

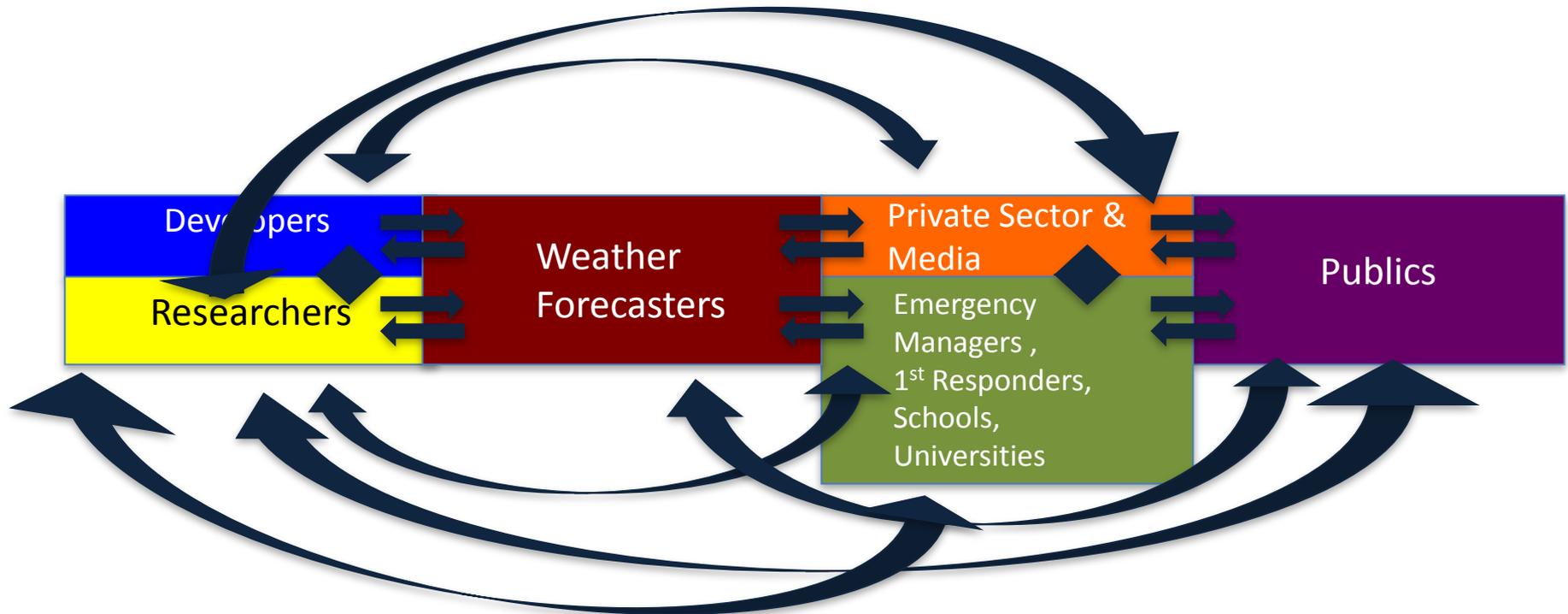
K-12 School and University Officials' Sources and Preferences of Weather Information

Stephanie Hoekstra and Amy C. Nichols

February 28, 2012



SSWIM develops research projects that highlight how stakeholders make weather sensitive decisions while building relationships among meteorologists, product developers, and stakeholders.



The Hazardous Weather Testbed and Warn-on-Forecast group need to know how stakeholders use weather information to support their decisions.

Collaboration with the National Oceanic and Atmospheric Administration's Hazardous Weather Testbed and Warn-On-Forecast

- **Warn-On-Forecast**
 - **New tornado prediction paradigm**
 - **Warn-on-Detection → Warn-on-Forecast**
 - **Possible implications include longer lead-time**



<https://secure.nssl.noaa.gov/projects/ewp/blog/page/6/>

- **Hazardous Weather Testbed**
 - **Hazardous Weather Testbed → Experimental Warning Program → Probabilistic Hazards Information**
 - **Increased spatial, temporal, and intensity information**
 - **Longer lead-time with greater uncertainty**



Research Questions

- 1. What sources of information do key decision makers access during tornado warnings?**
 - Hoekstra- K-12 school officials and staff
 - Nichols- University decision makers
- 2. What is the timeline of events in decision making?***
 - Hoekstra- Components of whether or not to shelter students in place
 - Nichols- Emergency notification of campus
- 3. What non-weather factors influence how decisions are made?***
- 4. What types of weather information might improve operations, and how might a longer lead time change the decision making process?**

*Discussed in following presentation



Sampling Methodology

- Using Google Earth, we layered Iowa Environmental Mesonet National Weather Service (NWS) Warning Archives with Place data
 - Provides spatial verification that schools and/or universities are located within a warning polygon
 - Provides NWS text based warning information

Sampling Criteria

•Nichols

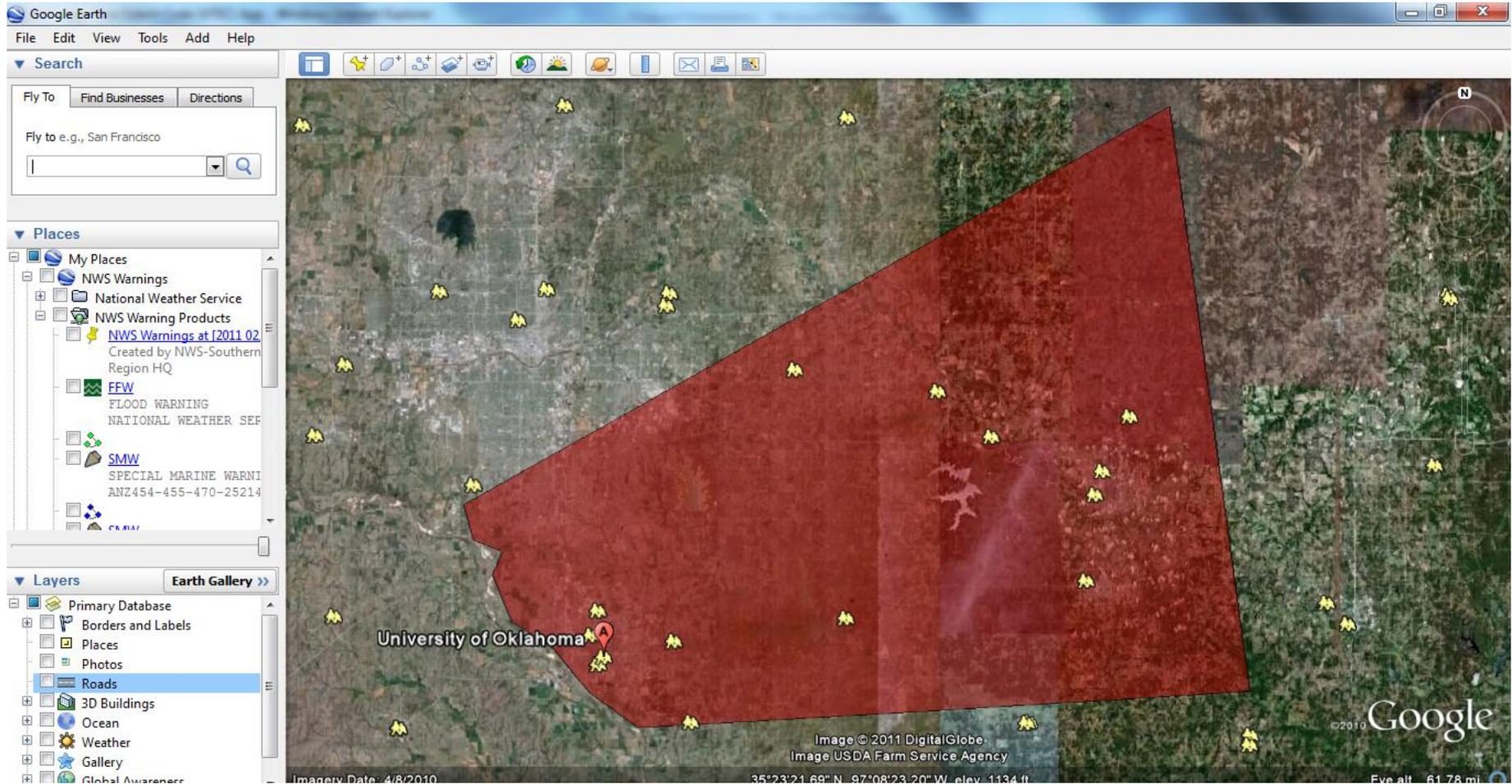
- Nationwide
- Public, state universities
- Student populations over 5000
- Title IV institutions

•Hoekstra

- Nationwide
- Public schools



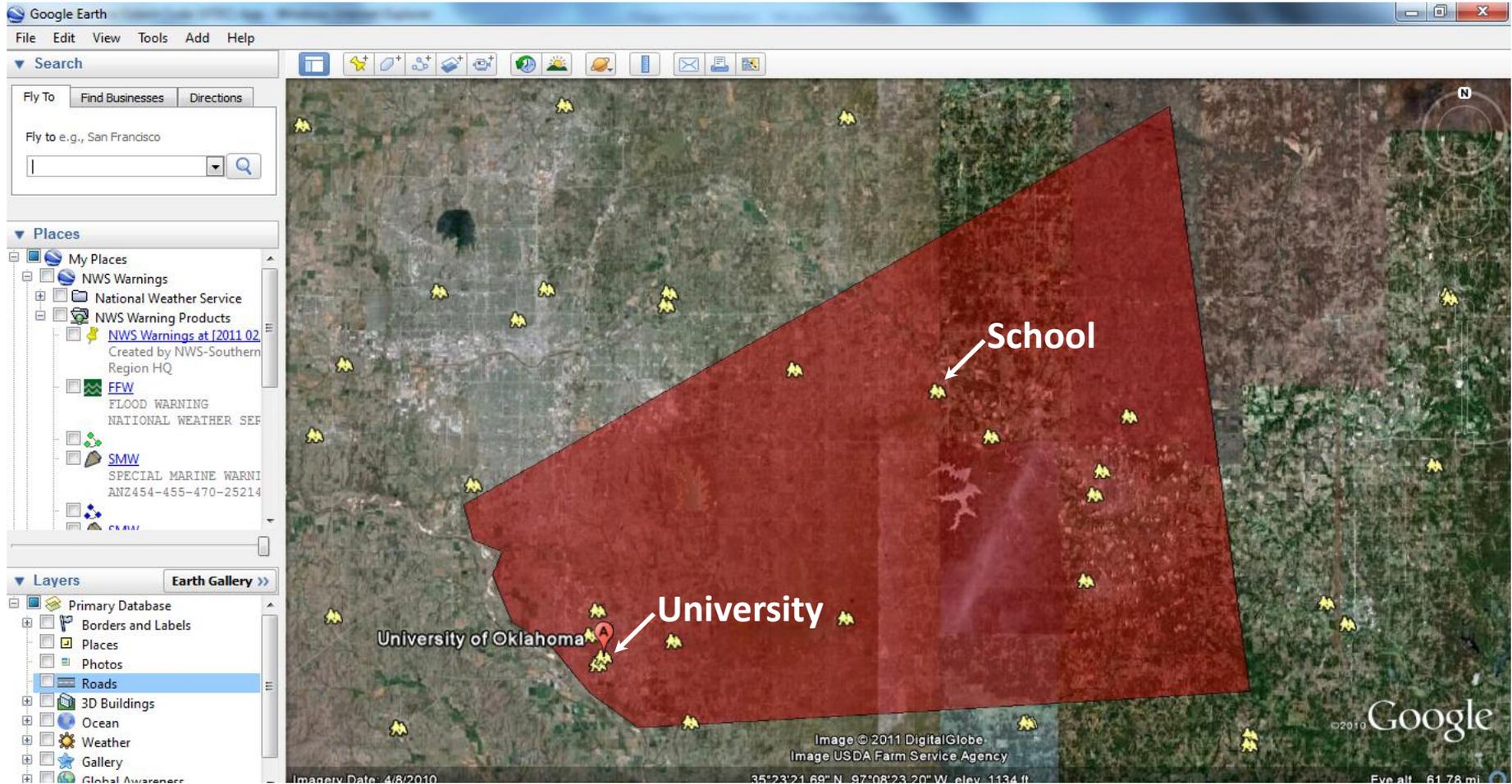
Google Earth Warning Polygon



May 10, 2010, Oklahoma



Google Earth Warning Polygon



May 10, 2010, Oklahoma



Weaving Social Science Into Weather and Climate Research and Practice

Project Methodology

- Semi-structured interviews
- Phone and in-person interviews with decision makers
- Decision makers determined via snowball sampling
 - Snowball sampling reveals key decision makers relevant to each institution



Participants



6 School Districts

- 4 Superintendents
- 1 Assistant Superintendent
- 2 Principals
- 1 Director of Safety and Security
- 1 Director of Transportation
- 1 Technology Director
- 1 Communication and Public Relations Officer



5 Public Universities

- 5 University Emergency Managers
- 1 Public Safety Administrator
- 1 Media Relations Administrator
- 2 Housing Administrators
- 1 Meteorologist



Sources of information- School district officials

- Local TV Stations
- NOAA Storm Prediction Center Websites
- NOAA Weather Radio
- Local University Meteorology Programs
- Transportation Directors/Safety Directors
- Personal Relationships with Meteorologists



http://blog.al.com/spotnews/2011/06/james_spahn_blasts_number_of_f.html



<http://emergencyradioguide.com/>



Sources of information- University officials

- NWS Web Packet
- NWS Webinar
- SPC Website
- Convective Outlooks
- Hazardous Weather Outlooks
- Mesoscale Discussions
- Watch Information
- Watch Probabilities
- Radar
- NWS Chat
- NWS Email
- NWS Text Message
- NOAA Weather Radio
- Interactive NWS (iNWS)
- Law Enforcement Administration Data System
- NWS Warnings (SVR, TOR)
- Severe Weather Statement
- EMs Weather Information Network
- Other Public/State Weather Services



Sources of information- University officials

- TV Station News
- Weather.com
- Local TV Text Message
- Weather Channel
- TV Station Radar (Local, Non-Local)
- GR Level 3
- GR2 Analyst
- Weather Tap
- Other Radar Sources (unspecified)
- Local Meteorologist
- Neighboring EM
- Local EM
- Campus Police
- Staff Communication
- Local EOC Radio
- Storm Spotters via Local EM
- Environmental Cues
- Campus Text Message
- Campus Email
- Power Company Email



Sources of Information

Why they use them...



Permission from Matt Meister

Trust
Credibility
Accuracy
Convenience
Relevancy
Redundancy



http://science.nasa.gov/science-news/science-at-nasa/2009/22apr_severeweather/



School District Officials

Positive personal relationship between the officials and the source of information



University EMs

Positive working relationship between the EM and the source of information

SSWIM



Stakeholder weather preferences

- **Direct communication with NWS or Weather Information Provider**
 - WFOs should reach out to their campuses and school districts and create these relationships if they don't already exist
 - Schools need guidance



“Again, the relationship between us and the National Weather Service is impeccable.... You don't necessarily have that same level of partnership and that same level of service at other offices..., if there was a way to institutionalize that and make it mandatory across the country so everybody has that same level of support, that'd be critical.”

–University Emergency Manager



Stakeholder weather preferences

- More spatial, timing, and intensity specificity to determine impacts and give advanced notice



“... knowing where it will be, even if it doesn't materialize, is probably the single most important. ”

- School District Technology Director

Stakeholder views on increased lead time

- **Mixed reviews**

- Increased lead time vs. spatial specificity, accuracy, and false alarms



“I recognize that there is a balancing act because greater lead time will also probably lend itself to inaccuracy, and too many false warnings we know result in people not paying attention to all of the warnings, the legitimacy of warnings. ”

-School District Superintendent

Stakeholder views on increased lead time

- Increased lead-time with uncertainty will provide time to go over plans and communicate with departments on campus
 - Many would hold off on taking action until the weather became more imminent



“... if we had that kind of information, we could probably communicate it via email to various... interested parties ... to give them a heads up that there’s an increased potential for a tornado affecting our area.... We could even... possibly send out something to the entire campus so that they’d be ready and... review what procedures they should take should a warning... a critical warning be issued.”



–University Emergency Manager

Stakeholder views on increased lead time

- **Warn-on-Forecast will be a paradigm shift**
 - Will force school districts and universities to modify existing plans
 - Uncertainty about what that would entail



“Yeah that would drastically change what we do.. We'd really have to think through that one, and it would certainly change the way we prepare for this. ”

-School District Assistant Superintendent



Observations and suggestions

1. Warnings under the Warn-on-Forecast paradigm will have to be reframed and redefined with the input of stakeholder groups.
 - How will current warning systems work with the WoF paradigm? *How can a siren communicate a 30% probability?*
 - Will warnings with uncertainty be a “warning”, an “enhanced watch”, or something entirely different?



Concluding thoughts...

- What are the ways that product developers can accommodate these findings to provide what weather sensitive decision makers need?
- A substantial investment is needed to ensure that meteorological products are developed in a useful and meaningful way
- Social science requires multiple studies by multiple scientists to understand the complexities of decision making



<http://www.garner-es.com/eocSupport/>



<http://www.nationalguard.mil/news/archives/2010/04/042710-Mongolian.aspx>



Concluding thoughts...

- Product development must occur with the inclusion of ALL user perspectives and needs
- Needs are individualistic



http://commons.wikimedia.org/wiki/File:FEMA_-_36205_-_Federal_and_Local_Emergency_Managers_work_together_in_Palo,Iowa.jpg

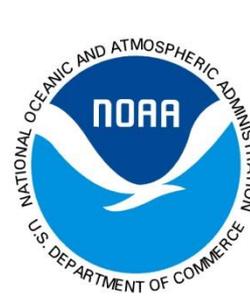
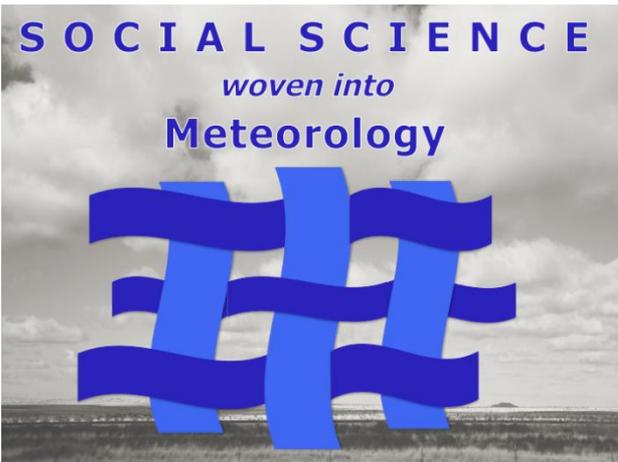


<http://www.renci.org/news/releases/ncema-conference-to-reveal-new-disaster-management-tools>



<http://insighteatorlando.com/index.php/rollingfeatured/master-disaster-plan>





How Space and Time Influence the Decision Making of K-12 School and University Officials During Tornado Warnings

Amy C. Nichols and Stephanie Hoekstra

February 28, 2012



Weather Information Used

Local TV stations
 NOAA websites
 NOAA Weather radios
 Local universities/meteorologists
 Transportation/Safety Director



Clear (Majority of Year) **Approaching (~1-2 Days)** **Warning (~15-50 mins)** **Passed (~1 Day)**



Severe Weather Status at School Districts



Weather Information Used

Radar Services
 Local Emergency Managers
 Private Weather Services

NWS Forecasts
 NWS Briefings/Packets

Forecasts

Watches

TO Warning

Warning Expiration
 Radar Services

Monitor Weather

Monitor Weather / Communicate with
 Weather Information Providers

Prepare/Write Plans

Relay of Weather Information to
 Administration/Staff/Departments

Modify Systems

Spatial Assessment
 of Severe Weather
 for Possible
 Impacts to Campus

Build Relationships

Exercises

Determine Special
 Events on Campus

Education

Activate
 Emergency
 Notification
 Systems

Assess Impacts

Other Event Types

Assess
 Vulnerabilities

Coordinate Staff
 and Recovery

Non-Severe
 (Majority of Year)

Severe Weather
 Approaching
 (~1-2 Days)

Warning
 (~30-50 mins)

Severe Weather
 Passed
 (~1 Day)



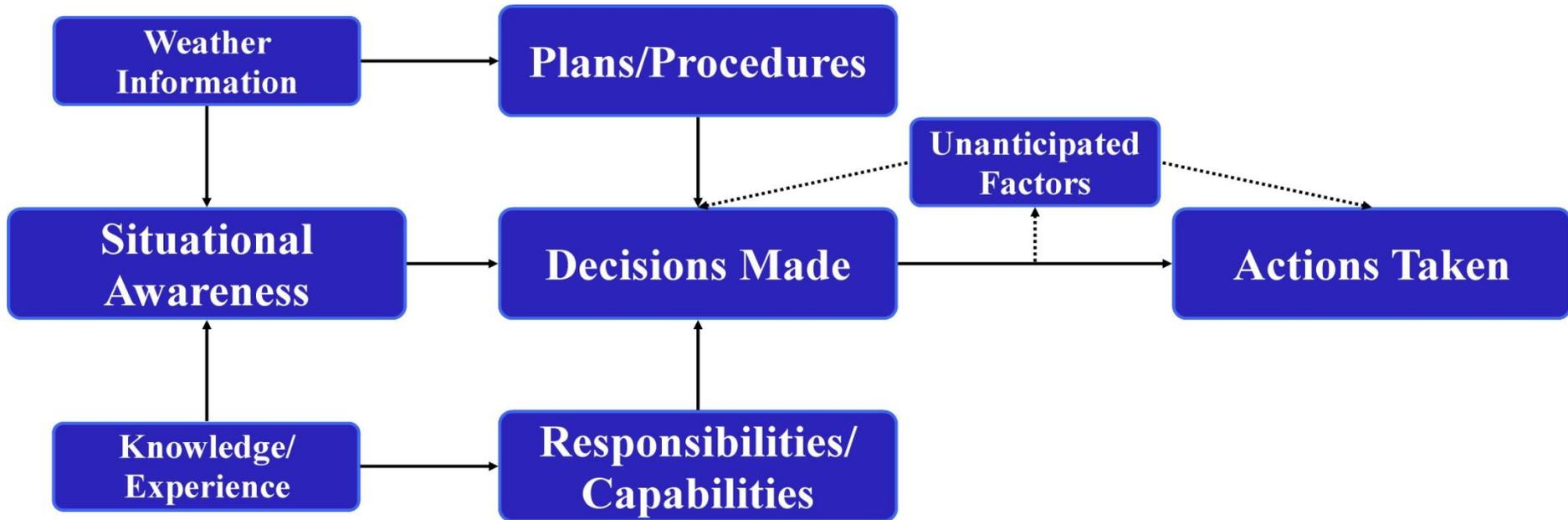
Severe Weather Status at University

SSWIM

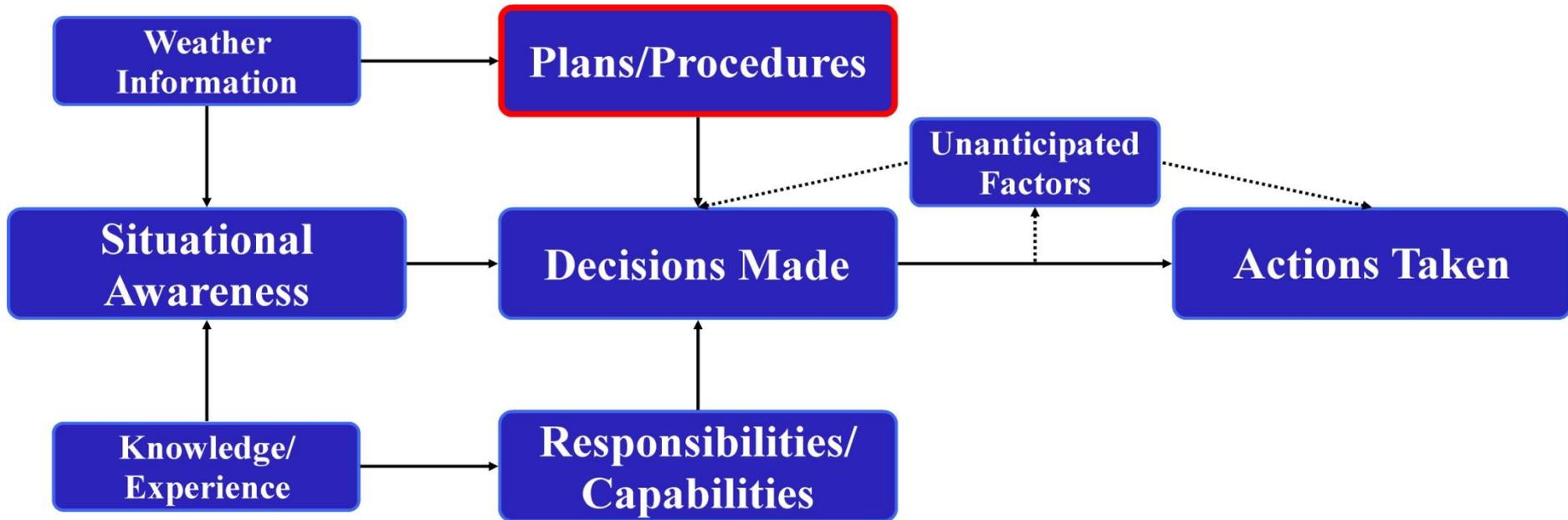


Weaving Social Science Into Weather and Climate Research and Practice

How non-weather factors affect decision making

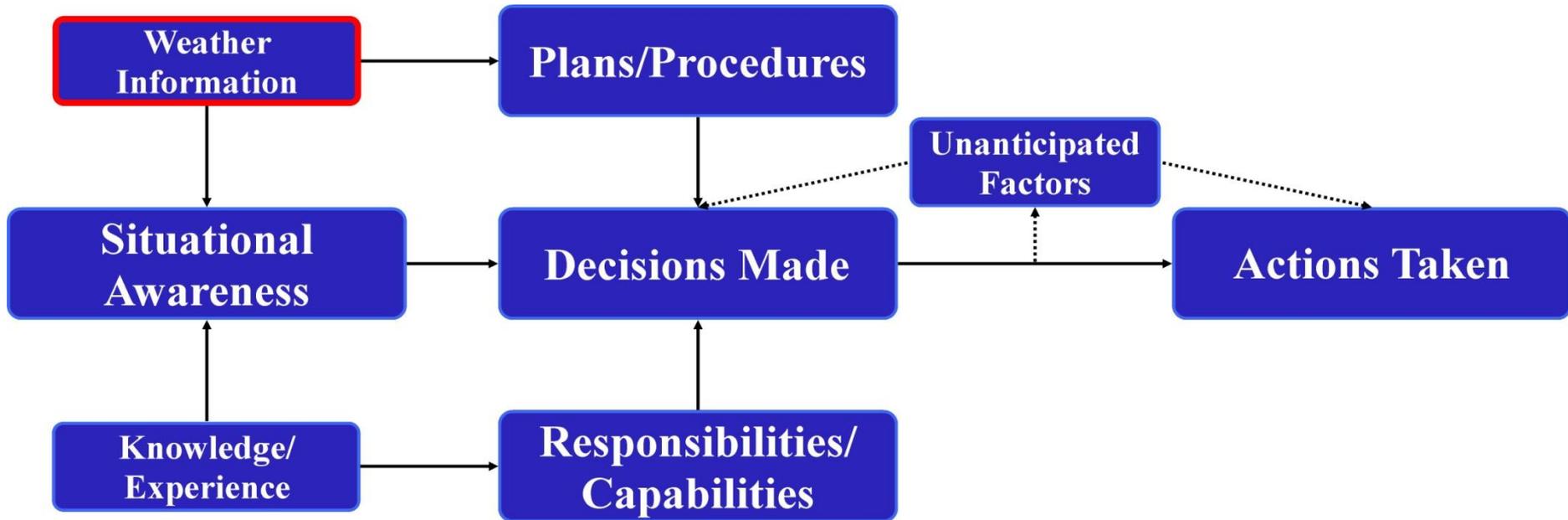


How non-weather factors affect decision making



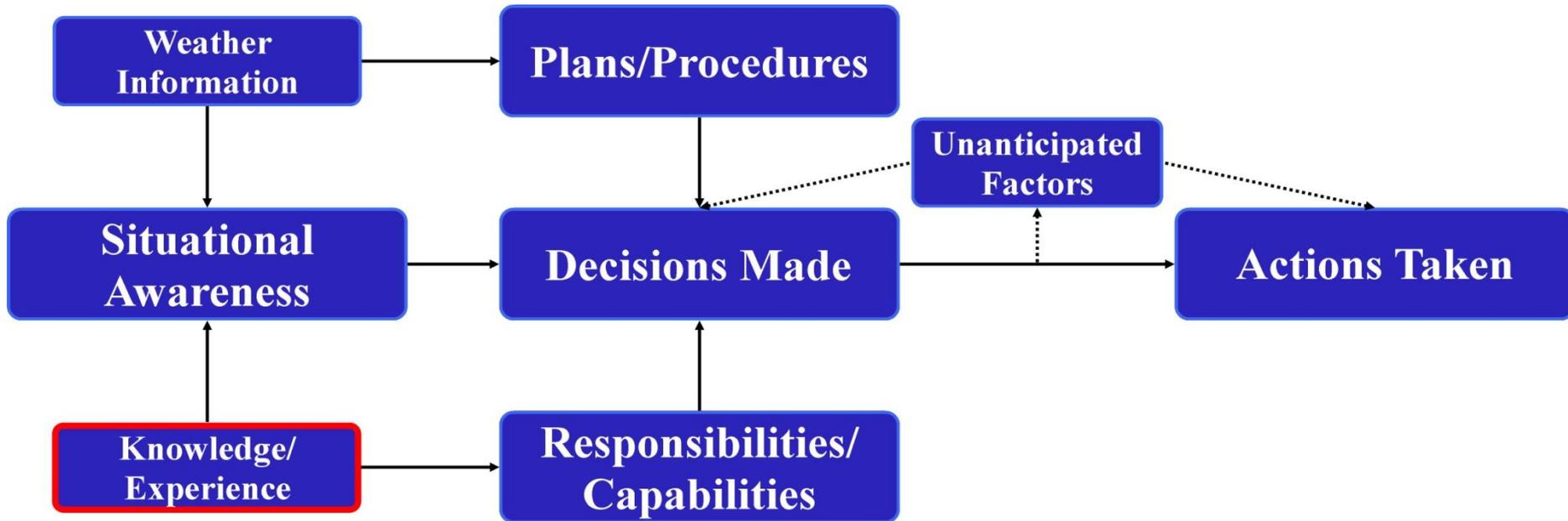
Plans/Procedures
Which plans need to be activated?
What are standard procedures?

How non-weather factors affect decision making



Weather Information
Does it affect campus(es)?
When will it get here?
How intense is the weather?

How non-weather factors affect decision making



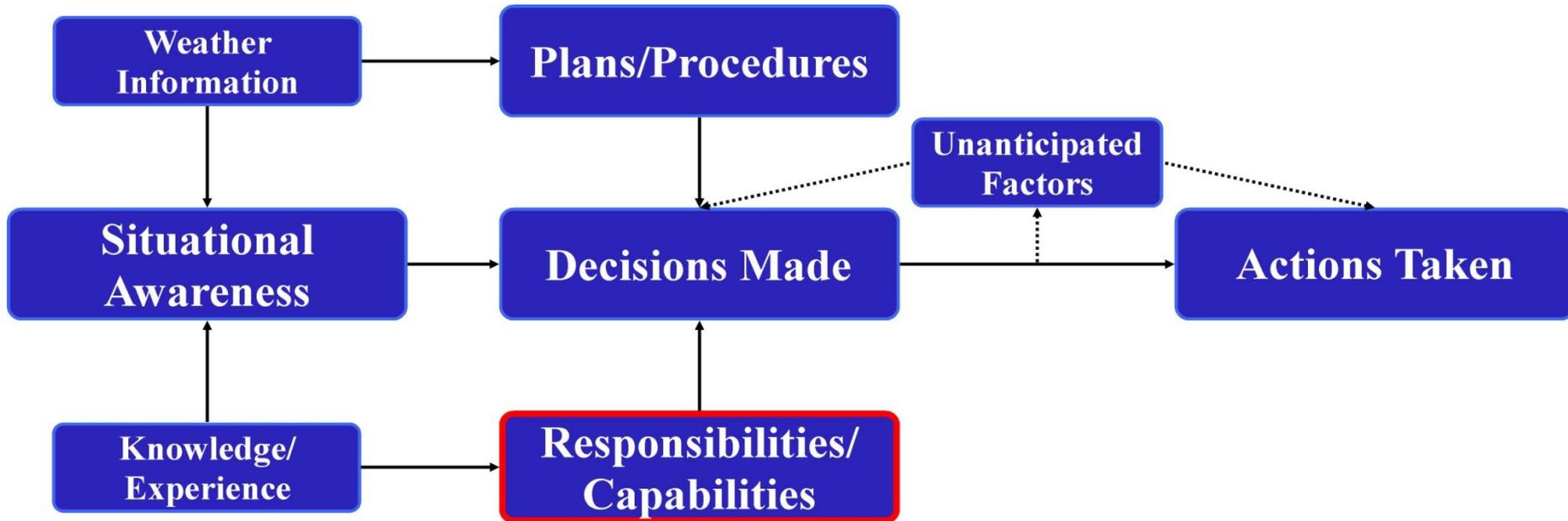
Knowledge/Experience

Are there special events on or off campus?

Do I have vulnerable populations?

What have I learned from experience/
recent events?

How non-weather factors affect decision making



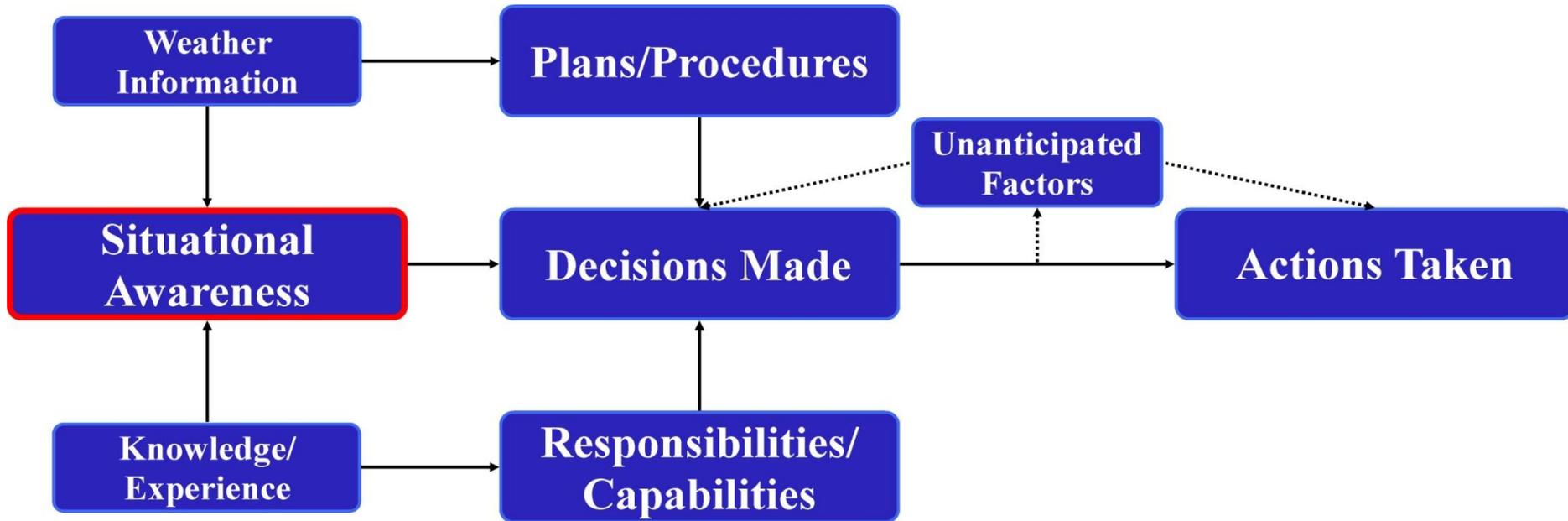
Responsibilities/Capabilities

What are my job requirements?

What am I responsible for?

Am I at full or diminished capability?

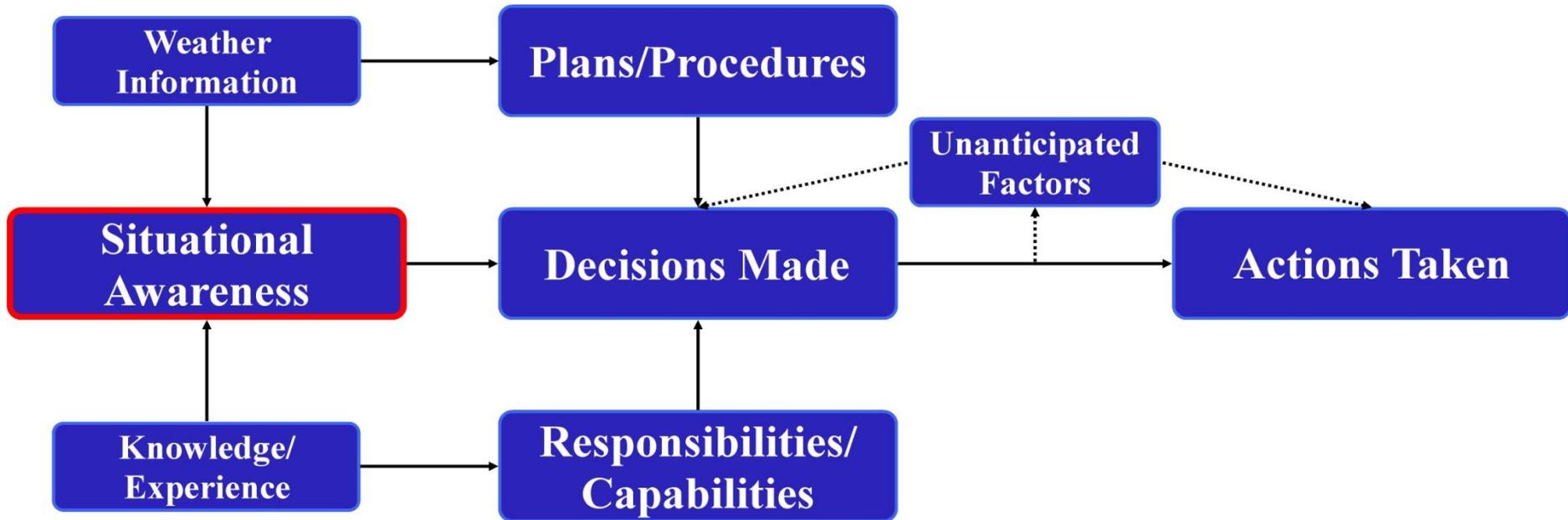
How non-weather factors affect decision making



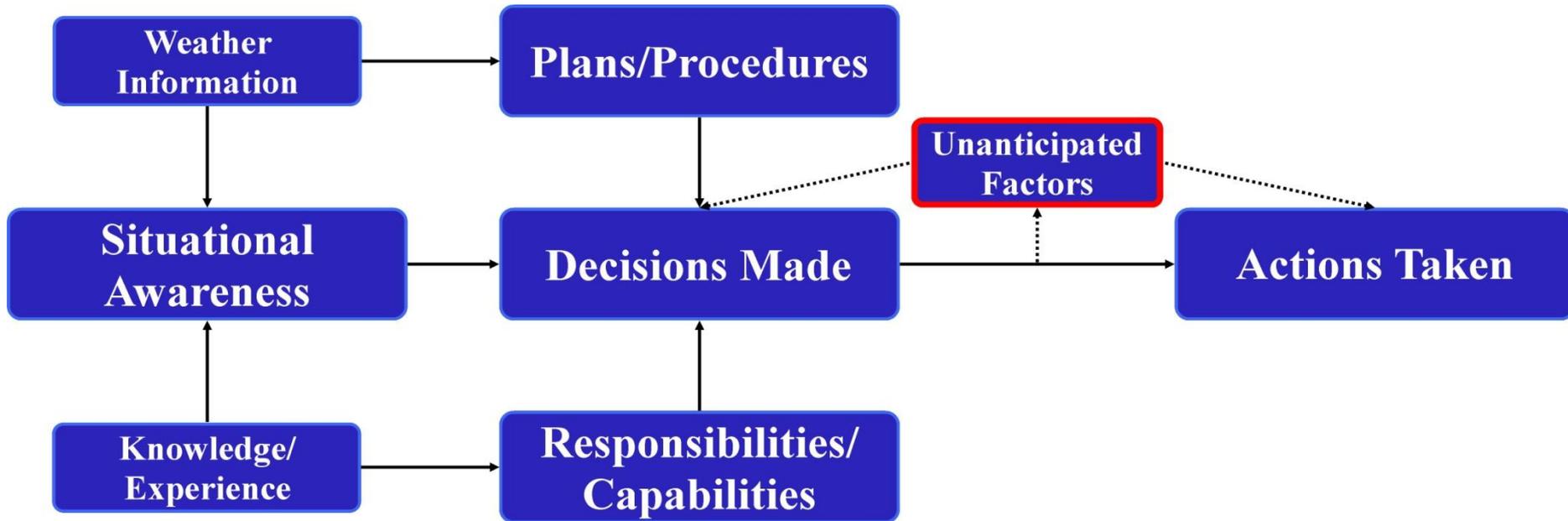
Situational Awareness
What time is it?
Where are the people?
Are they exposed? Congregated? Safe?



How non-weather factors affect decision making



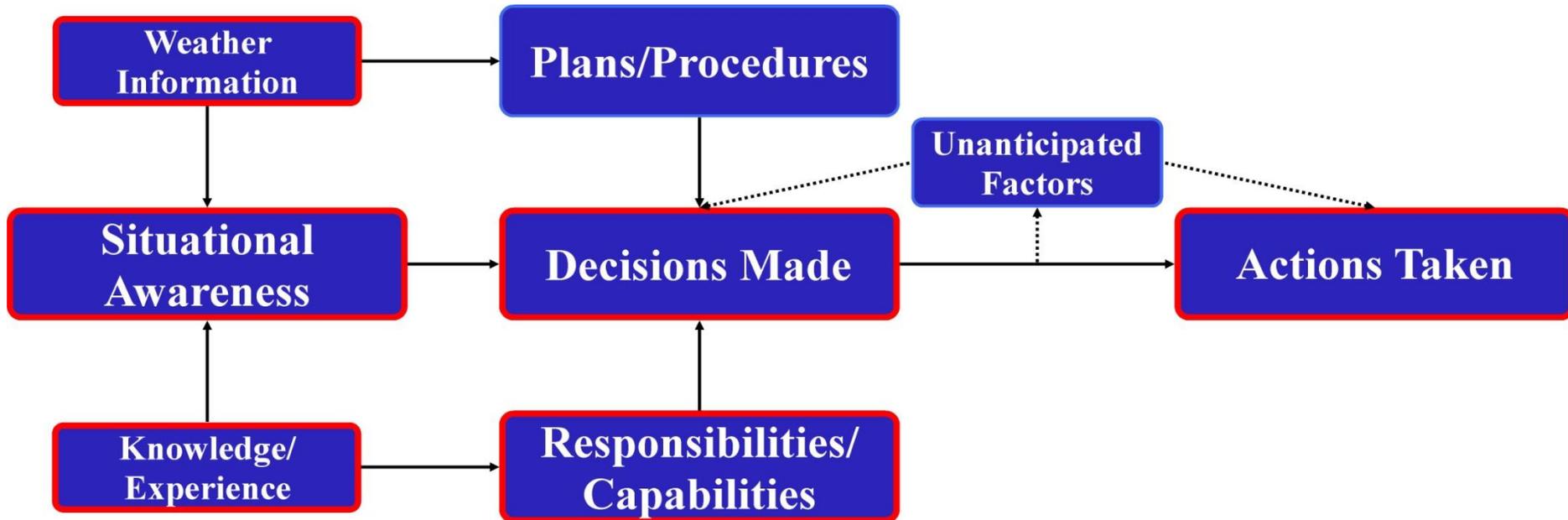
How non-weather factors affect decision making



Unanticipated Factors

People not in place.
People unfamiliar with systems.
System/plan fails to work.

How non-weather factors affect decision making

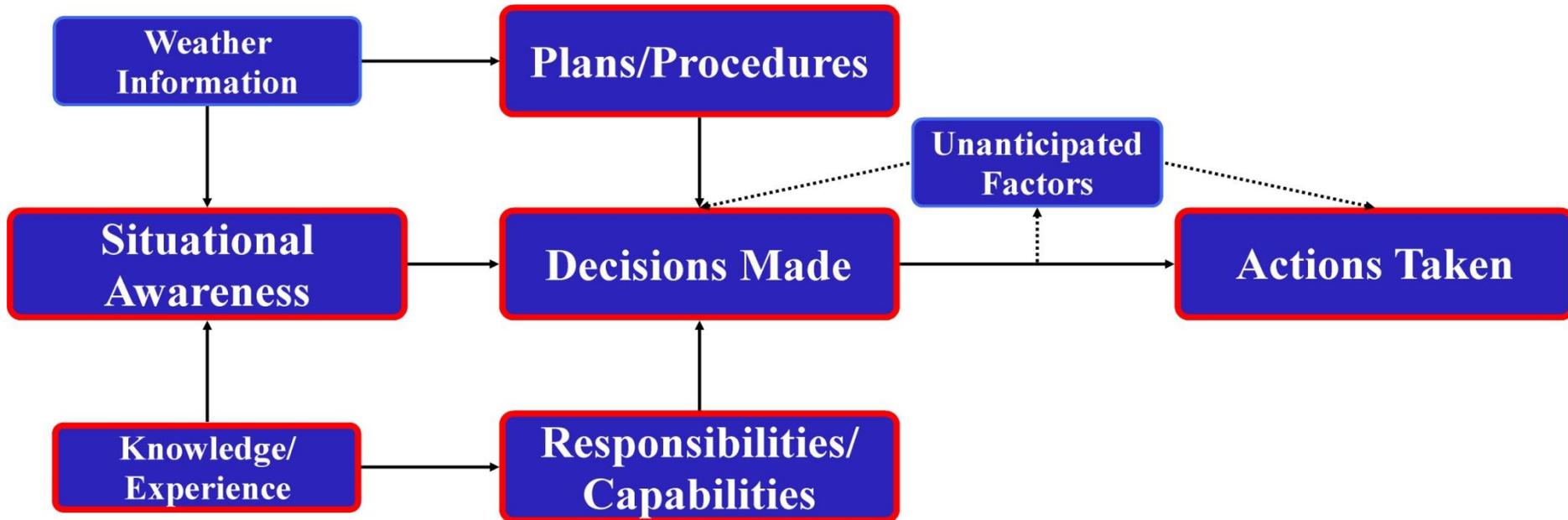


 “...one of the things that was going on involved the Chancellor at a speaking engagement at our library and the influence of the weather conditions prompted us to have a couple of [emergency response] team members available with the ENS system to give timely notification of a severe weather impact to our area.”

“...it’s our job to make sure that we are ahead of the game when it comes to protecting them with these types of... weather related activities.”

-University Emergency Manager

How non-weather factors affect decision making

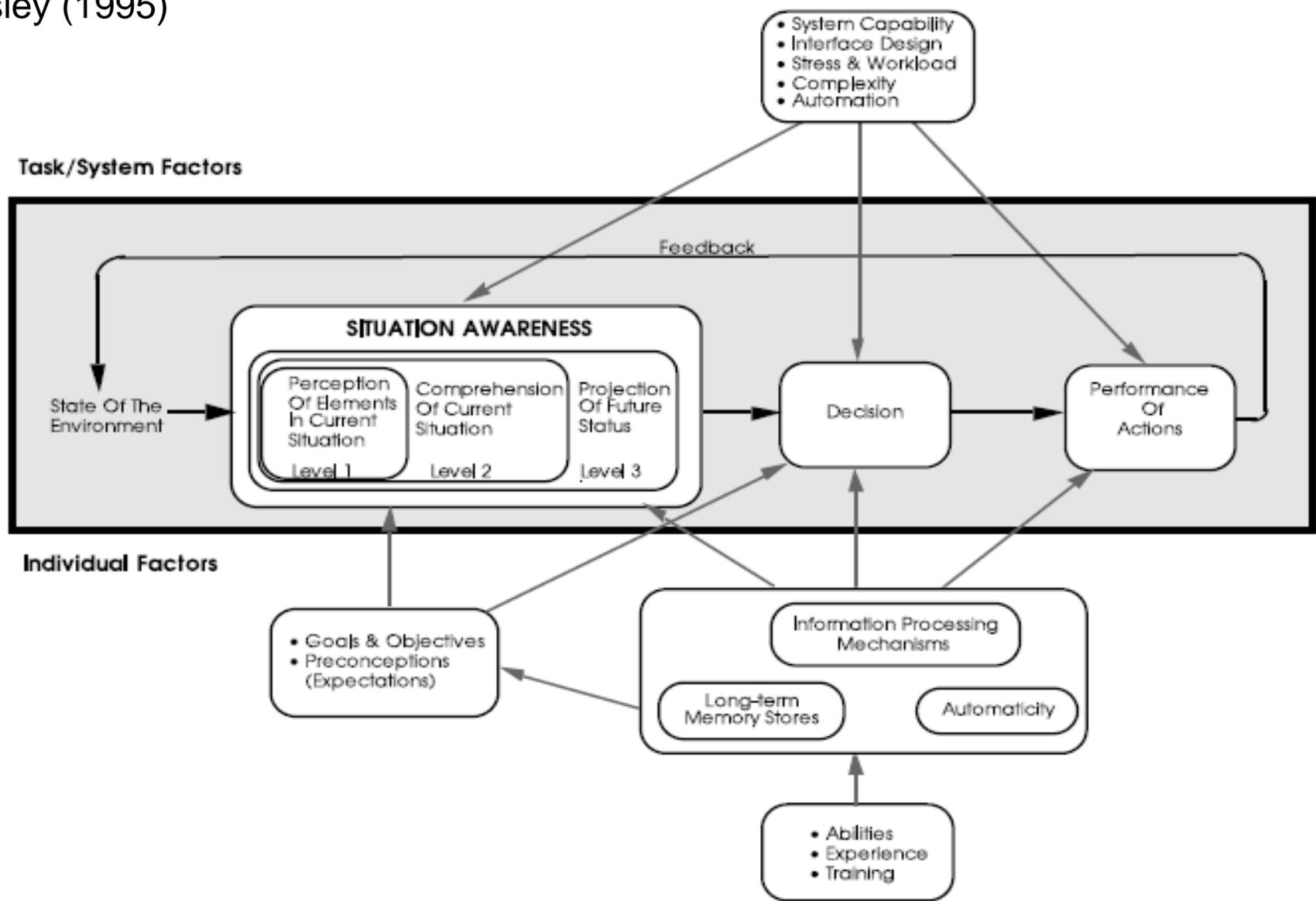


 “...even though the gym now we have learned engineering-wise is not the elite place to go, the other reason I did that [shelter students in the gym] first thing in the morning and may do it in the future is my teachers aren't on duty yet, contractually, so that first thing in the morning we only had about 10 adults to supervise about 1,000 kids. We needed them in one location because that could create more problems than the possible damage from a tornado if the kids are just running loose all over the place.”

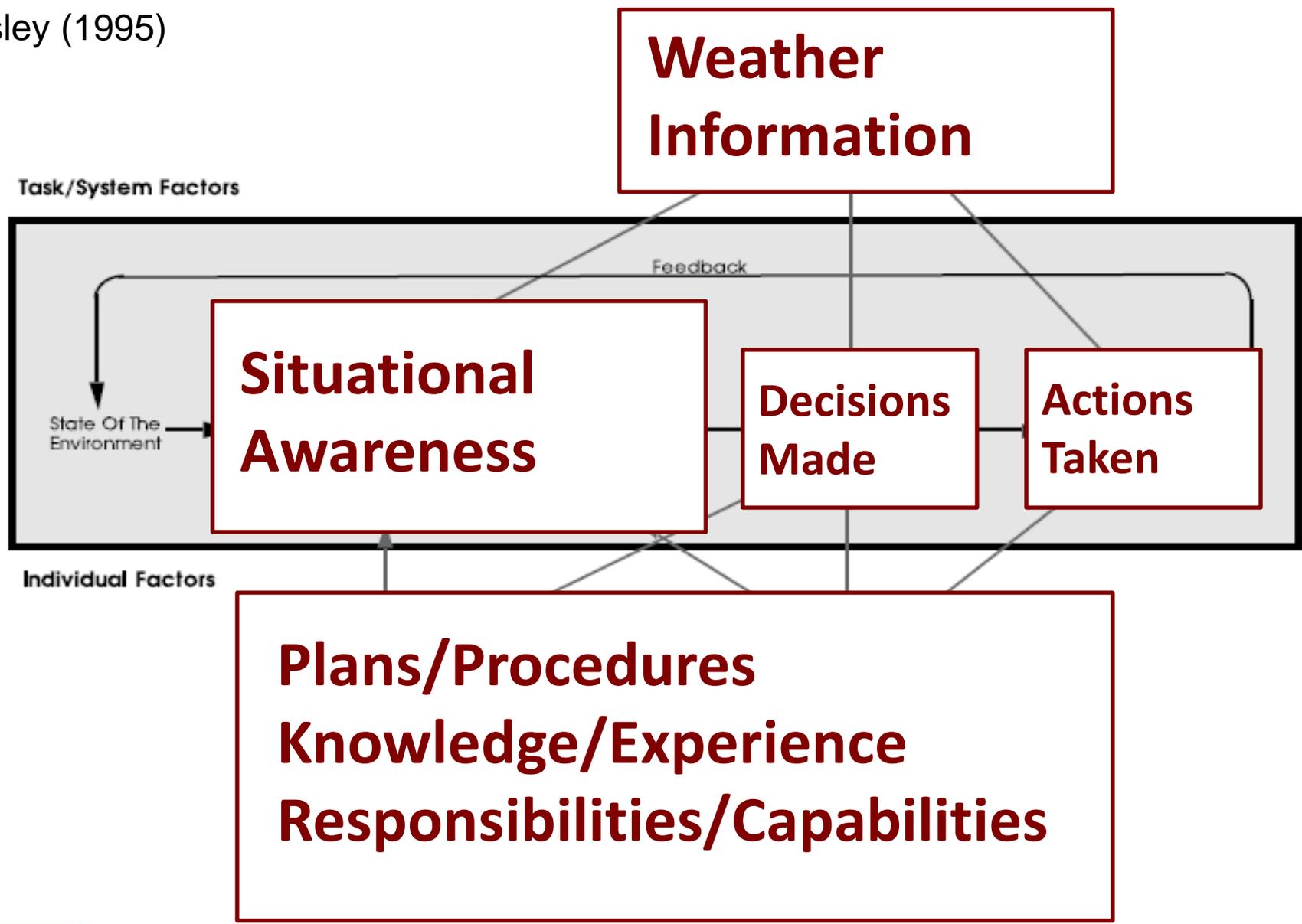
-School Principal



Endsley (1995)



Endsley (1995)



The situation matters...

“If the severe thunderstorm warning came an hour and a half earlier when the bars are letting out I know that I may have hundreds or a thousand people who are walking back from a bar to a residence hall. They’re more at risk at that time than any other time so that may have prompted a little more aggressive warning.”

-University Emergency Manager



Thank You

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References:

Endsley, M.R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors*, 37(1), 32-64.

