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Stakeholder Analysis in the Context of Natural Disaster Mitigation: The Case of Flooding in Three U.S. Cities

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Abstract: This research identifies ways community dialogue can inform natural disaster mitigation planning. We use stakeholder analysis to explore indirect public engagement related to flooding in three U.S. cities (Tulsa, OK; Fayetteville, AR; and Waco, TX). Using publicly available data, we identify the types of stakeholders and potential motivating factors leading them to contribute to community discourse. We find a wide range of engaged stakeholders representing governments, organizations, groups, and individuals directly and indirectly impacted by a natural disaster. These results provide information valuable for tailoring direct engagement efforts to reach residents not participating in the discussion, especially those with elevated vulnerabilities or untapped resources who can co-produce flood mitigation strategies designed to make their property and public infrastructure more flood-resilient and improve community sustainability.

Keywords: stakeholders; community dialogue; disaster mitigation



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1. Introduction

Climate change has exacerbated the intensity and impact of natural disasters such as hurricanes, wildfires, and floods on local communities [1]. To ensure sustainable development and achieve coordinated climate change mitigation, it is essential to explore what tools or strategies for resource planning and strategic decision making are used in public for-profit and nonprofit organizations in times of crisis. Public and nonprofit management, public policy, and administration scholars have concluded that collaborative governance, citizen participation, and community-engaged research result in the co-production of shared values [2–5]. Co-production is when an individual influences the support and services received or when people come together to influence how services are designed, commissioned, and delivered [6]. In 1995, Moore suggested that co-production of public goods and services can improve the attainment of public values [7]. Public value was defined as an alternative logic to private value and emphasized that an individual should not only consider their self-interest but also promote the collective purpose of society. Years later, Bryson and colleagues expanded the definition to incorporate things valued by, or suitable for, the whole of society as assessed against criteria—such as efficiency, transparency, fairness, equity, and representation [8].

However, evidence from natural hazard mitigation research shows that collaborative activities often face various challenges, especially when identifying resource allocation and decision-making strategies [2]. The novelty of our approach is the ability to leverage an exploratory case study approach and stakeholder analysis method to describe how community dialogue can inform natural disaster mitigation planning [5,9–11]. Using 242 public data sources published between 1987 and 2022, we explore the types of stakeholders engaged in public discourse about flooding, their interests (or stake in the problem), and motivations for expressing their preferences on flooding issues in three U.S. cities: Tulsa, OK; Fayetteville, AR; and Waco, TX. These cities have a long history of extreme flooding events that include extreme precipitation in a short period and riverine flooding.

There is normative literature, but more empirical research on stakeholder engagement is needed. Most theoretical presentations are drawn from the business management literature and take a specific organization as the unit of analysis. Typically, the primary focus is on an organization's executives, management, and staff [12] and how what they do is influenced by the firm's stockholders [13]. Seldom do they discuss stakeholders who are external to the organization or do not fall into the categories of influencer, claimant, collaborator, or recipient [14]. Until 1996, there was little differentiation between whether the stakeholder was an individual or organization representative [15].

Our overarching research question considers how community dialogue can inform natural disaster mitigation planning by individuals, organizations, and government representatives. Our findings document four types of stakeholders consistently prominent in public discourse: government employees, elected officials, community members, and subject matter experts. Government employees are internal stakeholders. Mixed stakeholders are elected officials and subject matter experts with a collaborative relationship with the government. Community members are individuals and groups who are active in the discussion about flooding impacts and planning. They are external stakeholders. This research concludes that communities can leverage public discourse as a mechanism for identifying who is and who should be engaged in community conversations about planning mitigation efforts. Improving the breadth and representativeness of stakeholder engagement can enrich mitigation planning efforts to make a community more natural disaster-resilient.

2. Background on Selected Cases

Mitigating future risks related to natural disasters, such as extreme flooding, is at the center of concern for public policy and administration scholars [16,17]. It is crucial to explore decision-making processes and policy changes and how they promote a more secure future immune from catastrophic consequences after a natural disaster. Flood prevention has received much attention from natural hazard and policy scholars since it is a natural hazard phenomenon exacerbated by the impact of climate change [18].

This research employs stakeholder analysis of public discourse in the context of floods as a natural hazard phenomenon to determine who is currently involved in discussions that lead to decisions that change policies and promote mitigation actions to improve community resilience. Knowledge about participants in community discourse will benefit community leaders, given the significance of sustainable development and the necessity of practical local mitigation activities to address community resilience [19,20].

Three cities were selected as cases based on their commonality of a long history of extreme flooding events and downstream riverine flooding [21–23]. These cities have experienced significant flooding events for over 100 years and are prone to overflow from rivers and dams due to heavy precipitation, causing inundation and urban flooding. There are nuanced differences in the causes and consequences of flooding over time and the success of mitigation efforts. Thus, we have chosen these cases based on their contiguous geographic location, the presence of governmental departments tasked with addressing the flooding issues, and the Community Rating System (CRS) class-level differences. The CRS is a voluntary incentive program encouraging community floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program. Communities beyond the minimum floodplain management requirements earn flood insurance discounts for residents [24]. The Federal Emergency Management Agency administers the program. Over 1500 communities participate in the program nationwide. We selected a case in our study that did not participate in the program [24]. Table 1 describes the geographic and socioeconomic/housing factors in the three cases selected. Tulsa has CRS level 1 and qualifies for a 45% flood insurance premium reduction; Waco does not participate in this voluntary rating system. Fayetteville has CRS level 9, a 5% flood insurance premium discount.

Table 1. City/county characteristics of selected cases.

	Fayetteville	Tulsa	Waco
Population	95,230	411,401	139,594
Sq Miles Land, Water	55.8 and 1.4	197.8 and 4.1	95.5 and 11.3
Median Housing Cost ¹	USD 361,887	USD 225,268	USD 247,999
CRS Class Level/Discount %	9/5%	1/45%	Not eligible
Hazard Mitigation Plan Level	County: 13 Cities, Special Districts	City	County: 20 Cities
Median Price per Square Foot ¹	USD 197	USD 132	USD 168
Average Housing Square Footage	1837	1707	1476
Average Flood Insurance Premium ²	USD 1020	USD 892	USD 1058
Median Flood Insurance Cost per Square Foot	USD 0.56	USD 0.52	USD 0.72

¹ Source: <https://www.rockethomes.com/real-estate-trends/ar/fayetteville> for Fayetteville; <https://www.rockethomes.com/real-estate-trends/ok/tulsa> for Tulsa; <https://www.rockethomes.com/real-estate-trends/tx/waco> for Waco accessed on 20 September 2023. ² Source: <https://www.moneygeek.com/insurance/flood/arkansas-flood-insurance-costs/> for Fayetteville; <https://www.moneygeek.com/insurance/flood/texas-flood-insurance-costs/> for Tulsa, and <https://www.moneygeek.com/insurance/flood/oklahoma-flood-insurance-costs/> for Waco accessed on 20 September 2023.

Information on the population, land and water space, and governments creating the hazard mitigation plan is provided in Table 1. Data on housing costs and price per square foot are also included to provide an understanding of the relative burden of flood insurance premiums in these three cities. This research is exploratory; most data reported herein are descriptive, and we provide comparisons across cities. Exploring variations in contextual data enables us to suggest if these variables should be included in future research to test causal relationships empirically. Additional data documenting first-person perceptions of the outcomes of engagement activities and the incorporation of stakeholder preferences in flood management and mitigation policy would also be valuable. Once these relationships are documented, testing the causal relationships of these variables in a combined data set with flood insurance premium pricing will be possible. The following section reviews stakeholder engagement theory and presents research questions.

3. Stakeholder Theory and Research Questions

Public policy and public administration literature concludes that stakeholder engagement is vital for the success of policy decision processes and implementation activities in environmental policy since it promotes sensitivity to non-government-affiliated participants' needs [25]. In addition to informing viable policy solutions for wicked policy problems, strategic stakeholder engagement is also crucial for an organization's sustainability [10]. Franklin [10] (p. 1) states that "the leaders of the organization must think strategically about stakeholder engagement and institutionalize regimes to assure that stakeholder input is available to inform decisions."

Stakeholder theories vary in their definitions of a stakeholder depending on disciplinary tradition. In business, the main contribution of stakeholder theories was to divert managers' attention from profit maximization, satisfy the stockholders, and consider non-stockholders' interests [26,27]. On the other hand, public policy and public administration theories view stakeholders from a broader perspective [10,25,28,29]. Franklin [10] (p. 19) defines "[a] stakeholder as anyone or anything (represented by a human) that can influence, or is influenced by, the activities or behaviors of another stakeholder". This definition of stakeholders is encompassing and not restricted to humans but extends to inanimates. In addition, when describing stakeholders as people, we may be talking not only about those who are alive now, but we could also consider future generations' interests [10]. From an organization's perspective, stakeholders are an input into engagement since these individuals already exist outside the organization, even though an organization may not currently interact or engage with specific stakeholders.

Research on natural hazard mitigation and adaptation shows that groups who wish to collaborate with government organizations and political officials face various challenges,

particularly during resource allocation decision making [2]. Therefore, it is vital to know the stakeholders and their preferences for a policy decision or organizational action, particularly regarding natural resource allocation, disaster mitigation, and other decision-making scenarios related to environmental policy. This knowledge can foster fruitful stakeholder collaboration for climate mitigation and adaptation strategies and inform natural disaster mitigation and adaptation planning essential for building community resilience. To better understand this, our first research question (**RQ1**) is as follows: *Who are the stakeholders engaged in the public discourse surrounding flood mitigation policy and flooding disaster activities?*

Community plans for climate adaptation aim to mitigate the damage to the natural, built, and human infrastructure caused by extreme weather events. Infrastructure damage affects people, organizations, and governments in different ways. For example, flooding can temporarily stop water and electrical service in all types of buildings, damage individuals' homes, harm people and animals they care for, block the roads they use to reach work or to buy food, and even destroy the natural spaces they use for recreation activities.

Much of the recovery efforts are led by government and private sector organizations; however, co-production is required from individuals and groups during the clean-up, but more importantly, in creating plans and taking action to implement these plans to avoid similar types of damage when experiencing future extreme weather events. Therefore, people, animals, organizations, and governments are stakeholders whose unique perspectives and preferences must be represented and understood in community dialogue. In return, these stakeholders must consider their role in the co-production of community safety and their contribution of resources for hazard mitigation [30,31]. Our second research question considers stakeholders' motivations and interests in this context. **RQ2:** *What interests lead stakeholders to engage in flood mitigation policy discussions?*

The ability of stakeholders to work with each other is vital for improving policy outcomes and facilitating the policymaking process in environmental issues [20]. A focus on overlapping values supports effective stakeholder engagement [10]. This is particularly challenging since different value dimensions can be hierarchical and overlapping [24]. Values influence the interactions between stakeholders and organizations [10] (p. 10). Organizations attempt to create value in their transactions to ensure sustainability as a good business practice. However, sustainability is more likely to be achieved when there are high levels of congruence between the values pursued by the organization and the value expectations of stakeholders [10] (p. 11). These value rankings are at the core of stakeholders' interests. Orr [25] (p. 26) advocates for an interest-based typology of stakeholders to explain what might motivate them to become involved in the policymaking process, arguing some stakeholders have a genuine concern for the policy issue. Yet, others might have less authentic motivators, like seeking prestige or institutional legitimacy. Consideration of stakeholder motivations is essential as they are at the core of various levels of interests, access to resources, and expertise of stakeholders involved with specific policy issues [20].

There is a lack of consensus on the categorization of stakeholders. Categorization can help predict who will engage at each stage of the disaster cycle. McGlashan and Williams [30] note that stakeholders' engagement in policy decision processes differs based on resources and policy process influence. These differences impact levels of involvement in and suggest various practical techniques for fostering stakeholder involvement throughout the policy cycle. Franklin [10] concurs and argues that there are role-based obligations for people with a professional duty during the flooding cycle. These differ from an individual's obligations to their family, friends, and members of affiliation-based organizations such as churches or social clubs. Role identity is fluid and not mutually exclusive. However, professional role obligations, as the name suggests, mean that an individual will do what the organization wishes, even if it does not overlap with their individual obligations or preferences [10].

Our third research question examines the notion that stakeholder actions during the disaster cycle may arise from a person's professional role obligations or based on personal

obligations. **RQ3:** *What roles influence stakeholders to engage in public dialogue concerning flood mitigation?*

4. Research Methodology

Our research examines independent variables identified in Franklin's stakeholder engagement model [10] to answer these research questions. The qualitative data for the variables were gathered from public discourse. Researchers from the Southern Climate Impacts Planning Program (SCIPP), with funding from the Climate Program Office in the U.S. Department of Commerce, gathered these data.

As the background information on the selection of case cities described, the three cities selected for the analysis are Tulsa, Fayetteville, and Waco. The research team searched and coded multiple sources of public discourse, including city and regional newspapers, internet general commentary, government websites, and planning and disaster mitigation documents for each city/county between 1987 and 2022. The research team identified information in each source about each stakeholder mentioned, the impacts they experienced from flooding, if they were speaking on behalf of their professional role in an organization, and the stage of the disaster cycle.

The primary search terms were "flood" and "flooding", and the secondary search terms were "disaster", "FEMA", and "funding". Two coders worked in parallel to assign values to information related to the variables of interest. After reading the article, the coders assigned the appropriate codebook values to the type of stakeholder, who or what was being represented, the nature of the stakeholder's experience related to the flooding, the phase in the disaster cycle they were engaged in, and other relevant information.

The data set includes 242 data sources: 49% are about flooding in Tulsa, 30% are about flooding in Fayetteville, and 21% describe flooding in Waco. Within these 242 data sources are 599 stakeholders in the Tulsa public discourse documents, averaging 5.1 stakeholders per data source. Fayetteville has 526 stakeholders mentioned in public discourse for an average of 7.3 per source. Waco public discourse described 400 stakeholders, averaging 7.7 stakeholders per data source. These data sources were coded based on the operationalizations of Franklin's [10] categories of stakeholders' interests, the impacts they experienced, and the interests represented when they engaged in public discourse.

Public discourse sources described many different stakeholders. The raw data for different stakeholder types were reduced to four categories representing distinct types of stakeholders based on who they represented. In addition, the related role-based obligation that likely motivated the stakeholder to become involved in the community dialogue about flooding events was coded, and the researchers coded the impacts they experienced as well. The codebook definitions and codes that could be used are described next.

Over 36 kinds of stakeholders were consolidated into five types of stakeholders. A role-based obligation, **Professional** or **Individual**, was assigned to each. As the name suggests, **Government** was a consolidated category representing public administrators at any level of government organization. These stakeholders were assumed to act based on a professional obligation when their governmental affiliation was mentioned in a specific data source. The category **Residents/Community** was used when specific persons spoke as individuals or members of a community organization such as a Homeowners' Association. Community members were commenting from an individual viewpoint. **Elected Officials** from any level of government were grouped and were coded as representing people based on a professional role perspective. The code for **Subject Matter Experts** was assigned to individuals and groups representing Climate Science, Weather Forecasting, and Emergency Services activities. Like Government Employees and Elected Officials, they have a professional role-based obligation. Stakeholders in public discourse that mentioned building activities before, during, or after a flooding event were assigned the code of **Economic Development** and professional role responsibility.

For all stakeholders, the team coded the impacts each stakeholder experienced in a specific flooding event. The codes were **Direct**, meaning they experienced some damage to

their property, provided direct services, or experienced an inability to conduct “normal” activity during any flooding disaster phase. **Indirect** impacts meant that they were engaged in public discourse and described the impacts experienced by others—including victims, such as people or animals, who did not survey the flooding event and future users whom future mitigation plan activities would impact.

The three natural disaster phases used in this research were **Weather Alert** (provided before any flooding event), **Disaster Response** (activities during the flooding event), and **Lessons Learned** (activities after the flooding event that documented what happened to provide information to inform future planning and hazard mitigation activities). This typology is specific to the language choices in the public discourse data identified for this study. It is noted that disaster cycles are described inconsistently in the literature but often include response, recovery, mitigation, and planning [31]. Our typology adds Weather Alerts and combines the response and recovery phases and mitigation and planning into Lessons Learned, forming the basis for future mitigation planning.

Threats to internal validity were mitigated by the explicit articulation and consistent application of search terms to avoid selection bias. Coding integrity was increased by the group development and revision of the variable code book and by coding verification by a second research team member. The external threat of replicability is relatively low since the search terms and time window were consistently applied, and all public data sources we identified in the different document types searched were coded and analyzed.

5. Results

5.1. Stakeholders Mentioned in Public Discourse

Our first research question asked who the stakeholders are in the flood mitigation policy domain. Our analysis found 36 distinct types of stakeholders mentioned in public discourse. The research team used the Q-sort procedure to reduce this number to the first groups presented in Table 2. Reviewing this table, we can see that for Fayetteville, the largest group is Residents/Community, followed by Elected Officials and Government Employees and then Subject Matter Experts. For Tulsa, the largest group engaged with this subject is Government Employees compared to the other two cases, followed by Community Members, Elected Officials, and Subject Matter Experts. For Waco, the largest group of stakeholders is Government Employees, followed by Subject Matter Experts and then Residents/Community and Elected Officials.

Table 2. Stakeholder types identified by city.

Stakeholder Type	Fayetteville	Tulsa	Waco	ALL
Government	42%	40%	33%	39%
Residents/Community	24%	29%	33%	28%
Elected Officials	18%	12%	18%	16%
Subject Matter Experts	11%	11%	9%	11%
Economic Development	6%	7%	7%	7%

Note: Columns total 100% horizontally.

A chi-square test examining differences in the types of stakeholders prominent in public discourse revealed a highly statistically significant difference between the three cities ($\chi^2 = 21.33, p < 0.001$). The most notable differences are that Tulsa had 21% fewer Elected Officials, Fayetteville had 16% fewer Economic Development interests represented, and Waco had 11% fewer Subject Matter Experts and 15% fewer government representatives featured in public discourse than the three-city averages.

This information gives us a sense of the magnitude of differences in the kinds of stakeholders who already have voices in community discussions of flooding events. Further, the data suggest that those charged with engagement activities for hazard mitigation planning can use this information to determine where outreach efforts for missing voices are essential. Based on this, the stakeholder type should be considered an independent

variable as models of the impact of stakeholder engagement are developed and tested. Future research should explore how the mix of stakeholders visible in public discourse influences the hazard mitigation activities included in future planning.

5.2. Stakeholders' Motivations and Interests

Our second research question examined the motivations and interests of stakeholders to be involved in the flooding mitigation policy domain in three selected cases. Extant literature suggests that stakeholders with previous flooding experience will be more motivated to engage in flooding mitigation discussions and activities. Stakeholder impacts from flooding were categorized as Direct, meaning they had personally suffered flood damage to personal property or persons they were affiliated with, or Indirect, meaning their daily activities were made more difficult as the flood waters receded and public infrastructure use was limited. We predict that more direct impacts from a flood disaster will motivate stakeholders to share their stories and promote future action to reduce future flooding or flood damage. However, stakeholders with indirect disaster impacts might also play a role in protecting people before and after a disaster has occurred. Future research is needed to confirm these assumptions.

To examine the type of impact each stakeholder experienced from the disaster, we considered the phase of the disaster stage in our results. As Table 3 shows, there are differences in the direct and indirect impacts experienced by stakeholders based on three disaster stages: Weather Alert, Disaster Response, and Lessons Learned.

Table 3. Types of impacts stakeholders experienced by the disaster stage.

Impacts/Disaster Stage	Fayetteville	Tulsa	Waco	All
Direct Impact	34%	38%	35%	36%
Weather Alert	2%	8%	11%	7%
Disaster Response	15%	11%	1%	10%
Lessons Learned	17%	19%	23%	19%
Indirect Impact	66%	62%	65%	64%
Weather Alert	2%	11%	27%	12%
Disaster Response	20%	19%	1%	15%
Lessons Learned	43%	33%	38%	38%
Total	100%	100%	100%	100%

There are statistically significant differences in public discourse analysis of stakeholders' experiencing direct versus indirect impacts ($\chi^2 = 42.92$, $p < 0.001$). On average, 36% of stakeholders featured in the public discourse experienced direct effects on themselves or their property from flooding events. The difference is easily seen in the 64% of stakeholders who experienced indirect effects from flooding in the three cities. This finding is interesting since public discourse on indirect effects can also provide insights into mitigation activities that may reduce these impacts. To explore this further, we disaggregated the data to examine impacts based on the disaster stage.

A closer examination of the relationship between the type of impact a stakeholder experienced and the stage of the flooding disaster revealed nuanced differences between the cities. Waco had minimal reporting on stakeholders during disaster response. However, public discourse in Tulsa and Fayetteville revealed what stakeholders commonly do to assist others in reducing the negative impacts of the disaster. The differences across cities based on the disaster phase were statistically significant for stakeholders with direct impacts ($\chi^2 = 100.91$, $p < 0.001$) as well as for those experiencing indirect impacts ($\chi^2 = 150.75$, $p < 0.001$). Knowing the magnitude of differences based on the disaster phases allows for targeted actions to reduce human and property losses and emergency response costs by applying lessons learned and focusing on the increased efficacy of communicating alerts for future severe weather threats.

5.3. Stakeholders' Role-Based Obligations

Our third research question asked what roles stakeholders likely played in the decision and policymaking processes for flooding response and mitigation. Stakeholders' roles in the policymaking process determine their level of engagement in stakeholder collaboration. We analyzed whether stakeholders had a professional or individual role in participation. Our rationale is that stakeholders with a professional role are obligated to engage in the process involuntarily. In contrast, stakeholders with an individual role are self-motivated to participate in community assistance related to flooding.

The difference between professional and individual role-based obligations can be understood by the example of a motorist who is stranded because their car has stalled in a flooded roadway. Emergency services personnel, such as police or firefighters, have professional role-based obligations. People who have a boat and go to the stranded vehicle to assist the driver have an individual obligation based on their role in the flooding event.

There is support for our assumptions about these differences. On average, 67% of all active stakeholders have a professional role obligation, with Fayetteville being the highest at 71%. These differences are statistically significant when comparing the three cities ($\chi^2 = 189.00, p < 0.001$). The average for stakeholders with individual role-based obligations was 33%, with Tulsa and Waco slightly higher than at 35% and 36%, respectively. These differences for individuals are also statistically significant (individual $\chi^2 = 76.57, p < 0.001$).

In addition, Table 4 examines stakeholders' role obligations based on disaster stages. The differences based on the phase of the disaster were also statistically significant for both role obligation types ($\chi^2 = 150.75, p < 0.001$). These results document that stakeholder engagement in the different stages of the disaster is quite different between the cities for both the professional and individual role-based obligations. The most significant difference is the over-representation of professionals in the Disaster Response stage in Fayetteville and Tulsa compared to Waco. However, public discourse during the Disaster Response phase is meager in Waco at just 3% overall.

Table 4. Stakeholders' role-based obligations by disaster stage.

Role-Based Obligation by Disaster Stage	Fayetteville	Tulsa	Waco	Total
Professional	71%	65%	64%	67%
Weather Alert	4%	14%	26%	14%
Disaster Response	29%	18%	2%	18%
Lessons Learned	39%	33%	37%	36%
Individual	29%	35%	36%	33%
Weather Alert	1%	5%	11%	5%
Disaster Response	6%	11%	1%	7%
Lessons Learned	22%	19%	24%	21%
Total	100%	100%	100%	100%

Gaining a deeper understanding of this data artifact through qualitative research methods could be beneficial to understanding how other stakeholders, such as individual property owners, can take actions to reduce flooding impacts in the future. Yet, in all cities, the main emphasis is on lessons learned, no matter which stakeholder is quoted in public discourse. The next section discusses our findings and identifies policymaking implications for improved flood mitigation efficacy and community resilience.

6. Discussion

This research documents who is engaged in public discourse about natural disaster events in three different communities. Using 242 public data sources published between 1987 and 2022, we present exploratory and descriptive data on three cases to analyze stakeholder engagement in community dialogue that can inform natural disaster response,

recovery, and hazard mitigation planning [5–8]. Knowing the types of stakeholders, the impacts they experienced, and the role-based obligations that motivated them to participate, we can enrich stakeholder participation and community engagement literature and provide contextual information to make policy and decision processes more robust for organizations in all sectors.

Our first research question asked who the common stakeholders in community discourse were. We found many stakeholders prominent in public discourse in all three cases. Unsurprisingly, Government Employees constitute the highest percentage of stakeholders active in public discourse. A comparison of the proportion of Economic Development stakeholders and Residents/Community stakeholders finds significant differences in stakeholders who are involved in public discourse related to flooding and flood mitigation activities, with Economic Development stakeholders being engaged in Fayetteville and Tulsa, while Residents/Community-focused perspectives are represented at higher rates in Tulsa public discourse.

The statistically significant differences in who is represented in public discourse may not be surprising since government representatives and resident/community activists are often the two most prominent voices in public meetings. However, from a future planning perspective, the perspectives of elected officials, subject matter experts, and those contributing to economic development activities in the community inject additional perspectives into the public dialogue about how to develop and fund mitigation activities to avoid future human and infrastructure damage.

Future research would benefit from examining informational and campaign literature during elections to see how current and future elected officials communicate about hazard mitigation and climate resilience and to what extent this communication is aligned with the perspectives of the community they serve [32–34]. In addition, public discourse through organizations such as the Chamber of Commerce and local builders' associations can provide insights into these stakeholders' preferences and potential resource contributions [35,36].

The findings for our second research question related to stakeholders' motivations in engaging with the policy issue confirm the importance of understanding the time frame for the communication to ensure that all stakeholders are kept informed to make the rescue responses and recovery efforts timelier and more efficient. We found statistically significant differences between the three cities based on the timing of disaster stages and when they alert people so that they can prepare (present), when they respond to the disaster (past), or when they conduct planning activities to prevent disaster events (future).

Notably, the public discourse coverage of various types of stakeholders in Waco has the most limited focus compared to Fayetteville and Tulsa. Reviewing differences in public discourse by stakeholder type, Waco primarily mentions Government officials in the public discourse of flooding impacts. In the other two cities, it is a mix of Government and Elected Officials and high-profile members of the Community. For stakeholders indirectly impacted by a flooding disaster, we note that these stakeholders are Subject Matter Experts with the unique resources necessary to assess risks and recommend mitigation activities. These differences were also highly statistically significant.

This research documents the wide variety of stakeholders in over 36 distinct categories concerned about flooding in their community. For flooding mitigation activities to be identified and successfully implemented, representatives of these stakeholders can provide critical and missing perspectives about their concerns and the actions they support for mitigation and adaptation. Purposefully engaging all kinds of people representing the different stakeholders in community dialogues has the added benefit of providing an opportunity to learn about their sincere preferences by forcing them to priority-rank alternatives. In addition, data can be gathered on stakeholders' willingness to pay or willingness to share resources and co-producing activities that make their property and the infrastructure of their community more "flood-wise".

To summarize, the relationship patterns between direct versus indirect impacts by disaster stage (presented in Table 3) are like those based on the stakeholders' roles and the

disaster stage (shown in Table 4). The main difference is that public discourse in Fayetteville has a higher percentage of professional role-based obligation stakeholders offering their perspectives on the lessons learned and how these can inform future planning efforts. A deeper understanding of the perspectives of those who do not have a role-based obligation but who are speaking on this topic could reveal novel strategies or unleveraged resources that can be incorporated into future planning efforts. At a minimum, engaging voluntarily participating stakeholders can raise awareness of their role in future mitigation efforts that could benefit them personally and the community overall. Although these data allow for a direct test of the relations with the implicit dependent variable (reductions in the cost of flood insurance premiums and damage caused by flooding), we argue that leveraging these variables can improve engagement activities, leading to hazard mitigation activities that may reduce flood insurance premiums in the future.

7. Conclusions and Implications for Sustainable Strategic Development

Using information from public discourse in three cities/counties (Fayetteville, AR; Tulsa, OK; and Waco, TX) between 1987 and 2022, we analyze who is active in community dialogue before, during, and after an extreme flooding event. Our exploratory research seeks to understand how stakeholders active in community dialogue can inform natural disaster warnings, responses, and future mitigation. We present a descriptive analysis of stakeholder types, the impacts they experience during the three stages of severe weather events, and the role-based obligation prompting them to engage in their community. This analysis identifies variables with significant differences between the cities.

There is a wide range of engaged stakeholders representing the governments, organizations, and groups who have been active and contributing to disaster relief programs. Communities can use this research to design opportunities to increase the number of stakeholders engaged in policy and decision-making activities for hazard mitigation efforts. Our data suggest that Tulsa has relied more on the engagement of professional role-obligated stakeholders, which might leave the potential contributions of the nonprofit and voluntary sectors untapped. Designing activities to engage these stakeholders in policymaking will help incorporate supplemental financial resources and other non-financial contributions in flood mitigation events.

In addition to describing typical stakeholders active in community discussions of flooding and flood mitigation activities, we looked at what could motivate engagement. We find two important factors that motivate stakeholders to be more active or use their voices concerning natural disasters. The first factor is stakeholders' experience of the flood and its aftermath. The second factor is related to stakeholders' role-based obligation relative to flood mitigation policy. The high statistically significant differences for these variables of interest confirm the importance of including these two motivators for causal modeling in future research. These results also provide valuable information for tailoring direct engagement efforts to reach community members who are not participating. This is particularly important since the information can guide communities in uncovering non-participants with elevated vulnerabilities and stakeholders with untapped resources and a willingness to engage in co-production activities.

More enhanced stakeholder engagement and institutionalizing stakeholder collaboration may help vulnerable cities and communities enhance their resource capacity via cost-sharing of climate change mitigation with various stakeholders. Pragmatically, this research gives practitioners a systemic means for discovering who needs to be involved in strategic stakeholder participation activities to institutionalize their stakeholder engagement regimes [10]. These results offer insight into components of a causal model to understand what behaviors could be leveraged during hazard mitigation planning and activities to reduce flooding risk and to make flood insurance affordable through premium discounts offered to "flood-wise" communities.

While our research contributes novel findings on who is present in public discourse due to the impacts they have experienced from flooding and the kind of role-based obliga-

tion they have, our study also has limitations. First, our analysis purposefully considered who is represented in public discourse and how this differs between cities. While we use publicly available data, not all stakeholders are included in these public sources so that other voices may be represented. The next iteration of this research could explore who is not represented in the community dialogue. Second, we acknowledge differences in the number of data sources by city. This research is exploratory and presents descriptive findings. This is appropriate since the three cities were purposefully chosen to leverage differences to understand the broader applicability of the variables in the study. This research model provides a template for introducing more communities into the data set to test a causal model with reduced flood insurance premiums as an outcome and a more flood-wise city as the desired social impact.

This exploratory research on an indirect public engagement mechanism to learn who contributes to public discourse may serve as a foundation for follow-up studies that include non-traditional social media sources. Although social media may be less informed, more self-interested, and opinion-driven, purposefully following social media representation of various stakeholders and capturing comments in other public venues will provide more issue-focused and preference-based data for inferential quantitative analysis [37–39]. When combined with other data, such as those from elite interviews, researchers will be well positioned to capture data on the descriptive variables presented in this analysis. Expanding the data set to include multiple data sources and methods offers the opportunity for the triangulation of the preferences of stakeholders in the community. These data can be analyzed in relation to desired outcomes, such as the sincere preferences of stakeholders in the community and how these may be driven by considerations of reduced flood insurance premiums, as well as taking action to create a “flood-wise”, resilient and sustainable community, which are the broader social impacts desired.

To conclude, our research findings on stakeholders represented in public discourse related to a natural disaster event within three different communities confirm that there is a wide range of stakeholders representing the governments, organizations, groups, and individuals who have been impacted, as well as those who provided disaster relief or have proposed future disaster mitigation strategies. Our findings have important implications for the further development of stakeholder engagement theory. They also reveal practical applications for communities that experience extreme climate events and need to develop hazard mitigation plans to make their community more resilient.

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