Vacant Properties and Emergency Snow Route Coverage: Assessing Neighborhood Risk and Service Accessibility in Syracuse

Project Title and Summary

This project analyzes how vacant property concentration intersects with emergency snow route coverage across Syracuse neighborhoods. By integrating the City's Vacant Properties dataset with Emergency Snow Routes and geographic boundary data, the project aims to identify neighborhoods where housing vacancy and winter service accessibility may compound risk. The resulting analysis will help residents, city officials, and community organizations better understand spatial inequities in infrastructure readiness and inform more targeted planning for winter response, housing stabilization, and neighborhood resilience.

Problem Statement

Syracuse experiences severe winter weather that places significant demands on city infrastructure, emergency response, and resident mobility. Emergency snow routes are critical corridors prioritized for snow removal to ensure access for emergency services, transit, and essential travel. At the same time, neighborhoods with high concentrations of vacant properties may face additional challenges, including reduced informal oversight, increased safety concerns, and delayed recovery following severe weather events.

This   project   asks:
How do vacant property patterns align with emergency snow route coverage across Syracuse neighborhoods, and are there areas where high vacancy coincides with limited prioritized winter access?

Answering this question matters because it highlights potential compounding vulnerabilities. City officials can use these insights to evaluate whether winter service prioritization aligns with neighborhood needs. Community organizations can better advocate for infrastructure improvements, and residents gain transparency into how critical services intersect with neighborhood conditions during extreme weather.

Data Sources

Primary Datasets

- **Vacant Properties (Vacant_Properties.csv)**

    o   Property-level vacancy indicators with city-wide geographic coverage

    o   Suitable for aggregation at neighborhood or census tract level

    o   Limitation: limited information on vacancy duration or cause

- **Emergency Snow Routes (Emergency_Snow_Routes.csv)**

    o   Road segments prioritized for snow removal during emergencies

    o   Strong operational relevance for winter accessibility and safety

    o   Limitation: does not capture service quality or response time

Supporting Datasets

- **Neighborhood or Census Tract Boundaries**

  o Used for spatial aggregation and comparison

- **311 Service Requests (optional)**

  o Provides contextual insight into winter-related or infrastructure complaints

- **Code Enforcement Violations (optional)**

  o Adds housing condition context to vacancy patterns

External Data (if incorporated)

- **American Community Survey (ACS)**

  o Used for population normalization and neighborhood context

Technical Approach

The analysis will be conducted using Python, leveraging pandas for data processing and geopandas for spatial analysis. Vacant properties will be geocoded and aggregated by neighborhood or census tract. Emergency snow routes will be spatially overlaid to calculate metrics such as route density, proximity of vacant properties to prioritized corridors, and neighborhood-level coverage ratios.

LLM augmentation will be applied in a controlled and validated manner. Large language models will be used to synthesize complex spatial findings into clear, plain-language explanations for non-technical audiences and to assist in summarizing neighborhood-level patterns. All LLM-generated narratives will be validated against quantitative metrics and reviewed manually to ensure accuracy, neutrality, and responsible interpretation.

Deliverable Description

The final deliverable will consist of:

- **An interactive dashboard** featuring:

  o Maps of vacant properties and emergency snow routes

  o Neighborhood-level indicators combining vacancy concentration and route coverage

  o Comparative visualizations highlighting potential risk areas

- **A written analytical report** detailing data sources, methodology, findings, limitations, and policy-relevant insights.

These deliverables will be designed to be understandable, reusable, and suitable for inclusion on the Syracuse Open Data projects page.

Success Criteria

- Clear identification of neighborhoods where high vacancy coincides with limited snow route coverage

- Accurate and interpretable geospatial visualizations

- Transparent documentation of assumptions and data limitations

- Responsible and validated use of LLM-assisted interpretation

- Insights that plausibly inform winter preparedness, infrastructure planning, or community advocacy

Timeline

Week 1

- Validate Vacant Properties and Emergency Snow Routes datasets

- Clean and preprocess spatial data

- Perform exploratory spatial joins and coverage analysis

Week 2

- Compute neighborhood-level metrics and comparative indicators

- Apply LLM-assisted summarization and interpretation

- Build dashboard visualizations

- Draft and finalize analytical report

Risks and Mitigations

- **Spatial misalignment between datasets**

    o Mitigation: validate joins visually and through summary statistics

- **Overinterpretation of overlap patterns**

    o Mitigation: avoid causal claims and frame findings as risk indicators

- **Incomplete vacancy or route data**

    o Mitigation: focus on relative comparisons and document gaps

- **LLM narrative drift or bias**

    o Mitigation: ground all narratives in quantitative results and human review