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**Navigating Rising Waters: Empowering Shunganunga Creek Floodplain Communities
through Protection Motivation Theory**

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Abstract

In communities like those near Topeka's Shunganunga Creek, where flooding is a frequent and expected part of life, risk communication must adapt to meet the unique circumstances of residents. To understand how people in this floodplain perceive risk and respond to flood warnings, we interviewed 11 residents, guided by principles from Protection Motivation Theory. Participants, including long-time community members and local educators, shared how they perceive risk messages and make protective decisions during flood events. We identified key communication barriers through qualitative thematic analysis, including distrust of official sources, accessibility issues, and reliance on social networks for information. Our study highlights that official warnings emphasize scientific accuracy but do not always align with how at-risk populations interpret and respond to risk. Traditional top-down communication strategies often struggle to account for the localized needs of communities, leading to disregard and inaction from residents. We recommend tailoring flood risk communication to be clear and relatable, addressing the unique circumstances of floodplain communities. Shifting toward community-centered outreach, incorporating trusted local figures, assistance information, and cultural relevance will strengthen resilience against future flooding in a changing climate.

Keywords: flooding, risk perception, floodplain, communication, protection motivation theory

Navigating Rising Waters: Empowering Shunganunga Creek Floodplain Communities using Protection Motivation Theory

In the heart of the United States, Topeka, the capital of Kansas, is a community facing a pressing issue: the increasing threat of floods. Topeka is situated along the Kansas River and other smaller waterways, including the Shunganunga Creek, which spans 17 miles through the city. In May 2007, 11 inches of heavy rainfall flooded neighborhoods in Topeka, displacing hundreds of people and causing extensive property damage (Ryan, 2018). The threat has since intensified: Office of Water Prediction (2024a, 2024b) records show that at two Shunganunga Creek gauges, eight of the ten highest crests, and nearly half of all historical peaks, occurred within the past decade, indicating growing urgency to address floods in Topeka.

Anthropogenic climate change drives global changes, with effects evident in extreme events, such as heavy precipitation. As our atmosphere warms, the air can hold more moisture, which increases the likelihood of heavier rainfall events and higher flooding risks in parts of the United States (National Oceanic and Atmospheric Administration, 2025). The 5th National Climate Assessment conducted by the U.S. Global Change Research Program (2023) projects significant changes in precipitation patterns for Shawnee County, which includes Topeka, KS in a changing climate. Precipitation on the year's wettest day is expected to increase by 7–10%. The annual number of days with rainfall in the top 1% of historical events is projected to rise by 17–43%, and the total precipitation on those extreme rainfall days is expected to increase by 15–29%. This shift has implications for Topeka, particularly along the Shunganunga Creek, where flash flooding poses a recurring, significant threat.

A flash flood is a sudden, intense flood that develops within a few hours of heavy rainfall, resulting in rapidly rising water levels in low-lying areas (National Weather Service,

n.d.-a). These events can turn small creeks into powerful currents, flooding streets, homes, and infrastructure in minutes (National Weather Service, n.d.-b). In comparison, a floodplain is a flat or low-lying area adjacent to a river or stream prone to flooding and are natural buffers that absorb floodwaters. Flooding is hazardous in urban areas where absorption is limited. The Shunganunga Creek watershed covers approximately 72 square miles, with over 53% of this area developed, reducing its capacity to absorb heavy rainfall and increasing surface runoff (Ryan, 2018). Without updated infrastructure, climate change and urban development will put additional strain on these systems as they have to handle extreme precipitation projections.

Effective communication strategies have become increasingly vital in protecting floodplain communities as the climate continues to change. The Kansas Response Plan identifies a high risk of floods, tornadoes, and other extreme weather events, outlining plans for preparing for hazardous events (Kansas Adjutant General's Department, n.d.). One of the many National Weather Service (NWS) public safety campaigns, "Turn Around, Don't Drown®," is one of the organization's ways to communicate with residents. However, while they attempt to emphasize clear messaging, these messages often fail to reach or resonate with residents in vulnerable areas (Grothmann & Reusswig, 2006; Stephens et al., 2024). To effectively reach people, it is crucial to recognize the roles of the audience, stakeholders, and community leaders when developing and implementing communication strategies.

A 2020 news interview with a Topeka resident revealed confusion about flood risk and delayed reaction in taking protective action during flooding events: "We're going to do what we can do to get the water out now, but it's a battle because it's raining. Still raining, and it's supposed to rain tonight, and the creek is still rising... We knew we were in a flood zone, we didn't think it would be this soon" (Stephens, 2020). Research has shown that residents are more

likely to respond to flood warnings when they are specific, actionable, and emphasize clear steps to take during an emergency (Sutton et al., 2021). However, current communication efforts often lack the clarity needed to prompt immediate action, leaving communities at greater risk: "They keep saying, back then it was going to be 99 years before this happens again, and this has only been 13 years" (Stephens, 2020).

This proposed study examines the flooding vulnerability of residents living near Shunganunga Creek and evaluates strategies to enhance communication that fosters protective behaviors. Applying established frameworks and theories in risk communication, we explore the factors that shape how residents respond to flood warnings and preparedness efforts in an area that continually floods. We use qualitative semi-structured interviews to understand how residents perceive flood risks and identify the barriers that prevent effective communication. As the climate changes, enhancing communication is essential to protect lives and reduce flood-related economic and social impacts in vulnerable communities, such as those along Shunganunga Creek.

Literature Review

Risk Perception

Slovic (1978) first defined risk perception as a subjective assessment influenced by personal experiences, emotions, and cultural contexts, rather than statistical probabilities alone. His work introduced systematically organized risks based on characteristics such as dread and perceived control. Compared to other research at the time, Slovic (1987) emphasized that the public's risk perception often differs from how experts assess it and the qualitative ideas that shape individual judgments. For example, risks perceived as uncontrollable or associated with

high dread levels, such as nuclear power or chemical spills, typically evoke higher concern, even if their statistical likelihood is low (Slovic, 1987).

Risk perception has expanded from Slovic's (1978) original cognitive model to a multidimensional construct shaped by various factors. Demographic variables such as age, gender, income, and education can correlate with different threat appraisals (Lechowska, 2018; Siegrist and Árvál, 2020; Ali et al., 2022). Cultural values and social norms can also shape how individuals and communities interpret hazards; belief systems influence whether threats are seen as acceptable or dangerous (Douglas & Wildavsky, 1982; Siegrist & Árvál, 2020). Trust in institutions and perceived self-efficacy affect risk perception; people who trust authorities or feel capable of managing threats are more likely to take protective actions (Kellens et al., 2012; Grothmann & Reuswig, 2006). Additionally, psychological factors such as heuristics and optimism bias can skew assessments, causing individuals to overestimate rare, vivid risks or downplay their vulnerability, which may limit preparedness despite awareness (O'Neill et al., 2016; Grothmann & Reuswig, 2006).

Risk perception is vital in deciding whether individuals take proactive measures to protect themselves against potential threats. For example, people who are more likely to engage in protective behaviors, such as purchasing insurance or stockpiling emergency supplies, often perceive higher levels of risk (Ali et al., 2022). Grothmann and Reuswig (2006) emphasize that perceived self-efficacy is key in motivating protective actions. People with a stronger belief in their ability to mitigate risk are more likely to prepare, but those with less confidence may be less likely to take the steps needed to protect themselves. When attempting to combat this problem, effective risk communication strategies can utilize an understanding of risk to enhance residents' confidence in their ability to act and help develop protective behaviors.

124 **Risk Perception in Floodplain Communities**

125 Floodplains present unique challenges in risk perception and protective behaviors from
126 frequent and often severe flood risks. Infrastructure plays a significant role in this challenge:
127 levees and dams can create the "levee effect," a false sense of security among residents that can
128 lead to reduced preparedness (Jean, 2023). Ludy and Kondolf (2012) demonstrate that people in
129 floodplains often assume that flood defenses will fully protect them, leading individuals and
130 communities to underestimate risk and fail to take necessary precautions. Complacency,
131 especially surrounding floods, is dangerous, as it may cause people to delay evacuation or
132 disregard taking precautions like purchasing flood insurance, which can worsen the impact of
133 flooding when it does occur (Kellens et al., 2012).

134 Proximity to floodplains can strongly influence risk perception, as people living close
135 may perceive higher risks and are more likely to take protective actions than those living further
136 away (Lechowska, 2018; Grothmann & Reusswig, 2006). In comparison, individuals living
137 further from floodplains often underestimate flood risks, seeing themselves as less vulnerable.
138 Ludy and Kondolf (2012) found that residents without direct flood experience are more likely to
139 underestimate these risks, trusting the landscape or infrastructure to protect them.

140 Economic factors also shape risk perception in floodplain areas. Studies show that
141 residents in flood-prone areas are often drawn by lower property costs because housing prices are
142 typically more affordable (Jean, 2023). Affordability becomes a problem because people can
143 prioritize financial benefits over safety: lower-income residents are less likely to take protective
144 measures due to financial constraints and limited access to risk information (Ali et al., 2022).
145 The financial considerations of residents complicate efforts to promote preparedness, as

individuals who prioritize short-term economic gains may be less receptive to warnings or guidance on flood risks.

Protection Motivation Theory

Rogers (1975) first introduced Protection Motivation Theory (PMT) as a framework to understand the psychological processes that lead individuals to adopt protective behaviors in response to perceived threats. The idea behind PMT is that people assess potential threats and decide whether to engage in protective actions based on *threat appraisal* and *coping appraisal* (Figure 1; Rogers, 1975). Threat appraisal examines the perceived severity and vulnerability to a specific threat, while coping appraisal considers the perceived efficacy of protective action and the self-efficacy to carry it out. These appraisals are driven by the emotional response to fear, which heightens the awareness of danger and encourages people to weigh the benefits of acting against the potential consequences of inaction. Designed initially to explain reactions to health threats, PMT has expanded to encompass a range of risk communication contexts, including natural hazards, where it provides a beneficial framework for examining how people assess and respond to extreme weather hazards (Sutton et al., 2021; Rainear & Lin, 2020).

The core components of PMT are *perceived threat*, *perceived efficacy*, and *fear arousal*, all of which play a significant role in determining protection motivation. The perceived threat has two subsections: severity and vulnerability. Severity is the person's assessment of the potential damage or harm that the risk presents, while vulnerability is the perceived likelihood of personally experiencing the risk (Rogers, 1975). In PMT, these components shape one's overall *threat appraisal*. For example, high perceived severity and vulnerability can lead to better protection motivation. People are more likely to consider taking preventative actions if they feel they are at significant risk (Neuwirth et al., 2002).

Perceived efficacy is another essential portion of PMT, encompassing response and self-efficacy. Response efficacy refers to an individual's belief that a specific protective action will reduce or eliminate a threat. At the same time, self-efficacy is the confidence in the ability to perform the necessary actions (Neuwirth et al., 2002). According to PMT, the two components shape one's overall *coping appraisal*. Bubeck et al. (2012) found that individuals who believed in the effectiveness of flood mitigation strategies and in their capability to implement them were more likely to take proactive steps to protect themselves and their property against flooding. Lastly, fear arousal influences the emotional response to a perceived threat.

The factors above provide the foundation for designing messages that encourage protective behaviors by strategically addressing threat and coping appraisals. An effective PMT message first underscores the severity of the threat and its relevance, then builds confidence in one's ability to respond (Weyrich et al., 2020). In risk communication, designers use this framework to highlight the dangers of inaction alongside the benefits of preventive measures (Neuwirth et al., 2002). Yet threat appeals alone fall short if recipients do not also learn how to protect themselves; therefore, PMT-based messages must equally reinforce response efficacy and self-efficacy, showing audiences that the recommended steps are both practical and effective (Neuwirth et al., 2002). Despite these insights, research has yet to fully explore how varying mixes of threat and coping information shape protective behaviors in floodplain communities, where local concerns and capacities can differ significantly (Botzen et al., 2019).

This study builds on existing research by examining how Shunganunga Creek residents interpret flood risks and by refining communication strategies to prompt protective measures in floodplain neighborhoods more effectively. The primary research questions guiding this study are based on the idea that clear, concise, and actionable messages are more likely to prompt

immediate responses, thereby reducing the risks associated with flooding (Neuwirth et al., 2002; Rainear & Lin, 2020; Sutton et al., 2021). To help prompt these responses, it is critical to understand residents' risk perceptions when designing communication strategies that effectively address their concerns and priorities (Grothmann & Reusswig, 2006; Bubeck et al., 2012). By examining how residents of the Shunganunga Creek floodplain perceive flood risks and respond to current communication efforts, we seek to answer the following research questions:

RQ1: How do various factors in the individual, community, and societal levels shape residents' perceptions of flooding risks in the Shunganunga Creek area?

RQ2: How can current flood risk communication messages be improved to enhance threat and coping appraisal, thereby motivating residents to take protective actions?

Method

Participants

This study involved 11 community members, 18 or older, living near or along the Shunganunga Creek floodplain that have previously experienced flooding. We employed Patton (2001)'s critical case sampling, a technique used in qualitative research to find cases that are most likely to "yield the most information and have the greatest impact on the development of knowledge" (Patton, 2001, p. 236). By working with participants who live in areas impacted by Shunganunga Creek and have experienced flooding in the past, we can develop evidence-based solutions to help affected communities across this region.

Among the 11 Shunganunga Creek residents who took part in the study, just over half identified as male (55%) and the remainder as female (45%). Racially, the group was predominantly white (91%), with Black participants comprising the remaining 9%. These participant characteristics align well with recent U.S. Census Bureau (2023) data for the Topeka

area, which reports a population that is 47.9% male, 52.1% female, 71% White, and 9.7% Black. Participants varied in their time in Kansas, spanning anywhere from 20 years to 72 years, with a median time of 38 years.

Procedures

In adherence to university guidelines, we obtained Institutional Review Board approval for the study, which included reviewing questionnaires, procedures, and recruitment materials. Following approval, we posted flyers and social media posts on Facebook and Instagram to begin participant recruitment. The first author accessed community forums in the local area and utilized Facebook and Instagram to target individuals residing near Shunganunga Creek. The first author conducted all interviews via Zoom to maximize convenience and accessibility. With participants' verbal consent, each session was recorded for precise transcription and analysis, except for one interviewee who declined recording. In that case, the first author documented the conversation with detailed notes.

All interviews followed a semi-structured format, allowing participants to ask questions and elaborate on their responses throughout. Semi-structured interviews are valuable because they allow researchers to explore topics in depth while maintaining consistency, resulting in richer data collection and greater adaptability (Kakilla, 2021). Each interview opened with an ice-breaker that invited participants to recount the weather hazards they experienced while growing up in Topeka, Kansas. After completing the icebreaker, the interview continued with semi-structured questions that focused on their risk perception of the most common weather hazards in their area, their understanding and beliefs about community resilience, and potential communication changes they would like to see in the future for floods. In addition, the questionnaire also included questions that followed the theoretical premises of PMT, including

threat appraisal and coping appraisal (Rogers, 1975). The questions can be found in the Supplemental Materials for further reading.

After completing the interviews, the first author transcribed the audio recordings. Each interview lasted an average of 40 minutes (SD = 23 minutes 14 seconds). We removed all identifying information from the transcripts, assigned pseudonyms to participants, and deleted the audio files once transcription was finished.

Thematic Analysis

The data was analyzed using a qualitative, reflexive thematic analysis, following Braun and Clarke's (2006) strategy: (1) become familiar with the data; (2) code or label data extracts; (3) develop themes or patterns; (4) generate and review themes; (5) specify, define, and name overall themes; and (6) write up. The first author conducted all data analysis. NVivo, a qualitative data analysis software package, assisted with data organization and analysis. First, the first author transcribed the audio files and revised them for clarity to become familiar with the data. Second, the first author employed a latent approach to coding, interpreting the underlying meanings and themes within participants' responses through the lens of PMT. This method enabled the analysis to extend beyond surface-level content, allowing for the identification of nuanced perceptions, emotions, and motivations. Third, themes were created by inspecting the codes. Fourth, the themes were reviewed to ensure they accurately represented the data. Fifth, the themes were defined. Lastly, a write-up connected the analytic portion with the data and ensured that the examples and research questions aligned.

Validation Strategies

The authors implemented validation strategies developed by Cresswell and Poth (2018) to ensure that these findings accurately represent the participants' statements. In qualitative

research, validation is the “attempt to assess the ‘accuracy’ of the findings, as best described by the researcher, the participants, and the readers” (Cresswell & Poth, 2018, p. 259). It is suggested that researchers apply at least two of the nine validation strategies to validate the accuracy of their findings. In this research, we implemented three strategies.

First, researcher bias was addressed through reflexivity by acknowledging the values, biases, and experiences brought to the qualitative research process, as recommended by Creswell and Poth (2018). Disclosing this information provides readers with a clear understanding of the researcher’s perspective. A lifelong Topeka resident and trained meteorologist, the first author is familiar with local hazards and communication practices, shares many community experiences, and understands inequities along Shunganunga Creek. These ties fostered rapport but also risked scientific and positional bias. Acknowledging these factors increases the study’s credibility.

Second, member checking was employed to ensure the accuracy and credibility of the data interpretation, as recommended by Creswell and Poth (2018). After completing the initial analysis, all participants received an email summarizing the preliminary findings and highlighting where their quotes were used to support the conclusions. This allowed them to validate or challenge interpretations from their perspective, ensuring that their voices were accurately represented. Most residents replied to our follow-up emails and confirmed that their original responses required no changes, so we did not modify any of the data.

Lastly, the authors implemented thick descriptions by providing detailed accounts of the participants and their experiences to capture their perspectives (Creswell & Poth, 2018). Richly describing each participant's context, background, and various viewpoints allowed for a comprehensive understanding of the diverse perspectives represented in the study. Our research benefited from applying thick description, as different individuals may perceive and respond to

flood risk messages based on their social, cultural, and situational backgrounds (Bubeck et al., 2012). Thick descriptions enabled a viable comparison across groups, fostering a deeper understanding of protection motivation within communities along the Shunganunga Creek.

Findings

Risk Perceptions in the Shunganunga Creek (RQ1)

Residents' views of flood risk along Shunganunga Creek reflected a layered mix of individual, community, and wider societal influences. While several participants described flooding as a serious local hazard, many saw it as less urgent than tornadoes or winter storms. Economic resources, personal flood histories, and the strength of neighborhood support networks all shaped how people judged and responded to rising water. Gaps in awareness and preparedness further widened these differences. The following sections unpack four recurrent themes that together explain the community's flood-risk perceptions; definitions for each theme appear in Table 1.

Socioeconomic Inequities

Flooding disproportionately affected lower-income communities in Topeka, where residents faced high flood insurance costs, limited recovery resources, and infrastructural deficiencies. Neighborhood structural layouts restricted mobility, increasing vulnerability during flash flooding events. Sarah, a mother and lifelong Topeka resident, has spent nearly four decades living in low-income neighborhoods across the city. However, she expressed that her current neighborhood's set-up does not give her an adequate way to leave if floodwaters rise: "Oh, I think the impact would be severe there. In the little neighborhood that I live in, there are only a few ways in and out, and many streets don't connect all the way through."

Outside of infrastructure, many residents highlighted how systemic inequalities in urban planning and economic opportunities contribute to flood risk in low-income communities. A born and raised Topekan, Riley has experienced weather hazards ranging from flooding to windstorms. She has seen firsthand how specific neighborhoods bear a heavier burden from weather hazards due to their placement in the city:

I see how Shunga¹ affects the communities, especially in [inner city community] and the surrounding areas. That's not personal to me, but I see how it affects the community. I see how that area, specifically the lower income parts of Topeka, are affected more than just environmentally, like how it's placed in Topeka, but also like the areas and neighborhoods.

The compounded effect of limited economic mobility left some residents with few options for leaving the floodplain. Some residents expressed that flood insurance is inaccessible, forcing them to rely on community aid or government programs. Despite awareness of flood risk, financial limitations prevented some residents from making home modifications to prevent future damage from flash flooding. Alice has lived in Topeka for over 40 years and spent most of that time along the Shunga. During that time, she has become a mother and a grandma and has experienced a multitude of flooding events. As someone who cares deeply about her family, she expressed frustration about knowing what needs to be done but not having the resources to act:

We know that every time it rains hard, the water starts creeping up, but what can we do? Raise our houses? We can't afford that. The city says they don't have the money, either, so we just wait and hope.

The Role of Proximity and Lived Experiences

Living closer to the creek and having prior flooding experiences also shaped residents' risk perceptions. Those with firsthand experience were more likely to recognize the dangers and prepare accordingly, but residents often underestimated the potential impacts that flash flooding

¹Residents often refer to Shunganunga Creek simply as "Shunga," a synonymous nickname that we use interchangeably with the full name at various points in the manuscript.

brought to their area. Bryce currently lives in an apartment with a friend. During his time along the Shunga, he has witnessed the dangers and problems associated with flash flooding events. He expressed how his lack of personal exposure to flooding contributed to a lower risk perception: "A lot of people, like me, for instance, haven't had that terrible of an experience with a flood, so we don't have respect for the power of a flood."

Linda, who has lived in Topeka for 65 years, has lived near and far from Shunganunga Creek. Her risk perception changed as she moved away from the creek, but she still remembers her mom taking precautionary behaviors after their home was flooded.

I feel like it won't affect me now, which I guess it could at some point, but I think I would pay more attention to it. If we were still over there on [street by the creek], I would definitely be paying more attention to it than I do. I'm in the center of town now. I'm nowhere near there. I think that's probably why I hesitate; I'm not fearful of it. I remember that after the flood, it seemed like every time they would come and say, 'We're supposed to be getting heavy rains or something,' my mom would start putting the furniture up on boxes. That went on for a while till she got comfortable.

Competing Hazards Diminish Flood Risk Perception

Despite the increasing threat of floods, residents prioritized preparedness for other natural hazards like tornadoes and winter storms. This resulted in lower preparedness and a reduced risk perception of the potential hazards running through their backyards. Riley's family has had a traumatic experience with a tornado. Since then, the way her family prepares for when the sirens go off is different than what it once was, and their mindset has significantly changed:

[My family] was in a traumatic tornado event. It was the last bad tornado that hit western Kansas. Because of that, my dad has always been overly prepared for storms. I think that, geographically, some rural areas are much more prepared for storms [than floods]. They have tornado shelters, basements, and storm doors that have real protection.

Flooding, tornadoes, and winter storms are frequent in the area (Kansas Adjutant General's Department, n.d.). However, the slow-onset nature of flooding makes it less of an immediate threat in the minds of a few residents, reducing the need to prepare. As a result, flood

preparedness efforts often are not prioritized, leaving residents vulnerable when extreme rainfall occurs and susceptible to increasing flood risks. Michael has lived in Topeka for almost 40 years. During his time, especially while living along the Shunga, he has spent much of his life preparing for weather-related disasters. He expressed how discrepancy shapes public perception of flooding events: "People around here see tornadoes on the news every spring. We get sirens, alerts, and drills for tornadoes, but no one really talks about what to do in a flood. That's why it's not on people's minds."

Cultural Norms and Community Dynamics

The culture surrounding Shunganunga Creek shaped attitudes toward flooding. Those with a strong sense of community felt more organized and had strong aid networks. Those who did not lacked collective preparedness. Sarah has witnessed a flash flood firsthand and expressed that she is lucky there is a small hill near where she lives so her home does not get hit with the worst of the water. However, due to this, she acknowledged that she only has a general idea of how to protect herself during a flood and noted that their neighborhood association did not proactively address flood risks, leaving individual residents like herself responsible for their protection: "It wasn't something that my neighborhood association said, 'Hey, we live close to the Shunga. Let's do a here's how you would pile sandbags if needed.'"

Repeated flooding once forced a nearby elementary school to close after one wing became chronically water-logged during heavy rain. Growing up near the neighborhood, Riley remembered how those events prompted her family to keep flashlights handy and turn on the weather radio whenever storms approached. She also realized that many households lack such resources and worried that limited access to hazard-education programs, community support, and emergency shelters leave her neighbors exposed: "Overall, the effects of weather in Topeka and

the lack of education, community resources, and emergency shelter-type resources affect the community as a whole. That makes me worried for Topeka when weather events occur."

However, not all residents expressed the same unpreparedness or lack of support as others. Aaron, a resident who has lived in Topeka for 25 years, recently moved away from the Shunganunga creek. He expressed that when community support is available, there is a greater sense of security in the face of a flooding event. When his house flooded in 2007, his community's help during the flood helped him recover:

When I use the word community, it is not just where you live. Right? The community is the people that are in your corner. That's the community that helps guide you and raises you... Do we still have that sense of community? I must say no... It's different. We're scared to talk to folks.

Protection Motivation Theory in the Shunganunga Creek (RQ2)

Effective flood risk communication ensures that residents understand, evaluate, and take necessary protective actions. However, existing strategies often failed to resonate with individuals due to a lack of localized, relatable messaging, insufficient guidance on practical protective measures, and an absence of emotional support for those with past flood-related trauma. Participants recommended community-driven approaches to help bridge these gaps by integrating local expertise and fostering trust. The following themes in Table 2 outline key strategies for improving flood risk communication, answering RQ2.

Enhancing Threat Appraisal Through Clear and Relatable Messaging

Clear and relatable messaging enhanced public understanding of flood risks and encouraged protective behaviors. Many residents emphasized that trusted sources should easily interpret and communicate flood warnings. Bryce recently moved from his childhood home along the Shunganunga to an apartment building with friends adjacent to the creek. Due to his

411 experience with frequent extreme weather hazards, he expressed that people are more likely to
412 take warnings seriously if the message is delivered by someone they trust:

413 If you have people who know how to connect with people personally and relate to them,
414 show them that I'm not some random scientist from New York telling you what to do
415 with your life. I am somebody like you who lives in a house down the road and who is in
416 the same boat as you. I think that relationship would help a lot.

417
418 Many residents emphasized that personal connections and clear communication could
419 significantly enhance the public's response to flood threats, but vague or impersonal warnings
420 can undermine preparedness. Ethan, who has spent his whole life in Topeka and recently moved
421 next to the Shunganunga, said that the lack of specificity in flood warnings makes him uncertain
422 whether he is at risk:

423 I, however, don't find them very helpful since they are so vague. When I receive them, it
424 just gives the name of the town or city affected, and that's it. They don't specify which
425 area the flooding is occurring in.

426
427 ***Strengthening Coping Appraisal through Accessible Measures and Actionable Guidance***

428 To strengthen coping appraisal, residents revealed the need of clear step-by-step flood
429 preparedness measures to have the tools they need to protect themselves. Local alerting
430 authorities can enhance public confidence and improve community resilience by making
431 preparedness guidance widely available and easy to understand. Matthew was born and raised in
432 Topeka, where he lived along the Shunganunga and experienced flooding as a child. He has
433 moved across the country for his profession, where he has experienced flash flooding from
434 various water hazards and had to respond promptly. He expressed how difficult it is to know
435 what steps to take without proper communication now that he's back living in his hometown:

436 Having that checklist of [flood recommendations] is important, and then you can do the
437 other [actions] if you have time to do them. A quick 3 or 5 top priorities to do in this
438 emergency... and communicating that ahead of time, I think is helpful.

439

440 Participants emphasized that education played a crucial role in helping residents understand
 441 flood risk and respond effectively. They called for more transparent and accessible initiatives,
 442 including workshops, public information campaigns, and tailored guidance for specific
 443 neighborhoods, arguing that, without this baseline knowledge, communities remained
 444 underprepared when floods occurred. In 2007, Janet awoke to firemen pounding on her door to
 445 tell her that the creek was quickly creeping into her yard. At the time, she felt unprepared and
 446 returned to significant wall damage in her home. To mitigate this problem for others, she
 447 suggested a formal system to educate residents in floodplains about flood preparedness:

448 I don't know if you can mandate it, but at least something that would go through. What do
 449 you do in a flood if it happens? Are people aware of those kinds of things? I don't know if
 450 you can mandate or make it a requirement, but at least there should be some mechanism
 451 for when people reside or choose to reside in a floodplain that they know what to do in
 452 case it happens.

453
 454 *Address Heightened Anxiety and Trauma from Previous Floods*

455 Many residents who have experienced a traumatic flooding event carried emotional
 456 burdens that shaped their response to future flood risks. Long-time Topeka resident Janet lived
 457 through a severe flood in 2007 that caused significant damage to her home. It took her family
 458 over a month to recover. Now, she has lingering fear and anxiety about flooding events:

459 Well, I suppose I was trying to stay calm because I had the kids here. I wasn't frightened,
 460 but I think because I lived through it before. When you live through catastrophes, you
 461 kind of get that PTSD stuff going on.

462
 463 Having children, elderly parents, and pets caused extreme stress during a flooding event. All
 464 residents interviewed expressed the need to protect their loved ones and, if possible, their
 465 property during a flood. Linda experienced such a severe flood that the Federal Emergency
 466 Management Agency (FEMA) had to boat her and her family out of their house (Figure 2). She

467 described her helplessness when they could not reach some family members due to the rising
468 floodwaters:

469 He got up and went to get them. And he called me, and he said, 'I can't get to them.' And
470 I was like, 'What do you mean you can't get to them?' And he couldn't get past [a street
471 where the creek flooded.] He couldn't get to them. So he said, 'There's nothing we can
472 do. We can't get to them.'

473

474 ***Leverage Community Knowledge, Resources, and Networks***

475 According to participants, integrating community knowledge, resources, and networks
476 can enhance flood risk communication by leveraging local expertise, collaboration, and trusted
477 relationships. Many residents emphasized that having trusted community figures and
478 organizations is critical in relaying important flood preparedness messages because people are
479 more likely to take warnings seriously from people they trust. During his 20 years in Topeka,
480 Bryce has only experienced minor flooding events along the Shunganunga Creek. However, he
481 expressed that his neighbors, who were deeper into the floodplain, had different experiences
482 from his. As a person deeply connected to his community, he suggested bringing neighborhoods
483 together through grassroots organizations, sponsoring a community event, and communicating
484 with residents about flood risks can increase overall awareness and preparedness:

485 Print out a couple of hundred like pamphlets and put them in people's mailboxes and
486 doors and say, 'If you would like to be informed about the risks that you might face
487 living in this community and some steps that you might take if you want to talk to a
488 weather expert. If you want to talk to a scientist, if you want to talk to a community
489 leader, come to this.'

490

491 Beyond printed flyers and brochures, participants stressed the central role of
492 neighborhood leaders in raising awareness and mobilizing response. Many noted that formal
493 warning systems often miss pockets of the population. In practice, residents turn first to
494 churches, civic clubs, and informal block groups for timely information, supplies, and cleanup
495 help. Strengthening these community-based networks, they suggested, would bolster both

immediate response and longer-term resilience far more effectively than relying solely on outside agencies. Matthew noted that he had no children during his interview. However, he recognized that having older family members or children can create additional challenges during a flooding situation, prompting him to develop a plan to keep people safe. He emphasized the need to be proactive in putting measures in place to protect community members instead of waiting for a disaster to happen to make a change: "I feel like it takes experiencing some of that, and then implementing a new plan is reactionary. Then we'd get really good at reacting to disasters when, instead, I think we should be trying to prevent them."

Participants also recommended forging stronger partnerships among government agencies, nonprofits, and neighborhood leaders to create a comprehensive foundation for flood preparedness, and they emphasized that community-led programs had equipped residents to reduce risks and speed recovery. Linda is a Topeka resident who has been living for almost 70 years and in her older age, moved away from the creek. During her time, she has experienced many types of weather phenomena. She suggested getting residents to be more proactive during a flash flood: "If we had more community meetings or outreach efforts before flood season, people would be more prepared. Right now, we rely too much on last-minute warnings, but by then, it's often too late to take meaningful action."

Discussion

Risk Perceptions Across the Shunganunga

Flood risk perception is shaped by combining social, cultural, and situational factors, but the weight of each varies depending on the region and circumstances (Slovic, 1987; Kellens et al., 2012). In flood-prone areas like the Shunganunga Creek floodplain, residents have developed specific ways of engaging with flood-related information shaped by prior experiences, competing

hazard awareness, and socioeconomic variables. The unique scenario creates communication challenges, as risk cannot be entirely eliminated for those living in a floodplain. Current flood risk messaging does not always align with the realities of Shunganunga residents, who need an approach to recognizing how they prioritize threats and process risk information.

Firsthand experiences with flooding shaped risk perception for Shunganunga residents, aligning with Grothmann and Reusswig's (2006) argument that personal exposure increases preparedness behaviors. However, the extent to which lived experiences translated into sustained preparedness varied among participants. When flood events were infrequent, residents often ceased to recognize the hazard altogether. Slovic (1987) argued that when a hazard is not immediate, it is deprioritized, even when the risk is real. Without consistent reinforcement, past disasters become stories rather than lessons, and when the next flood comes, communities are caught unprepared. These findings challenge the assumption that flood risk perception naturally increases over time in flood-prone areas. The Shunganunga floodplain contrasts with regions where recurrent flooding maintains a sense of urgency, as seen in studies by Bubeck et al. (2012). Addressing this cycle of risk disengagement requires more than periodic warnings; continuous education and reinforcement of preparedness behaviors are necessary to ensure that floods remain a recognized threat (Bubeck et al., 2012).

How residents perceive competing hazards additionally complicates flood preparedness. Flooding is a recurring threat in the Shunganunga floodplain, but it is not considered the most immediate and feared hazard to residents. Tornadoes and winter storms are more front-facing, leading residents to prioritize preparedness efforts toward these more visible threats instead of the slower-developing flood risk (Slovic, 1987; Rainear & Lin, 2021). Tornadoes, for example, present an immediate and highly destructive threat that demands an urgent response. The

psychological eminence of tornadoes and other severe storms overshadow flood risk, reinforcing a cycle where flooding remains an acknowledged but deprioritized hazard.

Socioeconomic inequities limit what residents know about flood risk and what they can realistically do about it. Along the Shunganunga Creek, many residents recognized the danger but felt preparation was out of reach due to financial strain. O'Neill et al. (2016) argue that vulnerability increases when people lack the resources to act, even if they recognize hazards. Some residents described how suggestions like elevating homes or buying insurance were unrealistic given their income, housing status, or family responsibilities. Jean (2023) notes that when preparedness guidance overlooks these barriers, it can deepen feelings of helplessness. Some residents felt flood messaging assumed stable income, homeownership, and spare time, conditions not shared by many in their community. Without practical options, flood risk becomes something to endure, not manage. To reduce this burden, preparedness efforts must offer strategies that reflect the constraints of floodplain communities. Risk communication that acknowledges these inequities and provides accessible, affordable steps can shift preparedness from an abstract goal to an achievable reality (Lechowska, 2018).

Advancing Shunganunga Safety through Protection Motivation Theory

Recognizing risk is only the first step toward preparedness; the ability and willingness to take protective action are equally important. PMT provides a framework for understanding how individuals assess risk and determine whether they can respond effectively (Rogers, 1975). Threat appraisal, which determines the perceived severity and likelihood of a hazard, is accompanied by coping appraisal, which assesses whether people feel capable of mitigating the risk (Bubeck et al., 2012). Self-efficacy, or the belief in one's ability to take protective action, and response efficacy, or the perceived effectiveness of those actions, play crucial roles in

determining whether individuals engage in preparedness behaviors (Ali et al., 2022). Findings from the Shunganunga Creek floodplain highlight that while some residents may recognize the threat of flooding, most of the interviewed residents lack confidence in their ability to take meaningful action.

Flood warnings need to be clear, relatable, and localized to be effective. Many residents struggled to interpret broad and impersonal flash flood alerts, leaving them uncertain about when and how to act. Raine and Lin (2021) argue that enhancing threat appraisal requires messages that resonate with residents' lived experiences. Similarly, Kellens et al. (2013) found that people are likely to see a threat seriously when warnings are tailored to their specific geographic and social context. Many Shunganunga residents felt disengaged from flood alerts that failed to specify which areas were most vulnerable or which actions would be the most effective for their circumstances. Addressing this disengagement will require flood warnings that not only convey risk but also provide information in a way that is immediately relevant and actionable for the communities they serve.

Even when individuals recognize a flash flood threat, their ability to respond effectively is shaped by whether they believe their actions will be successful. Many residents doubt the effectiveness of protective measures, particularly when past mitigation efforts have struggled, or financial constraints limit their options. Lechowska (2018) describes how coping appraisal depends on access to transparent, feasible guidance that aligns with individuals' resources. Residents may ignore the hazard of inadequate preparation without achievable, practical steps. Many residents expressed frustration that flood preparedness guidance assumes many personal factors they may not have, such as financial stability, no children, or being young. Strategies like reinforcing homes, purchasing flood insurance, or relocating may be unrealistic for floodplain

communities. Residents need straightforward, affordable ways to manage flood risk to break this cycle. Strengthening coping appraisal in messaging involves offering practical and accessible strategies for diverse socioeconomic conditions. When people see that preparedness is feasible and worthwhile, they are more likely to act (Bubeck et al., 2012; Rainear & Lin, 2021).

Past flood experiences shape how individuals perceive and react to future threats. Bubeck et al. (2012) found that exposure to flooding can create either increased engagement or learned helplessness, where individuals feel powerless against recurring disasters. Many Shunganunga residents spoke of the emotional toll of past floods but lacked the resources to channel their fear into action. This pattern reflects findings from Ali et al. (2022), who argue that when people endure repeated disasters without seeing real improvements in mitigation, they often disengage from preparedness entirely. Fear alone does not drive action; people benefit from knowing that preparation is worth it. Some residents reported that past flooding reinforced their belief that no preparation would be adequate, which diminishes response efficacy. Navigating flood-related trauma requires more than issuing warnings; there is a need for sustained engagement, resources to foster mental resilience, and messaging that promotes a sense of control rather than inevitability (Rainear & Lin, 2021).

Findings from Shunganunga Creek residents show that people are more likely to listen to warnings and implement preparedness measures when information comes from a familiar and trusted source instead of government agencies. While Ali et al. (2022) discuss the role of government credibility in influencing preparedness, Topeka residents expressed a more substantial reliance on informal warning systems like word-of-mouth communication, community leaders, and local organizations. Shunganunga residents' ideas aligned with Rainear and Lin (2021) findings that individuals are more inclined to trust preparedness

recommendations when they come from sources embedded in their daily lives rather than external agencies. However, this dependence on social networks can introduce challenges like misinformation and unverified advice that can circulate quickly (Trujillo-Falcón et al., 2024). To maximize response efficacy, adapting flood preparedness strategies to include community leaders in formal warning systems can ensure that actionable information is widely disseminated while maintaining the trust and engagement of residents (Bubeck et al., 2012; Lechowska, 2018).

Practical Recommendations

Starting June 2nd, 2025, flood stage categories along the Shunganunga Creek will be revised after evaluations show that flooding occurs at lower levels than previously suggested (National Weather Service, 2025). With this new change, there must be an evolution of flash flood communication strategies to support floodplain communities that face persistent and compounding challenges. Currently, messaging often fails to reach many Topeka residents with diverse needs, leaving them without clear, actionable guidance during flash floods. Moving toward a more tailored approach that prioritizes accessibility, and engagement can help ensure all individuals feel empowered to respond to flooding threats.

The widely recognized "Turn Around, Don't Drown" (TADD; Figure 3) campaign does not adequately address the unique challenges that floodplain communities face. The message emphasizes avoiding flooded roadways but does not guide residents who cannot evacuate or reach higher ground. Studies have questioned the effectiveness of TADD. Bryant (2021) found that the campaign lacks measurable impacts on driver behavior in flooded roadways. Haghdoost et al. (2024) highlighted that despite public awareness efforts, some people do not take weather warnings seriously due to their attitude towards flood risks and lack of sufficient knowledge on the subject, which in this case leads to an increase in motor vehicle-related drownings. Phasing

out TADD in favor of a more personalized, community-driven approach can combat these problems. While the NWS offers numerous resources related to flood safety, a critical need remains for more tailored efforts to address the diverse needs of floodplain residents, ensuring that preparedness is practical and actionable for all populations. For floodplain communities, it may not be feasible for people to leave their homes or have the necessary resources to reach safety. We suggest that new messaging strategies be developed in collaboration with at-risk communities to align with local needs and incorporate research-driven methods to enhance personalization while maintaining clarity and accessibility. This can be achieved by examining the disaster cycle and identifying actions to take before, during, and after an event. Furthermore, warning messages that follow established risk communication frameworks, such as the Warning Response Model, can bolster recipients' response efficacy and self-efficacy, thereby increasing their confidence to act during flash flood emergencies (e.g., Sutton et al., 2021).

From a community-based standpoint, many residents in the Shunganunga Creek floodplain are unaware of available resources to protect themselves. We suggest developing public events to bring the community together that introduce residents to existing NWS and emergency management resources and incorporate residents' lived experiences to build trust with community members. In addition to learning about warnings, these events should also include guidance on financial assistance programs, emergency preparedness strategies, and hands-on demonstrations. Making this information more accessible will enable agencies to bridge the gap between existing flood mitigation programs and those who need them. By working together with community members and practitioners, we can plan *with* residents instead of *for* them, because we must address the flooding and hazard navigation that are residents' realities.

656 Lastly, we suggest creating a formal program alongside communication researchers that
657 prioritizes continuous data collection to track changes in threat appraisal and evaluate the
658 effectiveness of implemented changes while specifically engaging vulnerable communities.
659 Local governments and emergency management agencies can reassess and refine their outreach
660 strategies based on community feedback and emerging research, while also creating sustainable,
661 adaptive flood preparedness initiatives that are responsive to the needs of at-risk populations.

662 **Limitations and Future Research**

663 We recognize that this study's findings are specific to the Shunganunga Creek floodplain
664 and may not be fully generalizable to other flood-prone areas with different social, economic,
665 and geographic conditions. We also acknowledge that this project had limited participation from
666 key stakeholders, which may constrain the depth of qualitative insights and the applicability of
667 our suggested policy recommendations. We recommend that future research prioritize broader
668 stakeholder engagement to enhance the generalizability of these strategies and explore ways to
669 tailor specific warnings and messages to the needs of different communities.

670 **Conclusion**

671 As the climate changes, communication strategies must adapt to meet the evolving needs
672 of floodplain residents who face recurring complex challenges. We can work to ensure that all
673 residents, regardless of socioeconomic inequities or physical limitations, are prepared to respond
674 effectively to flood threats by transitioning toward more personalized risk communication
675 strategies, expanding public reach efforts, and fostering long-term community engagement.
676 Transforming communication strategies is about delivering information and empowering
677 floodplain residents with the knowledge and resources they need to protect their lives, homes,

and futures. By doing so, we can transform risk into resilience by building systems that warn communities and enhance their capacity to recover, adapt, and thrive.

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Data Availability Statement

Due to Institutional Review Board protocols and ethical considerations related to working with a specific vulnerable population, the data collected for this study cannot be publicly shared. Participants were assured anonymity, and data access is restricted to protect their privacy.

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Supplemental Material

Interview Questionnaire

Ice Breaker

- How long have you lived in Topeka? What kind of weather disasters have you experienced while living in this area?

Risk Perception and Protection Motivation Theory

- According to the most recent Kansas Response Plan, here is a list of common weather disasters experienced in the Topeka area: **tornadoes, windstorms, floods, winter storms, and wildfires**. Could you rank them according to what you believe personally poses the most significant risk to you? Do you feel more or less vulnerable to some hazards more than others? Why?
- When you ranked flooding in terms of risk, what specific concerns or experiences led you to place it where you did? If a flood were to occur in your area, how severe do you think the impacts would be for you and your community?
- Have you received any communication or warnings about flood risks in your area? If so, how clear and helpful was it that you found that information?
- If you were to receive a flood warning, how confident would you be that you could take action to stay safe? Are there steps you believe you could take to protect yourself, or do you feel uncertain about what actions to take?
- According to the National Weather Service, these actions are recommended during flood warnings: (1) Get to higher ground; (2) Do not drive into water; (3) Stay informed. Do you think the actions recommended would help keep you safe? Why or why not?

Community Resilience

- 812 ● How would you describe your community's ability to recover from floods? What are its
813 strengths and weaknesses?
- 814 ● For members that have lived in Topeka for most of their lives: Have you noticed any
815 changes in how the community prepares for or responds to floods over time?
- 816 ● Could you describe factors that you believe contribute to building resilience to floods
817 within your community? These could include but are not limited to community support,
818 local infrastructure, and emergency services.

819 **Communication and Solutions**

- 820 ● What kinds of communication about flood risks would be most helpful to you? Are there
821 specific ways to better communicate warnings or safety information?
- 822 ● If you had the chance to recommend policy changes to improve flood preparedness or
823 recovery, what would they be? Are there specific actions you believe local, or state
824 officials should take to protect your community better?

Tables and Figures**Table 1**

RQ1: How do various factors in the individual, community, and societal levels shape residents' perceptions of flooding risks in the Shunganunga Creek area?

Theme	Definition
Socioeconomic Inequities	Socioeconomic inequities in flood-prone areas are evident in the disproportionate impact on lower-income neighborhoods, where inadequate infrastructure, high flood insurance premiums, and limited recovery resources heighten vulnerabilities.
The Role of Proximity and Lived Experience	Individuals who live closer to Shunganunga Creek and have experienced flooding events in the past are more aware of flood risk than those who have not.
Competing Hazards Diminish Flood Risk Perception	Due to the variety and severity of storms in Northeast Kansas, all residents chose hazards such as tornadoes, wind, and winter storms above flash floods due to their impacts.
Cultural Norms and Community Dynamics	Local culture in the surrounding community of the Shunganunga Creek shapes attitudes toward flooding, with some communities feeling more organized and supported than others.

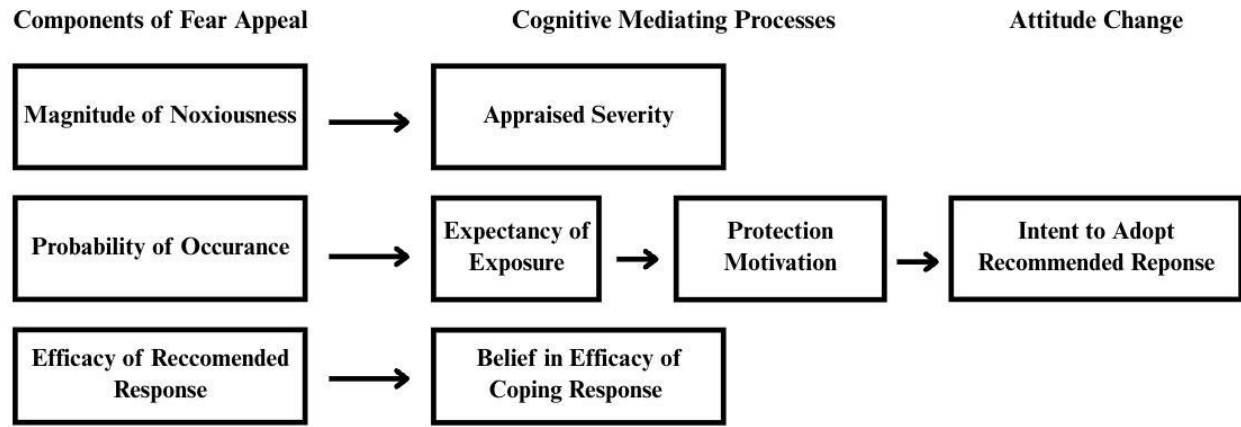
Table 2

RQ2: How can current flood risk communication messages be improved to enhance threat and coping appraisal, thereby motivating residents to take protective actions?

Theme	Definition
Enhancing Threat Appraisal Through Clear and Relatable Messaging	Clear and relatable messaging enhances threat appraisal by delivering accurate, localized information about flood risks in a way that resonates with residents' lived experiences along Shunganunga Creek.
Strengthening Coping Appraisal through Accessible Measures and Actionable Guidance	Accessible measures and actionable guidance strengthen coping appraisal by equipping residents with practical, easy-to-implement protective actions and resources, ensuring they feel confident in their ability to reduce risks and manage potential flooding impacts.
Address Heightened Anxiety and Trauma from Previous Floods	Acknowledging past experiences and addressing the anxiety and trauma caused by previous floods while providing emotional support resources and fostering trust through empathetic, resilience-focused messaging improves flood risk communication and helps communities prepare.
Leverage Community Knowledge, Resources, and Networks	Implementing community knowledge, resources, and networks can enhance flood risk communication by integrating local expertise, fostering collaboration, and leveraging existing relationships to disseminate information more effectively and build collective resilience against flooding.

836 **Figure 1**

837 *Schema of the Protection Motivation Theory*



838

839 **Figure 2**

840 *2007 Shunga Flood, submitted by Linda with permission*

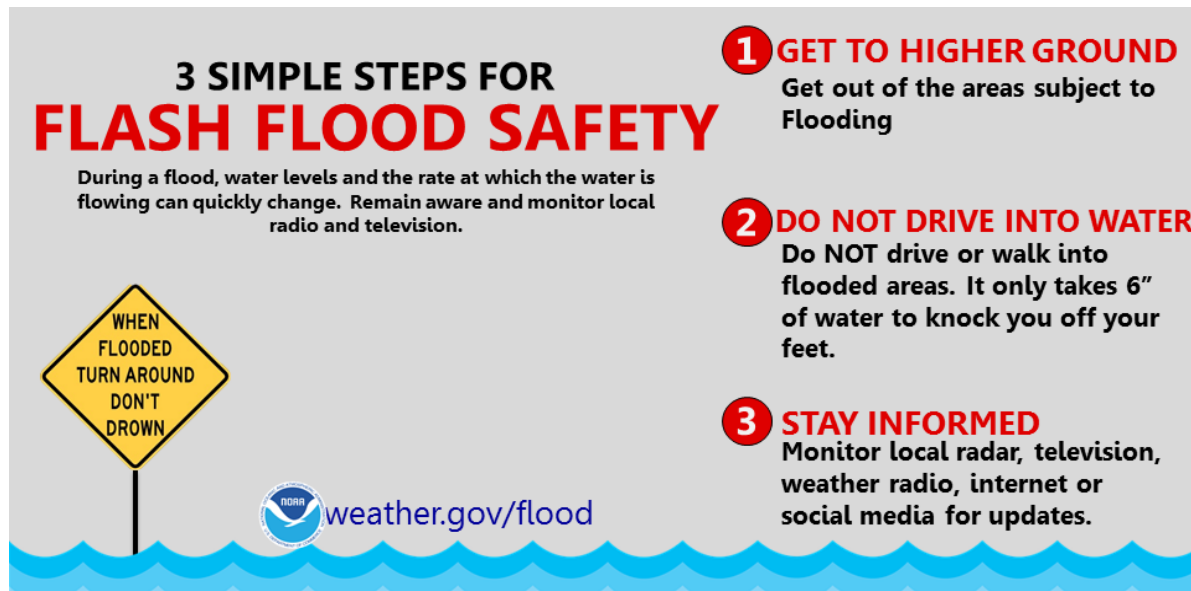
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842

843 **Figure 3**

844 *National Weather Service Turn Around Don't Drown® Campaign*



845