Study Committee 3

Power System Environmental Performance

10163_2022

# Indigenous Vulnerability and Corporate Climate Change Strategy for the Electricity Companies in Brazil

Katia Cristina GARCIA*, Luciana Rocha Leal da PAZ, Wanderson SILVA, Igor RAUPP, Denise Ferreira de MATOS, Camila VASCONCELLOS

Electrical Energy Research Center (CEPEL) - Brazil

## Motivation

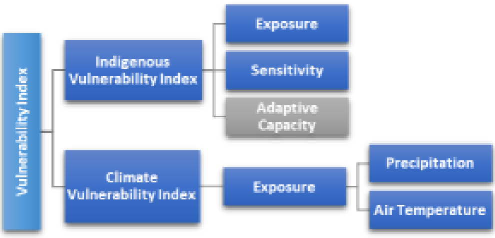
The electricity sector has been a major player in global climate change. Despite the mitigation actions that may be implemented, it is necessary to develop methodologies and tools to identify and measure the associated risks that climate change may impose to the sector.

This paper analyses the specific aspects of the indigenous population's vulnerability to climate change in Brazil, by proposing an index that can guide ambitious climate adaptation strategies for the electricity companies operating near indigenous lands.

## Method/Approach

### Indigenous Vulnerability Index (IVI)

- **Exposure:** Pressures and economic interests on the indigenous lands and surroundings (ex.: existing roads, mining activities, electricity generation plants, oil and gas plants, agriculture, and logging). Map algebra is used to synthesize the pressures, giving different values to the geographic features, indicating the potential for negative interaction with indigenous territories.
- **Sensitivity:** Internal stress factors including the level of protection of the indigenous lands and the environmental quality of the river basin, which is assessed by information on land use and deforestation, presence of protected areas, pre-existing conflicts, and territorial loss by invasions.
- **Adaptive Capacity:** structural levels of stress including legal and administrative aspects of the community, the relationship, and engagement with other groups, the interethnic contact with the surrounding society, and the level of protection of the area near indigenous lands, beyond others.



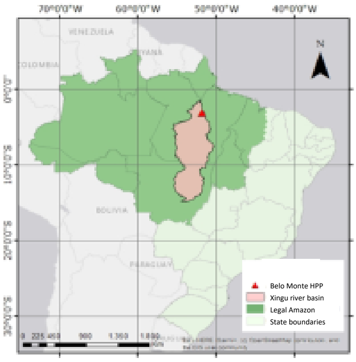

### Climate Vulnerability Index (CVI)

- **Exposure:** historical air temperature and precipitation change data (from 1980 to 2013).

  **Precipitation**: Annual total precipitation and the occurrence of heavy precipitation or consecutive dry days.

  **Air temperature:** Mean air temperature and the occurrence of cold nights or warm days.

## Study case: Xingu River Basin




As an exercise, it was selected a Brazilian river basin with elements that could help the construction of the methodology for IVI and CVI. Xingu basin, the selected one, has indigenous lands, protected areas, rural settlements, mining projects, electricity sector projects, logging, deforestation, and other elements that allow the application and testing of the methodology.

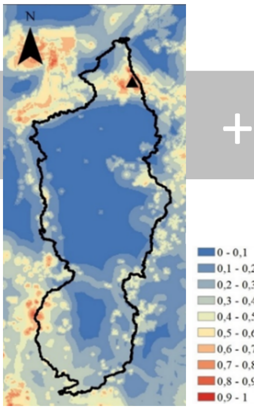
Study Committee C3

POWER SYSTEM ENVIRONMENTAL PERFORMANCE

10163_2022

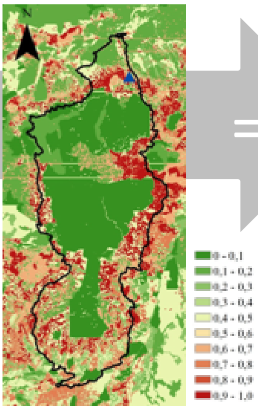
# Indigenous Vulnerability and Corporate Climate Change Strategy for the Electricity Companies in Brazil

**Exposure Index**



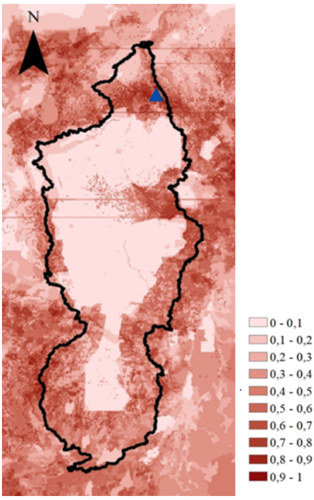

+

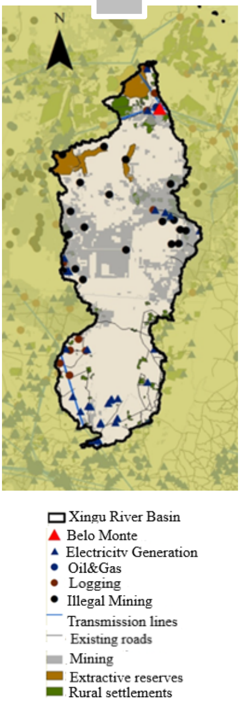
**Sensitivity Index**



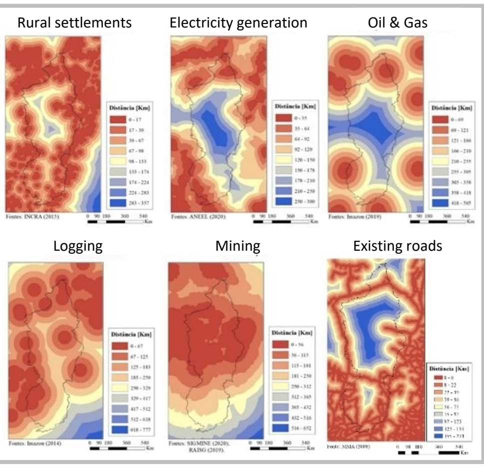
=

**Exposure + Sensitivity**




The Sensitivity component shows the internal stress factors including the level of protection of the indigenous lands, which is assessed by information of land use and deforestation considering existence of protected areas, pre-existing conflicts, territorial loss by invasions and the environmental quality of the river basin. The categories of each of these features were used to assign pressures within the layers, allowing a classification of the items.




http://www.cigre.org

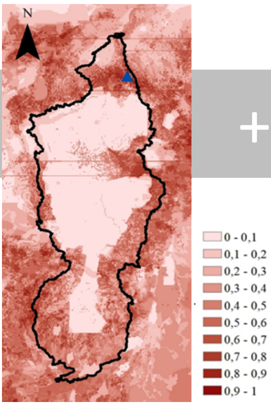
Study Committee C3

POWER SYSTEM ENVIRONMENTAL PERFORMANCE

10163_2022

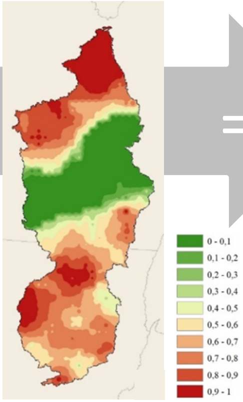
# Indigenous Vulnerability and Corporate Climate Change Strategy for the Electricity Companies in Brazil

**Exposure + Sensitivity**



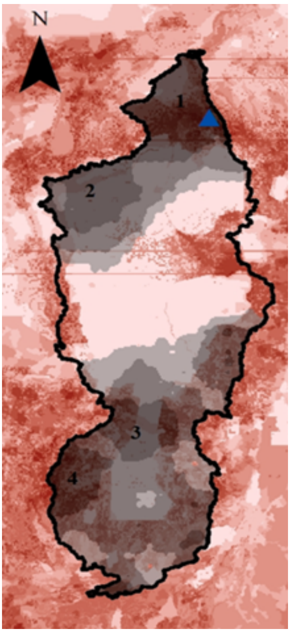

+

**Climate Vulnerability Index**




=

**Vulnerability Index**




Composed of two parts: IVCT (air temperature) and IVCP (precipitation). Each one represents the climate variable by two indicators: a main indicator (associated with the average) and another associated with the extreme.
Both IVCT and IVCP are calculated using historic data and considering whether there was a statistically significant change in the indicators over time through statistical tests. Once the IVCT and IVCP are obtained, the IVC is calculated considering the cumulativeness of them.

Sub-regions:

1: HPP and the largest urbanized region in the basin are located;

2: Region adjacent to the Transamazônica road, with a large concentration of deforested area in the external part of the basin;

3: Indigenous Land surrounded on both sides by agricultural production areas;

4: High index of exposure (settlements, logging poles and roads) and sensitivity (agricultural production and deforestation).

## Conclusion

The final map shows the most vulnerable areas that should be prioritized in terms of adaptation measures to climate change.

It is suggested that electricity companies operating in these areas include the analysis of the aspects of vulnerability as proposed by this paper in their corporate climate strategies. The identification of the most vulnerable indigenous lands and groups, and their most pressing needs should contribute to mapping which adjustments must be made to increase the resilience of these populations and at the same time reduce the climate, social, reputational, or legal risks to electricity companies that operate near those areas.