

Summer Undergrad. Research Presentation

Evaluating the Impacts of Affordable Housing on Physical Activity, Health, and Climate Resilience in Brazil

Ongoing project (Jan 2025- Dec 2025)
Funded by the Global Incubator Seed Grants program

PI: Rodrigo Siqueira Reis

Mentors: Milena Franco Silva and Yi Wang

Undergraduate student: Ellie Hockman

Primary Objective

To co-create a research framework to evaluate the health and climate resilience impacts of Brazil's "**Minha Casa Minha Vida**" (MCMV) affordable housing program.



About the MCMV Program in Brazil

What is it?

A large-scale federal housing program in Brazil, launched in 2009, aimed at reducing the housing deficit by providing affordable housing to low- and middle-income families.

Who funds it?

Primarily funded by the Brazilian federal government, with financial support from public banks like *Caixa Econômica Federal*.

Who benefits?

Prioritized families earning up to 3 minimum wages (about USD \$700/month), especially those in precarious housing conditions or informal settlements.



About the MCMV Program in Brazil



What are the goals?

Reduce the housing deficit, promote social inclusion, and stimulate the economy and construction sector

How does it work?

The government subsidizes construction and offers favorable financing so families can purchase homes with low monthly payments.

Scale and reach: Over 6 million housing units contracted across Brazil since its launch.

Challenges and criticisms: Peripheral locations with limited access to jobs, services, and transit; poor construction quality and standardized design; missed opportunities for urban integration and climate resilience

Aim 1

Develop a comprehensive framework to evaluate the MCMV's impact on climate resilience and health outcomes in participating communities.

Milestone 1

Systematic Review – Mentor Milena

Conduct a **systematic review** within affordable housing programs in Brazil, focusing on how they influence health outcomes and climate resilience

Milestone 2

Spatial Mapping – Mentor Yi

Create a **Geographic Information Systems**-based database to map climate-related risks across MCMV sites, identifying climate vulnerability hotspots and their intersection with socioeconomic factors, to inform targeted interventions within MCMV communities

Milestone 1

Peer-reviewed articles

To systematically synthesize peer-reviewed evidence on the health outcomes associated with affordable housing programs in Brazil. It also explores the connections between these outcomes and climate-related exposures, clarifying how environmental factors may interact with housing conditions to influence health

n = 6 articles

Grey literature

To systematically synthesize evidence from grey literature sources to explore health outcomes, accessibility, and spatial segregation linked to the MCMV program, specifically.

Milestone 1

Grey literature

Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Document type	Grey literature, including dissertations, theses, full papers from conference proceedings, government documents, and program evaluations. This includes materials from NGOs and research institutes such as IPEA, IPARDES, and FIOCRUZ.	Editorials, Letters to the Editor, Opinion papers, Magazine articles, Books and book chapters, Book reviews, Posters and conference abstracts, Study protocols, and Research-based commentaries.
Study design	RCTs, quasi-experimental, cohort, case-control, cross-sectional, ecological, case reports, natural experiments.	Theoretical studies, text and opinion, systematic reviews and meta-analysis
Timeframe	From 2009 to 2025	Before 2009
Language	English, Portuguese, Spanish	Other languages that not English, Portuguese or Spanish
Population	No population restriction	No population restriction
Setting	Brazil	Any other setting that not Brazil or studies that include Brazil in their analysis together with other settings but do not focus specifically in Brazil
Outcome	Clearly document the health outcomes experienced by residents of the MCMV program, their accessibility , or any spatial segregation associated with the program's location.	<ul style="list-style-type: none">- Do not specifically document health outcomes, accessibility, or spatial segregation as they relate to residents of the MCMV program.- Focus exclusively on describing the programs themselves, including details such as the target population, the estimated number of units constructed, or future investments
Exposure	Explicitly have the MCMV program as the exposure variable	Do not explicitly consider the MCMV program as the exposure variable

Milestone 1

Grey literature

Keywords utilized in each database

1. MCMV and its variations
2. Health outcomes

Brazilian databases

National events/conferences

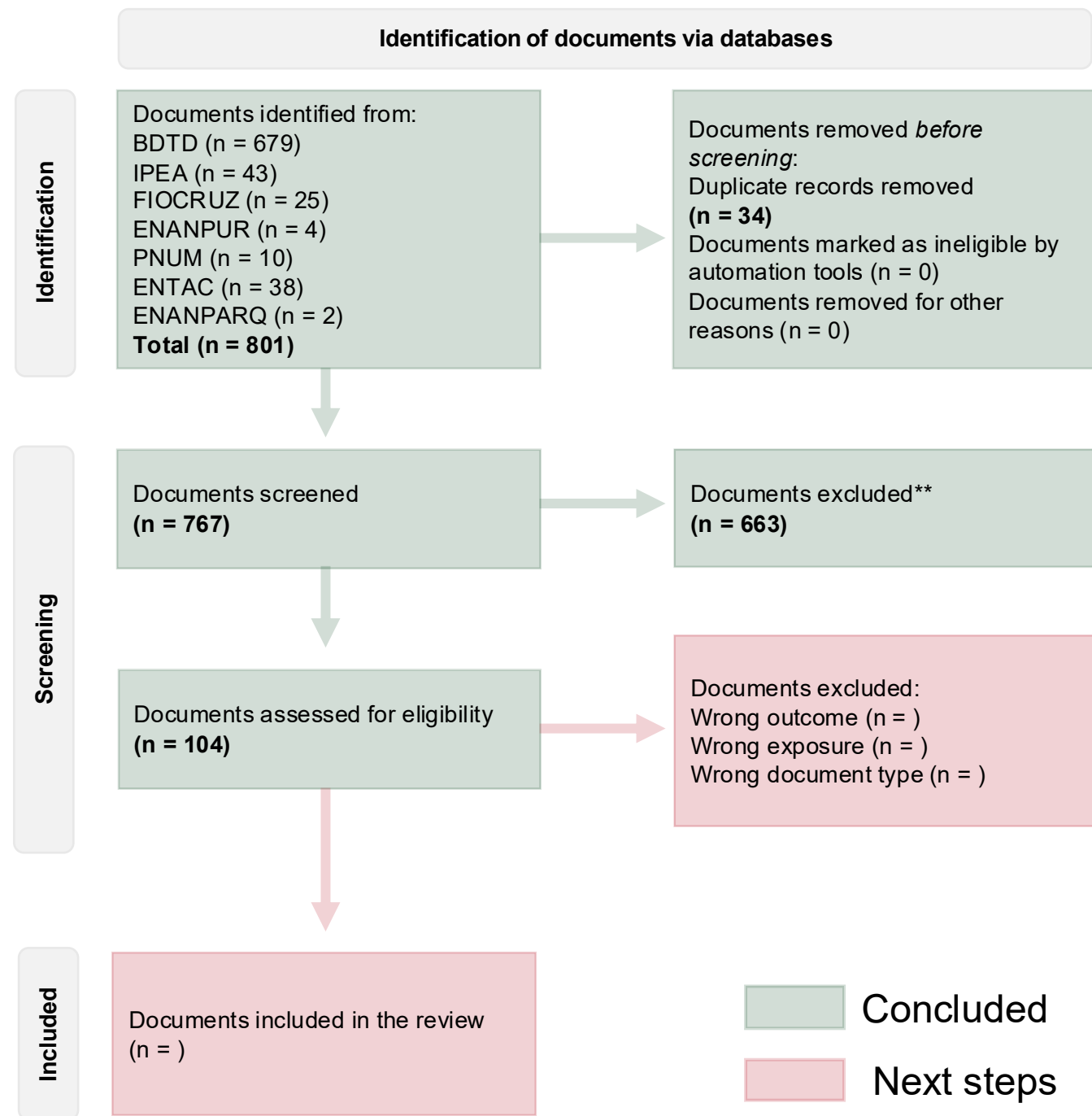
Databases	Keywords
BDTD	"My House My Life" OR "MCMV" OR "PMCMV" OR "Minha Casa, Minha Vida" AND "Wellness" OR Wellbeing OR "Well being" OR "Functional Status" OR Health OR Healthcare OR HRQOL OR "Life Quality" OR "Quality of Life" OR Addiction OR Alcoholism OR "Drug abuse" OR "Substance abuse" OR "Substance dependenc*" OR "Drug dependenc*" OR "Substance related disorders" OR Anxiety OR "Bipolar disorder" OR "Bipolar disorders" OR Depression OR "Eating disorders" OR "Mental disorders" OR "Mental Hygiene" OR "Psychological disorders" OR "Psychosocial Functioning" OR Obesity OR "Physical Inactivity" OR "Sedentary Behavio*" OR "Sedentary Lifestyle" OR "Sedentary Life style" OR "Active mobility" OR "Active transport*" OR "Active commut*" OR "Active travel" OR Bicycling OR Biking OR "Endurance Training" OR Exercise OR Exercises OR Exercising OR Fitness OR "High-Intensity Interval Training" OR "Physical Activities" OR "Physical Activity" OR "Physical conditioning" OR Pedestrians OR "Sport*" OR Walkability OR Walking OR Running OR "Chronic Condition" OR "Chronic Conditions" OR "Chronic Disease" OR "Chronic diseases" OR "Chronic fatigue syndrome" OR "Chronic Illness" OR "Chronic Illnesses" OR "Chronically Ill" OR "Non-communicable disease" OR "Non-communicable diseases" OR "Non-infectious Disease" OR "Non-infectious Diseases" OR "Noncommunicable Disease" OR "Noncommunicable Diseases" OR "Noninfectious disease" OR "Noninfectious Diseases" OR "Post-Lyme Disease Syndrome" OR Diabetes OR "Diabetes mellitus" OR "kidney disease" OR "kidney diseases" OR "kidney failure" OR "Renal Insufficiency" OR "Cardiac Disease" OR "Cardiac Diseases" OR "Cardiac Disorder" OR "Cardiac Disorders" OR "Cardiac Event" OR "Cardiac Events" OR "Cardiovascular Disease" OR "Cardiovascular Diseases" OR "Coronary Disease" OR "Coronary diseases" OR "Cerebral Infarction" OR "Cerebrovascular Accident" OR "Cerebrovascular Accidents" OR "Cerebrovascular disorder" OR "Cerebrovascular disorders" OR CVA OR CVAs OR "Heart Disease" OR "Heart Diseases" OR "Heart Disorder" OR "Heart Disorders" OR "Heart Failure" OR "High blood pressure" OR "High cholesterol" OR "Heart Arrest" OR "Heart attack" OR "Heart attacks" OR Hypertension OR "Myocardial infarction" OR "Myocardial infarctions" OR "Myocardial Ischemia" OR "Stroke" OR "Strokes" OR Cancer OR Cancers OR Malignancies OR Malignancy OR Neoplasm OR Neoplasms OR Asthma OR "Respiratory Tract Diseases" OR "Chronic Obstructive Airway Disease" OR "Chronic Obstructive Lung Disease" OR "Chronic obstructive pulmonary disease" OR "Chronic Obstructive Pulmonary Diseases" OR "Chronic respiratory diseases" OR COAD OR COPD OR "Pulmonary Disease" OR "pulmonary diseases" OR COVID OR "COVID19" OR "Novel coronavirus" OR "SARS-COV-2" OR Malnourish* OR Malnutrition* OR Nutrient* OR Nutrition* OR Undernutrition* OR "Environmental Exposure" OR "Environmental Exposures" OR "Pesticide Residue*" OR Pollution OR Death OR "Fatal Outcome" OR "Fatal outcomes" OR "Fatality Rate" OR "Survival Rate" OR Morbidity OR Mortality OR "Suicide" OR "Population Surveillance" OR "Epidemiology" OR "Epidemics" OR "Disease outbreaks" OR "Disease transmittion*" OR "Disease transmission*"
IPEA	"Minha Casa, Minha Vida"
FIOCRUZ	"Minha Casa, Minha Vida" AND "Health"
ENANPARQ	"MCMV" OR "Minha Casa, Minha Vida"
ENANPUR	"MCMV"
ENTAC	"MCMV" OR "Minha Casa, Minha Vida"
PNUM	"MCMV" OR "Minha Casa, Minha Vida"

Milestone 1

Grey literature

Preliminary results

- First screening (abstracts and titles/executive summaries) = **767 documents**
- Second screening (full text) = **104 documents**



Milestone 1

Grey literature

Screening process on Rayyan

The screenshot shows the Rayyan screening interface for a project titled "MCMV Grey Literature Review". The interface is divided into several sections:

- Navigation:** Includes "Overview", "Review Data", "Screening" (active), and "Full Text Screening".
- Document List:** A list of 5 articles, each with a checkbox, a status (e.g., "Included"), a date, and a green checkmark with the name "Ellie".
- Document Details:** A large view of the selected document, showing the title, author, publication type (RPRT), journal information, and Rayyan Reference ID (264047704). It also includes a "Search Methods" section with buttons for "Include", "Maybe", "Exclude", and "Exclude with Re...".
- Filters:** A sidebar on the right with "Keywords for include" and "Keywords for exclude" sections, both currently empty.
- Chat:** A vertical chat window on the left labeled "Chat with ResearchPilot™ Beta".
- Header:** Includes a search bar, an "Upgrade" button, and various utility icons.

Annotations in blue highlight key areas:

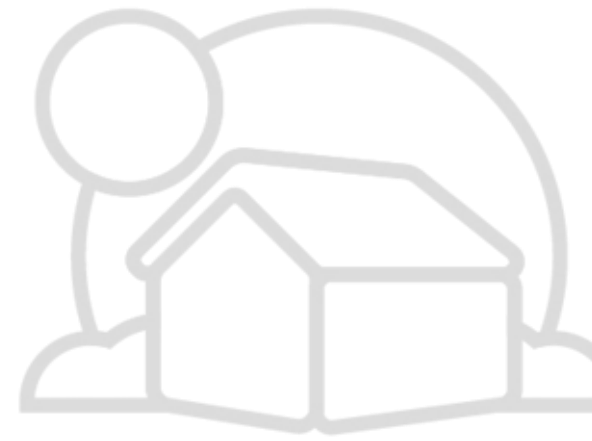
- Documents:** Points to the list of articles on the left.
- Documents Details/ information:** Points to the detailed view of the selected document.
- Decisions:** Points to the "Include", "Maybe", and "Exclude" buttons at the bottom of the document details.

Milestone 2. Building a Geo-Spatial Database for MCMV projects

Yi Wang

Postdoctoral Research Associate

School of Public Health, Washington University in St. Louis



The Gap: No Nationwide GIS Database on MCMV

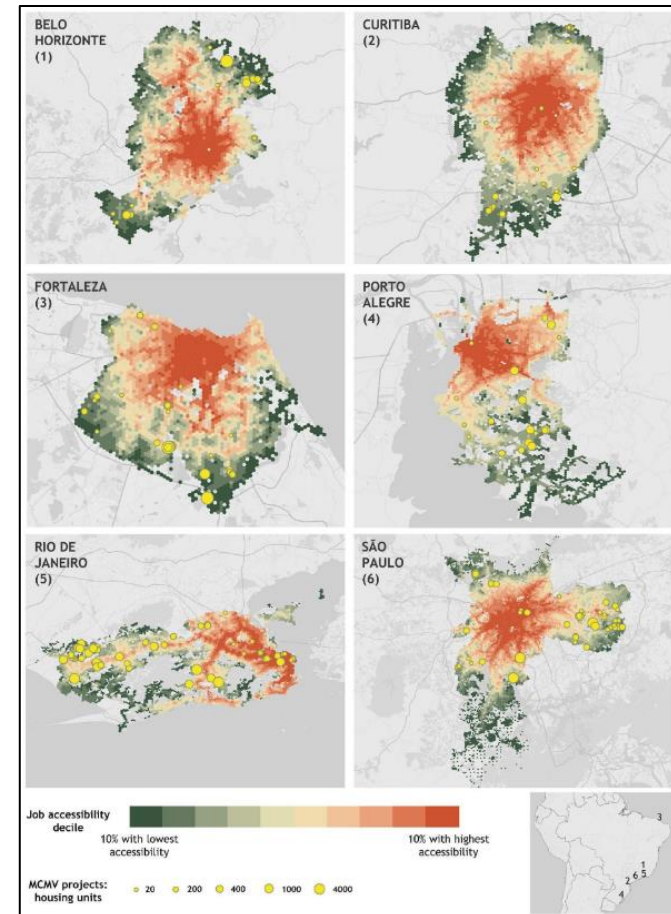
Existing Studies mostly focus on large cities

Minha Casa Minha Vida (MCMV), Access and Mobility: A Case for Transit-Oriented Low-Income Housing in Rio de Janeiro

Working Paper WP18LN1

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Institute for Transportation & Development Policy (ITDP)

Clarisse Linka
Institute for Transportation & Development Policy (ITDP)



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Social housing and accessibility in Brazil's unequal cities

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Only 9% of the MCMV projects are in large cities

Much remains unknown about MCMV projects in smaller cities

City Type	# of MCMV Projects	%	# of MCMV Units	%
Metropolis	363	9%	159,956	12%
Regional Capital	993	25%	396,591	30%
Sub-Regional Center	923	23%	298,620	23%
Zone Center	183	5%	41,284	3%
Local Center	1,492	38%	422,089	32%
Total	3,954	100%	1,318,540	100%

Note: Include MCMV Faixa 1 Projects between 2009 and 2019.

Goals of Milestone 2

- **To geocode all MCMV projects in Brazil**
- **Link the geocoded projects w/ demographic & climate data**

Data Sources

- MCMV Data from the Ministry of Cities (Textual Description of Project Location)
- Demographic Data from Brazilian Census (2010 & 2022)
- Climate Data from multiple sources
 - Xavier, A. C., Scanlon, B. R., King, C. W., & Alves, A. I. (2022). New improved Brazilian daily weather gridded data (1961–2020). *International Journal of Climatology*, 42(16), 8390–8404. <https://doi.org/10.1002/joc.7731>
 - Zeri, M., Cunha, A. P., Cunningham, C., Guedes, M., & Costa, L. (2024). *A long-term database of the Integrated Drought Index for Brazil from 2003 to 2023. 1.* <https://doi.org/10.17632/dd95bhn7mh.1>
 - Andela, N., & Jones, M. W. (2024). *Update of: The Global Fire Atlas of individual fire size, duration, speed and direction* [Dataset]. Zenodo. <https://zenodo.org/records/11400062>

Geocoding MCMV Addresses

Converting a textual description of a location into coordinates

Input

'Condomínio Crixas 1, São Bartolomeu - São Sebastião, Brasília - DF, Brazil'



Google Maps Platform

+



python™

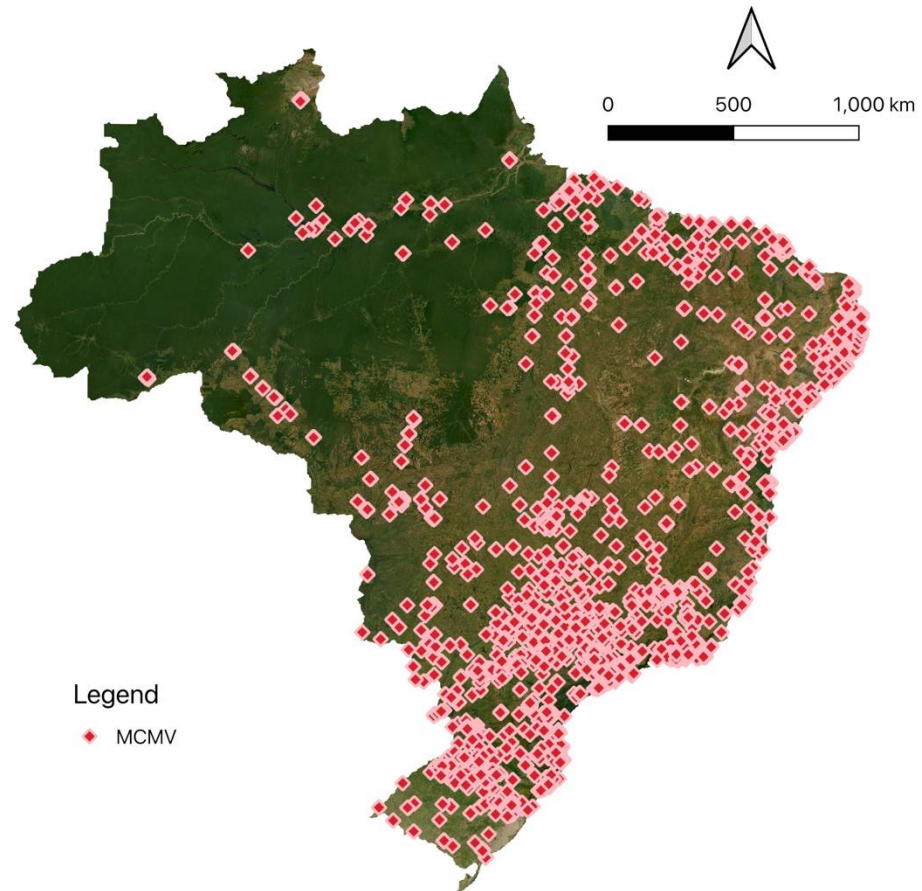
Output

{'lat': -15.9187392, 'lng': -47.7603738}

Geocoding MCMV Addresses

We geocoded 3,954 MCMV projects (2009-2019)

- Over 1.3 million affordable housing units



However, Geocoding is not always accurate. 😞

Poor quality textual address input leads to inaccurate coordinate results

Accurate Geocoding



Inaccurate Geocoding

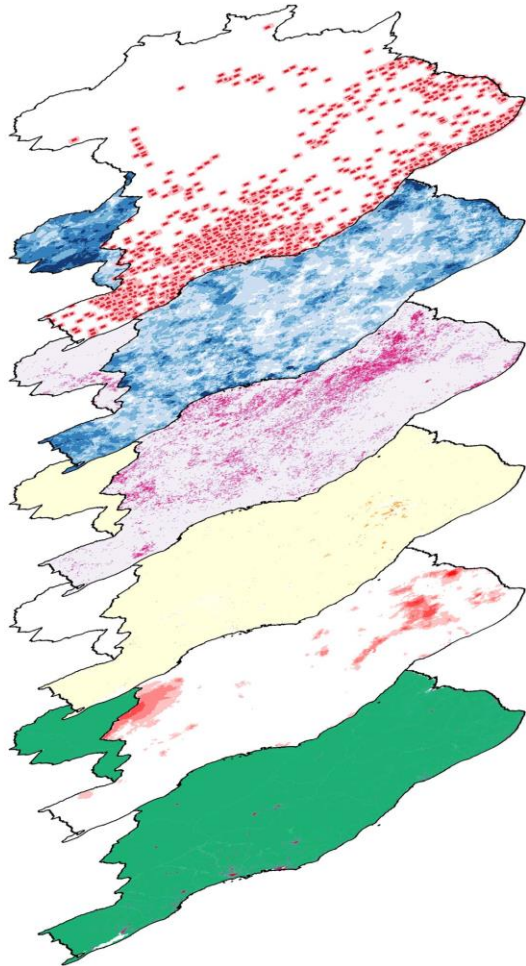
- Default to Town/City/Street Centroid
- In this study, we consider any geocoded points that are >100 meters (0.06 miles) away from the actual MCMV site to be inaccurately geocoded.

Geocoding Verification & Manual Correction

Previous sampling and verification indicate an accuracy rate of ~50%

- Ellie is leading the work on geocoding verification and correction.
- **Our goal is to improve the geocoding accuracy rate to 85%**, which is the minimum acceptable level for spatial analysis (Andresen et al., 2020; Ratcliffe, 2001).

Integrating Climate Data



MCMV projects (2009-2019)

Extreme Precipitation Days (2009-2023)

Wildfire Occurrences (2009-2023)

Extreme Drought Months (2009-2023)

Extreme Heat Days (2009-2023)

Urban-Rural Categorization (2022)

Next Steps

Once we hit the 85% geocoding accuracy rate

- Link MCMV projects to climate and demographic data
- Identify climate vulnerability hotspots and their intersection with socioeconomic factors, to inform targeted interventions within MCMV communities.