



# SUSTAINABILITY INDICATORS OF THE PRODUCTIVE SYSTEMS IN THE IBIRAPUITÃ RIVER BASIN, BRAZIL

Vicente Celestino Pires Silveira<sup>1</sup>; João Garibaldi Almeida Viana; Cláudia Garrastazu Ribeiro; Claudio Marques Ribeiro; Fernando Luiz Ferreira de Quadros; Jean François Tourrand; Jean Paolo Gomes Minella

<sup>1</sup>UFSM, Prédio 44, Sala 5110, Santa Maria - RS, Brasil, CEP 97105-900, Postgraduate Program in Rural Extension. vcpsilveira@gmail.com

## Introduction

The success of a given society or community depends fundamentally on the ability to manage local natural resources to generate prosperity without degrading them over time. The sustainability attributes of production systems are considered for their relevance at the global level. Climate change and biodiversity loss are two of the most urgent issues of the Anthropocene. Agricultural development projects aim to find alternatives to maximize food production, but it is essential to integrate water management and energy generation after considering the local issues. In this project, the Socio-Economic-Ambiental principle of the MESMIS acts indirectly on the sustainability attributes, whereas the indicators of the water-energy-food dimensions directly affects sustainable attributes.

## Methodology

In the NEXUS-MESMIS methodology Socio-Economic-Ambiental principle of the MESMIS acts indirectly on the sustainability attributes, whereas the indicators of the water-energy-food dimensions directly affects these attributes (Figure 1). To represent the heterogeneity systems in the Ibirapuitã Catchment area, the characteristics of the different sub-catchments were used as references during the selection of properties, therefore, a total of 121 farms were sampled (Figure 2). The measures attributes were self-reliance, productivity, adaptability, stability, and equity.

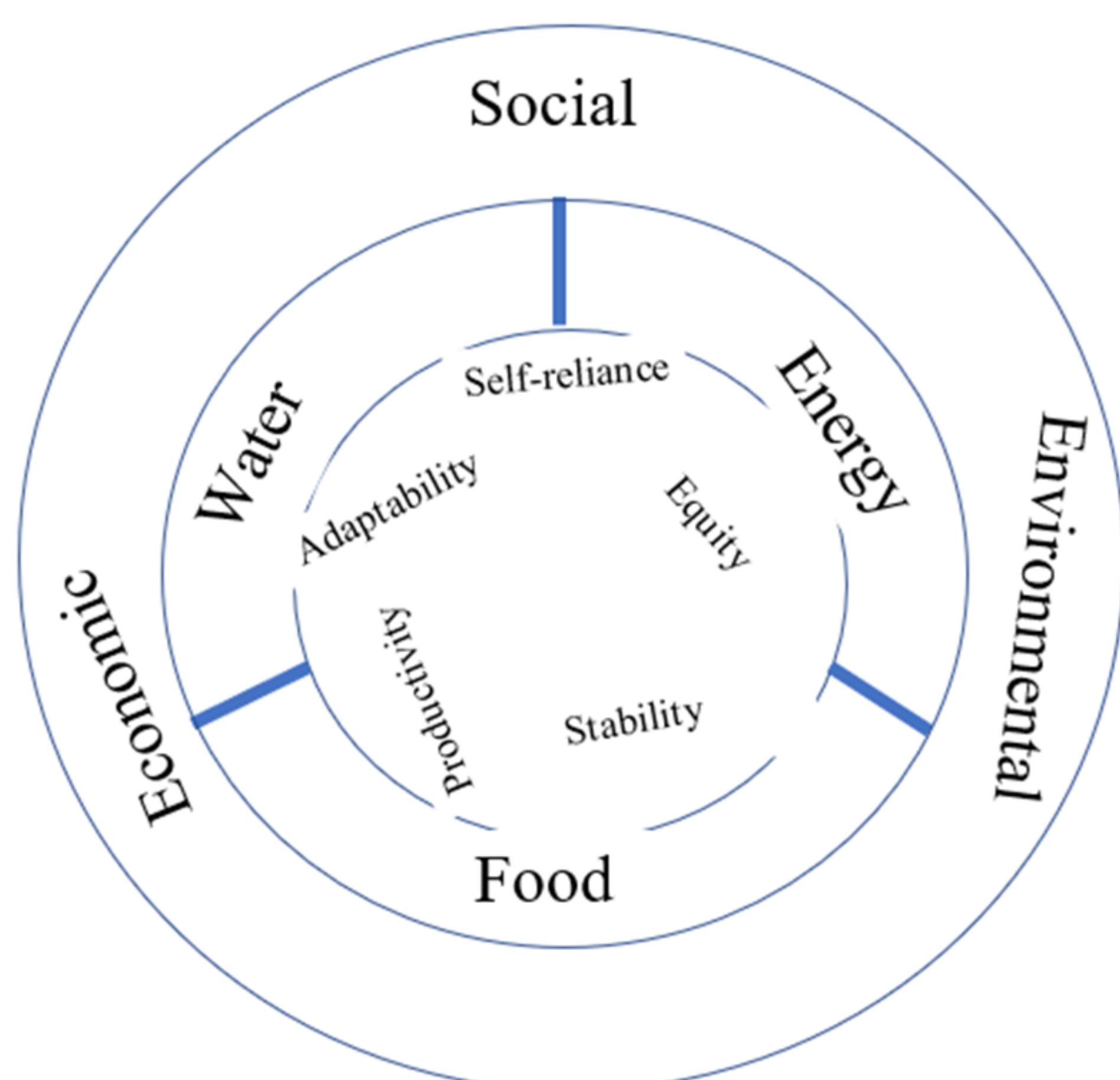


Figure 1. NEXUS-MESMIS methodology framework

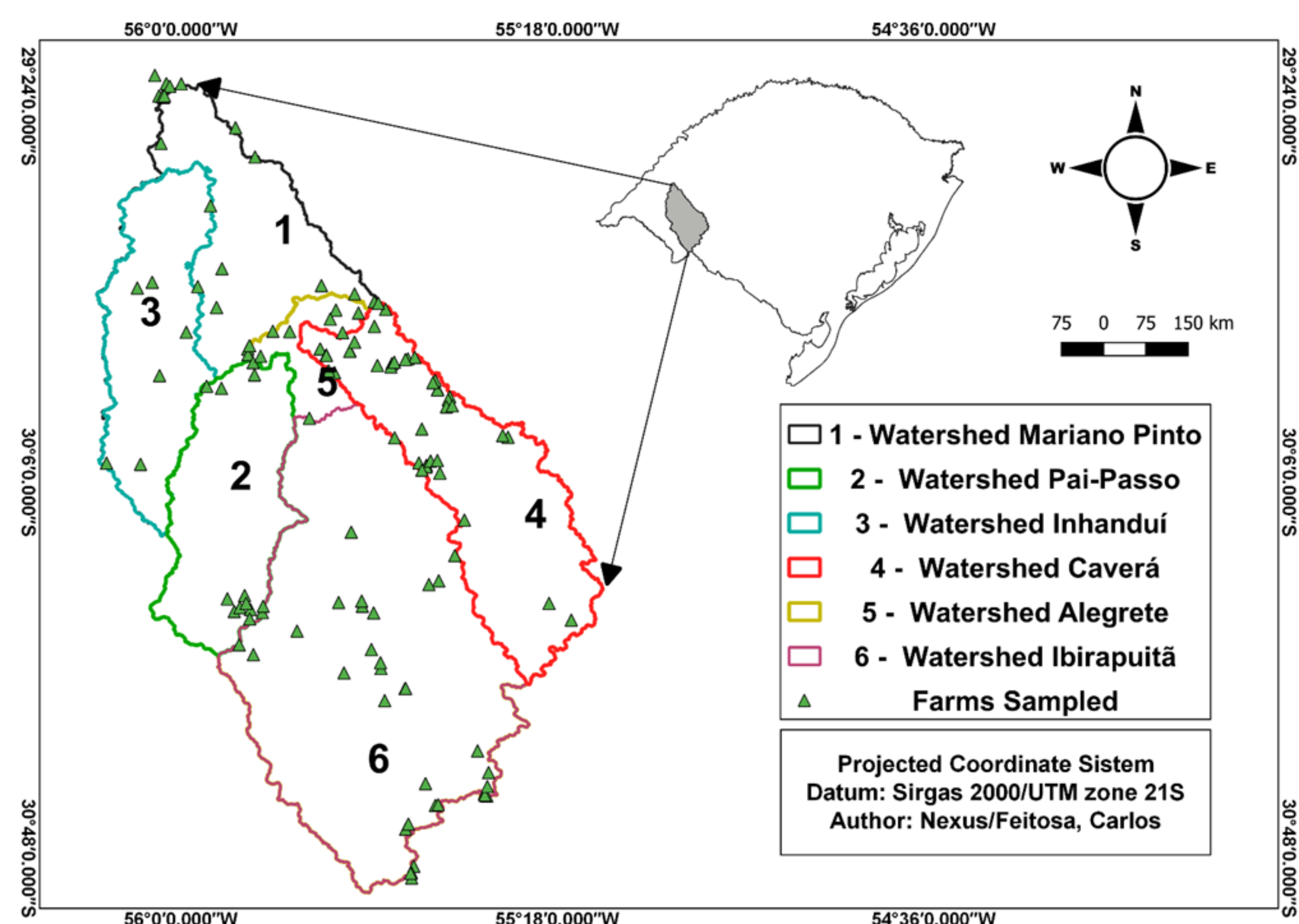


Figure 2. Spatial locations of the sampled properties in the Ibirapuitã Catchment

## Results and discussion

The average of all the properties of the basin suggested that the attributes reflect medium sustainability. The Self-reliance attribute had the highest value of 73%, whereas the Equity attribute had a weight of 63%, which was the lowest value. The farm with the lowest sustainability presented two indicators, namely equity and stability, at the low level with weightage of 48% and 45%, respectively. In contrast, the property with greater sustainability presents all the attributes in the quartile of high sustainability highlighted adaptability with 88% and equity with 80%.

The sub-catchment that corresponds practically to the Ibirapuitã protect area presented the highest score with a value of 70.24%. The Pai Passo sub-catchment was the one that presented the lowest sustainability score, presenting the lowest scores in all attributes: Self-management (64%), Productivity (68%), Adaptability (61%), Stability (64%) and Equity (55%).

Table 2. Sustainability scores of the different attributes in the Ibirapuitã Catchment.

Ibirapuitã sub-catchment	Sustainability Score *
Ibirapuitã	70,85 <sup>a</sup>
Alegrete	68,36 <sup>ab</sup>
Caverá	68,30 <sup>ab</sup>
Mariano Pinto	65,63 <sup>abc</sup>
Inhanduí	63,55 <sup>bc</sup>
Pai Passo	62,21 <sup>c</sup>

\*Distinct letters indicate significant difference between means by Tukey test ( $p < 0.05$ ).

## Conclusions and Outlook

The results obtained demonstrate the applicability of the NEXUS-MESMIS methodology in measuring the sustainability of the production systems in the context of the Ibirapuitã River Basin.