Sharing is Caring:

How Multi-Stakeholder Collaboration Accelerates Hurricane Helene Restoration

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June 9th, 2026 @ 4:30 pm
43rd Meeting of the American Society of Reclamation Sciences
"After the Fall: Restoration After Natural Disasters"

University of Wyoming, School of Energy Resources
Marian H. Rochelle Gateway Center, Ballroom D
Laramie, WY

Photo: National Weather Service
Sept. 27, 2024

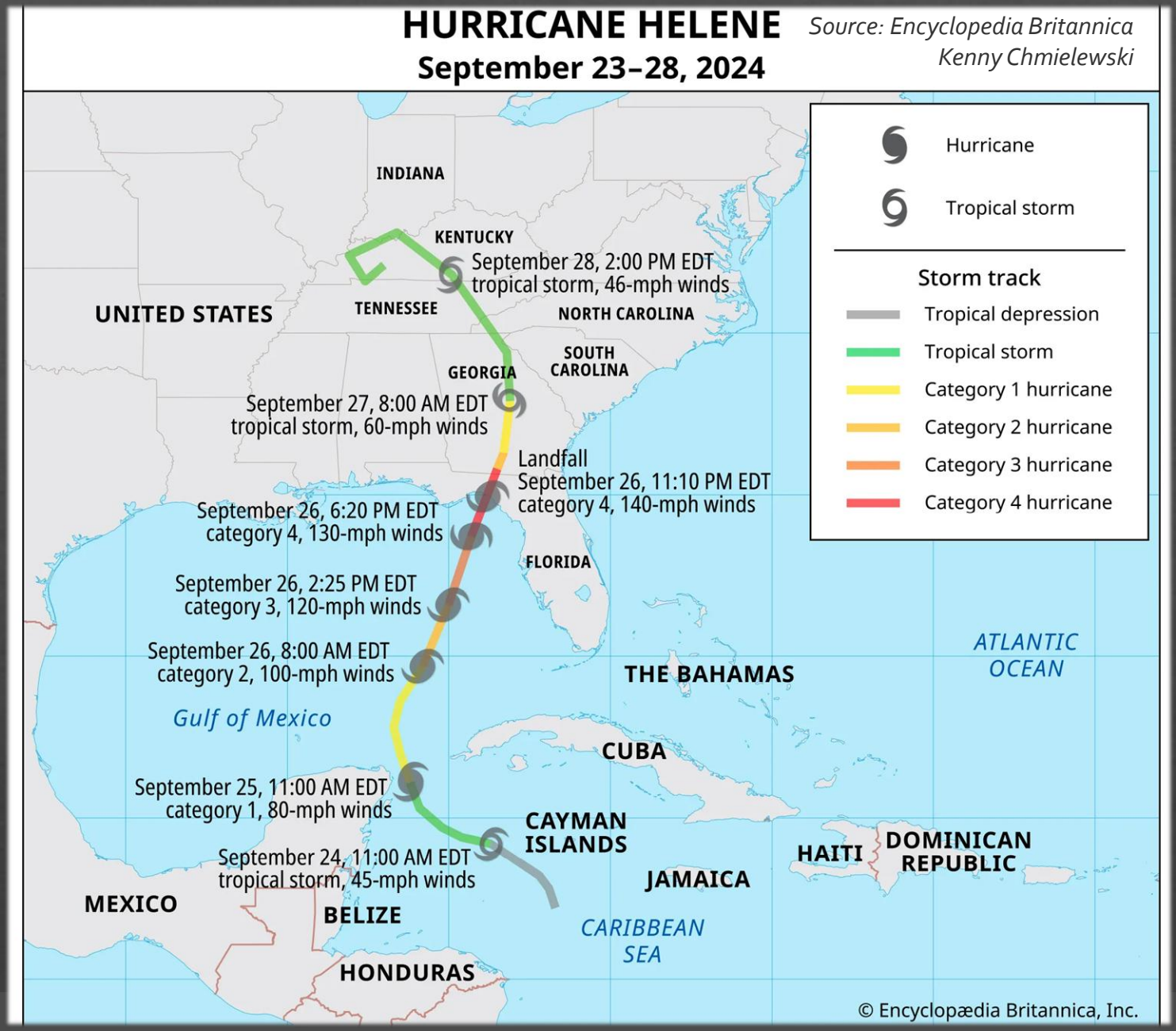
THE UNIVERSITY OF TENNESSEE KNOXVILLE
Earth, Environmental, and Planetary Sciences

The Storm: Hurricane Helene at a Glance

~250 lives lost	$78.7B estimated damage
40T gallons of rain	Sept. '24 landfall and inland impact

States Affected: FL, GA, SC, NC, TN

One of the deadliest inland hurricane events in modern U,S history, Helene drove catastrophic flooding across Appalachia, reshaped river channels, and triggered cascading ecological damage – particularly in western North Carolina and eastern Tennessee.



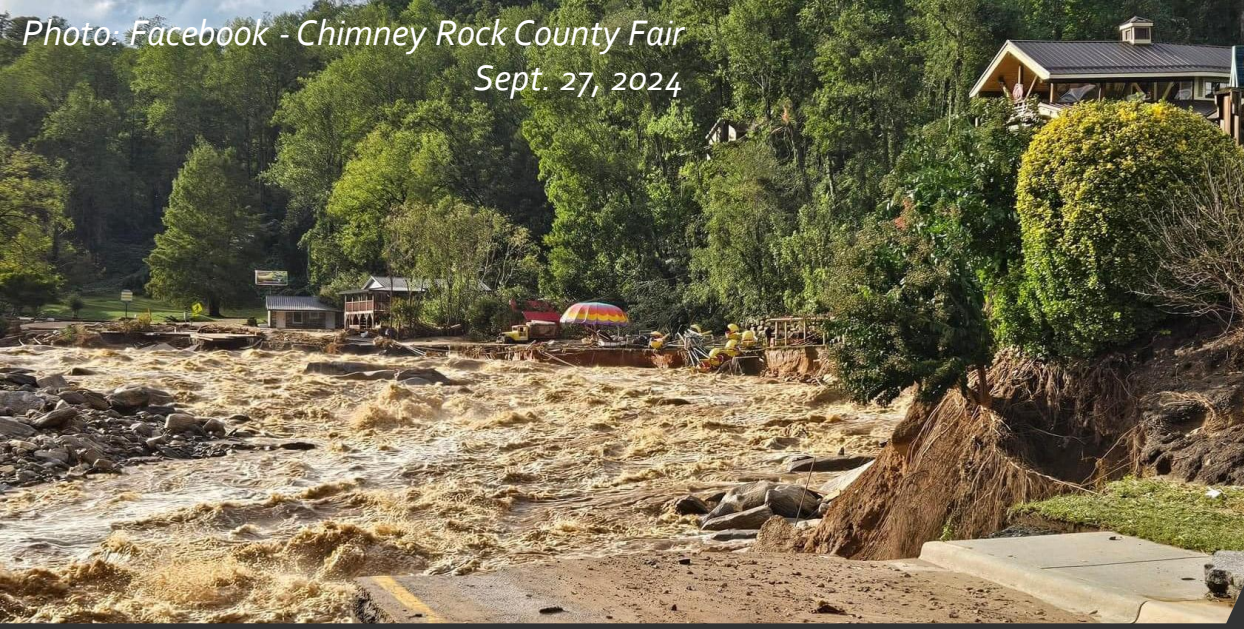
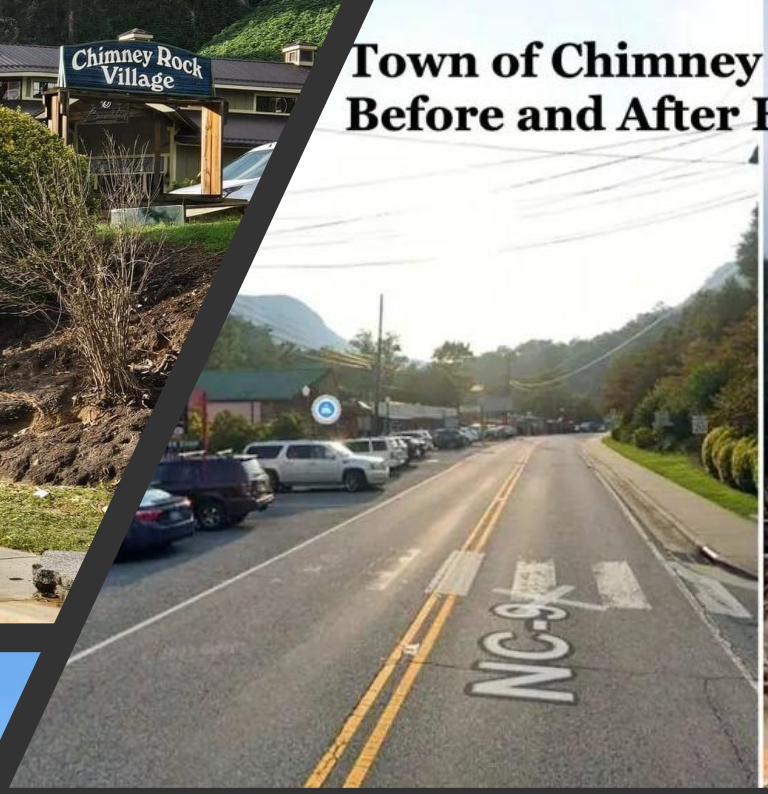


Photo: Facebook - Chimney Rock County Fair
Sept. 27, 2024



Town of Chimney Rock, North Carolina
Before and After Hurricane Helene

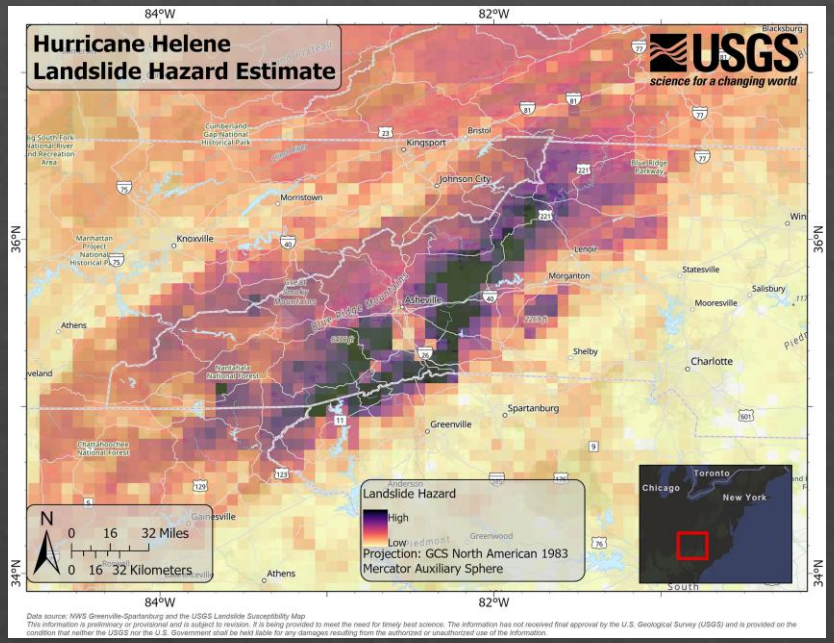
Photo: AppalachianReseach.com
Vermon Taylor

Photo: Associated Press
Kate Payne

Photo: New York Times
Billy Bowling/EPA

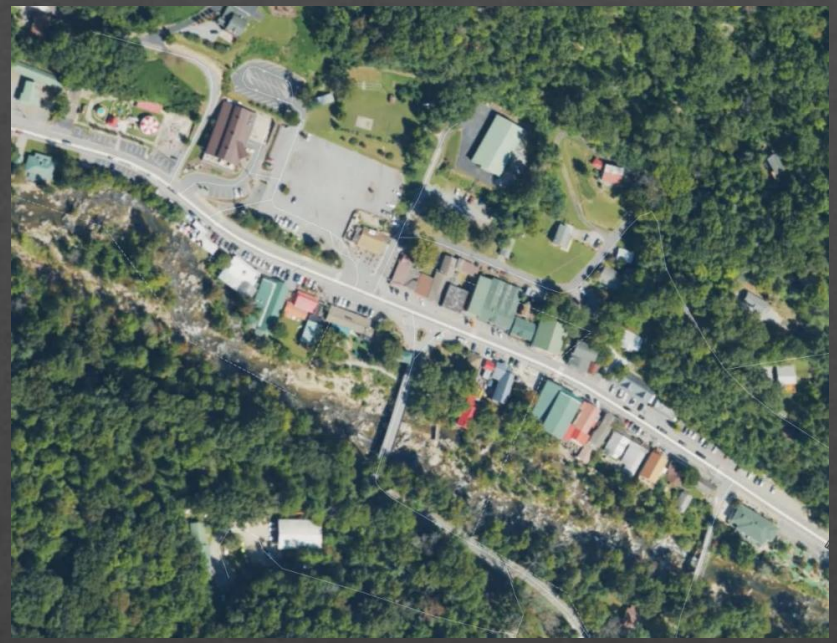
Environmental Footprint

- ~2,000 landslides



- Triggered across the mountain terrain of WNC and surrounding regions, destabilizing slopes and dramatically altering watersheds.

- reshaped river channels



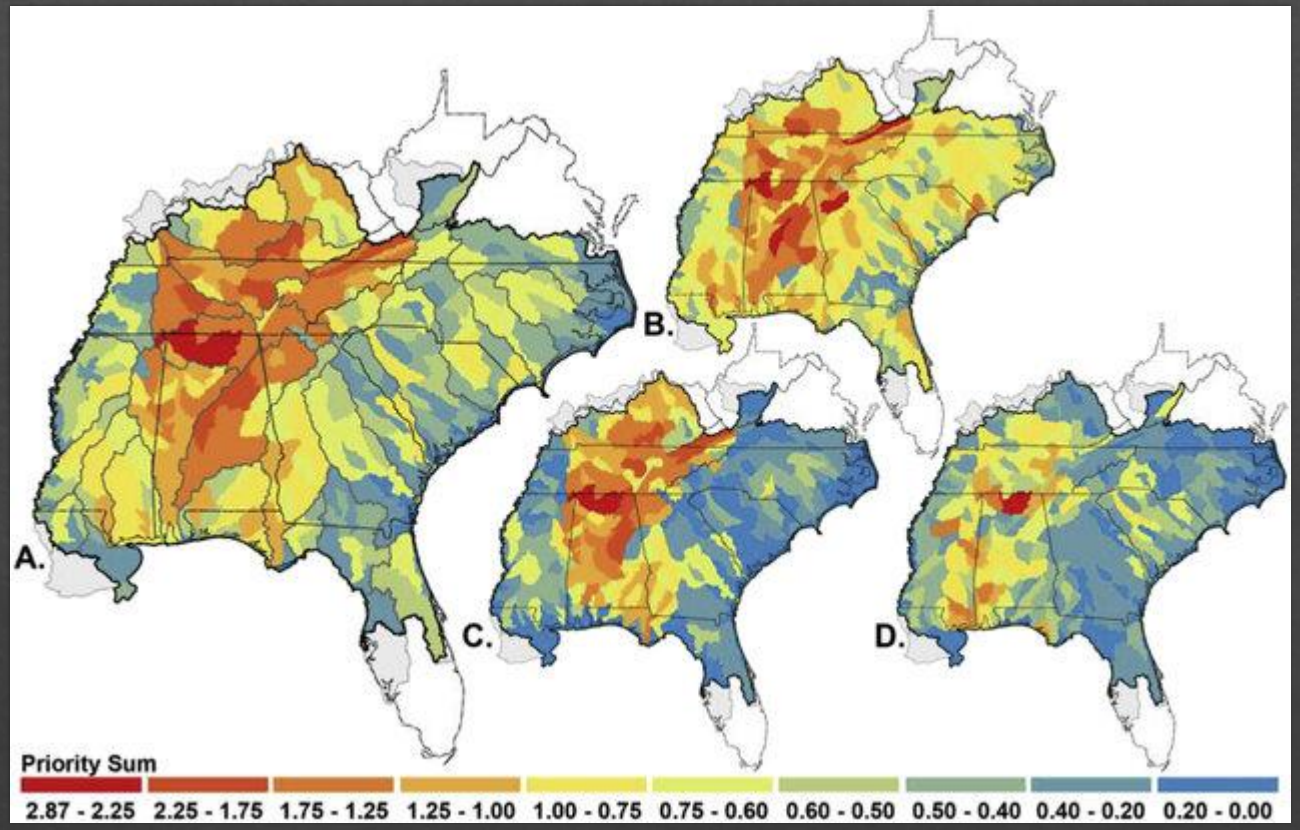
- Unprecedented flood energy reshaped streambeds and floodplains, altering habitat structure for decades to come.

- 800,000 acres of timberland

- Destruction of timber across the region — one of the largest single-event losses in the southeastern U.. national forests.

Freshwater Biodiversity at Risk

The southern Appalachians host globally significant freshwater endemism; impacts threaten rare mussels, crayfish, and fish.



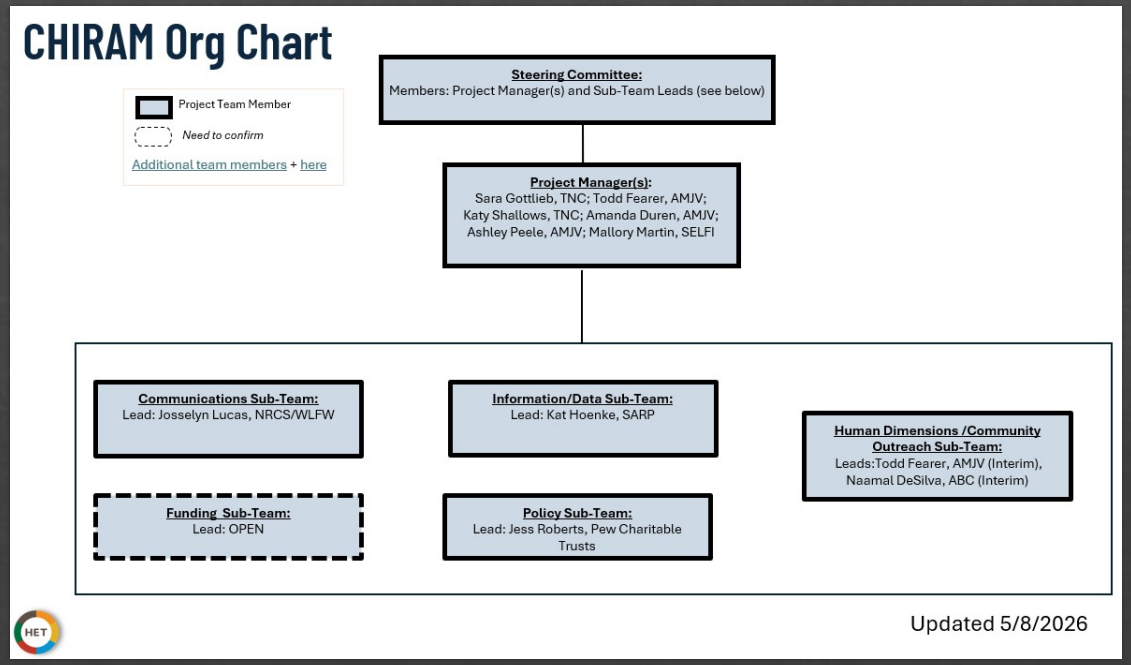
Overall priority score by watershed for all taxa (A), fishes (B), mussels (C), and crayfishes (D)
Source: Elkins et. al 2019

Source: (left) Smokies Life/Phillip Briggs
(right) MountainTrue/Andy HIll

Source: (right) Penderland Fire Department
(left) Facebook – Garner, NC

CHIRAM: Collaboration on Helene Impact, Recovery, Assessment, & Monitoring

"provides a collaborative space for organizations to coordinate, share information, exchange lessons learned, and strengthen collective capacity to support ecological restoration and resilience-building efforts in the southern Appalachians"



CHIRAM Coordination Hub

- Federal Agencies
- State Agencies
- Nonprofits and NGOs
- Academic and Research

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Key Highlights:

- After Hurricane Helene in Sept. 2024, many groups assessed freshwater and terrestrial impacts, but region-wide coordination was limited.
- The Nature Conservancy convened partners in Feb. 2025 and Apr. 2025; AMJV/Appalachians People and Places joined under the CHIRAM umbrella.
- A steering committee and focused sub-teams drive progress, while CHIRAM meets twice per year and sub-teams meet more frequently as needed.

Working Groups =

Information and Data Repository	**Policy**	**Communications**	**Human Dimensions and Community Outreach**	**Funding**

Research Framing & Objectives:

Does multi-stakeholder data sharing accelerate environmental recovery after a major disaster?

What does the literature suggest?

We searched available peer-reviewed literature that investigated the effectiveness multi-agency collaboration and data sharing in response to natural disasters

Source: Georgia DNR

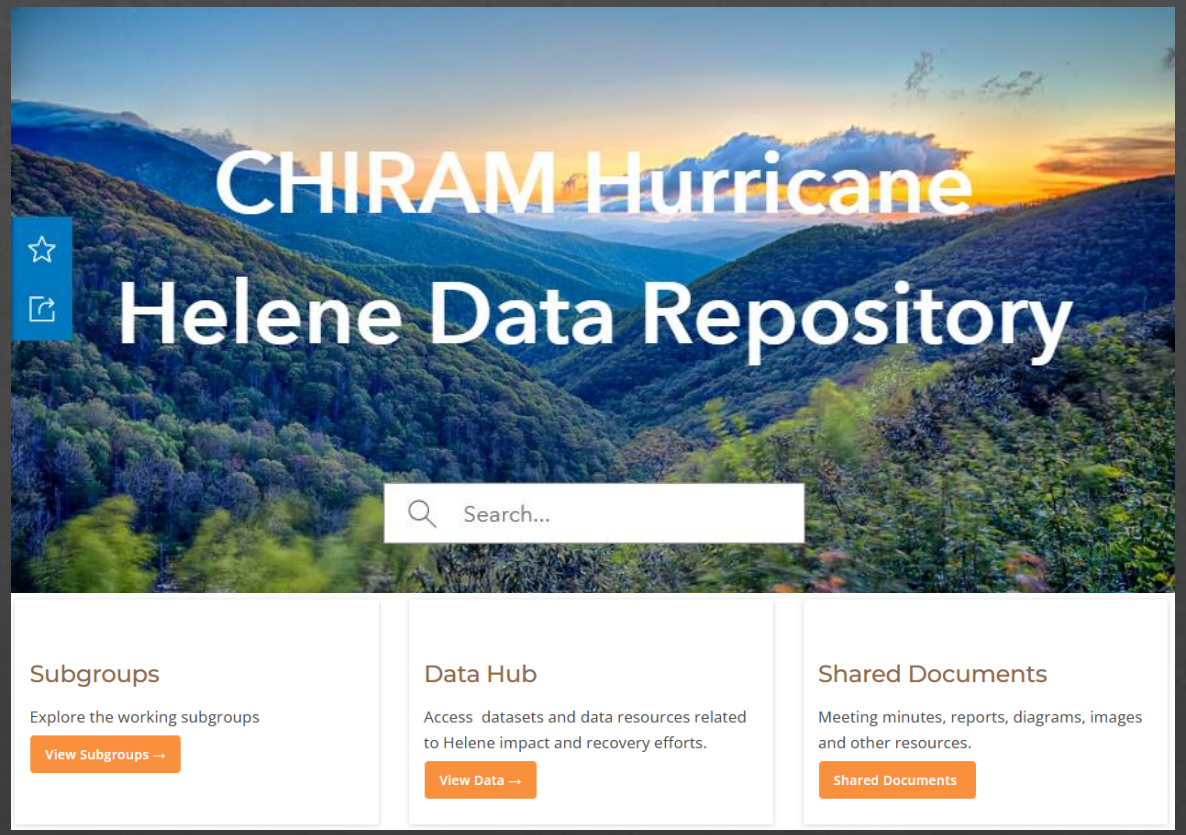
Databases:

- Web of Science
- Scopus
- OpenAlex (AI search)
- Semantic Scholar (AI search)

Search Strategy:

- Natural Disaster (especially flash floods)
- Muli-stakeholder Scope
- Collaborative Data Sharing
- Environmental Recovery (especially long-term)

What does CHIRAM's response suggest?



Methods: Does multi-stakeholder data sharing accelerate environmental recovery after a major disaster?

01

Systematic Literature Review

Peer-reviewed literature on post-disaster flood recovery, multi-stakeholder coordination, and Appalachian ecology, using a structured search and screening protocol.

02

Gray Literature & Agency Reports

Federal agencies (USFS, FEMA, Army Corps, USGS), state emergency management, and nonprofit partners — emerging reports from the Helene response catalogued and analyzed.

03

Framework Analysis

Evaluation of CHIRAM coordination structures, interagency agreement mechanisms (incl. Good Neighbor Agreements), and data-sharing platforms used during recovery.

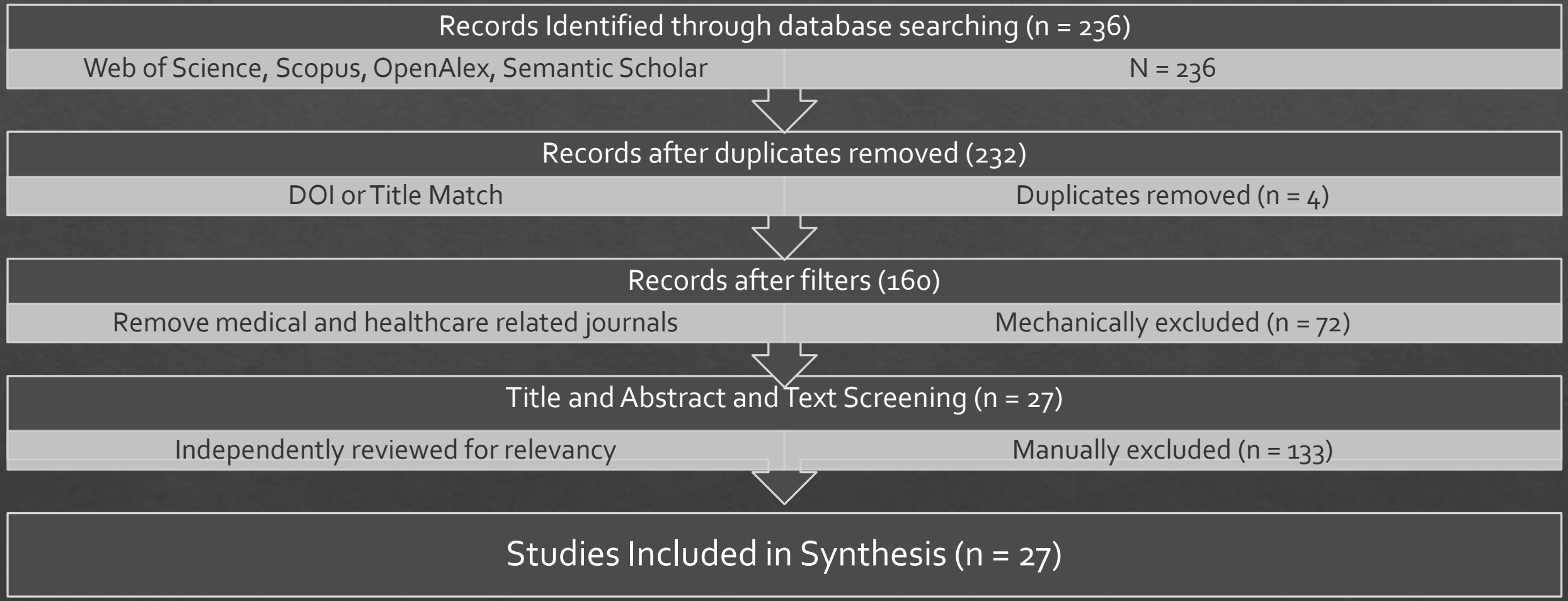
04

Case Study Identification

Documented notable instances of rapid remedial action and coordination success, as well as persistent challenges and gaps in the environmental recovery process.

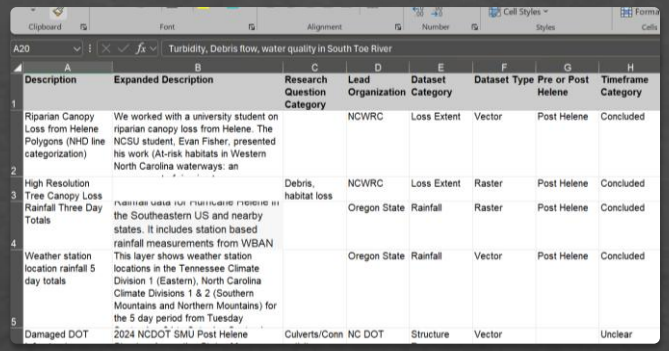
Methods: Does multi-stakeholder data sharing accelerate environmental recovery after a major disaster?

What does the literature suggest? (PRISMA diagram)



Methods: Does multi-stakeholder data sharing accelerate environmental recovery after a major disaster?

What does CHIRAM's response suggest?



Description	Expanded Description	Research Question Category	Lead Organization	Dataset Category	Dataset Type	Pre or Post Helene	Timeframe Category
Riparian Canopy Loss from Helene Polygons (NHD line categorization)	We worked with a university student on riparian canopy loss from Helene. The NCSU student, Evan Fisher, presented his work (At-risk habitats in Western North Carolina waterways: an		NCWRC	Loss Extent	Vector	Post Helene	Concluded
High Resolution Tree Canopy Loss		Debris, habitat loss	NCWRC	Loss Extent	Raster	Post Helene	Concluded
Rainfall Three Day Totals	Rainfall data for Hurricane Helene in the Southeastern US and nearby states. It includes station based rainfall measurements from WBAN		Oregon State	Rainfall	Raster	Post Helene	Concluded
Weather station location rainfall 5 day totals	This layer shows weather station locations in the Tennessee Climate Division 1 (Eastern), North Carolina Climate Divisions 1 & 2 (Southern Mountains and Northern Mountains) for the 5 day period from Tuesday		Oregon State	Rainfall	Vector	Post Helene	Concluded
Damaged DOT	2024 NCDOT SMU Post Helene	Culverts/Conn	NC DOT	Structure	Vector		Unclear

CHIRAM Data Sharing Platform Investigation

Searched both the private a public environmental monitoring data that is available to CHIRAM Memebers

CHIRAM Personnel Interviews/Meeting Minutes

Participated in full, sub-committee, and individual meeting with CHIRAM personnel.

CHIRAM Public and Grey Literature Reporting

Reviewed the public and grey literature shared to the CHIRAM data hub for environmental restoration preogess

Results: Literature Review

Multi-agency environmental responses to natural disasters tended to follow a predicable trajectory that led to repeatable missteps in data-sharing that delayed ecological restoration.

Predictable Timeline:

Acute Phase
- Strong data-sharing and communication of damage assessments/reporting
- Centralized priority setting

Near-term
- Intermediate data-sharing and communication after initial cleanup
- Disbursed priority setting

Long-term
- Poor data-sharing and communication
- Duplicating efforts and unreported data

Focus of Study	Wood et al. 2002	Donahue and Tuohy 2006	Lester and Krejci 2007	Celik and Corbacioglu 2010	Taohidul Islam and Chik 2011	Guttieri 2014	Hansel et al. 2015	Sharma et al. 2016	Shibata et al. 2016	Steigenberger 2016	Sikder and Hossain 2019	Kar et al. 2020	Kijewski-Correa et al. 2021	Thakur et al. 2021	Guerrero et al. 2023	Majlingova and Kádár 2025	Sam-Mbomah et al. 2025	Azhar et al. 2025	Mohamed 2026	Chen et al. 2026	Scapellato et al. 2026	Paudyal 2026	Magstadt et al. 2026
Collaboration Structure	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Data Sharing Mechanism	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Barriers Addressed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Operational Outcomes	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Coordination Timeline	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	X	*	*	*	*	*
Information System Type	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Data Sources Integrated	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Data Accessibility	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Identified Data Gaps	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Recovery Phase Focus	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ecological Or Infrastructure Outcomes	*	X	X	X	*	X	*	*	*	X	*	*	*	*	X	*	*	*	X	*	*	*	*
Priority Setting Mechanism	*	X	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Adaptive Management	*	X	*	*	*	*	X	*	*	*	*	*	*	*	*	X	X	X	X	*	*	X	*
Lessons Learned Transferred	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Results: Literature Review

Barriers to Coordination

- Institutional silos
- Fragmented data systems
- Weak inter-agency communication
- Multiple command structures
- Data availability

Data Sharing Mechanism

- Web-based platforms
- Geospatial information systems
- Model of Models
- Crowdsourcing
- Social media

Adaptive Management

- Centralized command structure understood by all parties
- Data-driven prioritization
- Diverse skill-sets of stakeholders
- Accurate accounting of resources and services

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	Barriers Addressed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Operational Outcomes	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
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	Ecological Or Infrastructure Outcomes	*	✖	✖	✖	*	✖	*	*	*	✖	*	*	*	*	✖	*	*	*	✖	*	*	*	*
	Priority Setting Mechanism	*	✖	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Adaptive Management	*	✖	*	*	*	*	✖	*	*	*	*	*	*	*	*	✖	✖	✖	✖	*	*	✖	*
	Lessons Learned Transferred	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

CHIRAM: Who's at the Table?

Federal Agencies

FEMA DHS
EPA
USACE
USDA
USFWS
USNF

State Agencies

NC Department of Transportation
NC Department of Wildlife
NC Department of Natural and Cultural Resources
Tennessee Valley Authority
TN Department of Environment and Concervation
TN Wildlife Resources Agency

Research Institutions

Middle State University
TN Tech
University of North Carolina
University of North Carolina Greensboro
University of Tennessee
VA Tech
Western Carolina University

NGOs and Nonprofits

American Rivers
American Whitewater
Amphibian and Reptile Conservancy
Concervation Fisheries
Pew Trust Foundation
Southeast Aquatic Resources Partnership
The Nature Concervancy
Restoration and Resilience Collaborative

Consulting Firms

Anchor QEA
Ecosystems Services
EnviroScience Inc
Equinex Environmental
Trout Unlimited
Waggoner and Ball
Waterborne Environmental
Wildlands Engineering

Unprecedented levels of interagency coordination — the most complex multi-sector environmental response in the region's history.

CHIRAM: How are they working together?
(notable coordination wins)

Debris Removal:

Emergency T & E Relocation:

Riparian Restoration

Community Involvement:

Continued Monitoring and Data Sharing:

Continued Coordination and Leadership:

CHIRAM is making strategic moves to maintain the level of coordination that existed in the acute phase of the flood and avoid following the predictable timeline of inter-agency coordination.

With a centralized command, lead by The Nature Conservancy, a ten-year multi-agency data-sharing partnership timeline has been set with sustained funding for CHIRAM from the US Forest Service. And individual donors.

The full group meets semi-annually, sub-groups meet quarterly.

The individual agencies are sharing their data as it comes in, sometimes in real time.

All data and reports are available to any member.

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Questions?

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Photo: National Weather Service
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