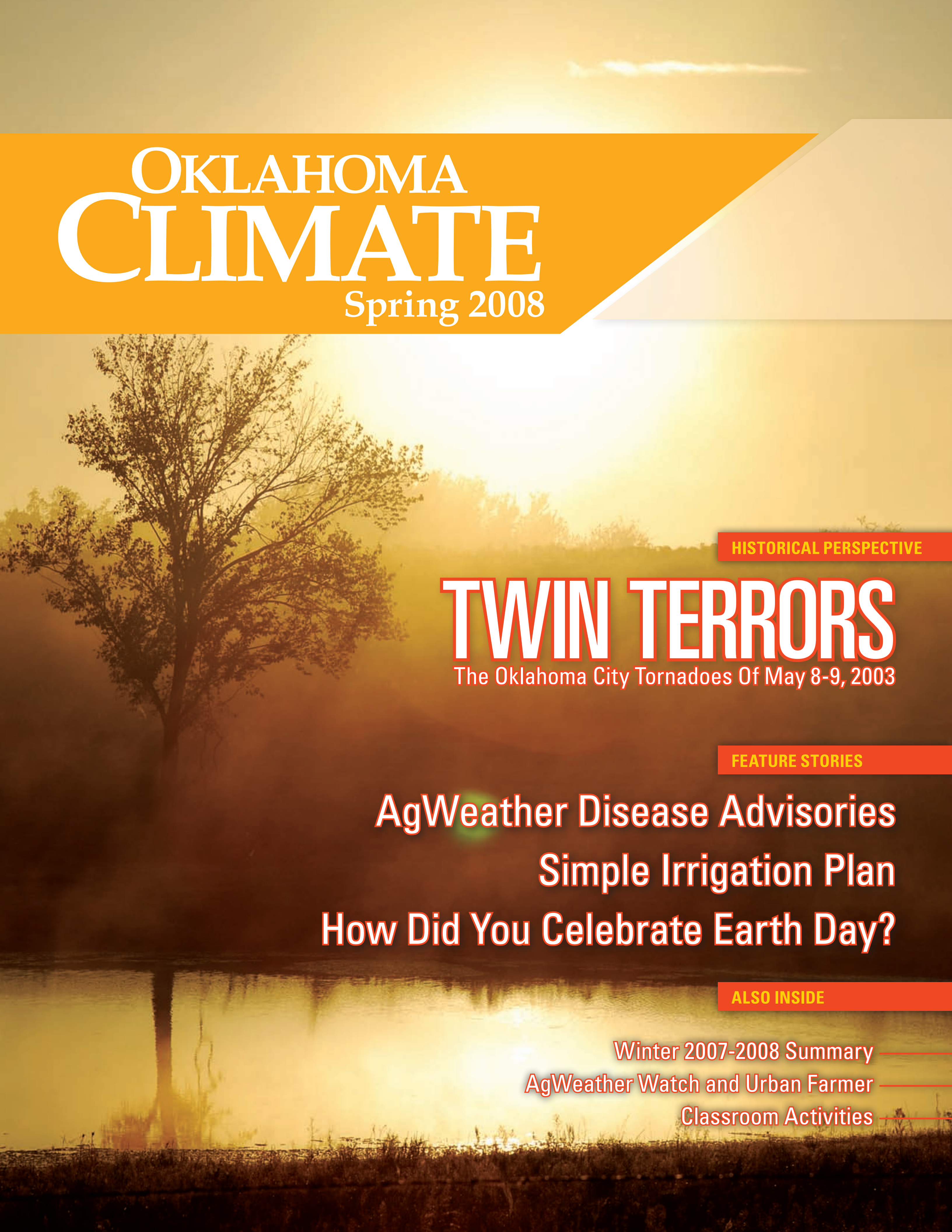

Oklahoma Climate

Spring 2008

HISTORICAL PERSPECTIVE

TWIN TERRORS

The Oklahoma City Tornadoes Of May 8-9, 2003

FEATURE STORIES

AgWeather Disease Advisories

Simple Irrigation Plan

How Did You Celebrate Earth Day?

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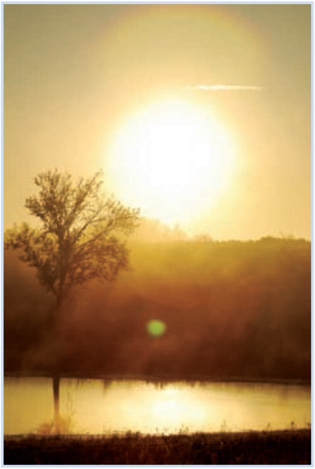


Oklahoma Climate
Spring 2008

Cover Photo: by Laura Martin.
If you have a photo that you would like to be considered for the cover of Oklahoma Climate, please contact:

Gary McManus
gmcmanus@mesonet.org

MESSAGE FROM THE EDITOR

Gary McManus

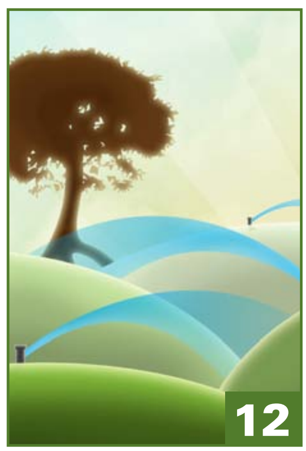
May 3, 1999, represents the horror of what could occur if violent tornadoes should happen to strike a densely-populated urban area such as Oklahoma City. The result, of course, is burned into Oklahoma's collective psyche – 36 dead, hundreds injured, and over $1 billion in damages. The successive-day tornadoes that struck Oklahoma City on May 8-9, 2003, represent another scenario: what if violent tornadoes strike a densely-populated urban area, cause a lot of the same type of damage and destruction but without the widespread injuries and deaths? To be fair, the tornadoes of May 8-9 were puppies compared to the F5 behemoth of May 3, 1999. Still, the Oklahoma City metropolitan area took a direct strike by significant tornadoes twice and everybody lived to tell about it. As it turns out, disasters are really efficient teaching tools and do more for raising awareness than a hundred public service announcements. The sorrow and loss of May 3, 1999, yielded a public much more attune to severe weather, and that is difficult to do in a city and state so used to weather disasters. Our historical perspective takes a look back at the May 8-9 tornadoes in an attempt to show what occurred, as well as what could have been.

Do you ever wonder how much water your lawn needs? Is keeping up with the Jones' green lawn becoming more and more difficult? Well learn how to take some of that burden off your shoulders with a feature article about the Oklahoma Mesonet's Simple Irrigation Plan (SIP, for short). This product will tell you how much and when to water your lawn, and it even takes into account what type of sprinkler you have! We chronicle another great Mesonet product – for the agricultural community this time – with a look at the Agweather Disease Advisories. These advisories help farmers protect their crops from all the various organisms that do harm, and best of all, it's free of charge. In our third feature article, learn what it's like to spend Earth Day with 5000 fourth- and fifth-grade students at the Oklahoma City Zoo. This annual fun day was spent teaching Oklahoma kids about science and nature. If storm chasing is your cup of tea, our interview this issue is with Howie Bluestein, one of the first and most famous storm chasers of 'em all. Featured on "Nova", this University of Oklahoma meteorology professor has experienced being up close and personal with nearly all types of severe weather, from massive tornadoes to an airplane ride through the inside of a Hurricane's eye...and he has the pictures to prove it!

You may be a bit foggy about...well, fog, so our classroom exercise allows students to learn all about how the murky stuff forms and the different types that can form. In addition, be sure to read our regular features dealing with agricultural weather, weather safety, and a weather summary of the winter months.

I sincerely hope you enjoy this issue of "Oklahoma Climate." If you have any questions or comments, please feel free to contact me at gmcmanus@mesonet.org.

Gary McManus – Editor



Oklahoma Climatological Survey

TWIN TERRORS

THE OKLAHOMA CITY TORNADOES OF MAY 8-9, 2003

Gary McManus – Assistant State Climatologist

Oklahoma City knows tornadoes. Its large size makes a nice target for tornadic supercells as they march to the northeast, spawned by drylines in the fertile breeding grounds of southwestern Oklahoma. The worst of those tornado strikes occurred on May 3, 1999, as a violent F5 twister moved through Moore and Oklahoma City and became, as indicated by the Norman National Weather Service (NWS) office: "the deadliest (36 killed), costliest ($1 billion in damage), and most violent (first and only F5) tornado on record in the immediate OKC area."

Now fast-forward five years and try to imagine the horror of Oklahoma City residents as another potential May 3-type scenario began to unfold before their eyes. To add insult to injury, Mother Nature spread the terror of this event over two days as a series of tornadoes struck central Oklahoma on May 8-9, 2003, leaving 145 injured. Estimates from the two days of violent weather are widely varying, but the 33 tornadoes that struck Oklahoma in early May did an estimated $1.1 billion in damage. The majority of that damage estimate was attributed to the May 8-9 event, with another $438 million provided by FEMA for uninsured losses and damage to public infrastructure. Those estimates included 2889 single-family homes damaged and 432 destroyed, five public buildings with major damage – three of which were schools, and more than 100 businesses damaged or destroyed. In retrospect, the lack of more fatalities could be credited to the experience garnered from those previous storms, the advancement of severe weather detection and preparedness of local, state, and federal authorities.

MAY 8: MOORE, OKLAHOMA CITY, MIDWEST CITY, CHOCTAW

Conditions were ripe for rotating supercells on May 8, and state and local authorities were alerted that morning of the seriousness of the situation by the NWS. At 7 a.m., NWS forecasters cautioned about the possibility for supercell thunderstorms and the threat of tornadoes in its "hazardous weather outlook" bulletin:

> Thunderstorms are expected to develop initially along and possibly ahead of the dry line around 3-4 p.m. as the upper disturbance arrives to provide mid-level lift. Rapid development and strengthening to severe levels is likely due to the expected high instability and the continued presence of strong vertical wind shear over the area. A few storms may evolve into supercells, with an attendant risk of very large hail, along with a few t ornadoes.

A strong upper level system had tracked into the Central Plains and dragged an associated surface low with it. A dryline in western Texas was expected to move eastward towards Oklahoma, and a strong warm front had moved into far northern Oklahoma, which provided ample moisture for thunderstorm development. At 4:09 p.m., the NWS office in Norman issued a severe thunderstorm warning for Grady County, southwest and upstream of the Oklahoma City area. Radar data showed the thunderstorm had developed into a supercell by 4:27 p.m. with rotation at mid-levels indicated. At 4:33 p.m., radar indicated a possible tornado near Pocasset in Grady county, prompting the first tornado warning of the May 8 event. The classic supercell thunderstorm continued to move east towards Moore and south Oklahoma City without producing a confirmed tornado. At 4:49 p.m., a tornado warning was issued for Cleveland, McClain, and southern Oklahoma counties. Following the touchdown of a weak tornado farther to the west, the second and more violent tornado formed in Moore, quickly intensifying to F3 strength.

The damage track was initially quite narrow, but its destructive path widened as it moved through northwest Moore towards I-35, leaving damaged and destroyed homes in its wake. The tornado leveled several structures on the west side of I-35, including two hotels, several restaurants, and an office park. The tornado weakened as it crossed I-35, with sporadic F2 damage noted by a NWS survey team. The tornado intensified to F4 strength briefly as it neared Sunnylane Road, devestating a manafacturing plant just south of I-240. The tornado once again reached F4 strength as it hit the General Motors assembly plant, inflicing over $100 million in damage to the facility. The tornado continued its trek towards the northeast where it reached F4 strength once again. The tornado eventually weakened and dissipated south of Choctaw.

MAY 8 DAMAGES

The tornadoes that struck Oklahoma City, Moore, Midwest City, and Choctaw on May 8 were on the ground approximately 33 minutes, travelled 17.5 miles, reached a maximum width of 700 yards, and a maximum intensity of F4. Structural damage included:

Moore: 300 homes destroyed, 300 homes with major damage, 300 homes with minor damage, 150 homes affected, 30 multi-family homes with major damage, 22 businesses with minor damage and six businesses with major damage.

Oklahoma City/Midwest City: 93 homes destroyed, 400 homes with major damage, 400 homes with minor damage, 15 mobile homes with minor damage, 10 multi-family units with major damage, 15 businesses with major damage and 5 businesses with minor damage.

Choctaw: 29 homes destroyed, 28 homes with major damage, 47 homes with minor damage, 223 homes affected, 3 mobile homes destroyed and 1 mobile home with minor damage.

MAY 9: BETHANY, OKLAHOMA CITY, JONES, STROUD

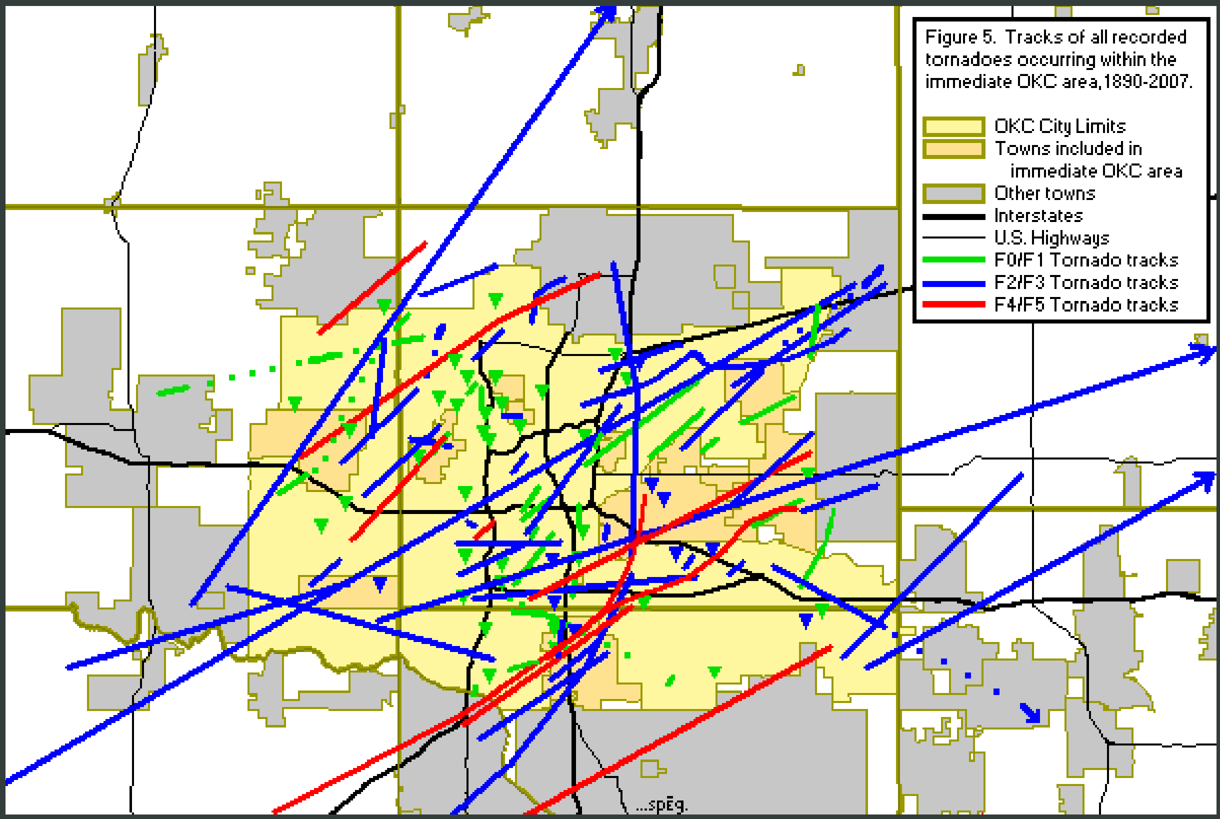
The weather conditions that spawned the destructive tornadoes in central Oklahoma on the eighth were still in place the following day. At 1:17 p.m., the NWS office in Norman issued a regional weather discussion which mentioned an approaching upper level disturbance and soaring daytime temperatures could trigger thunderstorms – with associated tornadoes – later in the afternoon:

> Conditions are expected to become increasingly favorable for supercell thunderstorm development as the day progresses. Storms that develop during the mid- to late-afternoon will have the potential to become severe very quickly, and some may produce tornadoes.

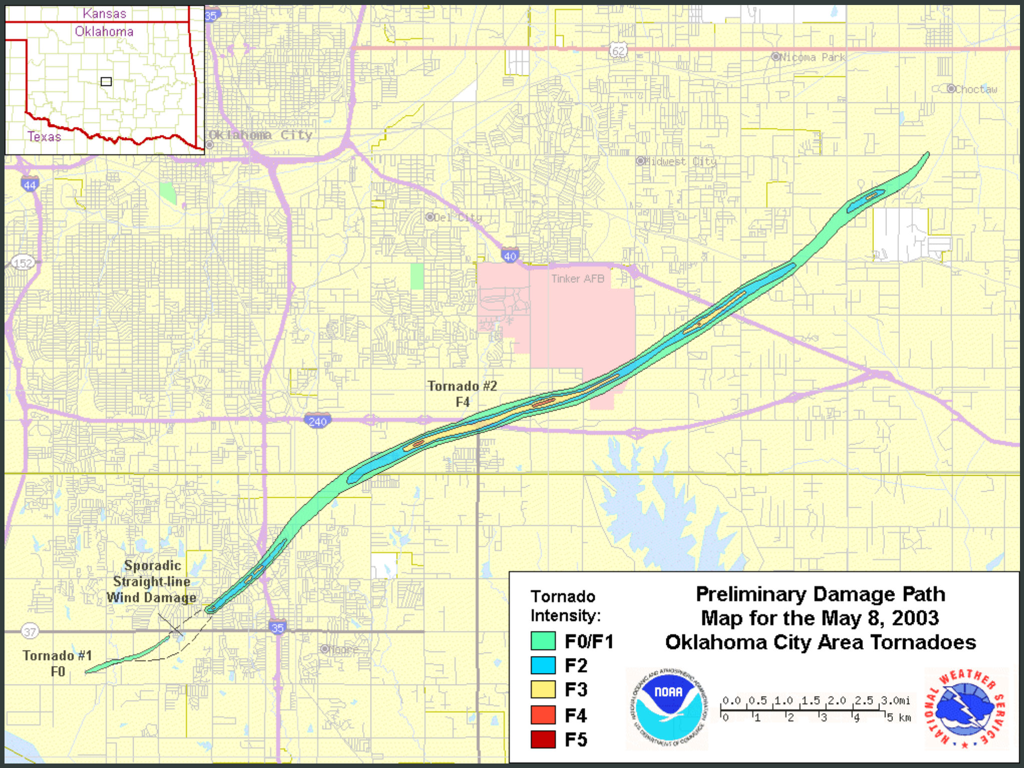
At 3:29 p.m., a tornado watch was issued for 32 counties in the state, including those in central Oklahoma. A thunderstorm exploded along the dryline in Greer County, which prompted a severe thunderstorm warning at 6:32 p.m. The storm quickly became a supercell and plodded towards the northeast with baseball-sized hail and 70 mph winds into Beckham, Kiowa and Washita Counties. The first tornado warning for this storm was issued at 9:09 p.m. for Caddo County.

After dropping three tornadoes to the west, the storm crossed over into Oklahoma County and continued doing damage from Yukon into parts of central Bethany, but this damage was determined by the NWS damage survey team to be a result of straight line winds. A fourth tornado hit Bethany and Warr Acres, causing damage to Wiley Post Airport along the way. There were three distinct areas of F1 damage contained within a larger area of F0 damage, marking this as a multiple-vortex tornado. The fifth tornado of the night strengthened to an F3, doing considerable damage to homes and an elementary school. The tornado weakened back to an F0/F1 before increasing to F3 intensity briefly once again. It then turned to the right and traveled easterly for a short time, diminishing to F0/F1 intensity. The tornado then traveled to the northeast, approximately one mile south of I-44, paralleling the highway. It strengthened briefly to F2 intensity once more on the northern fringe of Jones before dissipating two miles south of Luther. This tornado was on the ground for 36 minutes and a distance of nine miles, reached a maximum width of 880 yards, and was officially rated F3 in strength.

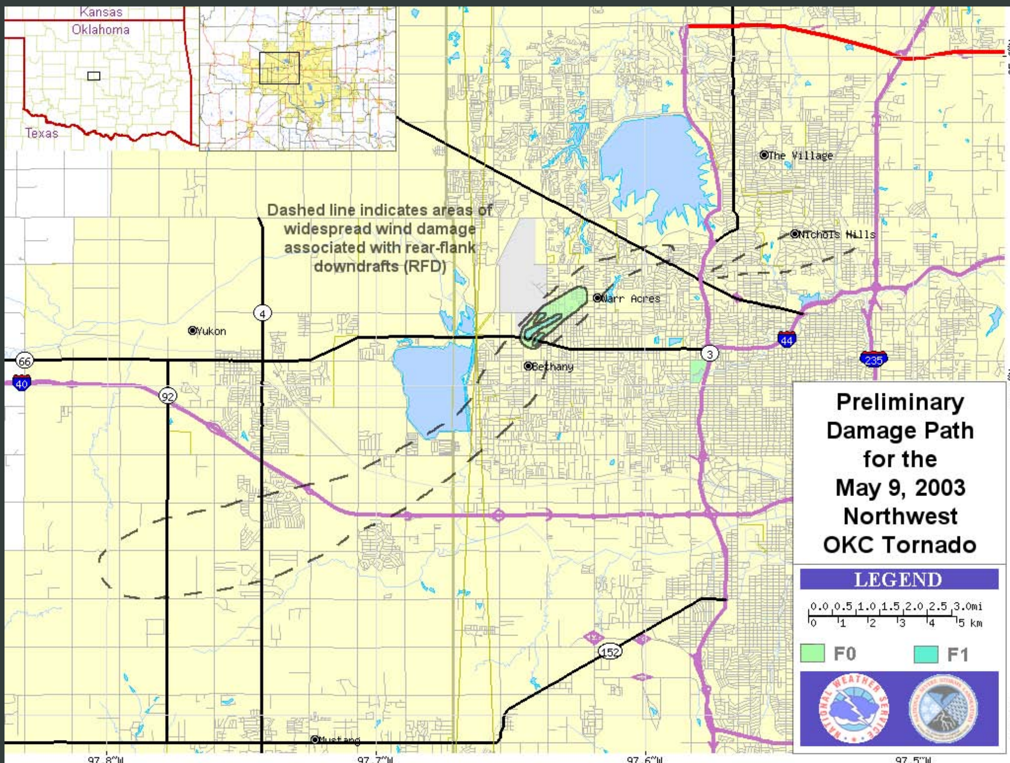
There were three distinct areas of F1 damage contained within a larger area of F0 damage, marking this as a MULTIPLE-VORTEX TORNADO.



Tracks of all recorded tornadoes occurring wholly or partly within the immediate Oklahoma City area, 1890-2007 (courtesy of NWS).



Damage path of the May 8, 2003, Oklahoma City tornado (courtesy of NWS).



Damage path of a May 9, 2003, Oklahoma City tornado (courtesy of NWS). Areas within the dashed line were damaged by straight-line winds rather than a tornado.

MAY 9 DAMAGES

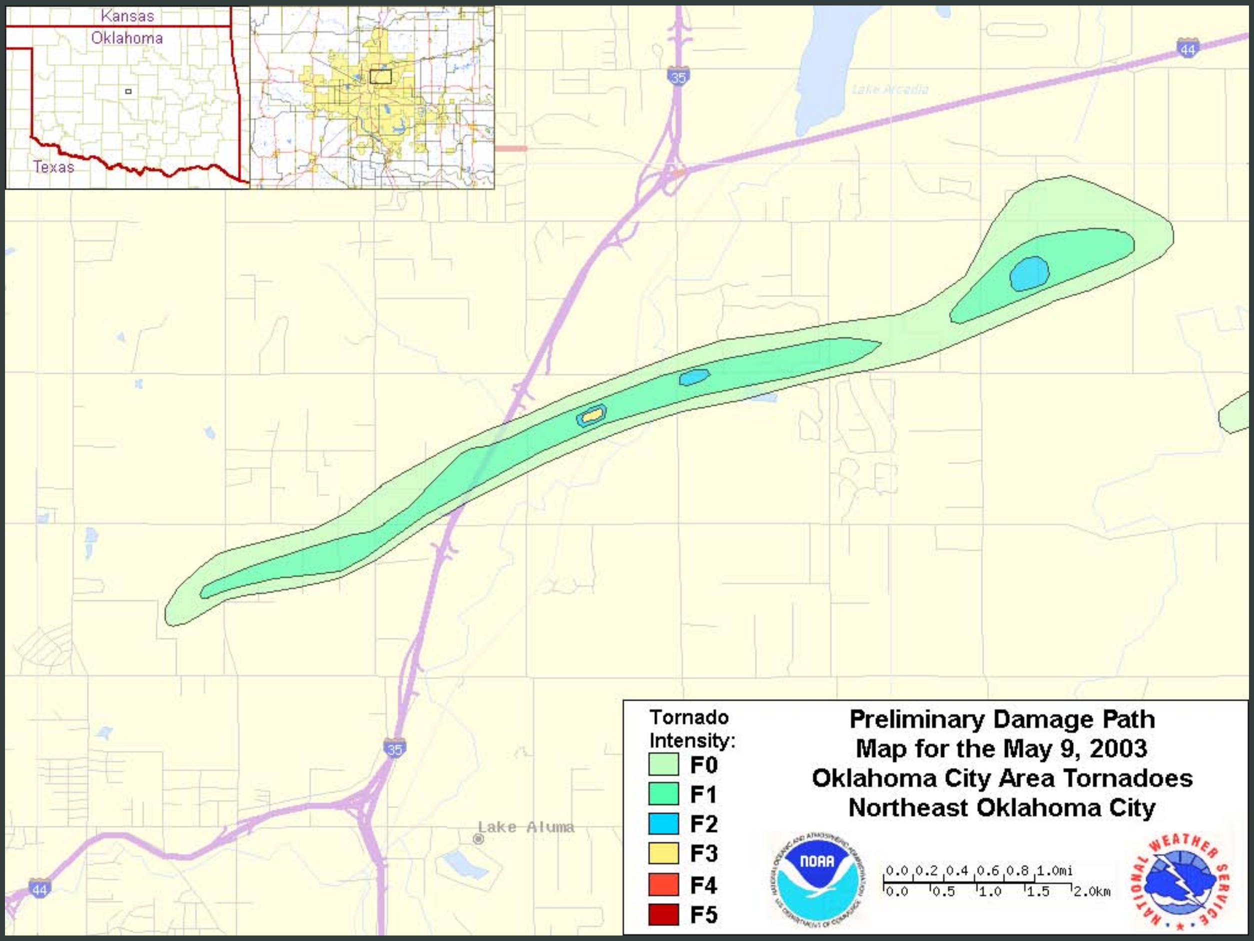
Oklahoma City and the surrounding areas affected by this tornadic thunderstorm were extremely fortunate that the damage was not more severe. The twisters were actually more fleeting than it appeared at the time. Much of the damage from this day was a result of straight-line winds from the storm's rear-flank downdraft (RFD). Had a longer-lived tornado occurred as the storm traversed Oklahoma City's large population base, the damage could have been catastrophic. Regardless, the storm still inflicted sporadic amounts of significant damage along its path, although the amounts are not as clear as the previous day's tally. Those cities with confirmed damage figures include:

Bethany: 471 homes affected, 10 destroyed; 5 public buildings with major damage;

Jones: 4 homes with major damage, 1 home with minor damage, 7 homes affected, 6 businesses destroyed, 3 businesses affected and 1 public building affected. ■

TOP TEN DEADLIEST OKLAHOMA TORNADOES (1882 - 2008)

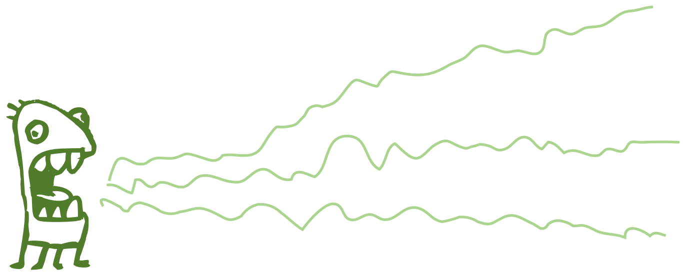
RANK	CITY/TOWN	DATE	F-SCALE	FATALITIES	INJURIES
1	Woodward	4/9/47	F5	116	n/a
2	Snyder	5/10/05	F5	97	58
3	Peggs	5/2/20	F4	71	100
4	Antlers	4/12/45	F5	69	353
5	Pryor	4/27/42	F4	52	350
6	Bridge Creek - Moore - OKC	5/3/99	F5	36	583
7	Oklahoma City	6/12/42	F4	35	29
8	Cleveland County	04/25/1893	F4	33	~100
9	Bethany	11/19/30	F4	23	77
10	McAlester	05/08/1882	F3	21	42



Damage path of a May 9, 2003, Oklahoma City tornado (courtesy of NWS).

CLASSROOM ACTIVITY ANSWERS

1. Cape Disappointment experiences heavy fog approximately 107 days a year. (2556 hours divided by 24 hours = 106.5 days)
2. Locations that experience 25 or more days of fog a year include low-lying areas such as most of the Gulf Coast, Atlantic Coast, and Pacific Coast (especially over western Washington and Oregon); and along much of the Appalachians.
3. Most coastal areas are low-lying, so they fit one ideal condition. Along the Appalachians, there is probably mostly upslope fog.
4. The Panhandle of Oklahoma sees 15-20 days of fog per year, most of Western Oklahoma sees 15-20 days, and the rest of the state sees 10-15 days of fog on average.
5. These states are generally very dry and are located at a high elevation. Neither characteristic is an ideal fog condition.
6. Answers may vary. One possible answer: There is generally more moisture over the eastern and especially southeastern United States than there is east of the Rockies. With higher dewpoint temperatures, air temperatures do not have to cool very much for condensation to occur. Furthermore, with moist air coming from both the Gulf of Mexico and the Atlantic, there can be upslope fog on either side of the Appalachians. Since most of the moisture from the Pacific Ocean is lost on the western side of the Rockies, there is very little moisture available when the air reaches the eastern edge of the Rockies. When moist Gulf of Mexico air comes into the Plains, fog can occur. Another possible answer: In general, there are more trees in the eastern United States than in the Plains. These trees can help block wind, which can lead to conditions favorable for radiation fog (weak or calm winds).



Agweather Disease Advisories from the Oklahoma Mesonet

by Albert Sutherland, CPH, CCA
Mesonet Agriculture Program Coordinator

Plant disease outbreaks can devastate farm crops. When left unchecked, plant disease attacks reduce crop yield and quality. This can leave farmers with lots of expenses and little crop income.

Bacteria, fungi, oomycetes, nematodes and viruses are some of the culprits that cause plant diseases. While a plant disease organism may be on or near a host plant, it takes the right weather conditions for the disease organism to attack.

The Oklahoma Mesonet, Oklahoma's weather network, has developed fungal disease advisories for peanut, pecan, spinach and watermelon. These advisories indicate when weather conditions are right for fungal disease outbreaks based on air temperature and relative humidity. Pest advisories record the number of hours of favorable weather conditions. When enough hours have accumulated a control action is recommended. All of the Mesonet plant disease advisories can be accessed FREE of charge on the Oklahoma Agweather Web site at http://agweather.mesonet.org.

Fungicides are an important tool that farmers use to control fungal plant diseases. The downside to using fungicides is the cost and potential environmental impact. To assist the farmer, weather-based plant disease advisories can be employed that identify the best times for fungicide application. The graph in Figure 1 shows how favorable disease hours collected for spinach white rust at the Wister Mesonet site in 2004. In this example, enough spinach white rust hours had accumulated to warrant a spray recommendation. Advisories like this allow crop producers to maximize fungicide effectiveness, so that fungicide expense and possible environmental impacts are minimized.

Fungal disease attack in Oklahoma varies greatly from year to year. The graph in Figure 2 shows the season-long accumulation of pecan scab hours over the past years at the Perkins Mesonet site. In 2007, a very rainy year, the pecan scab hours for Perkins topped out at over 410 scab hours (black line). In the droughty year of 2006, the pecan scab hours at Perkins did not even hit 80 scab hours (dark brown line). Pest advisories do a good job of tracking the disease pressure farmers face each growing season.

Below is a brief review of the Mesonet weather-based fungal disease advisories on the Oklahoma Agweather Web site. These advisories use air temperature and high relative humidity to log the number of hours when the weather is favorable for pest organism development.

Peanut Leaf Spot Advisor

A peanut leaf spot hour is recorded when the air temperature is between 60.5˚F and 86˚F and the relative humidity is at or above 90%. Beginning 30 days after planting or ten days since the last spray, the Peanut Leaf Spot Advisor accumulates leaf spot hours and recommends a fungicide application once 36 such hours are met or exceeded.

Pecan Scab Advisor

A pecan scab hour is recorded when the air temperature is at or above 70˚F and the relative humidity is at or above 90%. From May 1 or fourteen days since the last spray, the Pecan Scab Advisor accumulates scab hours. Pecan scab risk becomes high for highly susceptible varieties when 10 pecan scab hours have accumulated. The threshold is 20 scab hours for moderately susceptible varieties and 30 scab hours for resistant varieties and native pecan trees.

Spinach White Rust Advisor

A spinach white rust hour is defined as one hour with relative humidity at or above 90% and an air temperature in the range of 52-68°F. When relative humidity is at or above 90% and the air temperature is above or below the range of 52-68°F, the spinach white rust hours are weighted to account for slower fungal development. Infection hours begin to accumulate from the first true leaf stage or at the end of a 7-day fungicide control window. The model assumes that disease infection is controlled for 7 days after the application of a fungicide labeled for control of spinach white rust.

Watermelon Anthracnose Advisor

A watermelon anthracnose hour is defined as one hour with relative humidity greater than or equal to 80% and air temperature between 68˚F and 86˚F. The advisory recommends a spray when 80 infection hours have accumulated since either the date of first male watermelon flowering or the last fungicide application.

As of May 2008, the Pecan Scab Advisor and Spinach White Rust Advisor are the two Mesonet pest advisories that use the National Weather Service 84-hour North American Model (NAM) forecast to project favorable disease conditions. The forecast feature will be added to the Peanut Leaf Spot Advisor later in 2008.

The intent behind the Oklahoma Mesonet pest advisories is to provide an additional management tool to help determine when pest control measures are needed. These weather-based advisories are a tool that growers use in addition to their experience and best judgment. Pest advisories can alert farmers to times when disease outbreaks are likely and when a control action may be needed.

For pest management advisories and more information check out Oklahoma Agweather Web site at http://agweather.mesonet.org. Another source for pest management information is your local OSU Cooperative Extension Service office. Contact information for your local OSU Extension office is available at http://countyext2.okstate.edu.

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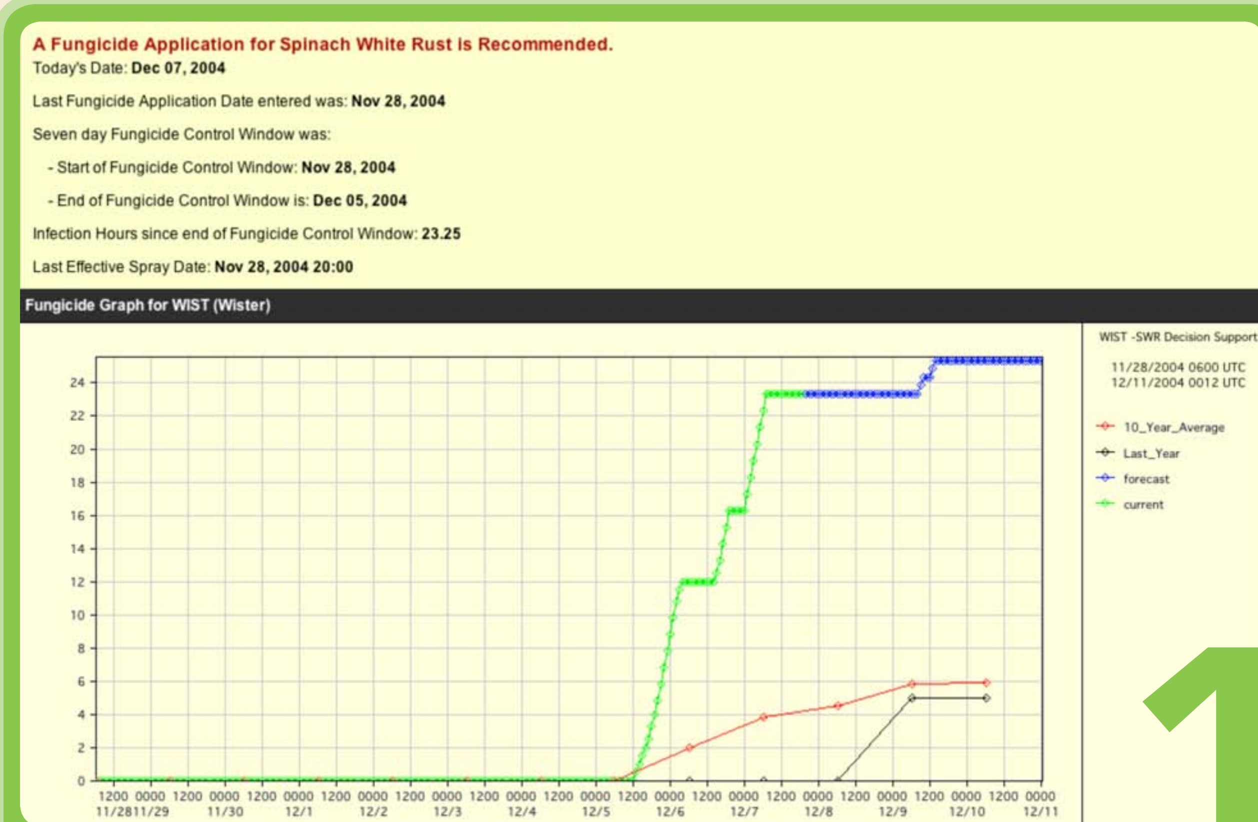


Figure 1: Agweather Spinach White Rust Fungicide Decision Support graph

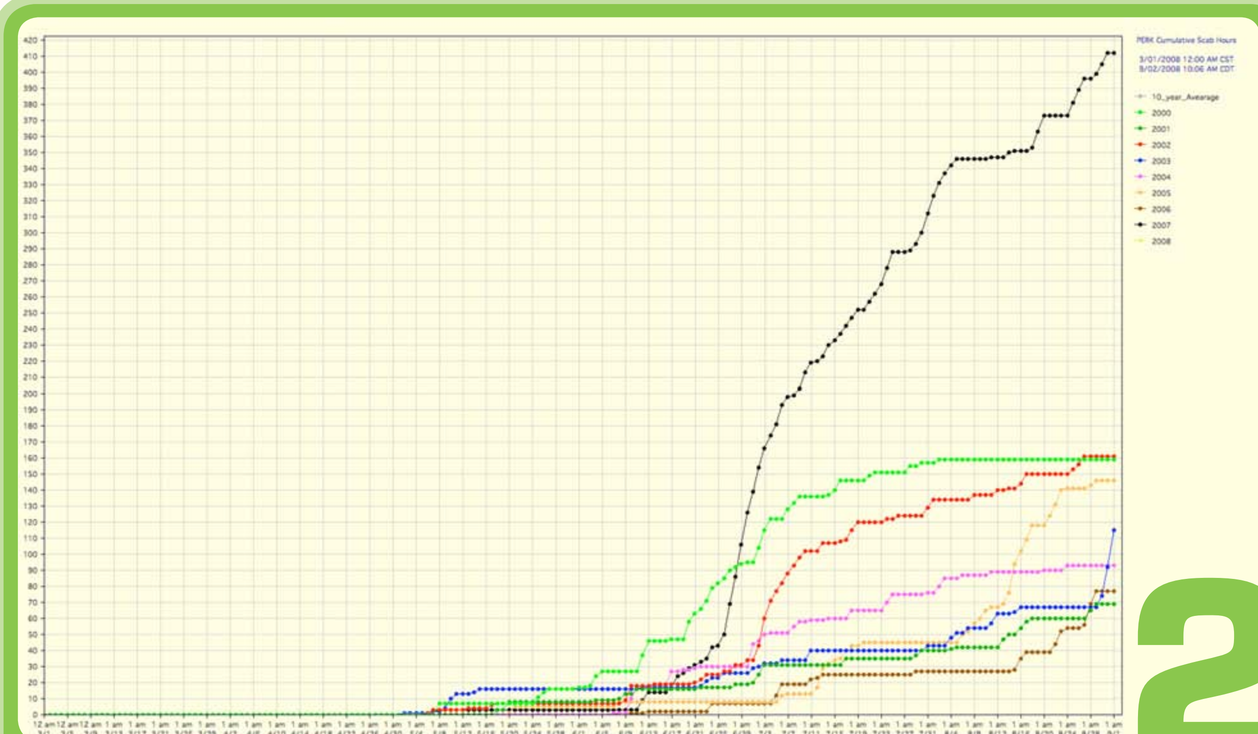


Figure 2: Agweather Season-long Pecan Scab Hours Comparison graph

HOWIE

DR. BLUE

Nestled in a fifth-story office overlooking the University of Oklahoma research campus, Dr. "Howie" Bluestein is exactly where he wants to be – immersed in a world of meteorology.

Even before he is asked about his career, his passion for weather is apparent. Storm chasing photos sit neatly on top of filing cabinets. Stacks of papers litter every available surface, while rows of boxes line the floors.

In a clipped, Bostonian accent, Bluestein describes childhood experiences that have shaped his fascination with weather. Growing up in Boston, Mass., and Miami Beach, Fla., Bluestein witnessed many different examples of extraordinary weather.

"When I was pretty young, there were a lot of exciting things going on. A tornado struck 40 miles west of our house, the eye of a hurricane passed over the top of us, a television blew up in front of my eyes and we had really good snowstorms. It was hard not to be interested in the weather."

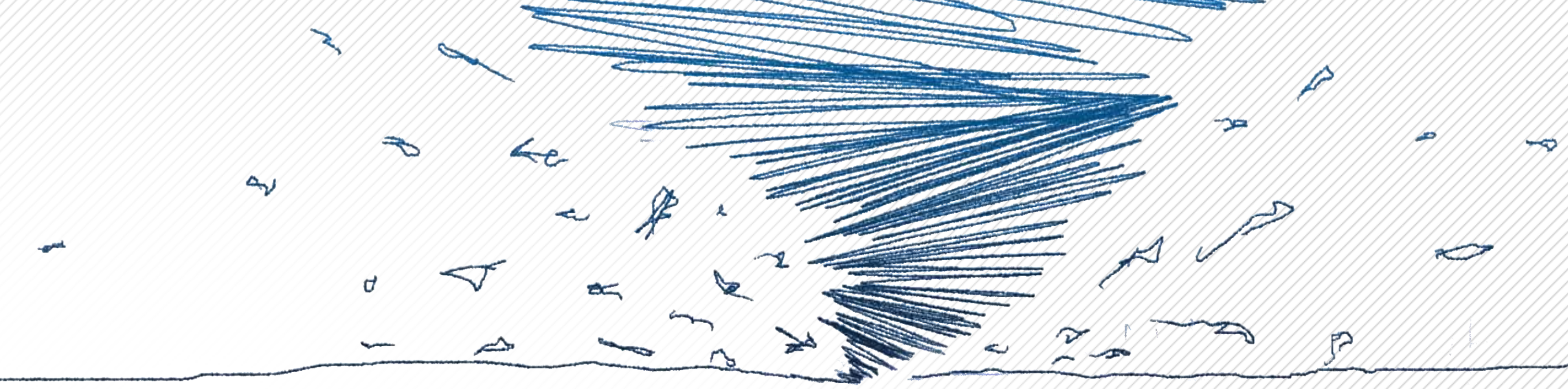
Despite his interest in meteorology, Bluestein pursued an electrical engineering degree at the Massachusetts Institute of Technology.

"I've always been interested in meteorology but I never knew you could pursue a research position in it. There were no role models in meteorology except TV weathermen and I didn't want to do that. It seemed like hard work. You have to look good and sound good. You have to be charming all the time."

Nevertheless, Bluestein began taking some undergraduate courses in meteorology. He met Dr. Fred Sanders, professor emeritus of meteorology and mentor to an entire generation of weather researchers.

"Once I met him, I knew that's what I wanted to do when I grew up," said Bluestein.

He graduated with a bachelor's degree in electrical engineering in 1971 and went on to earn a master's degree in electrical engineering and a master's degree in meteorology in 1972. Four years later, Bluestein completed his Ph.D. in meteorology.



STEIN

BY LAURA MARTIN
Mesonet Agricultural Extension Associate

Just like his own mentor, Bluestein began teaching and leading a new generation of meteorology students. For 31 years, he has taught meteorology courses at the University of Oklahoma. Bluestein said his favorite part of teaching is interacting with the students, which can be rewarding and humorous. Bluestein smiled as he shared one of his many memorable teaching moments.

"I like to look out the window when I'm teaching. Sometimes I have the students turn around so I can point out certain things. I came into class one day and a group of students had turned around all of the seats so they were facing the window, too," Bluestein said with a chuckle.

In addition to teaching, Bluestein's enjoys the beauty and awe of tornadoes. He has spent more than 30 years chasing storms. The chances of catching a tornado are remarkably slim, making them hard to observe and hard to study. But, when a chaser catches a tornado, the experience is thrilling and rewarding.

"At the same time I'm watching [the tornado's] beauty, I'm also collecting data to study later. I'm hoping to learn why some thunderstorms produce tornadoes and others don't. I'm hoping this allows us to forecast better."

As described in his book, Tornado Alley: Monster Storms of the Great Plains, the ability to predict tornadoes is still rudimentary. Tornadoes remain very mysterious.

"At best, we can say that in eight to 12 hours, there might be some storms that might produce one or more tornadoes over a very broad area, sometimes covering several states," stated Bluestein. "An hour or so in advance we can narrow down the area that might be affected, but we still cannot say whether a storm will bring a tornado."

Bluestein hopes that the future brings better forecasting, more sophisticated observing instruments, and more realistic simulations of weather phenomenon in order to better address weather situations.

"Weather affects everybody's life: how they dress, commuting, food production. You live it, you see it, you feel it. It affects every aspect of life." ■

Simple Irrigation Plan

The Simple Irrigation Plan, SIP for short, is not really about irrigation. Its focus is on using water more efficiently and water conservation. Lawn watering in Oklahoma has been a guessing game.

When does a lawn really need water? How much does it need? How long does a certain type of sprinkler need to run to put on the water needed?

by Albert Sutherland, CPH, CCA
Mesonet Agriculture Program Coordinator

The Simple Irrigation Plan answers these lawn watering questions. SIP changes lawn watering from a guessing game to knowing the precise amount of water a lawn needs. The science behind SIP is powerful enough to handle variations in local weather, recent rainfall, grass type and factor in when a lawn was last watered.

Yet with all of the science behind SIP, this new online lawn watering tool is simple and quick to use. At the Web site, **http://sip.mesonet.org**, users are taken through a few brief steps. At each step the user is asked to make a simple choice. With just a few clicks, a customized watering time is calculated.

SIP has three product options: Simple Watering, Advanced Watering and Advanced Watering Plus. The Simple Watering option provides the quickest answer. In **5-10 seconds**, a person will be able to enter general information about their lawn and find out how long to run a specific sprinkler. The recommended time has a range to allow for variations in sprinkler age, water pressure and coverage.

What information needs to be entered to make SIP work? First, the nearest Oklahoma Mesonet site is selected. Then, the user enters how many days have passed since the last time they watered or it rained. In the third step, the type of grass is selected. In the last step, the type of sprinkler is entered.

SIP selections are made by clicking on pictures. The pictures make it easy to get through the steps quickly. No extra time is spent navigating through long lists or complicated selections. The details and science are there, but they are moved to the background, out of the user's way.

Sprinkler choices include both hose-end and automatic sprinkler systems. More sprinkler choices for each group will be added in the future.

Another feature of the Simple Irrigation Plan is an online water cost calculator. SIP uses the sprinkler gallons per minute of water delivery and user selected municipal water rate to calculate a lawn watering cost. The program can be used to calculate cost for a single sprinkler run or for watering a large lawn area with multiple moves. For automatic sprinkler systems, the number of heads in a single zone is entered.

Watering costs vary a lot from town to town. SIP has water rates from the Oklahoma Municipal League for over **200 communities**. SIP has the capacity to determine the water cost of running sprinklers, before the water is ever turned on.

Advanced Watering and Advanced Watering Plus are for those who are willing to enter more information to get a more accurate watering time. Advanced Watering and Advanced Watering Plus allow users to enter data for multiple zones.

The only difference between Advanced Watering and Advanced Watering Plus is that the user can save zone inputs. To save settings with Advanced Watering Plus the user must request a **FREE** account and password. Accounts are created only for use with SIP Advanced Watering Plus. No personal data is needed to sign up for an Advanced Watering Plus account and password. To create an account, users send an email to **sip@mesonet.org**.

The science behind SIP is based on evapotranspiration, the combined water loss from evaporation off the soil surface and plant transpiration. A daily evapotranspiration value is calculated for each of the **120 Mesonet stations** across the state. The weather parameters use to calculate evapotranspiration includes air temperature, relative humidity, wind speed and solar radiation. Seasonally adjusted turfgrass coefficients are used to calculate a unique daily water loss for bermudagrass, zoysiagrass and tall fescue.

For more information, check out the "Learn More" section on the SIP Web site at http://sip.mesonet.org. A great source of lawn and yard care information is your local OSU Cooperative Extension Service office. Contact information for your local OSU Extension office is available at **http://countyext2.okstate.edu**.

The Oklahoma Mesonet, Oklahoma's weather network, is jointly managed by Oklahoma State University and the University of Oklahoma to serve the weather information needs of all Oklahomans.

WINTER 2007-2008 SUMMARY

by Gary McManus

A rather tired refrain was sung again as another destructive ice storm visited the state. Unlike the other ice storms since the turn of the millennium, this monster's damage footprint included the state's largest population centers of Oklahoma City and Tulsa. While the ice accumulations were not quite as significant as those past storms, ice-laden tree limbs caused widespread damage to electrical power systems, leaving nearly 700,000 residences and businesses without power. The preliminary count of four tornadoes that occurred in January ties that month's record set back in 1967. Abundant precipitation in the east and northern parts of the state was not enough to counteract dry areas in the south and west, resulting in a below-normal statewide rainfall tally. The season finished with a small deficit to rank as the 53rd wettest on record. Winter temperatures statewide were virtually normal.

Precipitation: A dry January was offset by above normal precipitation during December and February to keep the winter statewide-average precipitation total near the normal mark. Most of northern Oklahoma was up to four inches above normal, in addition to similar conditions in the southeast corner while much of southern Oklahoma was up to four inches below normal. The Panhandle, which has been struck in a dry pattern since the winter of 2006-07, did manage its 28th wettest such season on record, but that amounted to a meager surplus of just about a quarter of an inch. South central Oklahoma had a deficit of over two inches, ranking the season as the 35th driest winter on record for that part of the state.

Temperature: The seasonal temperature was split much like the precipitation, although the pattern was much more chaotic. The western Panhandle and the northeast were the coolest areas of the state. The northeast managed to finish nearly a degree below normal – the 40th coolest winter on record for that area.

DECEMBER DAILY HIGHLIGHTS

December 1-2: The month's first two days were very un-December like, with highs in the 60s and 70s to go along with gusty winds from the south. A cold front intruded into the pleasant weather on the second, whipping winds around to the north and dropping temperatures into the 50s. Light rain fell in association with the cold front, but amounts were less than a half of an inch.

December 3-7: The cold front's cooler weather quickly faded over the next several days, and temperatures returned to the 60s and 70s through the fourth. Another cold front passed through on the fifth and temperatures dropped from the 70s back into more seasonable 40s. An upper-level disturbance moved over the state on the sixth and generated a bout of freezing drizzle in the north. A warm front moved into the state from the south on the seventh. Lows remained in the 50s in southern Oklahoma, although they still fell into the freezing range in the north. Light drizzle fell under overcast skies, a precursor to an approaching powerful upper-level storm system.

December 8-12: This four-day period saw the state experience one of its most devastating ice storms in recorded history. An upper-level storm system from the west sent out several waves of energy, each producing a wave of heavy icing. Freezing drizzle began falling in the northwest around noon. Low temperatures were separated from the upper 60s in the southeast and the teens in the northwest by the cold front. The ice storm began in earnest late on the eighth and early on the ninth. Areas of moderate to heavy freezing rain and sleet moved northeast over much of Oklahoma during this time. Ice began collecting on power lines and power outages began to increase over northwestern and central Oklahoma. As the day went on, the heaviest freezing rain moved to the northeast and caused similar problems across that area. Another wave of precipitation moved up and over the state from the southwest that evening. Each additional wave of heavy precipitation left an additional layer of ice on elevated surfaces and roadways. Some of the precipitation was convective, and was accompanied by thunder. These bands of freezing rain continually regenerated and moved from the southwest to the northeast, especially along the I-44 corridor. This meant that the state's two largest metropolitan areas were in the heaviest accumulation footprint. The precipitation shifted to the northwest by the evening of the 10th, and a northward-advancing warm front eventually allowed temperatures to rise above freezing in the southeastern half of Oklahoma later that night and early on the 11th. The southeastern one-third was lucky enough to remain above freezing for the most part through the storm system's visit, so the 3-4 inches of precipitation that fell in that area was mostly liquid.

December 13-15: Patchy fog and light snow greeted the state on the 13th. The northwest received a bit of a break with a bit of sunshine, allowing temperatures there to rise into the 40s. Other areas of the state struggled to reach the 40s due to lingering cloud cover. The 14th-15th were gray and damp. Snow fell on the 15th in northern Oklahoma. The snow was accompanied by strong northerly winds, at times gusting to over 50 mph. Temperatures remained above freezing in the south, which allowed for rain instead of snow. More than two inches of rain fell in the extreme southeast during this three-day period.

December 16-21: The next six days were a welcome respite after the frozen nightmare of the previous week. Clear skies and seasonable weather stuck around throughout the period. Low temperatures were still on the cold side, in the 20s and 30s mostly, but high temperatures rebounded into the 50s and 60s. A few 70s showed up on the 21st.

December 22-23: A strong cold front entered the state with frigid temperatures and strong northerly winds as well as snow, sleet, and freezing rain. Skies cleared as high pressure at the surface moved in and temperatures rose into the 50s across the snow-free areas. Temperatures remained in the 30s where snow fell, however.

December 24-28: This five-day period was a mixture of pleasant weather and more of the wintry weather found earlier in the month. A few flurries and sprinkles fell on the 24th before skies cleared and temperatures warmed into the 50s and 60s on the 25th. A very quick-moving storm system on the 26th dropped almost a half-foot of snow in east central Oklahoma near Shawnee and Seminole. The 27th was quite chilly as well with more light drizzle and snow. Highs across the state remained in the 20s and 30s. Northern Oklahoma saw another good dusting of snow on the 28th as another upper-level storm passed over the state.

December 29-31: The 29th saw the lowest temperature of the month, -2 degrees, recorded by the Hooker Mesonet site. The rest of the state's low temperatures were from the single-digits to the mid-20s. Temperatures rebounded into the 40s and 50s, generally, with more of the same the next couple of days to end the month.

JANUARY DAILY HIGHLIGHTS

January 1-6: A cold start to the month finally gave way to some warm weather by the fourth. After highs in the 30s and 40s for a few days, strong southerly winds kicked in on the fourth which allowed temperatures to increase into the 50s and 60s. The temperatures skyrocketed on the fifth and sixth. Oklahoma City set record highs both days, 72 degrees on the fifth and 75 degrees on the sixth, and temperatures around the state were 15-20 degrees above normal. Unfortunately, the high temperatures and winds exacerbated wildfire conditions and several large fires ignited on the sixth.

January 7-8: The only real severe weather during January came on the seventh as a dry line moved into western Oklahoma. Thunderstorms fired in the afternoon and marched across the state. Four weak tornadoes touched down in the northeast with little damage being reported. Up to two-inch hail was reported in the northeast and thunderstorm winds across the state gusted to over 60 mph. A 74 mph wind gust was reported by the Adair Mesonet site. Heavy rains were also a problem as flash flooding was widespread in east central parts of the state. The cold front continued to move across the state on the eighth.

January 9-15: The weather calmed considerably following the severe episode on the seventh. The winds were still fairly strong for the next seven days and temperatures moderated into the 50s and 60s for the most part. Skies were mostly clear throughout this period.

January 16-20: A strong cold front greeted the day on the 16th. Temperatures dropped into the 20s and 30s behind the front with some light freezing drizzle to add travel problems to the cold weather. Lows plummeted on the 17th. The Boise City Mesonet site recorded a low temperature of -4 degrees, the coldest measured temperature of the month and the winter. Several other northwestern sites were below freezing as well, with single digits and teens scattered across the rest of the state. The weather remained seasonable, if not below normal, through the 20th.

January 21-27: Another cold front on the 21st generated a round of light freezing drizzle as it collided with milder and more humid air from the Gulf. The cold front meant more seasonable weather for the next few days until temperatures began to moderate on the 25th. A few 60s were recorded in the southern parts of the state, but a few 30s remained in the extreme north. Highs increased on the 26th and 27th into the 60s and 70s.

January 28-31: An approaching upper-level storm system on the 28th kicked winds up from the south at 35 mph as moisture surged in from the south. A fast-moving cold front on the 29th set the stage for a bit of snow in the northwest and winds gusted to over 55 mph behind the front. A few winds of 60 mph were recorded by the Oklahoma Mesonet in northwestern Oklahoma. The 30th was clear and mild with highs in the 50s and 60s. A final cold front was in store for the month's final day with snow and strong winds. The heaviest snow was confined to the extreme northern edge of the state where 5-8 inches fell in localized areas. Lesser amounts of 1-3 inches fell near I-40, while southern Oklahoma was left out of the snowy weather.

FEBRUARY DAILY HIGHLIGHTS

February 1-2: Snow cover from the last day in January left the northern half of the state shivering on the first. Low temperatures ranged from zero degrees at snow-packed Alva to 28 degrees in Wister. Southerly winds returned, however, and high temperatures rose into the 50s and 60s. The morning was a bit milder on the second with lows mostly in the 20s and 30s. Winds died down after the passage of a weak cold front. Temperatures still managed to rise into the 50s and 60s following the front's passage.

February 3-5: A warm front moved north into southern Oklahoma overnight on the third and brought increasing clouds and fog. Lows were in the 20s in the north to near 50 in the south. High temperatures likewise were in the 50s in northern Oklahoma and the 70s in the south. With a warm start, record-setting heat occurred at Oklahoma City, Tulsa and McAlester with highs in the upper 70s and lower 80s. The fifth saw showers and storms develop across the state along a cold front. Some severe weather occurred with the storms, especially in central Oklahoma where high winds and some hail were noted. As the cold front passed, some of that rain turned to light snow in the northwest as temperatures fell 20 degrees.

February 6-9: Typical February weather was in store for the state over the next several days. Some light snow in the north on the sixth and seventh. Highs ranged from the 30s to the 50s after lows in the 20s and 30s. Temperatures warmed a bit on the eighth and ninth with highs reported in the 50s, 60s and 70s.

February 10-13: A cold front moved into the northern parts of the state on the 10th. Temperatures dropped steadily during the afternoon. Highs reached the 30s in the north but managed to rise into the 70s in the south ahead of the cold front. Light freezing rain greeted the state early on the 11th with a few embedded thunderstorms. Accumulations of up to one-half of an inch of ice were reported across the north. The cold front retreated to the north on the 11th as a warm front, triggering another round of storms. Light rain and freezing rain fell north of the front, with storms forming along the boundary late on the 11th and early on the 12th. The heaviest rains were confined to the southeast where one-two inches fell across a broad area. The cold front eventually passed through the state for good on the 12th. Skies cleared that afternoon and high pressure at the surface allowed winds to diminish. Highs were from the 30s in the northwest to the 50s in the southeast. Another clear day followed on the 13th. After a cold start in the teens and 20s, highs rose into the 50s and 60s.

February 14-17: A strong cold front on the 14th dropped temperatures from the 60s and 70s into the 40s and 50s. Light freezing drizzle formed on the 15th in central sections of the state. Showers and storms moved into the southwest that evening. The precipitation began freezing later as temperatures dropped. The heaviest precipitation fell on the 16th, most of it as rain although a bit of freezing rain occurred in the northwest. The rain, which was triggered by an upper-level disturbance traveling through Texas, was widespread for most of the day. A few of the storms were severe. The storms continued overnight into the 17th as the center of the upper-level low moved to the east.

February 18-19: A pleasant respite from the cold blustery days. Mostly clear skies led to morning lows in the 20s and 30s, but afternoon highs rose into the 60s and 70s by the 19th.

February 20-22: Yet another strong cold front visited the state from the north on the 20th. Temperatures in the 40s and 50s were soon replaced with 20s and 30s. Temperatures still managed to reach into the 50s in southern Oklahoma. The cold air express continued into the 21st. Freezing rain and sleet fell in the north and mixed with rain in central Oklahoma. The skies remained gray with scattered reports of freezing drizzle on the 22nd as the storm system moved off to the east. Skies cleared later that afternoon but temperatures remained chilly in the 30s and 40s. A few 50s were reported on the 22nd where the clouds managed to dissipate early.

February 23-24: A quiet period with just a few light rain showers scattered about, lows in the 30s gave way to highs in the 50s and 60s.

February 25-29: Two more cold fronts managed to pass through the state before the month was finished. A strong front on the 25th ruined a day that had temperatures in the 60s and 70s. The winds made for a blustery couple of days following the cold front, gusting to 40 mph. High pressure settled in on the 27th which calmed the winds. Highs on the 28th reached into the 70s over many parts of the state. A weak cold front on the 29th did little to kill the warmth and highs on leap day reached the 60s and 70s statewide.

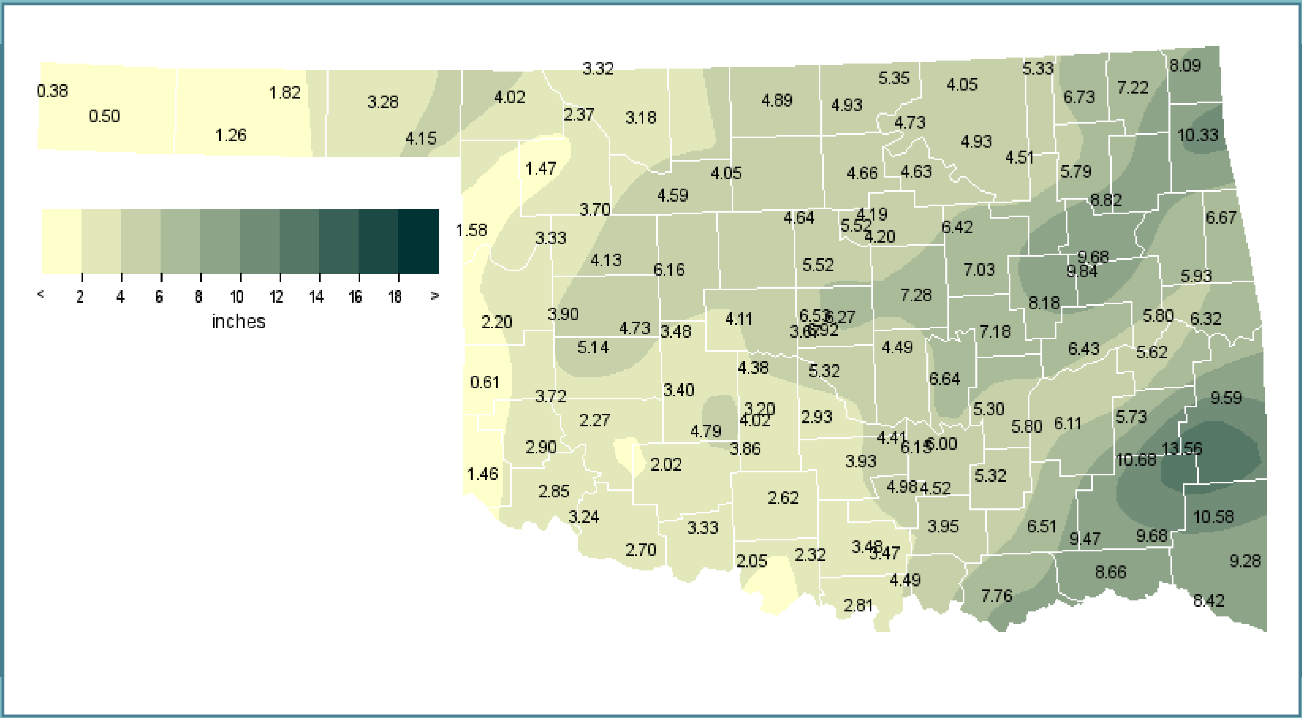
Winter 2007-08 Statewide Extremes

Description	Extreme	Station	Date
High Temperature	84°F	Newport	February 4
Low Temperature	-4°F	Boise City	January 17
High Precipitation	13.56 in.	Talihina	
Low Precipitation	0.38 in.	Kenton	

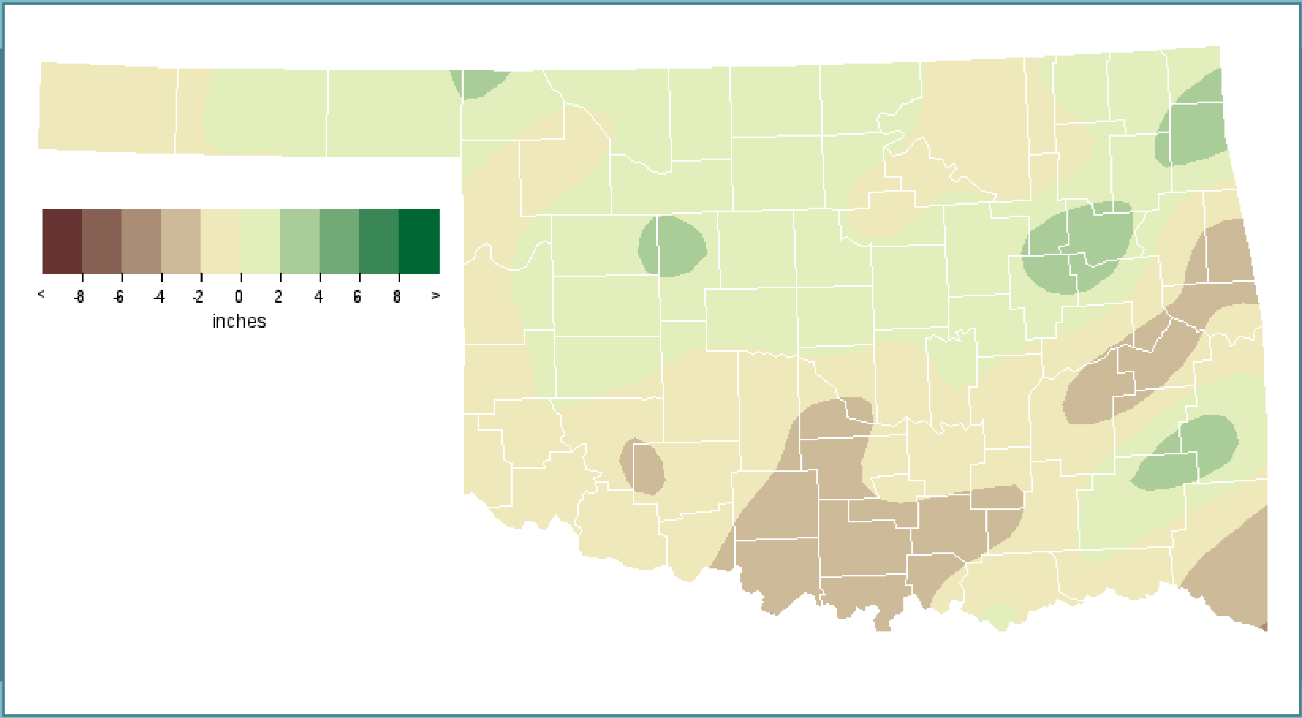
Winter 2007-08 Statewide Statistics

	Average	Depart.	Rank (1895-2008)
Temperature	38.9°F	0.1°F	54th Coolest
	Total	**Depart.**	**Rank (1895-2008)**
Precipitation	4.95 in.	-0.28 in.	53rd Wettest

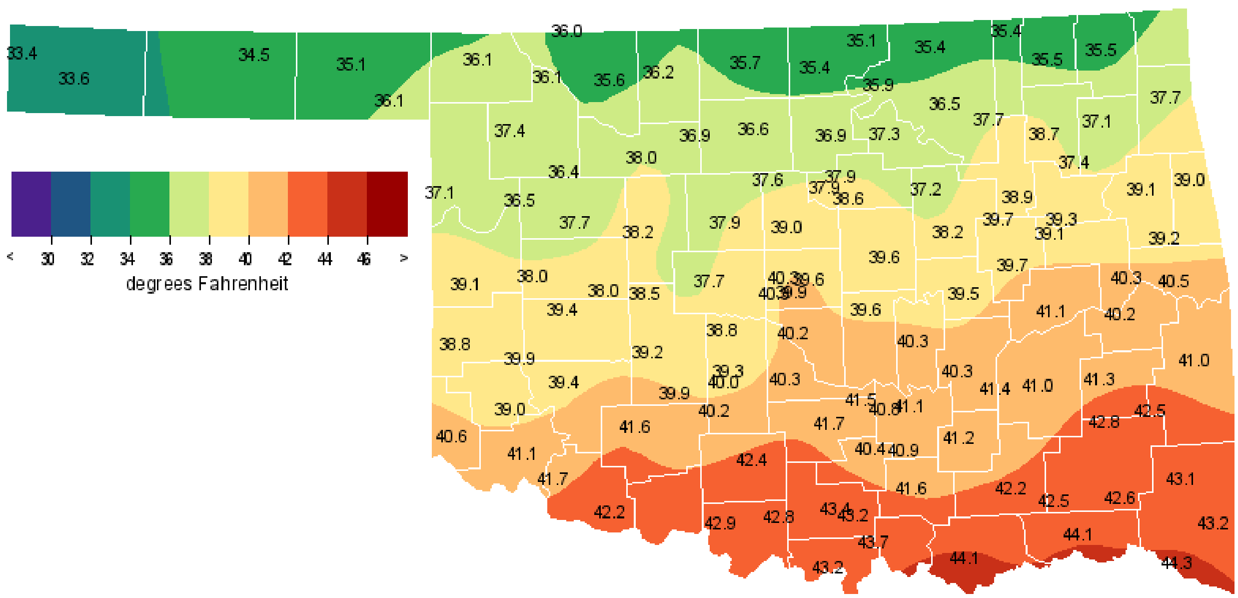
OBSERVED RAINFALL



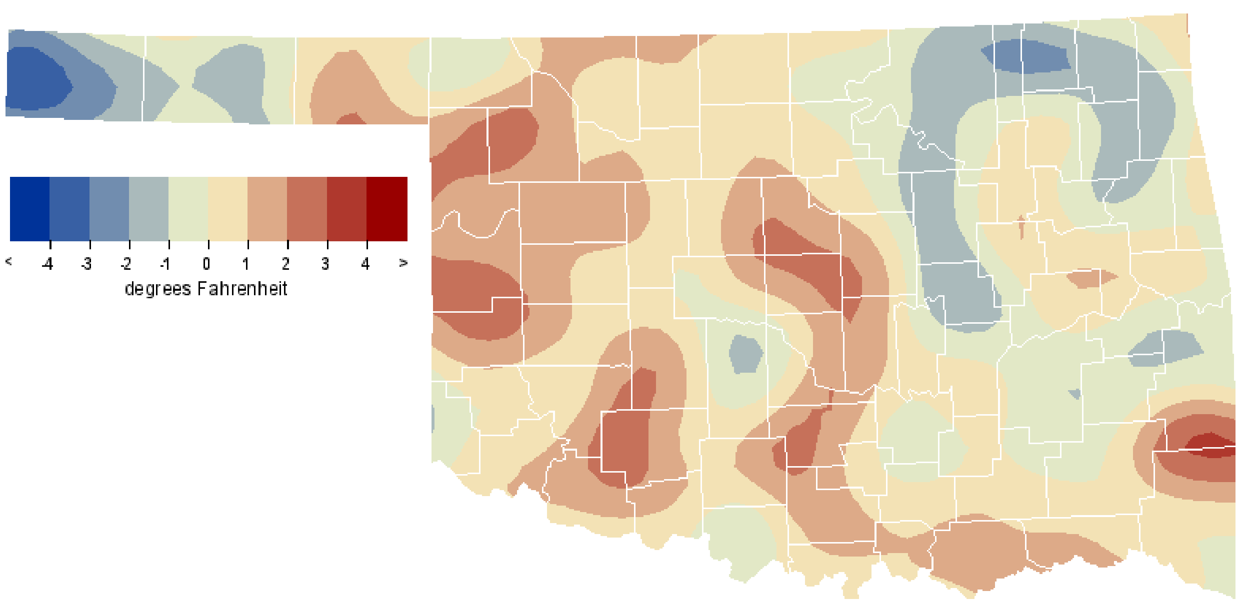
RAINFALL DEPARTURE FROM NORMAL



AVERAGE TEMPERATURE



TEMPERATURE DEPARTURE FROM NORMAL



WINTER 2007-08 MESONET PRECIPITATION COMPARISON

Climate Division	Precipitation (inches)	Departure from Normal (inches)	Rank since 1895	Wettest on Record (Year)	Driest on Record (Year)	2007
Panhandle	2.12	0.26	28th Wettest	5.13 (1960)	0.10 (1904)	4.74
North Central	3.86	0.41	38th Wettest	7.78 (1985)	0.52 (2006)	4.45
Northeast	6.53	0.70	38th Wettest	15.24 (1985)	1.64 (2006)	7.37
West Central	3.77	0.61	30th Wettest	7.83 (1960)	0.21 (1909)	4.73
Central	5.20	-0.04	37th Wettest	13.80 (1985)	0.38 (1909)	5.92
East Central	6.55	-0.99	52nd Driest	14.59 (1938)	1.97 (1918)	9.88
Southwest	2.95	-0.82	53rd Driest	9.05 (1985)	0.14 (1909)	4.41
South Central	4.40	-2.24	35th Driest	13.36 (1998)	0.53 (1909)	7.40
Southeast	9.57	-0.46	56th Wettest	20.47 (1932)	3.13 (1963)	11.34
Statewide	4.95	-0.28	53rd Wettest	10.37 (1985)	1.24 (1909)	6.62

MESONET TEMPERATURE COMPARISON WINTER 2007-08

Climate Division	Average Temp (F)	Departure from Normal (F)	Rank since 1895	Hottest on Record (Year)	Coldest on Record (Year)	2007
Panhandle	35.1	-0.2	50th Coolest	40.1 (2000)	27.1 (1899)	34.1
North Central	36.3	0.0	47th Coolest	43.0 (1992)	27.5 (1979)	36.6
Northeast	37.0	-0.7	40th Coolest	43.9 (1932)	29.4 (1979)	37.8
West Central	38.4	0.8	47th Warmest	43.4 (1992)	29.5 (1979)	37.8
Central	39.1	0.0	55th Coolest	44.7 (1992)	30.8 (1905)	39.1
East Central	40.0	-0.1	47th Coolest	45.6 (1932)	32.7 (1978)	40.4
Southwest	40.3	0.2	55th Warmest	44.9 (1952)	32.4 (1899)	39.8
South Central	42.2	0.2	52nd Coolest	47.6 (1952)	34.7 (1905)	41.9
Southeast	42.8	0.6	56th Warmest	48.4 (1932)	35.3 (1978)	42.3
Statewide	38.9	0.1	54th Coolest	44.0 (1992)	31.2 (1905)	38.8

MESONET EXTREMES FOR WINTER 2007-08

Climate Division	High Temp	Day	Station	Low Temp	Day	Station	High Monthly Rainfall	Station	High Daily Rainfall	Day	Station
Panhandle	76	Jan 28th	Buffalo	-4	Jan 17th	Boise City	4.15	Slapout	1.77	Dec 11th	Slapout
North Central	81	Jan 28th	Alva	0	Feb 1st	Alva	5.35	Newkirk	1.46	Dec 11th	Alva
Northeast	81	Feb 4th	Bixby	2	Feb 1st	Burbank	10.33	Jay	2.75	Jan 7th	Porter
West Central	81	Jan 28th	Butler	2	Feb 1st	Camargo	6.16	Watonga	2.08	Feb 16th	Weatherford
Central	81	Feb 4th	Bowlegs	5	Feb 1st	Marshall	7.28	Chandler	2.54	Dec 11th	Norman
East Central	81	Feb 4th	Calvin	9	Jan 23rd	Cookson	9.84	Haskell	2.63	Jan 7th	Haskell
Southwest	82	Feb 4th	Walters	7	Jan 19th	Mangum	4.79	Apache	1.81	Feb 16th	Apache
South Central	84	Feb 4th	Newport	8	Feb 1st	Sulphur	7.76	Durant	2.14	Feb 16th	Durant
Southeast	80	Dec 2nd	Idabel	9	Jan 20th	Wister	13.56	Talihina	3.37	Feb 16th	Talihina
Statewide	84	Feb 4th	Newport	-4	Jan 17th	Boise City	13.56	Talihina	3.37	Feb 16th	Talihina

AGRICULTURE WEATHER WATCH

BY: Albert Sutherland, CPA, CCA
Mesonet Assistant Extension Specialist
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April in 2008 has seen some cold weather, but nothing like the Easter Freeze of 2007. Two major factors have led to less freeze injury in 2008 than occurred in 2007.

In 2007, crops in northeast Oklahoma suffered widespread damage. Tahlequah was one of the colder sites, with three consecutive nights of freezing temperatures. On April 6, 2007, the low was 28˚F. On April 7, the temperature dropped to 23˚F. The third night, April 8, the temperature fell to a frigid 18˚F.

Figure 1: Hours below 32˚F from April 1 to April 15, 2008

Figure 2: Hours below 32˚F from April 16 to April 30, 2008

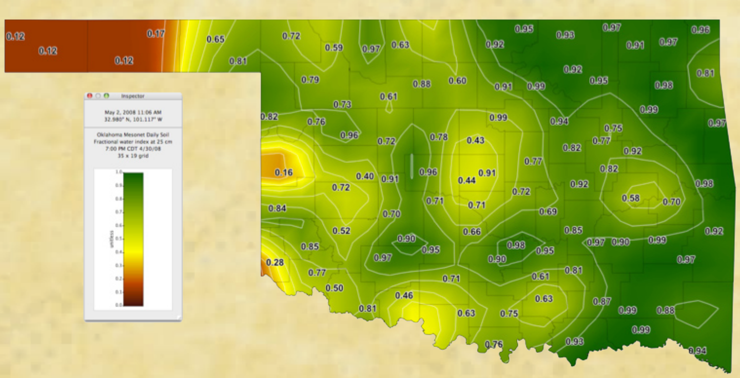

Figure 3: 25-cm (10-inch) Fractional Water Index soil moisture April 30, 2008.

The map in Figure 1 shows the number of hours below 32˚F from April 1 to April 15, 2008. In 2008, the Tahlequah Mesonet site experienced only one night when the temperature dropped below freezing. That was April 14, when the temperature bottomed out at 25˚F. So in 2008, Tahlequah had only one night when the temperature went below freezing and that low was 7˚F higher than the 2007 low of 18˚F.

The other reason the cold in 2008 was less damaging was the difference in March weather. In 2007, March was a significantly warmer month. The March 2007 Oklahoma Monthly Climate Summary noted:

> Oklahoma was significantly warm during March (2007) with all areas of the state finishing in the top three warmest on record, between 6-9 degrees above normal.

The March 2008 Oklahoma Monthly Climate Summary reported air temperatures closer to normal.

The map in Figure 2 shows that during the second half of April 2008 only the Oklahoma Panhandle experienced significant cold weather.

So at the end of April 2008, the Oklahoma crops were in much better condition than the end of April 2007. With record high prices and continued favorable weather through harvest, Oklahoma farmers are hoping to overcome some of the financial damage from wheat losses due to drought in 2006 and flooding in 2007.

Soil moisture at 10 inches on April 30, 2008 (see Figure 3) was adequate for most of Oklahoma. Yet there existed a real need for rainfall in a number of areas of Oklahoma. There were very dry soils in the Panhandle and several areas in western Oklahoma. In addition some locations scattered across central Oklahoma have Fractional Water Index values of less than 0.50. Fractional Water Index is a soil moisture scale of 0 to 1, with 0 being powder dry and 1 saturated.

The Panhandle needed a good soaking rain of more than 2 inches in early May, while a rain of 1 inch or more was needed across the western two-thirds of Oklahoma. The mild temperatures have crops growing well and progressing to growth stages that will require additional moisture.

Pastures for the most part were in good shape at the end of April, with only 12 percent reported to be poor or very poor in the April 28, 2008 edition of the USDA Oklahoma Crop Weather. This same report indicated that soil preparation and planting for most row crops was slightly behind the average of the last 5 years. ■

To access the products mentioned in AgWatch go to Oklahoma AgWeather at http://agweather.mesonet.org. Data on the Oklahoma Agweather Web site is from the Oklahoma Mesonet, managed in partnership by the University of Oklahoma and Oklahoma State University and operated by the Oklahoma Climatological Survey.

BY: ALBERT SUTHERLAND, CPA, CCA
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MAY

- Early May is a super time to plant all of those heat loving perennials and annuals. These plants like warmer soil temperatures and the warmer May weather. While picking out flowering plants at your favorite nursery or garden center, remember to take home colorful foliage plants, such as caladiums and coleus.
- Vegetables that do best planted in May (when soil temperatures are close to 70°F) include okra, southern pea, sweet potato, cantaloupe, and watermelon.
- Bermudagrass will be ready for its second fertilizer application in late May. Consider using a slow release nitrogen product that will give your grass more uniform growth and color, while reducing the risk of nutrient runoff.
- After mid-May, soils are typically warm enough to seed bermudagrass or buffalograss.
- After warm-season lawns have "greened-up" and "filled-in," control broadleaf and grassy weeds with the appropriate weed control material.
- Clean out the water garden. Divide and repot water garden plants.

JUNE

- Fertilize turfgrass areas in mid-June. Apply fertilizer ahead of a good rain or before watering lawn areas.
- Control broadleaf lawn weeds with a product containing 2,4-D hormonal herbicide on days when the air temperature stays below 90°F and the wind will not cause drift to nearby landscape plants. For best results, apply on days following a good rain or watering.
- Control young crabgrass plants with a MSMA product when daytime air temperatures are above 80°F and below 90°F.
- Apply an approved fungicide on tall fescue to control brown patch disease during times of when the nighttime air temperature is consistently above 60°F and the nighttime humidity is above 80%.
- Mulch flower and shrub beds. Use finer mulches around flowers and coarser bark mulches for shrubs and trees. Leave a gap between a plant's main stem or trunk and the mulch.
- Keep an eye out for powdery mildew on ornamental plants and treat as needed.
- Control rose black spot with an approved fungicide.
- Take out weeds while they are still small. The larger the weed the more work it takes to pull or cut.
- Apply an approved fungicide for the pine needle blight disease, Dothistroma Needle Blight.
- Check plants for sucking insect pests and treat as needed.

JULY

- Check plants for water stress and water as needed.
- Control lawn white grubs with an approved insect growth hormone or systemic insecticide product.
- July is a good time for light to moderate pruning of ornamental trees and pines. The July heat helps reduce sap flow from branch cuts. Make your pruning cuts on the branch side of the branch collar to hasten callus growth over the cut surfaces.
- Continue treatments for rose black spot with an approved fungicide.
- Check plants for spider mites and treat before populations get too high.
- Divide and replant hybrid iris.
- Harvest garden vegetables in the morning, the coolest time of the day.
- Prepare and plant the fall vegetable garden. This is the month to plant frost sensitive vegetables, such as sweet corn, cilantro, pepper, and summer squash.

Nicole Giuliano

Focus *on* Fog

Have you ever woken up in the morning and not been able to see your mailbox (or other nearby objects)? Have you noticed that a couple of hours after sunrise, everything is often clear again? Fog typically forms overnight, sometimes hiding objects that are only a few feet away from you. It also usually disappears quickly after the sun rises and warms the earth, creating little air circulations that make the fog droplets evaporate.

Fog forms when the air cools to the temperature at which water vapor begins to condense into tiny water droplets (this is called the dewpoint temperature). This is also how clouds form, so fog is actually a cloud that is near the ground. If the air temperature is within 5 degrees Fahrenheit of the dewpoint temperature and the air is getting colder, fog may form. This is why fog is more common at night—the air near the ground cools when the sun is not warming the surface of the earth.

For the most commonly occurring fog, ideal conditions usually include nearly calm winds, clear skies, and a low-lying location (such as a river valley). Not surprisingly, the foggiest place in the United States, Cape Disappointment, Washington, is near sea level. This foggy spot is located at the mouth of the Columbia River, and it averages 2,556 hours of heavy fog each year.

There are four main types of fog: radiation, advection, evaporation (or mixing), and upslope fog. Cooling of the Earth's surface produces the first type of fog—radiation (or ground) fog. As mentioned above, the ground cools at night since the sun is not warming it. While the ground cools, the temperature of the air just above the ground cools to near the dewpoint temperature. This "meeting" of the air temperature and dewpoint temperature leads to water vapor condensing into tiny liquid droplets, and produces radiation fog. Most of the fog that we experience in Oklahoma is radiation fog.

Figure 1 - Radiation Fog

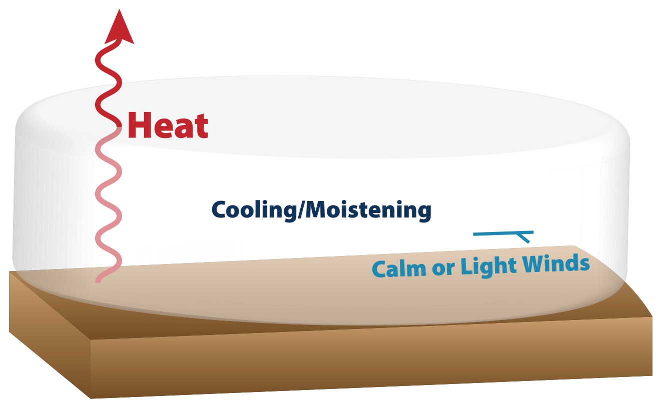
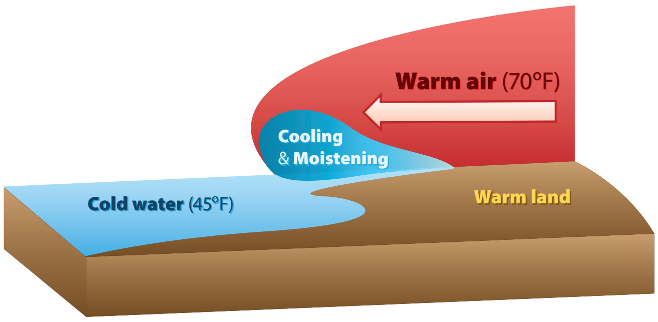


Figure 2 - Advection Fog



The second type of fog, advection fog, occurs when warm, moist air blows over a cold surface. The warm air is cooled from below and the air temperature drops down to near the dewpoint temperature, creating fog. Unlike radiation fog, advection fog requires wind and can form even when winds are strong. An example of classic advection fog is the fog that often forms near the Golden Gate Bridge in San Francisco. Though it is more rare than radiation fog, advection fog can also be found in Oklahoma. When warm, moist air from the Gulf of Mexico moves over cold land, it can produce advection fog that slowly rolls into the state.

Continued >>

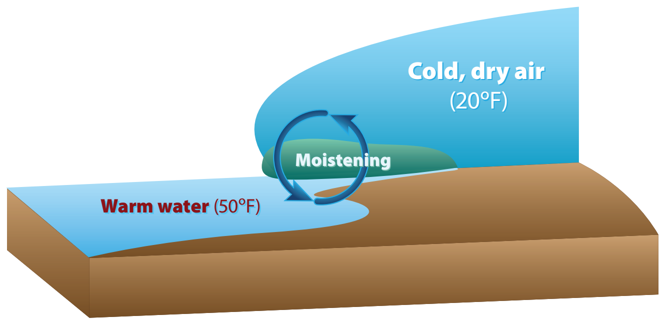
Evaporation fog, the third fog type, happens when moist air mixes with cold, dry air to form a low-lying cloud. An example is steam fog, which forms when cold air blows over warm water, such as a lake. Water takes a lot longer to warm up or to cool down than the land, so it is not unusual in the winter for lakes to have a warmer temperature than the nearby land. Liquid water evaporates from the body of water, becoming water vapor (a gas) and increasing the moisture in the cold, relatively dry air mass. More moisture in the air increases the dewpoint temperature, which means that the air temperature does not have to fall much to reach the dewpoint temperature. Since warm, moist air is less dense ("lighter") than cold, dry air, the warm air rises into the cold air, which gives the appearance of "steam." Steam fog occurs occasionally on Oklahoma roads, over lakes and streams, and in cold air near fronts.

The fourth and final type, upslope fog, forms as moist air flows up a hill or mountain. Moist air is forced upward, so that it rises, expands, and cools. If its air temperature reaches the dewpoint temperature, fog forms. A dramatic upslope fog can sometimes be seen on the eastern side of the Rockies, where there is a large change in elevation. However, even less steep terrain features, such as the Wichita Mountains of Oklahoma, can be sufficient for upslope fog formation.

In general, fog is considered to be a nuisance, especially when it comes to driving. When a car enters a foggy area, a driver should slow down due to reduced visibility. Unfortunately, there is a high risk that a careless driver may rear-end the slow-moving vehicle because he or she cannot see the vehicle ahead. To increase visibility and to reduce the amount of scattered light reflecting back, a driver should use the low beam rather than the high beam lights. Fog is also a hazard for ships and airplanes, which have difficulty navigating in low visibility conditions. In fact, to avoid accidents, many airlines delay or sometimes even cancel flights when fog becomes too dense.

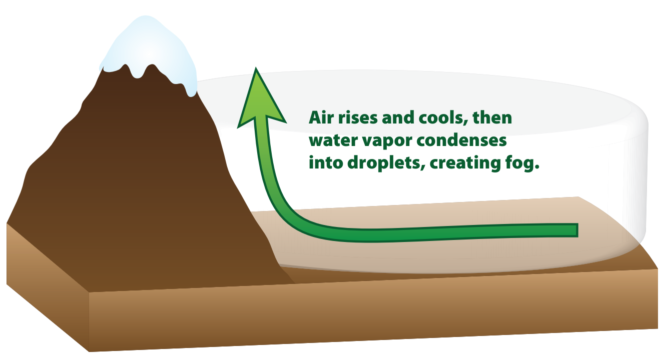
Classroom >>

Figure 3 - Evaporation Fog



The warm air over the water and the cold air above mix, and finally end up at nearly the same temperature. At the same time, the air becomes saturated as the dewpoint temperature rises due to the increase in moisture.

Figure 4 - Upslope Fog



Nicole Giuliano

Questions

1. How many days does Cape Disappointment experience heavy fog?
   (Hint: convert 2,556 hours to days. Remember, there are 24 hours in 1 day.)

2. Look at the fog graphic "Mean Annual Number of Days with Fog" on the following page.
   What geographical locations experience 25 or more days of fog per year?

3. Why do you think these areas have so much fog?
   (Hint: look at the ideal fog conditions as well as the four major types of fog.)

4. According to the fog graphic, how many days of fog per year does your part of the state see (e.g., central Oklahoma)? Is it more often or less often than you expected?

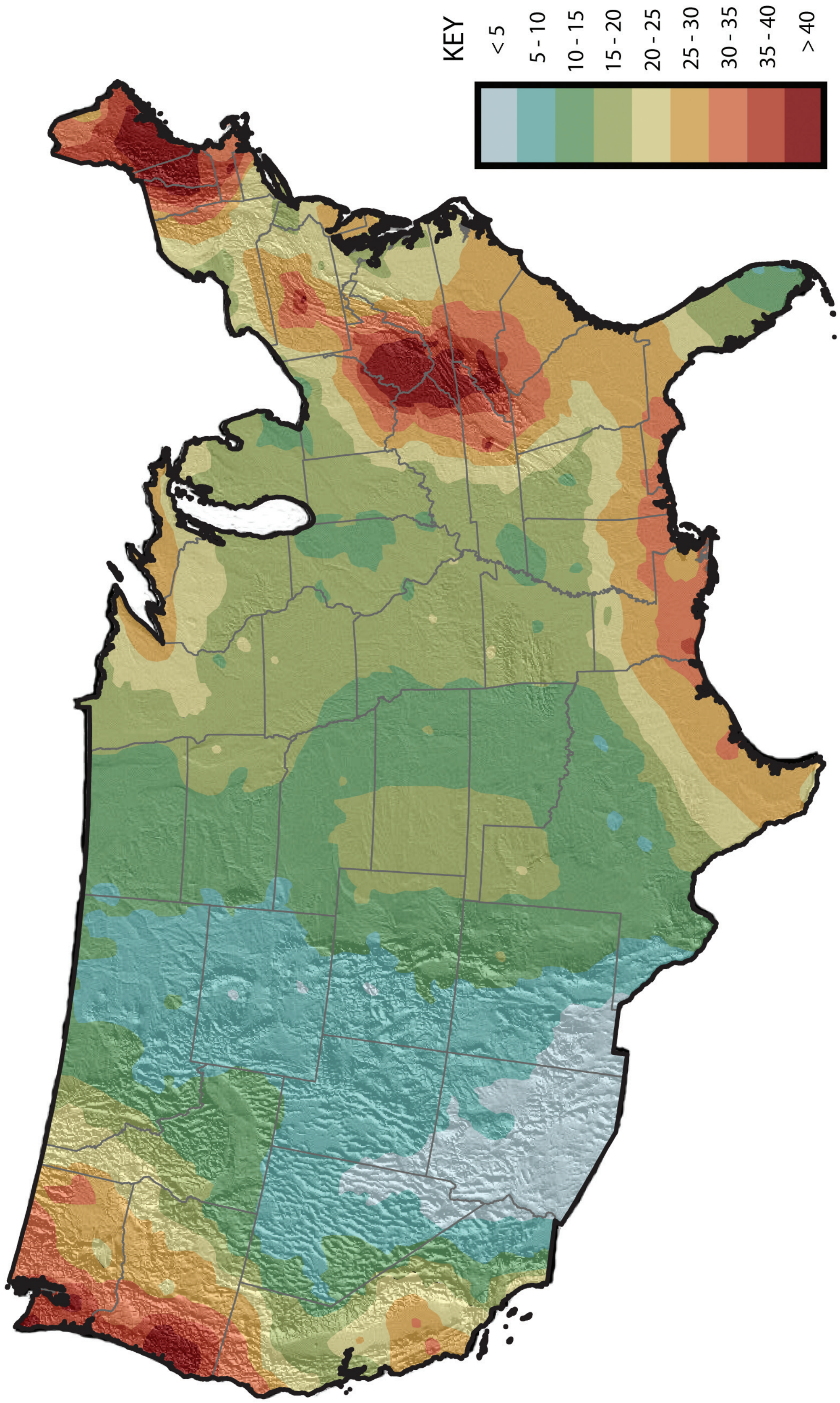
5. Why do you think that Arizona, western New Mexico, and southeastern Nevada have fewer fog days?

6. What is one possible reason why there is so much fog near the Appalachians,
   but not as much near the Rocky Mountains?

Answers on page 7

Classroom (Fog Map) >>

■ **Figure 1 - Mean Annual Number of Days with Fog** (< .25 mile visibility)



How did you celebrate Earth Day?

Did you plant a tree? Did you walk your soda can down the hallway to the recycle bin instead of placing it in the trash can by your chair? Did you spend a day at the Oklahoma City Zoo with over 5,000 4th and 5th grade students?

by Andrea Melvin
Outreach Program Manager

If you weren't involved in the latter, you don't know what you are missing. Seven full-time employees of the Oklahoma Climatological Survey (OCS) along with two summer interns from France and one University of Oklahoma undergraduate student joined over 200 other federal, state, and non-profit employees at the 7th annual ScienceFest Oklahoma held at the Oklahoma City Zoological Park and Botanical Garden on April 24, 2008. ▶

ScienceFest Oklahoma is an annual event to celebrate Earth Day. The event is designed to foster scientific literacy while educating children about protecting the environment, conserving natural resources, and using alternative fuels and technologies. Environmental Educators create a day-long event packed with exciting exhibits, presentations, and hands-on demonstrations all developed to show the importance of scientific applications in the environment. The hands-on demonstrations use basic geology, biology, physical science, health and environmental sciences to teach the children how these impact everyday life.

Andrea Melvin, Program Manager for EarthStorm, has served on the ScienceFest Steering Committee for the past three years. Andrea attended monthly planning meeting to discuss issues ranging from volunteer recruitment and training to registration to parking buses. This year the committee had a special meeting to discuss a "weather plan" in case of wet weather (ScienceFest committee members are not allowed to use the r-word, r-a-i-n.). Andrea recruited and organized the activity stations. Nicole Giuliano, an Outreach Program Manager, helped recreate and modify the ScienceFest map which showed where each activity station was located within the Zoo. ScienceFest 2008 provided 38 activity stations for participants to visit throughout the day. Activities ranged from mining to water conservation to wind power.

Ryan Davis, Graphic Artist; Brad Illston, Research Associate; Dr. Jeff Basara, Directory of Research; along with Maxime Renoux and Arnaud Rival, OCS research interns from the University of Limoges in France operated activity station #35 My Storm Scale. Using a small portable weather station, students used a lid from a storage container to create a wind. The weather station recorded the wind observation. The student's wind observation was then converted to an Enhanced Fujita Scale value to determine the student's tornado value. For example, a student creating a wind of 0-2 mph was given tornado value of EF0. Students received a tornado stamp along with a stamp of their F-scale value. This brought out a competitive streak between the students and the adults.

Dr. Basara reported "They definitely got into trying to be as strong of a tornado as possible and for a while, we had kids 15+ deep waiting their turn to give it a shot. We also had some fun with the adults who tried it out and somehow only managed F0 ratings (the kids loved that). A few of the kids who were disappointed with their ratings began to heckle Brad."

OVERHEARD

Brad Illston: **"Are you heckling me?"**

Kid 1: "Yes, because you stink."

Kid 2: "Man, they gave me an **F0** just to make me look bad."

Kid 3: "This is the **best booth** here!"

Kid 4: "**I'm an F5! I'm an F5!** WOOooOoOooo aaaAAHHHHH!" (said while jumping around and screaming)

Kid 5: "Look! I got an **F4**."

Ryan Davis: "Awesome, according to the scale you are a **devastating** tornado!"

Kid's Mom: "That would be ***her***."

"I got pretty beat up yesterday: moving tables, slinging hot dogs, and most of all, the FORCEFUL high-fives I got from kids on the way to the bus. It was totally worth it!"

Other OCS staff signed up to be general volunteers and were assigned fun jobs like the gauntlet, condiment engineer, or placed on recycle detail. Dr. Mark Shafer, Director of Climate Services, was an important member of the gauntlet. The ScienceFest Gauntlet was a wall of volunteers who provide a safe walking lane from the Remington Park Parking lot to the Zoo entrance. The gauntlet was made visible by their matching lime green ScienceFest t-shirts. Mark had a great view of the growing number of buses in the parking lot. He was one of the first volunteers to greet students as they began their trek to the Zoo and one of the last volunteers to receive the high-fives as students loaded onto the buses.

Derek Arndt, Assistant State Climatologist, "I got pretty beat up yesterday: moving tables, slinging hot dogs, and most of all, the FORCEFUL high-fives I got from kids on the way to the bus. It was totally worth it!"

Jennifer Brooks, Lindsay Elementary School, "I wanted to thank you for the wonderful day. My students really enjoyed themselves. And they came back telling me about all the different things they saw and learned. This is my third year going to ScienceFest and I see something different every year. I really think this program is wonderful. Thank you again for all you do."

John Odgers, Oklahoma Bioenergy Center, "What a fun day! Thank you so much for letting us participate, and be sure to include the Oklahoma Bioenergy Center on the list for next year. Our location was great, too. All the volunteers were awesome and helpful, and the kids were fun and amazing. The weather was near perfect all day long. (okay … a little less wind would have been nice) Anyway, just wanted to thank you again for a great day! Please pass along our appreciation to everyone who helped make this happen."

So if your Earth Day didn't end with sore feet from walking all over the Zoo and sore hands from 5,000 high-fives, then join us at the Oklahoma City Zoo next April for ScienceFest 2009.

Financial support of ScienceFest Oklahoma was provided by the Oklahoma Department of Environmental Quality, OGE Energy Corp., Office of the Secretary of the Environment, and the Oklahoma Department of Commerce to cover the cost of Zoo admission for 5,000 students and 1,000 chaperones, two Fin and Feather shows, lunches for participants and volunteers, along with volunteer and presenter t-shirts.

Extreme Weather:

Tornado Myths and Myth-Conceptions

Andrea Melvin – Outreach Programs Coordinator and
Gary McManus – Assistant State Climatologist

As with any type of myth or legend, those of the weather variety can be quite entertaining. Who knew that sticking a knife in the ground in front of a tornado would cause it to split and bypass your area? Of course, with Oklahoma's proclivity for weather extremes, some of those myths can lead to disaster if taken at face value. When it comes to weather safety, it's always important to separate fact from fiction. And remember, if a tornado hits while you are reading this, don't bother opening any windows...TAKE COVER IMMEDIATELY!

True or False: People caught in the open should take shelter under overpasses or bridges.

False! Do not take shelter under overpasses or bridges. A wind tunnel forms under the overpass piling up debris which can injure or kill anyone underneath.

True or False: Areas near lakes, rivers, and mountains are safe from tornadoes.

False! No place is safe from tornadoes. In 1987, a tornado near Yellowstone National Park left a path of destruction up and down a 10,000-foot mountain, crossing the Continental Divide. The tri-state tornado of March 18, 1925, crossed the Mississippi River undeterred. The Salt Lake City tornado of August 11, 1999, crossed a canyon, descending one side and rising up the other. Indian burial grounds, lakes, rivers, or mountains do not deter tornadoes.

True or False: The low pressure associated with a tornado causes buildings to explode as the tornado passes overhead.

False! Air pressure in a tornado does not cause buildings to explode. Buildings are damaged by violent winds associated with a tornado and by the debris blown at high velocities by a tornado's winds. In most cases, building damage is caused when the roof is pulled off and the walls collapse.

True or False: Windows should be opened before a tornado approaches to equalize pressure and minimize damage.

False! You should leave the windows alone. The most important action you can take is to go immediately to your tornado safe place. Damage happens when wind gets inside a home through a broken window, door, or damaged roof. Keep the windows closed and stay away from them. Flying debris could shatter the glass and cause injury.

True or False: The southwest corner of a building is the safest place to be during a tornado.

False! The southwest corner is no safer than any other corner. If tornado winds enter the room, debris has a tendency to collect in corners. When selecting a tornado safe place, look for a place on the lowest level and away from windows – a basement or storm cellar is best.

True or False: If you are driving and a tornado is sighted, you should turn and drive at right angles to the tornado.

False! Many people are injured or killed when they remain in their vehicles during a tornado. If you are in a vehicle during a tornado, the safest thing to do is go to a nearby sturdy building and go inside to an area on the lowest level without windows.

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