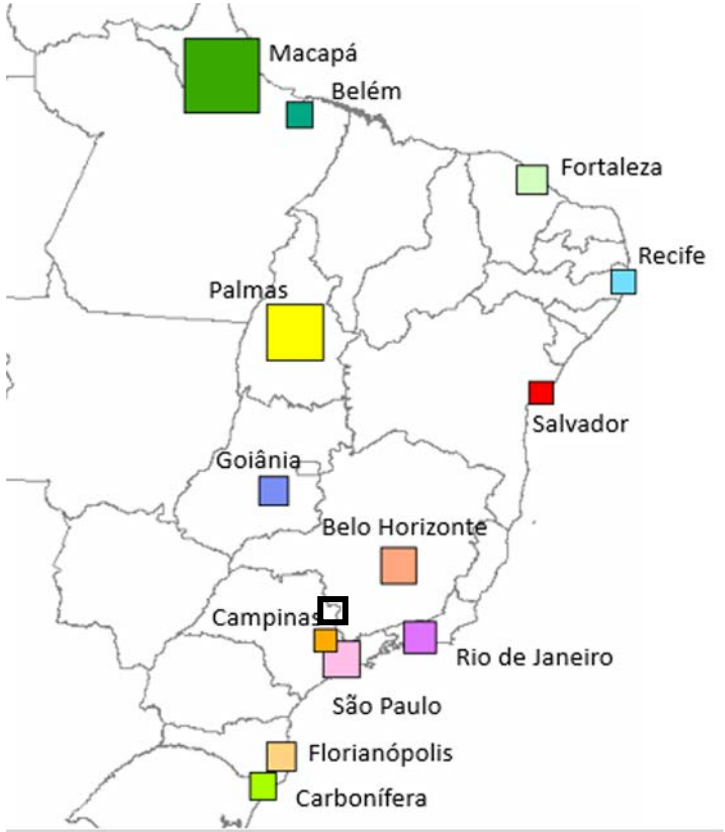
Paulista State University, Brazil

Trees for CP Metropolitan Region

Trees for Campinas Metropolitan Region

The MRC is densely occupied, especially in the urban area. It is a dynamic region, both economically and technologically, encompassing important research and teaching centers. The intense development of this region led to the rapid occupation of the territory, without adequate planning. As a consequence, serious damage to natural resources was unleashed in this territory, demanding more effective strategies for the use and occupation of land.



Location of the study area

According to an IBGE estimate (2020), the MRC is formed by 20 municipalities, housing 3,304,338 inhabitants, of which 2,725,293 people live in the urban area and only 71,844 live in the rural area. The total territorial area is 3,644.9 km², therefore, the demographic density is 767.40 inhab./km².

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Requirements

General Requirements, of the Project “Geodesign Brazil, Trees for Metropolitan Regions”

- Increase the area of robust vegetation by 30% by 2050, as a contribution to carbon sequestration;
- Contemplate the 10 systems, but always giving priority to projects that could be associated with carbon credit.

Specific Requirements, from the Project MRC:

- Urban expansion area subject to flooding and in overlapping integral protection conservation unit
- Recomposition of vegetation in springs
- Possible conflict of interest Possible Area of Urban Expansion and Archaeological Sites, Caves and Area subject to weathering and erosion.
- Important water conservation area in APA
- Natural water body - impact (urban expansion).
- Sugarcane monoculture (extremely technified).
- Housing - Urban area practiced in a high temperature region
- Area with high density of buildings, but without easy access to health equipment.

Innovations

2035

WAT – Water retention and pollution reduction
AGR – Family and organic farming
GRN – Native vegetation in river springs and riparian forests. Green urban streets. Vertical urban farms. Green roofs
ENE – Solar roads
TRA – electrification of transport and Hiperloop
IND/COM – Industry 4.0
INS – Health - Implementation of virtual care
HAB - Smart window

2050

TUR - Glampings; Self-sufficient stadiums
TRA - Electrify of the public and private vehicles
HAB - Substitution of concrete with materials that contribute to lower urban temperatures.
WAT - Integration of vegetation with constructions and water retention in buildings; Pollution reduction
GRN - Urban gardens; Green roofs; Fauna and flora corridors; Vertical urban farms; Native vegetation in the springs and in the rivers.
ENE - 50% of homes in the MRC must have Photovoltaic Plates; Solar Highway; Power to Gas
INS - Health - Implementation of virtual care
AGR - Family and organic farming
COM - Implementation of Intelligent Infrastructure.

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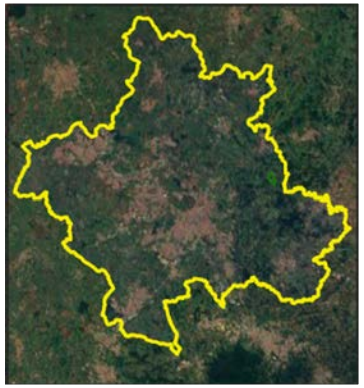
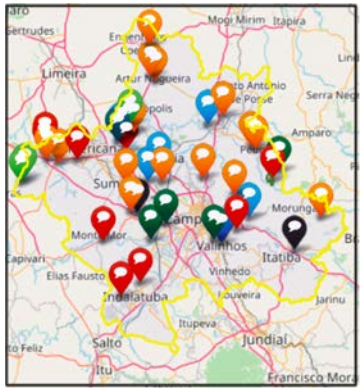
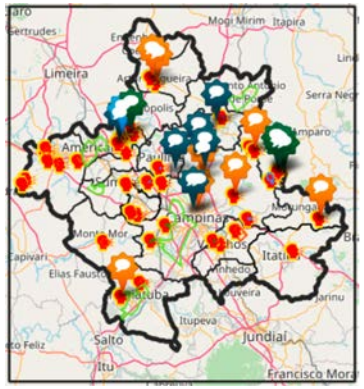


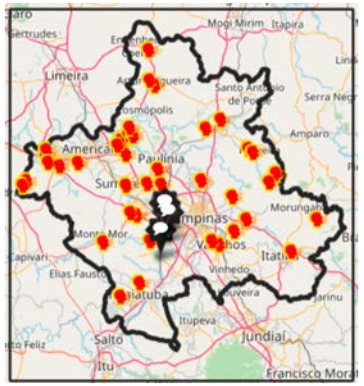
Location map



Current 2020



Non-adopter 2035



Non-adopter 2050

They prepared proposals for all themes, mainly distributed along the central-northwest axis. Vegetation and Housing predominated. Then the Housing system, with proposals to expand the housing of the Minha Casa Minha Vida and afforestation projects.

Day 1 - **Reading enrichment** - potentialities, vulnerabilities, characteristics and needs in the 2020 scenario, by **Annotations** (43 maps).

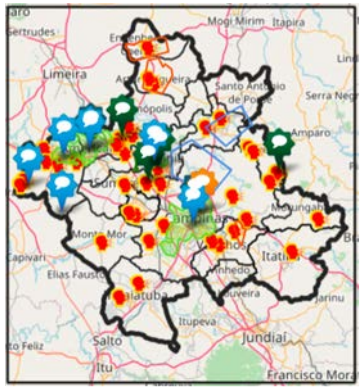
Day 2 - **Construction of Ideas** for "Non-Adopter" 2035 and 2050 (**Dialogues** tool**)**

Day 3 - **Construction of ideas** for the "Late-Adopter" 2035 and 2050, (**Dialogues**). Target to increase 30% of CCO2 by 2050. The **Widgets** tool made it possible to calculate the percentage achieved for CCO2 proposals. Used list of assumptions.

Day 4 - **Construction of ideas** for the "Early-Adopter" 2050 (**Dialogues**). **Widgets** used to increase CCO2 by 30%. Assumption list. Time to **comment** and **voting** (Dialog tool).

Day 5 - **Analysis of the ideas** for the Early-Adopter 2050, presentation and discussion of the proposals

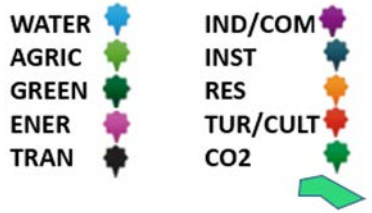
Late adopter 2035

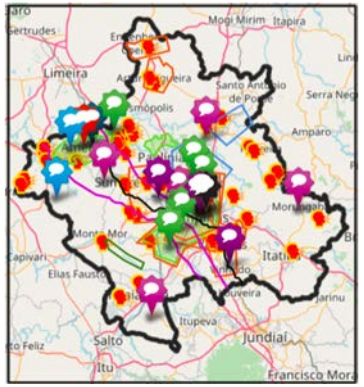


Late adopter 2050

They increased 96.54% of CCO2 in 2050. It is worth mentioning that the vegetation index of the MRC is very low, which explains the large number of projects for the vegetation system.

Geodesign Systems:





Early adopter 2050

Expansion of vegetation in practically all axes (restoration of riparian vegetation and of conservation units, urban afforestation. In the 2050 proposal, they focused on housing, transport, energy, vegetation and agriculture, with an increase of CCO_2 of 142.34% by 2050.

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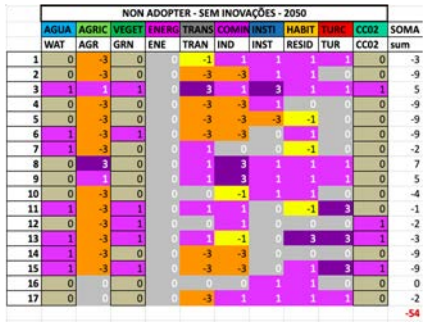
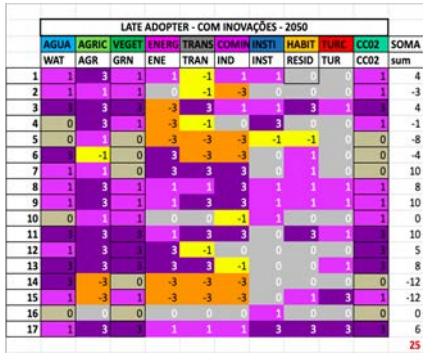
SDG 2020

Non-adopter 2035

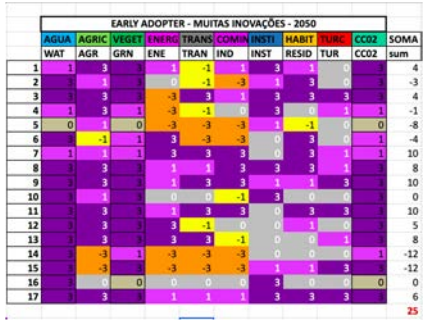


Non-adopter 2050

Late adopter 2035



Late adopter 2050



Early adopter 2050

Non adopter SDG

Proposals without innovations were prepared by all participants, for the scenario of 2035 and 2050. The ideas were developed based on what already exists, that is, in a traditional way, without seeking new elements, without changes. Thus, most of the goals were not achieved and it was not possible to reach the goal of increasing CCO_2 by 30%.

Late adopter SDG

All drew up proposals with innovations, for 2035 and 2050. For 2035, the ideas were built based on the enrichment of reading and adopting modern, innovative alternatives, from the menu of ideas on the website from the IGC and the professional and research experiences of the participants. Thus, many SDG targets were achieved and CCO_2 exceeded expectations, reaching 96.54%.

Early adopter SDG

They all created proposals with many innovations for the 2050 scenario, based on the 2035 scenario with innovations, as many had continuity. In addition, new proposals were elaborated, based on the suggestions from the website of IGC and according to the academic and professional experiences of the participants. Most of the goals of the SDG were achieved and that of the CCO_2 reached 142.34%, far exceeding the established goal.

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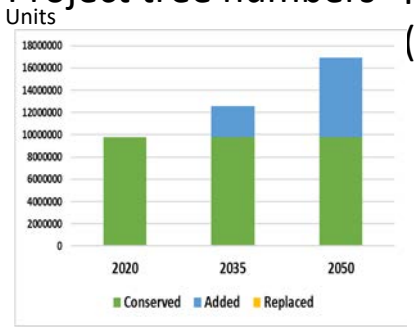
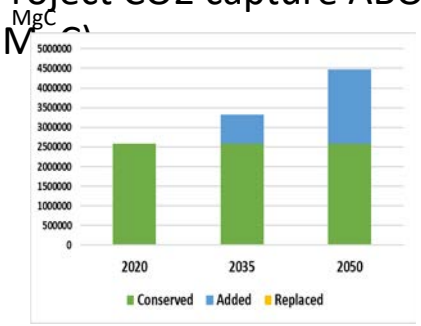
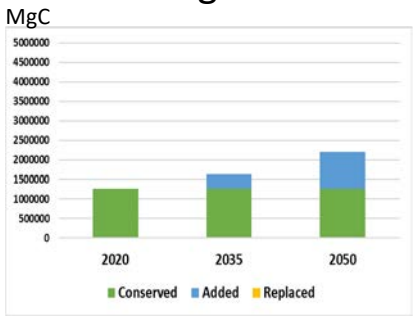
Project-level assessment

Project tree numbers

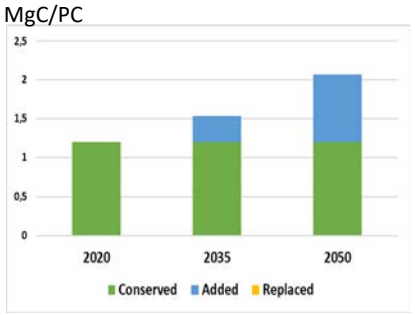


Project CO2 capture ABOVE BELOW ground (MgC)



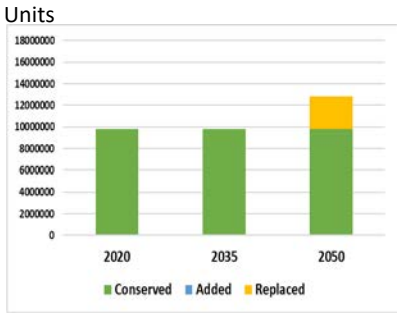


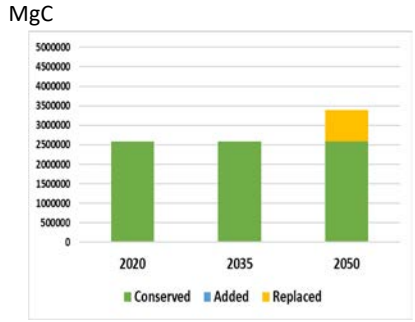
Project Carbon per capita (MgC/PC)

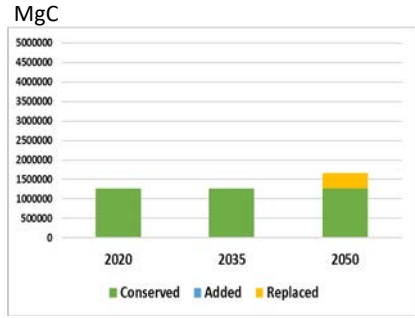


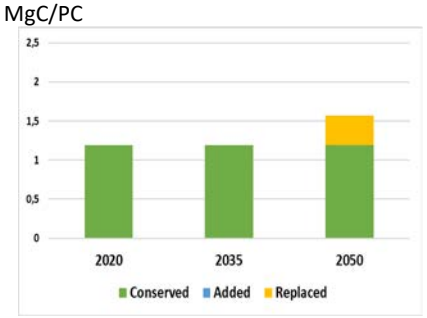
Until 2050 they will increase CCO2 in 142.34%, with 16913058 trees: 9776683 conserved, 7136375 added and 0 replaced. This is a total of 4471594 MgC of CCO_2 above ground and 2195149 MgC below, 2.06 MgC/PC.

Early adopter scenario



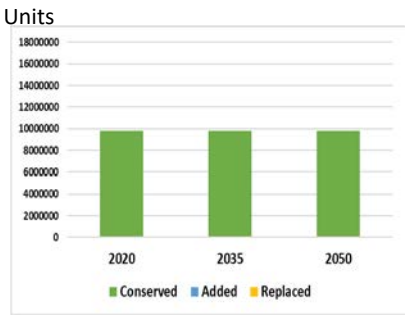


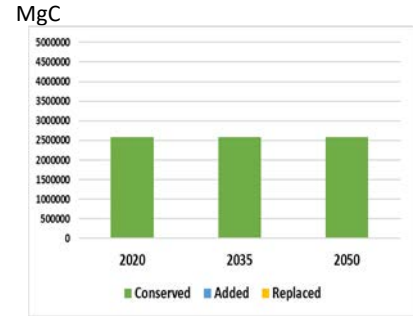


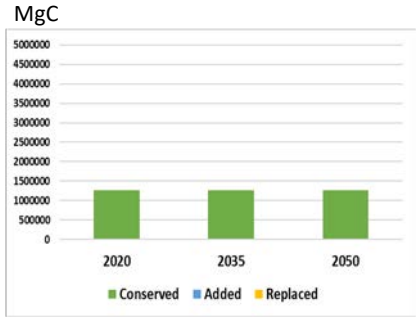


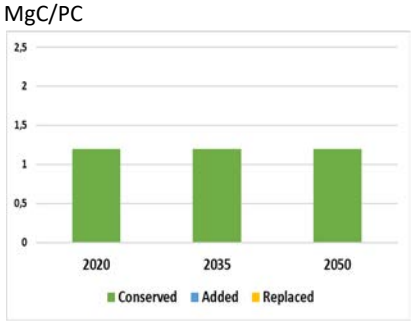
Until 2050 they will increase CCO_2 in 96.54%, with 12824353 trees: 9776683 conserved, 0 added and 3047670 replaced. This is a total of 3390593 MgC of CCO_2 above ground and 1664475 MgC below, 1.57 MgC/PC.

Late adopter scenario









Until 2050 they will increase CCO_2 in 0%, with 9776683 trees: all of them conserving existing areas, none added, and none replaced. This is a total of 2584828 MgC of CCO_2 above ground and 1268917 MgC below, 1.20 MgC/PC.

Non adopter scenario

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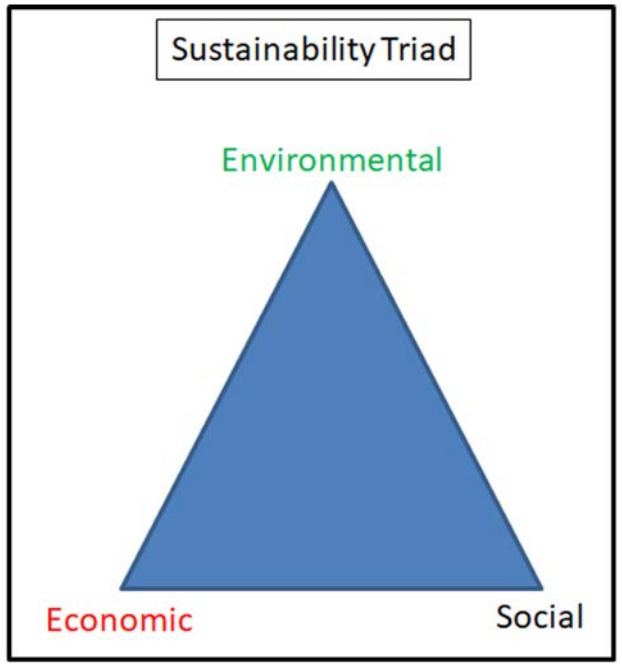
Geodesign from the perspective of sustainability

Participants were divided into three groups with 4 members:

- ➔ Environmental:
  - Vegetation
  - Carbon Credit
  - Hydrography
- ➔ Economic:
  - Energy
  - Trade / Industry
  - Transport
  - Agriculture
- ➔ Social:
  - Housing
  - Institutions
  - Tourism / Culture / Leisure



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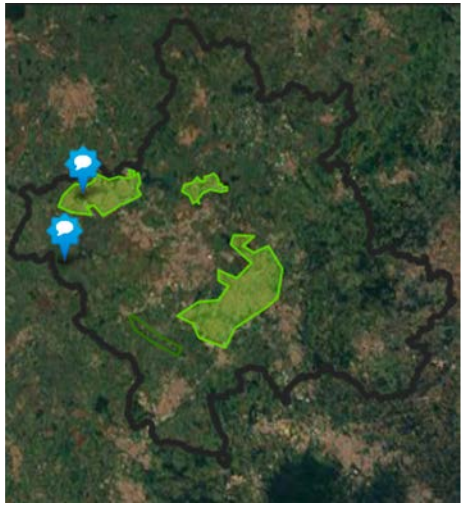
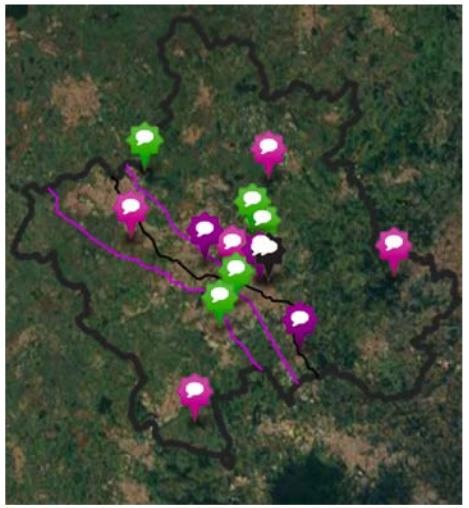
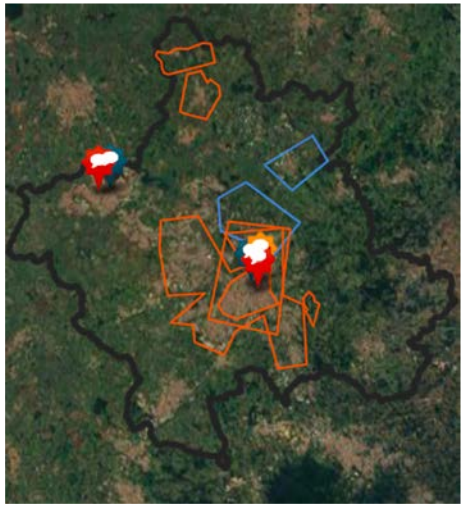
Group proposals



Environmental



Economic



Social

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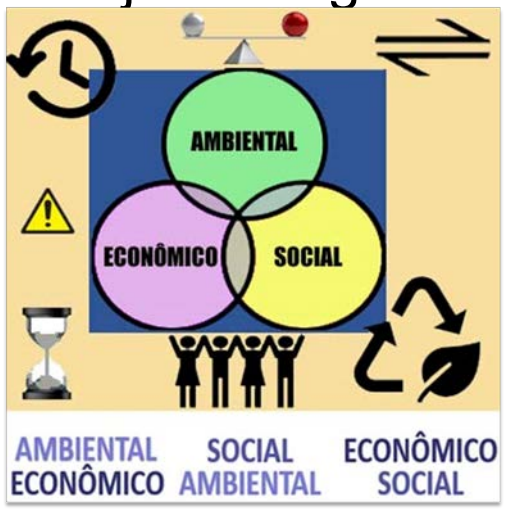
Method Description

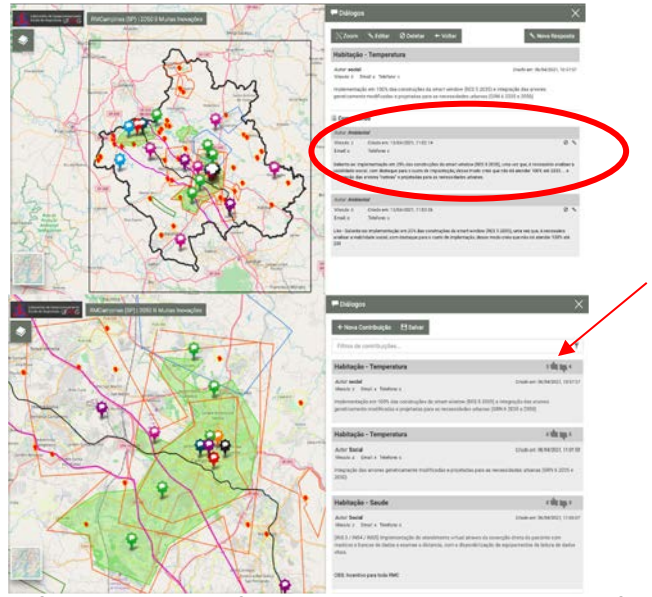
Pre-workshop: definition of the main variables for each of the systems and elaboration of 43 maps for all areas in Brazil, resulting in similar Web-GIS for all. Planning of the automated calculation tool for number of trees, CCO_2 and percentages. Workshop: The technology was GISColab, a Brazilian Geodesign Platform developed by UFMG, based on SDI (Spatial Data Information) and OGC standard for consumption of data via WMS or WFS, allowing in both cases the increment in performances by WPS (Web Processing Service). Each group made adaptations to the process, demonstrating the flexibility of the method and the platform. In the MRCP study, the composition of the actors according to sustainable development values was highlighted.

Project Images

Project Images

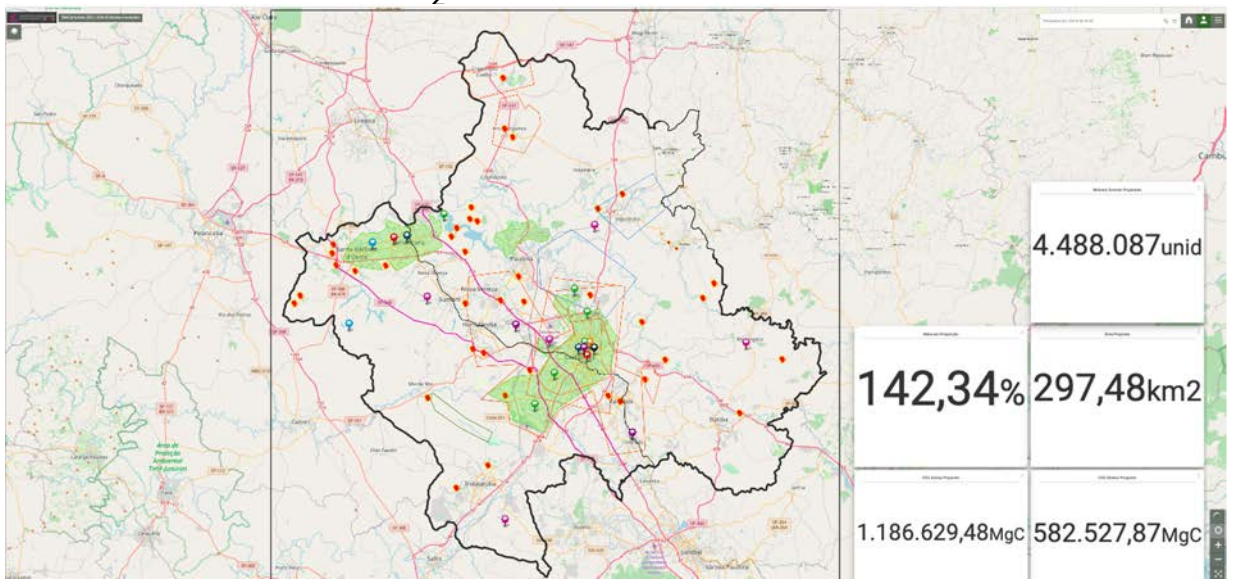


Decision-making process



Dialogues – Ideas, comments and voting

Measurement of CCO_2 metrics



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Project Participants

Great Teacher (Instructor): Prof. Andréia Medinilha Pancher
Msc. Ana Isabel de Sá

and 12 Student Participants, graduate students in Geography at UNESP and UNICAMP, São Paulo.

Graduate students in Geography at UNESP:
Angislene de Fatima Ferreira Andrade
Caio de Luca do Nascimento
Consuelo Carolina Perinotto
Gustavo Benedito Medeiros Alves
Jéssica Alves da Silva
Marcelo Costa
Maria Teresa Mariano
Rodolfo Augusto da Costa
Sáhira Michele da Silva Celestino
Tiago Oyan Aguiar

Graduate students in Geography at UNICAMP:
Isabela Magalhães Bordignon
Lucas Pinto Seixas

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Supporting Materials

- Related discipline:
- URBAN ENVIRONMENTAL QUALITY ANALYSIS: support of geotechnologies for the integration of thematic data - PPGG-UNESP

- Sources of data
  - INDE – National Spatial Data Infrastructure, Brazil.
  - IBGE – Brazilian Institute of Geography and Statistics.
  - Brazilian Agencies: IPHAN, ICMBIO, INPE, MMA , ANA
  - EarthExplorer – USGS – Landsat Images
  - EarthData – Alaska.edu – Alos Palsar Images
  - Spawn, S.A., and H.K. Gibbs. 2020. Global Aboveground and Belowground Biomass Carbon Density Maps for the Year 2010. ORNL DAAC, Oak Ridge, Tennessee, USA.
  - Crowther, T. W., Glick, H. B., Covey, K. R., et al. (2015). Mapping tree density at a global scale. Nature, 525(7568), 201-205.

- Key software used
  - GISColab – Laboratório de Geoprocessamento da EA-UFMG & Christian Freitas

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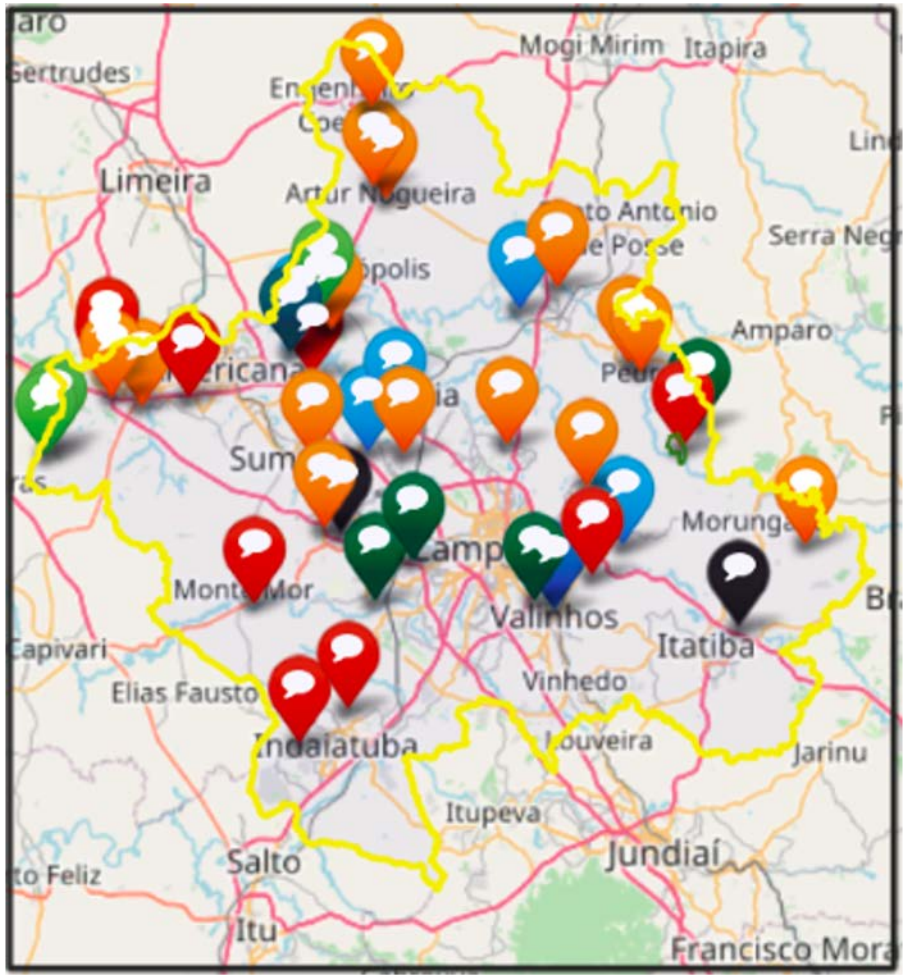

Current 2020 situation

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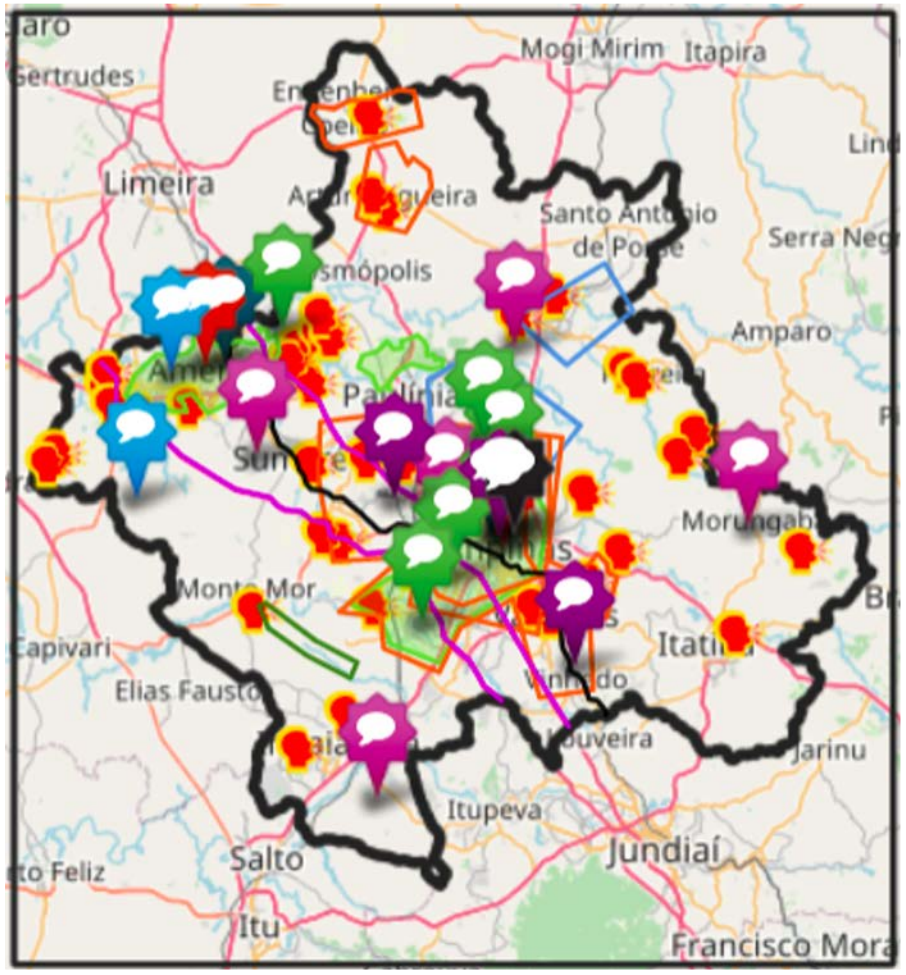
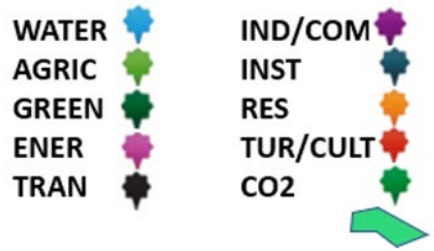


Map legend



Negotiated or recommended plan

The current scenario was worked from the enrichment of the reading in which the participants register alerts, highlights of potentialities to be explored and vulnerabilities to be corrected. They prepared a considerable volume of proposals (113 in all), covering all 10 systems with good proposals, but they stood out in the analyzes and criticisms.