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Deadly Silence: An Assessment of Emergency Alert Systems for Lincoln County, Georgia

Gretchen B. Keneson,
Augusta State University, gkeneson@aug.edu

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Gretchen B. Keneson
Augusta State University

Abstract: Rural counties have a predisposition to sustaining catastrophic losses during natural emergencies. These counties tend to have poorer economic conditions that exacerbate attempts at hazard mitigation. Emergency Alerts Systems (EAS) are the most efficient and effective ways to provide information of impending danger. This study will compare and contrast different EAS to determine which would accommodate the needs of a community. The most successful way for most counties to alert citizens is through the use of a combination of redundant systems. For pastoral Lincoln County, Georgia the optimal systems are an alert siren and auto call capabilities. Both of these systems are able to meet the needs of all residents, and provide the ability to save both lives and property.

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Introduction

In December 2008, a study released by The University of South Carolina found that residents of the South living near the Gulf Coast and Atlantic Ocean have a greater risk of dying from a natural hazard than anywhere else in the country[1]. Most of the southern counties have prepared for highly publicized events like hurricanes. But events that occur frequently, like the fast rising summer afternoon storm, have been almost forgotten about when planning for events that may kill. By having an alert system in place, such as a siren or radio warning, those afternoon storms that turn into tornado outbreaks do not have to be deadly. An Emergency Alert System (EAS) can be an invaluable mitigation tool for counties of any size. This research will try to establish a need for EAS in rural Lincoln County, Georgia.

This paper will assess Lincoln County's need for an EAS by looking at several factors for mitigation. The hazards that the county faces must be determined first. Data has been gathered for 114 years worth of weather events from existing sources, such as the local newspaper and the National Oceanic and Atmospheric Administration (NOAA) using an applied approach. Also, data has been collected from the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Plan that shows that the county has experienced extensive damage to humans, livestock and structures from natural disasters[2].

Once those hazards or risks are recognized, an evaluation of all EAS's and alternatives can be executed. This paper will weigh the options available and recommend the best suited EAS for the county. A review of the literature and studies that consider background information, popular theories and the advantages and disadvantages of existing systems will be conducted.

Lastly, every resident's need must be planned for and met by the proper system. The implementation of the best system could protect the nearly 8,400 residents of this small rural county. EAS can help county residents prepare for possible threats[3]. To ensure that the best system has been chosen to meet Lincoln County's needs, it will be compared with both a benchmark and a gold standard county within Georgia.

Background Information

The tragic events that occurred on September 11, 2001 crashed the telecommunication capabilities both within and outside of New York City. These events exposed a weakness in the U.S. ability to warn citizens. In 2006, President George W. Bush issued executive order 13407 which established a policy "to have an effective, reliable, integrated, flexible, and comprehensive system to alert and warn the American people in situations of war, terrorist attack, natural disaster, and other hazards to public safety and well-being" (p.1226). This order set forth

[1] Borden & Cutter, 2008
[2] Doss, 2008
[3] Heath & Palenchar, 2000

functions for the Department of Homeland Security (DHS) to help communities establish EAS and be able to follow the Federal Communications Commission (FCC) guidelines.

The FCC (2005) defines Emergency Alert Systems (EAS) as a national public warning system that requires all national broadcasters to provide the communications capability for the President to address the American public during a national emergency. The system also may be used by state and local authorities to deliver important emergency information that is area specific, such as AMBER alerts regarding missing persons and weather information. A warning system is designed to detect impending disaster, provide information to those at risk, and enable quick decision making for action[4].

The FCC mandates that all EAS equipment be tested weekly, and these tests not be performed during important events such as a Presidential speech, the World Series or the Super Bowl. Another requirement is that all broadcast stations must install and maintain EAS decoders and encoders, and keep a copy of the latest version of the EAS Handbook readily available. All receiving stations for emergency messages must keep complete logs of all received emergency information and how they transmitted it. In addition, the FCC mandates that with every audio alert given by local radio stations, the television stations must transmit the warning in a visual image, such as a text crawl, across the screen. Along with the FCC and FEMA, the National Weather Service (NWS), broadcasters, the alerting equipment industry, and emergency managers across the nation make up the current EAS infrastructure[5].

The United States government has acknowledged that efficient and effective warning systems can lessen the effects of many types of disasters. After a killer tornado ripped through Alabama in March 1994, former Vice President Al Gore set out to make weather radio receivers common in homes. He campaigned for an increase in the number of people who could be reached by warnings from NOAA[6]. This type of an Emergency Alert System can save lives because it provides the easiest use for citizens.

In 2000, Congress made revisions to Section 713 of the Communications Act of 1996 to require broadcasters to provided needed and detailed emergency information to their viewers[7]. Under the authority of the Department of Homeland Security (DHS), FEMA has developed an alert system that is slowly being implemented throughout the U.S. It is known as the Integrated Public Alert and Warning System (IPAWS)[8]. This system will be able to alert most people of an impending disaster through various devices.

While the southern region suffers from hurricanes and tornadoes, a "Death Map" of natural hazard mortality in the U.S. created by University of South Carolina researchers, revealed that everyday hazards such as severe summer and winter weather along with heat actually cause the majority of natural hazard deaths within the U.S. This study examined data collected from 1970-2004 and found "Heat/drought ranked highest among hazards categories causing 19.6% of total deaths, closely followed by severe summer weather (18.8%) and winter weather (18.1%).

[4] Sorensen, 2000
[5] Executive Order No. 13407, 2006
[6] Wood & Weisman, 2003
[7] Wood & Weisman, 2003
[8] Strohm, 2008

Geophysical events (such as earthquakes), wildfires, and hurricanes are responsible for less than 5% of total deaths combined" (p.4). EAS must be able to communicate instructions for all events along the hazard scale to be fully effective[9].

Lincoln County, located in the southern region between Atlanta and Savannah, is a small farming county with one city, two stoplights, and almost 8,400 people. Like many other places in America, it is vulnerable to natural and man-made hazards. Unfortunately, Lincoln County has no Emergency Alert System and no way to warn residents to any looming threat.

Currently, warning messages issued to Lincoln County from the National Weather Service (NWS), located in Columbia, South Carolina, are handled in a personal way. The sequence of alerts begins with the Emergency Management Agency (EMA) Director's BlackBerry vibrating with the warning; he then verbally transmits the message to E-911 Dispatch, who then informs all members of Public Safety (Police, Sheriff, EMS and Fire/Rescue) to the hazard. McLuckie (1970) concluded that personally handled warnings take a long time to spread, are distorted in the relay, and will more than likely never reach any other citizen especially those in isolated areas. The McLuckie study was ground breaking in the area of Emergency Alert research. This study is still applicable today because of similar methods used within Lincoln County.

The most important phase of disaster response is the quick and easy issuance of a warning[10]. McLuckie (1970) remarked that without a vital command point, information cannot be organized to alert the rest of the county of the hazard. The county does not have one central point where information of the dangerous event is collected. Approximately 47 miles from Lincolnton, in Graniteville, S.C, there was a chlorine spill during the night. Lives were put at risk because there was no alert given to local residents until four hours after it occurred[11]. The county must identify and mitigate for the disabled and aged, the poor and illiterate, and be able to alert those children at home alone or outside playing. A system to warn of even the most unforeseen events, such as the Graniteville spill, should be in place for the protection of all persons[12].

Literature Review

America has been able to warn its citizens of approaching danger since 1951. Harry S. Truman created a method of broadcasting emergency information to the American public in the event of an enemy attack during the Cold War. This method was the first of its kind and was known as the Control of Electromagnetic Radiation (CONELRAD). In 1963, John F. Kennedy replaced CONELRAD with the Emergency Broadcast System (EBS), and in 1994 it was replaced by the Emergency Alert System (EAS) that is currently in use (FCC, 2005).

While some areas of the country do not have EAS, other areas have the technological capability to alert citizens of impending danger, but have not assigned the system for alert purposes. Such was the case in Jarrell County, Texas on May 27, 1997, when multiple tornadoes swept through

[9] Borden & Cutter, 2008
[10] Fox, Webb, Bally, Sleigh, Pierce, Sills et al., 2004
[11] Potter, 2005
[12] McLuckie, 1970

the area. Of the 29 tornado-related deaths on that day, 27 occurred in Jarrell County[13]. The National Weather Service issued tornado watches. Officials in Jarrell had the opportunity to alert residents because an emergency siren existed, but the siren was only used to summon volunteer fire fighters to the aftermath of the disaster[14].

The National Weather Service interviewed residents in the path of the 1997 Texas outbreak and found that most persons understood tornado safety and protocols, so that if they were alerted to an impending threat they would know how to react[15]. Citizens that realize risks exist are more willing to become knowledgeable of emergency measures[16]. A focus group's results showed that community residents want as much information as possible to be able to protect themselves[17]. Heath and Palenchar (2000) researched a 1996 study that found no difference in ready response within three varying communities of high, medium and low levels of emergency preparedness. The study showed that if the community provided the citizens with the information they needed about a crisis event, the alert systems in place were very effective.

In New Orleans, the emergency preparedness plan failed after Hurricane Katrina, leaving no one and no way to disseminate information to residents still in the flooding city[18]. The citizens had no information on what dangers existed or how to protect themselves. Water was engulfing the city and there was no activated EAS to disseminate information.

Emergency Alert Systems help spread information rapidly to reduce threats and lessen the effects of traumatic situations. "Faced with an emergency, members of the public need detailed information about the nature of the threat, how to protect themselves and families, and the official response to the situation."[19] Morrow (1999) found that because of advanced warning systems, Hurricane Andrew resulted in only a few deaths in 9 out of 6600 mobile homes lost. McLuckie (1970) notes that alerted communities have the possibility to take action to help minimize or eliminate the impact of damaging situations. A good example of this is the community of Hilton Head Island, South Carolina. The resorts have an emergency preparedness plan that requires employees to throw patio furniture into the pools before the arrival of a hurricane. This is to protect both property and humans from deadly projectile furniture. If a county can alert people to hazards, lives can be saved[20].

Mitigating for the Needs of All Residents

An all-encompassing alert system would possess the capability to send the warning out in several ways, including a method tailored to meet the individual needs of the impaired. Morrow (1999)

[13] Centers for Disease Control and Prevention, 1997
[14] Centers for Disease Control and Prevention, 1997
[15] Centers for Disease Control and Prevention, 1997
[16] Heath & Palenchar, 2000
[17] Wray, Becker, Henderson, Glik, Jupka, et al. 2008
[18] Perry & Lindell, 2007
[19] Wray et al., 2008, p.2217
[20] Gimbal, 2003

noted that within any given area there will be a significant part of the population that will require assistance during an emergency. Wood and Weisman (2003) found that hearing impaired residents within "tornado alley"-an area that includes parts of Texas, Oklahoma, Kansas and Nebraska-get their alerts from television, other individuals or cable/satellite weather channels. Persons with hearing and vision disabilities can be presented with inadequate captioning during breaking news on the T.V. or the lack of an audio description of the crawl alerts. Mitigating for these circumstances is beneficial to those within an at-risk area.

The Government Accountability Office (GAO) in 2007 examined a model created by the National Center for Accessible Media (NCAM) that showed warning messages should be compatible with "various transmission systems and provide warning message details in text, audio, multiple languages, and images or other visual forms" (p. 22). NCAM recommends that multiple forms of warning methods be used for people with disabilities and at-risk audiences.

An alert system can be the difference between life and death for people with disabilities within a rural community[21]. Residents with physical and mental limitations should be considered when designing the disaster response. Enders and Brandt (2007) note that Hurricane Katrina brought to light the need for greater incorporation and organization of preparedness efforts for those with disabilities. Disasters present dire consequences for this population because they are not often part of the emergency preparedness process[22].

Emergency Alert System Options

Within the current EAS infrastructure are four possible Emergency Alert System options. The options most commonly used in the United States are *alert sirens*, which are basic enough to be the primary system for any county, *auto call systems* are the newest and would be a good alternative system because they are able to send alerts by phone, text or email, *specific area messaging encoding* (SAME) is used by the National Weather Service for communication of threats through radio, television and cable, and, lastly, *microwave relay towers*, which are the most economical. The towers are also designed for transmission over long distances in areas prone to power outages.

Alert sirens

An alert siren (formally known as a Civil Defense Siren) is either an electromechanical or electronic device that generates a loud warning sign. It was initially designed during World War II to warn against potential air raids. Now, throughout the U.S., the sirens warn against tornados. They are also found within a 10-mile radius of most nuclear power plants.

[21] Strohm, 2008
[22] Enders & Brandt, 2007

Most sirens are capable of producing two, if not three, common tones. The most common is the steady tone used to alert of impending weather or tsunamis. The second is the wail, is the original tone alerting an impending attack on the U.S. The last, and not often available, is the tone most commonly used to alert volunteer firefighters. This tone alternates between high and low pitches. The high-low has been used in wildfire prone areas to alert residents to shut off main water valves, so the fire department could get the best pressure. It is commonly used in flash flood and tornado prone areas[23].

The alert sirens can also be used to warn residents of a hazardous material release from a nearby plant or railway, such as in the case of the Graniteville spill[24]. In Washington State, alert sirens are posted around the base of Mount Rainier. The sirens are on alert for any seismic activity indicating a possible volcanic eruption.

Sirens can produce tones in all directions simultaneously or by using a rotator to tone 360 degrees. They can be activated over the phone lines, and most models come with battery backups.

One of the criticisms of the alert siren is no information comes with the alert. Even the electronic system, which operates like a loud speaker, cannot sufficiently broadcast an audible voice message over a long distance. Distortion of the message comes from an echo caused by sound waves bouncing off buildings, and may not be audible to people in their homes or asleep. Sorensen (2000) notes that another limitation is many people do not pay attention to the sirens simply because they do not know the meaning of each tone.

Auto call systems (phone/text/email)

The Immediate Response Information System (IRIS) is can alert people inside or outside of their homes by sending emergency information via telephone, cell phone text messages or emails to computers (Brush, 2008). Many universities began using an emergency text and email system after the Virginia Tech University tragedy in 2007. This system can send valuable information to students, faculty and staff regarding natural or man-made threats that could affect the campus. More advanced messaging notification systems can even play live or up to eight pre-recorded messages[25].

The most important phase of disaster response is the quick and easy issuance of a warning[26]. IRIS can provide basic information quickly and spread it over a very large area. The "five specific topics that are important to include in assembling the actual content of a public warning message are the nature, location, guidance, time and source of the hazard or risk."[27] More

[23] Sorensen, 2000
[24] Potter, 2005
[25] Conference-Bridge, 2008
[26] Fox et al., 2004, McLuckie, 1970
[27] Sorensen, 2000, p. 121

provided information helps people to take the necessary precautions and lessens the strain on E-911 centers with calls from confused citizens.

One challenge with employing IRIS is residents must sign up for the system. This may not be as easy as it sounds for some residents due to mental or physical disabilities, or for those financially burdened who cannot afford a house phone, cell phone or a computer. Moreover, West (2008) notes that hackers into an EAS caused mass hysteria by delivering false information around a high school.

Specific Area Messaging Encoding (SAME)

This system is one of the most commonly used, and employs FCC mandated broadcast decoders and encoders. SAME sends the tone alerts over the television, radio and cable systems. The alerts can be sent out in several different languages within a community. Almost all alert facilities and agencies use SAME for emergencies. This uniformity saves lives by reaching more people with timely, specific warnings. The alert can be disseminated up to 40 miles from the transmitter location[28].

Some disadvantages of SAME are that it requires specifically equipped consumer products that must be programmed with the county's NOAA frequency. The frequencies can be programmed by a local public safety member[29]. Satellite companies must arrange and frequently pay a fee to participate in the warning system, and signal range can be severely decreased by elevation and forest density.

Microwave radio relays

Microwave radio relays are used to transmit both digital and analog signals. Signals are sent by a large antenna installed in higher elevations. The antenna needs a line of sight path to send signals for telephone calls and T.V. programs. Microwave relay is used in emergency management to disseminate information over portable radios[30].

During an emergency, maintaining radio contact is extremely important and can be life saving. The relay EAS can spread information over long, flat distances, and microwave radio relays have low operating costs, which make it ideal for a small community. The infrastructure is very efficient and can be backed up. The relay towers are also easy to maintain[31].

[28] CDC, 1997

[29] Pamela Tucker, Director of the Columbia County Emergency Management Agency, personal communication, February 2, 2009

[30] Farnham, 2005

[31] Farnham, 2005

This EAS has only two disadvantages. The most significant may be the interference of water (in the form of a lake). This is a disadvantage because Lincoln County is bordered by Clarks Hill Lake. Also, radio waves need an obstacle-free path, because otherwise there can be interference in the relay. A line of sight must be maintained between towers, which could be hard to accomplish with timber being a large source of the county's revenue.

Summary

None of the alert systems are perfect, and there is little information on how to incorporate warnings in HDTV. The hazard codes are continuously changing due to updates and some of the systems are susceptible to computer hackers[32]. Also, some of the systems do not comply with captioning mandates for the hearing impaired. Furthermore, the Government Accounting Office (2007) found after conducting a test of the national auto call system, three of the 33 primary relay stations failed to relay the emergency text message. Other noted limitations of EAS are poor training and coordination of those responsible for implementation.

Despite some EAS shortcomings, the system has been designed to save lives. The GAO has recognized that an "accurate and wide-reaching public alert and warning system is critical to public safety."[33] FCC officials testified before Congress to their commitment to making sure that those with disabilities will have equal access to emergency alerts. The potential impact of having an alert system could be life saving for a rural community.

Methodology

Posavac and Carey (2007) define a need as "something (X) that people must have to be in a satisfactory state. Without X they would be in an unsatisfactory state; with X they achieve but do not exceed a satisfactory state" (p. 114). The hypothesis is that Lincoln County, Georgia has a need for an EAS. An alert system would provide for a safer environment by warning of impending threats both natural and man-made. The research will try to show the necessity by evaluating the county's normative and relative needs.

Normative Needs:

Kettner, Moroney and Martin (2008) suggest establishing a normative need by using existing data sources. Research from secondary sources can be useful and often provide the most efficient approach for assessing need when there are issues with both time and resources. Natural events that have occurred within Lincoln County over the past 114 years have been compiled by using existing data from sources such as: secure networks at Lincoln County Public Safety with access granted by the Emergency Management Director; Georgia Emergency Management Agency (GEMA) and the Federal Emergency Management Agency (FEMA), NOAA on-line sources and the Lincoln County Pre-Mitigation Plan. Permission was granted by

[32] O'Meara, 2003

[33] GAO, 2007, p. 3

Probate Judge Lee Moss to look through past Lincoln Journals in his archives for weather events and their effects.

The occurrence of each severe weather event- hail, tornadoes, summer and winter storms, drought and flooding- has been documented and used to estimate the rate of recurrence. Classified within summer storms are events of high winds and lightning. Winter storms consist of accumulation of snow and destructive ice. Each of the events are recorded, for each county, by year of occurrence, the location, the amount or intensity, the property or life lost and estimated financial cost.

As noted by Kettner et al, "needs based planning is not only possible but necessary for the design and implementation of effective human services."[34] The conditions that each of the four types of EAS are best used for has been outlined and examined to determine which would best meet all of the needs of the community; for example a siren to alert those outdoors in the agricultural portion of the county, or the patrons to Elijah Clark State Park.

Relative Needs:

The relative needs assessment examines both the similarities and the differences in demographics and levels of emergency alert services between the Lincoln County community and the counties of Putnam and Columbia. Data for that analysis has been collected from the University of Georgia at www.georgiastats.uga.edu and the U.S. Census. The county demographic comparisons are more similar between Lincoln and Putnam counties. Both of these counties are bordered by Georgia lakes, Clarks Hill (J. Strom Thurmond Lake in South Carolina), and Lake Oconee, respectively.

The level of emergency preparedness in Putnam County will be used as a benchmark to evaluate Lincoln County. Putnam County Sheriff Howard Sills stated that similar to Lincoln County, Putnam County has "no equipment to notify the public of any emergency situation." To warn residents, he "just opens the door and yells out."[35] Sheriff Sills believes Putnam County's greatest natural threats are tornados or catastrophic flooding due to dam breakage. He has requested from the commission to purchase reverse 911 capabilities, but the board has denied funding. Lincoln County shares these concerns.

Columbia County has attained a gold standard for emergency preparedness within the surrounding area. The county has been certified as a Storm Ready Community by meeting the 48 criterion for receiving and disseminating emergency information established by the National Weather Service. Some of these criteria are: having a locally owner radar (such as Viper 6 in Augusta, GA), an active telephone tree to critical facilities, and a local alert broadcast system.

The assessments conducted focused on uncovering the needs of the area. The research compares and contrasts which EAS will best suit the county, along with details of what other counties have accomplished. With the use of an EAS, there can be a decrease in threats to residents along with significant economic savings.

[34] Kettner et al, 2008, p.54

[35] personal communication, February 27, 2009

Results

The Georgia Association of Broadcasters (n.d.) noted that more than 70% of all EAS activations were due to weather related disasters. Weather and demographic information was gathered from several existing sources. Each of the following tables and charts will show evidence to support the hypothesis that Lincoln County needs an EAS.

Weather Patterns

Table 1 summarizes the 114 years of data from Lincoln County, and shows the percentage of events that have occurred within the county. Each event is considered to be potentially hazardous. The possible economic devastation has been detailed within the Pre-Disaster plan. The estimated financial loss is $299.5 million if the county lost all 10,278 structures/properties in the area[36].

Table 1 displays the calculated percentage of chance of occurrence for each event. The percentage was attained by counting the number of each hazard occurrence and dividing them by 114 years. Wildfires have occurred most frequently in Lincoln County. The literature has shown that an alert siren has been used before to protect during this type of event.

TABLE 1
Event and Percentage Chance of Annual Occurrence (1894-2008)

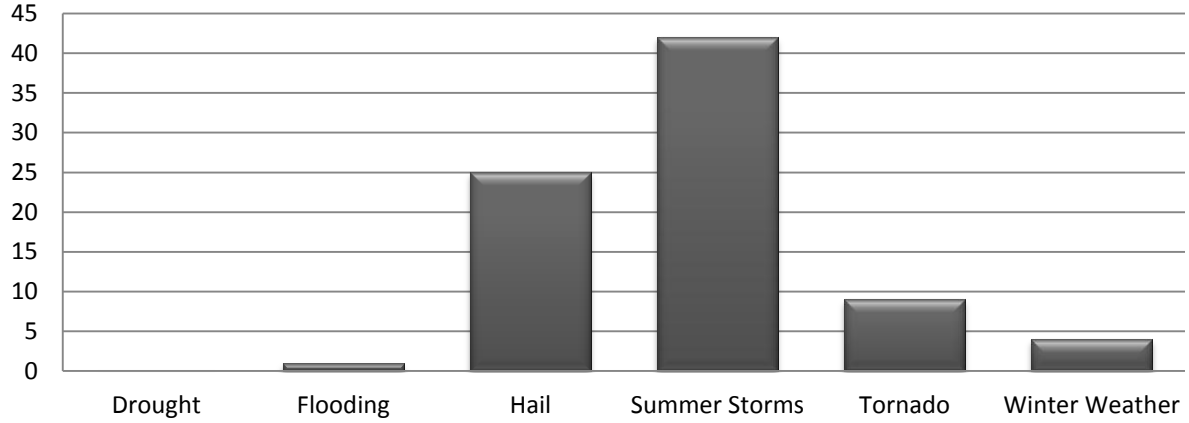
	Percentages
Thunderstorm	44
Hail	25
Tornado	22
Winter Storm	15
Earthquake	8
Drought	19
Wildfire	81
Flood	11

Source: Doss, 2008

Data for county comparisons was gathered from the NOAA's National Climate Data Center (NCDC) (NOAA, n.d.). NCDC has weather event information at the county level for up to seven different hazards. The information from this source reflects the events that occurred during January 1, 1950 through December 31, 2008, and has been invaluable to show the dangers that each has faced (Charts 1-3).

[36] Doss, 2008

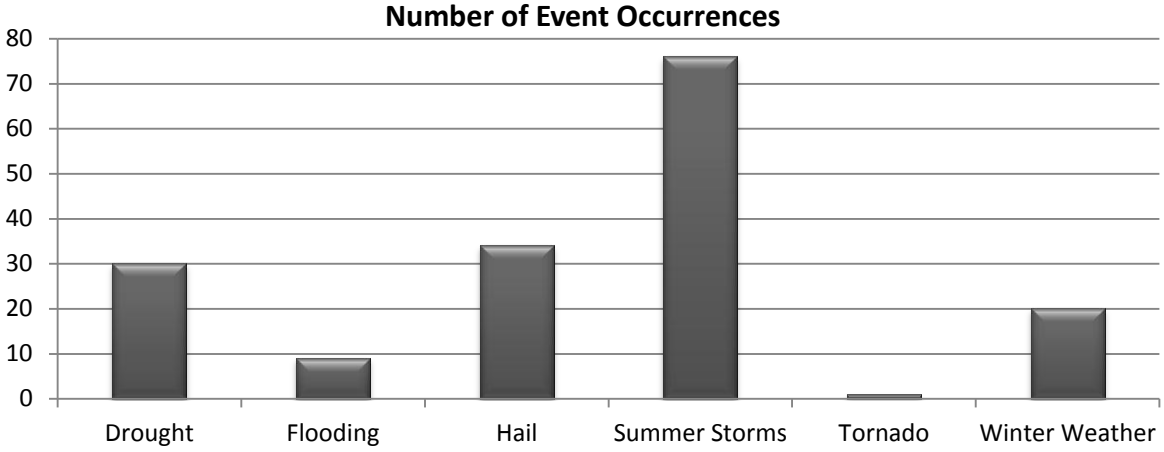
Chart 1: Lincoln County's Number of Event Occurrences



N = 81

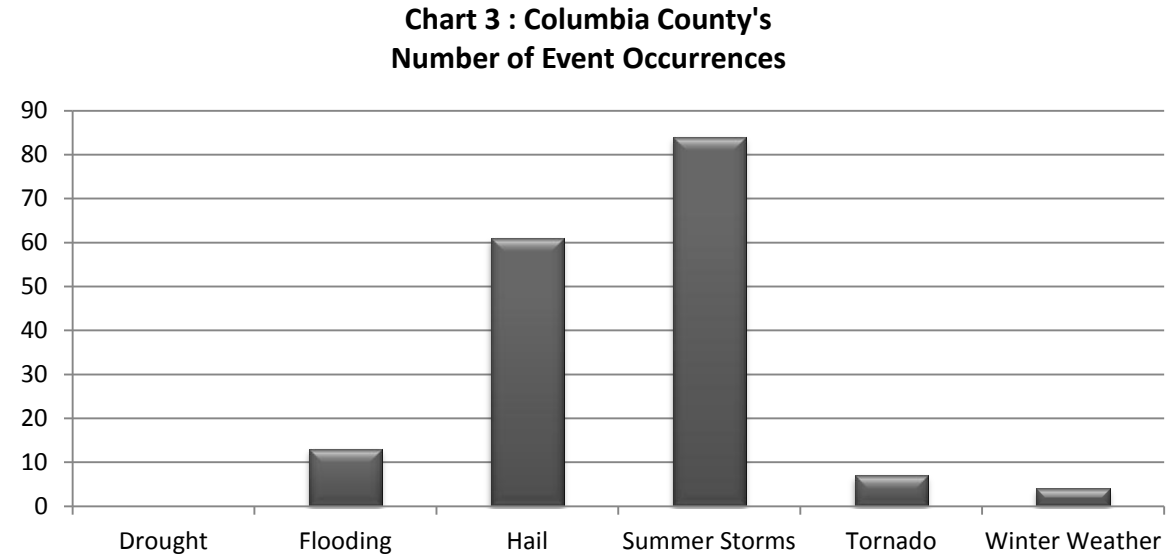
Source: www.ncdc.noaa.gov

Chart 2: Putnam County's Number of Event Occurrences



N = 170

Source: www.ncdc.noaa.gov

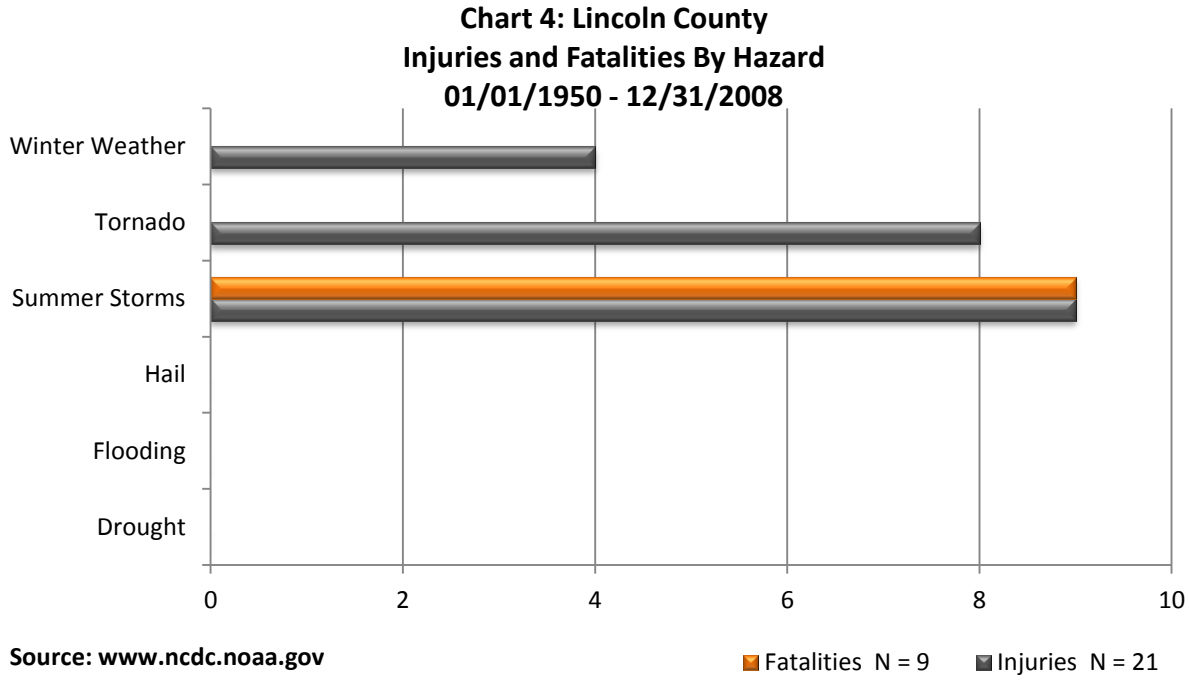


N = 169

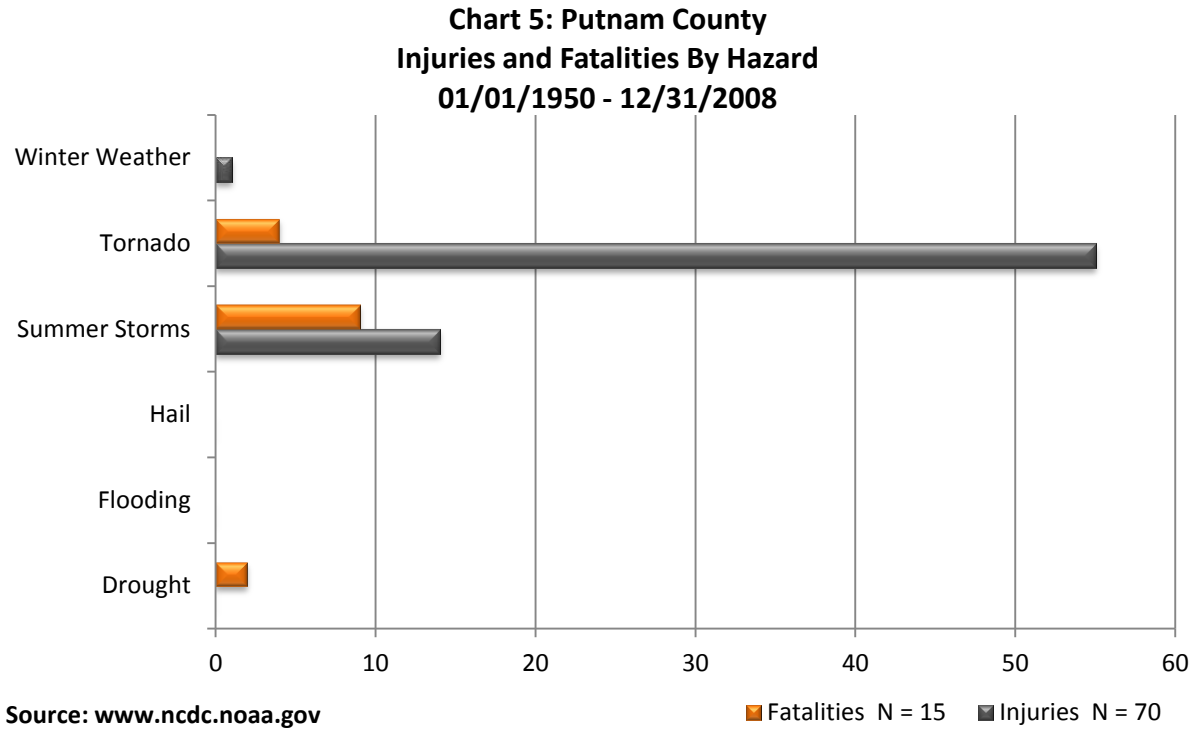
Source: www.ncdc.noaa.gov

The three most frequently occurring threats are summer storms, tornadoes, and hail. Each of these events is potentially deadly and could result in economic losses. This data is very useful not only in mitigation, but in determining which EAS could best alert the county.

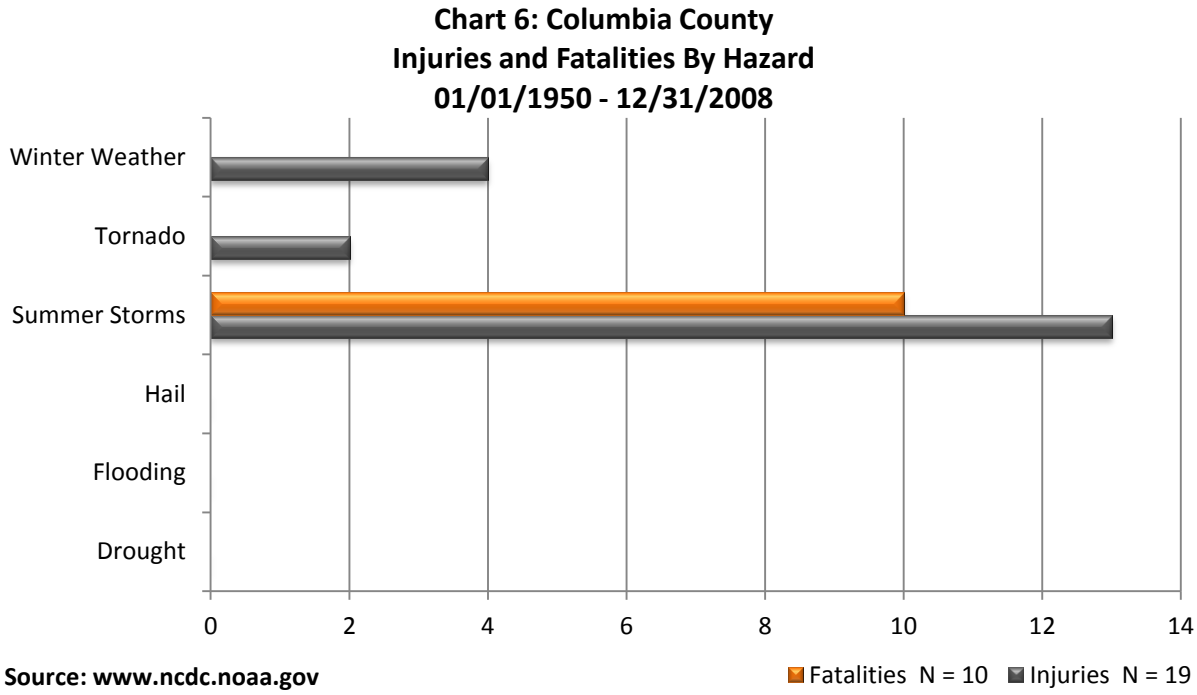
Injuries and Fatalities:



Source: www.ncdc.noaa.gov



Also, within the NCDC data are the number of both injuries and fatalities from each of the weather events that occurred from 1950 to late in 2008. As shown in Charts 4-6, there have been numerous injuries and deaths that have occurred in each county during the 59-year period. Columbia County is the only one to have EAS capabilities note the decreased number of injuries in comparison to the other counties.



Demographics

Tables 2-4 are demographic tables that will help show the similarities and differences between the three counties. Lincoln and Putnam counties are comparable in most demographics. Columbia County far surpasses not only the other two but Georgia as well in median income, and has a lower percentage in poverty. The income and poverty levels need to be considered when considering funding and expenses for EAS, such as for funding IRIS or the purchase of alert radios for each household.

TABLE 2 Percentage of Population by Race (2007)			
	Black	Hispanic	White
Lincoln County	32.4	1.0	66.51
Putnam County	27.2	4.6	71.16
Columbia County	15.1	3.1	79.51
Georgia	30.0	7.8	65.57

Source: www.georgiastats.uga.edu

TABLE 3 Median Household Income, in U.S. Dollars (2006-2007)	
Lincoln County	30799
Putnam County	37224
Columbia County	64514
Georgia	49692
United States	49901

Source: www.census.gov

TABLE 4 Percentage of Population in Poverty by Race (1999)			
	Black	Hispanic	White
Lincoln County	26.6	9.1	9.6
Putnam County	28.6	42.4	8.0
Columbia County	12.8	9.9	4.1
Georgia	23.1	21.6	8.2

Source: www.georgiastats.uga.edu

Education*:*

The majority of residents within each county's highest level of education is high-school or below. The EAS that is decided upon for Lincoln County should reflect the educational levels and needs of the community. By conducting further research among the citizens, the county can decide if informational classes will need to be held.

TABLE 5 Education Attained by Percentage of Population (2000)			
	Lincoln County	**Putnam County**	**Columbia County**
No High School Diploma	29.0	24.5	12.1
High School Graduate	36.3	40.5	25.8
Bachelor's Degree	6.2	8.6	20.0
Graduate or Professional Degree	3.8	5.8	12.0

Source: www.georgiastats.uga.edu

Special Needs:
Both Tables 6 and 7 show important aspects of each county's communities. The age of the population must be considered when planning for an EAS and mitigation. It is examined with regards to mobility and sensory needs that the aging population may have. The differently-able within the community will also need to be considered during mitigation to provide for any learning or mobility needs.

TABLE 6
Age of Population (2007)

	Lincoln County	Putnam County	Columbia County
% Under 19 years old	23.24	24.44	30.15
% Over 65 years old	16.15	16.75	9.02
Total Median Age	42.0	40.4	35.7

Source: www.georgiastats.uga.edu

TABLE 7
Percentage of Population with Specific Disabilities (2000)

	Lincoln County	Putnam County	Columbia County
Sensory	10.3	11.1	11.4
Physical	27.2	27.4	23.6
Mental	15.1	11.8	14.4
Not able to go outside of home	20.8	20.1	18.1

Source: www.georgiastats.uga.edu

Discussion

The only way to efficiently and effectively prepare for a catastrophe is to have some warning of the event. I believe that the perfect alert for Lincoln County could be addressed by a combination of systems. A single warning system will not meet the requirements for all types of hazardous situations, and by having a mix of alerts it will be easier to not dismiss the alert as being false.

Weather Patterns:
The data that has been gathered shows that the Southern region and counties within have a high tendency for severe weather events. Table 1 and Chart 1 show that Lincoln County is prone to hazardous weather such as tornadoes, hail and summer storms. As described throughout the literature each of these events can cause death and wreak economic havoc, and the proper EAS for these weather events can save lives (Chart 4) and property.

Demographics:
As compared to the United States and the three other counties, Lincoln County has a significantly low median household income (Table 3). The cost of each EAS is a concern because of the lower taxable income for the county. If county officials apply for a match grant for an alert system, they will have to make sure they can raise the funds needed to qualify.

The percentage of population in poverty (Table 4) shows Lincoln County is going to have to consider any additional components each resident may have to pay for. Also, all ages and special needs must be addressed. Columbia County has used a computer program to alert public safety officials when there is a power outage to those residents that are disabled and reliant on electricity for survival. Pam Tucker recommends that Lincoln County "spend a couple million dollars for a siren system and MUST invest in an EAS encoder," so that the EMA Director can interrupt any TV and radio communication to provide information. She feels that nothing is more "doable than to get a NOAA Weather Radio into each home and offer to program it."[37]

Emergency Alert Systems:

Columbia County has already implemented the use of sirens and auto call systems. All of their EAS capabilities were decided upon by basing the need on redundancy. Pam Tucker explains, "If one system can hit 50% – 60%" of the community "you need to keep adding until you can reach 100% [of residents], 100% of the time. The key to EAS is redundancy."[38]

Cable is not offered to all Lincoln County residents, so programming comes from satellite or antenna TV. During inclement weather, satellites can lose signal prohibiting a warning from coming through. Antenna TV has become virtually obsolete since the change to digital television broadcast on February 17, 2009. An alert siren must be able to provide warning in these situations.

My recommendation for Lincoln County is the alert siren and the IRIS auto call system. I chose the siren because it will alert farmers in the fields, children playing outside, boaters on the lake, and those who do not have the finances for phones or T.V.'s. The different tone capabilities can be published in the paper or mailed out to residents so that they can be recognized easily. The IRIS auto call was chosen because of the efficiency to get the warning out quickly and over a large area. Normally, at an E-911 station only one or two dispatchers are working. The ability to auto call out a warning gives dispatchers the freedom to concentrate on their tasks and send the alert simultaneously.

IRIS was selected also because of the low installation and training cost that can be split by both the city and the county. The system's cost is roughly $1500 for set-up and training. Lincolnton and Lincoln County could share the cost or charge members of the community up to a $10 monthly service fee[39].

Summary

The needs assessments conducted within this paper focused on uncovering the needs of rural Lincoln County, Georgia. The research compared and contrasted which EAS would best suit the county, along with what other counties have accomplished. Lincoln County needs an Emergency Alert System to help decrease the threats to residents and significantly decrease economic losses. An Emergency Alert Siren and Auto Call System can help them achieve their goals of safety.

[37] P.Tucker, personal communication, February, 2, 2009
[38] Pam Tucker, personal communication, February 2, 2009
[39] Conference-Bridge, 2008

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Appendix:
Lincoln County Hazard Data

Summer Storms:

Date	Wind Speed	Reported Damage	Location of Event	Estimated Losses
07/1893	NR*	Rains accompanied very high winds and thunder	County Wide	NR
9/1/1949	NR	Severe winds and rains caused from a Florida Hurricane	County Wide	NR
10/1/1959	NR	Hurricane Gracie provided heavy rains, twisting winds and uprooted trees	County Wide	NR
6/9/1960	NR	Bolt of lightning struck and killed 11 year old boy and knocked 2 others to the ground.	Amity Community	NR
1/31/1963	NR	Wind storm damaged barns and residences	Loco Community	NR
7/9/1970	NR	1 Man killed and 2 females injured by a lightning strike during a violent lightning and wind storm	Soap Creek	NR
6/28/1972	NR	Strong winds cause minor property damage	County Wide	NR
7/6/1972	NR	A sudden thunderstorm with high winds damaged boats and sunk several	Clarks Hill Lake	NR
5/11/1973	NR	Strong winds reported. There were no damage or loss estimates reported	County Wide	NR
5/28/1979	NR	Strong winds reported. There were no damage or loss estimates reported	County Wide	NR
3/6/1983	NR	Strong winds reported. There was minimal damage. No loss estimated reported	County Wide	NR
12/28/1983	NR	Strong winds reported. There were no damage or loss estimates reported	County Wide	NR
7/13/1985	NR	Strong winds reported. There were no damage or loss estimates reported	County Wide	NR
9/28/1989	NR	Hurricane Hugo brought heavy winds and large quantities of rainfall uprooted trees	School Street	NR
8/9/1991	NR	Strong winds reported. There were no damage or loss estimates reported	County Wide	NR
8/15/1991	NR	A solid wall of high winds brought high winds and large hail (microburst)	Lincolnton	NR
12/11/1993	45 kts	High winds, gusting to as high as 50 mph for at least four straight hours caused power outages	Lincoln County and North Georgia	NR
6/27/1994	NR	Numerous trees, large limbs and power lines were downed by thunderstorm winds	County Wide	$5,000
6/28/1994	NR	Numerous trees were downed by thunderstorm winds	County Wide	$5,000
6/10/1995	NR	Numerous trees, power lines and campers were damaged	Elijah Clark State Park	NR
6/10/1995	NR	A second storm on this date caused damage to seven awnings, a pop-up camper and two cars	Elijah Clark State Park	$25,000
10/5/1995	NR	Thunderstorms spawned from Hurricane Opal caused wide-spread damage	Entire State of Georgia and Lincoln County	$75,000,000

Date	Wind Speed	Reported Damage	Location of Event	Estimated Losses
6/13/1996	50 kts	A severe thunderstorm damaged a new building on a golf course and blew down numerous trees	Lincolnton and Lincoln County	NR
4/22/1997	60 kts	Reports of downed trees and power lines. One barn and several storage buildings were destroyed	Lincolnton	$75,000
7/16/1997	65 kts	Reports of numerous downed trees	County Wide	NR
9/10/1997	50 kts	Reports of strong winds and limbs in roadway	County Wide	NR
6/9/1998	65 kts	Reports of strong winds and downed trees	County Wide	NR
6/16/1998	50 kts	Reports of strong winds and downed trees	County Wide	NR
6/19/1998	60 kts	Reports of strong winds and downed trees	County Wide	NR
11/3/1998	NR	Hurricane Earl brought wind gusts that blew out windows in the NAPA building	Lincolnton	NR
5/6/1999	50 kts	Reports of power lines down	Southern Lincoln County	NR
1/19/2001	55 kts	Strong winds down trees	Southern Lincoln County	NR
6/6/2001	55 kts	Reports of trees and power lines down	Lincolnton	NR
6/14/2001	50 kts	Reports of strong winds and trees down	County Wide	NR
8/24/2001	50 kts	Reports of strong winds and trees down	County Wide	NR
5/13/2002	50 kts	Reports of strong winds and trees down	County Wide	NR
11/11/2002	60 kts	Several homes damaged by falling trees	Northern Lincoln County	$12,000
2/22/2003	55 kts	Reports of strong winds and downed trees	County Wide	NR
6/13/2003	60 kts	Report of tree falling onto a car	Lewis Family Road	$14,000
7/10/2003	55 kts	Reports of strong winds and downed trees	County Wide	NR
6/23/2004	50 kts	Reports of strong winds and downed trees	Midway Community	NR
11/24/2004	50 kts	Reports of strong winds and downed trees	Amity Community	NR
4/30/2005	50 kts	Reports of strong winds and downed trees	Southern Lincoln County	NR
7/15/2006	55 kts	Reports of strong winds and downed trees	Southern Lincoln County	NR
7/28/2006	65 kts	Reports of numerous trees down. 1 camper was overturned and 1 was crushed by a falling tree. 10-20 campers sustained minor to mod. damage. There was also wind damage to several park buildings. The power was out for several hours	Elijah Clark State Park	$100,000
8/3/2006	50 kts	Reports of screen porch being blown off a home	Soap Creek Road	$2,000
9/7/2006	NR	Lightning strikes a tree near a city residence	Lincolnton	NR
1/5/2007	55 kts	Strong winds and trees downed	Elijah Clark St. Park	NR
1/11/2007	50 kts	Straight line winds cause property damage	Lincolnton	$2,000
4/19/2007	50 kts	high winds blow off church steeple	Lincoln County	$5,000

Source: E. Doss (2008)

Hail:

Date	Hail Size (Inches)	Reported Damage	Location of Event	Estimated Losses
6/10/1893	1/4	Hail reported. There were no damage or loss estimates reported	County Wide	NR
6/3/1954	1 1/2	Hail reported. Damage to foliage	County Wide	NR
6/4/1959	3/4	Hail reported. Damaged to crops	County Wide	NR
4/24/1967	2	Hail reported up to 2 inches in size	County Wide	NR
5/23/1969	1/4	Hail and wind	County Wide	NR
2/1/1971	1/4	Hail reported. No damage or loss estimates reported	County Wide	NR
5/15/1972	1/4	Hail reported. No damage or loss estimates reported	County Wide	NR
5/5/1974	1/4	Hail reported. No damage or loss estimates reported	County Wide	NR
5/3/1984	1/4	Hail reported. No damage or loss estimates reported	County Wide	NR
5/23/1988	5/6	Hail reported. No damage or loss estimates reported	County Wide	NR
3/20/1992	1/3	Hail reported. No damage or loss estimates reported	County Wide	NR
11/2/1995	3/4	Hail reported. No damage or loss estimates reported	Amity and Woodlawn Communities	NR
3/15/1996	3/4	Reports of hail falling up to .75 inches in size	County Wide	NR
4/13/1996	1	Reports of hail falling up to 1 inch in size	County Wide	NR
5/7/1996	1 3/4	Reports of hail falling up to 1.75 inches in size	Northern Lincoln County	NR
4/22/1997	1	Reports of hail falling up to 1 inch in size	Southwestern Lincoln County	NR
9/10/1997	3/4	Reports of hail falling up to .75 inches in size	Southern Lincoln County	NR
5/7/1998	7/8	Reports of hail up to .88 inches in size	County Wide	NR
5/7/1998	1 3/4	Additional report for this day of hail up to 1.75 inches falling	County Wide	NR
5/7/1998	7/8	Additional report for this day of hail up to .88 inches falling	Southwestern Lincoln County	NR
5/6/1999	7/8	Reports of hail up to .88 inches falling	County Wide	NR
5/13/1999	7/8	Reports of hail up to .88 inches falling	County Wide	NR
5/13/1999	3/4	Additional report for this day of hail up to .75 inches falling	Double Branches Community	NR
5/25/2000	3/4	Reports of hail falling up to .75 inches in size	Southwestern Lincoln County	NR
5/6/2003	1 3/4	Reports of hail falling up to 1.75 inches in size	Northern Lincoln County	NR
1/13/2005	3/4	Reports of hail falling up to .75 inches in size	Double Branches Community	NR
4/19/2006	3/4	Reports of hail falling up to .75 inches in size	Southwestern Lincoln County	NR
4/21/2006	3/4	Reports of hail falling up to .75 inches in size	Southwestern Lincoln County	NR

Source: E. Doss (2008)

Tornadoes:

Date	Magnitude	Reported Damage	Location of Event	Estimated Losses
1942	NR	A tornado, that was not rated, blew a women from her house	Lincoln County	NR
5/26/1949	NR	Tornadic winds uprooted trees and caused blanket power outages	County Wide	NR
6/11/1953	NR	Tornadic winds uproot trees	County Wide	NR
4/24/1958	F1	Tornadic winds uprooted trees and blew off roofs	County Wide	NR
10/15/1959	F1	Tornadic winds uprooted trees and blew off roofs	County Wide	NR
5/25/1992	NR	Torrential rains brought possible tornado touchdowns that tore apart ambulance bay	Lincolnton	NR
11/22/1992	F3	Reports describe a tornado followed a path that was 50 feet wide by almost 5 miles long	County Wide	$250,000
5/7/1998	F1	Reports that a tornado destroyed two chicken sheds, tore a roof off a home, and turned a home 90 degrees and moved it off its foundation	County Wide	$50,000
5/7/1998	F2	Reports that a tornado destroyed 12 homes and caused major damage to 15 other homes along with minor damages to 8 homes	Pineywoods Subdivision	$300,000
5/7/1998	F1	Reports that a tornado cause damage ranging from minor to major to several homes and mobile homes	County Wide	$50,000
5/7/1998	F2	Reports that a tornado destroyed seven homes and caused damage to almost a dozen other homes ranging from minor to major	Indian Cove Subdivision	$350,000
11/11/2002	F0	Reports that a tornado damaged trees	Chennault Community	NR
5/6/2003	F0	Reports of a tornado touch down, but no damage was reported	New Hope Community	NR
1/13/2005	F0	Reports of a tornado touch down, but no damage was reported	Double Branches Community	NR

Source: E. Doss (2008)

Winter Storms:

Date	Magnitude	Reported Damage	Location of Event	Estimated Losses
1/1893	8 inches	Snowfall	County Wide	NR
2/20/1958	Ice	The Savannah River iced over from bank to bank with temperatures around (-15) degrees	Eastern Lincoln County	NR
2/3/1961	Sleet	A winter storm brought sleet and freezing rain	County Wide	NR
12/31/1963	3 inches	Sleet	County Wide	NR
2/9/1967	5 inches	Snowfall	County Wide	NR
2/16/1969	3 inches	Ice	County Wide	NR
1/11/1973	Ice	A severe winter storm brought large amounts of ice causing a power outage for five hours	County Wide	NR
2/9/1973	8 inches	Snowfall	County Wide	NR
2/15/1973	12 inches	Record snowfall of 12 inches with drifts up to two feet high	County Wide	NR
1/15/1982	4 inches	Snowfall	County Wide	NR
1/21/1985	Freezing Temps.	A winter storm brought record low temperatures on average of (-6) degrees	County Wide	NR
1/7/1988	4 inches	Snowfall	County Wide	NR
3/2/1989	8 inches	A winter storm brought snow and temperatures on average around 25 degrees	County Wide	NR
1/2/2002	4-6 inches	A winter storm brought snowfall and caused power outages	County Wide	NR
1/26/2004	.5 to .75 inches	A winter storm brought ice and caused one fatality and four injuries, all related to automobile crashes. There were power outages to over 100,000 homes	Lincoln County and three surrounding counties also	NR
1/29/2005	.25 inches	A winter storm brought ice that aided in a number of automobile accidents	County Wide	NR
2/1/2007	.25 inches	A winter storm brought freezing rain that aided in a number of automobile accidents	County Wide	NR

Source: E. Doss (2008)

Earthquakes:

Date	Magnitude	Reported Damage	Epicenter and Distance Felt	Estimated Losses
11/1/1875	6.0	People had trouble walking	32.19 N, 81.16 W and felt up to 25 km away	NR
8/31/1886	6.6 - 7.3	Damage to chimneys and buildings	32.79 N, 79.94 W and felt throughout sixteen states	Approximately $24,000,000 for all resulting damage
1/23/1903	3.0	Strong shaking to houses	32.01 N, 80.85 W and felt up to 10 km away	NR
8/2/1974	4.9	No damage reported	33.87 N, 82.49 W and felt up to 8 km away	NR
11/5/1974	3.7	No damage reported	33.73 N, 82.22 W and felt up to 24 km away	NR
12/3/1974	3.6	No damage reported	33.95 N, 82.50 W and felt up to 17 km away	NR
1/3/1992	3.2	No damage reported	33.95 N, 82.46 W and felt up to 17 km away	NR
9/2/2001	2.7	No damage reported	33.79 N, 82.35 W and felt up to 11 km away	NR
3/14/2007	2.1	No damage reported	33.78 N, 82.32 W and felt up to 15 km away	NR
7/19/2007	2.7	No damage reported	33.61 N, 82.35 W and felt up to 23 km away	NR

Source: E. Doss (2008)

Drought:

Date	Severity	Reported Damage	Location of Event	Estimated Losses
10/31/1961	1 1/2 Months without rain	No rain has fallen since 9/19/61	County Wide	NR
3/9/1989	40% below normal	Rainfall amounts for the past 13 months are on average 40% below normal	County Wide	NR
5/11/1989	16 ft. below normal	A severe drought had caused Clarks Hill Lake to be dangerously sixteen feet below normal	County Wide	NR
8/12/1993	Damage to Farming	High temperatures and a severe lack of rainfall have caused a drought which is affecting feed for local cattle farmers	County Wide	NR
8/19/1999	Extreme Drought	With only .43 inches of rain in over a month and temperatures averaging 106 degrees the plaguing drought continues	County Wide	NR
6/22/2000	Danger to Boaters	Low lake levels from extreme drought have cause Action Level 2 to be enacted on lake to prevent harm to boaters	County Wide	NR
9/12/2002	Extreme Drought	Drought has hold on county for the fifth consecutive year and this is the driest year on record for the past 100 years	County Wide	NR
5/1/2008	Extreme Drought	Since October 1, 2007 the county has only received 70% of the average rainfall amount	County Wide	NR
8/7/2008	Extreme Drought	The city has three raw intake valves at Soap Creek. They are set at 321 above mean sea level (ft-msl), 314 ft-msl, and 307 ft-msl. Since the lake level is currently at 317.3 ft-msl, the city is drawing water out of the lowest intake valve, which is now about six feet below the water line.	County Wide	NR

Source: E. Doss (2008)

Flooding:

Date	Magnitude	Reported Damage	Location of Event	Estimated Losses
3/6/1952	Bridge Closure	Raysville Bridge was closed due to being one foot under water from heavy rains	Amity Community	NR
3/16/1960	Declaration of Disaster	County was declared a disaster area after roads and highways were washed out from heavy rains	County Wide	NR
6/27/1963	Road Closure	7.35 inches of rainfall caused road closure due to wash out	Soap Creek Area	NR
10/18/1990	Road Closure	Road closure due to water over the road	Allen Mullins Road	NR
6/30/1994	Road Closure	Eight inches of rain fell and washed out roads	Holiday Estates Subdivision	NR
6/6/2001	Flooding	Reports of severe street flooding	County Wide	$20,000

Source: E. Doss (2008)

Vulnerability Analysis:
2008 Hazard Vulnerability Analysis

Hazard Description	Is Event Significant	Frequency 1 Year	5 Year	10 Year	Maximum Population Affected
Agricultural Freeze	Y		X		8348
Air Transport Accident	N				
Bridge Failure	Y			>	8348
Brush, forest, wild fires	Y	X			8348
Civil Disturbance	N				
Commercial Nuclear Power Plant Incidents	N				
Critical Infrastructure Disruption (computer Threat, Gas Pipeline Disruption)	Y		X		8348
Drought	Y	X			8348
Exotic Pest and Disease (canker, red rings disease)	N				
Extreme Temperatures	Y	X			8348
Flood (Major)	N				
Flood (Minor)	Y			X	8348
Fixed Facility, Hazardous Material	N				
Oil Spill, Hazardous Material Coastal	N				
Highway Accident, Fuel Spill	Y		X		200
Rail Accident, Hazardous Material	N				
River, Hazardous Material	N				
Hurricane/Tropical Storm	Y	X			8348
Major Transportation Incidents	N				
Mass Immigration	N				
Nuclear Attack	N				
Pandemic Outbreak	Y				8348
Power Failure	Y	X			8348
Radiological Incident Transportation	N				
Severe Thunderstorms	Y	X			8348
Sinkholes and Subsidence	N				
Special Events (Dignitary Visits, Spring Break, ect.)	N				
Tropical Cyclone Events, *Storm Surge*	N				
Tropical Cyclone Events, *Wind*	N				
Terrorism	N				
Thunderstorms and Tornadoes	Y	X			8348
Urban Fire	N				
Wildfire	Y	X			8348

Source: E. Doss (2008)