
ORCHESTRA
do SILÊNCIO

Climate hazards, health risk and biodiversity loss predict the existence of climate adaptability policies except for highly vulnerable regions

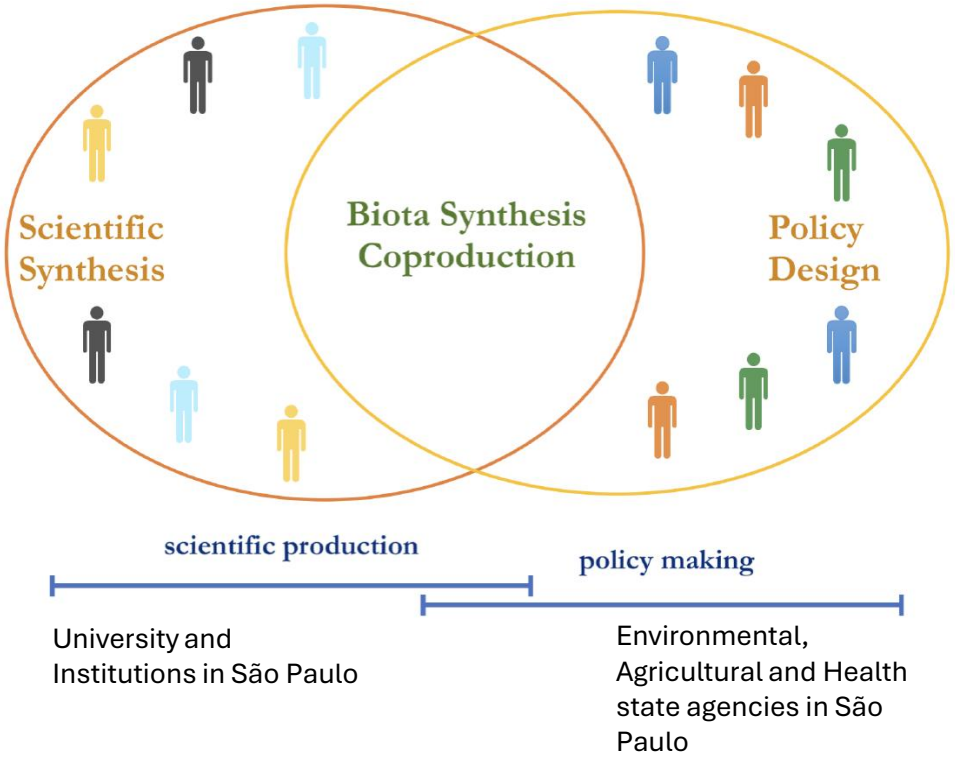
Evidence from 645 municipalities of São Paulo state

04 de fevereiro de 2026

2nd day workshop activities proposals

Department of Environment and Geography

Linking evidence on One Health, Biodiversity and Climate Justice for Climate Adaptation Policy in the State of São Paulo, Brazil



Building up on previous transdisciplinary experience

Understanding the use of evidence in policymaking

- Identify the **constraints and enablers** around effective integration of scientific evidence into climate adaptation policy.
- Understand effective evidence utilization mechanism, by **identifying ways of thinking** using Q-methodology and generate recommendations.
- Promote **addressing of interconnected environmental and health challenges**, by gathering and using biophysical and social data related to climate adaptation.

We aim to explore:

If evidence on climate impacts driving policies development?

Are we prepared to adapt to climate change? Or are we reacting to climate changes

Municipalities with greater socio-environmental risks (health, climate hazards, social vulnerability and biodiversity crisis) are also the regions with greater urban adaptability index?

How are we addressing of interconnected environmental and health challenges :

1) **U**AI = Urban adaptation index

2) Biodiversity

3) Health burden ↔ Disease and death regulation

4) Climate hazard regulation/preventi

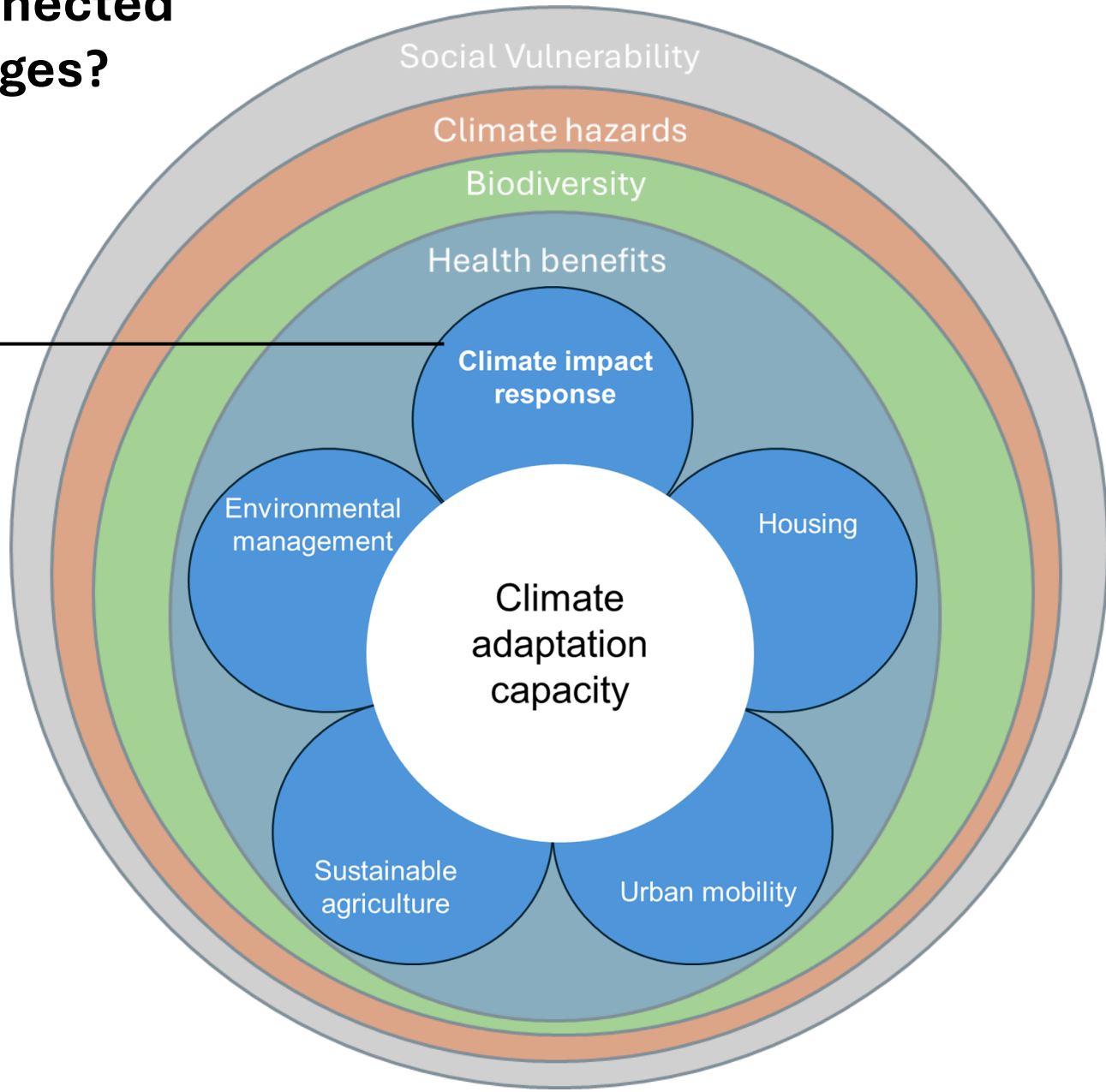
5) Environmental justice ↔ social vulnerability

How are we addressing of interconnected environmental and health challenges?

1st) The Climate adaptation capacity

We use the **UAI = Urban adaptation index** which integrates 26 variables grouped in five dimensions.

It represents governance the presence of governance instruments.

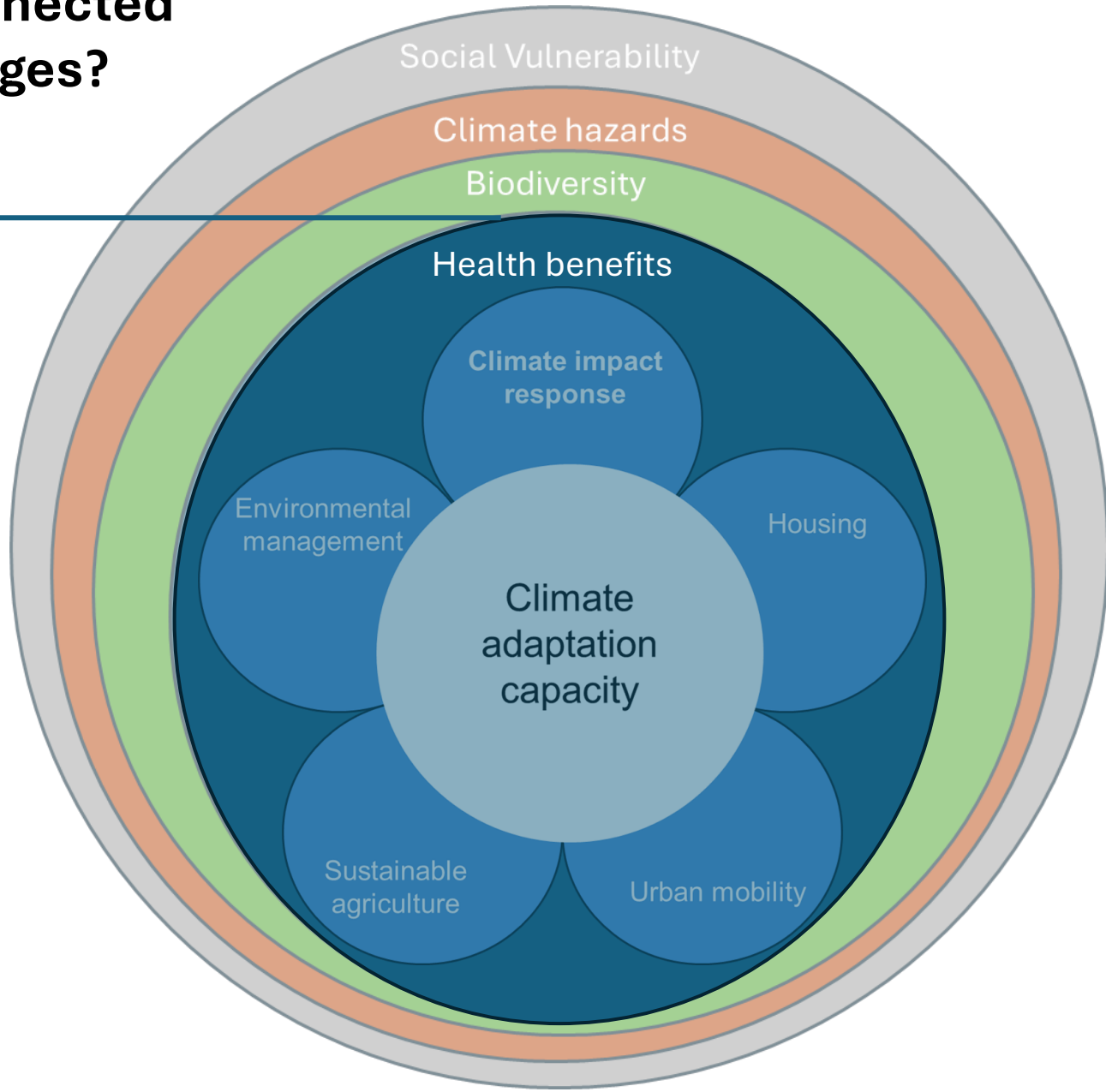


How are we addressing of interconnected environmental and health challenges?

2nd) Health burden

Here we are integrating: 5 zoonotic related (dengue, malaria, leishmaniosis, leptospirosis and diarrhea) disease and two health conditions (cardiovascular and respiratory).

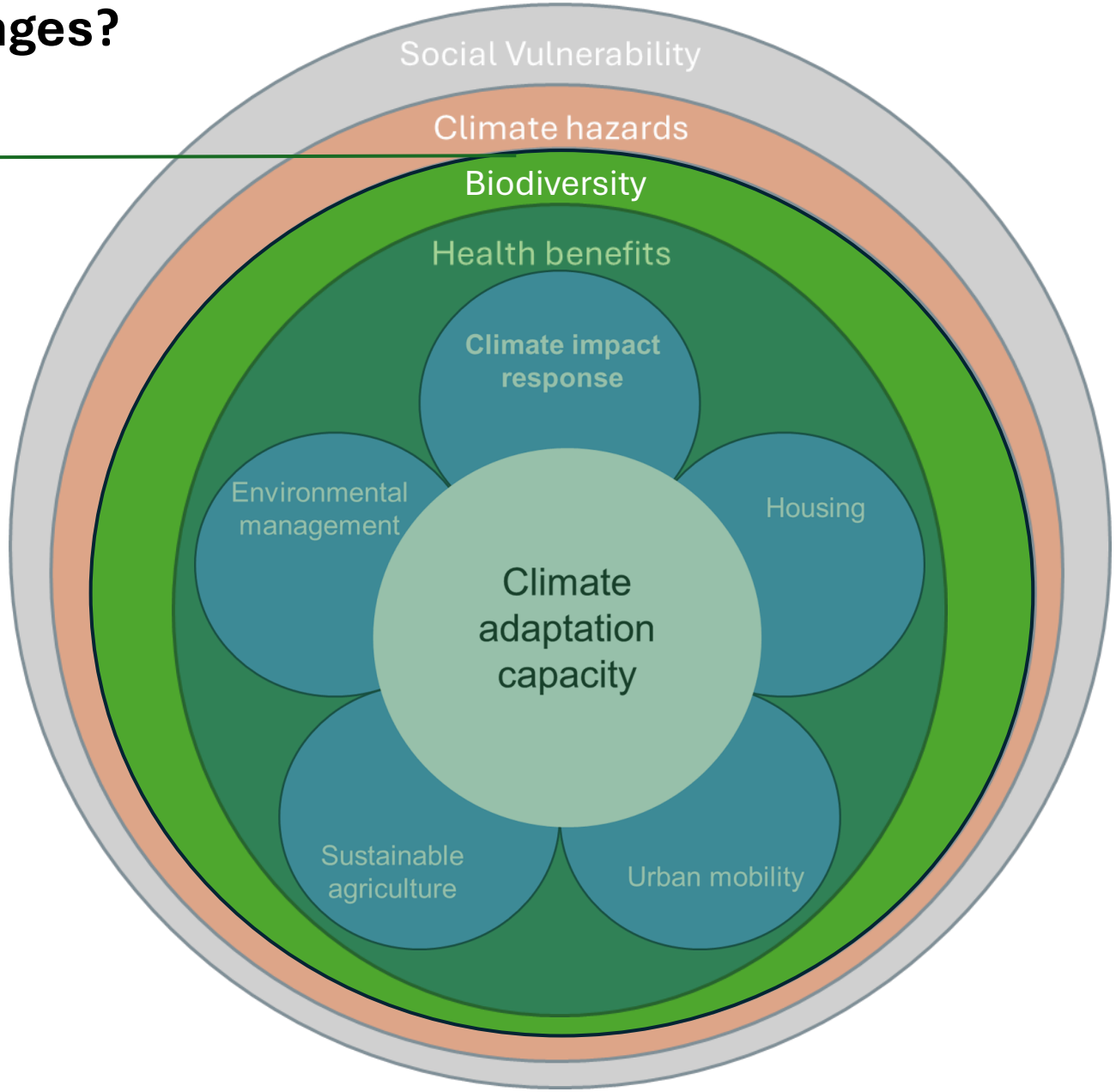
This includes using a variable for persistence and another one from occurrence, we use a 9 years window (2010-2019).



How are we addressing of interconnected environmental and health challenges?

3rd) Biodiversity

Here we are integrating: i) forest cover; ii) vertebrate species richness and iii) landscape configuration metrics associated to pollination deficit.



How are we addressing of interconnected environmental and health challenges?

4th) Climate hazards

We are integrating flooding risks, hydric stress, fire risk, heat wave risks.

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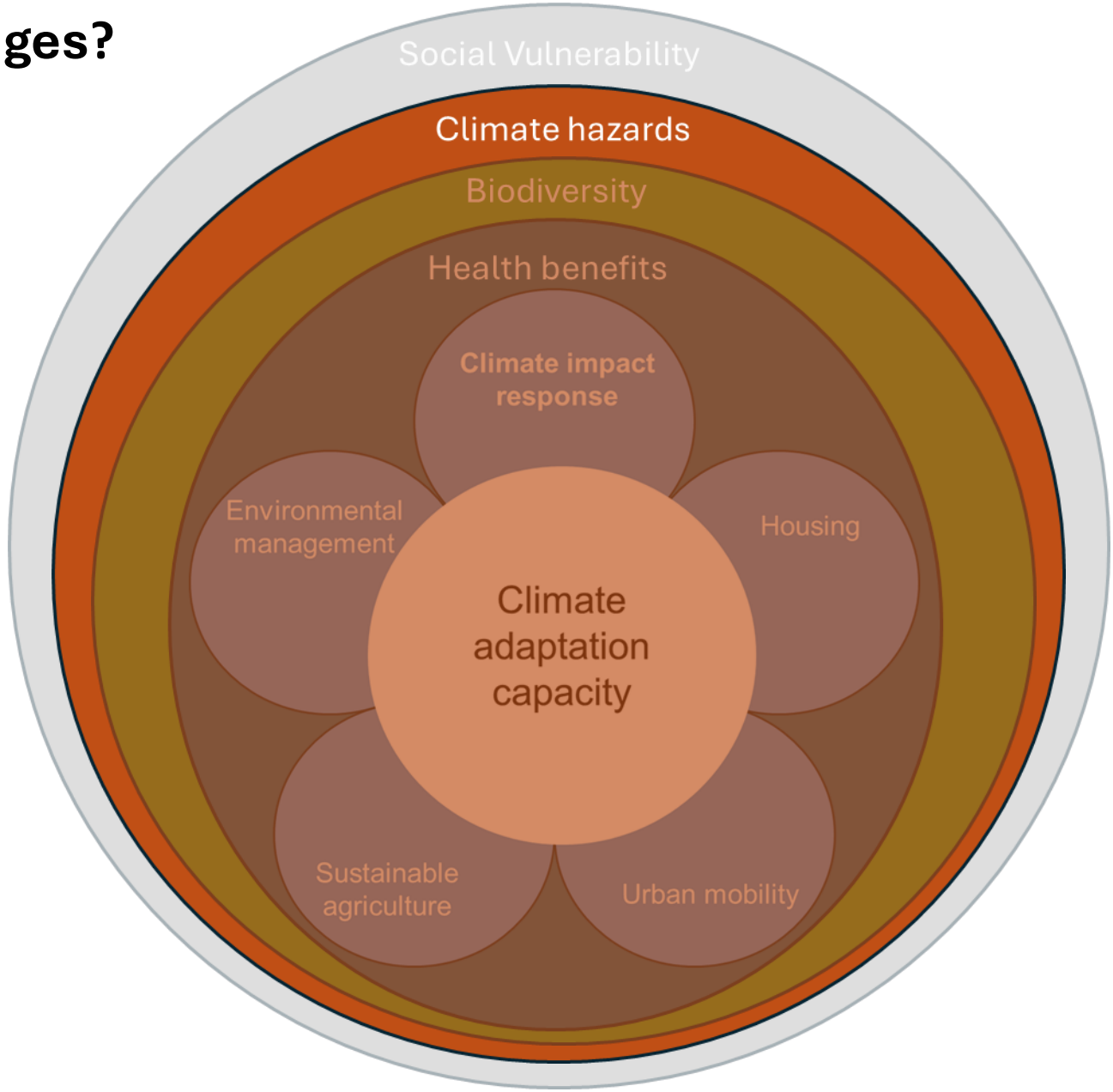

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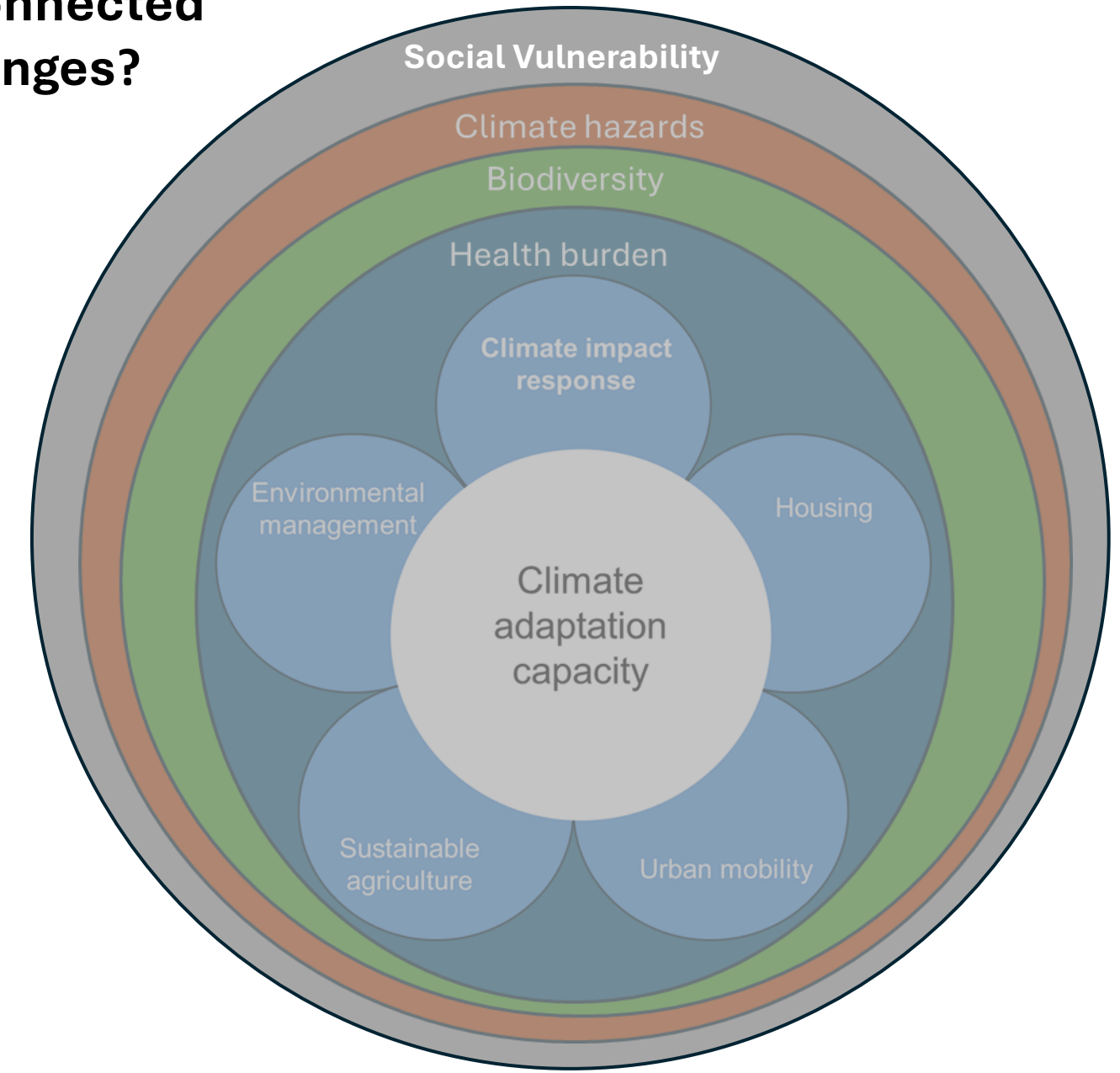
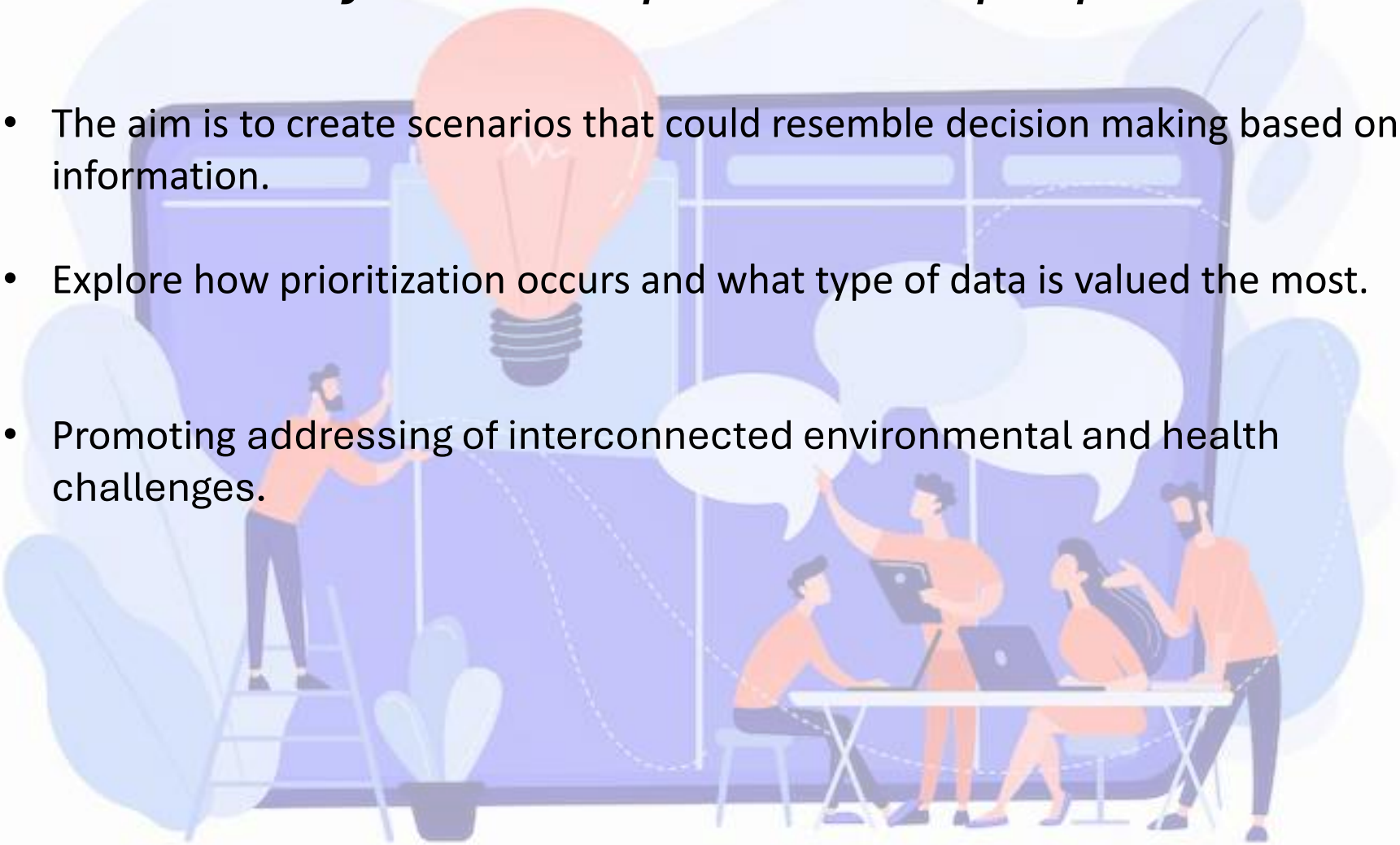


2nd day workshop activities proposals

- The aim is to create scenarios that could resemble decision making based on information.
- Explore how prioritization occurs and what type of data is valued the most.
- Promoting addressing of interconnected environmental and health challenges.



Day 2: 24rd of February 2026

1st Activity: Diagnosis and evidence – territorial mapping

Time: ~45 minutos

Format: small groups (3-4 people) with representative from different scale and backgrounds.

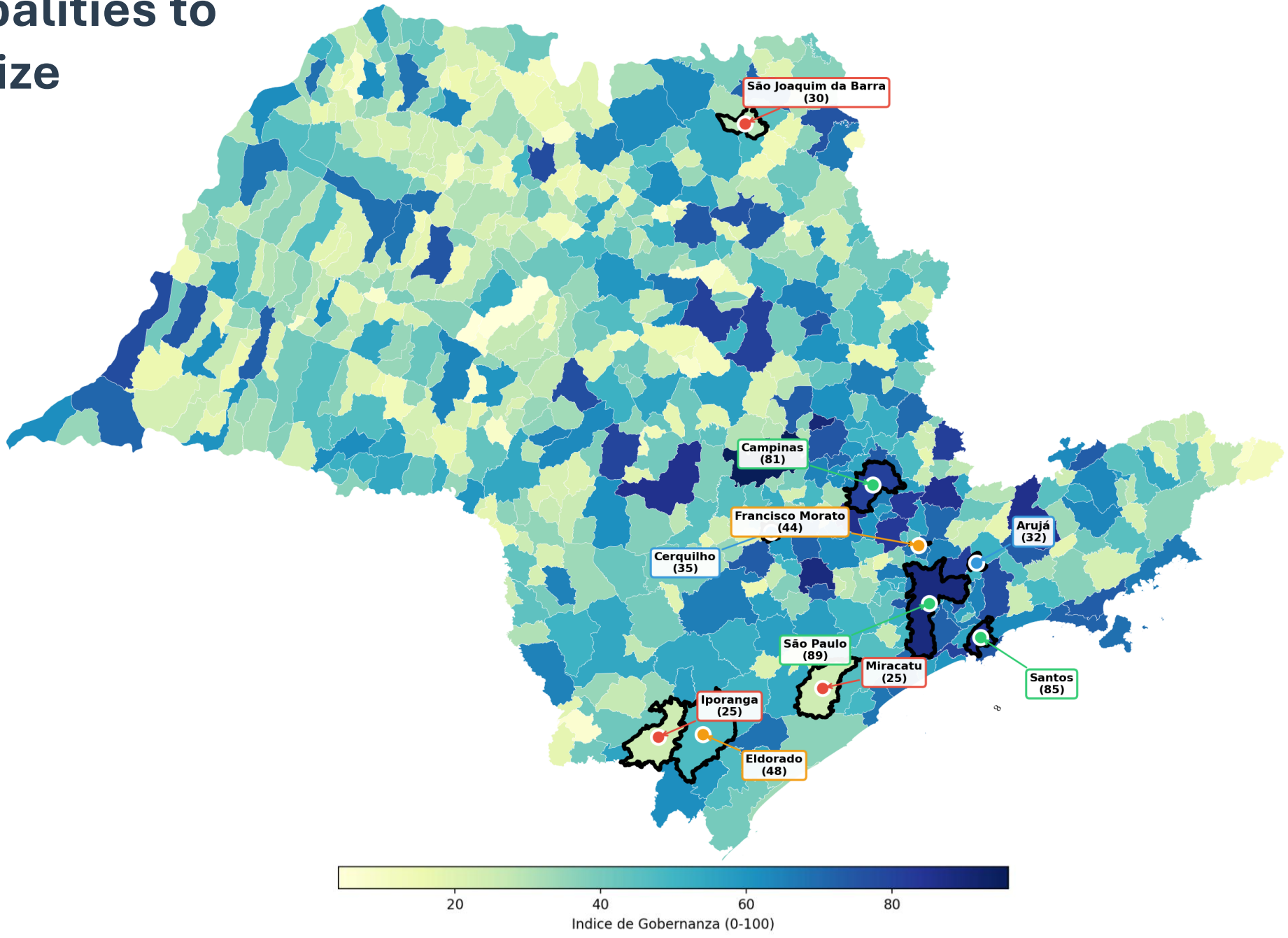
Description: Present a list of *10 municipalities* for participants **to rank based on previous experience, environmental and climate risks, and social vulnerability**.

The aim: connect available data with a prioritization exercise based on PEARC actions that should be implemented and monitored.

Initial information provided: For this participant will receive a list of variables (from nexus assessments) for which heat-maps can be provided showing municipalities values of risk and vulnerability. Each group will be allowed to select from a pool to inform their ranking.

Ten municipalities to rank/prioritize

Municipality
Iporanga
Campinas
Santos
S. Joaquim Barra
Miracatu
Eldorado
Francisco Morato
Sao Paulo
Aruja
Cerquilho



Task (groups must):

1. Select 6 variables from the pool above OR buy with initial 10 credits budget
2. Consult the corresponding heat-maps for those variables
3. Rank the 10 municipalities by priority for PEARC intervention
4. Propose a short list of priority actions

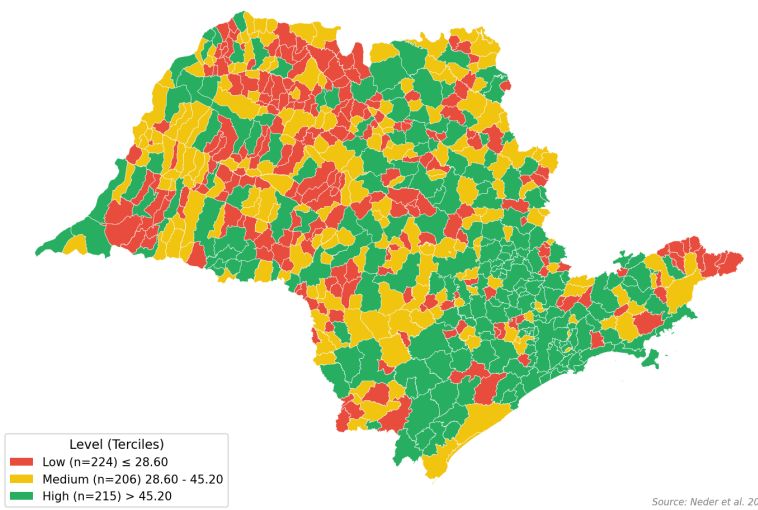
Guiding questions:

1) Are there any general patters?
2) Were your decision based on previous knowledge integrated with data?
3) Any unexpected insight?

Goals: Familiarize participants with the nexus assessment data and prompt discussion about territorial realities.
Materials: Municipality heat-maps (printed A2 or digital), pen and paper for ranking and priority actions.

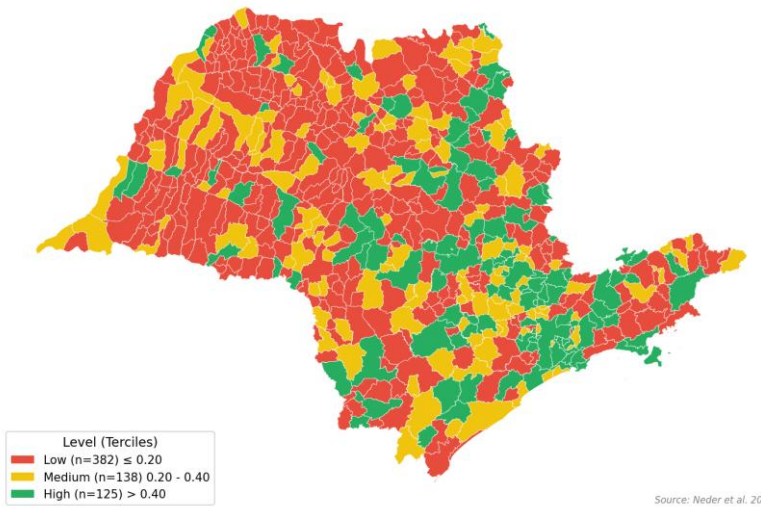
Urban adaptation index

02. Governance - UAI General
Gobernanza - UAI General



Source: Neder et al. 2021

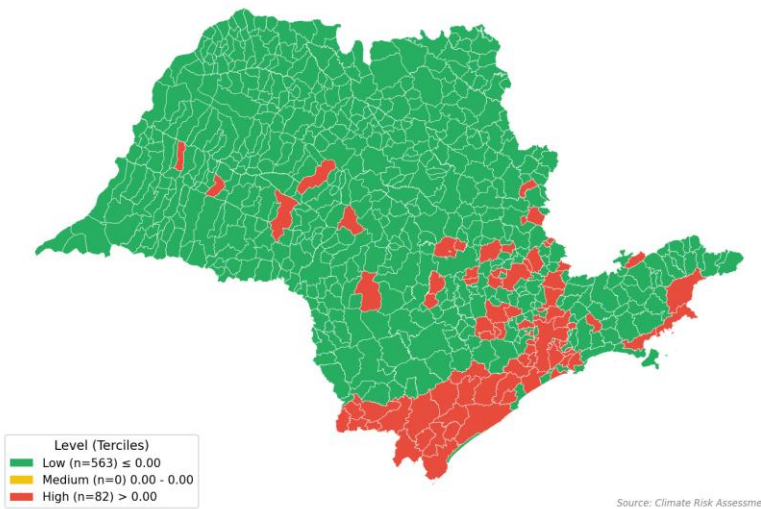
01. Governance - UAI Climatic Risk
Gobernanza - UAI Riesgo Climatico



Source: Neder et al. 2021

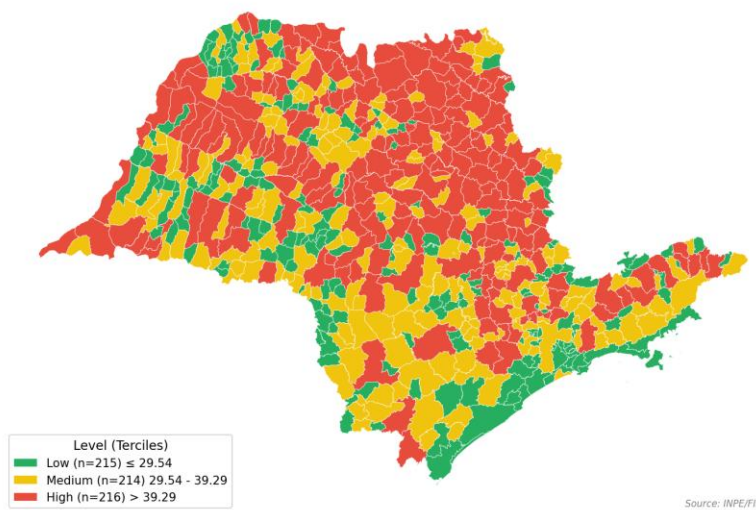
Climate risk layers

06. Flooding Risk
Riesgo de Inundacion



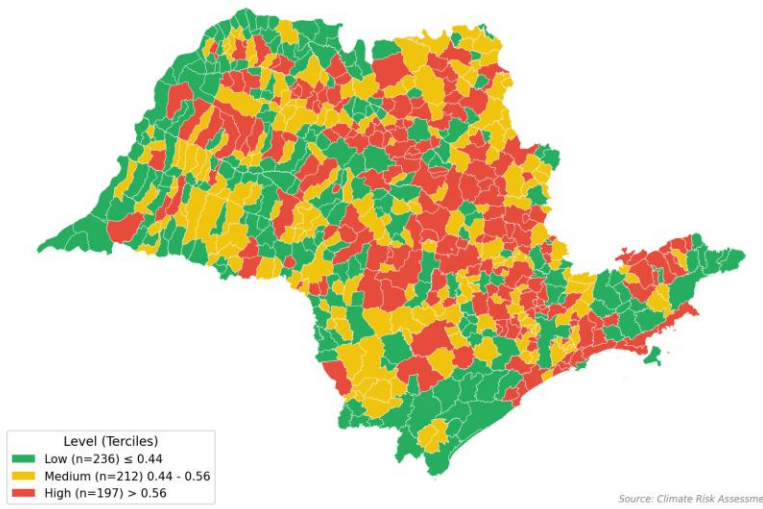
Source: Climate Risk Assessment

07. Fire Risk Index
Indice de Riesgo de Fuego



Source: INPE/FIRMS

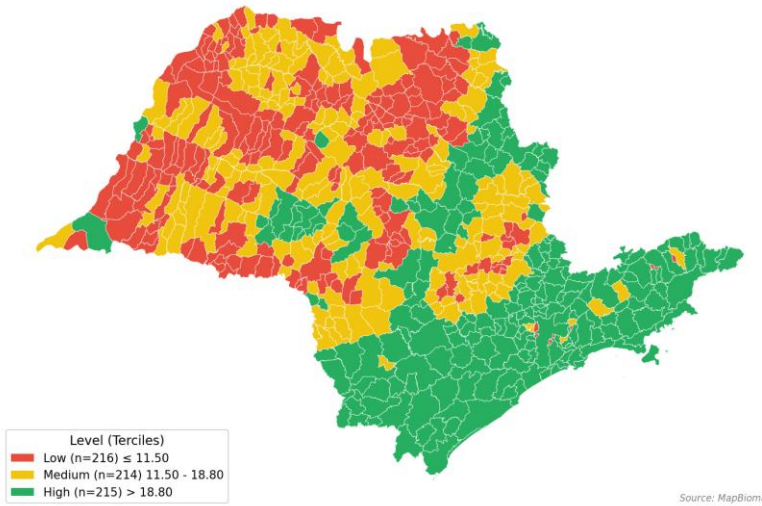
08. Hydric Stress Risk
Riesgo de Estres Hidrico



Source: Climate Risk Assessment

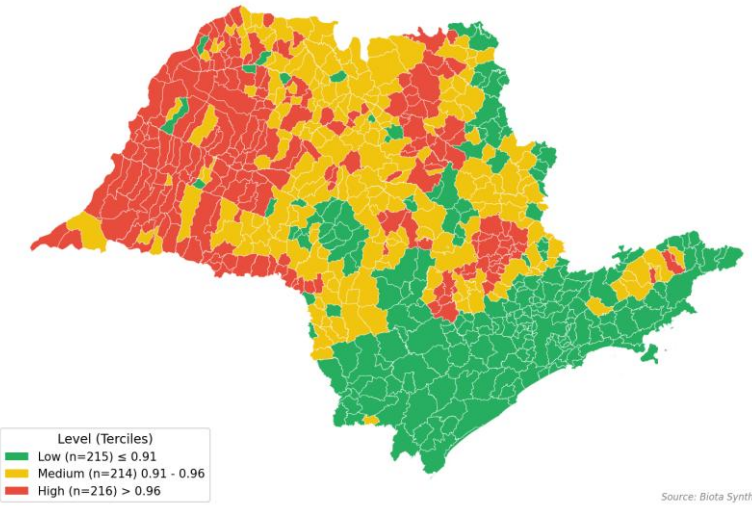
Biodiversity layers

04. Natural Habitat - Vegetation Cover (%)
Habitat Natural - Cobertura Vegetal (%)



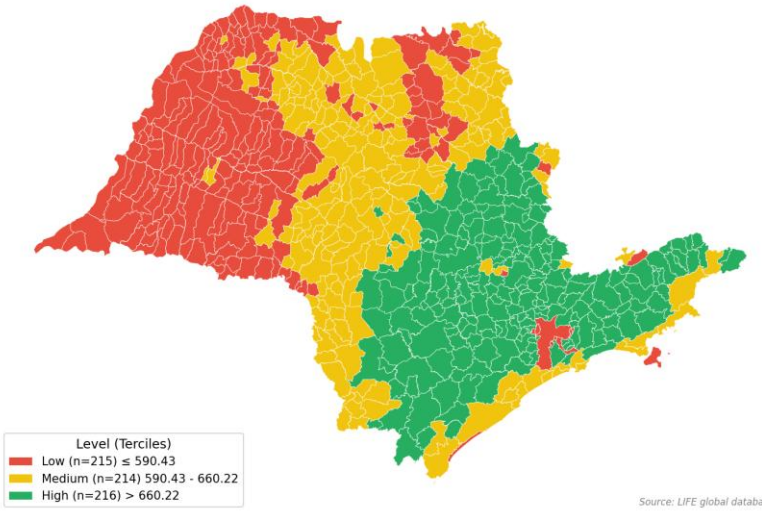
Source: MapBiomas

05. Pollination Deficit
Deficit de Polinizacion



Source: Biota Synthesis

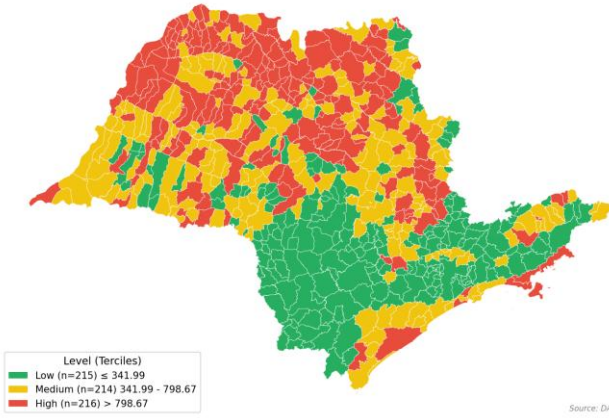
03. Biodiversity - Vertebrate Species Richness
Biodiversidad - Riqueza de Especies



Source: LIFE global database

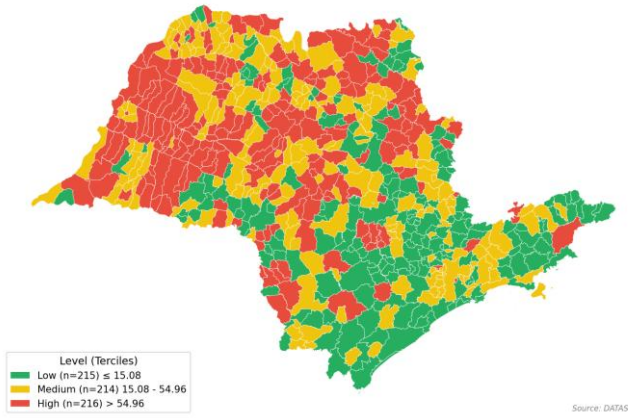
Health burden layers

09. Zoonotic Disease - Dengue Incidence (per 100k)
Enfermedad Zoonotica - Incidencia Dengue (por 100k)



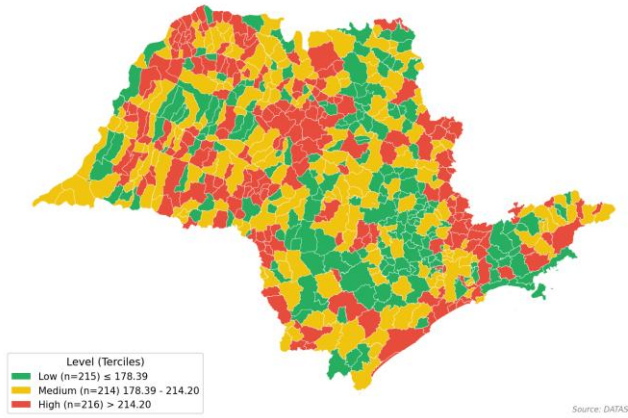
Source: Di

10. Water Pollution - Diarrhea Incidence (per 100k)
Contaminacion Agua - Incidencia Diarrea (por 100k)



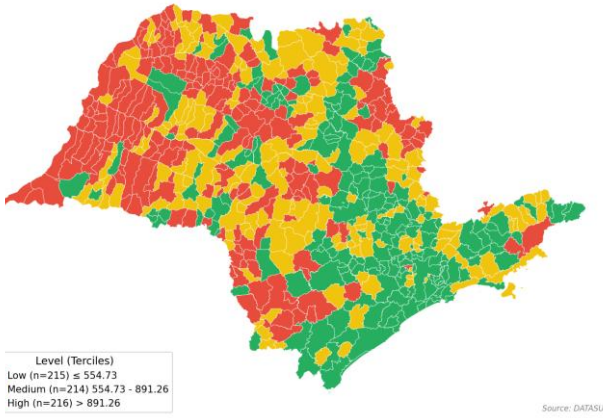
Source: DATASUS

11. Heat/Fire Health - CV Mortality (per 100k)
Salud Calor/Fuego - Mortalidad CV (por 100k)



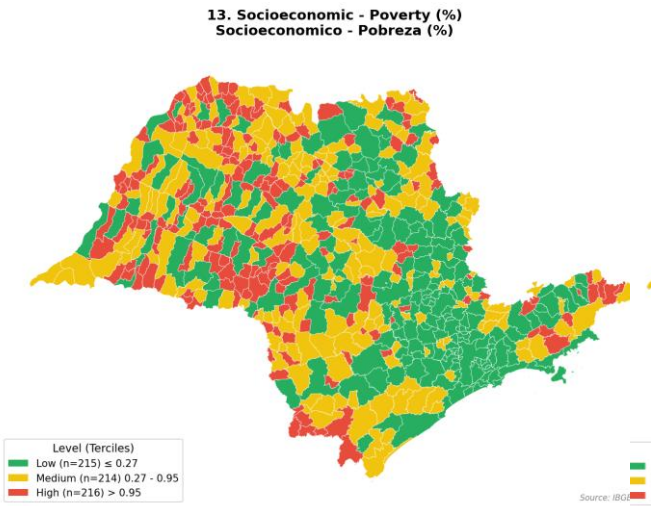
Source: DATASUS

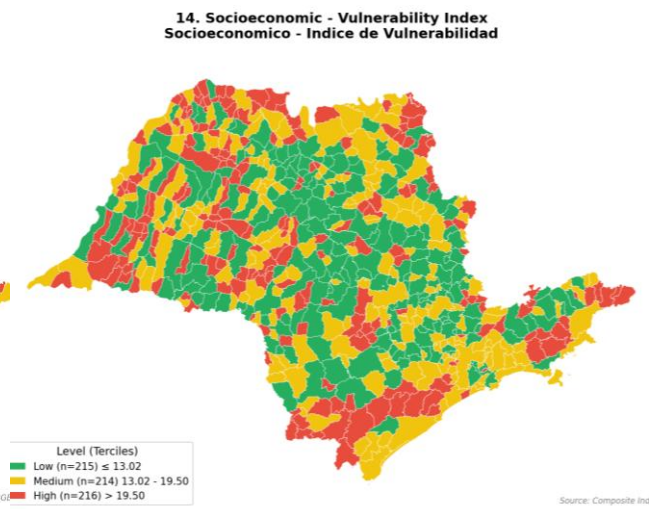
12. Heat/Fire Health - Respiratory Hosp. (per 100k)
Salud Calor/Fuego - Hosp. Respiratoria (por 100k)

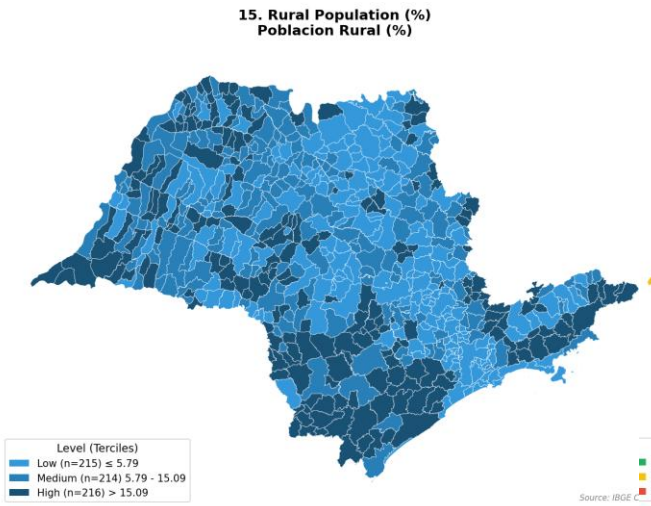


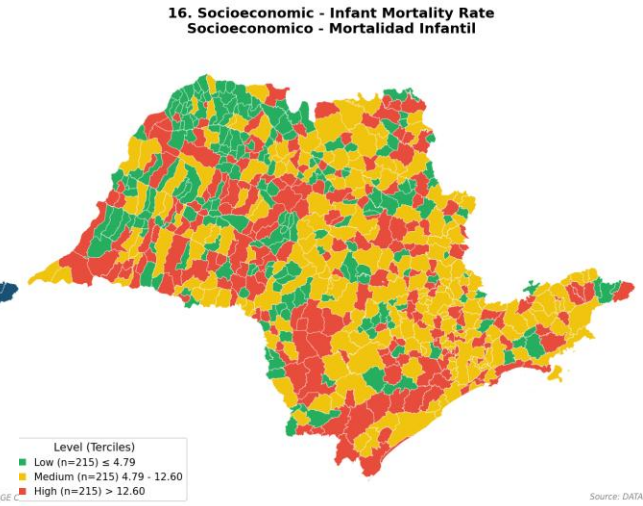
Source: DATASUS

Social vulnerability layers









2nd Activity: “Managing knowledge budgets and detect important correlations”

Time: ~60 minutes

Format: continues in groups of 4 or 5 people

Descriptions: We will give “information (knowledge) credits” to buy additional information (layers/variable). In the first activity groups chose 6 variables for the first raking exercise. Now, if they wish, they can purchase more variable information.

Credit system: each group will have *10 credits* to spend. Variable layers cost different amounts based on accessibility and data processing complexity:

One (1) credit (Easily accessible): `population`, `rural percentage`, ` urban percentage`

One (1) credit (Easily accessible): `forest cover`, `flooding risks`

Two (2) credits (Moderate processing): `mean species richness`, `pollination deficit`

Two (2) credits: Governance index`, `Climate risk governance index`

Two (2) credits: `percentage of population in poverty `, `vulnerability unified index`

Three (3) credits (Complex data): `incidence dengue`, `incidence diarrhea` ,` cardiovascular health death `

Three (3) credits (Complex data): `fire risk index`, `hydric stress risk` , `Respiratory hospitalization`

Four (4) credits (Most complex): `Composite health index`, `composite biodiversity index`, `climate risk composite index`

Rules:

- Groups start with 10 credits

- They can buy any combination of additional variables within their budget

- Each purchased variable grants access to its heat-map for all 10 municipalities

- Groups must then **re-rank** their municipalities and update their priority actions

Task: After purchasing new information:

1. Re-rank the 10 municipalities

2. Update the proposed priority actions

3. Identify which new variables changed their decisions most

Guiding Questions:

1. Are there any major changes from your first ranking?

2. What are the main correlations found?

3. Any unexpected insight?

4. Which variable provides the most decision-changing information?

Goal: Understand which knowledge dimensions are prioritized by which groups. Reveal how additional information changes (or doesn't change) decision-making. Simulate real-world constraints of data accessibility and cost.

3rd Activity: Nexus assessment and overreaching results

Time: ~60 minutes
Format: Small groups transitioning to integrated plenary discussion.

Description: To finalize the morning, we present the **integrated nexus assessment** — the combination of >70 variables testing the role of biodiversity at reducing environmental risks, plus the test of whether current policy structure underpins climate adaptive change.

[We will present a prioritization of PEARC actions for all 645 municipalities]:

Presentation (~15 min): Summary of nexus results including:

- *Dilution effect:* Municipalities with greater biodiversity have significantly less diarrhea incidence (r = -0.45)

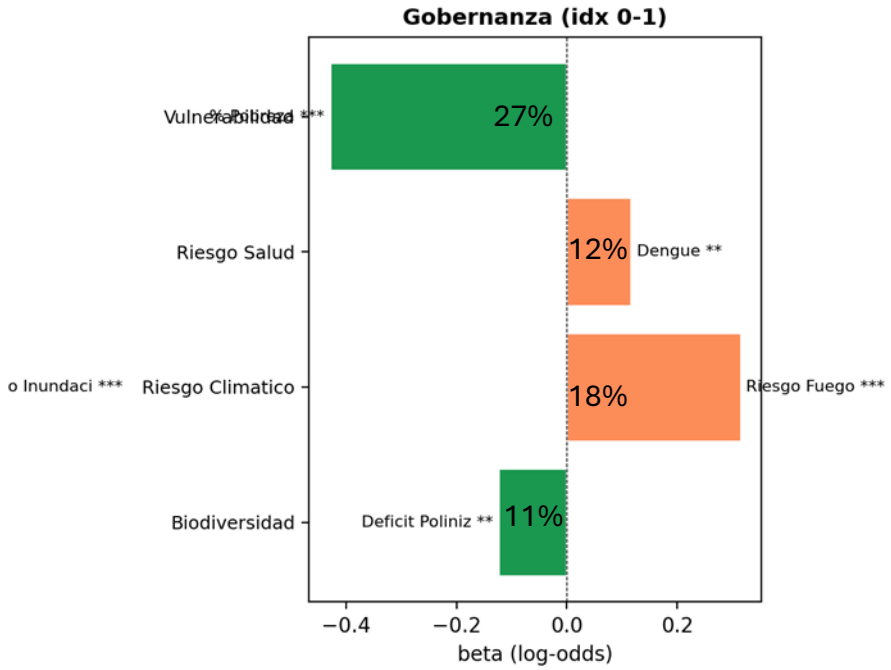
- *Paradox:* Municipalities with HIGHER climate risk have better governance (r = +0.29) — reactive policy elaboration

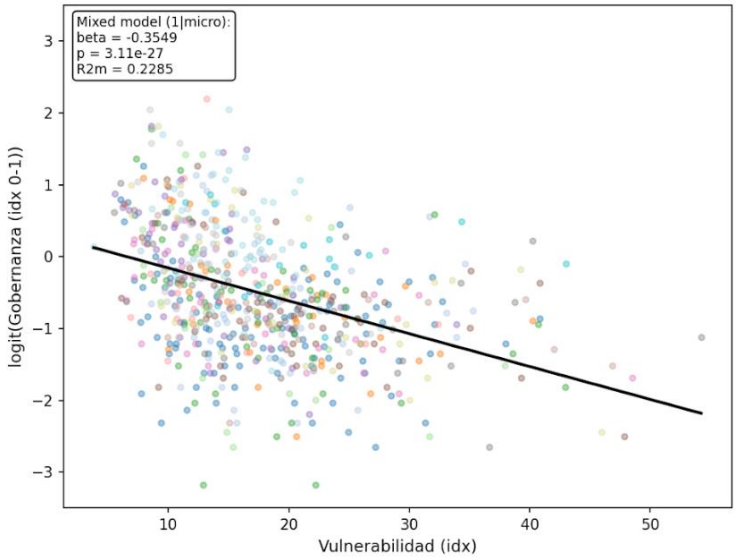
- *Vulnerability modulation:* Poverty and racial composition modify all relationships

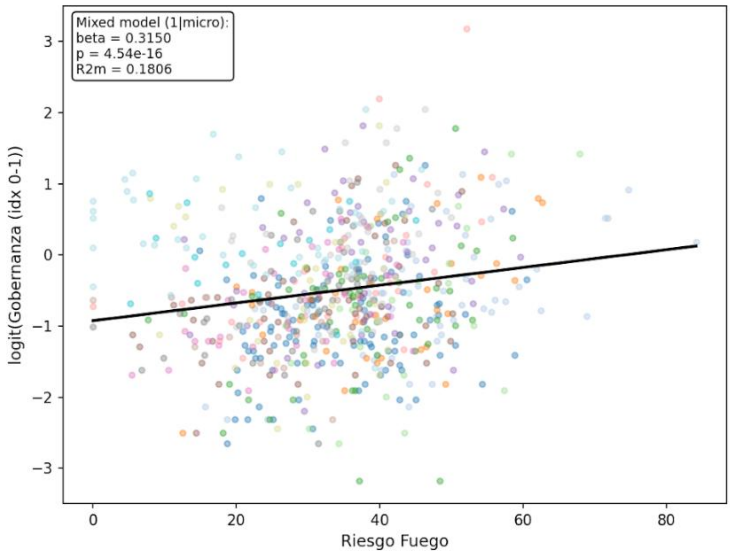
- *Quadrant classification:* 645 municipalities in 4 strategic groups

Following the presentation. We will provoke participants with the following questions:

What predicts policies presence within each dimension of socio-environmental risk?







Seemingly Urban adaptability policies are in place where fire climatic risk are greater (specially for fire risk) and where biodiversity is lower, and higher health problems are, specifically where dengue threats are greater. **Yet** the socio-economically vulnerable are being excluded, have less urban adaptability policies.

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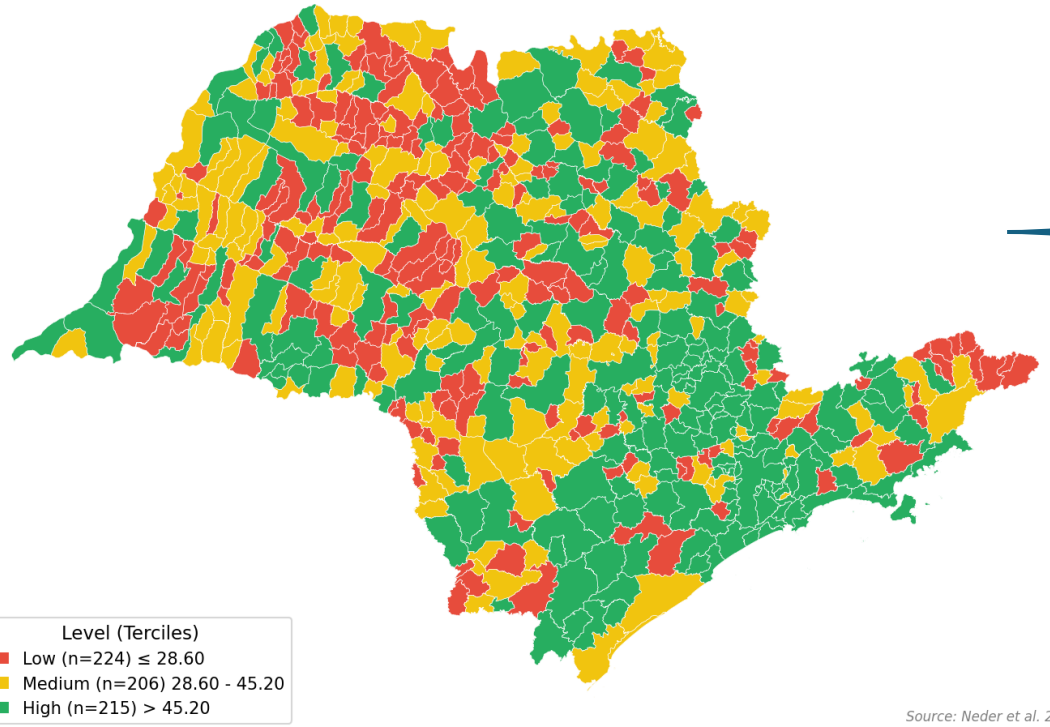

Source: Neder et al. 2021

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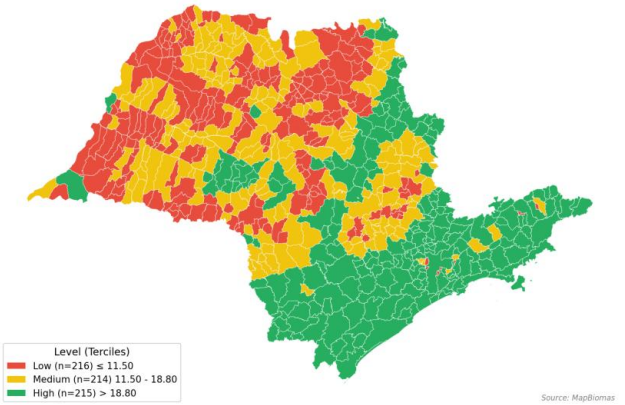
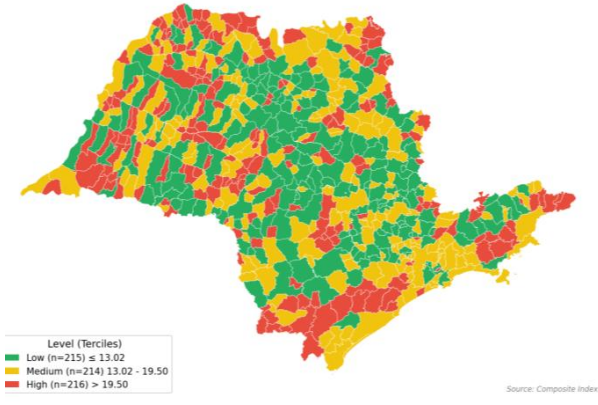


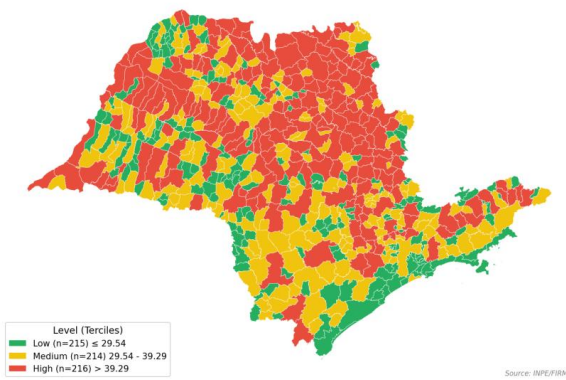
Source: MapBiomas

14. Socioeconomic - Vulnerability Index
Socioeconomico - Indice de Vulnerabilidad



Source: Composite Index

07. Fire Risk Index
Indice de Riesgo de Fuego



Source: INPE/FIRMS

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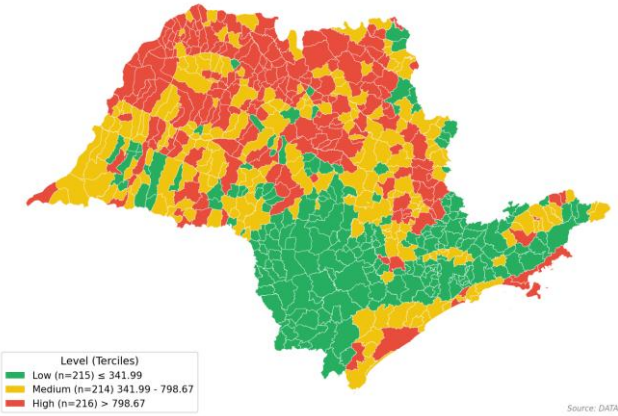
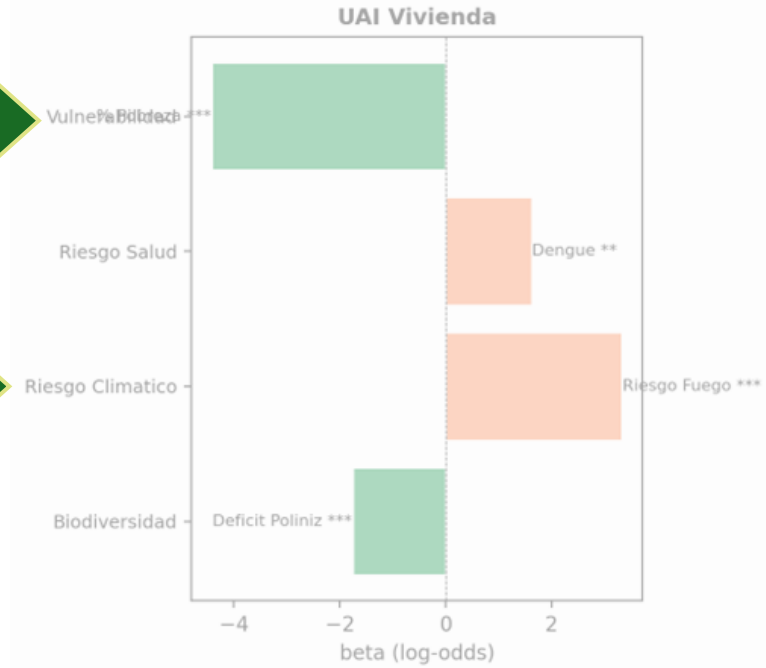
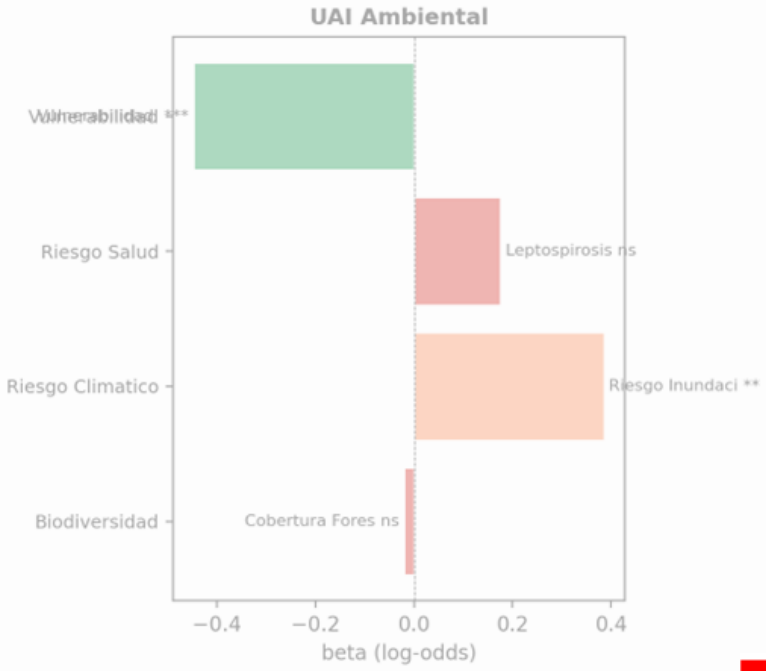
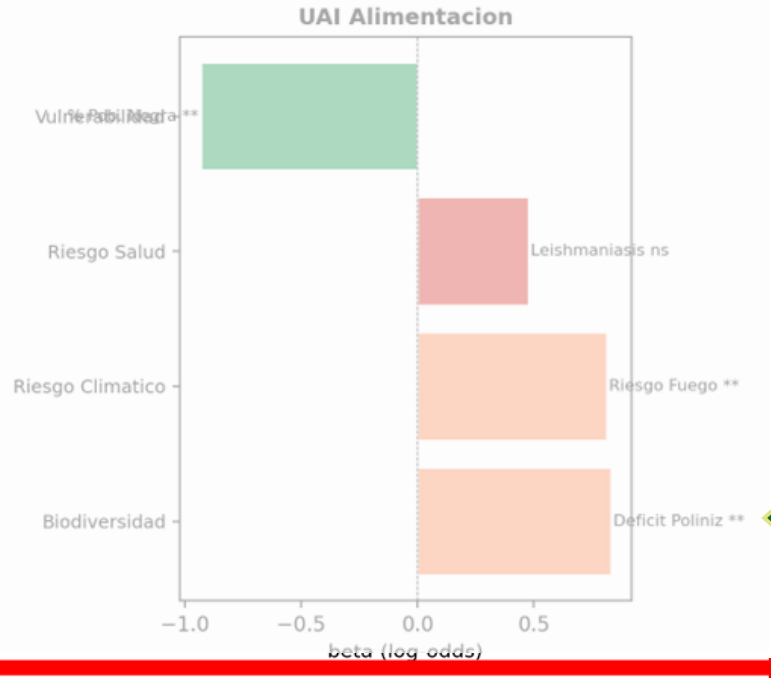


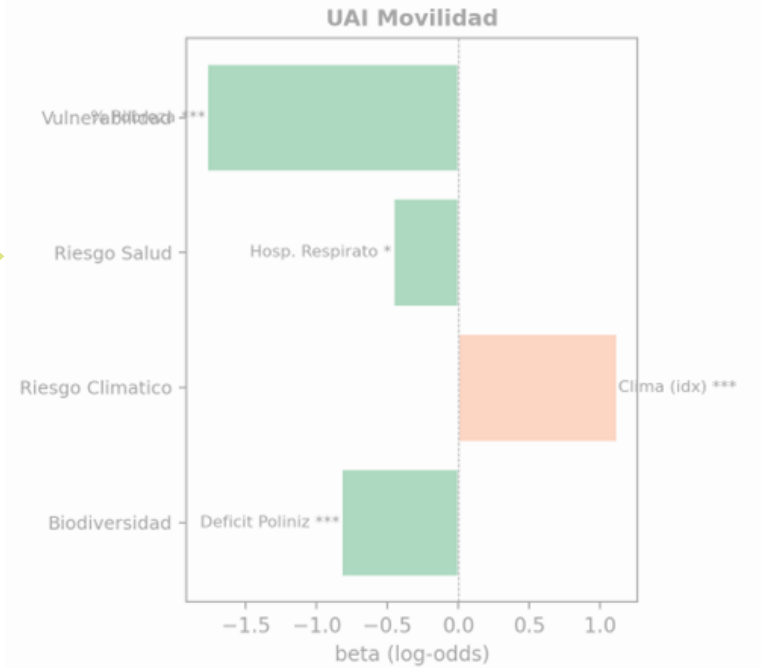
Source: DATASUS

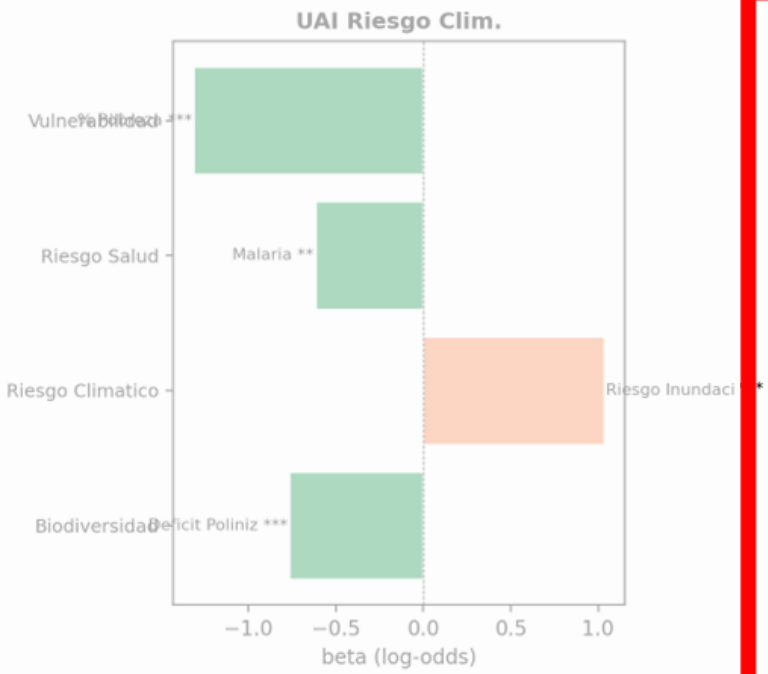
Is it the same for all the Urban adaptability components??

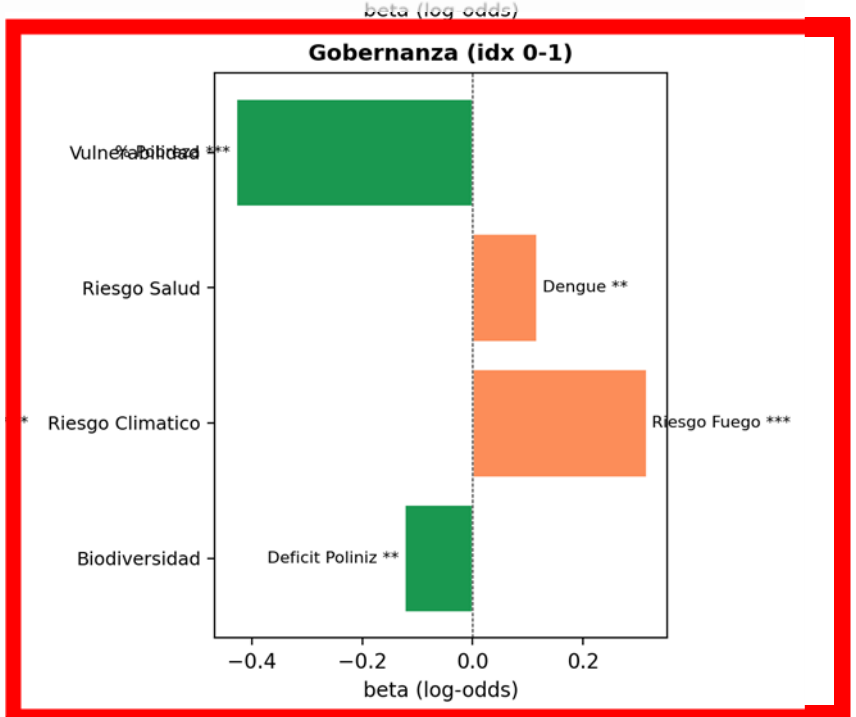












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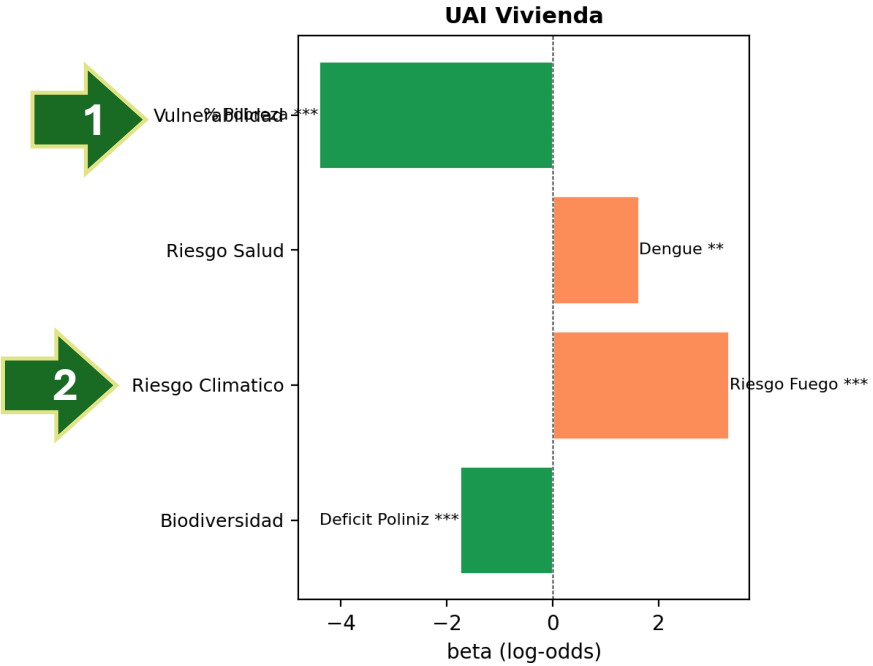
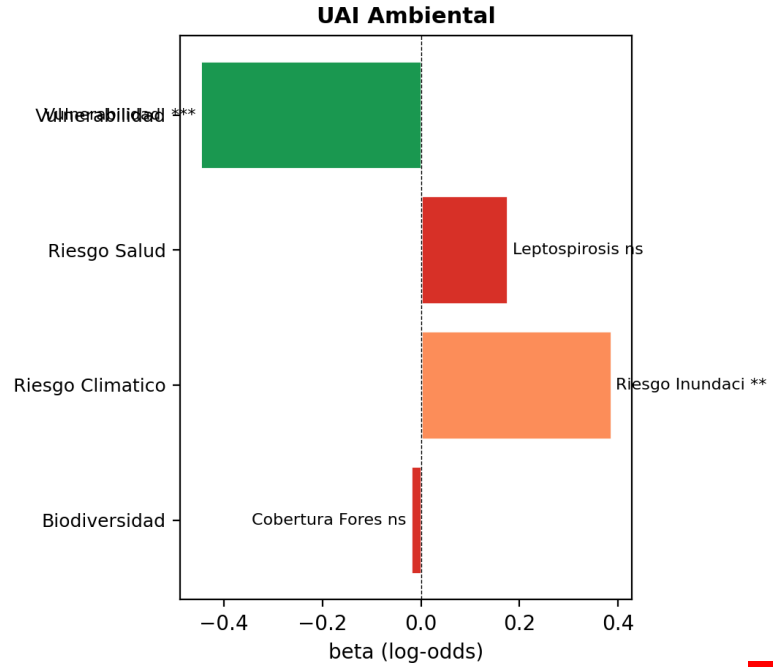
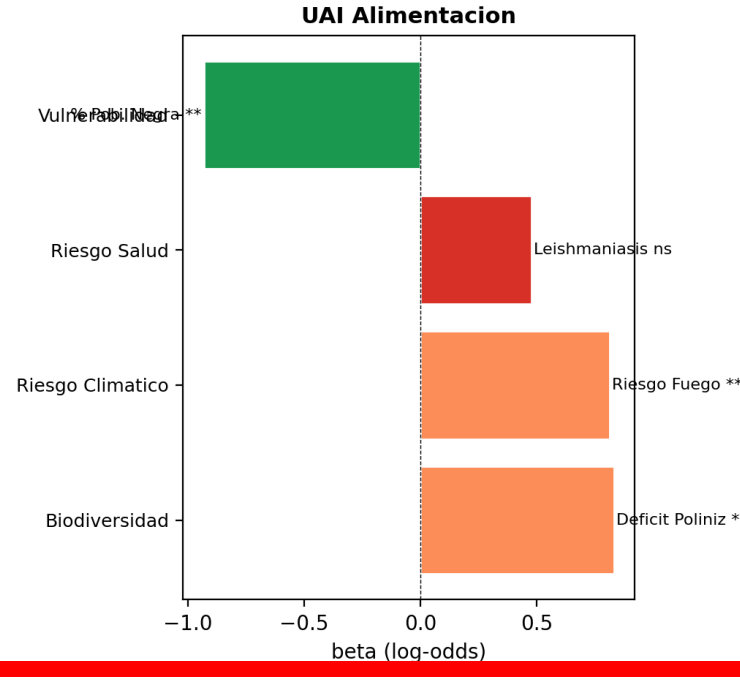
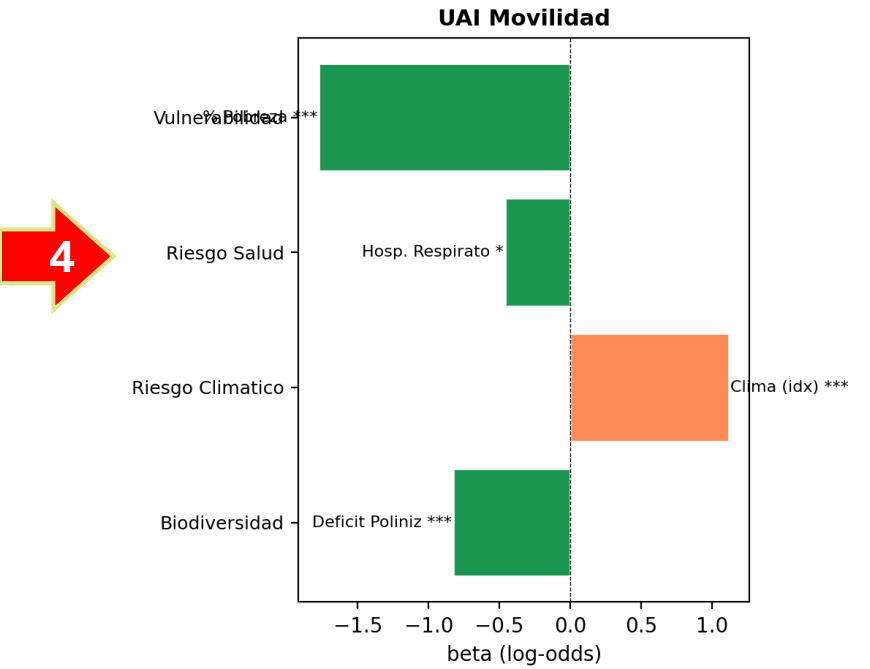
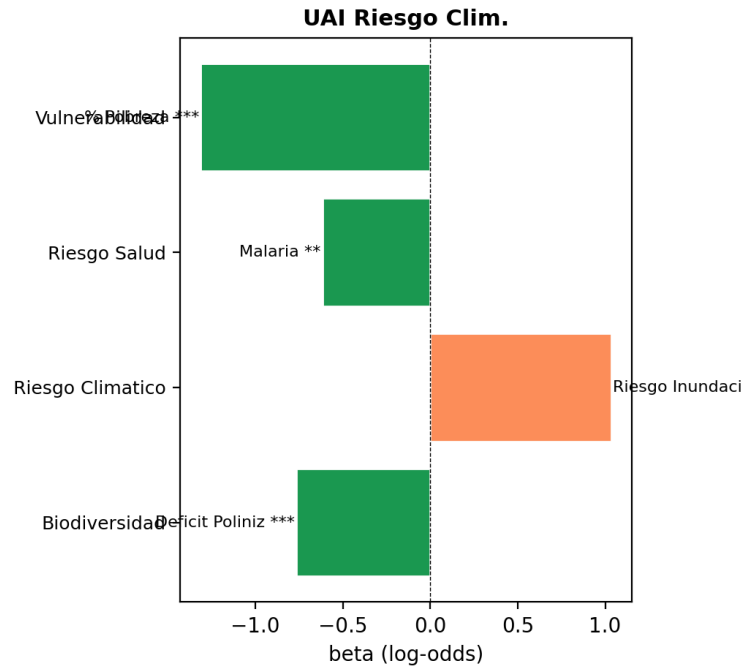






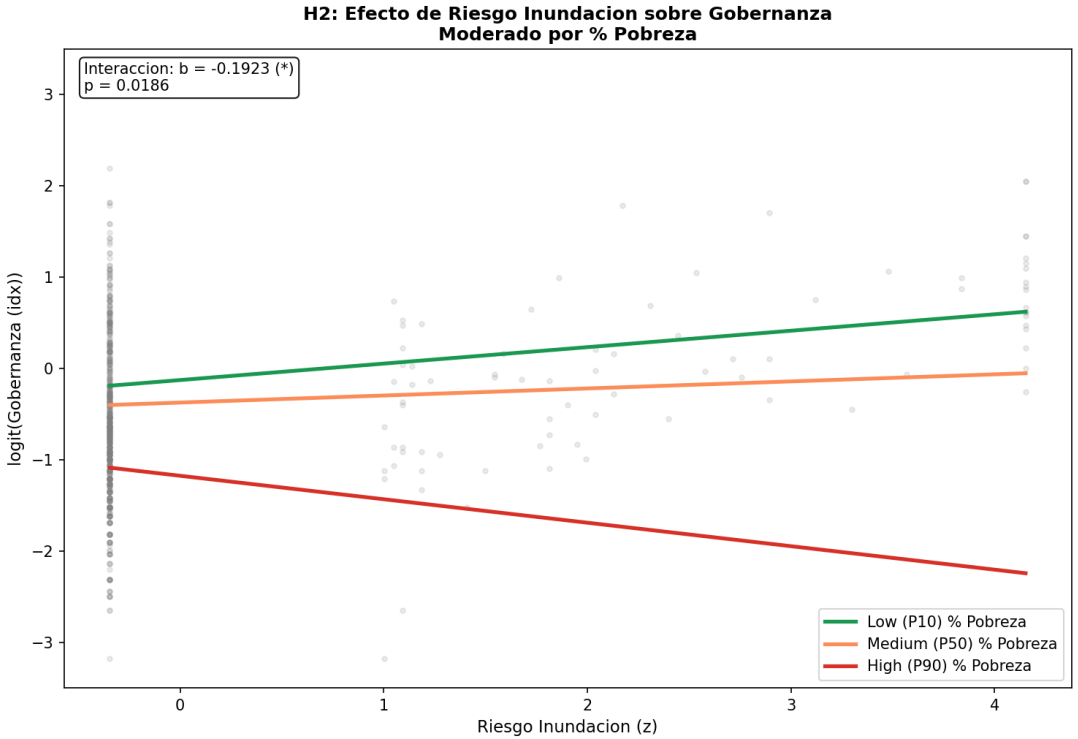


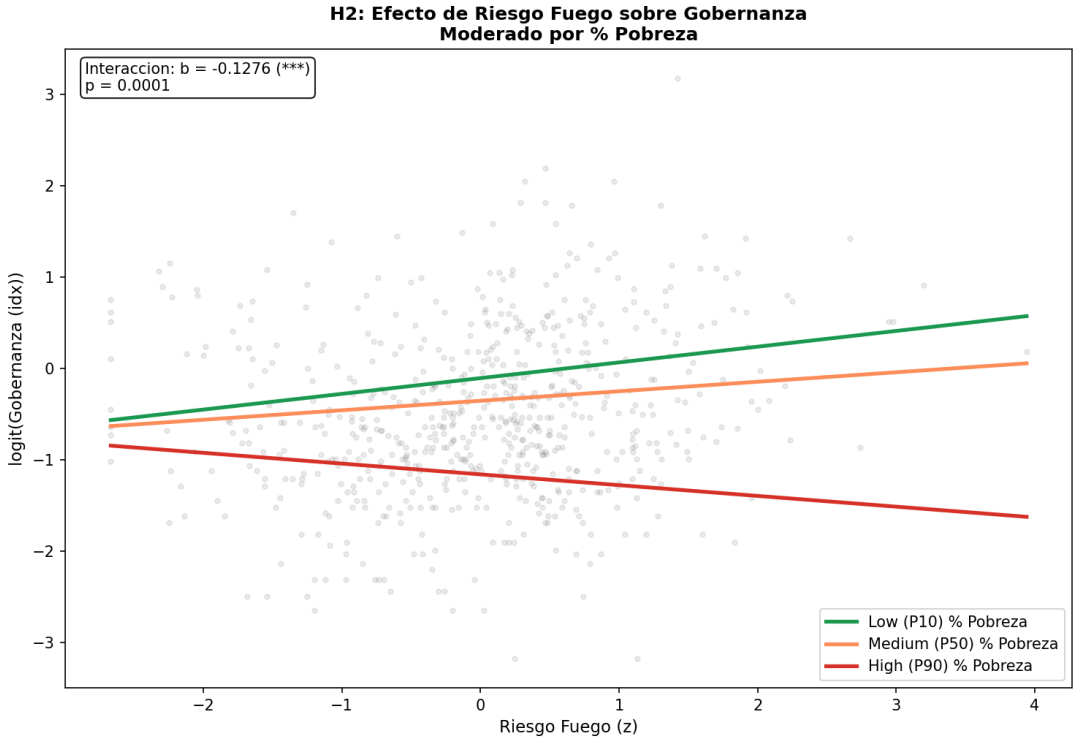


- Vulnerability is consistently less represented in CAP
- Climatic risk increases are consistently associated with CAP
- Health emergences has mixing variability which relate to social or conservation contexts.

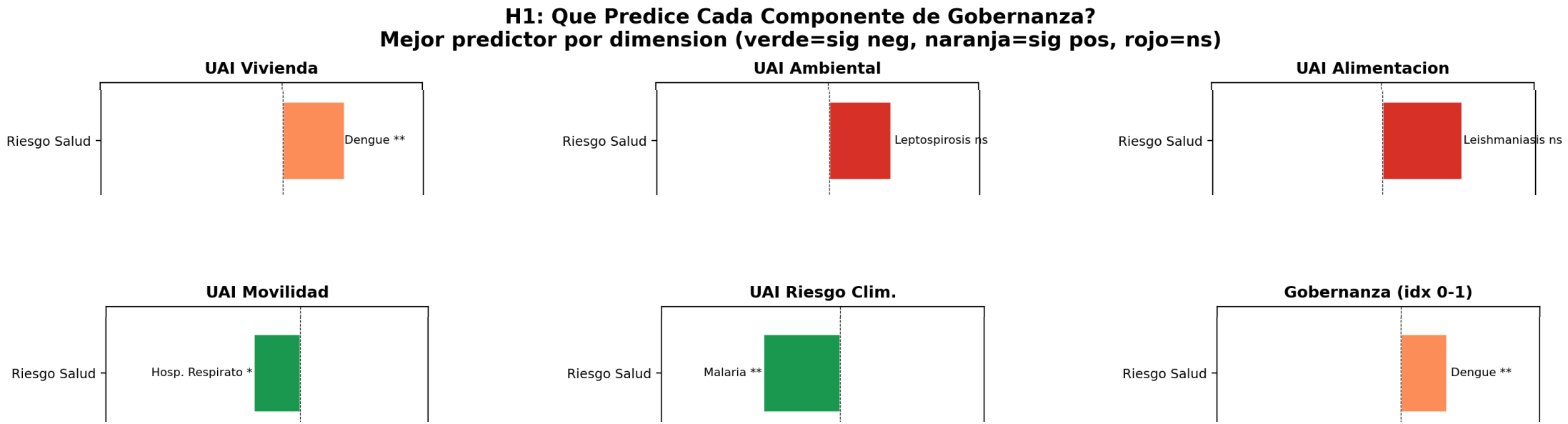
2.2) Foco em extremos climáticos e pobreza

The reactive climate adaptive policies (CAP), seems to be exclusive for municipalities that have lower proportion of poverty. Suggesting that wealthy municipalities are investing more in mitigations actions.

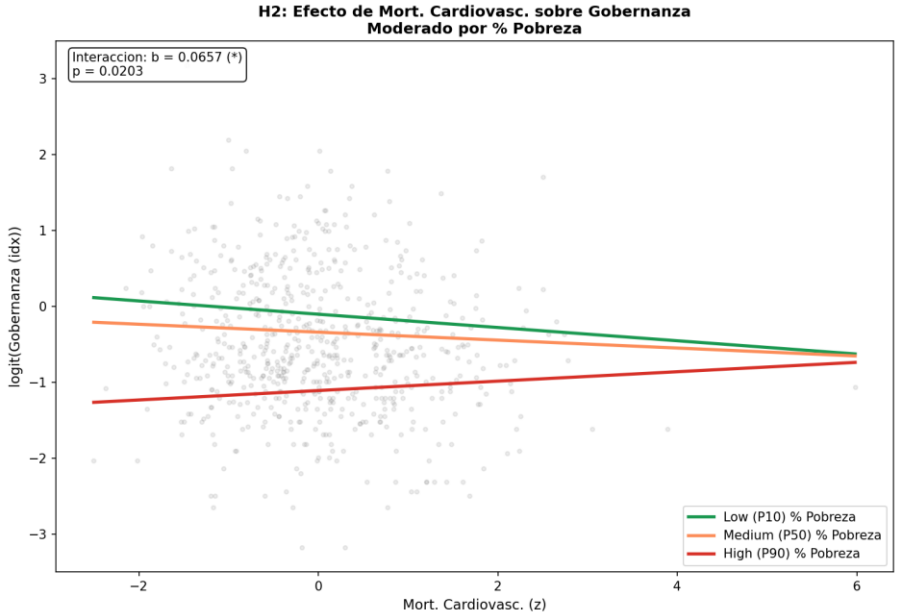




3) Foco em Saúde



Summary: Poverty consistently attenuates the effect of governance risks, except for cardiovascular mortality where it amplifies it.



More worryingly, there is a lack of climate adaptation in municipalities with higher health death due to cardiovascular disease and where population is more vulnerable.

Key messages:

1. Paradox of government

More policies -> more risks (reactive, not preventive)

2. Paradox of poverty

The most vulnerable -> less adaptive capacity

3. Paradox of conventional agriculture

More pollination deficit -> higher food security governance

Paradox related questions:

1) For some disease like malária, forest cover tends to increase its incidence, how can we deal with such trade-offs?

2) If municipalities with higher climatic risk have better governance have a , does it mean that good governance structure is in place? Can we change from reactive to preventive policy making?

3) Thinking of positive outcomes, in terms of reducing vulnerability, which are key aspect that you would like to pay attention to and why.

Connection to Day 1: Link the most contested/consensual themes from the Q-Methodology exercise to the empirical patterns found in the data.

Goal: Confront participants' mental models with empirical evidence. Bridge the gap between Day 1 (how evidence SHOULD be used) and Day 2 (HOW evidence looks in practice).

When categorizing the municipalities according to the nexus assessment

Q1 – Optimal - Potential policy gap (108 municipalities, 13%)

low climatic risk, low vulnerability. -> Preventive actions

Q2 – Risk - Mitigate (214 – 73% of the population)

high climatic risk, low vulnerability -> check CAP – improve preventive actions

Q3 – Critical - high climate Injustice (119 – 11%)

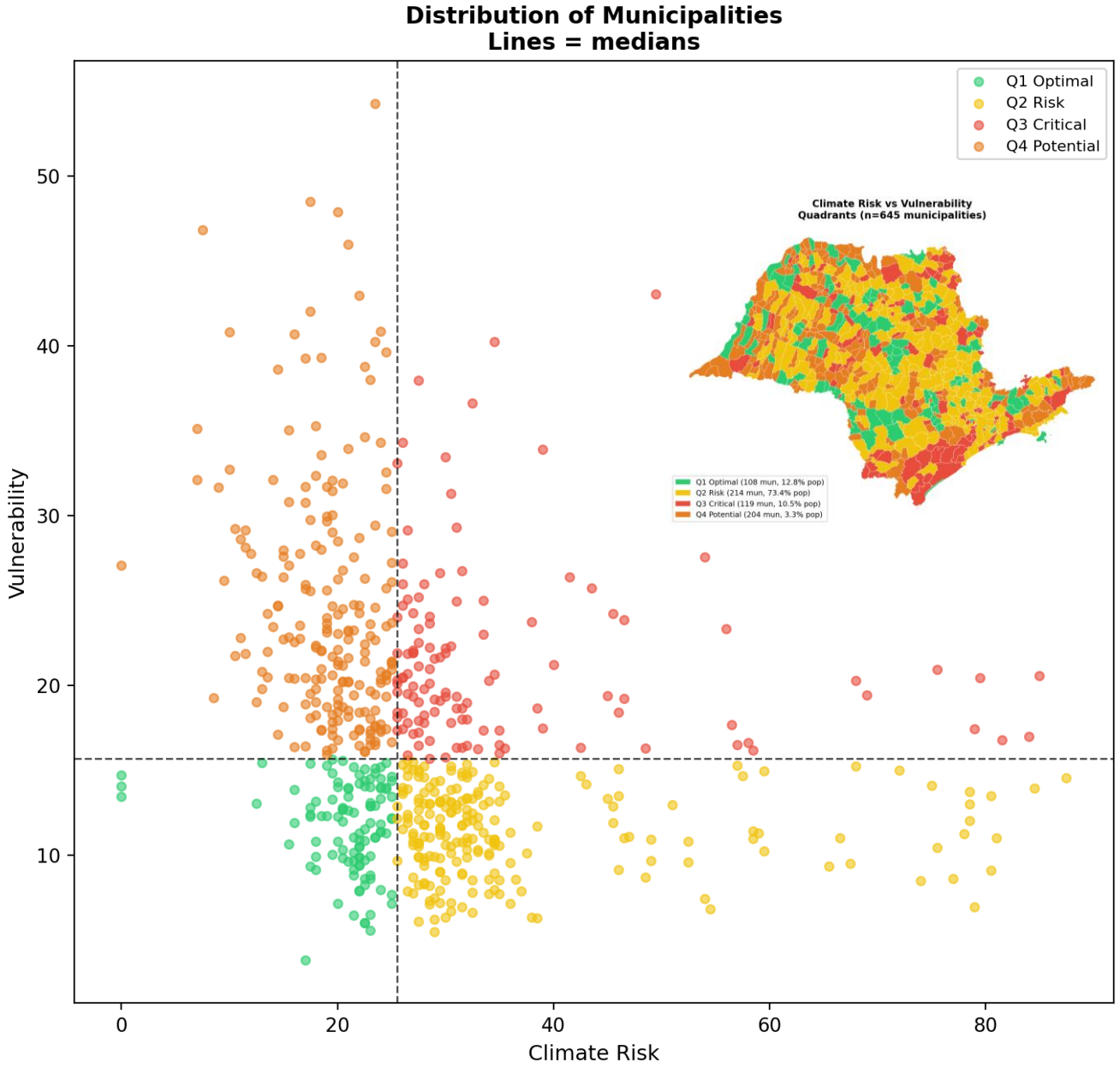
high climatic risk, high vulnerability. -> Improve social policies

Q4 – Potential – Furure development (204 – 3%)

low climatic risk, high vulnerability. -> Intervine future developmental threat

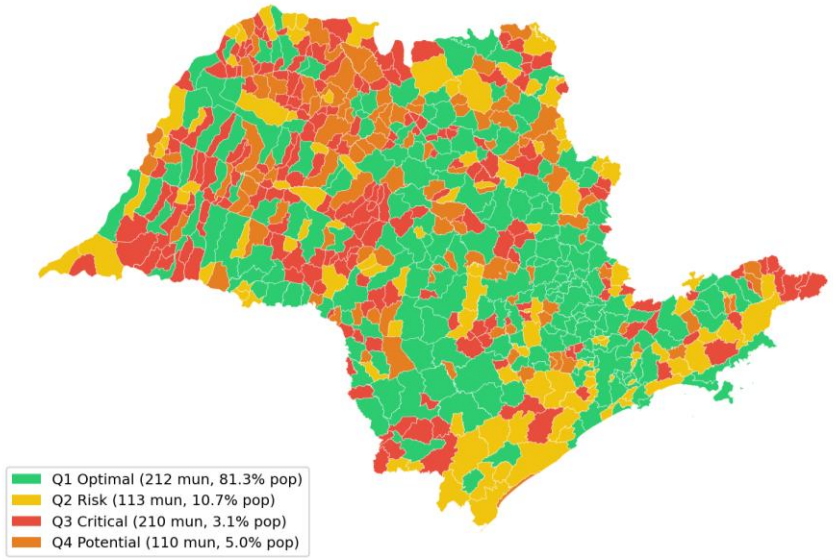
204 municipios en Q3:

Invisibles para politicas reactivas

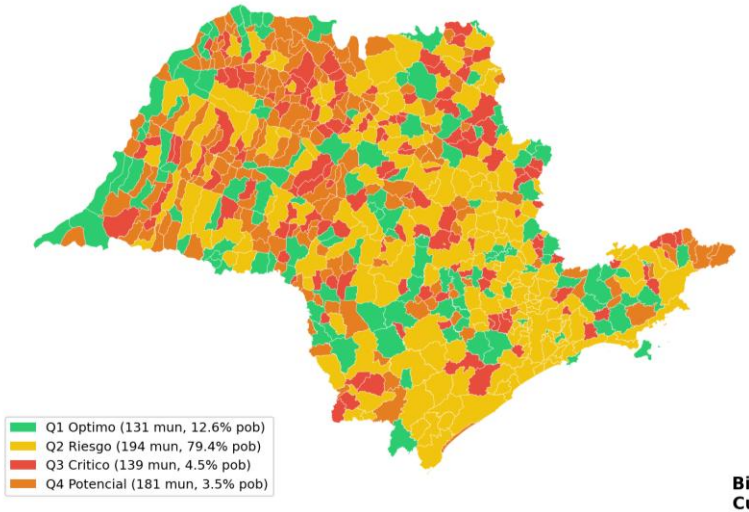


When categorizing the municipalities according to the nexus assessment

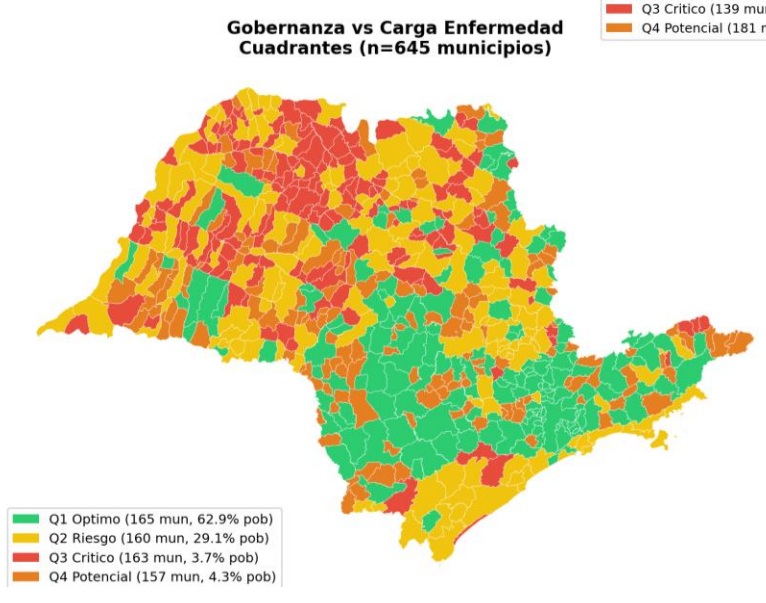
Vulnerability vs Governance Quadrants (n=645 municipalities)



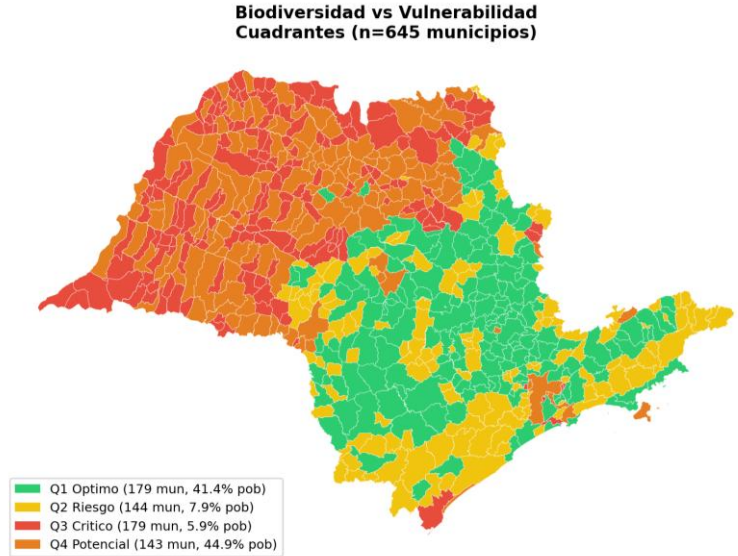
Gobernanza vs Riesgo Climatico Cuadrantes (n=645 municipios)



Gobernanza vs Carga Enfermedad Cuadrantes (n=645 municipios)



Biodiversidad vs Vulnerabilidad Cuadrantes (n=645 municipios)



How can we promote proactive policies?

1. Identify policies that address several risk
2. Strong climate injustice presence which needs to be minimized
3. Biodiversity as a key asset to address health issues and climatic hazards

Extra activities

Just to keep in mind

Day 3: 26th of February 2026 OR Alternative activity for the second part of Day 2

Activity 3: "Layering the Crisis — Hotspot Identification"

Time: ~60 minutes

Format: Small groups with large-scale maps

Description: Building on Day 2 insights, participants work with three overlapping layers:

1. Climatic Hazard (flood zones, fire risk)

2. Biodiversity / Pollination (the protective "green infrastructure")

3. Socio-economic / Health Vulnerability (the human impact)

Task: Find "Hotspots" where all three layers overlap.

Example: A municipality with high flood risk + low pollination services (lost natural drainage) + high socio-economic vulnerability.

Key Question: "How does biodiversity loss specifically worsen the health outcomes in this specific municipality?"

Activity 3.2: "The Adaptation Sprint — Co-Producing Policy Narratives"

Time: ~60 minutes

Format: Mixed groups (1 researcher + 2-3 policymakers)

Description: Using a specific "Hotspot" identified in Activity 3.1, each group drafts: *one policy intervention*:

Group	Focus	Task
A — Nature-based	Green infrastructure	How can we use pollination/biodiversity data to justify a "Green Corridor" that reduces heat islands?
B — Health/Social	Vulnerability reduction	How can we use vulnerability data to prioritize mobile health clinics in high-hazard zones?
C — Governance	Institutional strengthening	How can governance data identify which municipalities need capacity building?
D — Integrated	Multi-sector	Design an intervention that addresses climate + health + biodiversity simultaneously

Constraint: Each group must define the "Evidence Requirement" — what exact data do they need to convince a mayor or a treasury official?

Output: One-page policy brief per group.

Activity 3.3: "Designing the PEARC Feedback Loop"

Time: ~45 minutes

Format: Plenary co-design

Description: The group designs a protocol for how USP will provide ongoing data updates to the Secretariat, ensuring engagement doesn't end when the workshop does.

Design questions:

- What indicators should be monitored regularly?

- How often should data be updated?

- What format is most useful (dashboards, reports, alerts)?

- Who should have access?

- How to ensure municipal-level relevance?

Output: A "Terms of Engagement" document (e.g., monthly data briefings, shared dashboards, or "policy-ready" summaries).