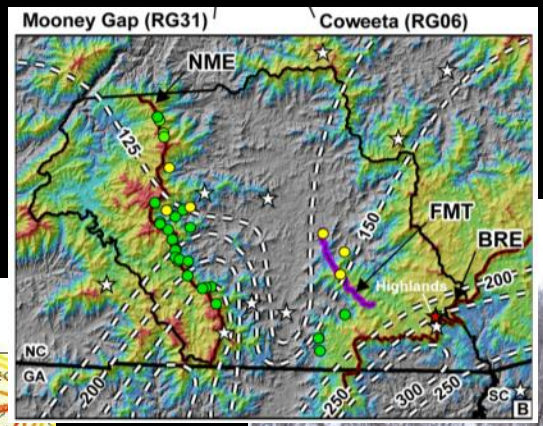
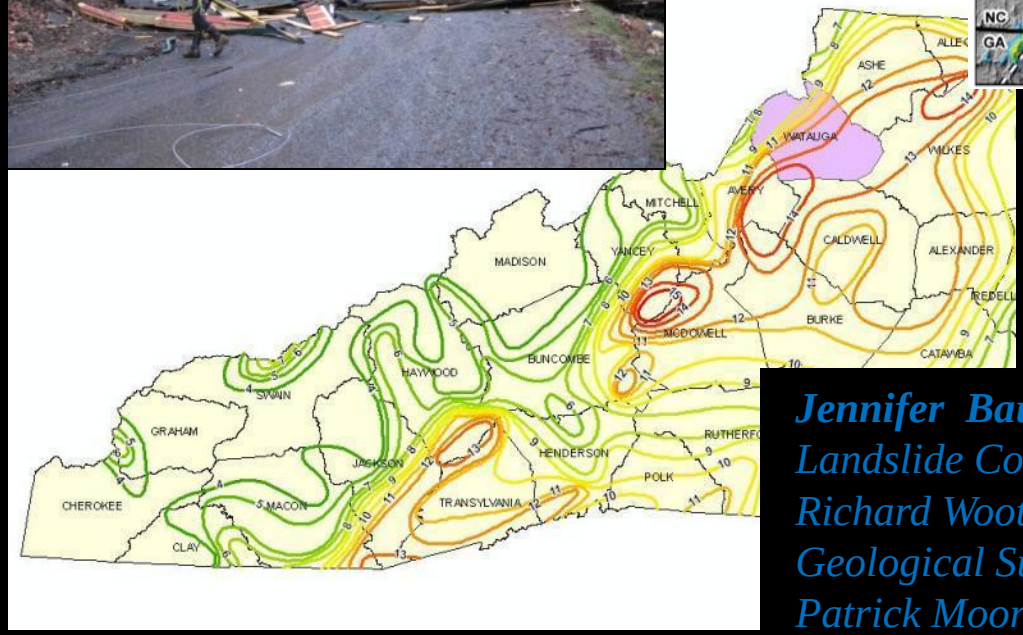
Landslides and Weather: An Interdisciplinary Approach To Anticipating the Hazard and Communicating the Threat

AEG Annual Meeting, Anchorage, AK Sept. 22, 2011





***Jennifer Bauer**, L.G. – Appalachian Landslide Consultants*
Richard Wooten, L.G. – North Carolina Geological Survey
Patrick Moore – National Weather Service

Peeks Creek Debris Flow

Macon County

Sept. 16, 2004 – Hurricane Ivan

Peeks Creek Task Force

NCGS and NWS involvement –

light bulb moment

Landslides and Weather Workshop

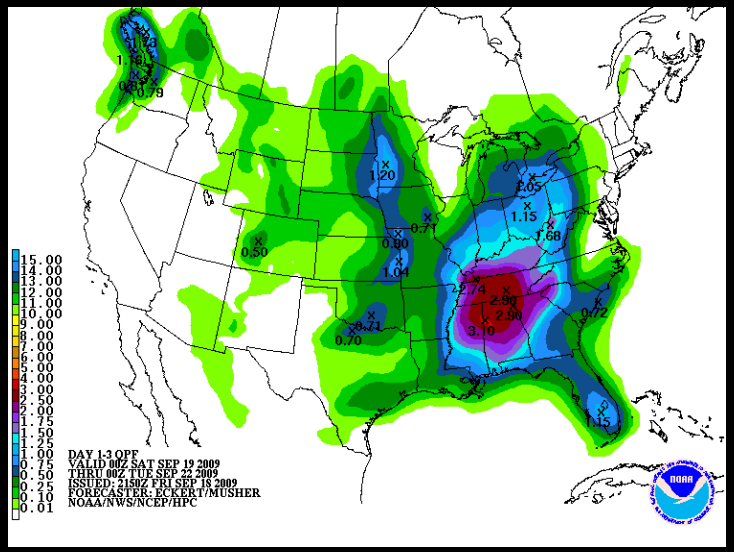
- Objectives

  1) Foster coordination and collaboration

  2) Establish communication to:
     - Anticipate
     - Communicate
     - Respond

Topics

- Current agency policies
- Research sharing
- Communicating the threat
- Improving the process



Key Agencies and Institutions

Federal

- NOAA - National Weather Service
- U.S. Forest Service
- U.S. Geological Survey

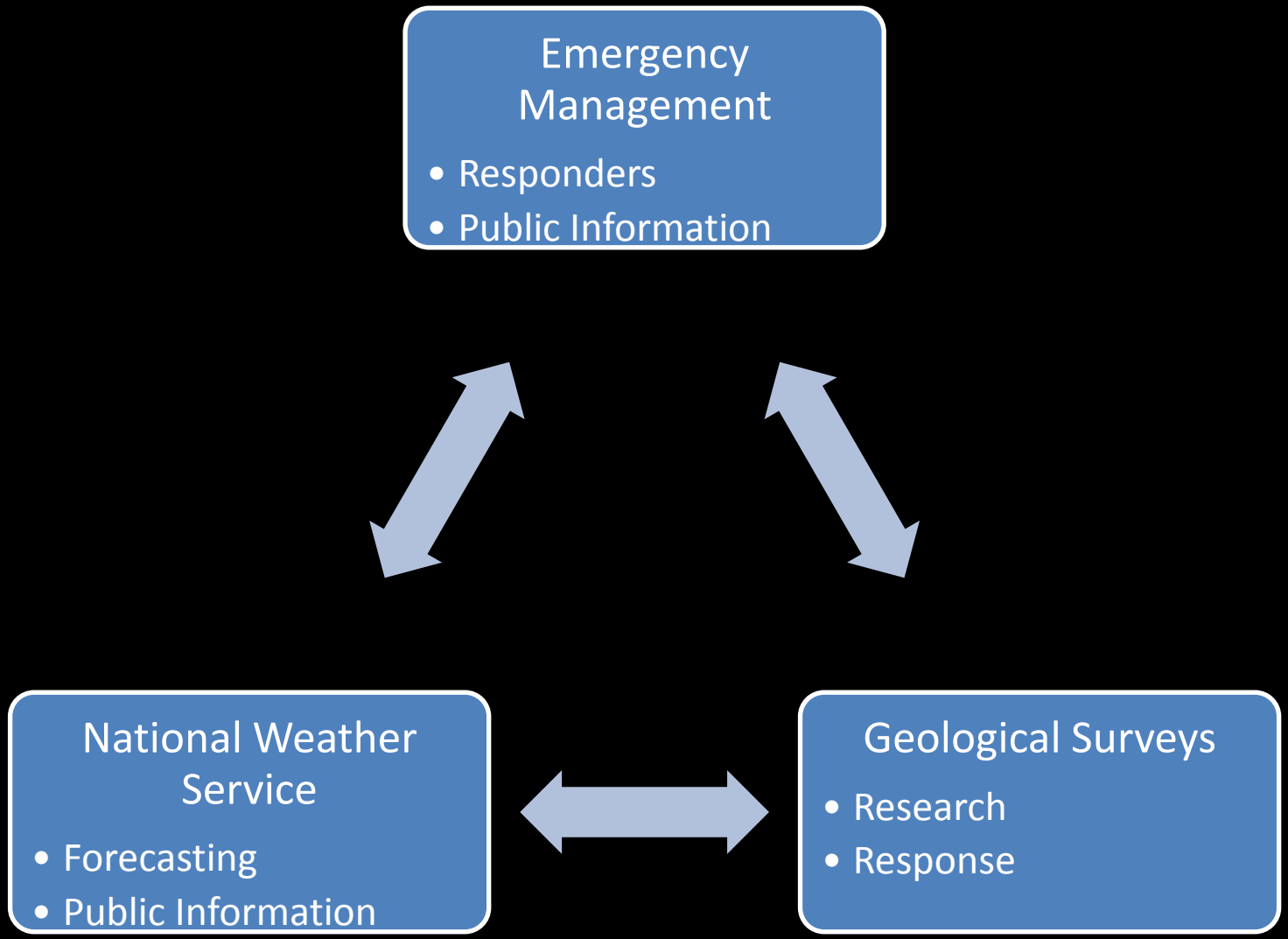
State

- North Carolina Department of Environment and Natural Resources
- North Carolina Division of Emergency Management
- North Carolina Geological Survey
- Kentucky Geological Survey
- Virginia Department of Mines, Minerals and Energy
- Virginia Department of Emergency Management

Academic

- Appalachian State University
- James Madison University

Triad of Communication



Current Practices

- National Weather Service
- US Geological Survey
- Virginia Department of Mines, Minerals, Energy
- North Carolina Department of Environment and Natural Resources and NC Geological Survey

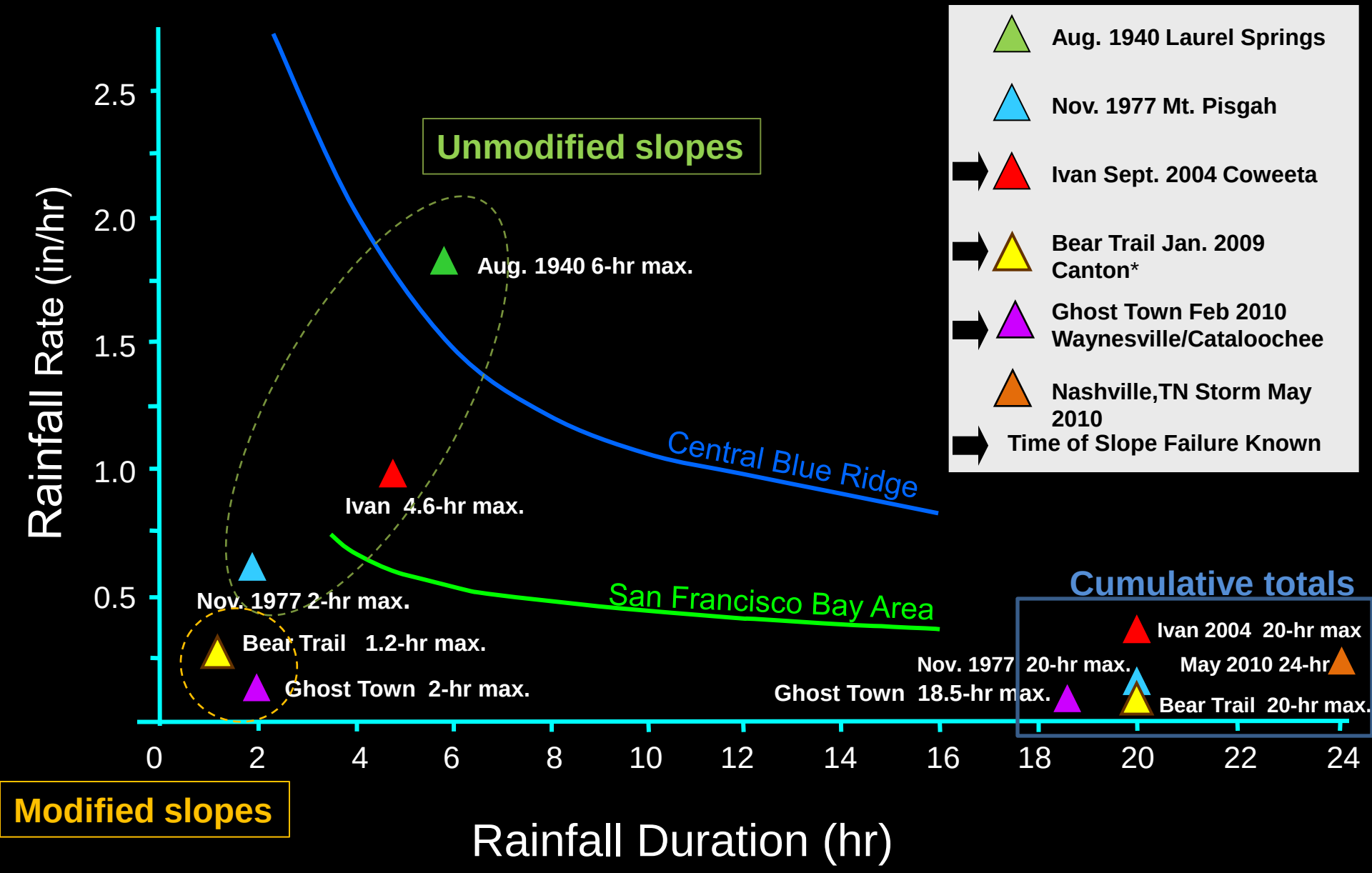
Information and Research shared

- USGS
- Kentucky Geological Survey
- National Weather Service
- James Madison University
- North Carolina Geological Survey

Summary of Research

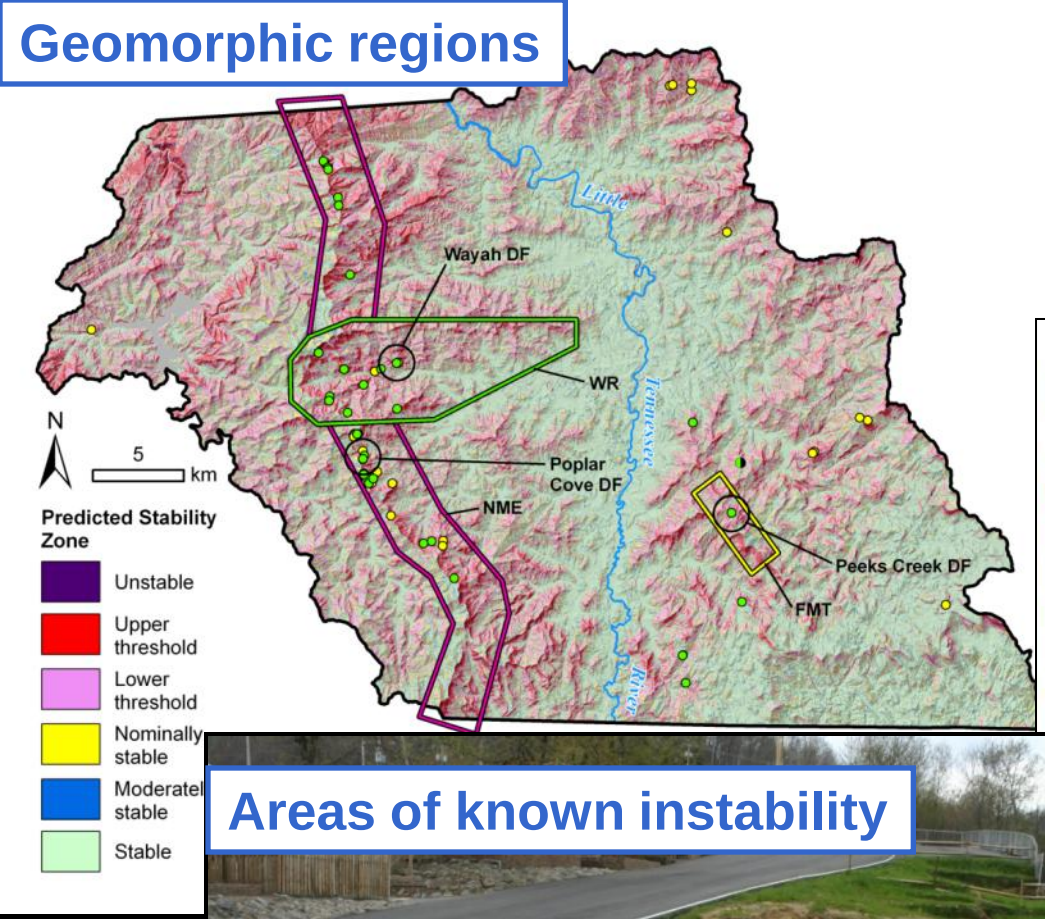
- Factors relating Weather and Landslide occurrence
  - Cumulative Rainfall totals from storms and tropical systems
  - Intensity and Duration of rainfall
  - Where the rainfall occurs

Rainfall thresholds for unmodified slopes vs. modified slopes

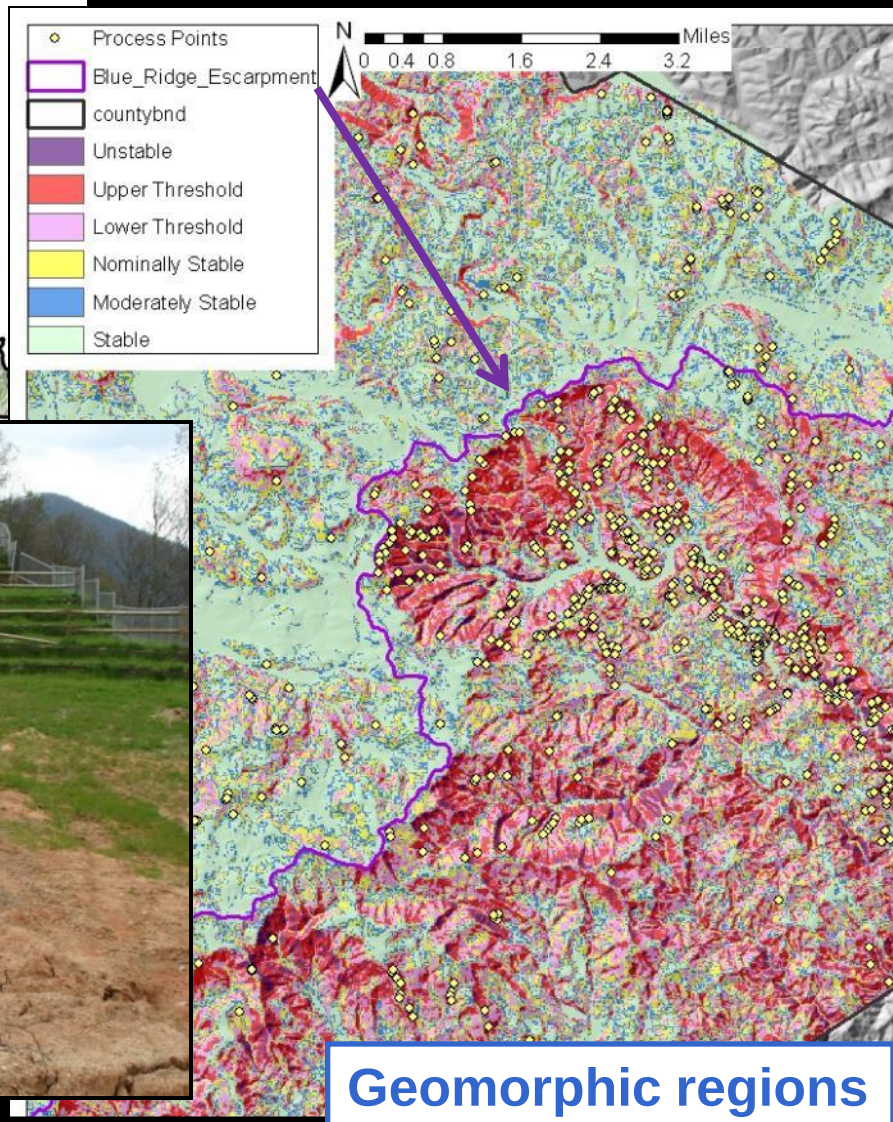


Adapted from Wieczorek, et al., 2009

Geomorphic regions



Locations to monitor in conjunction with predicted storm tracks:



Areas of known instability

Photos courtesy of The Mountaineer

Geomorphic regions

How can what we know and are learning be applied to public safety?

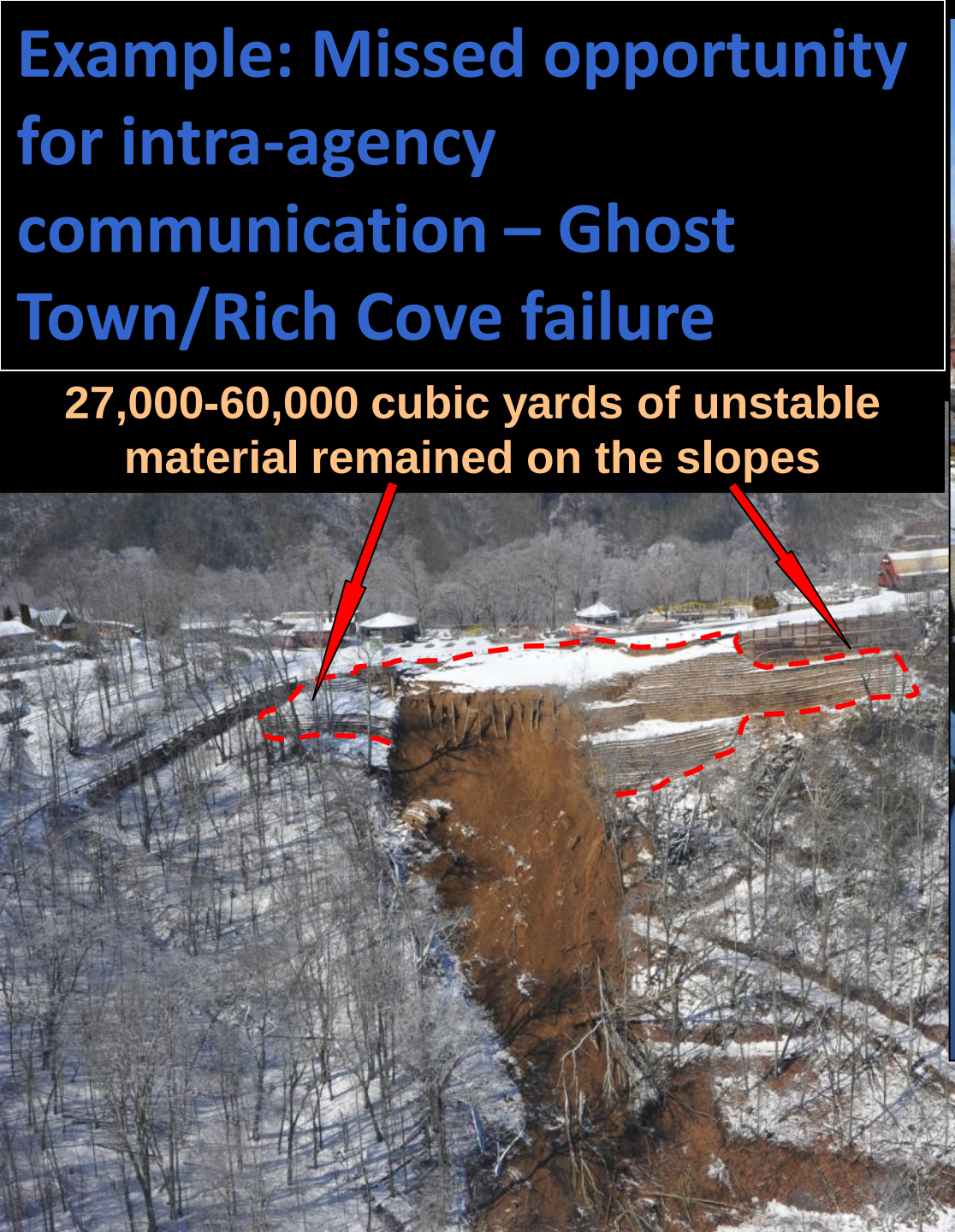
Collaboration between several entities (National Weather Service, NC Geological Survey, Emergency Management)

NWS-use predicted storm track and knowledge of antecedent moisture and high intensity cells

NCGS – compare to:
- **Geomorphic domains**
- **Areas already showing instability (with EM)**
- **Hazard areas on NCGS Landslide Hazard Maps**

All – Decide on warnings to be issued
- **When to issue it - amount of rain to trigger warning**
- **What areas might be affected – storm track + above items**
- **What action should people take – where should they go**

Example: Missed opportunity for intra-agency communication – Ghost Town/Rich Cove failure



P. Parton Photos

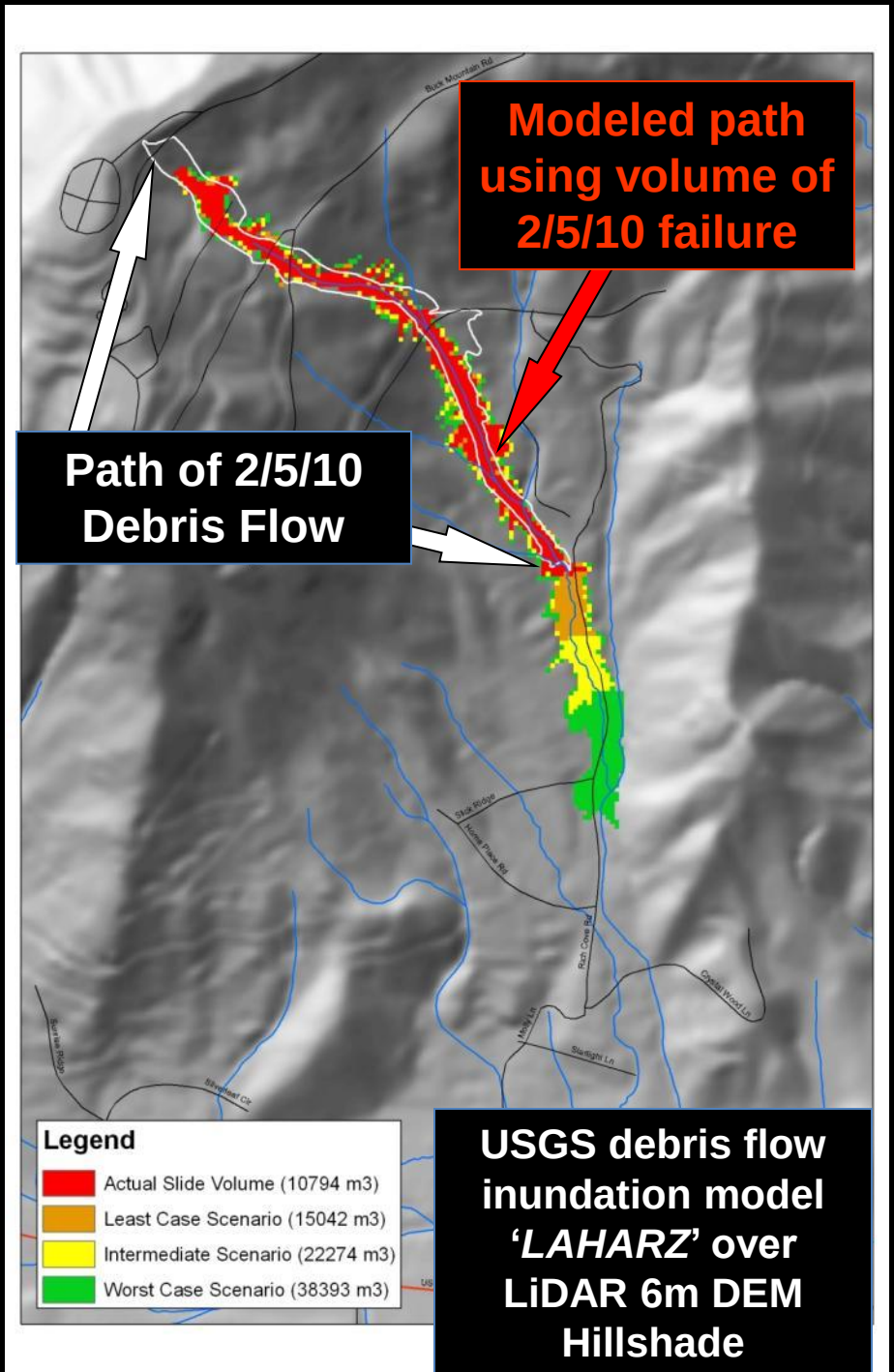
NCGS outlined Precautionary Zones

For Emergency Response Planning

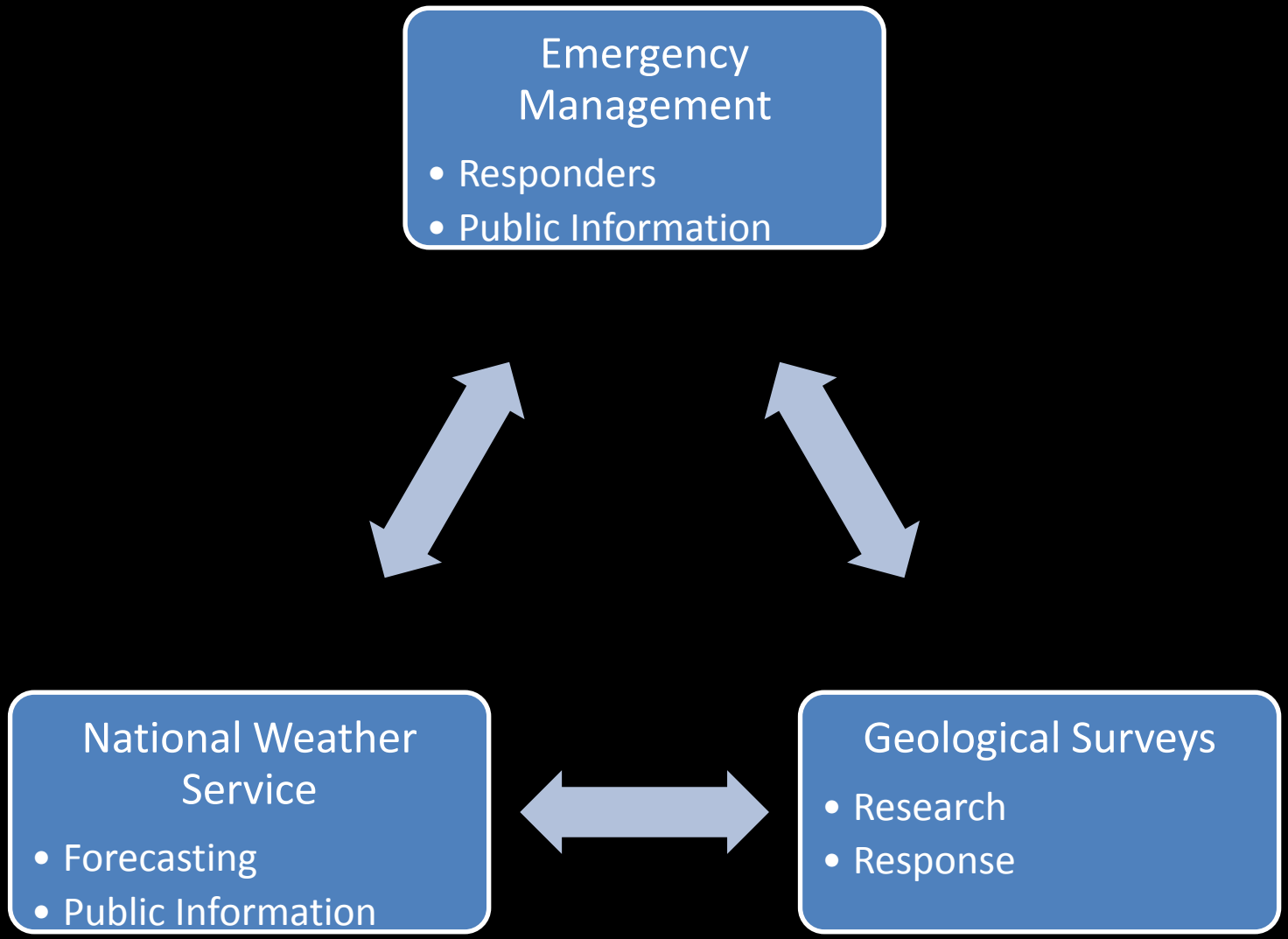
NCGS could have communicated potential failure location to NWS

NWS then could have directly communicated with Haywood Co. EM if an eminent storm threat was heading toward this location.

EM then could have alerted citizens within the precautionary zones once warned of an oncoming storm by the NWS.



Triad of Communication



Acknowledgements
Citizens of North Carolina

Questions?

Jennifer Bauer

Appalachian Landslide Consultants, PLLC

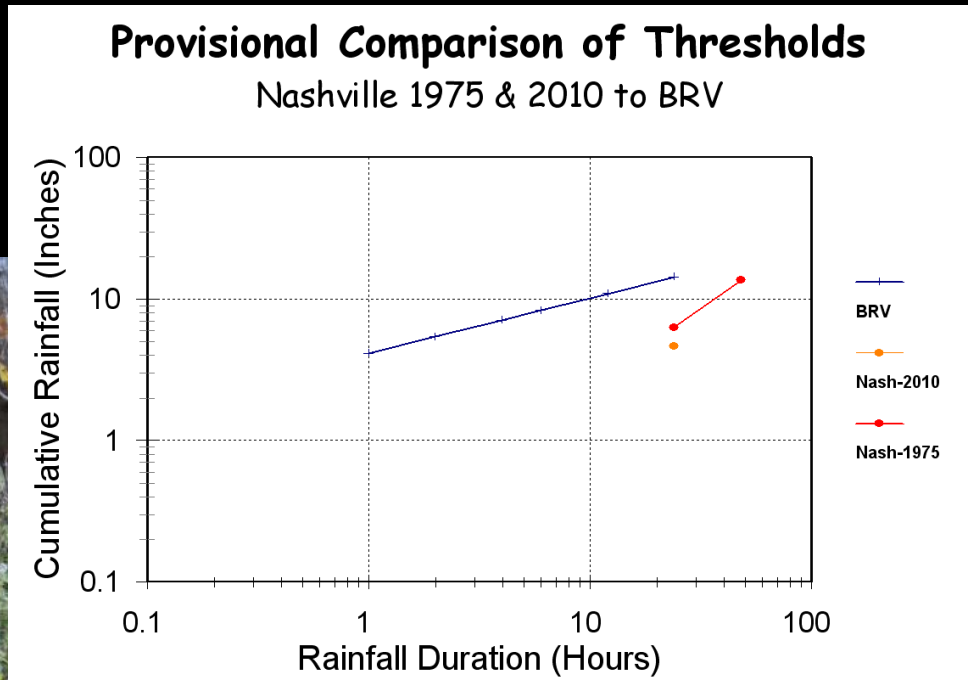
828-329-360

jennbbauer@gmail.com

Information and Research shared

USGS – May 2010 Nashville, TN storm

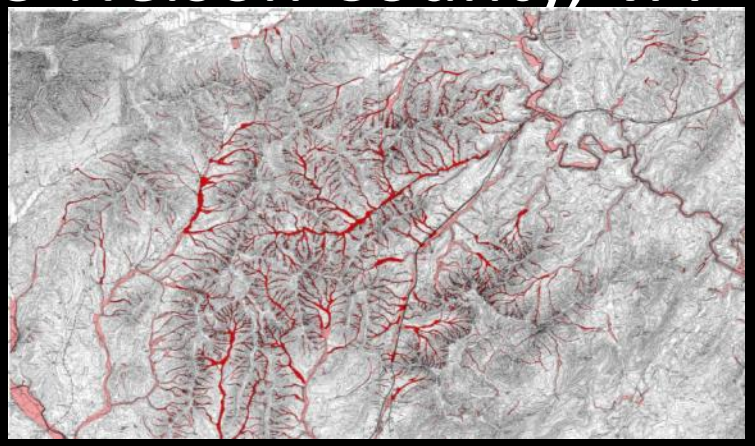
- 48 hour total is 13.57 inches, locally 17 inches
- 24 hour total 7.25 inches
- # landslides could be in 1000s

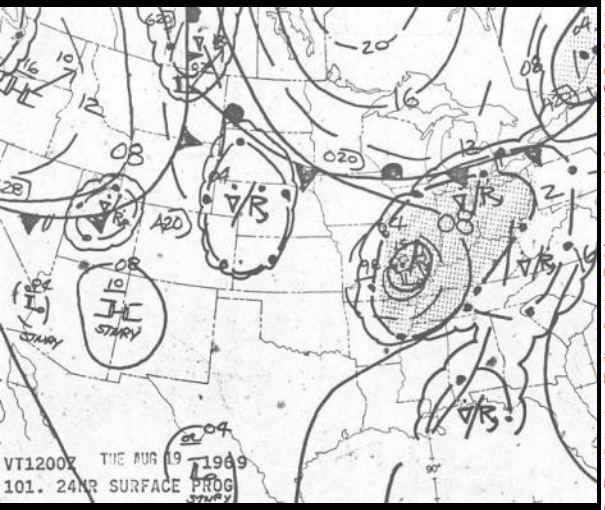


Information and Research shared

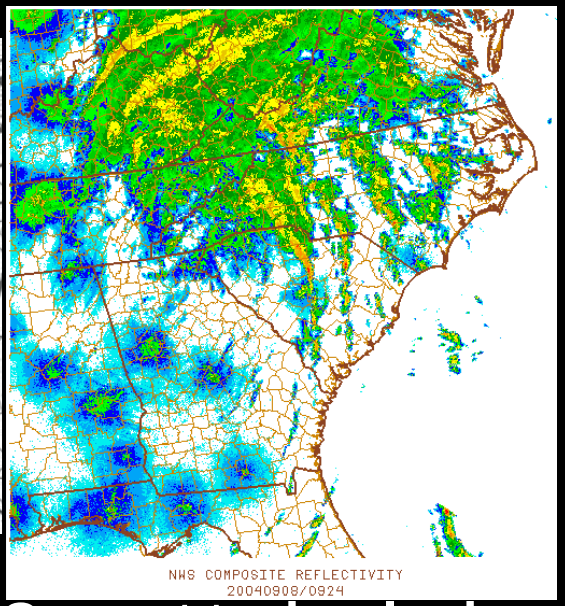
National Weather Service – 1969 Nelson County, VA

- 8 hour rainfall total was 27 inches
- Almost 3,800 landslides
- Changing technologies

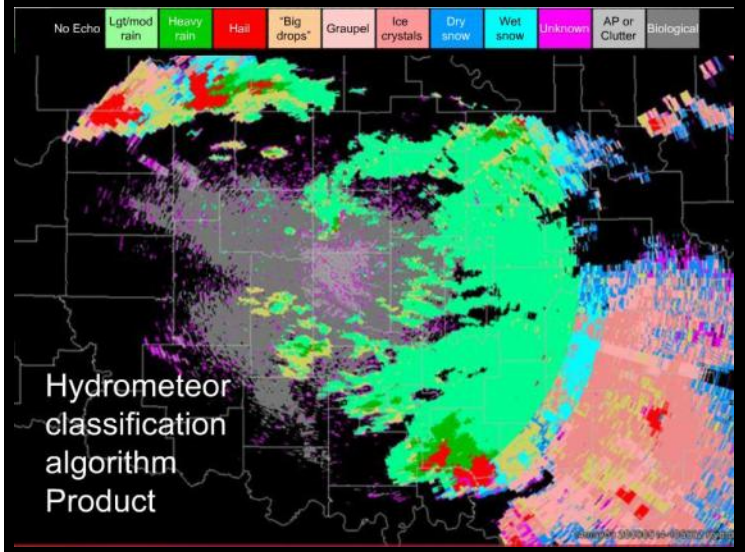




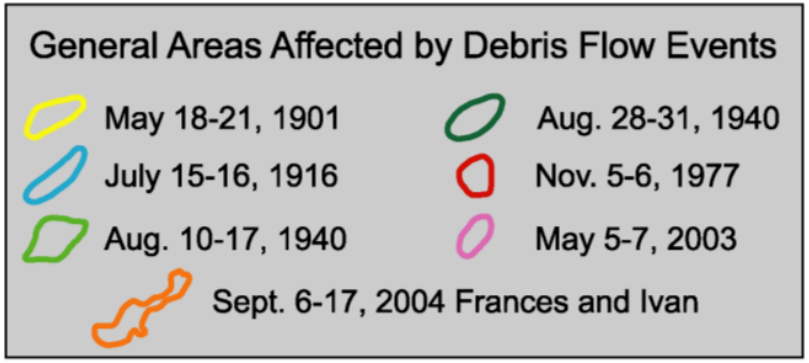
Past technologies



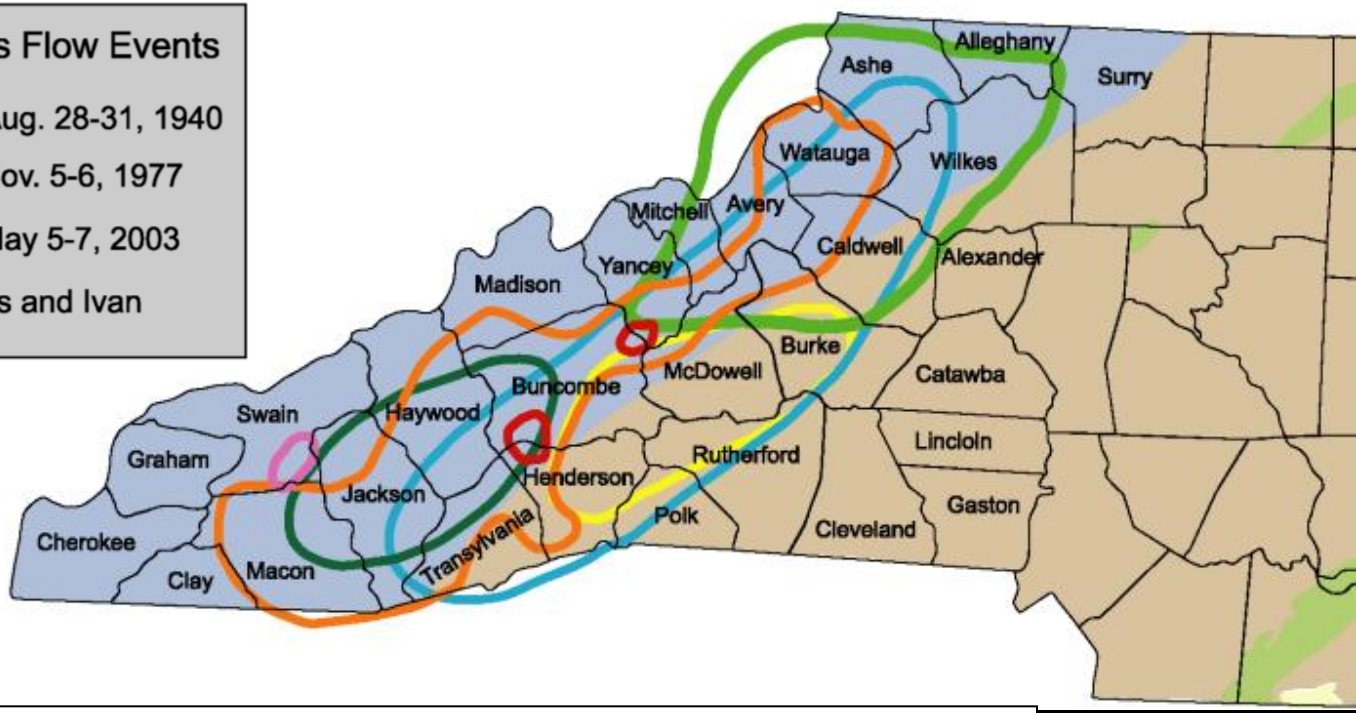
Current technologies

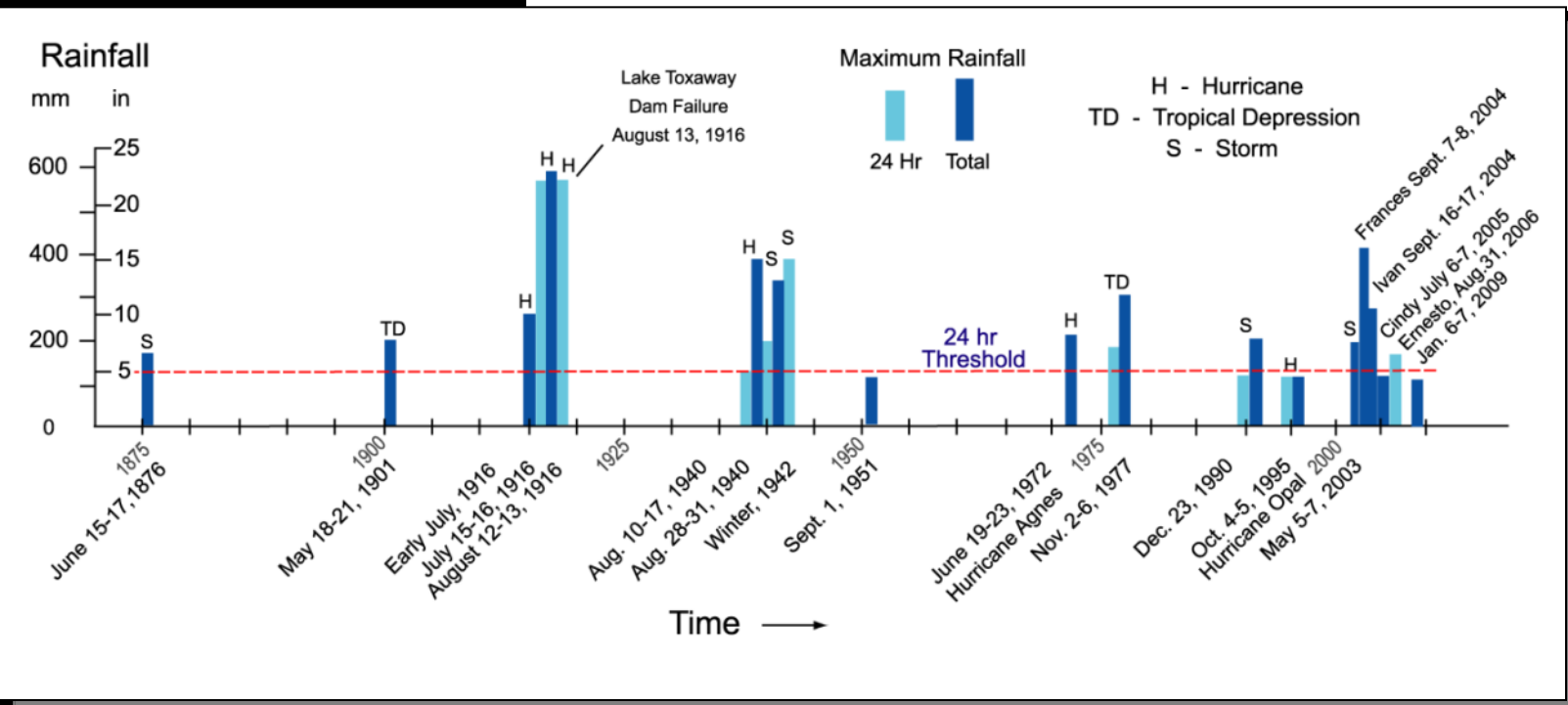


Future technologies



Recurring Weather Patterns

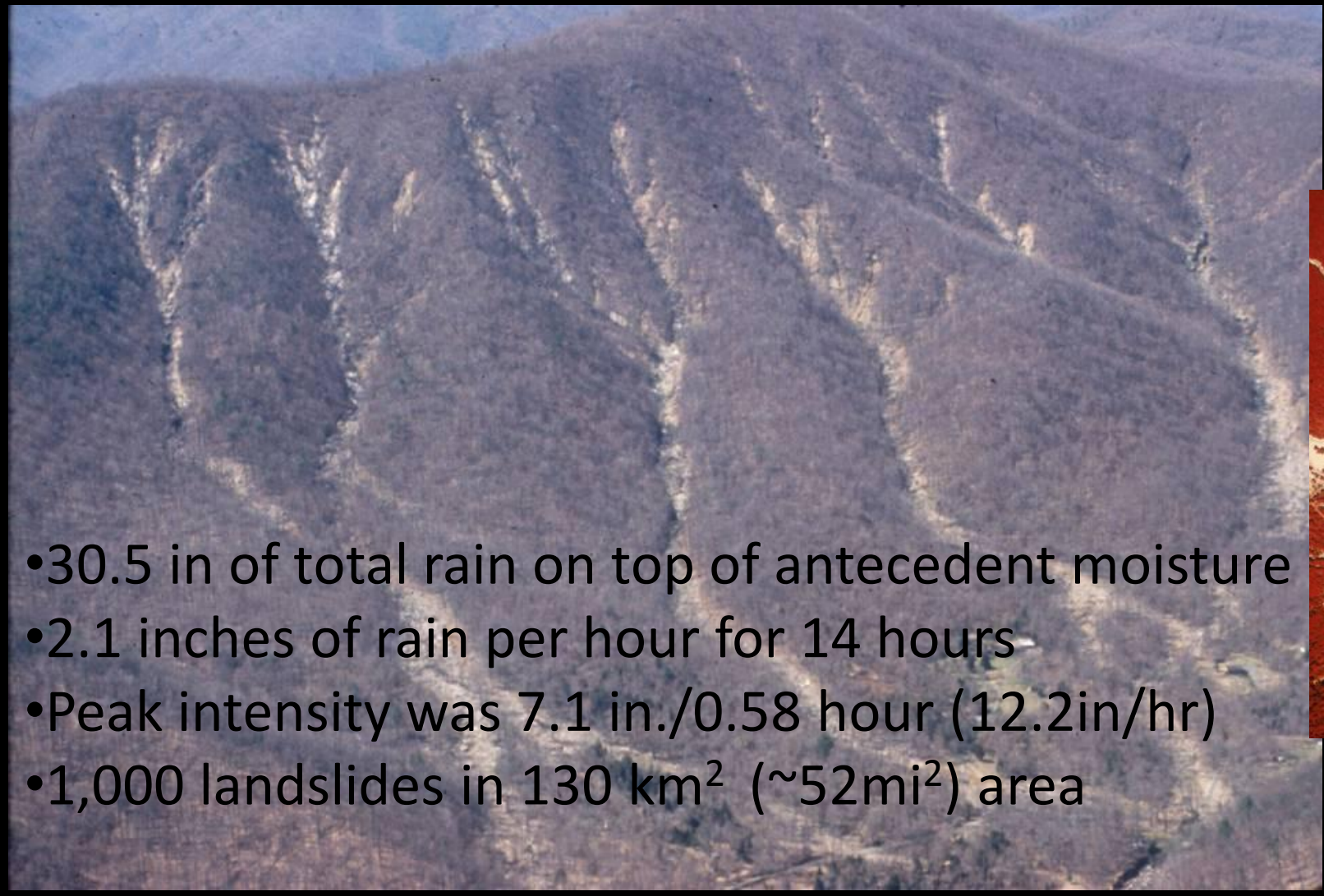




= High antecedent moisture conditions

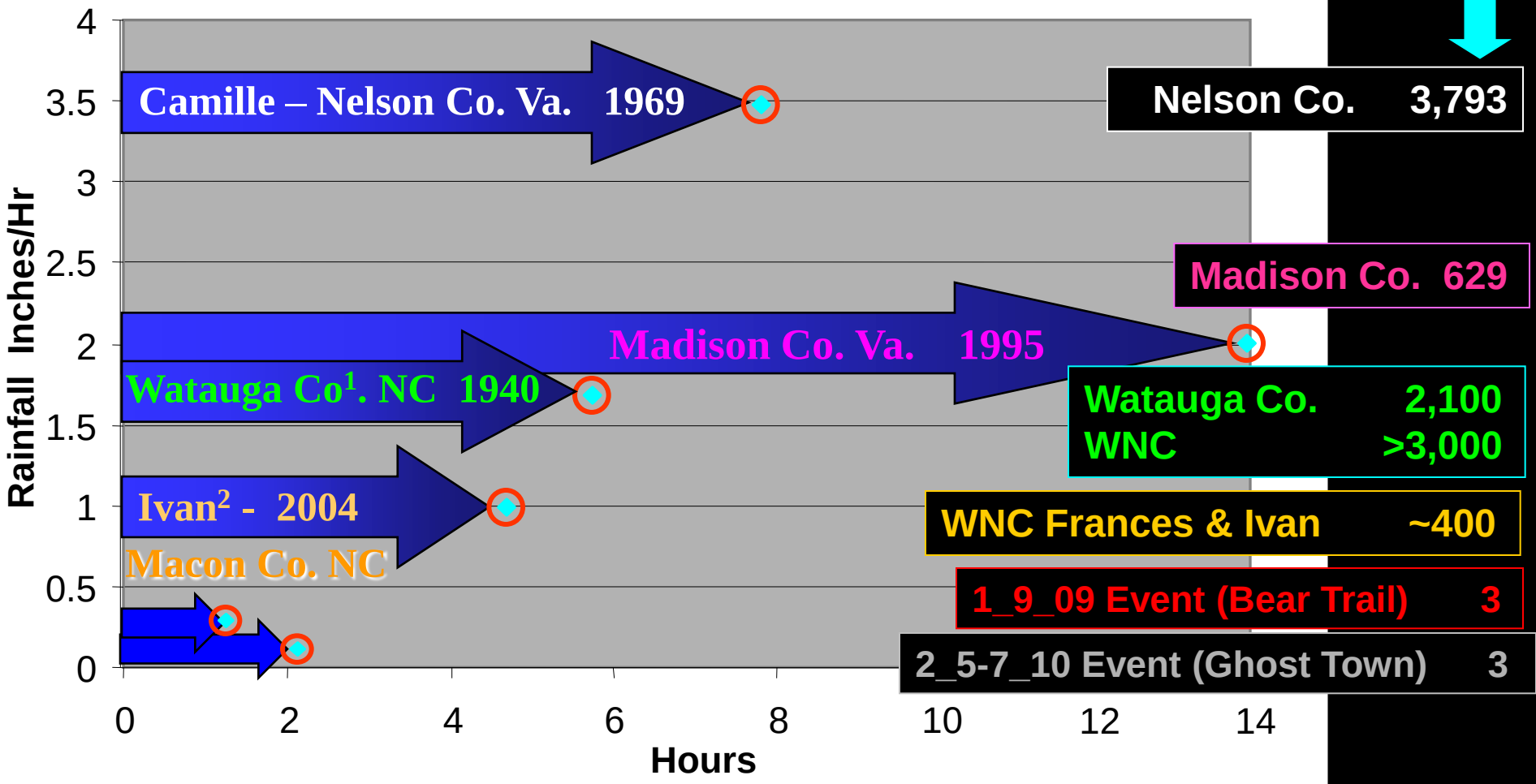
Information and Research shared

James Madison University – 1995 Madison County, VA



- 30.5 in of total rain on top of antecedent moisture
- 2.1 inches of rain per hour for 14 hours
- Peak intensity was 7.1 in./0.58 hour (12.2in/hr)
- 1,000 landslides in 130 km^2 (~52mi^2) area

Maximum Rainfall Rate and Duration



[1] Measured at Laurel Springs , Ashe/Allegheny County line

[2] Ivan Storm Total RG 31 Coweeta: 11.34 in / 38 hr. = 0.3 in/hr

(Data for Camille, Madison Co., and rainfall for Watauga Co. from Wieczorek and others, 2004)