human populations receive more protection than those that are dependent on government actions (TUANMU, 2016). However, such programs are not uniform and operate in heterogeneous

scenarios (MURADIAN et al., 2010). They tend to benefit only those populations that represent a real threat to nature rather than those who already live in harmony with nature and may become just one more commercial relationship between these populations, not replacing other forms of conservation (WUNDER, 2007). Thus, in isolation, these programs are not effective but must be accompanied by other conservation efforts (SÁNCHEZ-AZOFEIFA et al., 2007).

The search for a consensus between conservation and the survival of local populations depends essentially on the active participation of these populations as key players in the processes of the creation and management of CAs. Additionally, the principle of collectivity should not be excluded, and the interest of the general public should remain above that of small social groups. Decreasing these conflicts depends essentially on detailed planning (ENGEL et al., 2008) that minimizes them and does not place conservation and developmental interests on opposite sides. Hence, the role of the government is of paramount importance in ensuring serious conservation policies affiliated with forms of social inclusion.

CONCLUSIONS

The existence of conservation areas does not influence the Human Development Index of the municipalities Minas Gerais, but it is associated with higher socioeconomic inequalities, according to the analysis of the Gini Index values. Populations should be included in conservation efforts through programs that benefit these individuals, such as payment for environmental services and other conservation strategies.

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