Assessing Community's Post-Disaster Social Fabric associated with Home Buyout Program

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BACKGROUND

Flood hazards has always been serious concern to human and society. Adopting effective flood mitigation strategy for flood-prone area plays an important role in preventing future flood damage as well as increasing resilience to local residents. Home buyout programs have been implemented in the U.S. to reduce risks in vulnerable places by facilitating relocation of people and property away from hazardous areas (Greer and Binder, 2017). While buyouts are becoming more and more common as a tool in post-disaster recovery efforts, relatively little research has been conducted on investigating either the buyout process or its myriad effects on individual participants, households, and affected communities (McGhee et al., 2020). In this project, we use **Nashville 2010 flood event** to study home buyout program's impact on community's post-disaster social fabric.

The aim of this project was to simulate and estimate the extent to which buyouts may actually negatively affect community resilience using Nashville 2010 flood event.

Research Questions:
1) Does Home buyout program affect local community's post-disaster social vulnerability significantly?
2) How does Home buyout program affect local community's post-disaster social vulnerability?
3) Is Home buyout program's impact on local community's post-disaster social vulnerability related to spatial scale?

Hypothesis:
Home buyout program makes people relocate for the sake of individual's safety, however, negatively affects the social fabric and resilience from a community's perspective. When enough residents leave, the social fabric of the community can break down, the tax base for supporting schools and maintain infrastructure also leaves. In rural communities, this loss of community members can be significant, but elevating structures or relocating residents to maintain the community is often overlooked.

OBJECTIVES

1. Constitute social fabric score using variables that are align with our study context to numerically tract the social fabric identity of community.
2. Provide information to evaluate home buyout program's influence on community's post-disaster social fabric:
- Map the social fabric scores in the year of 2010 and after 2018 in a census tract scale.
- Map the social fabric scores in the year of 2010 and after 2018 in a census block scale.
3. Compare the social fabric score of pre-event and post-event (2010 and 2018) from two spatial scales: census tract and census block.

METHODS

I. Social Fabric Score (sfs): *a hybrid method of combining SoVI recipe and selected variables aligned with study scope*
- In this project's context, social fabric is understood as people's beliefs and sentiments in a community, including:
- **A sense of belonging and identification with a particular social unit;**
- **A sense of social justice and equity, particularly in government policies;**
- **A willingness to participate in shared activities, and possibly undertake voluntary work;**
- **Attitude of acceptance towards minorities and newcomers;**
- **A sense of safety and security;**
- **A sense of life satisfaction, happiness, and positive future expectations**

II. Example of variables selected
- **Demographic Diversity:** % racial/ethnic makeup, % disable population, % female population
- **Family Composition:** % single parent families, % single person households
- **Community Economic Finances:** annual revenue, annual debt
- **Community Identity, cohesion and engagement:** # resident participation in community-wide event
- **Socially Organized:** # community-wide events per year

III. Principal Component Analysis (PCA) and Cadastral-based Dasymetric Mapping

Principal component analysis (PCA) is used to reduce the dimension of the social fabric score variables data frame and construct our own social fabric score. Varimax rotation and Kaiser criterion is used for component selection and determination. We use Nelson et al. (2015) cadastral-based dasymetric mapping approach to assess the social fabric score at a higher spatial resolution (census block) to identify the impact of Home Buyout program on community's social fabric from a preciser perspective.
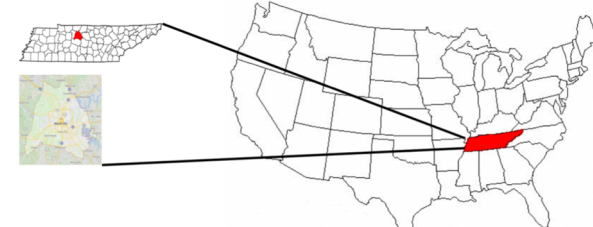

Fig.1 Study Context

Davidson county, one of the most populated counties in Middle Tennessee, was severely impacted by a 1000-year flood on May 2010. Two-day rain in some areas were greater than 19 inches (480 mm). This unprecedented heavy storm caused the Cumberland River in Nashville rise to 52 feet, marking a height previously unseen since 1937 (NWS, 2011). It is estimated that the flood caused more than $2 billion worth of damage in Davidson County.

RESULTS

Fig.2 shows the social fabric score of Davidson county in a census tract scale for pre-event (2010 year) and post-event (2018 year). Green color indicates better social fabric condition for a census tract and red color indicates worse social fabric condition for a census tract.
Fig.3 shows the social fabric score of the study area in a census block scale for pre-event (2010 year) and post-event (2018 year).

RESULTS

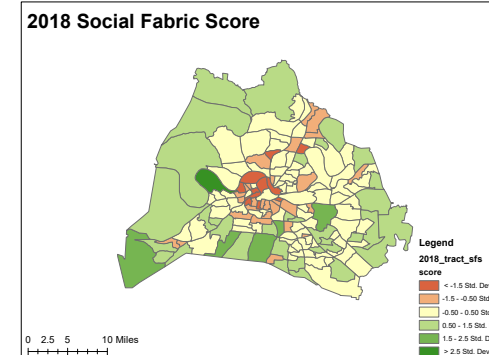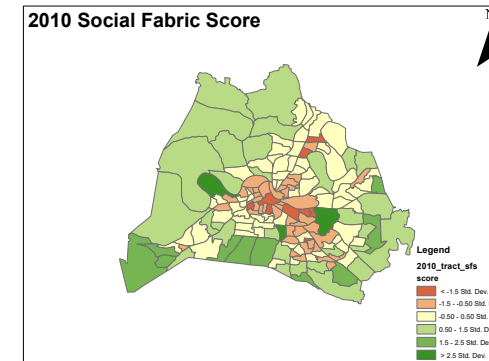**Fig.2 social fabric score comparison of Davidson county in census tract scale**
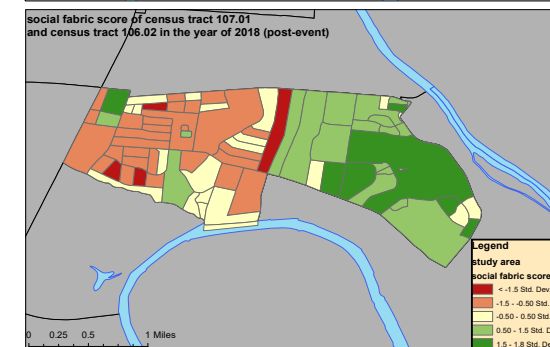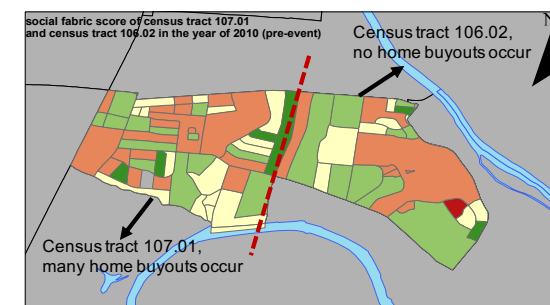

Fig.3 social fabric score comparison of study area in census block scale

DISCUSSION

In some region, the social fabric condition is getting better such as downtown area. This is because population is growing despite the 2010 flood. During the 2010 to 2018, migration is continuously coming in, enterprises build office in downtown area, these bring more people and more funds to support local community's tax base and infrastructure, thus further strengthening local community's social fabric condition. However, in some rural areas that are far away from downtown area, the social fabric condition gets worse. This is because the rural area can attract much less population and investment compared to downtown area, thus has no ability to buffer and remedy the negative effect of home buyout program that causes people to move. We can conclude that the flood hazard cause more harm to rural areas than urban areas from social fabric perspective, because urban areas have more potential means to offset the side effect of community's resilience policies and recover soon while rural areas does not have this ability. Nevertheless, from solely Fig.2 we cannot clearly see the trend of social fabric condition of Davidson county for pre-flood and post-flood, since the spatial scale is not precise enough.

In order to identify a community's social fabric condition's change for pre-flood and post-flood in a preciser scale (block scale), two census tracts are used as study area. Census tract 107.01 that is on the left side of the red dot line in Fig.3 is the tract with many home buyouts occur as study object while census tract 106.02 that is on the right side of the red dot line is the tract with no home buyouts occur as a control group. Fig.3 clearly shows that social fabric condition in census tract 107.01 decreases compared to census tract 106.02, indicating that home buyout program can negatively impact the social fabric condition of a community under the circumstance that all the other policies or community's change bring equal impact on both communities. In Fig.3, green color indicates a better social fabric condition while red color indicates a worse social fabric condition.

LITERATURE CITED

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