



**Step UP!**  
**Get READY!**  
**RESPOND!**

The creation of this booklet has been made possible with funding support by the National Sea Grant College Program in collaboration with NOAA National Disaster Preparedness Program, The S.C. Sea Grant Consortium, The James Near Center for Climate Studies, and The Citadel STEM Center.

This publication was prepared as a result of work sponsored by the South Carolina Sea Grant Consortium with National Oceanic and Atmospheric Administration financial assistance number NA23OAR4170319.



Suggested Citation: Koester, M. (2024). Kids Teaching Flood Resilience: The Who, What, Where, When, Why, and How. S.C. Sea Grant Consortium.

© 2024 Merrie Koester, Ph.D.

# Welcome to the world of **Kids Teaching Flood Resilience**

where youth ages 11-18 take part in a **RESILIENCE QUEST** with their Teacher Leaders and community mentors to build high impact forms of science literacy. They want to prove that they are not just kids, doing the work necessary to develop **POWER KNOWLEDGE** across five domains: 1) **Weather Smart**, 2) **Place Wise**, 3) **Storm Surge Smart**, 4) **Prep Ready**, and 4) **Water Safe**. Whenever possible, they also step up to learn water safety and survival skills, knowing that drowning is the number one cause of death from a hurricane.

## THE RESILIENCE QUEST



Affording opportunities for youth to **TEACH what they know**—to practice making and sharing a **Thing That Could Save Lives (TTCSL)**— is a fundamental part of the KTFR storymaking process. In our middle school program, we've been fortunate to bring in professional artists to work with smaller groups of courageous creatives who want to bring their communication art to a *performance* level. Very often, these talented youth have struggled to succeed in traditional test/text driven curricula and have rarely felt part of the story when they're in school.

A compelling story causes you to ask...



And Then What Happened?

Kids Teaching Flood Resilience  
Their World / Their Stories

# The Power of STORY



As a STORY, Kids Teaching Flood Resilience is about REAL KIDS being positioned and empowered as vital resources for family and community flood and hurricane resilience. Instead of being **EDUCATIONALLY VULNERABLE**, KTFR ambassadors know what to **NOTICE, KNOW, and DO** *before* a hurricane strikes.

The KTFR storymaking methods are highly generalizable to other flood prone coastal and inland riverine communities. What is consistently evident in this story—as patterns in the data—are the ways in which human alterations of the natural landscape have greatly contributed to flood hazard risks.

## ***Moving from So What? to Now What?***

Now, because of funding support from the NOAA Disaster Preparedness Program, anyone interested in developing their own KTFR stories can do so, knowing that this work meets key criteria for highly *effective* community resilience development programs:



### **Criteria for effective community resilience development programs**

- A high degree of self efficacy.
- Community empowerment.
- Problem-focused coping.
- A sense of community and commitment to action.

Paton and Johnston, 2001

## Kids Teaching Flood Resilience is designed for:

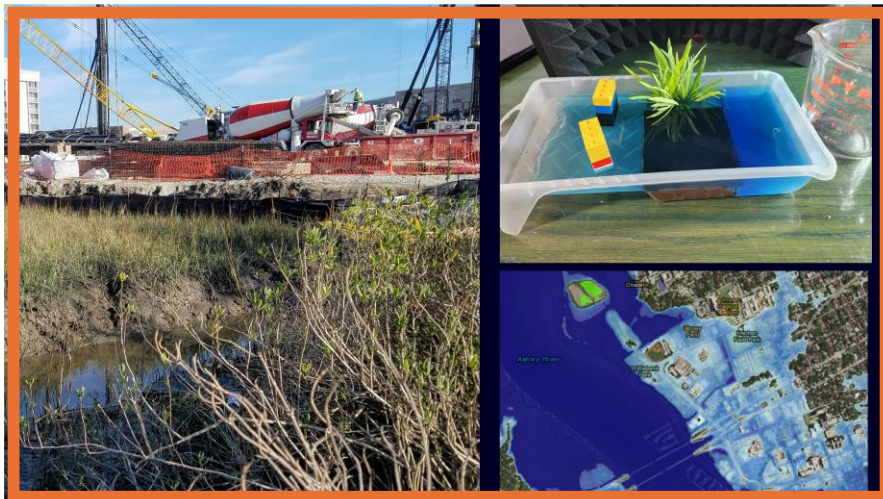
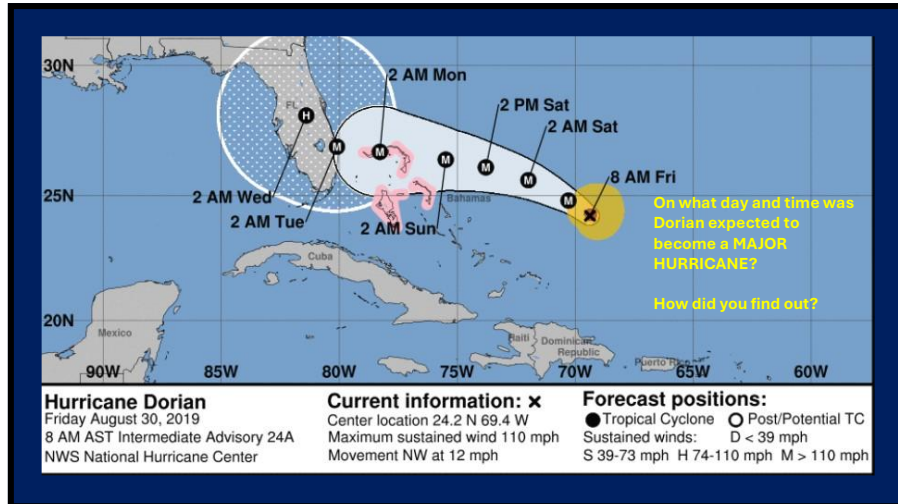
- Middle and high school science teachers—especially those serving youth living in highly flood prone communities. In KTFR, we learn science like our lives depended on it!
- Leaders of out-of-school youth leadership development programs ( like 4H and extension education programs in coastal and inland riverine communities.)
- City employees and emergency management specialists who have been tasked with deploying hazard risk reduction public information programs that connect and deliver.
- Higher education teacher education professors---as a research-based exemplar of meaningfully engaging pedagogies for all learners.
- Home school programs.



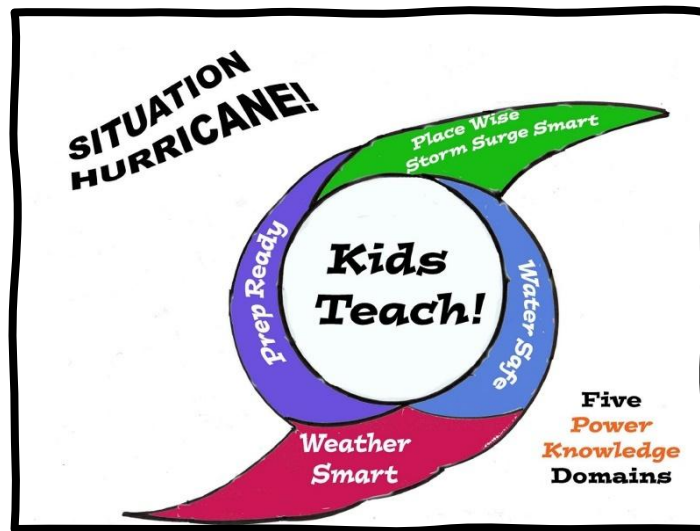
## A KTFR Participant Can Find Out and Explain...

- **How much time** they have to get ready before a weather event is upon them.
- What to pack in an **emergency kit** and what their **evacuation route** should it be necessary for them to leave.
- How to interpret **National Hurricane Center (NCH) Forecast Graphics** so that they know the storm's forward speed and direction, the wind speeds, the predicted landfall location and time, predicted arrival time of tropical storm force winds, and predicted storm surge inundation over the land.
- Their **storm surge flood inundation risk** based on 1) the elevation of their home, 2) whether it's built on top of a re-claimed wetland, 3) the moon and tide phase, 4) wind speed and direction, and 5) whether you will be in the right front quadrant of a hurricane or tropical storm.

- Why **slow-moving storms** can create **significant rainfall flooding** that can compound storm surge and inland riverine flooding hazards.
- ***What NOT to do when a hurricane is coming!***



# The KTFR POWER KNOWLEDGE Domains



KTFR is a quest to acquire **POWER KNOWLEDGE** over five domains, each with its own set of **SITUATIONS** to analyze and interpret and skill sets to master. The colors of each domain are story elements in themselves, acting as repeating cues throughout the experience to catalyze associative thinking.

**GET WEATHER SMART (Videos 1-6)** / An analysis and interpretation of information communicated in the state and national science standards and “NOAA Smart Tools”—the National Hurricane Center (NHC) forecast graphics, National Weather Service forecasts, and the NOAA Sea Rise Viewer. Patterns in the data from past hurricanes provide extra insight.

**GET PLACE-WISE (Video 7)** / A place-based analysis of their neighborhood’s proximity to the ocean, river, or stream, as well as its development history. For example, is their home place built on re-claimed saltmarsh? What evidence from maps can we find? What are their home/school’s land elevation and where are their community’s flood hazard spots? What challenges do engineers face in managing stormwater run-off in low lying areas? What can we learn from local cultural and indigenous people about sustainable land use practices and ways of being community?

**GET STORM SURGE SMART (Video 8)** / Technically part of the GET PLACE WISE learning, this inquiry includes an assessment of situational storm surge risk, especially the conditions that can lead to a Compound Coastal Water Event (CCWE). We have employed the NOAA NWS Potential Storm Surge Flooding Models, NOAA Sea Rise Viewer, land elevation and survey data from the USGS, place-based knowledge about storm drains and flooding hot spots, as well as how to use apps to find tide and moon phases, wind direction, and a model “worst case situation” hurricane scenarios.

**GET PREP READY (Video 9)** / Hurricane season preparation, including making family emergency plans, writing down family and other contact information, identifying evacuation routes, what to pack in an emergency kit, and what to do if you get separated from our family.

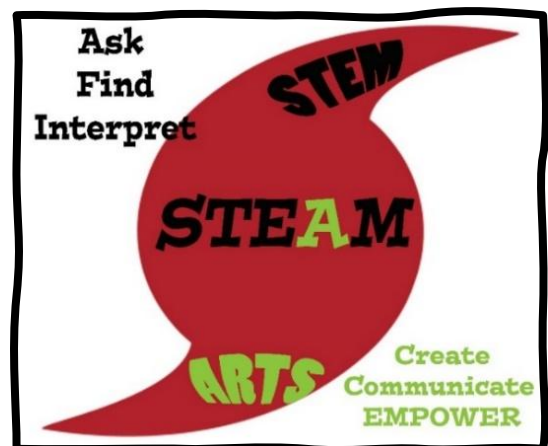
**GET WATER SAFE (Video 10)** / An analysis of youth and family member water survival capacities. NOTE: A key goal of the KTFR outreach is to address the disproportionately high drowning deaths among Black children and youth with culturally responsive methods developed by Thought Leader, Nicole Ashby, founder and director of [Gullah Swim Academy](#) in Charleston, SC.

**GAME ON. SITUATION HURRICANE (Video 11)** / Hurricanes are NO GAME. In this collaborative board game, it's impossible to win unless your team shows they have the POWER KNOWLEDGE they need to get themselves out of SITUATIONS.

## Learning as a Creative Process and Communication as Art

KTFR treats STEM learning as a creative process, fully recognizing that **effective communication about STEM matters is an ART.** The **STEAM** learning progression aims to develop a *storm of educative resilience*. Affording time, space, and resources for developing and practicing communication skills is considered a vital part of the KTFR resilience building story.

Creative agency is an essential part of what scholar Brittany Harker Martin (2018) describes as “**socially empowering learning.**” Martin’s research shows that higher measurable levels of **intellectual engagement** occur when teaching projects feature the following four characteristics: 1) are group-based, 2) create time, space and resources for *creative agency*, 3) situate learning in authentic, real-world problem solving that students can realistically solve, and 4) feature activities that have a positive social impact.





# The KTFR Storymaking Tools – An Overview

The following Storymaking Tools have been extensively field tested with youth ages 11-16.



## ***Kids Teaching Flood Resilience Digital Media Field Guide (under construction)***

This document will provide guidelines for how to facilitate vertically articulated KTFR teaching/ learning experiences. The Middle School Curriculum—***Step UP, Get READY, RESPOND***, foregrounds the key message, “Never Say **WHATEVER**, Especially in a Hurricane!” (also the name of the KTFR feature film), introduces the 5 POWER KNOWLEDGE domains, 10 key Resilience Capacity Skills, and features a series of interactive videos, game-based learning as well as informational text written in rap, hyperlinked to “Power Tools” for deeper learning. The high school KTFR curriculum—**Once Upon an Environmental Impact Situation**—takes a deeper dive into the use of drawing, model-based inquiry, mapping tools, citizen science, and science communication competency development.



## **A dedicated YouTube video playlist called KTFR & YOU**

These videos provide a plug-and-play way to shape your own KTFR stories, even if you have minimal content knowledge to begin with! Youth can watch these videos with their families, too. We’ve used these videos in many different ways—as bellringer activities during hurricane season, as part of a stand-alone weather unit, and (the favorite) as a dedicated part of “Flood Resilience Fridays.”



## **Printable GET HURRICANE SMART RAP**

Tapping into the power or rhyme and rhythm to communicate and remember important messaging, the KTFR POWER KNOWLEDGE has been concentrated into rap poetry, which has been hyperlinked to “SMART TOOLS” for deeper learning. Each POWER KNOWLEDGE domain has its own set of verses. Knowing their significance is necessary if your team is to win board game SITUATION HURRICANE.



## **KTFR FLOOD RESILIENCE LITERACY SURVEY**

As a metric for documenting one's pre/post "RESILIENCE CAPACITY LEVEL" from 1-10, this survey (if honestly answered), this survey provides a lot of insight about your knowledge and action gaps. Instructions for administering it are part of the KTFR & YOU video called **Building Resilience Capacity**.



### **RESILIENCE CAPACITY CONCEPTS**

Color coded by POWER KNOWLEDGE domain, this is a single page of terms that, when considered in relationship to one another, reveal the cause-and-effect relationships that can amplify flood hazard risk. At the top of the page are orange colored "Big Picture" concepts that frame the story. These RC Concepts are described in the first two KTFR & YOU videos.



### **THE GET HURRICANE SMART KAHOOT QUIZ**

Developed with a team of youth from Morningside Middle, this Kahoot Quiz has become a regular favorite with all of our KTFR participants, from students, teachers, and families to large groups of professional engineers.



### **KTFR SKETCHBOOK GUIDE (under construction)**

Throughout the KTFR storymaking process, drawing is considered a powerful form of language and communication. The KTFR Sketchbook is a place where narrative images called "KNOW"tations are made, telling stories like why storm drains can fail to depictions of a storm surge event. Sample entries are featured in this storymaking tool. Ways of incorporating sketchbook entries are also included the *KTFR & YOU* videos and the field guide. As you'll see, we also use the sketchbook as a place to glue in/safeguard key KTFR documents, like the RESILIENCE CAPACITY CONCEPTS and KTFR Flood and Hurricane Literacy Survey.



### **Foldable Emergency Contacts and Plan**

As a key component of the GET PREP READY session(s), this document can be completed as part of a family planning meeting and folded down to easily fit in a wallet or purse. Completing this form not only gets family members to write down cell phone numbers of family and emergency contacts (irretrievable if a cell phone dies or gets lost), doing so also starts conversations about where to meet up in case you get separated.



### **Moon Tide Factors**

This is a model-based learning activity for teaching why we have tides and why tides are highest at new and full moon phases.

Included by popular demand from our Teacher Leaders, this activity creates kinesthetic awareness of the fact that the Earth is rotating under the ocean, which itself is being pulled on by the gravitational forces of the sun and moon. Tracking the moon's phase and the tides (using mobile apps), while one also tracks a progressing storm on the National Hurricane Center (NHC) website, are essential parts of being flood and hurricane literate.



### **SITUATION HURRICANE / The Board Game Kit**

This game kit includes all the materials you'll need to print out the game board and cards as well as the links to purchase other basic supplies. We've also made our own game pieces and devised several different ways of playing the game, even as a large family-based event!



### **Trifold Board Displays**

This resource provides a highly interactive way of pulling an entire POWER KNOWLEDGE story together for youth-led family-based teaching.



### **KTFR LIVE! REAL KIDS / REAL TEACHING**

All KTFR youth get to practice performing their POWER KNOWLEDGE throughout the KTFR storymaking process, signifying that they've "arrived" at the turning point in the quest. We call this part of the quest ***KTFR LIVE!*** As you'll see here, some incredibly powerful work emerged when we got to work just a few hours with a professional artist.

**KTFR & YOU!**

**POWER KNOWLEDGE PLAYLIST ON YouTube!**

**Kids Teach!**

9 prep Ready

10 Water Safe

6 Weather Smart

8 Place Wise Storm Surge Smart

7

11

**GAME ON!**

© Merrie Koester, Ph.D

12



## Teaching Video Content

**1 SITUATION HURRICANE / Educational Vulnerability**

**2 Situation Hurricane / SANKOFA**

2

**3 Building Resilience Capacity**

**4 Time to Get Hurricane Smart!**

**5 Let's Talk Weather!**

**6 GET HURRICANE SMART! It's All in the Rap!**

**7 Get Place Wise: The Low Down on Flood Hazard Risk**

**8 Get Storm Surge Smart / When Right Is WRONG!**

**9 Get Prep Ready Do's and Don'ts**

7

**10 Get Water Safe With Gullah Swim Academy**

**11 GAME ON / SHOW WHAT YOU KNOW!**



## KTRF FLOOD RESILIENCE LITERACY SURVEY

Please answer YES or NO to the following questions. It's REALLY important that you answer honestly. If there is any doubt, then please answer NO. By the completion of your KTRF program, you should be able to answer a Big YES to all of these AND back that up with your own teaching!

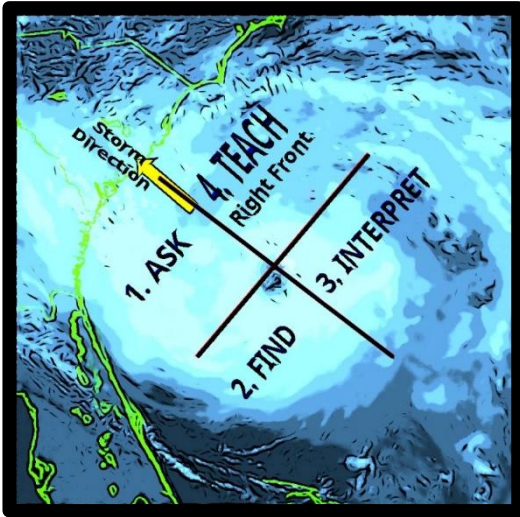
QUESTION	Pre-KTRF Answer	Post-KTRF Answer
<p><b>1. Do you know the difference between a Hurricane WATCH and WARNING?</b>  <i>Post Experience: Do you now know why this knowledge matters so much?</i></p>		
<p><b>2. Can you find and interpret forecast graphics by the National Hurricane Center (NHC)?</b>  <i>Post Experience: Are you now more confident you can do this?</i></p>		
<p><b>3. Do you regularly check the weather (and the NHC) THREE times a day, especially during hurricane season?</b>  <i>Post Experience: Are you now more likely to do this?</i></p>		
<p><b>4. Do you know the WORST possible landfall location of a hurricane for YOU?</b>  <i>Post Experience: Are you now more confident you can answer this question?</i></p>		
<p><b>5. Can you name FIVE factors that can INCREASE storm surge hazard risk?</b>  <i>Post Experience: Are you now more confident you can do this?</i></p>		
<p><b>6. Do you ALWAYS avoid walking or driving through a flooded area?</b>  <i>Post Experience: Are you now more likely to avoid flooded areas in the future?</i></p>		
<p><b>7. Have you and your family downloaded (and know how to use) a tide chart app, the FEMA app, and the state emergency management department app?</b>  <i>Post Experience: Are you now more likely to download and use these apps?</i></p>		
<p><b>8. Have you and your family 1) made a WRITTEN family emergency plan, including the phone numbers of emergency contacts; 2) identified your evacuation route; and 3) prepared an EMERGENCY KIT?</b>  <i>Post Experience: Are you now more likely to take these PREP-READY steps?</i></p>		
<p><b>9. Do you and your family always obey hurricane evacuation orders and leave?</b>  <i>Post Experience: Are you now more likely to obey evacuation orders in the future?</i></p>		
<p><b>10. Do you think it's important to learn how to swim?</b>  <i>Post Experience: Can you now explain three things to do to keep yourself and others safe in and around the water?</i></p>		

## RESILIENCE CAPACITY CONCEPTS

*How Are They Related?*

Power Knowledge Domain Key: **Orange** = Big Picture Knowledge / **Red** = Weather Smart/ **Green** = Place-Wise and Storm Surge Smart / **Purple** = Prep-Ready / **Blue** = Water Safe

SITUATION	DISASTER RISK	SITUATIONAL VULNERABILITY
HAZARD	RESILIENCE CAPACITY	POWER KNOWLEDGE
EDUCATIONAL VULNERABILITY	WHATEVER ATTITUDE	3 HAZARD SMART QUESTIONS
SANKOFA	RESILIENCE QUEST	DROWNING
WATER SAFETY SKILLS	NATIONAL HURRICANE CENTER (NHC) FORECAST GRAPHICS	WATCH vs. WARNING
TRACK FORECAST CONE ("Cone of Uncertainty")	LAND ELEVATION	STORMWATER FLOODING
RAINFALL INTENSITY	STORM SURGE FLOODING	TIDAL FLOODING
FILL-AND-BUILD ON WETLANDS	GLOBAL WARMING & SEA LEVEL RISE	STORM DRAIN FAILURE
TIDE & MOON PHASE	HURRICANE LANDFALL LOCATION	WIND SPEED AND DIRECTION
HURRICANE QUADRANT AND TORNADO RISK	HURRICANE CATEGORIES	EMERGENCY KIT
EVACUATION ROUTE	SMART CELL PHONE USE (FEMA App, State EMD App, Tide Chart App, Text, don't call!)	FAMILY EMERGENCY PLAN



## Build High Impact STEM Literacy!

Integrate evidence-based thinking, place-based analysis, model-based inquiry, and the creative arts to document and communicate flood and hurricane hazard risk.

### KTFR and the NGSS Science Standards

#### Dimension 1/ Science and Engineering Standards:

- Asking questions (for science) and defining problems.
- Engaging in argument from evidence
- Analyzing and interpreting data
- Constructing explanations

#### Dimension 2 – Cross Cutting Concepts

- Cause and effect relationships
- Patterns
- Scale, proportion, and quantity
- Stability and change

#### Dimension 3: Disciplinary Core Ideas (DCI)

- Earth's Systems – ESS2
  - ESS2.D: Weather and Climate

#### ESS3: Earth and human activity

- ESS3.B: Natural Hazards

# KTFR StoryMaking Stages



## 1. NOTICING

There's a weather SITUATION?

## 2. KNOWING

There's something I could learn that can help prevent getting into this SITUATION in the first place!

## 3. DOING

I can practice TEACHING this POWER KNOWLEDGE in ways I think can get people to listen and ACT!





## The Who, What, Where, When, Why, and HOW

Kids Teaching Flood Resilience is (KTFR) is a community resilience building initiative founded and directed by [Dr. Merrie Koester](#) of the University of SC Center for Science Education. This teaching material has been developed in with funding from the NOAA National Disaster Preparedness Program, in collaboration with SC Sea Grant Consortium, the Citadel's James Near Center for Climate Studies and STEM Center, together with a a robust team of Teacher Leaders, community STEM mentors, artists and, of course, KIDS!

The KTFR Story creates opportunities for middle and high school youth to communicate (with authority!) the cause-and-effect relationships, patterns in the data, and change over time that have and can continue to create flood hazard risk for their home place. They are anything but helpless children. They are science literate weather ready ambassadors!

