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"MULTICRITERIA ANALYSIS APPLIED TO THE SPATIAL ALLOCATION OF SUGARCANE AS A PLANNING SUPPORT SYSTEM FOR AGRICULTURAL EXPANSION IN BRAZIL"

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2013 Esri International User Conference
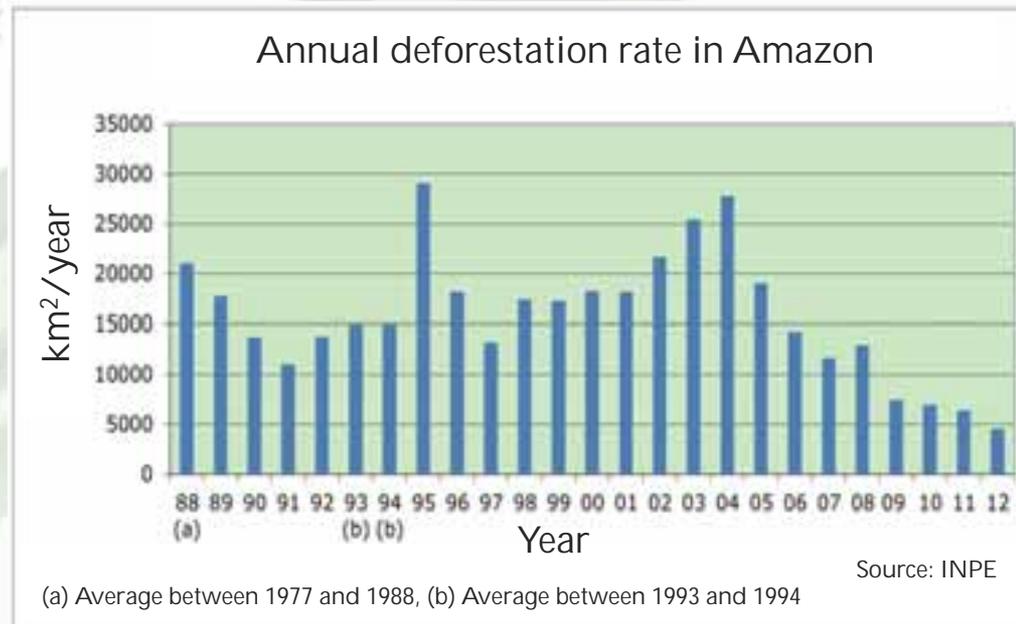July 8–12, 2013 │ San Diego, California

Introduction

- Brazil has chosen a development strategy that continues to rely heavily on the agricultural sector for economic growth.

- The advancement of agricultural frontier in Brazil is directly related to the loss of natural ecosystems.

- Agribusiness development

  X

  Environment

- Competitiveness

- Biofuels

- Increase Production

Annual deforestation rate in Amazon

Source: INPE

(a) Average between 1977 and 1988, (b) Average between 1993 and 1994

Problem Statement

Can the expansion of cultivation of crops be conducted without deforestation of our natural resources by the identification of existent suitable agricultural areas to support this expansion?
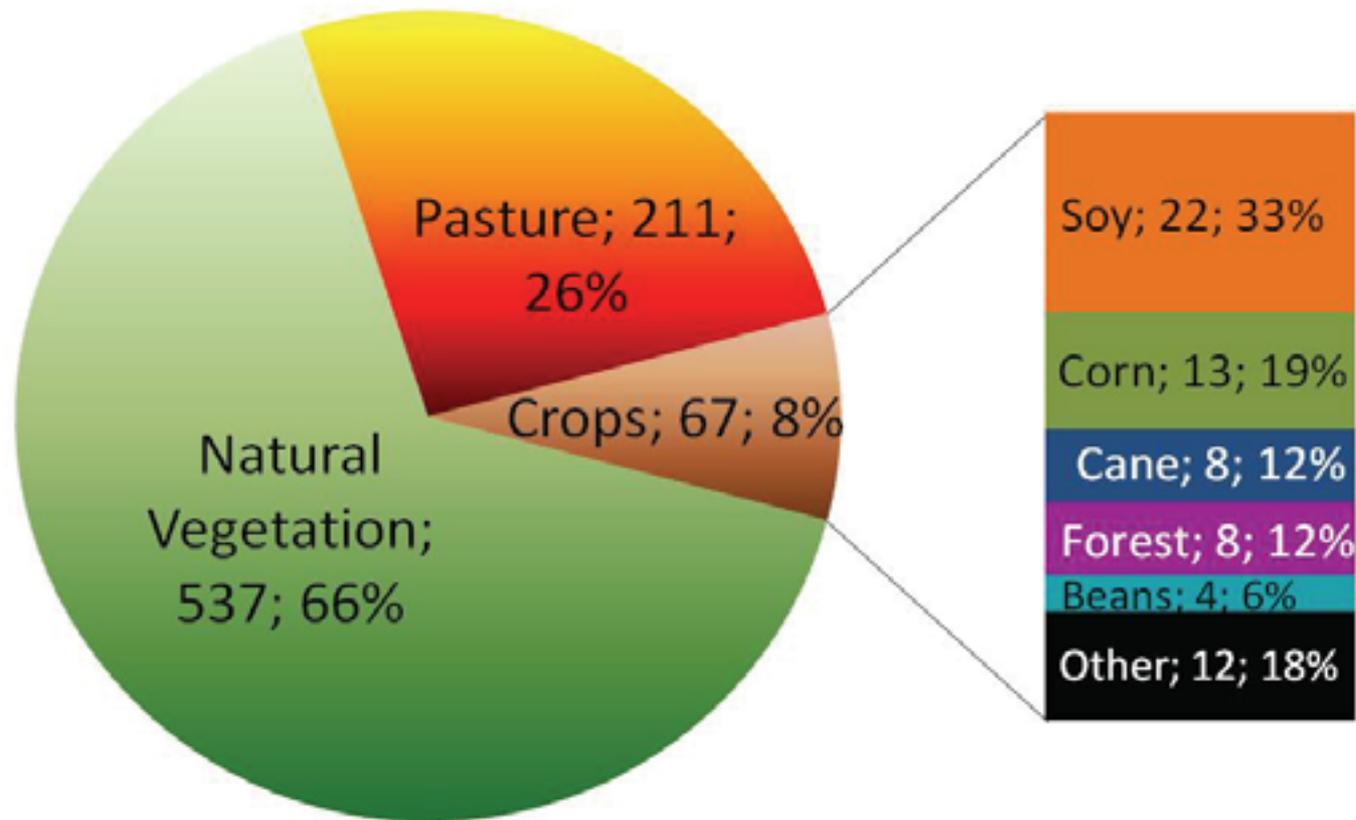
- **Changes in the Brazilian expansion agricultural pattern requires innovative solution!**

What would be the solution?

- **Conversion of pasture to agricultural plantations by agricultural planning of these new areas.**

Land Use in Brazil; Mha, %

Natural Vegetation ■ Pasture ■ Soy ■ Corn ■ Cane ■ Planted Forest ■ Beans ■ Other

Pasture; 211; 26%

Crops; 67; 8%

Natural Vegetation; 537; 66%

Soy; 22; 33%

Corn; 13; 19%

Cane; 8; 12%

Forest; 8; 12%

Beans; 4; 6%

Other; 12; 18%

Why use pasturelands?

Pasture are considered strategic locations for the advancement of agriculture mainly due to:

- Occupy large areas;

- Underuse lands;

- Easy Conversion;

- No use restrictions;

- Low cost of deployment for infrastructure;

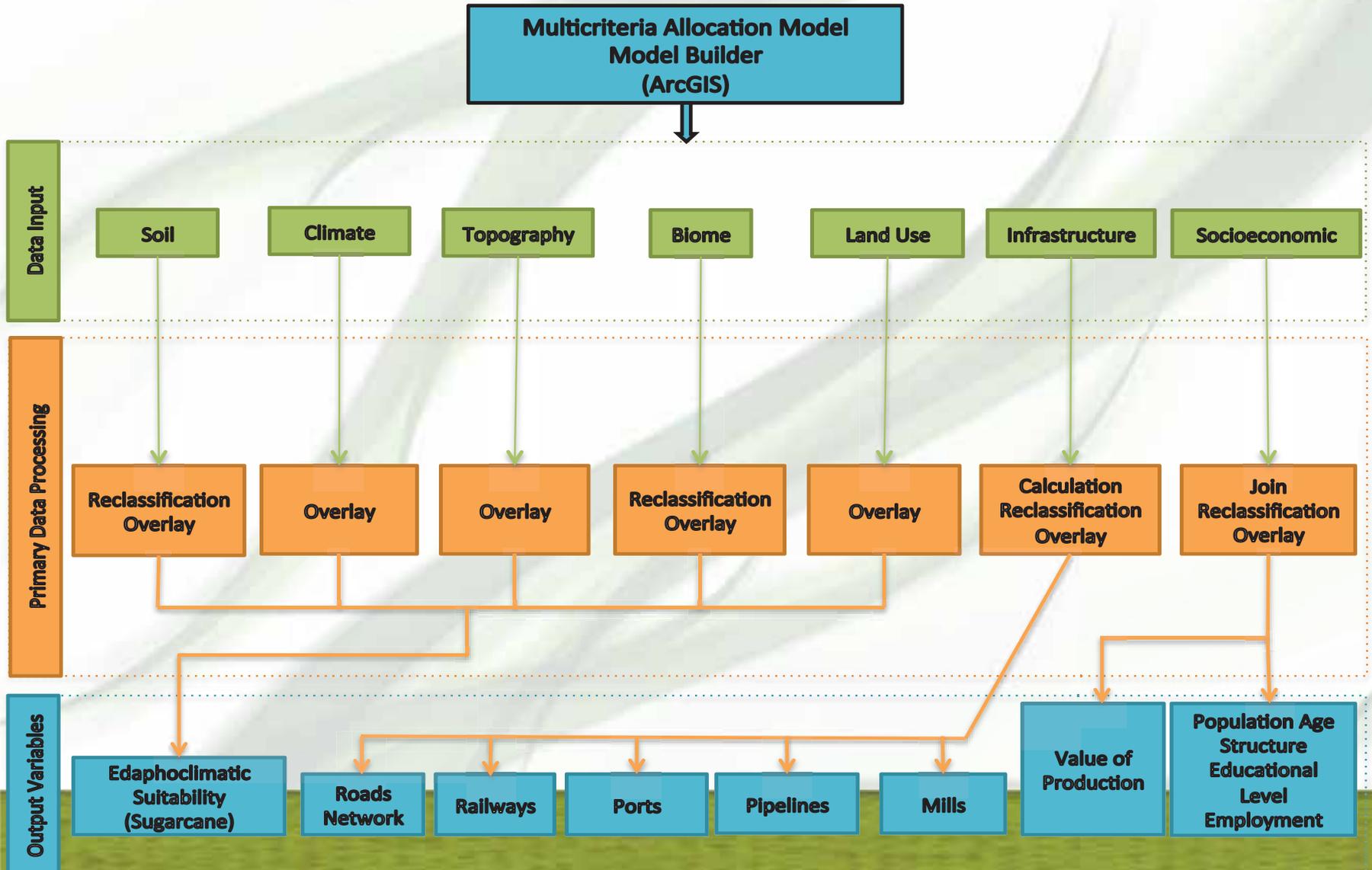# *Identifying the advantages of converting pasturelands to agriculture*

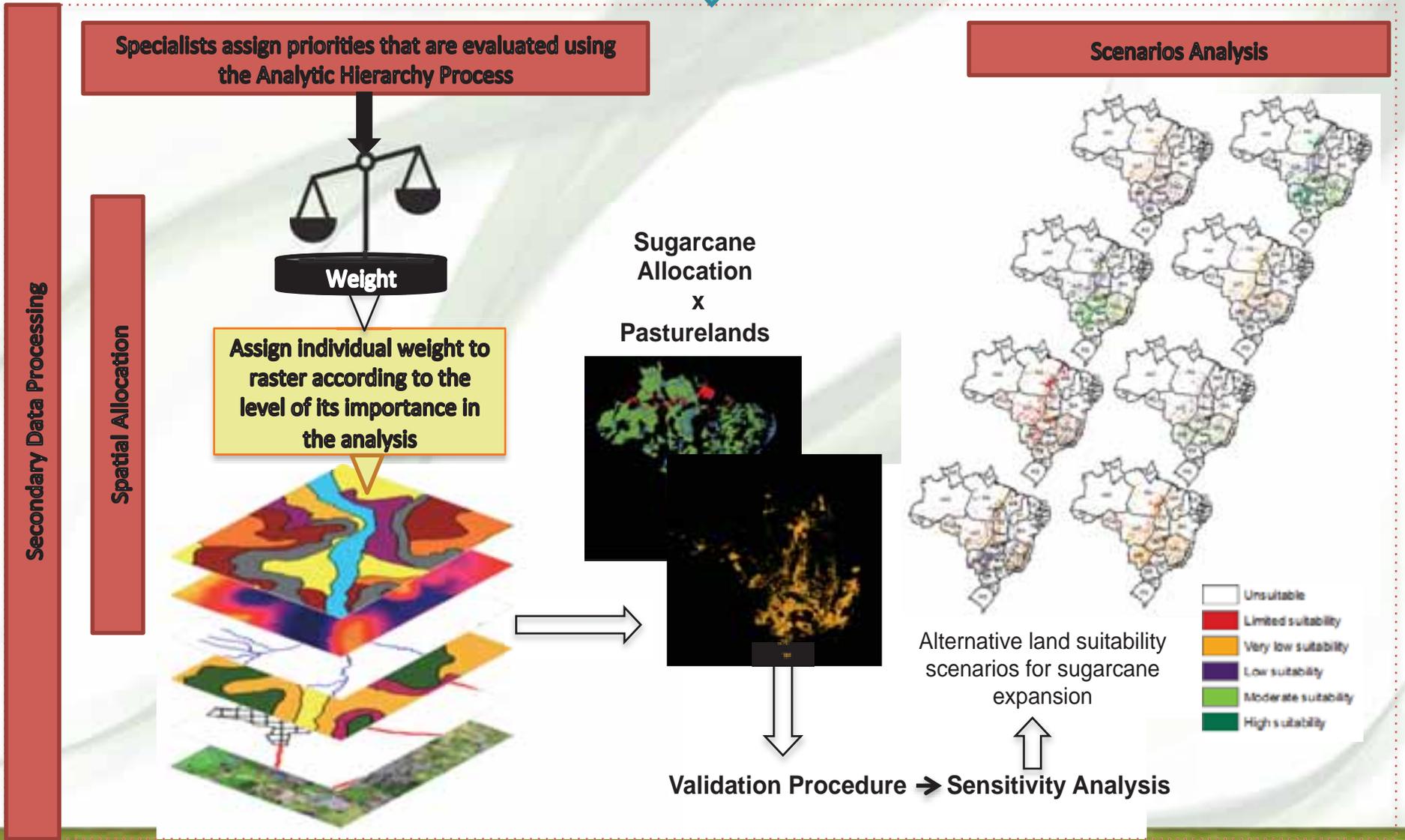# *What would be the advantages of the conversion?*

- Avoiding deforestation;

- More competitive products (standard of quality);

- Migration to further regions, allowing their development.

What would be the consequences of failing to establish a sustainable agricultural expansion?

- Increase of deforestation rates;

- Increase the amount of CO_2;

- Fragmentation of biodiversity.

Material and Methods

Secondary Data Processing

Spatial Allocation

Specialists assign priorities that are evaluated using the Analytic Hierarchy Process

Weight

Assign individual weight to raster according to the level of its importance in the analysis

Sugarcane Allocation x Pasturelands

Validation Procedure → Sensitivity Analysis

Scenarios Analysis

Alternative land suitability scenarios for sugarcane expansion

- Unsuitable
- Limited suitability
- Very low suitability
- Low suitability
- Moderate suitability
- High suitability

Objectives

- Design and implement a model substantiated with multicriteria analysis;

- Manage potential areas of pasture for agricultural expansion;

- Provide information to support decision making.
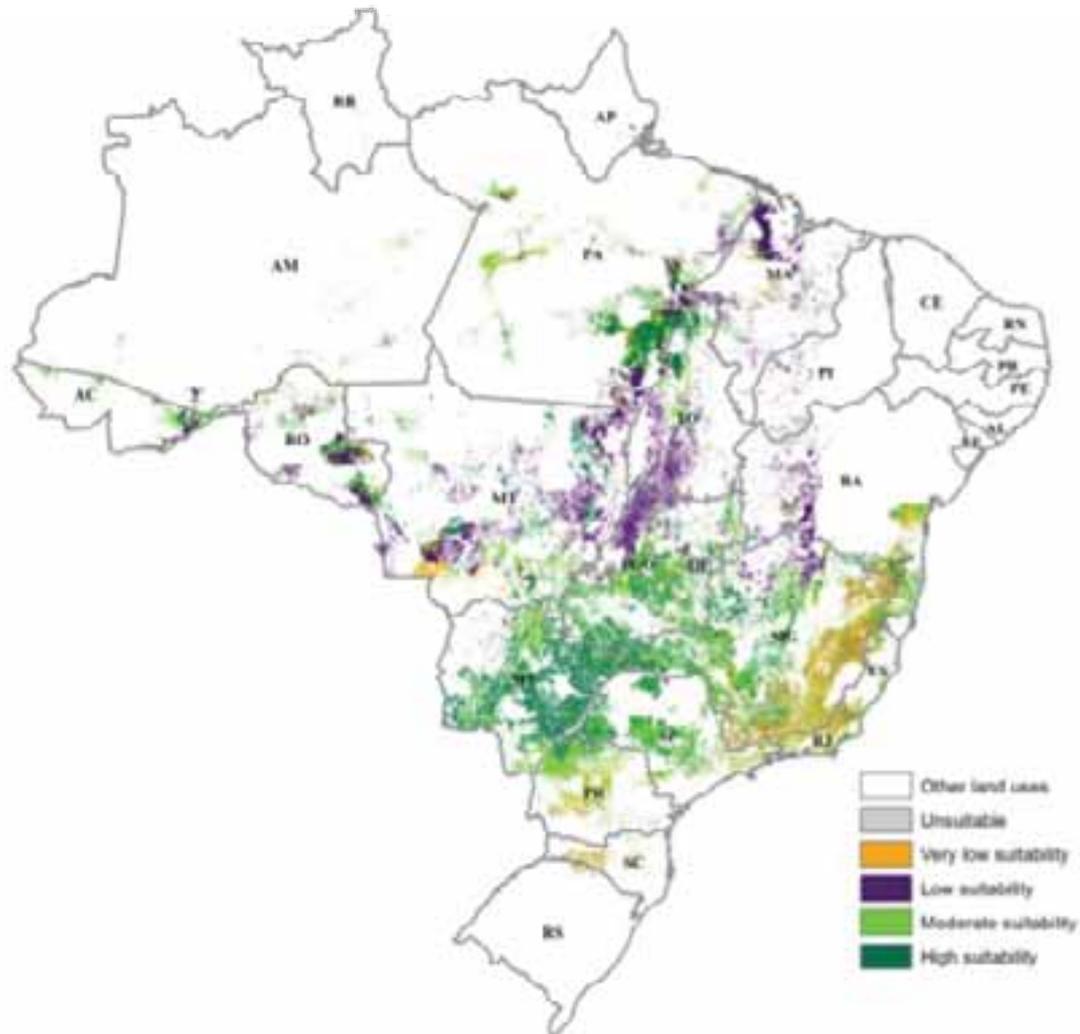
Results and Discussion

Figure 1. Soil suitability for sugarcane in cultivated pasturelands based on the weights derived from the analytical hierarchy process.

- Land covered by cultivated pasture occupies, approximately, 112 million of hectares;

- Excluding lands with some type of restriction, 108 million were considered of very low to high suitability lands for farming;

- 15 million hectares were of very low suitability, 27 million of low suitability, 31 million of moderate suitability and 35 million of high suitability for sugarcane allocation;

- The most suitable areas of pasturelands were predominantly concentrated in Goiás, Minas Gerais, Mato Grosso do Sul, Mato Grosso, Pará, São Paulo and Paraná;

- Advance in the rate of agricultural expansion in the short term without an increase in pressure on the ecosystem.

Spatialization of suitable areas for a feasible sugarcane expansion according to each alternative scenario

Conclusion

- Cattle production could release 66 million of hectares of moderate to high suitable lands to agriculture with minor intensification;

- Converting pasturelands to agriculture would contribute to an expansion of the agricultural land without compromising the environmental sustainability in Brazil.