# Societal Impacts and Public Perception

Advanced Warning Operations Course

IC Core 5

Lesson 3:Social Science Lessons-What Have We Learned From Recent Floods & Warnings?

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Colorado Springs

I am extremely pleased that this presentation is included in the course. I welcome comments & questions & hope to hear from students regularly.

# My role – applied geographer

- **Social scientist in world of engineers & physical scientists**
- **Mostly flash floods & warning systems**

Please let me know if you have case studies to share of user surveys or other collaborations between social and physical scientists. Also, please let me know if I can help with the development of questionnaires or surveys.

# Five part outline

- What we have learned since the 1976 Big Thompson Flood
- Recent Boulder, CO project
- 2003 flash floods
- Lessons from elsewhere
- Where we go from here

# Learning Objectives

1. Identify changes in aspects of the warning process since the 1976 Big Thompson Flash Flood.
2. As shown by the Boulder study, how have sources and dissemination changed?
3. Identify impacts and conventional wisdom that Dr. Eve Gruntfest is evaluating in the 2003-2006 National Science Foundation study.

# Social science can no longer be an add on

- **Meteorologists, hydrologists & engineers & social scientists**

- **Need for**
  hydro-meteorologists

**Constant cooperation – a Must**

What differences will new models and faster computers make if the messages do not get to the vulnerable populations in a timely fashion? Incorporate impact studies when new methods are first adopted.

# Social science lessons

- People do not panic in response to warnings
- People rarely get too much information

- "Cry wolf“ syndrome may not be applicable if previous misses are understood

These “lessons” are derived from old research. New in-depth studies must be undertaken to challenge these assumptions & earlier findings.

# Social science lessons

- Public wants information from multiple sources
- People actively seek to confirm risk

## The Big Thompson Flood in Colorado
## 140 died – July 31, 1976

- Who lived?
- Who died?
- Studied the behaviors that night

# The Big Thompson Flood

**New focus for next generation of policy makers & scientists involved in flood mitigation**

Now that generation is retiring. We need to keep this catastrophic event in public memory so residents, officials, & forecasters recognize that

# 1986
# Ten years later

- Signs
- FLASH FLOODS are recognized as different from slow rise floods
- Fewer people
- Real time detection

# 2004

## Changes in aspects of the warning process

- More federal agencies flood warning
- Increased vulnerability
- ALERT user groups combine detection / response

# 2004

## Changes in aspects of the warning process

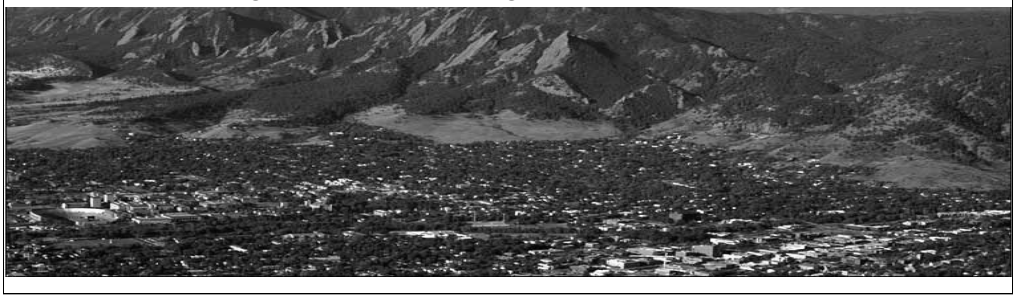
- Real time data – graphical formats
- Very high expectations of NWS forecasts and warnings
- Aging dams/ infrastructure

# An Evaluation of the Boulder Creek Local Flood Warning System - 2002

www.udfcd.org/FWP/LFWSresearch.htm

# Report addressed

- Public understanding of flood/flash flood terminology
- How & how often the public wants to be warned
- How the public will respond during a flash flood
- Where & how often the public obtains flash flood information
- To what degree false warnings will alter public response



# Methodology

- 60 question survey
- Defined 2 populations of Boulder Creek Floodplain Residents
  - Population A: Not in University of Colorado Family Housing
  - Population B: Living in University of Colorado Family Housing
- Sampled only residents in 100-year floodplain
- 291 respondents, 40% response rate

# Knowledge of flood terminology

Q. What does the term “100-year flood” mean?

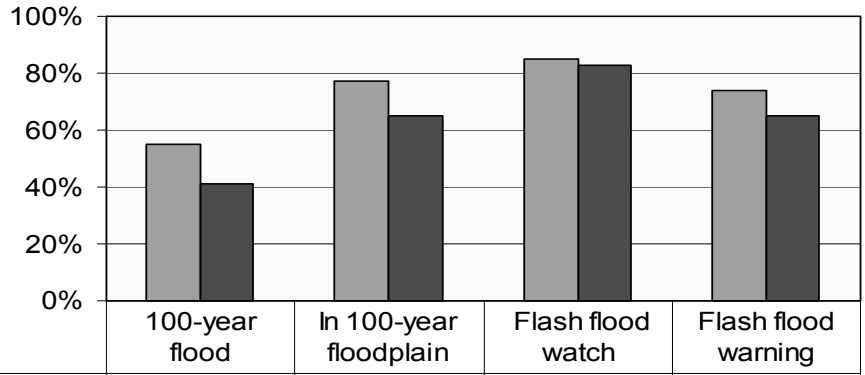
Q. Is your residence in the “100-year floodplain”?

Q. What does a “flash flood watch” mean?

Q. What does a “flash flood warning” mean?

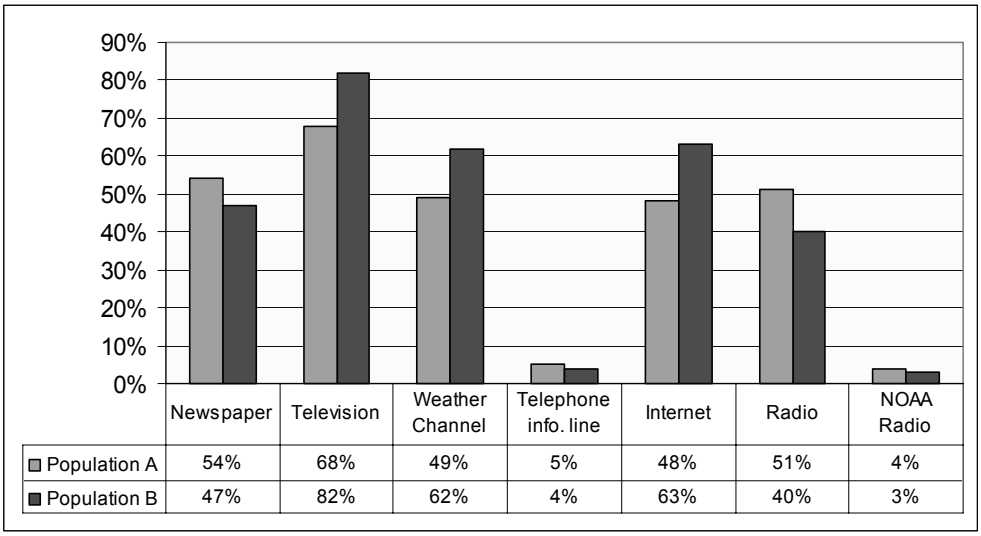
**30% answered all four questions correctly**

# Knowledge of Boulder Creek floodplain residents




| | 100-year flood | In 100-year floodplain | Flash flood watch | Flash flood warning |
|---|---|---|---|---|
| Pop. A | 55% | 77% | 85% | 74% |
| Pop. B | 41% | 65% | 83% | 65% |

# What are your weather information sources?




| | Newspaper | Television | Weather Channel | Telephone info. line | Internet | Radio | NOAA Radio |
|---|---|---|---|---|---|---|---|
| Population A | 54% | 68% | 49% | 5% | 48% | 51% | 4% |
| Population B | 47% | 82% | 62% | 4% | 63% | 40% | 3% |

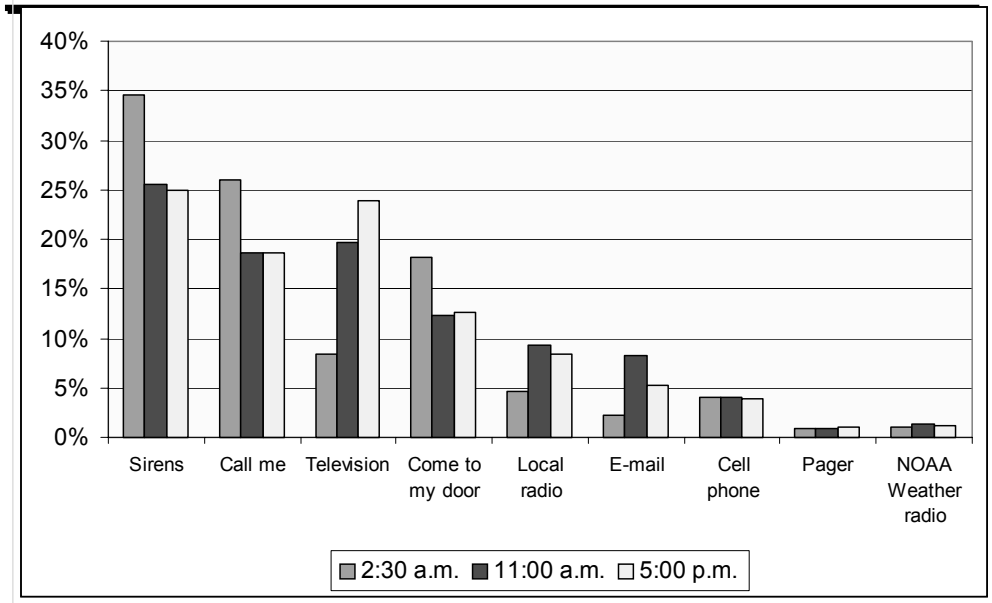
# Warning preferences

- Current dissemination via
  - Sirens, Automated call system (R-911)
  - Cable television, Radio, NOAA weather radio

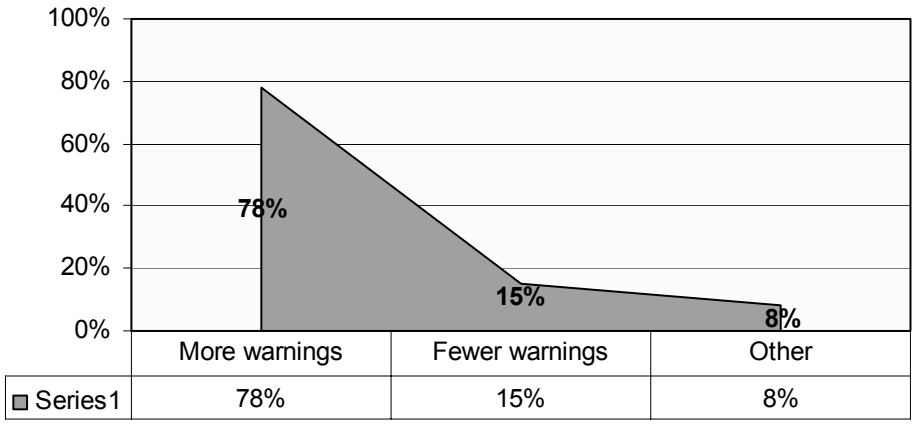
Q. What would be the best way(s) for officials to warn you about imminent flash floods at the following times:

2:30 a.m., 11:00 a.m., 5:00 p.m.

# Preferred methods



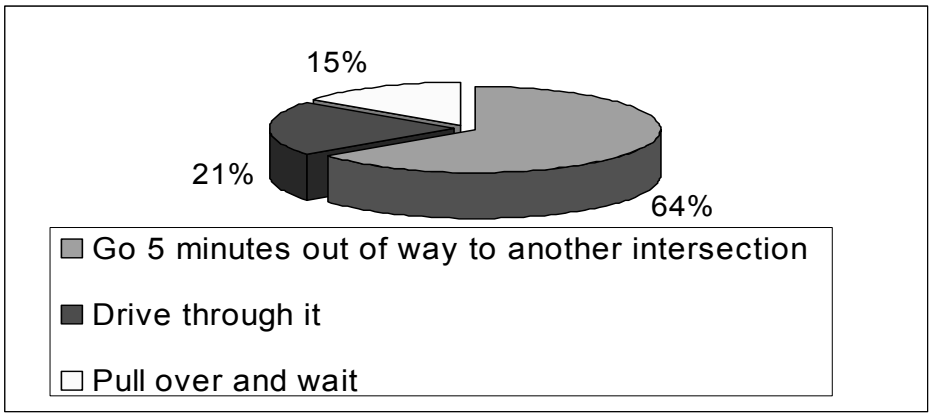
# Would you prefer more warnings even if there were false alarms rather than a missed event?




| | More warnings | Fewer warnings | Other |
|---|---|---|---|
| Series1 | 78% | 15% | 8% |

# Likely actions – driving in deep water

Q. You are driving & come to an intersection covered in water up to the middle of your tires, what do you do?



# Most important findings

- Now we have baseline data to evaluate existing/new efforts
- Don’t wait another 25 years
- Is the Boulder study good &/or bad news?!

# The last major research findings on warnings are 30 years old

- What about cell phones, Internet, private & public sources of information?
- How are diverse urban populations interpreting warnings?
- What about new “millennium” views of government?

# Our 2003-2006 National Science Foundation project will

- Evaluate impacts of
  - Demographic change
  - New & different sources of information
- Test conventional wisdom about
  - False alarms/ close calls
  - Lead times

**For Flash Floods & Tornadoes studying Denver and Austin**

# Toward improved understanding of warnings for short-fuse weather events

- Research team of psychologists & geographers
- Results from this research will provide new directions for future warning procedures

# Recent US flash flood statistics

- **1998-2002**
  - 369 fatalities (74/year)
  - 67% vehicle related
- **2003**
  - 79+ fatalities
  - 50% vehicle related
  - Deadliest event: Dec 25th Waterman Creek, CA

# 2003 noteworthy flash floods

**Las Vegas 19**
**August 2003**

# Jacob Creek/Kansas turnpike flash flood

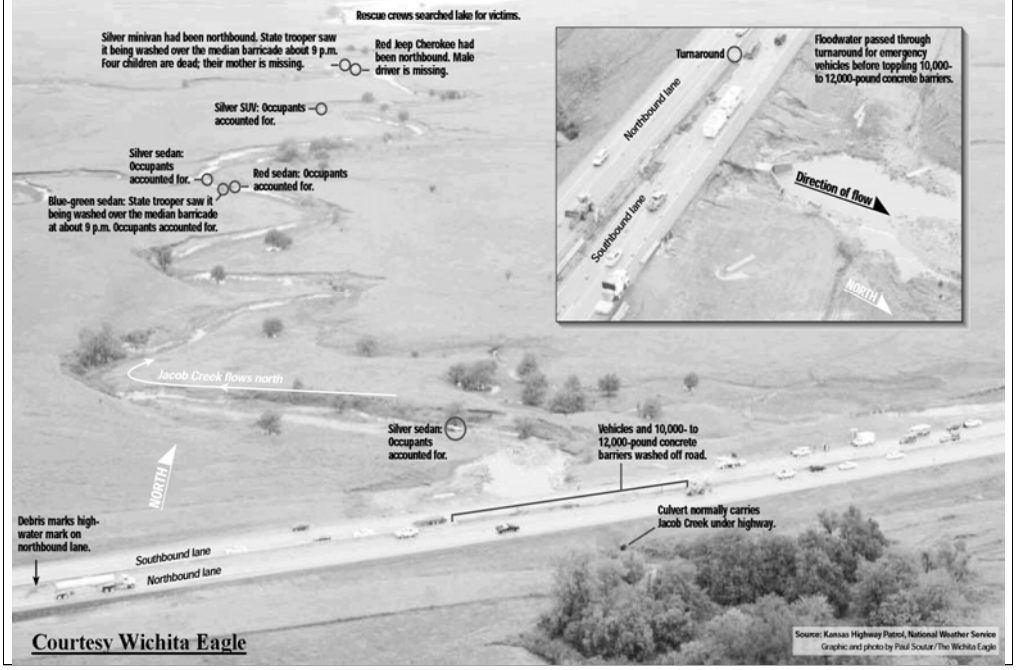
- 30 August 2003
- Chase/Lyon County line
- Small rural basin along interstate
- 3-4” in 3 hours

# 30 August 2003-- Kansas turnpike

- 7 vehicles (mostly abandoned) washed downstream 1 vehicle had 5 fatalities
- Should people abandon vehicles?
- Did 9-1-1 advise people to stay in cars?
- “Turn around don’t drown” was not a realistic option in this case.
- Was it really a freak rainfall & freak event?

# Jacob Creek's fatal flood

About 9 p.m. Saturday, heavy rain swept several motorists off I-35 south of Emporia at Jacob Creek. Extremely heavy rainfall caused the creek to overwhelm the culvert and overflow the highway, carrying with it concrete barricades and seven vehicles. Four people are confirmed dead. Two are missing.




Courtesy Wichita Eagle

Source: Kansas Highway Patrol, National Weather Service
Graphic and photo by Paul Soutar/The Wichita Eagle

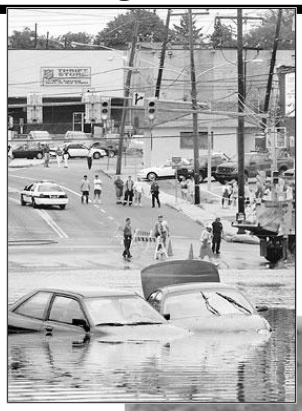
# Southern California flash flooding & debris flows

- Christmas day 2003
- San Bernardino County
  - Waterman Canyon
- 12-15 ft debris flow following peak rainfall rates of 3.36 in in one hour

The mudslides hit areas that were ravaged by wildfires in October.

**Did early warnings & closures following the fires save lives?**

# How can we convince people they are better wet than dead?



# Up against the auto industry

**Ad says: Warning: use the cup holders at your own risk**

# Lessons from elsewhere

# Research issues

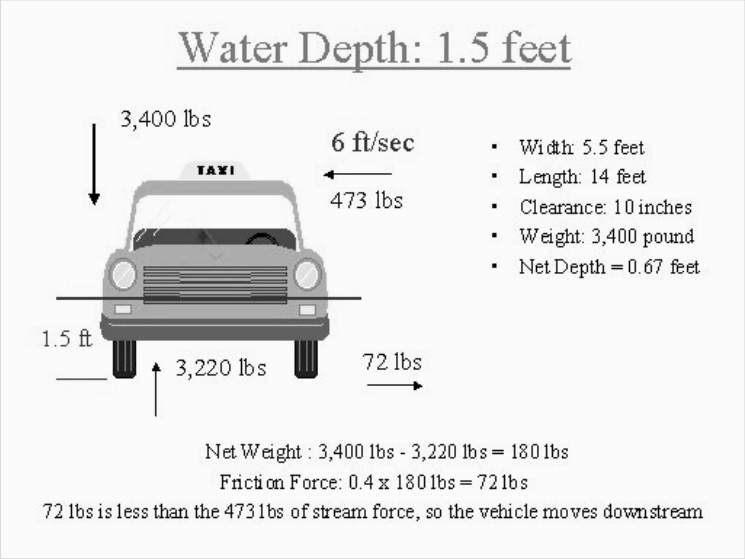
- Knowing more does not translate to reduced property losses – vulnerability increasing – account for age, gender, migration patterns

# Graphical images are everywhere

- How local?
- How real time?
- How useful?

# The car is not a boat

## At 1.5 feet the vehicle moves downstream – public education Maricopa County, Arizona



**Las Vegas Billboards 2003**

# 58 seconds in Tucson, Arizona June 22, 1977.

Photos copyright Jack Sheaffer *Arizona Daily Star*

# Dow & Cutter - Hurricanes Bertha & Fran – South Carolina

- People search elsewhere for information to assess their own risk

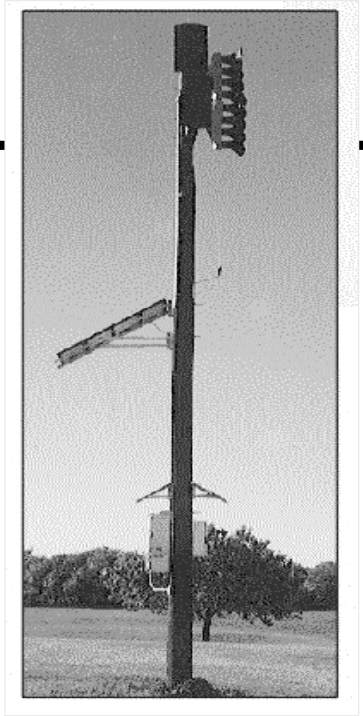
- "Official" sources are only some of many sources of information

Weather channel, quality of home construction, family situations, fear of delays in being allowed back home

## False alarm- Ventura, CA a siren test that went wrong

- Most said they would heed next siren
- Confidence in warning process was not reduced
- Served as a hands on practice for real emergency – family plans were developed

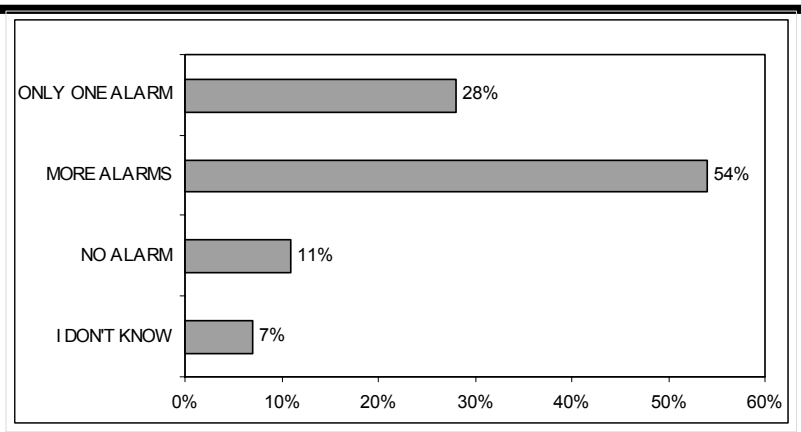
**Carsell's 2001 findings**



# Engineers & social scientists work together – outside the US

- Italian hydrologic engineer Enrica Caporali's flood warning follow-up study
- Two flood warnings in October 1992
  - Telephone survey of 518 residents

# Memory of the warnings




**82% remembered the warnings**

**28% remembered only one alarm**

**54% remembered two**

# After they heard the alarm

- 43% did nothing - 29% moved vehicles
- 83% judged the warnings positively

High level of public satisfaction with warning
-- but….

**THERE WAS NO FLOOD!**

- We rarely study warning response –
  but never when no flood occurs

# Not all floods are equal

- What are acceptable levels of risk?
- How do we address nuisance events vs catastrophic events?

**If 28 people die in Texas or France or 1000 people in Bangladesh– were the warnings successful?**

# Some events are so rare - Are warnings likely?

1999

- 30,000 dead Venezuela

2004

- 3000 dead Haiti

How can such deadly flash flood catastrophes occur with our current levels forecasting technologies?

# Key steps

- Develop a national warning strategy
- Identify definitions- for flash floods, for service missions
- Provide incentives for students and researchers
  - Research & workshops

# Who or what warning agency was most credible during the 1993 Midwestern U.S. floods?

Observing a slow rise flood is so much different than observing a flash flood, so when I had the opportunity to go to Missouri in 1993 during the devastating midwest floods, I did. Was the answer to the question the Corps of Engineers, the River Forecast Center, the tv meteorolologist or some others? I went to Hermann, Missouri for a few days, away from the commotion in St. Louis.

Gentlemen from Hermann, MO on the Missouri River. They have local knowledge & technical data from NWS, Corps of Engineers, local tv/radio and… latest news from “Dave” from the highway department who stops by to give them the an update about whether the access road to the bridges will force road closures later in the day, or whether current heavy rains at Kansas City will compound their local flooding or whether a levee break in an upstream down might reduce their local threat. They also use the “stick” for accurate local measurement.

Here are the Hermann residents 11 years later. Note that they have a laptop, a PDA, and a cell phone that provides real-time weather and river data. Would you think that they would also have a new truck? They also still have the “stick”.

# Expectations for 2014

- Numerous “natural” problem solving collaborations between social scientists, physical scientists, & practitioners
- Many “measured” successes – reduced losses
- Reduced vulnerability & integrated warning systems

Physical science & engineering advancements will only make a difference if research on warnings, warning response, & risk communication are better understood