49

A Systems-oriented Post-event Assessment Of Community Resilience

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BACKGROUND

The damage inflicted by Hurricane Harvey on Texas coastal communities compels us to rethink their resiliency (Fig 1, Box 1). Although the existence and importance of feedbacks among the constituents of a community are acknowledged in hazard mitigation plans (*1*), there has been limited number of comprehensive assessments of these systemic interactions among residents, institutions, and infrastructure in the context of disaster preparedness and hazard mitigation.

KNOWLEDGE GAP

What are the systemic interactions among agents, institutions, and infrastructure in the context of response to, and recovery from, an extreme event?

Fig 1. Constituents of Community Resilience.

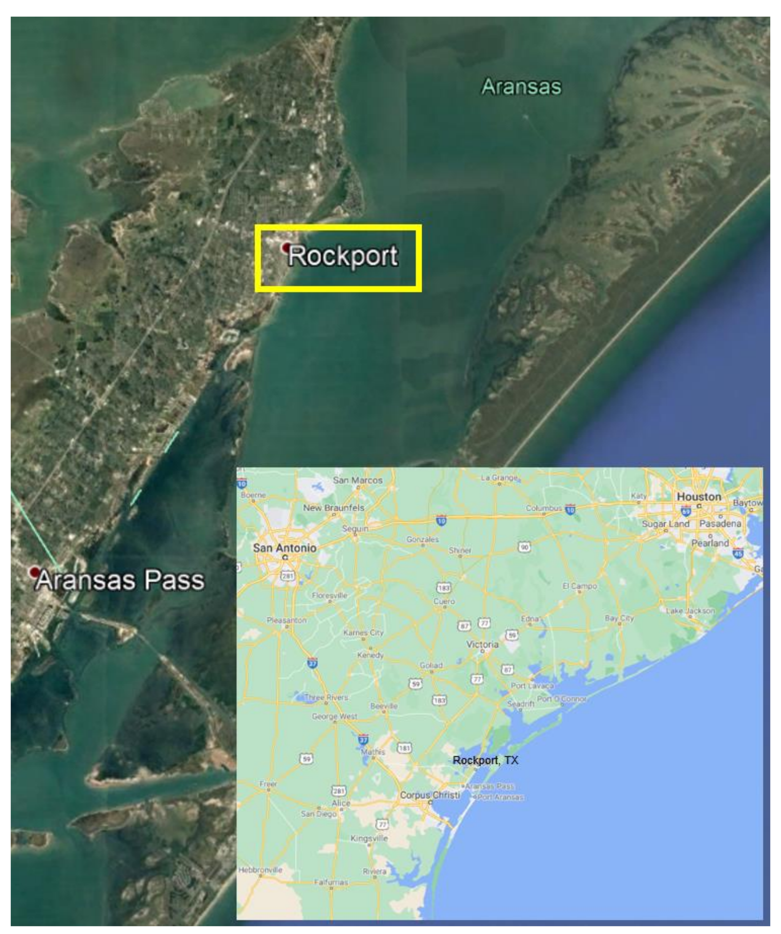

Fig 2. Rockport, Texas.

Box 1: Community Resilience

Community resilience is a measure of the sustained ability of a community to utilize available resources to respond to, withstand, and recover from adverse situations.

Fig 3.(A) Many houses sustained significant flooding damage. (B) Downed trees soon after their removal from a road. Photos by Kate de Gennaro.

ANALYTICAL APPROACH

We conduct a post-event assessment with explicit attention to feedbacks among the constituents of community resilience. We adopt a hybrid approach that meshes *i)* Post-Event Review Capability framework (2); *ii)* qualitative systems analysis using soft systems thinking (*3, 4*) to identify the most critical interactions among system components in collaboration with stakeholders; and *iii)* assessment of the state of critical infrastructure (e.g., drainage network). We implement our collaborative approach in the city of Rockport on the Texas coastal bend (Figs 2-3). We carried out initial interviews with several public officials. We conducted assessments of open roadside channels in a residential community using mobile lidar and a heuristic method was developed and used to calculate six assessment attributes. Once complete, we will share our findings from our analyses with Rockport public officials.

FINDINGS ON SYSTEMIC INTERACTIONS

- Interactions among the natural environment, built environment, and sociopolitical structure in Rockport in the aftermath of Harvey highlight various cascading effects (Fig 4).
- One cascading effect is the chain of influence from *Flooding & Wind* to *Electricity Supply* to *Power to Refrigerators* to *Food Spoilage* to *Debris* which can contribute to road closures, hampering *Transportation* (Fig 4).
- Awareness among residents is currently high but will likely decline through forgetting and the arrival of new residents with no history of the event, and complacency may go up again.

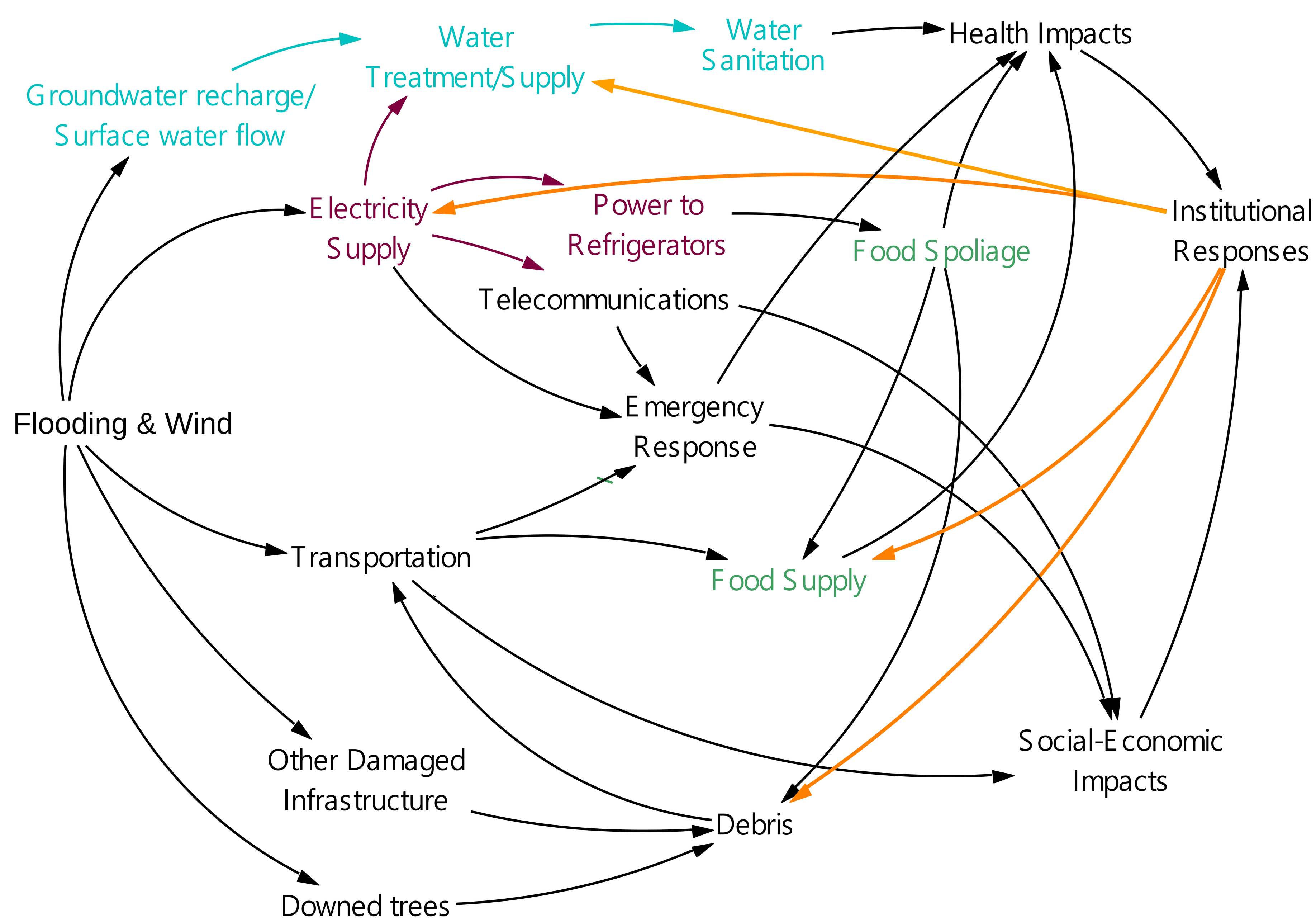

Fig 4. Systemic interactions involve water (blue), energy (maroon), and food (green) components.

FINDINGS ON CRITICAL INFRASTRUCTURE: ASSESSMENT OF DRAINAGE NETWORK

- All channel bottom widths and average lengths of pipes and culverts meet the design requirements (Figs 5-6; Table 1).
- More than half of the channels fail in longitudinal slope (Table 1).
- Most of the water is conveyed to both ends of the streets.
- Some areas possibly accumulate water instead of conveying towards the discharge points (Fig 7).

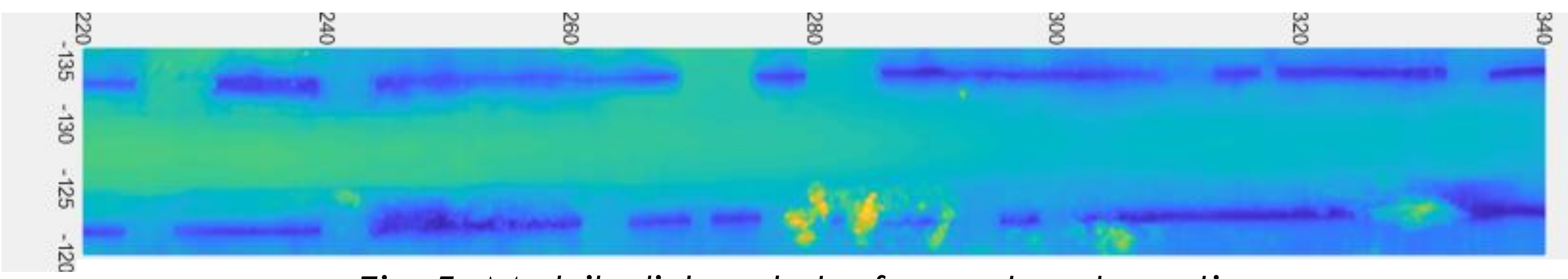

Fig 5. Mobile lidar data for a street section.

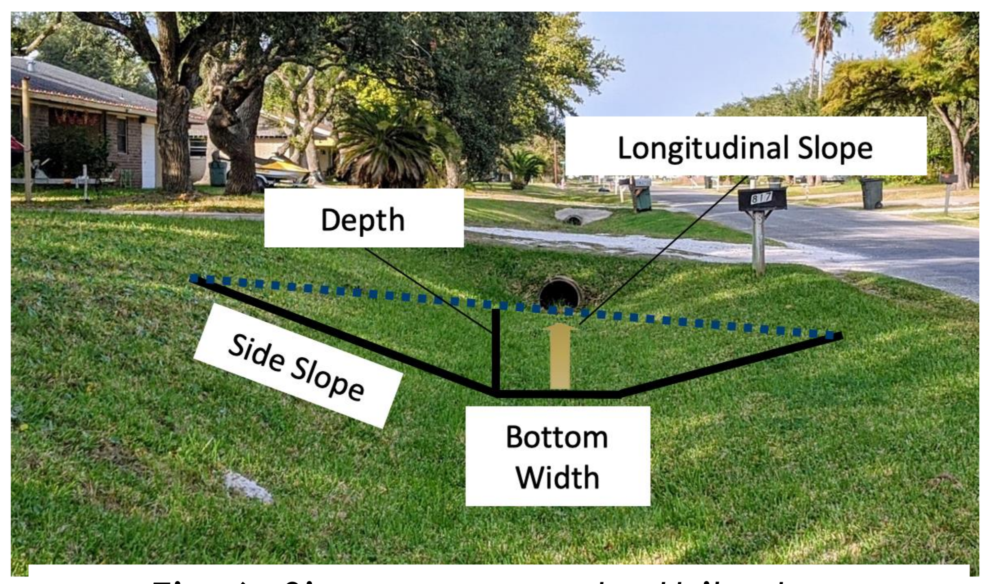

Fig 6. Six assessment attributes.

Table 1. Assessment of attributes.

Attributes	Passing Rate (%)
Channel Depth	68
Channel Bottom Width	100
Left Side Slope	84
Right Side Slope	68
Avg. P/C Length	100
Longitudinal Slope	45

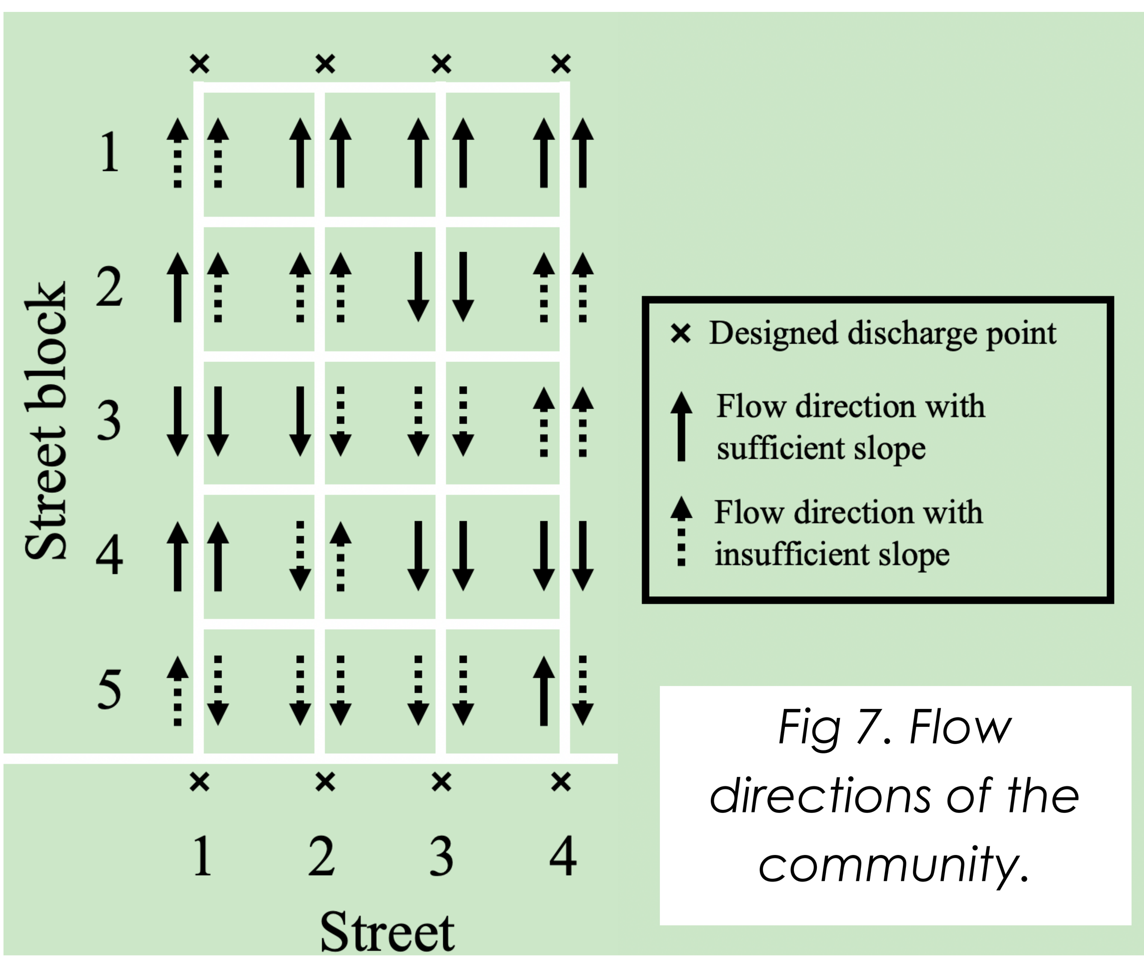

Fig 7. Flow directions of the community.

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