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The Mesmis Methodology Applied to Apa do Ibirapuitã Farmers in the Nexus Pampa Context

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Abstract

The Nexus Pampa Project is financed by the Brazilian Ministry of Science and Technology, and its goal is to verify and create scenarios that derive from the farming production systems present in the Ibirapuitã river basin, in the Brazilian Pampa Biome. The research method used in this project is the "*Marco para Evaluación de Sistemas de Manejo de Recursos Naturales Incorporando Indicadores de Sustentabilidad*" (MESMIS). This study describes the current scenario of the production systems in the APA do Ibirapuitã, taking into account the water, energy and food dimensions. The questionnaire was responded by twenty-two farmers in the period between the 20th and the 31st of July 2019. On a scale from 0 to 100%, where zero represents unsustainable and one hundred sustainable, the water, energy and food dimensions rated 61%, 75% and 49%, respectively. The results of the scopes analyzed for the water dimension were: human consumption (92%), production (35%), and degradation (72%). For the energy dimension: electrical (92%), thermal (27%), and mechanical (73%); and for the food dimension: organizational and institutional environment (56%), productive and technological environment (51%) and commercialization and consumption (39%). The results show that the food dimension presents the lowest rates, which can be explained by the low values of the scopes analyzed, especially referring to commercialization and consumption. Regarding the water dimension, its availability and quality for the productive system presents low values. Even though the energy dimension is the one with the highest value, thermal energy was found to be the one with the lowest rate. The results indicate the effectiveness of the MESMIS methodology in measuring the different levels of sustainability of the production systems present south of APA do Ibirapuitã.

Introduction

The methodology adopted in the Nexus Pampa project was briefly described in Silveira et al. (2019) and in further detail in Silveira (2020). Due to its transnational nature, the Pampa biome enables integrated, transdisciplinary and system interdependent research approaches. MESMIS methodology makes it possible to measure the sustainability of production systems in light of the Water-Energy-Food Nexus.

Despite farming being a traditional activity in the Pampa biome, due to the current socio-economic context of the region, the preservation of this biome and of farming activities which use its natural resources poses a great challenge. Farming activities need to become economically viable while still preserving the biome and promoting animal gain. High market prices of grains such as soybean also puts pressure on the areas destined for animal production, shifting the use of those lands from farming to crop production, which entails faster and more intense effects on the biodiversity of the Pampa biome (Silveira et al. 2017; Nicoloso et al. 2019).

This study describes the current scenario of the production systems in APA do Ibirapuitã, considering the water, energy, and food dimensions.

Methods and Study Site

This project is built on four action axes, three of which are directly connected to the Water, Energy and Food focus, and one that integrates the other three. The integrator axis connects the actions generated in each of the other axes by creating indicators that represent the systems studied.

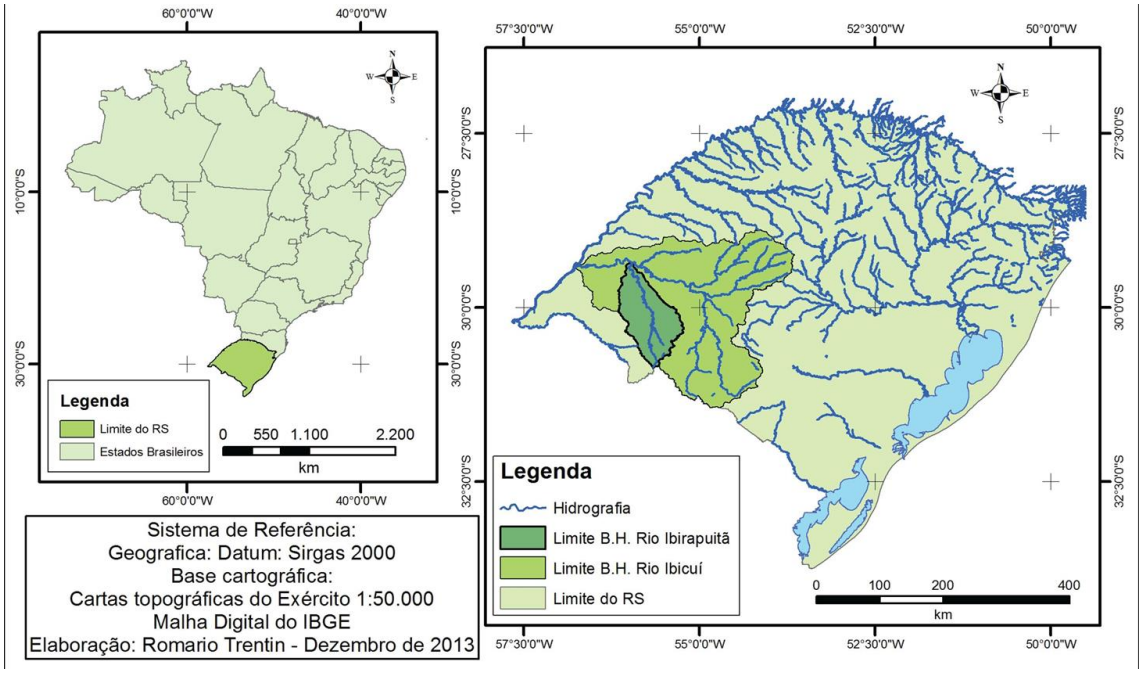

Figure 1. Map of the area where the project takes place. The Ibirapuitã river basin is highlighted on the map in the right.

The research method that is being used is the *Marco para Evaluación de Sistemas de Manejo de Recursos Naturales Incorporando Indicadores de Sustentabilidad* –MESMIS, presented by Masera et al. (1999). The MESMIS operational structure consists of six stages (Speelman et al. 2007) that are developed through participative methods, in which the result of each stage is the product of the contribution and perception of the actors involved:

Stage 1 – definition and description of the system(s) that will be assessed.

Stage 2 – identification of critical points in the system: positive or negative aspects that bring strength or vulnerability to the system, i.e., socioeconomical factors, techniques or procedures that may, individually or when combined, have crucial effects on the attributes of the systems described.

Stage 3 – selection of diagnostic criteria and indicators: the goal of this process is to create a necessary connection between attributes and critical points on the one hand, and critical points and indicators on the other. The difference between the diagnostic criteria and the indicators is that the first describes sustainability attributes, whereas the second describes a specific process inside the system.

Stage 4 – measuring and monitoring indicators. After determining the set of indicators, it is necessary to determine which procedure will be used for measuring and monitoring. Considering that sustainability refers to the behavior of farming systems in time, such procedures should collect information that contemplates the monitoring of processes along a certain period of time. These processes include bibliographic research, direct measuring, simulation models, interviews, and groups techniques, among others.

Stage 5 – integration of results. In this stage, the results obtained through monitoring of the indicators are gathered and combined. This is a crucial moment of the assessment because it is when the information compiled in previous stages is synthesized, and it is extremely important to clearly demonstrate the advantages and disadvantages of the farming systems studied in association to each indicator chosen for assessing sustainability. To achieve that goal, results may be demonstrated using methods for presenting quantitative or qualitative results in combination with graphic or mixed methods.

Stage 6 – conclusions and recommendations about farming systems. The assessment cycle is completed in this stage. The results previously analyzed are used as basis for issuing a "value judgement" comparing the systems as to their level of sustainability. The entire assessment process is reexamined, making way for the creation of new strategies for potential future cycles in qualitatively different scenarios.

Therefore, the MESMIS operational proposal is structured in successive cycles that generate a dynamic, spiral modeled process. This process contrasts with conventional methods that usually examine systems statically,

centralizing them in a specific period (Astier et al. 2002). This paper refers to the application of this methodology to a group of twenty-two farmers in the period between the 20th and the 31st of July 2019.

Results

On a scale from 0 to 100%, where zero represents unsustainable and one hundred sustainable, the water, energy and food dimensions rated 61%, 75% and 49%, respectively. When we verified the scopes analyzed for the water dimension, the results were: human consumption (92%), production (35%), and degradation (72%). For the energy dimension: electrical (92%), thermal (27%), and mechanical (73%); and for the food dimension: organizational and institutional environment (56%), productive and technological environment (51%) and commercialization and consumption (39%). (Figure 2).

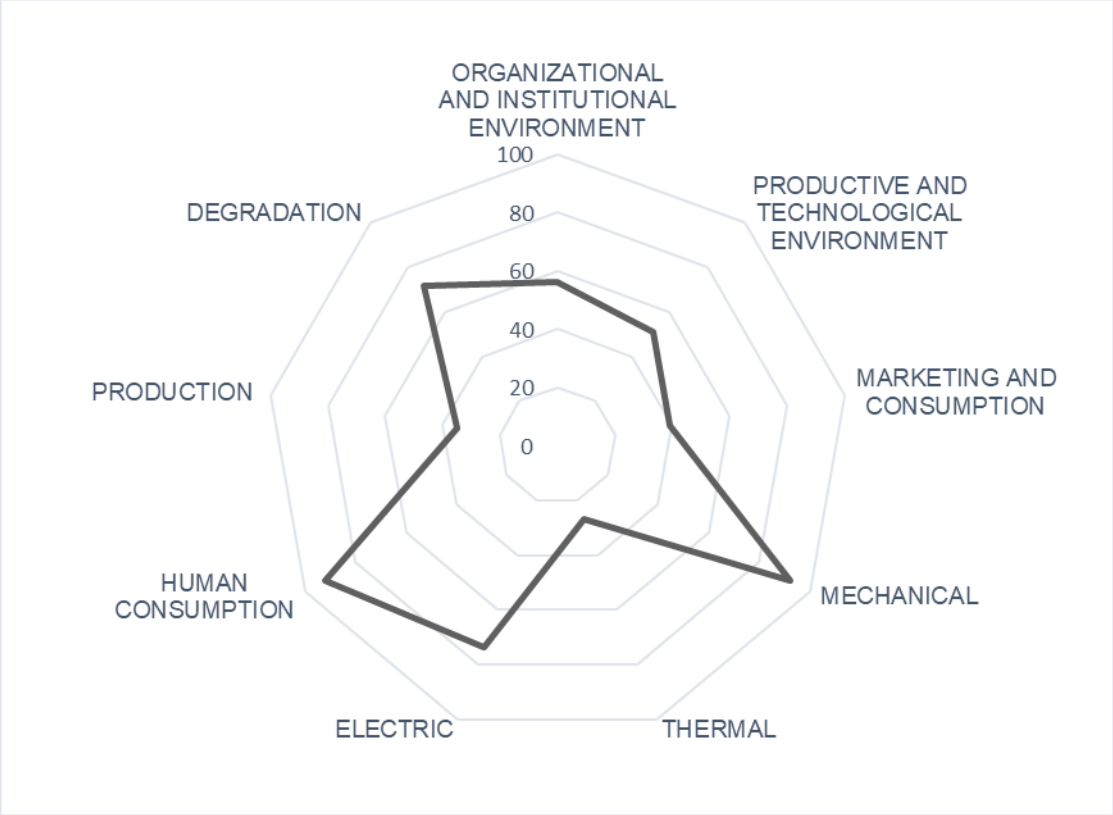

Figure 2. Indicators for Water, Energy and Food applied to farmers in the Ibirapuitã river basin protection area, Brazil.

Discussion [Conclusions/Implications]

The results show that the food dimension presents the lowest rates, which can be explained by the low values of the scopes analyzed, especially referring to commercialization and consumption. Regarding the water dimension, its availability and quality for the productive system presents low values. Even though the energy dimension is the one with the highest value, thermal energy was found to be the one with the lowest rate. The results indicate the effectiveness of the MESMIS methodology in measuring the different levels of sustainability of the production systems present south of the APA do Ibirapuitã.

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