Using GIS to Analyze Historical Flood Fatality Patterns

WV GeoCon 2026

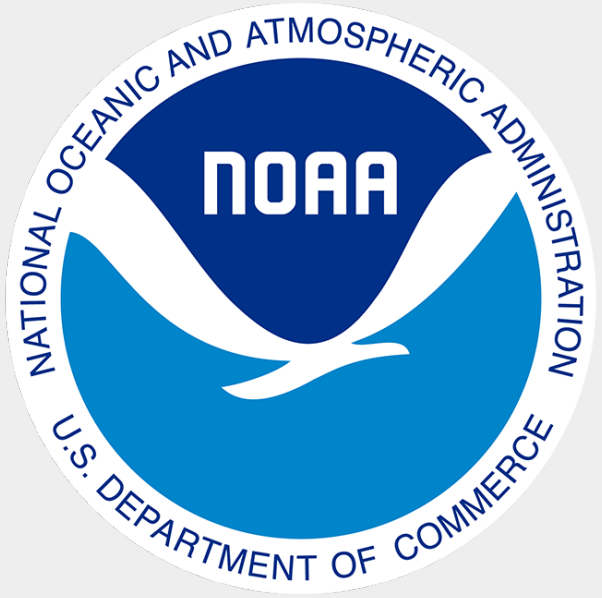
West Virginia GIS Technical Center

Why use GIS?

- Historical flood fatality records are spatially incomplete
- Fatality locations are dispersed across archival sources
- GIS enables spatial reconstruction and pattern analysis
- Supports flood mitigation and hazard planning

Data Sources

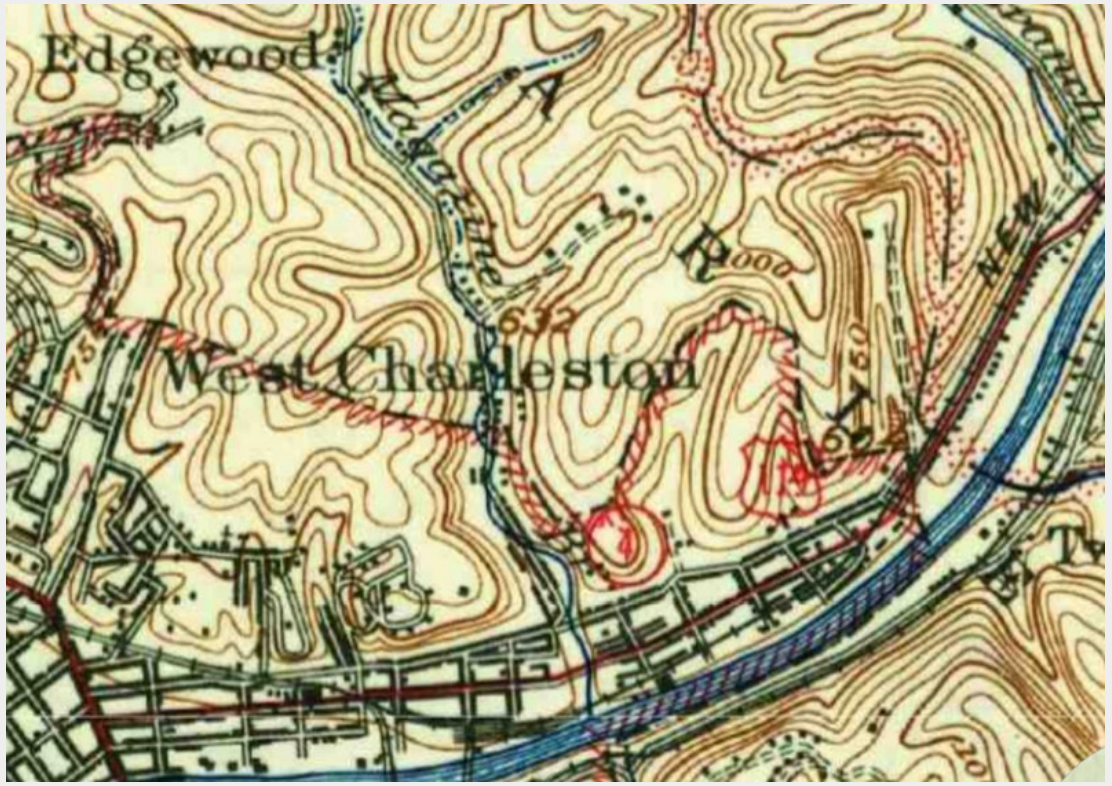
- Historical newspapers
- WV Culture Center
- FEMA
- NOAA rainfall / flood records
- USGS
- NID (National Inventory of Dams)




Historical Records
Data Extraction & Validation
Geocoding Historical Fatalities
GIS Database Development
Spatial Analysis
Geospatial Products

Last Name	First Name	Gender	Age	County	Location	Community	Watershed	Flood Source	Cause of Death
[redacted]		Female	27	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	House Swept Away - Drowned
[redacted]		Female	3	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	House Swept Away - Drowned
[redacted]		Male	60	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	House Swept Away - Drowned
[redacted]		Female	50	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	House Swept Away - Drowned
[redacted]		Female	3	Kanawha	164 Wertz Ave	Riverview	Upper Kanawha	NONE	In-Water Drowning
[redacted]		Female	6	Kanawha	164 Wertz Ave	Riverview	Upper Kanawha	NONE	In-Water Drowning
[redacted]		Female	42	Kanawha	63 B Garrison Ave	Charleston	Elk	Magazine Branch	House Swept Away - Drowned
[redacted]		Female	8	Kanawha	63 B Garrison Ave	Charleston	Elk	Magazine Branch	House Swept Away - Drowned
[redacted]		Male	38	Kanawha	Barton St. and Washington St.	Charleston	Lower Kanawha	NONE	Vehicular - Drowning
[redacted]		Male	66	Kanawha	145 Garrison Ave	Charleston	Elk	Magazine Branch	Mudslide - Drowning
[redacted]		Male	85	Kanawha	145 Garrison Ave	Charleston	Elk	Magazine Branch	Mudslide - Drowning
[redacted]		Male	7	Kanawha	275 Garrison Ave	Charleston	Elk	Magazine Branch	
[redacted]		Female	48	Kanawha	275 Garrison Ave	Charleston	Elk	Magazine Branch	
[redacted]		Female	8	Kanawha	65 Garrison Ave	Charleston	Elk	Magazine Branch	Drowning
[redacted]		Female	49	Kanawha	65 Garrison Ave	Charleston	Elk	Magazine Branch	Drowning
[redacted]		Male	6	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	Drowning
[redacted]		Male	4	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	Drowning
[redacted]		Female	5	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	Drowning
[redacted]		Male	11 mo.	Kanawha	Rutledge Rd	Twomile	Elk	Elk Two-Mile Creek	Drowning
[redacted]		Male	60	Kanawha	Keystone Dr	Twomile	Elk	Elk Two-Mile Creek	
[redacted]		Female	62	Kanawha	Keystone Dr	Twomile	Elk	Elk Two-Mile Creek	
[redacted]		Female	10	Kanawha	215 Garrison Ave	Charleston	Elk	Magazine Branch	Drowning

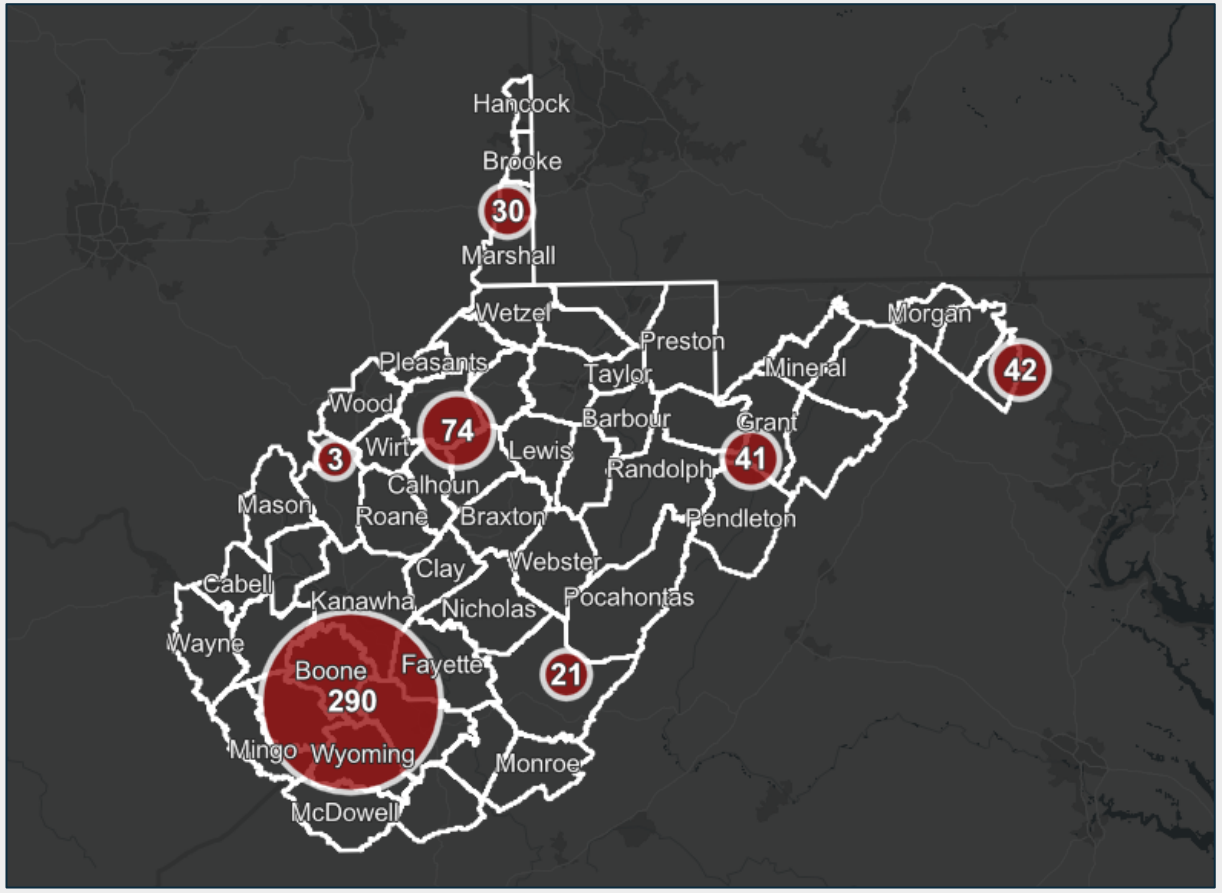
Geocoding Historical Fatalities



- Locations reconstructed from historical newspaper descriptions
- Historical place names and roadway changes complicated geolocation
- GIS aligned archival references with modern spatial datasets

Spatial Analysis

- Overlay with FEMA flood zones
- Stream / roadway analysis
- Watershed integration
- Comparison with post-flood mitigation structure locations



Flood Fatality

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

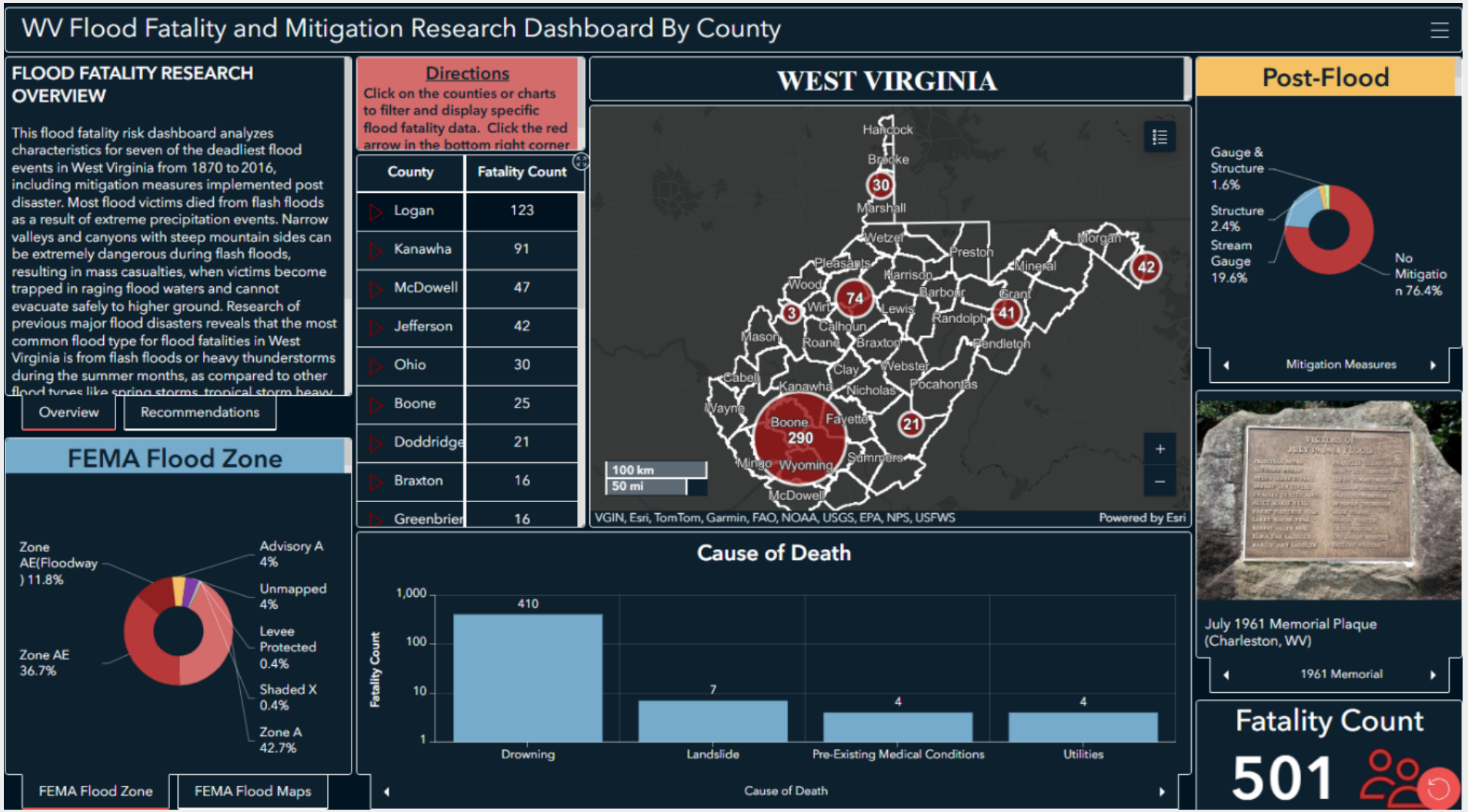
	Year *	Month	Gender	Age	County	Community	Flood Source	Mitigation	FEMA Flood Zone	Flood Type
1	2016	June	Male	60	Greenbrier	Caldwell	Howard Creek	Stream Gauge	Zone AE	Summer Thundersto
2	2016	June	Male	16	Greenbrier	White Sulphur Springs	Howard Creek	Stream Gauge	Zone AE(Floodway)	Summer Thundersto
3	2016	June	Female	33	Greenbrier	White Sulphur Springs	Howard Creek	Stream Gauge	Zone AE(Floodway)	Summer Thundersto
4	2016	June	Male	68	Greenbrier	White Sulphur Springs	Howard Creek	Stream Gauge	Zone AE(Floodway)	Summer Thundersto
5	2016	June	Female	54	Greenbrier	White Sulphur Springs	Howard Creek	Stream Gauge	Zone AE(Floodway)	Summer Thundersto
6	2016	June	Female	14	Greenbrier	White Sulphur Springs	Howard Creek	Stream Gauge	Zone AE(Floodway)	Summer Thundersto
7	1916	August	Male	Unknown	Raleigh	Whitesville	Toms Branch	NONE	Zone A	Summer Thundersto
8	2016	June	Male	82	Greenbrier	Rainelle	Sewell Creek	Stream Gauge	Shaded X	Summer Thundersto
9	2016	June	Female	60	Greenbrier	Neola	Anthony Creek	Stream Gauge	Zone A	Summer Thundersto
10	2016	June	Female	81	Greenbrier	Neola	Anthony Creek	Stream Gauge	Zone A	Summer Thundersto
11	2016	June	Female	80	Greenbrier	Rupert	Big Clear Creek	NONE	Zone A	Summer Thundersto
12	2016	June	Female	67	Greenbrier	Rupert	Big Clear Creek	NONE	Zone A	Summer Thundersto
13	2016	June	Male	70	Greenbrier	Rupert	Big Clear Creek	NONE	Zone A	Summer Thundersto
14	1916	August	Male	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Zone A	Summer Thundersto
15	1916	August	Female	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
16	1916	August	Male	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
17	1916	August	Female	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
18	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
19	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
20	1916	August	Male	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
21	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
22	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
23	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
24	1916	August	Unknown	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto
25	1916	August	Female	Unknown	Boone	Ferndale (Garrison)	Seng Creek	NONE	Advisory A	Summer Thundersto

Spatial Findings

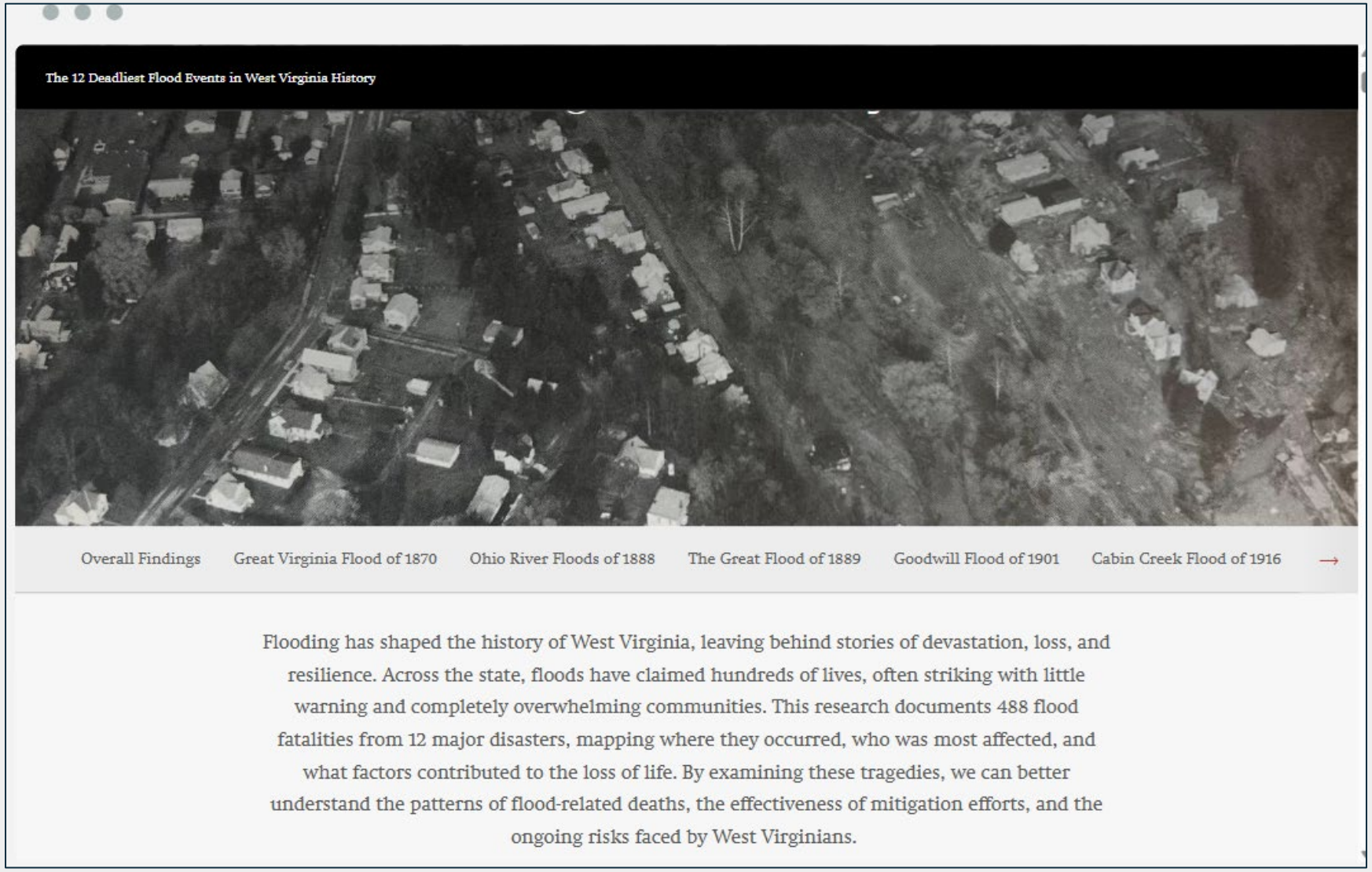
- Fatalities clustered in narrow valleys
- Several fatalities occurred outside modern FEMA flood zones
- Many deaths occurred near stream crossings and transportation corridors
- Majority of fatalities were part of mass casualty events

Geospatial Deliverables

Dashboards

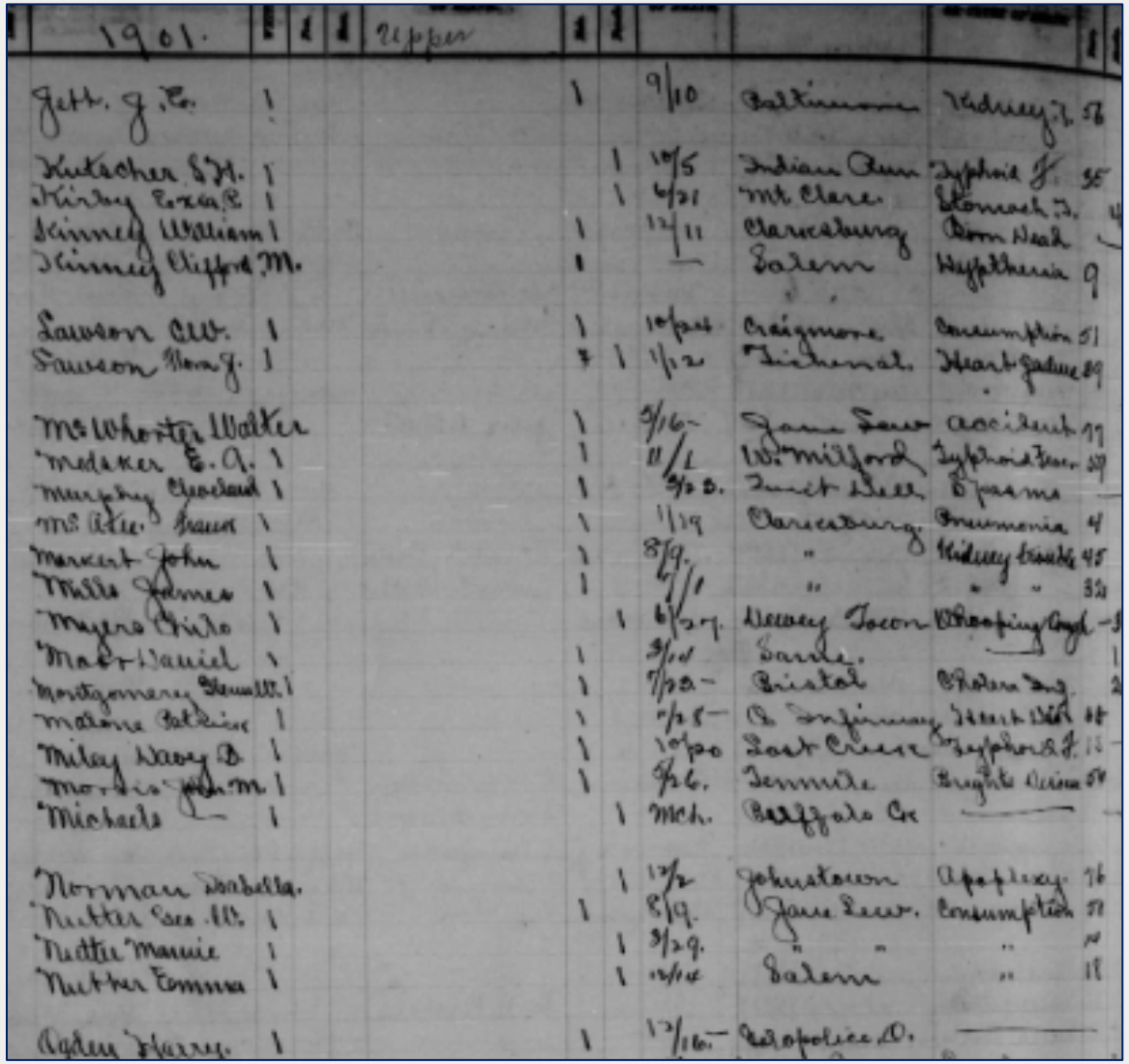

WV Flood Fatality and Mitigation Research Dashboard By County
FLOOD FATALITY RESEARCH OVERVIEW
This flood fatality risk dashboard analyzes characteristics for seven of the deadliest flood events in West Virginia from 1870 to 2016, including mitigation measures implemented post disaster. Most flood victims died from flash floods as a result of extreme precipitation events. Narrow valleys and canyons with steep mountain sides can be extremely dangerous during flash floods, resulting in mass casualties, when victims become trapped in raging flood waters and cannot evacuate safely to higher ground. Research of previous major flood disasters reveals that the most common flood type for flood fatalities in West Virginia is from flash floods or heavy thunderstorms during the summer months, as compared to other flood types like spring storms, tropical storm heavy
Overview
Recommendations
Directions
Click on the counties or charts to filter and display specific flood fatality data. Click the red arrow in the bottom right corner
County
Fatality Count
Logan 123
Kanawha 91
McDowell 47
Jefferson 42
Ohio 30
Boone 25
Doddridge 21
Braxton 16
Greenbrier 16
WEST VIRGINIA
Hancock
Brooke
Marshall
Wetzel
Pleasants
Wood
Wirt
Harrison
Preston
Mineral
Morgan
Barbour
Grant
Lewis
Randolph
Mason
Roane
Calhoun
Braxton
Pendleton
Webster
Clay
Cabell
Kanawha
Nicholas
Pocahontas
Wayne
Boone
Fayette
Mingo
Wyoming
Summers
McDowell
30
74
3
42
41
21
290
100 km
50 mi
VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS
Powered by Esri
Post-Flood
Gauge & Structure 1.6%
Structure 2.4%
Stream Gauge 19.6%
No Mitigation 76.4%
Mitigation Measures
July 1961 Memorial Plaque (Charleston, WV)
1961 Memorial
FEMA Flood Zone
Zone AE(Floodway) 11.8%
Advisory A 4%
Unmapped 4%
Levee Protected 0.4%
Zone AE 36.7%
Shaded X 0.4%
Zone A 42.7%
FEMA Flood Zone
FEMA Flood Maps
Cause of Death
Fatality Count
1,000
100
10
1
410
7
4
4
Drowning
Landslide
Pre-Existing Medical Conditions
Utilities
Cause of Death
Fatality Count
501

Story Map


The 12 Deadliest Flood Events in West Virginia History
Overall Findings
Great Virginia Flood of 1870
Ohio River Floods of 1888
The Great Flood of 1889
Goodwill Flood of 1901
Cabin Creek Flood of 1916
→
Flooding has shaped the history of West Virginia, leaving behind stories of devastation, loss, and resilience. Across the state, floods have claimed hundreds of lives, often striking with little warning and completely overwhelming communities. This research documents 488 flood fatalities from 12 major disasters, mapping where they occurred, who was most affected, and what factors contributed to the loss of life. By examining these tragedies, we can better understand the patterns of flood-related deaths, the effectiveness of mitigation efforts, and the ongoing risks faced by West Virginians.

Limitations

- Historical newspaper accounts often contained vague or inconsistent location descriptions
- Geocoding accuracy was limited by changing place names, road networks, and landscape features



Future GIS Applications

- Predictive modeling of future flood fatality risk
- Expansion into real-time hazard and evacuation planning
- Machine learning approaches for vulnerability predictions
- Integration of LiDAR and high-resolution terrain analysis

Thank you!

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