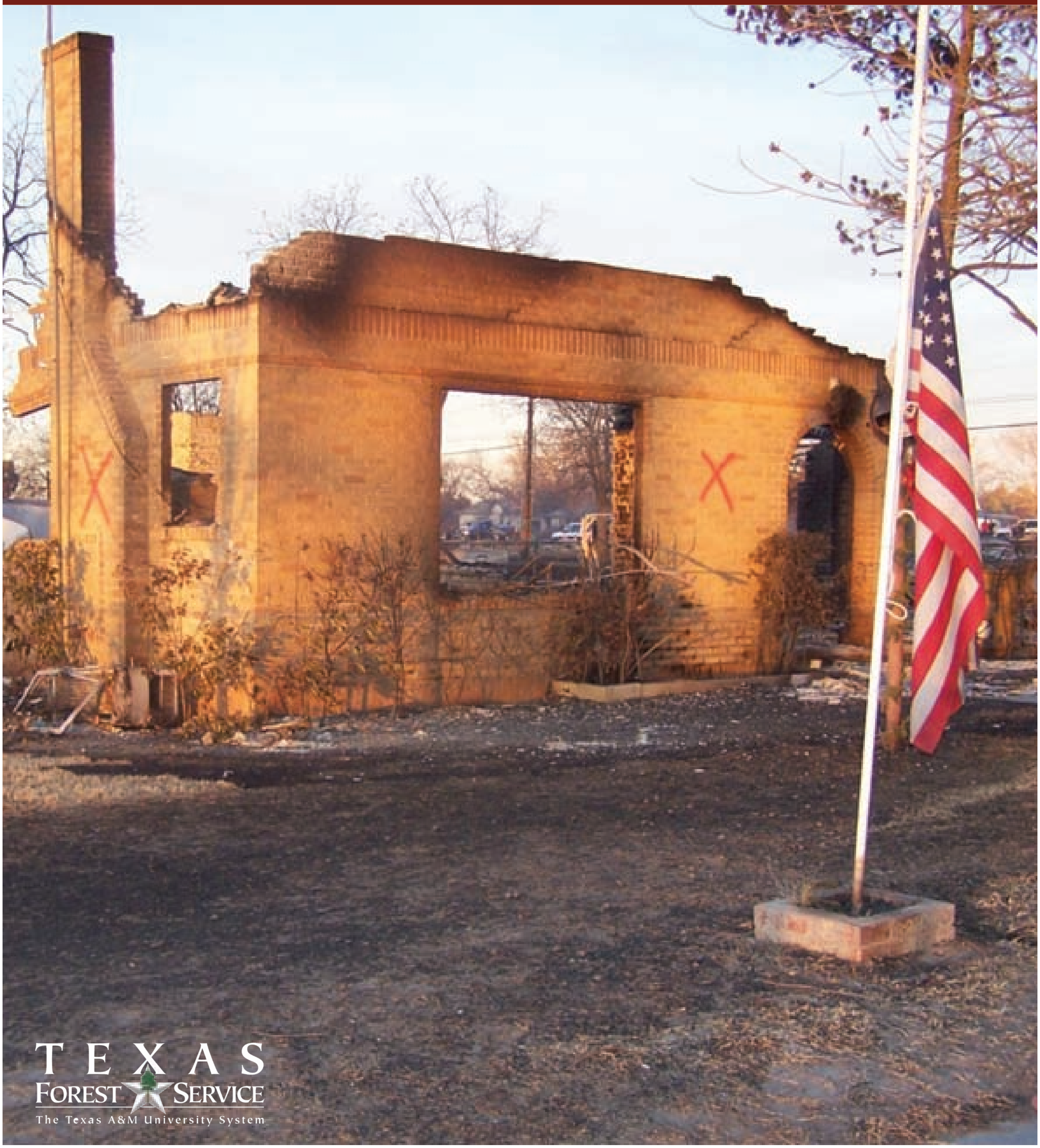
Cross Plains, Texas Wildland Fire Case Study



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TEXAS FOREST SERVICE
The Texas A&M University System

Abstract

On December 27, 2005, a devastating wildland fire raged across the northern plains of Texas. On this day, the town of Cross Plains was decimated by this fire. Like so many fire seasons across the western U.S., homes, communities and lives are increasingly impacted by these fire events. In contrast, the Cross Plains event happened in a seemingly unlikely place. The town is not surrounded by thick overgrown and over-mature forests. Nor is it located in steep, mountainous country. There are no expansive acres of public lands adjacent to the community. The town is not ripe for a fire catastrophe because of having homes of shake shingles.

So why then was Cross Plains a catastrophic urban wildland interface fire? To answer this question, Texas Forest Service conducted a case study of this wildland fire event.

First we must understand that Cross Plains was but a moment in a fire season that totaled 515 days in length. This season resulted in the loss of 734 homes and 1,320 other structures, and it took the lives of two firefighters and 17 civilians. The case study team reviewed several other significant interface fires in this fire season, and summaries of those events are included in the study. The main body of the report will, in fact, center on the events of December 27 and the days following the fire.

The case study team was tasked with understanding how the interactions of the fire environment and the community led to the destruction of homes, property and lives in Cross Plains. To do this, the team studied the fuels in and around Cross Plains, the weather prior to and during the event, and the structures that were impacted by fire. Detailed information on these topics and interactions are included in the main body of the study.

Fuels: The majority of fuels impacting the area were grasses. These grass fuel loadings were elevated due to changing land practices as well as a vigorous spring and summer growing seasons. Within the community, fuels were mainly short grass associated with suburban lawns and landscapes.

Weather: The above-average rainfall of spring and summer 2005 started to taper off in early fall. By November 2005, drought conditions were starting to escalate. For the month of December the area only received 10% of its normal precipitation. From September to December 2005, the area had only received 17% of its normal rain fall. On December 27, these drought conditions were magnified with a critical fire weather event. A cold front and corresponding dry line would result in winds in excess of 29 mph with gusts to 38. Relative humidity (RH) would plummet to 12%. These conditions resulted in extreme fire behavior, with some areas having flame lengths in excess of 30 ft. and spread rates exceeding 324 ft/min.

In order to understand how this fire environment impacted the community, the area was divided into seven study areas. Within these areas, detailed information was gathered on fuels and structures. Fire modeling programs were used to determine fire behavior outputs for each area. To determine the factors that allowed structures to ignite, a reverse risk assessment approach was used. This allowed the team to trace back the ignition pattern and sequence on the structure. A correlation was then drawn to determine which wildland fire behavior factor most influenced the ignition of the structure.

Three main areas of construction on the homes were reviewed. Of the 85 single-family homes lost, 93% had composite roofing and 7% had metal roofs. Wood siding was found on 85% of the homes lost. Surprisingly, 15% of the losses had brick siding. Pier-and-beam foundations were associated with 74% of the homes lost and 26% were on slab foundations. In addition to the 85 homes, 25 mobile homes were also lost. The majority of these homes were set on blocks, had vinyl siding and composite roofs. On the surface, the majority of the lost homes appeared to be somewhat fire resistant, having non-combustible roofs and a low amount of wildland fuels around the structure. A closer look revealed that many of the ignitions were the result of embers collecting under the unenclosed portions of pier-and-beam foundations. The majority of structures had some sort of deck or other combustible attachment. These collected embers and ignited, allowing fire to make entry to the structure. Finally, exposed openings and allowed for the collection of embers and heat to enter structures, resulting in interior ignitions.

Conclusions

The Cross Plains fire resulted in the loss of 85 single-family homes, 25 mobile homes, six hotel units and the First Methodist church. This was a devastating event for the community. The case study pointed out some key “take homes” to lessen the impact of losses from future wildfire events of this magnitude. With changing land uses, fuel concentrations will continue to build. This is true for not only communities in brush and timber areas but for grasslands as well. As Texas continues through the current drought cycle, we will most likely experience more of these types of interface fires. To effectively prevent devastating loss to a community, homeowners must become informed on measures to implement in the home ignition zone. Community leaders must develop and implement Community Wildfire Protection Plans (CWPP). Local response agencies must train for, and plan and execute a rapid coordinated response to all wildland incidents. Continued fire occurrence is assured; it will take cooperation and action from homeowners, community leaders and response agencies prior to a wildland event to most effectively protect homes and lives in the interface.

I would like to thank Mike Dunivan, Justice Jones and Karen Ridenour for their dedication and diligence in the reviewing of the data and assembling it into the text of this case study. Also, my thanks go to the rest of the WUI team who spent countless hours in gathering the information and developing the theories found within.

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Dedication

Unfortunately, the fire came too fast and furious to evacuate two residents — Maudie L. Sheppard, who lived on County Road 421, and Maddie Fay Wilson, who lived on 8th Street. Sheppard, 95, was bedridden and her family was unable to reach her in time. Wilson, 67, was a retired schoolteacher who was trying to escape when the firestorm consumed her home. We want to extend our thanks to all of the emergency personnel, volunteers and families that contributed their time and efforts to help all the families in Cross Plains.

Introduction

The early Earth had plenty of sparks. Even today lightning is a more than ample source of ignition. But these bolts have to strike something that will burn. An ignition, of course, is not the same as fire. Not every spark takes, not every fire can propagate. Human firebrands are most effective in dry biomes, where fire already existed or where the conditions for fire was present but lacked a suitable spark. Thus, people have favored fire-prone places to live and have shunned sites hostile to flame (Pyne).

Census data reports that in 1790, the population in the United States had reached 3,929,214, with 94.9% living in a rural setting and 5.1% living in an urban setting. Perhaps the single demographic fact most descriptive of social change in the United States is the constant increase in urbanization reported in every census since 1820. The rate of growth of the urban population has consistently exceeded that of the rural population (*Population Index).*

Across the United States as we continue to see small cities becoming larger, hectic and no longer quaint, many families are opting to move into developments surrounding these expanding cities in order to prolong the aesthetic beauty and natural surroundings of the geographical area. The interaction of these natural lands with human development consequently introduces significant implications for both the surrounding wildlands and community. This “community-meets-wildland” relationship constructs an environment where fires can move rapidly between vegetation and structures. Known as the Wildland Urban Interface (WUI), these communities have recently become of interest due to the large number of homes lost to wildland fire events. Due to terrain and natural vegetation, protection of these structures is more demanding. This continues to be the common sentiment when addressing WUI issues across the United States as the number of wildland fire events increase.

As we study the aftermath of devastating wildland fires which burn thousands if not millions of acres, destroy homes and take lives, the key components have been the re-examination of **the fuels** commonly described as heavily forested or thickly vegetated, **the topography** portrayed as steep, or mountainous, and finally **the weather** which is excessive and unusual for the area. The following is a synopsis of a typical wildland fire in a forested urban wildland interface community:

Tunnel (Oakland-Berkeley Hill, California) Fire – On October 20, 1991, a fire originated on a steep hillside in a box canyon above Highway 24 near the entrance to the Caldecott Tunnel. The weather conditions of east winds in excess of 65 mph, record high temperatures, and dense groves of damaged Monterey pines and eucalyptus trees were conditions for a major disaster (Parker 1992). Combustible construction materials played a role in the devastating effects of the fire. Specifically, the combustible materials used for porches, siding and roofing finish were identified. Roof construction varied and included asphalt shingles, ceramic tiles and untreated wood shingles. The vast majority of the homes had combustible roofs. Many of the roofs were flat, allowing burning embers to collect, or sloped with overhanging eaves allowing the underside to be exposed to burning vegetation. Other noteworthy points about the residential construction include:

1. *Most of the townhouses in the community were connected, allowing the fire to spread, largely due to the spacing of units.*
2. *Double-pane windows appeared to resist breakage, reduced the transmission of radiant energy and helped protect the interiors of the homes, even in areas of maximum fire intensity.*
3. *Homes built on slopes had open area under the homes ,allowing exposure to flame fronts and radiant energy. Wood decking facing the slope allowed for a clear path to the homes.*
4. *The contribution of wood framing to the overall spread of the fire was insignificant compared to the role of easily ignitable vegetation, combustible roofing and siding. Failure of wood framing led to structural collapse, but only after a long and intense exposure. (Parker 1992).*

The key parallels in catastrophic fires are the characteristics of being in heavy fuels, fluctuating topography and extreme fire weather conditions. High heat outputs from flaming fire fronts leave vulnerable homes having a propensity to ignition. Follow-up investigation of severe fire events needs to examine the capability of any individual fuel type as an intense ignition mechanism, regardless of the composition of vegetation. Heavy fuel loading in fine flashy grass environments needs to be acknowledged as capable of being significant in leading to disastrous wildland fires when compared in discussions to thick brush or timber fuels. Even with no topography, homes placed in miles and miles of flat prairies and rangeland are just as likely to ignite as homes in heavily wooded forested areas. In grass fuel types, it is just as important to focus on structure ignitability from a flaming front — not necessarily a 200-foot front, but a six- or eight- foot flaming front of a grass fire. Fires in prairie lands can move 400 to 600 ft/min with the potential for just as many losses occurring in this fuel type as the areas with heavier concentrations of fuels. The following rangeland wildland fires occurring in Texas establishes the need to acknowledge fine flashy fuel as presenting an equal threat to homes as wildland interface fires in timber and brush fuel types:

Big Country Fire – Late Thursday morning, March 10, 1988, two grass fires were burning in Callahan County, Texas, north of the Clyde community. Winds of 30 mph and RH in the 20s allowed these two fires to spread rapidly and eventually produced a full blown range fire. An approaching cold front during the event created wind shifts of almost 180° and RH to drop to 11%. Predominantly ranch land with scattered homes, in the end more than 366,000 acres of winter feed grass were destroyed along with 300 head of livestock, agriculture equipment and oil field damage.

Poolville Fire – During the unseasonably hot and dry February of 1996, Poolville, Texas was ablaze. At 08:00 on February 22, 1996, a large grass fire near the small town of Poolville, located about 35 miles northwest of Fort Worth, was reported. Fueled by 25 mph winds and 90º temperatures, the small rural volunteer fire department was overwhelmed by the blaze that destroyed more than 20,000 acres of agricultural grassland. By 23:00, 65 homes had been destroyed as well as 90 structures such as barns and outbuildings. The final report showed 52 minor injuries of firefighters and civilians (http://firechief.com/mag).

Attempting to comprehend the events of large wildland fires with individual case studies is equivalent to trying to understand a novel by reading individual random chapters. Each wildland fire event is a single observation of a multipart procedure; many observations of similar events are needed in order for patterns to emerge. However, careful examination of even a single fire can yield insights into the underlying physical processes.

The purpose of this case study is to accurately and objectively record and document findings relating to the incident as they pertained to local weather parameters and local fuel types in the geographical area, and to analyze the common denominators that led to home losses in the study area. It is the goal of the case study team to raise the level of awareness in regard to current messages available to homeowners and the need for them to be individualized by each community at risk. This investigation was conducted through a reverse risk assessment methodology. This assessment system is a process for determining the most probable cause of a home's ignition during a wildland fire event. Individual homes destroyed and damaged were evaluated with regard to construction, combustible materials on site, defensible space and landscaping, adjacent wildland fuels and fire behavior by working backward to determine the most probable cause of ignition. In some instances, the cause of home ignition is obvious, for others you have to make an "educated assumption" as to what the most likely cause was for ignition. This "reverse" methodology of home assessment provided insight on the wildfire events resulting in the development of strategies to lessen future losses, establish liaisons and minimize the impacts of wildfires on people and property in grassland type urban areas.

Texas

The challenge of managing wildland fire in the United States has dramatically increased in complexity and magnitude over the last four decades. Large wildfires now threaten millions of acres, both public and private, particularly where vegetation patterns have been altered by development, land-use practices and aggressive fire suppression.

Texas is the largest state in the mainland forty-eight, second only to Alaska in total land mass. This translates into 160 million square miles of potential fire risk, comprising many varieties and combinations of vegetation that can be conceived. Climatic extremes such as drought, abnormally high temperatures and high winds exacerbate what can already be a volatile situation. Include 22 million Texans into the equation, and you have a good cause for apprehension in the face of a significant fire season. Potential for fire, along with historical fire occurrence, gives cause for seeking changes at all levels of the state to raise public awareness of wildfire risk in the ever-growing urban wildland interface.

Historically, 1950 was considered one of the worst fire seasons in the state of Texas. At that time there were only 7,711,194 individuals living in the state (30 individuals per square mile). Texas' population projections on July 1, 2005, were reported at 22,775,044 (81 individuals per square mile) and projected to increased to 33,317,744 (127 individuals per square mile) by July 1, 2030. With a land area of 261,797 square miles of land, Texas is a big area to protect. Urban wildland interface communities attest to comprise 40% of the state's land area. Texas Forest Service survey data shows there are an estimated 1,497 volunteer fire departments, 236 combination fire departments with part-paid and part-volunteer, and 119 fully-paid departments in the state available to respond to these urban wildland fires. Many of these departments lack training in wildland firefighting in the urban wildland interface and have equipment priority needs for wildland personnel protective equipment, brush trucks and communication equipment. These limitations impact these agencies' abilities to assist in large complex wildland wildfires.

The state has seen some of the most extreme fire seasons on record within the last 10 years: 1996, 1998, 1999, 2000, 2001, 2005 and 2006. Historical trends appear to follow 30-year cycles of drought and subsequent extreme fires throughout the state. Based on projections of this climatic cycle, Texas is estimated to be ten years into the next 30-year cycle. This would correspond to the above-mentioned 10-year period of extreme fire seasons. In a declaration released by the Association of Fire Ecology, it was stated that climate changes will limit human's ability to manage wildland fires. "Under future drought and high heat scenarios, fires may become larger, more quickly moving and be more difficult to manage." Fire ecologists are now more frequently seeing wildland fire conditions previously considered rare.

2005 -2006 Winter Case Study Fires

Between December 2005 and April 2006, a total of 669 wildland fires raged across Texas, taking 17 lives, burning 1.6 million acres and destroying hundreds of homes (Weaver 2006). Where were these homes? They were not suburbs of surrounding cities, but instead in small rural communities, many established in the 1800s. During the 2005-2006 fire season, 85% of wildland fires occurred less than two miles from interface communities. The losses occurred in heavy fuel loads of flashy fine grasses with a flaming front of 6-8 ft., unlike complementary interface losses in heavy shrub and timber fuels with 200-foot flame fronts.

The North Texas Panhandle was the setting for six of these large devastating fires taking place from December 27, 2005, to January 9, 2006. The focus of the case study is the Cross Plains fire; Cross Plains provided the most comprehensive data and therefore is the primary fire in the study area evaluated. However, data is provided and comparisons are made with regard to all the fires within the study area. Within this two week time period, 287 homes were lost, 91,630 acres lost and, unfortunately, two lives were also lost. The other fires will be referenced throughout sections of the case study due to the correlations between losses occurring in similar fuels types and scenarios.

The following chart and map give the locations of the fires within Texas counties, along with acres and homes lost, during each wildland fire event from December 27, 2005 – March 12, 2006.

Fire Name	Acres Lost	Homes Lost	Start Time	Containment Time
Canyon Creek	130	47	12/27/05 14:00	12/27/05 18:00
Carbon	35,300	41	1/1/06 13:30	1/5/06 19:00
Cross Plains	6835	110	12/27/05 12:47	12/28/05 18:00
Huckabay	5,800	20	1/2/06 12:30	1/3/06 18:00
Mineral Wells	1,800	29	1/1/06 15:30	1/3/06 18:00
Ringgold	41,000	40	1/1/06 18:00	1/8/06 12:00
East Amarillo	900,000	89	3/12/06 10:00	3/20/06 18:00

Table 1 – Homes and acres lost.

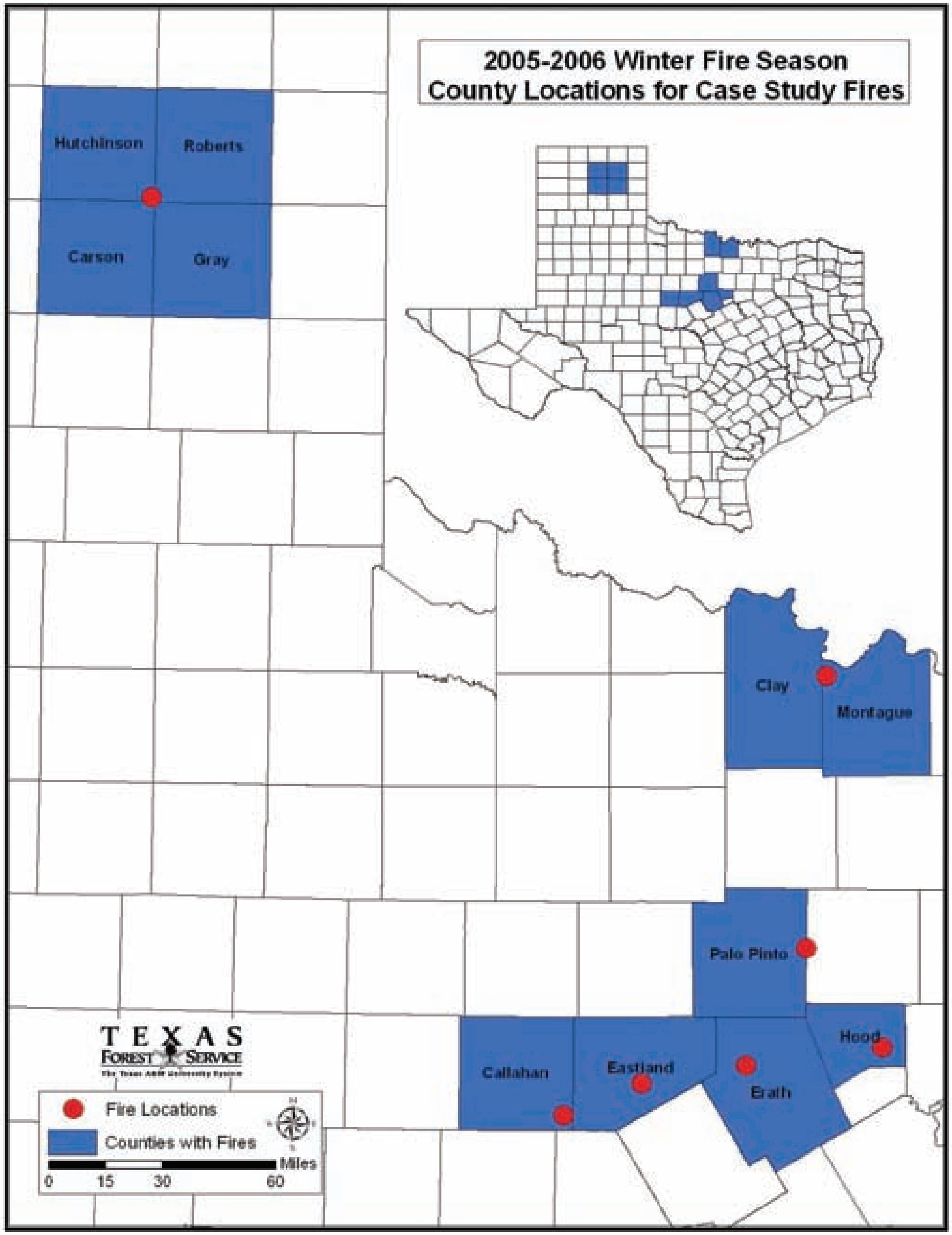


Figure 1 – Location of case study fires within the state.

Canyon Creek Fire, Hood County

The Red Cross has conducted an assessment of losses and damage, and 47 structures and 38 vehicles were lost. The Hood County grass fires forced hundreds of people to evacuate their homes while they watched and waited to see where the fire would go. The cause of the fire was determined to have been children playing with matches or fireworks. More than eight fire departments with 25 engines and support vehicles, a DPS helicopter and the Fire Marshall responded to the fire. More than 200 people faced either voluntary or mandatory evacuation to the local church. Weather for the area during active fire behavior was reported as winds at 23 mph with gusts to 39, temperature was 80° F and RH was 10%. An eyewitness reported seeing fire burning through short grass and moving toward wooden porches, consequently burning homes. Decks and landscaping timbers were often the ignition points to houses. Once the decks or porches ignited, the homes were gone in a matter of minutes.

Carbon Fire, Eastland County

The cause of the fire was determined to be power lines popping together, with the origin being behind a home in an open field off FM 187, directly under the power lines. Reports stated that five volunteer fire departments arrived on site to assist with the fire. The entire town of Carbon was under both mandatory and voluntary evacuation. Fire behavior by eyewitness' reports exhibited flame lengths from 40-50 ft., with rates of spread of approximately 300 ft/min. Spotting was observed ranging from ¼ to ½ mile. Weather for the area during active fire behavior was reported as winds W/SW at 35 mph with gusts up to 40-45, temperature of 84° F and RH of 10%. Extreme fire behavior was observed even into the evening as grass and brush actively burned at all times. Burnouts were conducted during the night, and ranchers were active, using cattle sprayers, etc. The fire burned 35,300 acres and destroyed eight homes. Several homes with metal roofs burned to the ground because of unscreened wooden decks or open attic vents.

Resident Larry Brach stated he observed fire whirls lifting off the ground and sitting down like tornadoes, igniting tops of telephone poles on the edge of the road. He estimated winds in the fire front at 70 mph, based on his visual observation of large oak trees bending. The leading edge of the fire was observed carrying coastal hay and other burning debris embers. One home that was lost was constructed of brick with a steel roof and concrete porches. It survived the initial flaming front, however, within 30 seconds of the main fire passing, the home was fully engulfed.

East Amarillo Complex Fire, Carson/Gray/Hutchinson/Roberts Counties

Made up of two large fires and six smaller ones merging together to burn over nine days, the fire resulted in the evacuation of eight towns. Winds of 44 mph with gusts of 61, temperature of 71° F, and RH of 9% facilitated the fire to burn more than 900,000 acres, taking twelve lives, causing the loss of 89 structures and causing an estimated 4,296 head of livestock to perish during the devastating wildfire event.

Photo courtesy of Texas Cooperative Extension

Huckabay Fire, Erath County

The origin of the fire was determined to have been on Diamond Ranch, west of Huckabay, and was attributed to downed power lines. Starting at 12:30, January 2, 2006, the fire actively burned with 4 ft. flames in mowed grass, fire whirls jumping 40-50 ft. and 11 ft. flames noted through flanks. Winds of 28 mph with gusts 40+, temperature of 85° F, and RH of 11% facilitated the fire to burn 10,000 acres, destroying six homes and 21 outbuildings. In a town of only 200, every melted mobile home and blackened yard still moves firefighters to tears. Homeowners and fire personnel watched as backing fires spread to homes that had survived the initial fire front but now ignited from the smallest flame. Recurring causes of ignition for homes included wooden decks, unscreened attic vents and wooden post-framed additions.

Mineral Wells – Airport Fire, Palo Pinto County

The Airport Fire occurred on January 1, 2006 in the community of Mineral Wells, which is located in North Central Texas. The neighborhood has one primary road, Cass Hollow, with several dead-end roads connected to the main road. The road winds for 1.5 miles with a terminus at the edge of a steep slope with a drop of over 100 ft. in elevation. Twelve homes were destroyed during the fire, and the airport was forced to shut down. The fire was primarily a wind-driven grass fire reportedly igniting after a power line was felled by high winds. On January 1, 2006, at 15:30, a downed electrical line ignited a fire in one-inch tall grass carrying the fire to unenclosed decks, allowing for dead leaves and other fine fuels to ignite. The final count was 12 homes lost and 1,800 acres burned. Estimated wind speeds of 18 mph with gusts of 34, temperature of 83º F, and RH of 7% were recorded during the wildfire. The fire burned across Cass Hollow and approximately 25 residents were forced to evacuate to the rear of the subdivision. One of the residents living at the end of the subdivision realized that the evacuees were trapped in their vehicles with no way to escape the oncoming blaze. She notified her husband who then cut their pasture fence to allow the evacuees to escape through the field, exiting to a rural road paralleling the community. Long one-way in one-way out roads can pose a significant risk to residents attempting to evacuate areas in a wildfire situation. This scenario also complicated the efforts of fire service personnel attempting to access these areas for structure protection. Fortunately, the residents were able to escape the oncoming fire due to the efforts of a concerned neighbor. Providing appropriate ingress and egress to future developments will minimize the occurrence of potential wildfire related entrapments. (Map in Appendix)

Ringgold Fire, Montague/Clay Counties

"It didn't take 30 minutes," Carol Ezzell said of the fire's run through town, destroying all but seven buildings on Main Street, including the post office. Starting at 12:00 on January 1, 2006, the fire burned 41,000 acres and destroyed 31 of the 39 homes in Ringgold. An old cemetery's grass and topsoil were also destroyed, but the headstones survived, demonstrating that it doesn't take timber, dense brush or high grasses to create hazardous fire conditions. Estimated wind speeds of 22 mph with gusts of 33, temperature of 88º F, and RH of 12% during the wildfire event were reported. Recurring causes of ignition for homes during this fire included wood fences attached to homes, exposed wood soffits and wood siding with vegetation in contact with home.

Cross Plains Wildfire Event

Seen over and over during these wildland events is the inconsistent fire behavior due to weather and the fast moving nature of the fires in short flashy fuels. Fires in many cases were erratic and exhibited extreme fire behavior, leaving little or no time for communities to react or prepare. This speaks to the fact that the work it takes to protect a home and communities from wildfire has to take place long before a fire occurs.

On December 27, 2005, a furious wildfire swept across the West Texas town of Cross Plains, killing two residents and destroying homes, businesses and a Methodist church. “We lost 110 homes but were able to save the downtown,” said Abilene Fire Chief Brad Fitzer. “I’ll never forget that night,” he said, and neither will Jim Hull, Texas State Forester and director of Texas Forest Service (TFS).

“The Cross Plains Fire was the beginning of what is turning into one of the worst wildfire sieges I have witnessed in my entire 40-year career with the agency,” said Hull (Grossman 2006).

Cross Plains, at the junction of State Highways 36 and 206 in southeastern Callahan County, was established as a post office in 1877. In its early years the community had the basic necessities such as a store, a cotton gin and gristmill, but little else. The town incorporated in 1910 with a population of 600. Two years later the Texas Central Railroad came through. The Katy (Missouri, Kansas and Texas) Railroad took over the Texas Central and for years ran “The Peanut Special” between Cross Plains and DeLeon (Comanche County). Peanuts were a major Callahan County crop. An oil boom in 1925 increased the population, and by 1940 it was more than 1,200. The population has hovered around the 1,000 mark for the last 50 years. Today, with a population of 1,068, Cross Plains covers a total area of 1.2 miles (US Census Bureau 2000).

The eastern quarter of Callahan County has vegetation typical of the Cross Timbers and Prairies regions, characterized by slow-growing scattered motts with savannas comprised of post oak (Quercus stellata) and blackjack oak(Quercus marilandica), cedar elm (Ulmus crassifolia), eastern red cedar (Juniperus virginiana) and other shrubs with an understory of green briar (Smilax laurifolia), yaupon (Ilex vomitoria), and mesquite (Prosopis glandulosa); undisturbed areas contained little bluestem (Schizachyrium scoparium), purpletop (Tridens flavus cupreus) Indiangrass (Sorghastrum nutans), tall dropseed (Sporobolus compositus), and panicums (Panicum sp.); more heavily grazed native pastures may be dominated by forbs and grasses such as buffalograss (Buchloe dactyloides), Texas wintergrass (Stipa leucotricha) and purple threeawn (Aristida purpurea).

Climate

The Low Rolling Plains division is located east of the High Plains, with Oklahoma bordering on the north and the Edwards Plateau bordering on the south. Cross Plains is situated in the Low Rolling Plains Climatic Division. The Low Rolling Plains generally receives its maximum precipitation in late spring and early autumn. These periods are coupled with relatively low winter and low summer precipitation (Corr 1967). The Low Rolling Plains is considered to be cool and relatively dry during the month of December. This is because of the frequency of cold fronts moving through Texas during the winter months. Cold fronts move through with such regularity that moist south winds preceding the fronts do not have time to penetrate far enough inland before the next front pushes through. Because of this, December is the third driest month in the Low Rolling Plains, normally yielding 1.27 inches of rain. In December, normal maximum daily temperatures reach 57° F with normal minimum daily relative humidity around 30 percent.

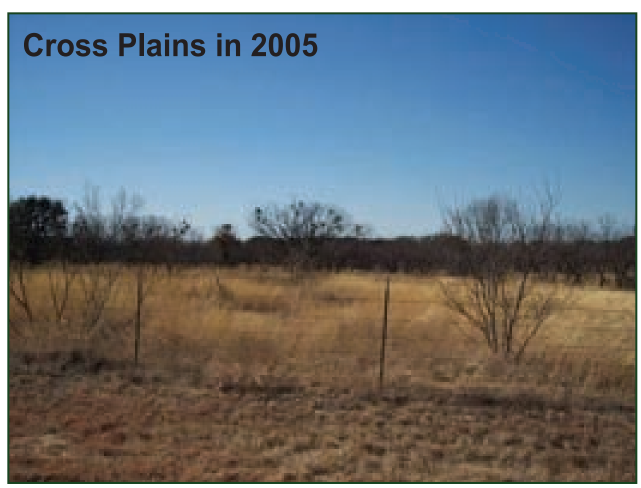
Fuels

Callahan County is located in the Rolling Plains Predictive Service Area (PSA). Fuel types commonly found in this PSA are grass and brush. Some timber fuel types made up of small stands of deciduous hardwoods are also present. The photos below are from the Cross Plains area around 1900, 1945 and 2005. Note the differences in fuel loadings between the pictures of 2005 and from the past. Overgrazing kept grass fuels from accumulating until the later part of the 21st century. In recent years, range and soil conservation programs have changed the way the rangelands are managed. The Rolling Plains PSA experienced above average rainfall in 2004 and during the growing season of 2005. Many of the grasslands in the area are not grazed as they were in the past because of changing land use. This change in land use coupled with an abundance of precipitation over the previous two growing seasons resulted in an increase of grass fuel loadings in the area.


Cross Plains in 1900s


Cross Plains in 1945


Cross Plains in 2005


Cross Plains in 2005

Weather Leading up to Wildfire

Warm, dry and windy could characterize the months leading up to the Cross Plains fire. In October frontal passages began moving through Texas. By the end of November, cold fronts were moving through frequently. During this period wind speeds and maximum daily temperatures were above normal; minimum daily humidity was below average. In fact, temperatures observed in Abilene (36 miles northwest of Cross Plains) on December 26 and 27 set record highs of 81 and 77 º F on those dates (Nagle 2006).

Since the nearest weather station is 30+ miles away, NEXRAD radar was used to estimate rainfall for the Cross Plains area. Above average rainfall experienced during the spring and summer began to taper off in the month of September. During September, the Cross Plains area received only 0.63 inches of rainfall (22% of normal). October wasn't much better, with the area receiving 0.73 inches (25% of normal). Drought conditions began to accelerate in November, and Cross Plains received no rainfall for the month. December 16 would be the last rain event before the fire occurred. On this date, NEXRAD estimates 0.08 inches of rain fell; hardly beneficial. Figure 4 demonstrates the monthly percent of normal rainfall for much of North Texas during December. Southeast Callahan County received less than 10% of normal rainfall during the month of December. The Cross Plains area received 17% of normal rainfall for the period of September through December.

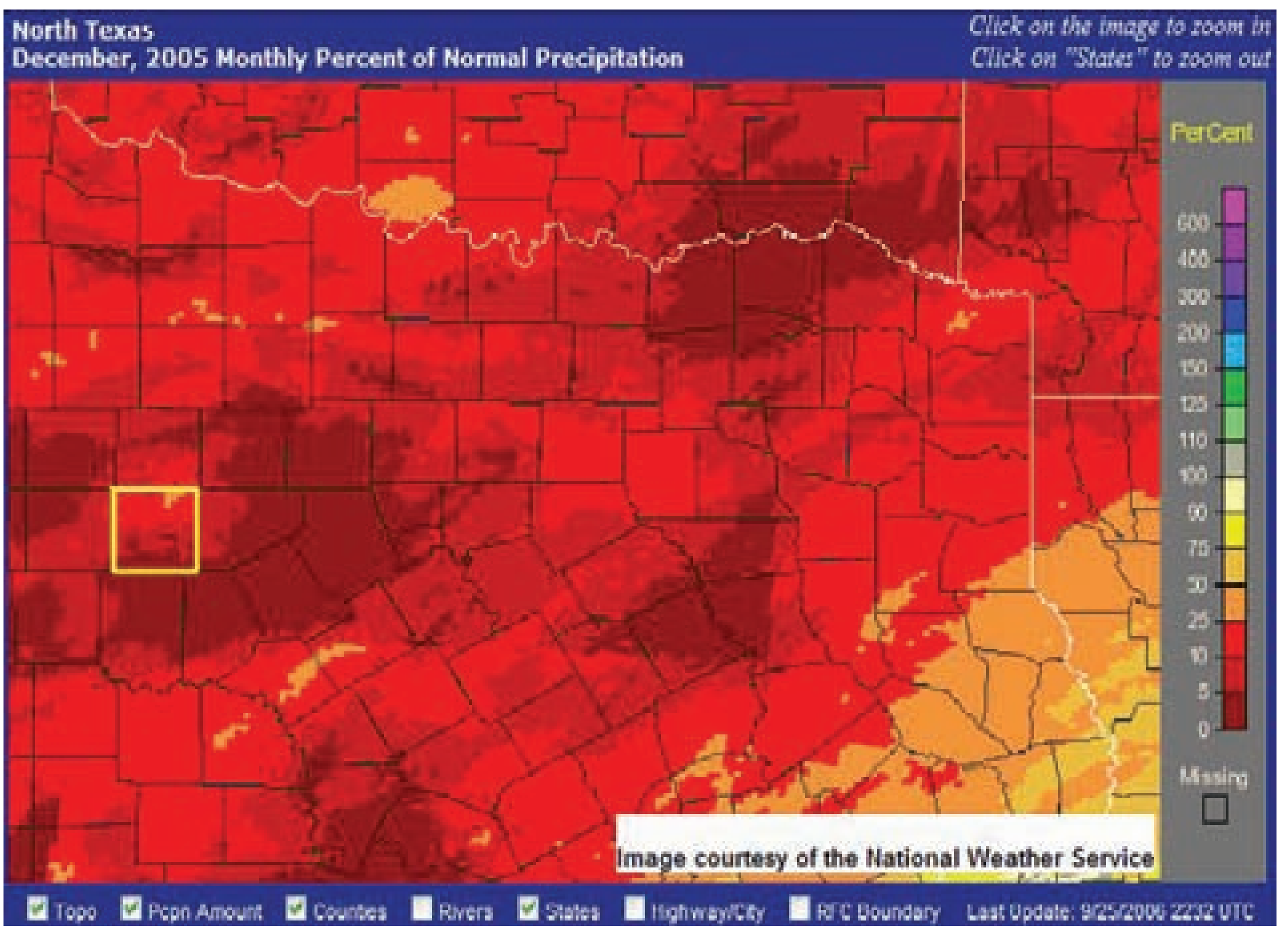


Figure 4 – Monthly percent of normal precipitation for North Texas in December 2005.

Daily 1300-hour weather observations, National Fire Danger Rating (NFDRS) indices and the Keetch-Byram Drought Index (KBDI) for November 1 through December 27 from the Hamby Remote Automated Weather Station (RAWS) are listed in Table 2. The Hamby RAWS was chosen to represent the Cross Plains area because it was the closest weather station to the fire and has similar vegetation and topography. Temperatures observed at Hamby were above normal on 37 out of the 57 days represented in Table 2. RH was below normal for 29 days during this period. The Hamby RAWS recorded a total of 0.08 inches of rainfall during the 57-day period. This observation compares well with the previously mentioned NEXRAD rainfall totals observed in Cross Plains.

1300 Weather observations, National Fire Danger Rating System indices and Keetch-Byram Drought Index (KBDI) for the Hamby Remote Automated Weather Station, located 38 miles Northwest of Cross Plains in Taylor County, Texas, November 1 - December 27, 2005

Date	Temp. (°F)	Relative Humidity (%)	Wind Speed (mph)	Precip. (in.)	Burning Index (78L)	Energy Release Component (78G)	Keetch Byram Drought Index
1-Nov-05	71	33	7	0	28	34	492
2-Nov-05	75	25	16	0	48	36	494
3-Nov-05	80	27	15	0	50	41	497
4-Nov-05	81	33	15	0	48	44	500
5-Nov-05	86	18	15	0	66	48	504
6-Nov-05	77	33	4	0	24	43	508
7-Nov-05	83	47	18	0	41	41	511
8-Nov-05	84	49	19	0	40	40	514
9-Nov-05	73	43	12	0	41	39	518
10-Nov-05	66	28	6	0	32	43	520
11-Nov-05	76	63	15	0	33	40	522
12-Nov-05	83	29	18	0	51	43	525
13-Nov-05	68	34	10	0	43	45	528
14-Nov-05	76	55	19	0	38	43	530
15-Nov-05	55	31	19	0	51	45	532
16-Nov-05	53	20	5	0	37	46	532
17-Nov-05	58	17	15	0	72	50	532
18-Nov-05	61	23	4	0	32	51	533
19-Nov-05	63	40	12	0	44	48	534
20-Nov-05	60	30	13	0	52	47	535
21-Nov-05	68	19	6	0	43	49	536
22-Nov-05	69	29	4	0	29	49	537
23-Nov-05	82	12	7	0	53	53	539
24-Nov-05	68	23	3	0	25	53	542
25-Nov-05	63	42	3	0	18	47	543
26-Nov-05	73	54	14	0	39	45	544
27-Nov-05	66	21	36	0	63	49	546
28-Nov-05	56	23	13	0	63	52	547
29-Nov-05	52	23	6	0	39	52	547
30-Nov-05	67	29	25	0	57	53	548
1-Dec-05	49	25	8	0	45	55	549
2-Dec-05	67	26	21	0	61	57	550
3-Dec-05	83	11	20	0	89	61	553
4-Dec-05	43	46	11	0	35	53	556
5-Dec-05	45	32	5	0	30	53	556
6-Dec-05	57	25	10	0	52	56	556
7-Dec-05	19	52	14	0	23	50	557
8-Dec-05	28	31	9	0	43	55	557
9-Dec-05	46	15	14	0	73	60	557
10-Dec-05	55	17	6	0	43	60	557
11-Dec-05	61	21	8	0	44	58	558
12-Dec-05	62	22	6	0	36	60	559
13-Dec-05	64	35	17	0	42	57	560
14-Dec-05	46	54	12	0	34	52	561
15-Dec-05	51	20	7	0	44	56	561
16-Dec-05	37	96	12	0.05	0	30	561
17-Dec-05	42	76	3	0.03	0	34	561
18-Dec-05	43	77	7	0	0	32	561
19-Dec-05	44	68	7	0	9	34	561
20-Dec-05	38	92	6	0	0	24	561
21-Dec-05	56	52	6	0	26	36	561
22-Dec-05	65	40	14	0	48	40	562
23-Dec-05	71	30	17	0	53	44	563
24-Dec-05	63	28	16	0	58	46	564
25-Dec-05	70	17	11	0	64	50	565
26-Dec-05	77	16	14	0	78	54	567
27-Dec-05	77	12	28	0	85	58	569

Table 2 – 1300 Weather observations.

Normally, the KBDI averages between 200 and 237 during the month of December at the Hamby weather station. When KBDI rises to 550 or higher, drought becomes a significant factor. The KBDI reached 550 at Hamby on December 2. Figure 3 illustrates the KBDI on December 27 for the state of Texas based on a 4 kilometer grid. The Callahan County boundary is outlined in red.

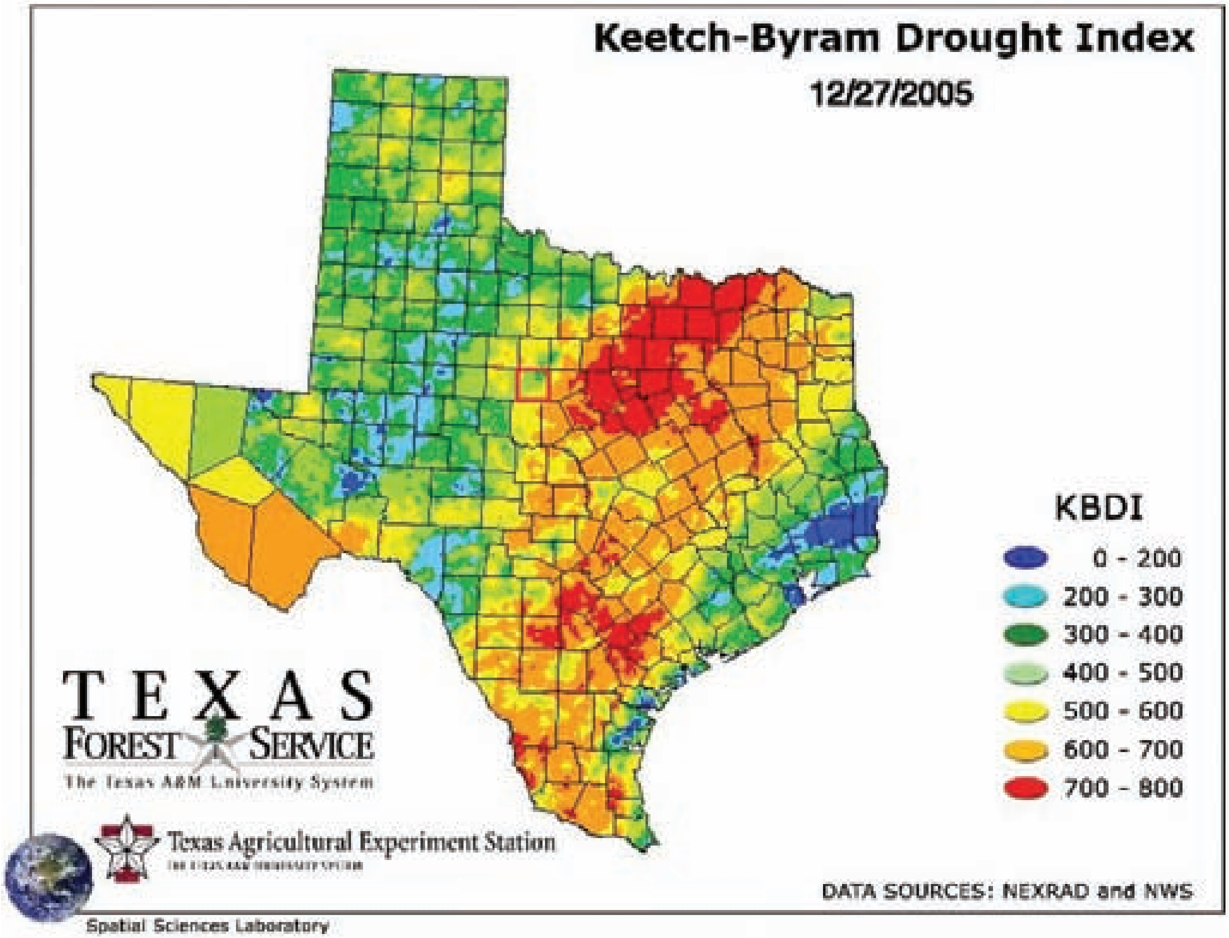


Figure 3 – KBDI for December 27, 2005.

Live fuel moisture (LFM) samples are taken monthly at various locations across Texas. Table 3 displays the results of LFM samples measured at Abilene State Park in Taylor County, Texas, from September through the month of December. Abilene State Park is located 43 miles W/NW of Cross Plains and 24 miles SW of the Hamby RAWS.

Date	Juniper LFM %	Live Oak LFM %	Grass LFM %
30-Sep-05	115	89	70
12-Oct-05	110	90	78
15-Nov-05	100	83	23
6-Dec-05	96	82	*cured

*Monthly LFM% not measured for grass fuels once frost cured.

Table 3 – Woody and herbaceous live fuel moisture (LFM) measured at Abilene State Park, Taylor County, Texas.

Live herbaceous fuels had been in the transition phase since September. By mid-November, live herbaceous fuels had completely frost-cured. This frost-cured condition sets the herbaceous fuel moisture equal to the 1-hour time lag dead fuel moisture. At Abilene State Park, woody live fuel moistures had not reached critical levels by the first week of December. This area of Taylor County had received more rainfall than the Cross Plains or Hamby areas. Therefore, live woody fuel moistures were significantly higher than those in Callahan County. By December, efforts were made to sample live woody fuels moistures more intensively than normal due to the escalating drought situation. Samples were taken in Callahan and Eastland Counties on December 6. In Callahan County, live oak was sampled with a resulting LFM of 78%. Juniper was sampled in Eastland County, resulting in 77% LFM. Eastland County borders Callahan on the east side. In the Rolling Plains PSA, the critically dry LFM threshold in juniper is below 80% with winds above 15 mph and RH less than 20%. With the same weather criteria met, the critically dry LFM threshold for live oak is less than 75%. Eastland and Callahan counties were experiencing similar conditions. Keeping this in mind, woody LFM in both live oak and juniper were near or below critical thresholds, making them susceptible to torching and crowning.

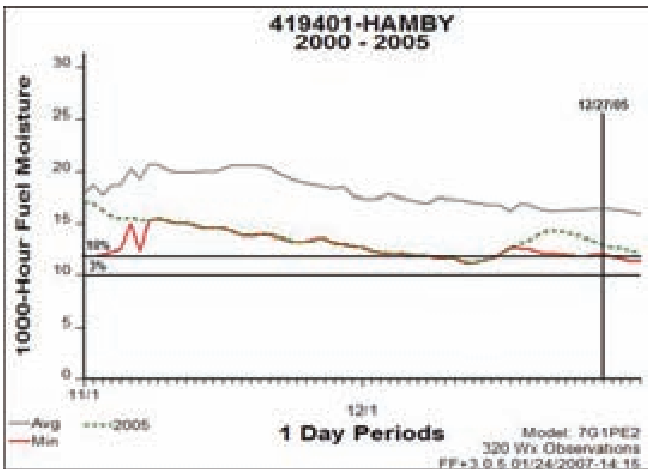


Figure 4 – 1,000-hour time lag fuel moistures calculated by Fire Family Plus using data from the Hamby RAWS Nov. 1 - Dec. 31, 2005.

At the beginning of November, 1,000-hour dead fuel moistures at Hamby were in good shape. (Figure 4) Dead fuel moistures greater than 16% are generally considered to have above normal moisture in areas represented by the Rolling Plains PSA. Over the course of the next 4 ½ weeks, 1,000-hour fuel moisture contents dropped to critical levels. They rose slightly after mid-December but were trending back downward prior to the fire. The 1,000-hour fuel moisture is another good indicator of long-term drying.

The time it takes for 100-hour dead fuel moistures to respond to increases or decreases in moisture is considerably less than the 1,000-hour fuels. Figure 5 displays the 100-hour fuel moisture trends through the month of December. At Hamby, the 100-hour fuel moistures during the first two weeks of December were at or slightly above critical levels. They rose to above average levels from December 16 – 21 before making a steady drop back to critical levels over a six-day period. Many of Texas' largest fires have occurred when 100-hour fuel moistures were at or below critical dryness and when the Energy Release Component (ERC) in fuel model 1978 G (short needle conifer) reaches its critical thresholds as well.

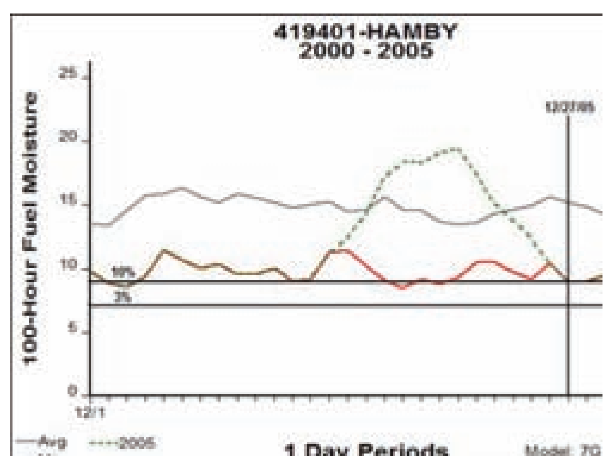


Figure 5 – 100-hour time lag fuel moistures calculated by Fire Family Plus using data from the Hamby RAWS Dec. 1 - Dec. 31, 2005.

The Burning Index (BI) exceeded the 90th percentile multiple times from November 1 - December 31. (Figure 6) The BI dropped at or near zero for a five-day period from December 16 – December 20. On the 21st, BI began to rise and exceeded the 90th percentile again the day after Christmas. Fuel model 1978 L (Western perennial grass) was used to model the conditions. Grass is usually where most fires initiate in the Rolling Plains PSA. The BI in fuel model 78L correlates well with large wind-driven fires because its calculations are weighted heavily on wind and 1-hour dead fuel moistures.

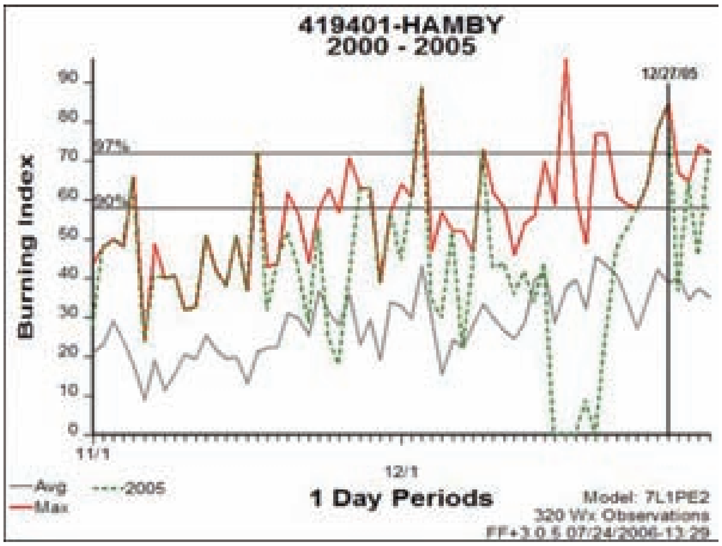


Figure 6 – Burning Index values calculated by Fire Family Plus using data from the Hamby RAWS, Nov. 1 - Dec. 31, 2005.

In Figure 7, the ERC was near or exceeded the 90th percentile from November 29 – December 14. The ERC dropped near average for a short time before rising sharply (34 points) over an eight-day period. Fuel model 1978 G (Short needle conifer) was used because all classes of live and dead fuels are represented in the model, making it a good tool to track seasonal severity. As previously stated, many of Texas' largest wildfires have occurred during periods when ERC 78G and 100-hour fuel moistures are at critical levels.

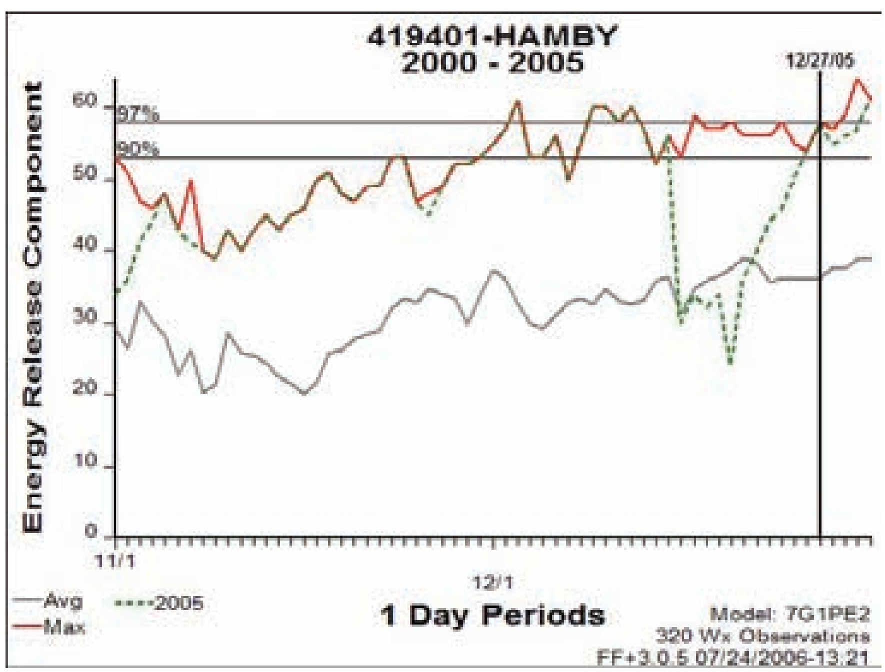
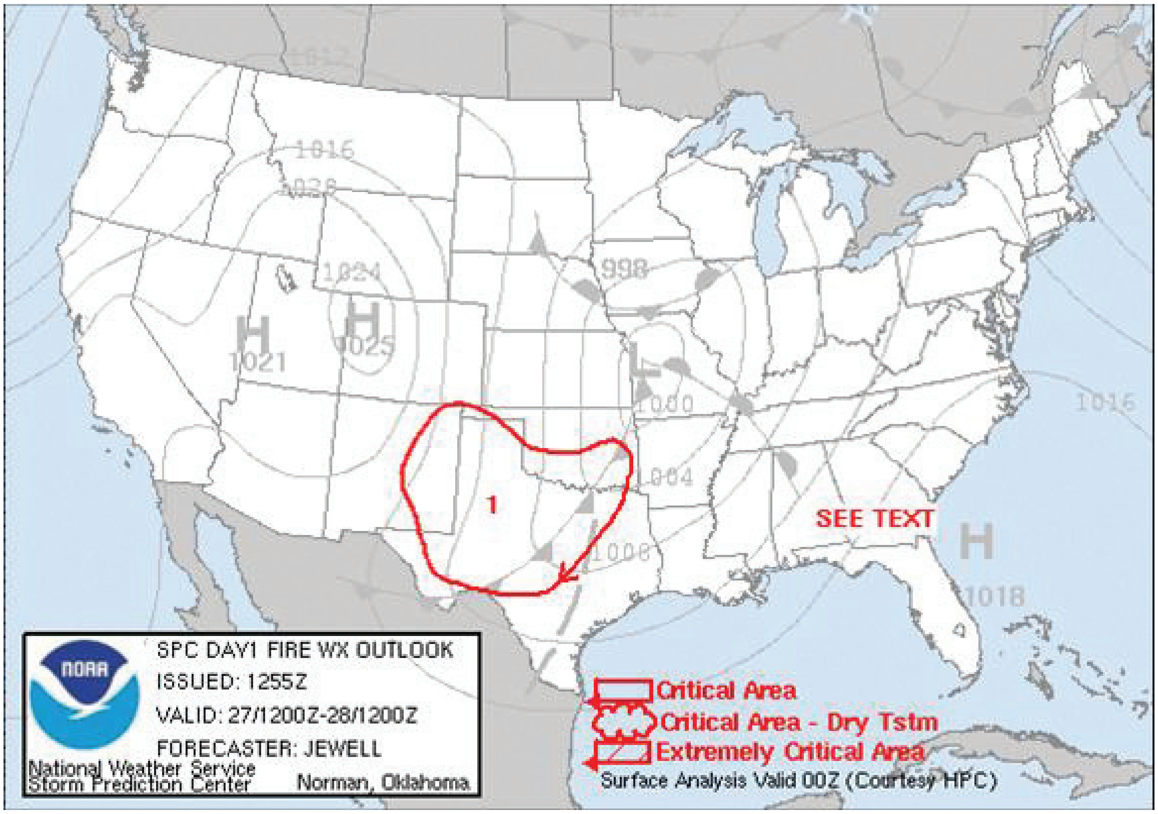


Figure 7 – ERC values calculated by Fire Family Plus using data from the Hamby RAWS, Nov. 1 - Dec. 31, 2005.

The Day of the Fire - National Weather Service Severe Fire Weather Outlook



DAY 1 FIRE WEATHER OUTLOOK RESENT 1
NWS STORM PREDICTION CENTER NORMAN OK
0654 AM CST TUE DEC 27 2005
VALID 271200Z - 281200Z

...CRITICAL FIRE WEATHER AREA FOR MUCH OF CENTRAL AND WRN TX / TX AND OK PNHDL / SRN OK / ERN NM...

...SYNOPSIS...
A FAST MOVING SHORTWAVE TROUGH WILL MOVE FROM THE CENTRAL HIGH PLAINS INTO THE MID MS VALLEY BY WED MORNING. AT THE SURFACE...LOW PRESSURE WILL DEEPEN ACROSS ERN KS / NERN OK AND WILL BE OVER WRN MO THIS AFTERNOON. WLY AND NWLY WINDS WILL BE STRONG BEHIND THIS LOW...WHERE THE AIR MASS WILL REMAIN VERY DRY. COMBINATION OF HIGH WINDS...LOW RH...WARM TEMPERATURES AND DROUGHT WILL CAUSE CRITICAL FIRE WEATHER CONDITIONS TO OCCUR OVER MUCH OF THE SRN PLAINS.

PRIMARY CONDITIONS: STRONG WINDS / LOW RH / DROUGHT

A STRONG AND PROGRESSIVE SHORTWAVE TROUGH WILL MOVE FROM NM AND CO INTO N TX/OK BY AFTERNOON. STRONG HEATING WILL HELP DOWNWARD TRANSPORT OF MOMENTUM WITH SUSTAINED WLY SURFACE WINDS OF 20-25 MPH...GUSTING INTO THE 30-40 MPH RANGE ACROSS MUCH OF THE AREA...THE EXCEPTION BEING INTO ERN OK AND NERN TX WHERE GUSTS TO 25-30 WILL STILL BE POSSIBLE. THE STRONGEST WINDS HOWEVER WILL BE OVER ERN NM AND WRN TX...WHERE SUSTAINED SPEEDS OF 30-40 MPH MAY OCCUR ALONG WITH GUSTS OVER 50 MPH. RH LEVELS WILL RANGE FROM 10-15 PERCENT OVER ERN NM AND W TX TO 20-30 PERCENT OVER ERN OK AND NERN TX.
TEMPERATURES WILL CONTINUE TO BE MUCH ABOVE NORMAL WITH HIGHS MAINLY IN THE 70S F.
JEWELL.. 12/27/2005

In the upper atmosphere, winds were experiencing vigorous mixing at 06:00 on the morning of the fire. The winds in the layers that were vigorously mixing are circled on Figure 8. This means that the temperature profile was dry adiabatic through this height in the atmosphere. When the temperature profile is dry adiabatic, it means that it is cooling at the highest rate possible as one moves higher in the atmosphere. When this takes place, it is very easy to get upward and downward motion in the atmosphere. Winds in the layer will be easily transported to the surface by this mixing when these conditions exist. The impact of this on the Cross Plains fire is that on December 27, this "mixed" layer upstream from the Rolling Plains PSA sustained winds of 45 knots out of the west and northwest and were headed for the Cross Plains area. Note the position of the 500mb trough axis at 06:00 and at 18:00 CST (Nagle – NWS 2006).

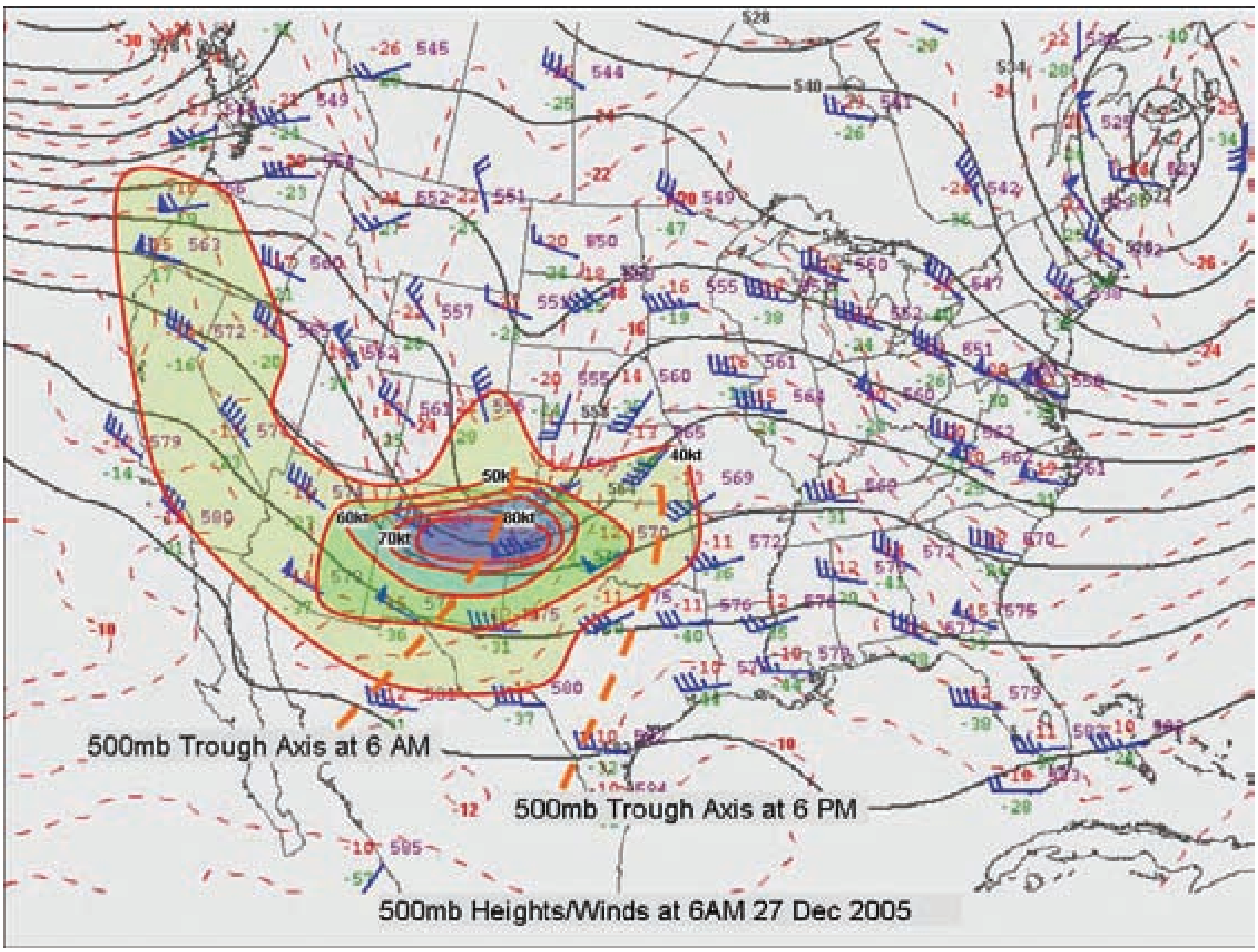


Figure 8 – 500mb Heights/Winds chart at 06:00 CST on Dec. 27, 2005. (Seth Nagle, M+NWS 2006)

At noon the day of the fire, a dry-line had already passed over the Cross Plains area lowering RH below critical fire weather thresholds of 20% for the Rolling Plains PSA. Westerly winds, ahead of an approaching cold front, were above critical fire weather thresholds of 15 mph. (Figure 9)

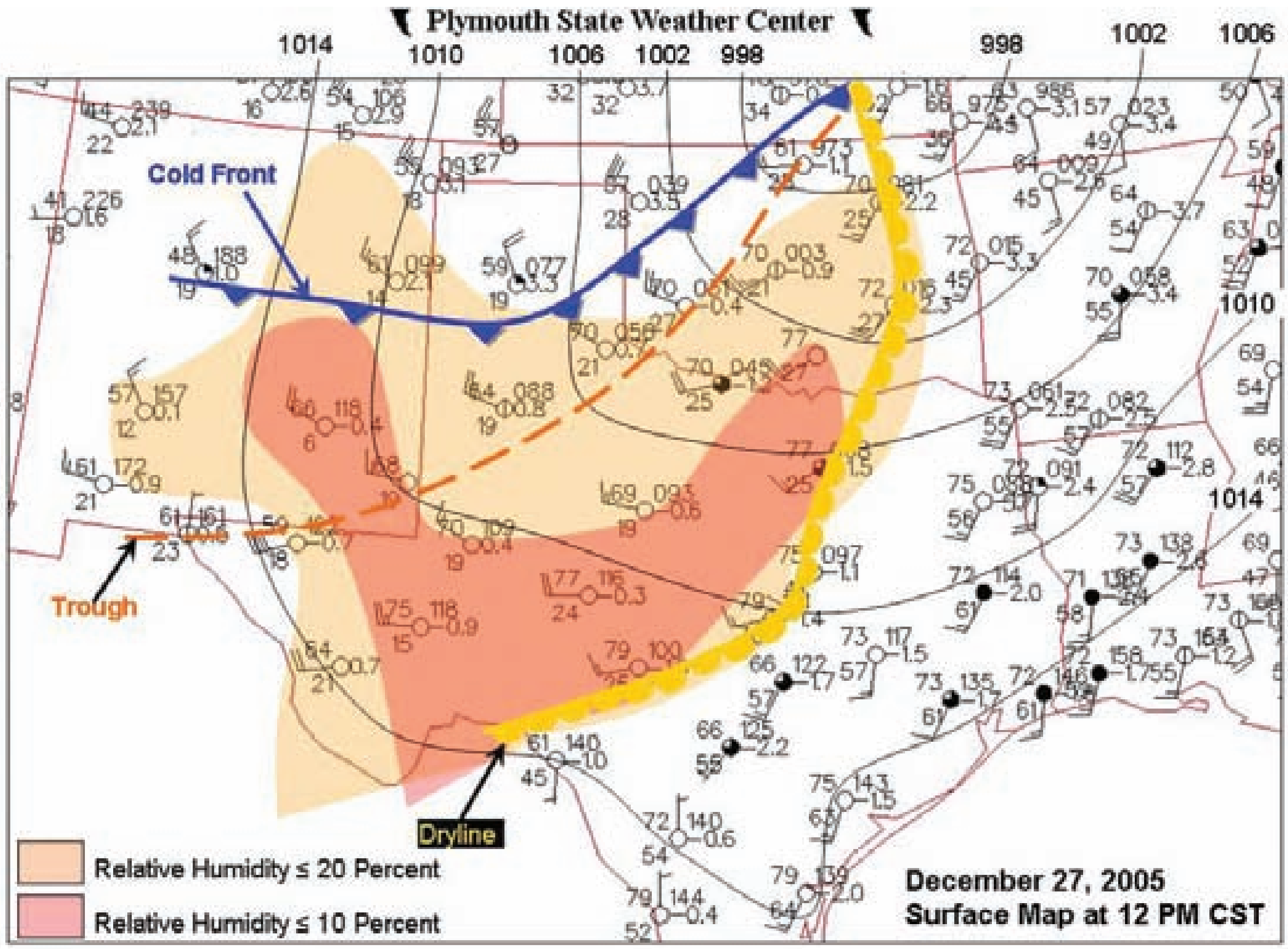


Figure 9 – Surface map at 12:00 CST on Dec. 27, 2005. (Seth Nagle, NWS 2006)

A wildfire of disastrous proportions was about to occur in Cross Plains. Critically dry fuels, increased fuel loadings and critical fire weather would align to produce a fast moving, uncontrollable wildfire. Figure 10 is a fire characteristics chart that demonstrates the difficulty firefighters would face that day. The gr4 (moderate load, dry climate grass) Fire Behavior Fuel Model was used to model the fire behavior during the most critical times on the 27th. Weather and fuels information from the Hamby RAWS was used to make calculations in Behave Plus. (Table 4)

Time (CST)	Weather					Dead Time-Lag Fuel Moistures	
	Temp. (°F)	RH (%)	Wind Speed (mph @ 20')	Wind Gusts (mph @ 20')	*Wind Direction (degrees)	1 Hour (%)	10 Hour (%)
12:00	70	16	19	30	270	5	7
13:00	77	12	28	37	292	5	7
14:00	76	14	29	38	292	4	7
15:00	75	15	24	35	292	4	7
16:00	74	16	20	28	292	6	7
17:00	72	17	13	24	292	6	7
18:00	61	21	6	16	292	9	6

Table 4 – Weather observations and dead time-lag fuel moistures derived from the Hamby RAWS, Taylor County, Texas, December 27, 2005. *Wind direction observations were taken from the Abilene Regional Airport 7 miles southwest of the Hamby RAWS. The Hamby wind direction sensor at the time of the fire was incorrect due to a faulty sensor.

From the time the fire initiated, it was beyond the control of mechanized equipment. Points 1 – 4 are plotted on Figure 10 to illustrate Surface Rate of Spread (ft./min.) over Heat per Unit Area (Btu/ft2), based on the four most critical hours of the event (12:00 – 15:00).

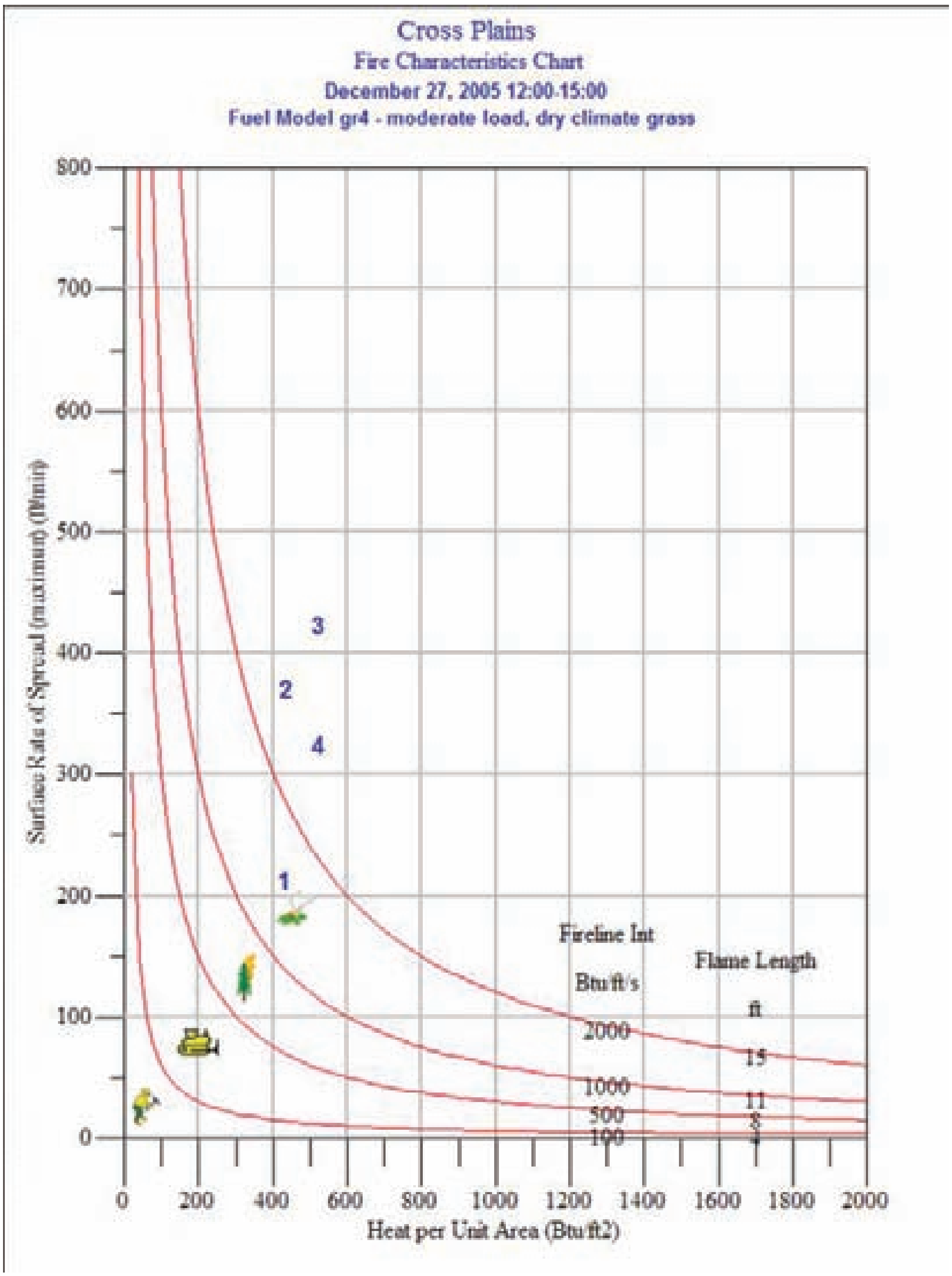


Figure 10 – Fire characteristics chart created in Behave Plus using the gr4 fuel model and weather data from the Hamby RAWS.

Fire Time Line

The following Cross Plains Fire Chronology for December 27, 2005, is based on dispatch records from the Callahan County Sheriff Department, Cross Plains Volunteer Fire Department, Situation/Fire Reports from Texas Forest Service and interviews with Cross Plains Fire Chief Bob Harrell and Abilene Fire Chief R. Bradford Fitzer. A second grass fire in Baird, Texas, approximately 28 miles from Cross Plains, had started at 12:11 prior to the Cross Plains fire, reducing the number of available resources.

December 27, 2005

12:49 – Cross Plains Volunteer Fire Department received call to respond to fire
12:53 – Cross Plains Volunteer Fire Department dispatches fire truck
12:57 – Cross Plains Volunteer Fire Department arrives on scene of fire
13:10 – Cross Plains Volunteer Fire Department requests assistance
13:15 – First home is lost to fire
13:30 – Additional fire departments begin to arrive on scene
14:18 – Car accident is reported on FM 880, fire has not reached this point
14:22 – Fire is reported to be approximately 2,400 acres
15:30 – Fire is reported in town
16:00 – First aerial reconnaissance of fire
17:52 – Resources are still unable to attach head of fire, structure protection main emphasis
20:28 – Water resources are exhausted, coordination takes place to bring in additional water resources
21:00 – Aerial reconnaissance shows fire 70% contained

December 28, 2005
18:00 – Fire contained

December 29, 2005
18:00 – Fire controlled

1200 Hour:

At 12:49 on December 27, 2005, the Cross Plains Volunteer Fire Department received a call from the Callahan County Dispatch to respond to a reported fire 3½ miles west of the town of Cross Plains on the south side of Highway 36. By the time it was reported, the fire had jumped the highway to the north side of Highway 36. Weather reports from Hamby this hour indicated temperature readings of 70° F, RH of 19% and sustained winds of 19 mph from the west with gusts of 30. At 12:53 fire trucks were dispatched and en route to the fire. Cross Plains Volunteer Fire Department arrived on scene at 12:57; the fire department reported a fast moving grass fire. At the time of ignition, 1-hour dead fuel moistures were calculated at 5%. Ten-hour dead fuel moistures were 7%. The surface rate of spread during the 12:00 hour was 2.4 mph in moderate load grass (gr4 fuel model) using Behave Plus. Calculated flame lengths in this grass model were 13 ft. this hour.

1300 Hour:

At 13:10 the Cross Plains VFD submitted a requested for full assistance from other local volunteer fire departments. By 13:15 the first structure was in flames, and by 13:29 the structure was lost and two additional homes were threatened. At approximately 13:20 the Rising Star Fire Department arrived on scene to assist Cross Plains Volunteer Fire Department. Additional fire departments from neighboring communities began to arrive and immediately give assistance by 13:30. While en route to the fire, Jim Davis (TFS Division Supervisor) observed a dark gray smoke column that was pushing straight up and not leaning over like most wind-driven fires. Upon this observation, Davis orders an air tanker. Weather observations at Hamby this hour were temperature of 77° F, RH of 12%, sustained winds were out of the west northwest at 28 mph with gusts measured at 37. Fine dead fuel moistures were still 5%. Rate of spread in the gr4 model was calculated at more than four mph. Flame lengths were calculated at 17 ft.

1400 Hour:

By 14:00 the fire had overtaken large pastures of frost-cured coastal grasses. Resources arriving on scene at 14:07 reported extreme fire behavior, 20 foot flame lengths at the head fire, and four-six foot flame lengths from the backing fire. During this hour, the rate of spread was just less than five mph, with flame lengths of 19 ft. in the GR4 fuel model. RH was 14%, the temperature was 76° F and sustained winds were 29 mph gusting to 38 out of the west northwest at Hamby. Fine dead fuel moistures had dropped to 4%. Very dense smoke caused visibility issues, making it impossible to attack the head of fire. Structure protection at this time was the main focus. At 14:40 Texas Department of Transportation was contacted to close FM 880, as fire was jumping the road. At 14:22 the fire was reported to have grown to 2,400 acres.

1500 Hour:

The fire traveled in a northeast direction toward Cross Plains, the modeled rate of spread was 3.7 mph with flame lengths in the gr4 model calculated at 17 ft. Wind gusts at the fire scene were reported to be 50 mph, and at times more, for the duration of five to 10 minutes. The Hamby RAWS reported sustained winds at 24 mph with gusts of 35 from the west northwest. The temperature was 75° F and RH was 15%. At 15:17 the fire is reported to have fully involved the north side of town. Evacuations became mandatory for the residents whose homes were directly threatened by the fire, but also voluntary as residents realized the magnitude of the situation. It was reported that of the town's 1,118 residents 900 people evacuated in less than two hours in an orderly manner. At approximately 15:30, a total of 29 additional fire departments had arrived at the fire, along with EMS services and additional doctors.

1600 Hour:

The first aerial reconnaissance of the fire began at 1600 and continued until dark. At 16:15 the fire was recorded to be 3,000 acres and had completely passed through town. Numerous structures were lost, while others continued to be threatened, as smaller fires continued to burn within the town. Structure protection continued to be the main focus as firefighters worked to prevent the spread of the fire to other homes by completely extinguishing the homes that had been compromised. Abilene Fire Department, located 45 miles away, was contacted at 16:30 and requested to give aide with all and any type of equipment they had available. During the hour, winds observed at Hamby had decreased slightly to 20 mph with gusts of 28 remaining out of the west northwest.

1700 Hour:

At 17:38 the size of the fire was measured at 5,000 acres by aerial reconnaissance and it continued to grow, but not at the rate previously witnessed. Weather at 17:00 from Hamby was temperature of 72° F, the RH had risen slightly to 17% and sustained wind speeds had decreased to 13 mph. Winds were still gusting above 20 mph. Fire behavior was still active in the grass fuels with surface spread rates modeled in Behave at 1.3 mph and flame lengths of 10 ft. Abilene Fire Department arrived on scene at 17:50, and the Abilene Fire Chief was assigned to be in charge of operations. As he arrived, he witnessed a wall of fire over the tops of two-story buildings moving toward the downtown area. At this time, the third wind shift had occurred, pushing the fire in a southeasterly direction, consuming homes on the east side of town and threatening numerous businesses in the downtown district. By 17:52 many structures were lost; however, the exact number was unknown at this time. Structure protections continued to be the main focus, as small spot fires continued to creep throughout the town, and resources were still unable to attack the head of the fire.

1800 - 1900 Hours:

Fire weather during this hour improved considerably. At Hamby, sustained winds had dropped to six mph. The temperature was 61° F, and RH was still rising at 21%. Fine dead fuel moistures had risen to 9%. Fire behavior was beginning to moderate, with modeled rates of spread at less than ½ mph in the gr4 model and flame lengths of six ft. During the next couple of hours a certain amount of control and order was established as the situation became more organized. At 18:46 all fire personnel involved were instructed to synchronize their radios to the same channel (TXFS Fire 1), and by 18:47 fuel and water tender staging areas were established. The Red Cross arrived at Cross Plains at 19:00, and by 19:15 they had set up a medical and rehab unit along with Guardian EMS.

2000- 2400 Hours:

At 20:28, as many as 30 buildings remained ablaze. Firefighters were quickly diminishing their water supply as they continuously fought the structure fires. Coordination quickly took place between the local units and DPS to bring in additional water resources. At 20:45 an emergency shelter was established for the firefighters as it became obvious this battle would carry over into the following day. Aerial reconnaissance at 21:00 showed the fire to be approximately 70% contained.

December 28, 2005

At 02:30 Abilene's Fire Chief briefed the Cross Plains Fire Chief and Assistant Chief as he relinquished his control of the incident. At 10:30 a few smokes were still visible, and by 11:32 the fire was determined to be 6,835 acres. Bulldozers continued operations as they put double bladed lines around the fire's perimeter, and mop-up continued on the hot spots.

December 29, 2006

The Cross Plains Fire was considered to be 100% contained at 18:00.

Case Study Methodology

The investigation of the fire was initiated by Texas Forest Service at the direction of the state WUI Coordinator. The intent of this case study is to learn from a tragic event and apply those lessons in the future to lessen the impact of a wildfire event.

Team's Charter

- To the greatest degree possible, identify factual data associated with the circumstances relating to the incident.
- Accurately and objectively record the findings gathered during field assessments, interviews and investigative efforts.
- Analyze the findings to identify the significant factors involved and their relationships.
- As appropriate, recommend actions that should be implemented immediately to lessen the impact of similar future occurrences.
- Establish liaison with, and involve appropriately, local, county, state and federal officials who have a jurisdictional responsibility relative to these incidents.
- Develop and submit an investigation report as soon as possible to the State Fire Chiefs, Rural Fire Defense Council, Division of Emergency Management (DEM), Association of Counties and Council of Governments (COGs), State Fire Marshall's Office and other concerned parties.
- Maintain awareness of the sensitive nature of information included in case study.
- Determine how case study can be utilized to reduce the potential for future urban wildland interface losses.

Home Loss Assessment

The overall area burned was observed by aircraft and vehicle throughout and following the fire event. A task force was assembled, consisting of Urban Wildland Interface specialists, to conduct home loss assessments from fire in the study area. These assessments were conducted utilizing an onsite reverse risk assessment. Assessments in Cross Plains were conducted on 20 of the homes destroyed and three damaged within 10 days of the fire. Due to high fire activity in surrounding counties and response duties placed on data collectors, further assessments were rescheduled for a later time. A follow-up assessment, beginning four months after the fire event, supplied additional details for remaining homes damaged or destroyed beyond recognition for evaluation during the initial assessment in regard to construction, fuels and landscape fuels. Susan McNeel with the Central Appraisal District of Baird County and Robert Harrell with the Cross Plains Volunteer Fire Department provided on-site information in the follow-up evaluation for homes lost and damaged.

The onsite reverse risk assessment consisted of the following components:

- A questionnaire (Appendix).
- A GPS location taken for each home assessed.
- When possible, interviews with residents were conducted.
- Photos of each home site (with or without home).
- Examination of the home to determine the probable cause of ignition or factors that could have contributed to a point of ignition.

- Presence of suppression forces at each structure assessed.
- Determination of the number of actual structures lost and location within the community.

During the initial assessments, and prior to returning for follow-up assessments, a number of the homes lost had been cleared and replaced by FEMA trailers or were being rebuilt. These homes were examined via tax appraisal cards and homeowner interviews.

Figure 11 shows an overview of the fire's perimeter and all homes lost or damaged during the fire event. Onsite data for homes lost or damaged was collected using Garmin Etrex Legends coordinated with tax appraisal cards for accurate verification of structures. The map was created in ESRI software ArcMap version 9.1, using Texas Natural Resources Information System data utilizing Stratmap transportation and 30 meter – 2004 National Agriculture Ortho-imagery (Map Projection information: NAD 1983, UTM Zone 14 Meters).

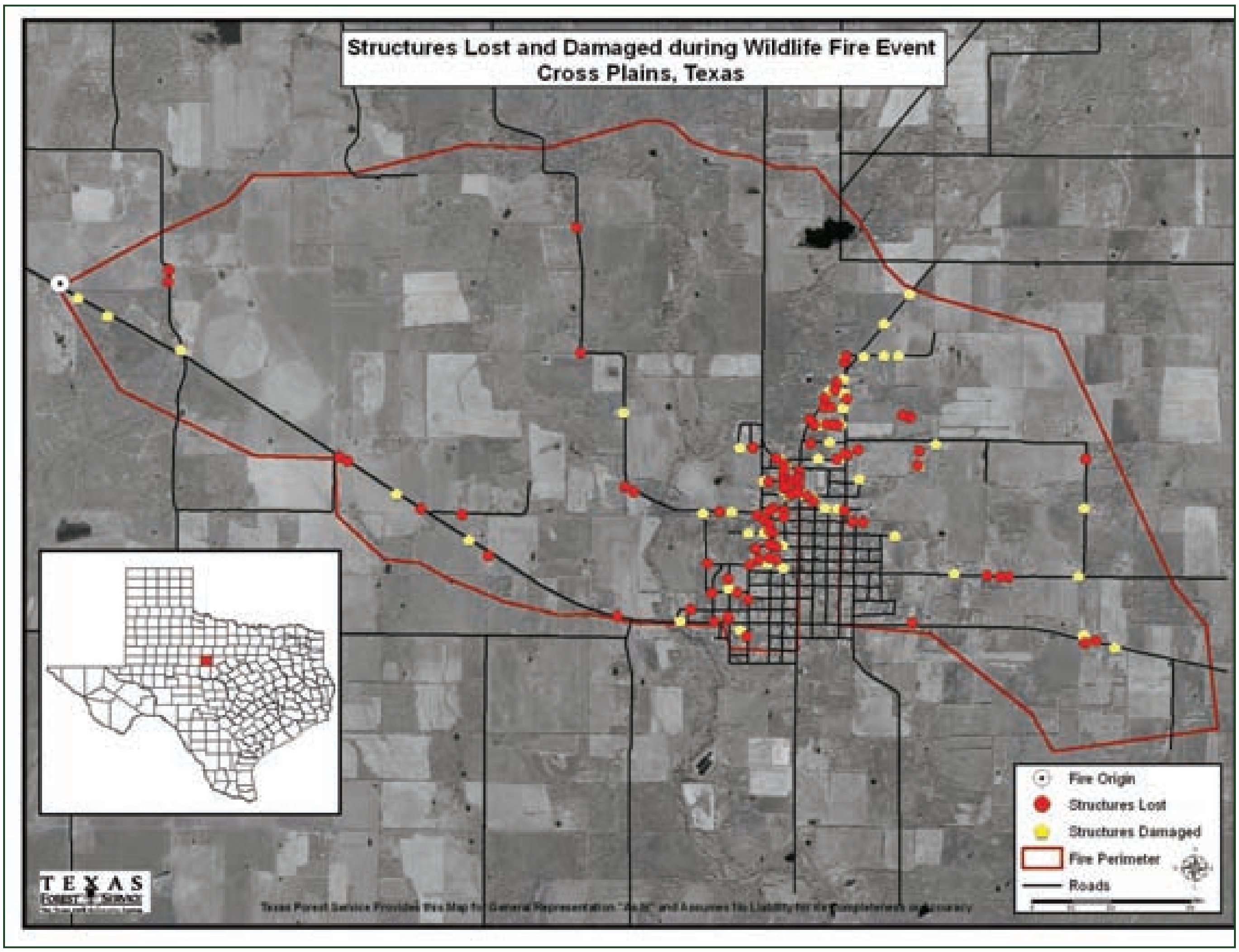


Figure 11 – Structures lost and damaged during the Cross Plains wildland fire event.

Modeling Fire Behavior

Fire models have existed for years and are continually being investigated and developed, with updates and modifications being made to existing models to keep in step with changes in research. The scope of this case study is not to discuss various modeling techniques. It is important to note, however, that current models examine fire behavior in wildland fuels independent of structures. The time scale associated with burning grass and burning individual trees is measured in tens of seconds, in contrast with the time scale for burning structures, which is measured in hours. Burning houses are shown to influence grass fire propagation, but excluding ignition it is not clear how grass fires influence the burning of houses. When a wildfire encounters an individual structure, the structure either resists the thermal insult or it ignites. Either way, the structure is no longer of interest for determination of wildfire behavior. It needs to be recognized that structures, when ignited, are part of the fuel system and that fire behavior with the structure included will be different than the fire behavior without the structure (Rehm 2006). The possible development of a urban wildland interface model based on wind-driven, ground-fire spread incorporating structures as fuels needs to be explored.

The fire modeling program FARSITE was used to look at fire behavior and fire spread for the Cross Plains wildfire event. FARSITE (Fire Area Simulator) is a two-dimensional, deterministic model for spatially and temporally simulating the spread and behavior of fires under conditions of heterogeneous terrain (i.e., elevations, slope and aspect), fuels and weather (Finney 1998). There are several assumptions and limitations to FARSITE as a modeling system. It is important that when reviewing results, model constraints and outputs from the models are viewed with this in mind.

GIS spatial fuel model and canopy cover data for Cross Plains was produced by incorporating polygons created using aerial imagery and ground truthing of the 7,000-acre fire area. Topography, slope and aspect were developed from 30 meter DEM data available from the Texas Natural Resources Information System (TNRIS). Final products were in raster formats of 30 meter grids using ArcMap/Spatial Analyst (version 9.1; ESRI, Redlands, CA) in a Universal Transverse Mercator, North American Datum of 1983 coordinate system.

To model fire growth, a single source ignition in FARSITE was started at the determined location of the fire start. All fire simulations were modeled without suppression. One-day simulations with a burn period of 1300-1700 hours were run. The simulation process was repeated multiple times with the same ignition point to validate the fire size, shape, rates of spread, flame lengths and fire intensity. Police reports and county dispatch records were used as a source of validation to confirm the fire's location throughout the day and the model's produced movement. FARSITE run (Figure 12) indicates the speed in which the fire spread through town. The majority of the south portion of the community experienced spread rates in the extreme range. The Fire Line Intensity run (Figure 13) indicated very high to extreme intensity in the study Area 3. This was an area with an exceedingly high concentration of structure loss. Flame length outputs (Figure 14) for the model confirm eye-witness reports of extreme flame lengths as the fire approached the town. Note flame lengths are well above the limits of control.

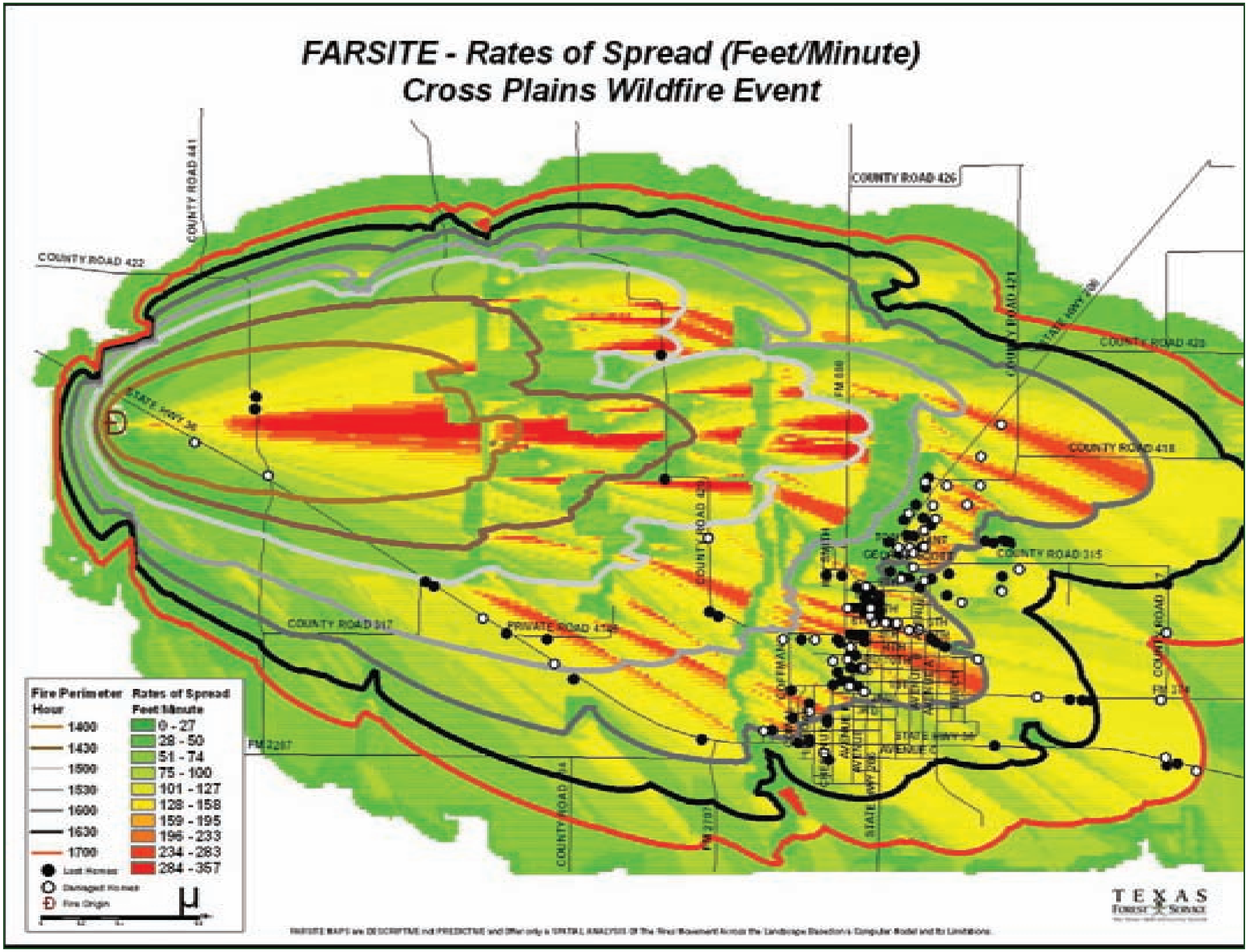


Figure 12 – Rates of spread.

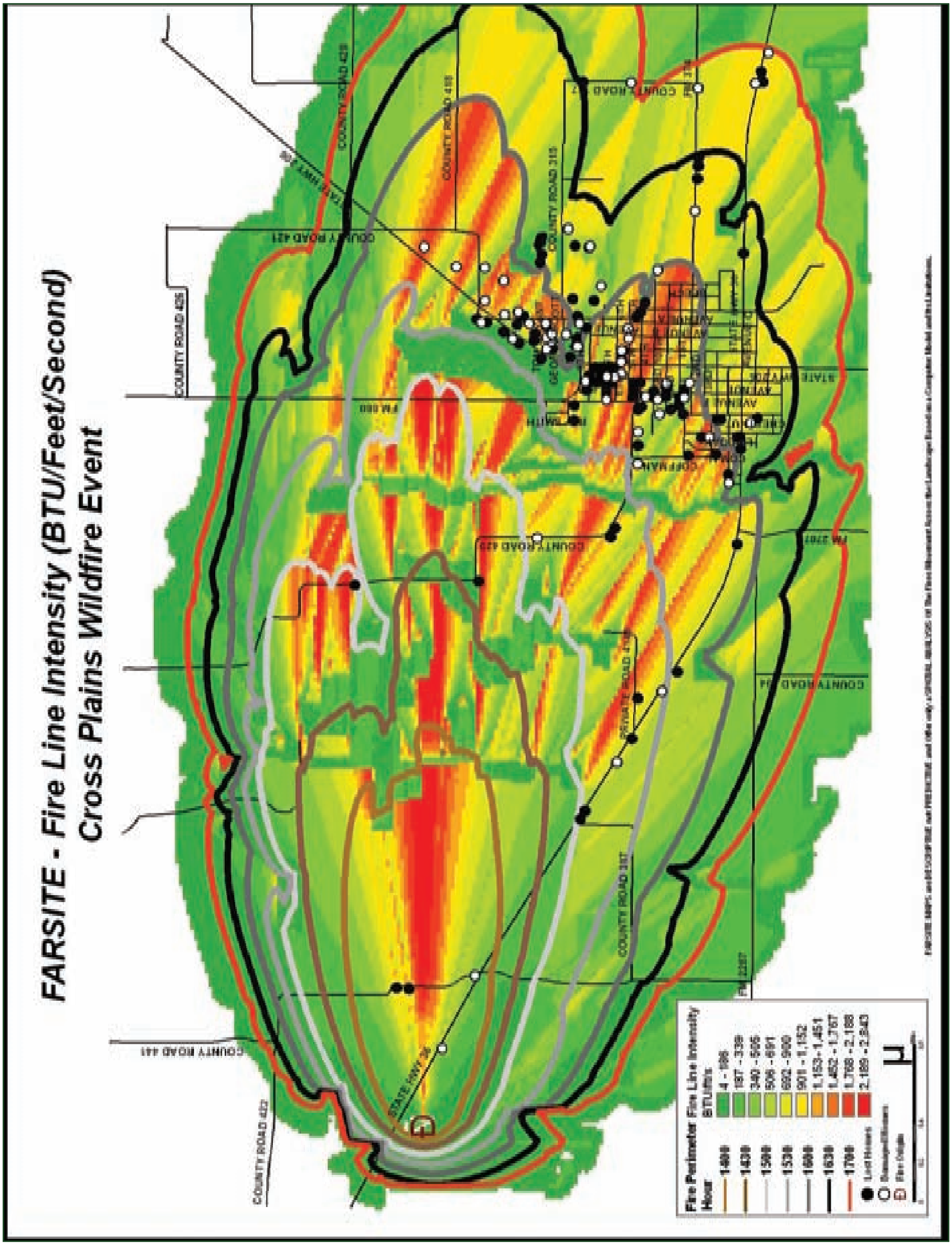


Figure 13 – Fire line intensity.

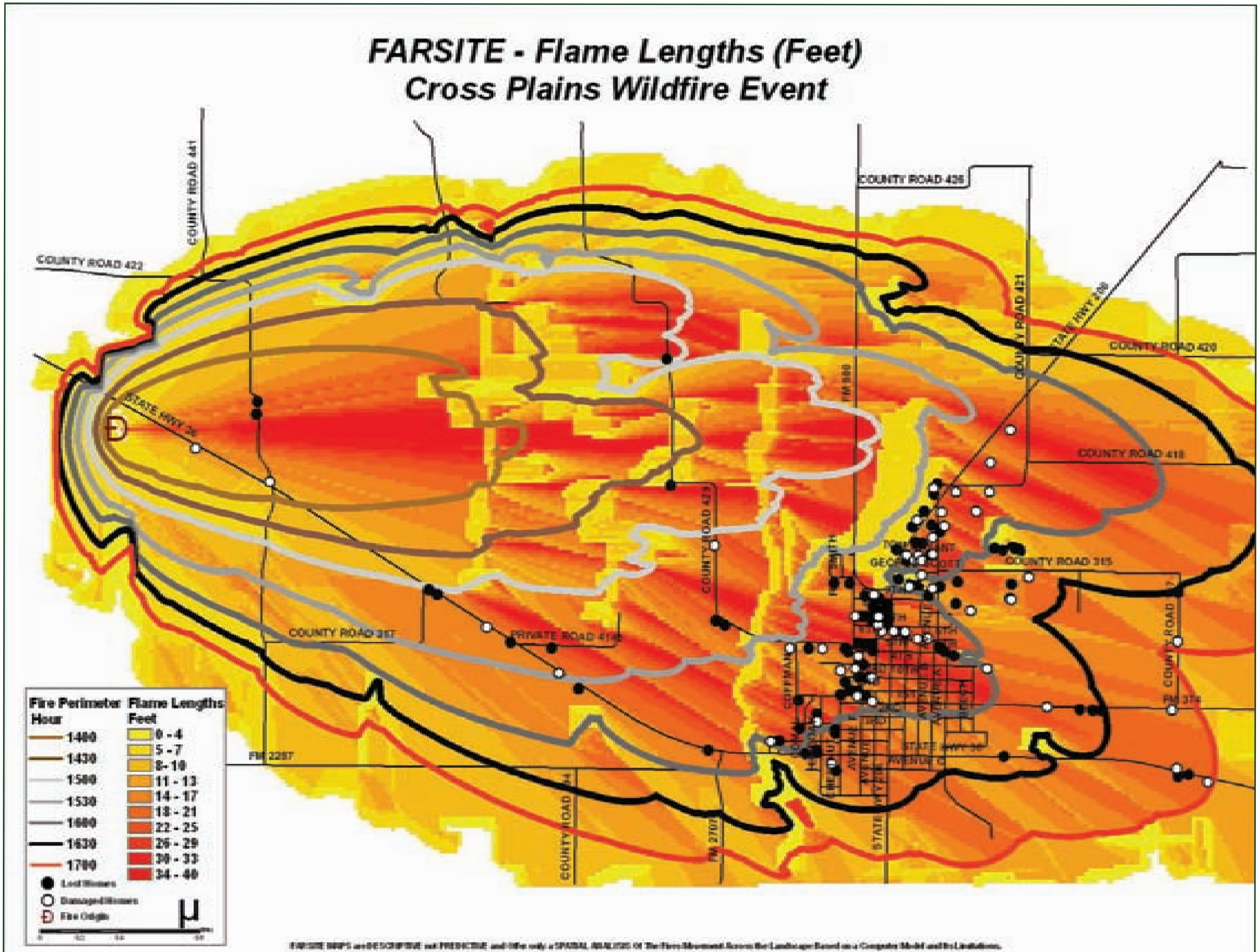


Figure 14 – Flame lengths.

Study Areas

Home losses during the Cross Plains fire have been broken down into seven primary study areas based on fuels and fire behavior in that unit. (Figure 15) This section of the case study will discuss the nuances involved in home ignition throughout the Cross Plains fire, as well as common denominators on the other fires within the study area. The entrance of fire on the leading edge into town was characterized by two scenarios: fire spread being pushed by extreme winds through predominately fine continuous herbaceous grasses; and open shrub overstories comprised of oak, cedar and yaupon with fine herbaceous grass understory. As the fire approached the community, radiant heat raised ambient temperatures and preheated flammable homes and vegetation in the path of the fire. The primary mechanism for home ignition during this fire was embers rolling along the ground and being carried aloft. These grass embers caused numerous spot fires, easily jumping roads, complicating fire suppression efforts and increasing the risk to residents and firefighters. Many homes were impacted by direct flame contact as fire traveled through short grass leading directly to structures. It was very often the case that the fire moved so quickly through an area that residual heat sources caused losses to occur after the main fire had passed. This direct flame contact occurred due to lack of breaks in continuous fuel beds such as residential lawns and landscape materials. Fire behavior outputs described in the study areas are based on outputs from BEHAVE Fuel Model GR4 and are described as a moderate load dry climate grass. Fuel Model 2 is described as a timber with grass and understory, and Fuel Model 9 is described as a hardwood litter.

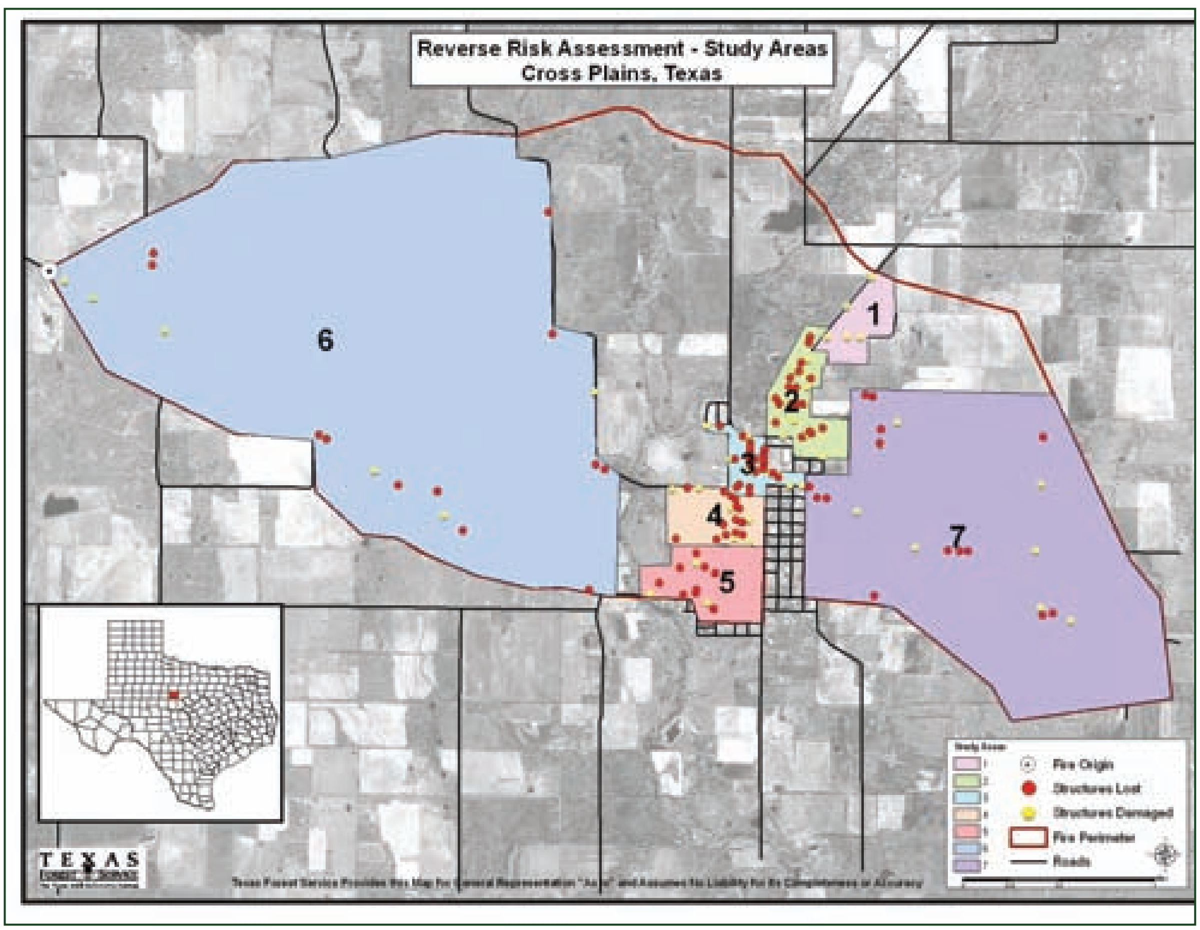


Figure 15 – Study areas for reverse risk assessment.

Area 1

Fire entered this area from a native grass field located in the northwest portion of Area 1. This area is adjacent to a plowed field located to the north of Area 1. Homes located in Fuel Model GR4, transitioning from a Fuel Model 2 located on the east side of State Hwy. 206, were impacted by the wildfire at approximately 17:15. As the fire front passed through Area 1, the rates of spread were 324 ft/min with sustained winds. Flame lengths were 17 ft. and fire line intensities were 2507 btu/ft/sec. Crossing State Hwy. 206, the fire approached two brick homes with manicured lawns and good defensible space. Jumping County Road 421, the fire went through a coastal Bermuda field which was close to knee-high, where eye witnesses saw 20-30 ft. flame lengths. Three brick homes were threatened after the fire jumped the gravel road. One brick home was damaged due to vegetation in contact with the roof's unenclosed soffits. Another brick home, 4, was lost due to a wooden deck located behind the home. An eyewitness homeowner stated that home 3 burned from behind, where smoldering embers under the deck caused the house to ignite. It is theorized that the plowed field north and northwest of Area 1 may have influenced the fire behavior by slowing the rate of spread and reducing heat outputs, a factor in saving these homes.


Case Study - Area 1
Cross Plains, Texas
1
2
3
4
5
COUNTY ROAD 421
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS
Forest Service

Map ID	Foundation	Siding	Roof	Structure Damage/ Loss	Loss of Outbuildings	Value of Losses	X-Factor
1	Slab	Brick	Composite	North end of house	4	$1,930.00	Vegetation
2	Slab	Brick	Composite	Cracked mortar on SE corner	5	$4,126.00	Undetermined
3	Slab	Brick	Composite	None	1	$4,233.00	N/A
4	Slab	Brick	Composite	None	1	$600.00	N/A
5	Slab	Brick	Composite	Total Loss	2	$138,239.00	Wooden Deck

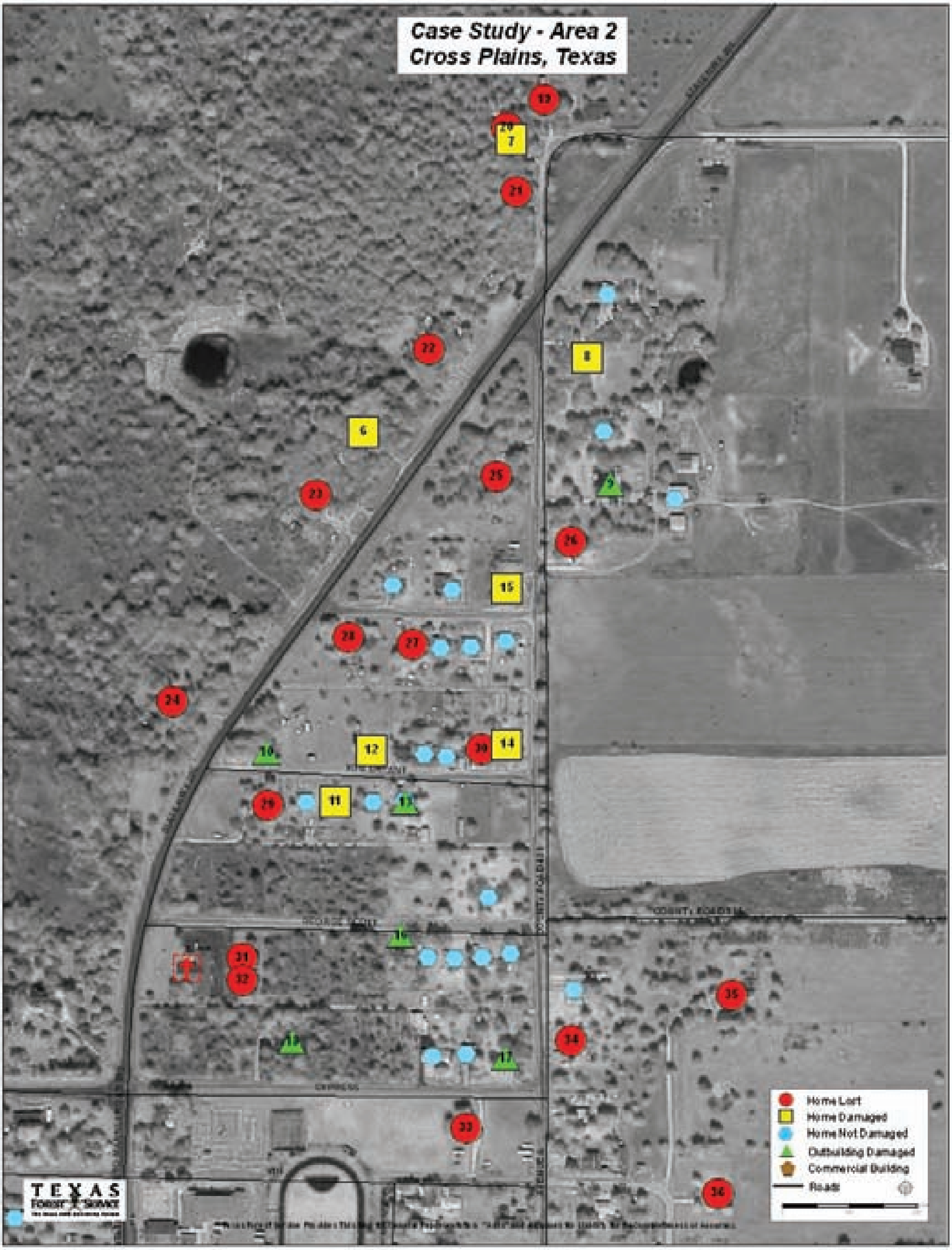
Table 5 – Map location of homes lost or damaged in study Area 1.
Total Value of Lost Structures: $138,239.00
Total Value of Damaged Structures: $10,889.00

A Closer Look at Home 4

The homeowner provided structure protection for this property. Although they lost their water supply from the well due to compromised electricity, they were able to use a horse trough onsite for a water source to extinguish the fire between the dog pen, the house and the burning fence line toward the home. The homeowner stated that the fire front had burned past the home, but a dramatic wind shift caused the fire to turn and put their home in direct threat from the newly created fire front.

Area 2

Homes were impacted directly by the leading edge of the fire coming out of a Fuel Model 2 located on both the east and west sides of State Hwy. 206. Fire activity in this area displayed rates of spread of 180 ft/min, flame lengths of 13 ft. and fire line intensities of 1584 btu/ft/sec. The flaming front moved through an over-story of post oak, with mid-story fuels of mesquite, greenbrier, yaupon and native grasses as the primary carrier of fire. After crossing County Road 421, a change in wind direction from the north caused the flaming fire front to turn in a southerly direction, creating a flanking fire which made a run through native grass and Bermuda fields with heavily matted fuels. The new head fire created a v-pattern with the opposing flanking fire coming from the west, sandwiching Area 2 between two opposing flanking fires and causing intense fire whirls and fire behavior. Eye witnesses on the west side of State Hwy. 206 stated the winter leaves of the post oak trees were bursting into flames before the flame front actually made it to the residence. Surrounding the Methodist church at the southwest corner of the area are the remnants of an exotic conifer plantation. Trees identified include blue spruce, shag pine, Arizona cypress, Leland cypress, red cedar and arborvitae. On the northwest side of State Hwy. 206, the fields were thick with post oak, cedar, juniper and mesquite, with excessive ladder fuels. The area located on the east side of State Hwy. 206 generally consisted of manicured lawns and homes constructed of brick or other masonry.



Case Study - Area 2
Cross Plains, Texas
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS FOREST SERVICE

Map ID	Foundation	Siding	Roof	House Structure	Loss of Outbuildings	Value of Losses	Possible X-Factors
6	Slab	Wood	Metal	Cracked all Windows/ Garage	1	Value not Reported	Open porch and Attached garage
7	Cinder Block	Vinyl	Composite	Back	2	$560.00	Deck
8	Slab	Brick	Metal	Car Port/ Windows East side	2	$2,000.00	Open porch and Attached garage
9	Slab	Brick	Composite	None	Barn	$14,500.00	N/A
10	Slab	Brick	Composite	None	1	$800.00	N/A
11	Slab	Brick	Composite	North/East/South sides of Home	1	$2,500.00	Open Eaves
12	Pier Beam	Wood	Composite	Back of House	1	$17,284.00	Patio
13	Slab	Brick	Composite	None	2	$5,002.00	N/A
14	Slab	Brick	Composite	Screen Porch	2	$2,312.00	Screen Porch
15	Slab	Brick	Composite	Eaves	1	$1,500.00	Open Eaves
16	Slab	Wood	Composite	None	4	$1,850.00	N/A
17	Slab	Brick	Composite	None	3	$2,479.00	N/A
18	Slab	Brick	Composite	None	3	$1,350.00	N/A
19	Cinder Block	Vinyl	Composite	Total Loss	0	$35,280.00	Mobile Home
20	Slab	Brick	Composite	Total Loss	0	$68,666.00	Open Porch
21	Slab	Brick	Composite	Total loss	1	$40,435.00	Undetermined
22	Slab	Brick	Composite	Total Loss	0	$105,792.00	Open Porch
23	Slab	Brick	Composite	Total Loss	0	$105,792.00	Open Porch
24	Slab	Wood	Composite	Total Loss	2	$117,871.00	Wood Deck
25	Slab	Wood	Composite	Total Loss	1	$64,676.00	Open porch
26	Cinder Block	Vinyl	Composite	Total Loss/Fatality	4	$11,450.00	Mobile Home
27	Pier Beam	Wood	Metal	Total Loss	1	$60,181.00	Open porch
28	Slab	Wood	Composite	Total Loss	3	$95,297.00	Undetermined
29	Pier Beam	Brick	Composite	Total Loss	0	$84,538.00	Open Foundation
30	Slab	Brick	Composite	Total Loss	1	$70,401.00	Undetermined
31	Pier Beam	Wood	Composite	Total Loss	1	$30,577.00	Open Foundation/ Eaves
32	Slab	Brick	Composite	Total Loss	1	$71,205.00	Open porch
33	Cinder Block	Vinyl	Composite	Total Loss	0	$33,984.00	Mobile Home
34	Concrete	Vinyl	Composite	Total Loss	0	$32,417.00	Mobile Home/ Wooden Carport
35	Slab	Wood	Composite	Total Loss	3	$124,166.00	Cedar post
36	Slab	Brick	Composite	Total Loss	3	$100,359.00	Undetermined
Church Commercial	Slab	Brick	Composite	Total Loss	0	$201,211.00	Undetermined

Table 6 – Map location of homes lost or damaged in study Area 2.
Total Value of Lost Structures: $ 1,232,249.00
Total Value of Damaged Structures: $ 52,137.00

A Closer Look at Home 8:
Metal roofing
Composite siding and enclosed soffits
Double-pane windows – Low E
Attic vents screened
Concrete slab
Lost garage
Lattice burned on back porch

Fire resistant building materials were used in the construction of this home. The roof is metal with hardy plank siding and a concrete foundation. Even though the fire burned up to the structure, this portion did not ignite. Although the windows on this home were double-pane, the minimal leaf litter generated enough heat intensity to break the first pane, but did not compromise the interior.

A Closer Look at Home 11:
Concrete slab
Brick
Composite roof
Wood enclosed soffits
Firebrands entered screened attic vents
The house appeared to have burned from the inside out.

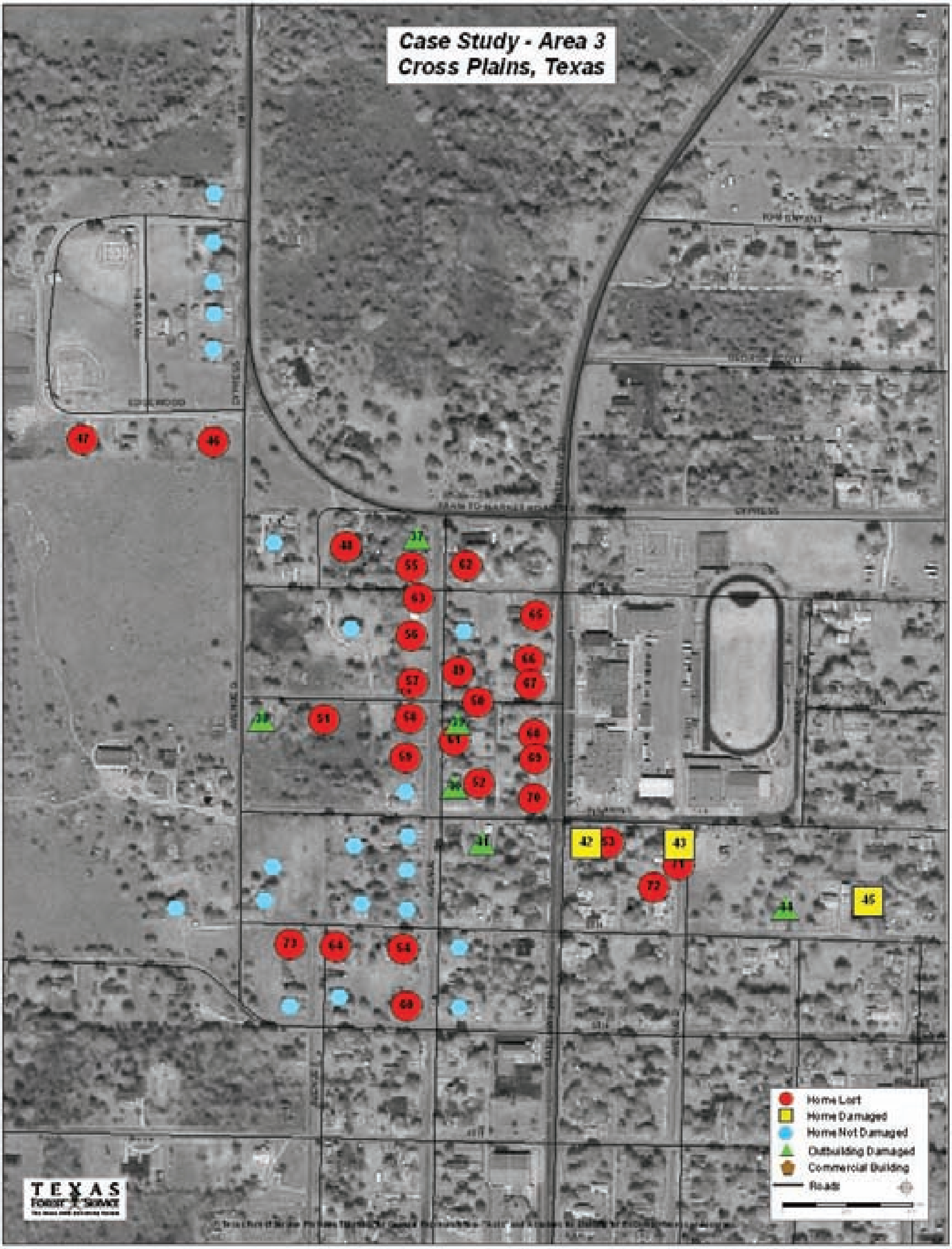
Although the adjacent structure burned, the fuels between the two structures were not consumed. Structure-to-structure ignition from radiant heat was not the most likely cause of these home ignitions. Unconsumed shrubs and grass indicate that ignition from landscaping was not the principle factor involved in the ignition. Fine ember firebrands were noted. They had accumulated near the homes and penetrated any access point on structures in the fire's path, such as attic and foundation vents. This can be seen in the profuse amount of grass embers caked against screens. Grass embers were such that the 1/8" screen which would normally be adequate to keep embers in a timber fuel type from entering the attic and compromising the structure were inadequate in this instance.

A Closer Look at Home 34:
Older manufactured home with metal skirting
Concrete slab
Wooden frame car port was point of exposure

The carport was supported by wooden beams with a composite asphalt overhang that ignited due to direct contact with the wooden beams.

Area 3

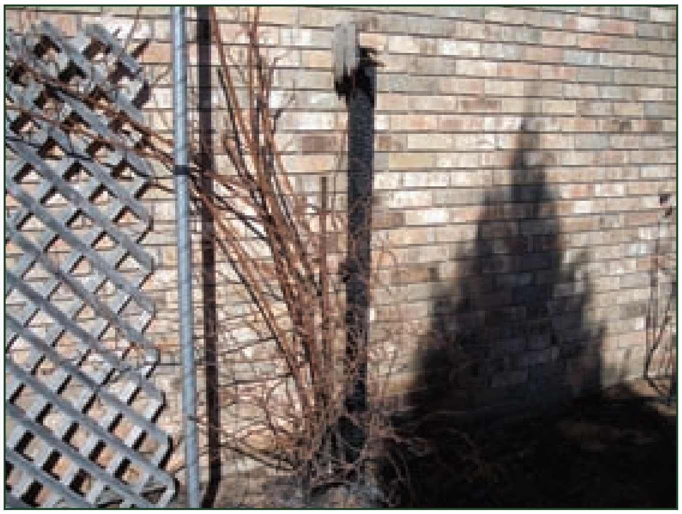
The fire aggressively burned through Fuel Model 9 prior to entering Fuel Model 1 on the west side of State Hwy. 206 in which the homes were located. Fire activity in this area exhibited rates of spread of 34 ft/min, flame lengths of 6 ft. and fireline intensities of 232 btu/ft/sec. This area includes Main Street and is more or less the center of town. The fire came across a native grass and mesquite field. Eyewitnesses saw 40-50 foot flame lengths. Most of the structures in this area are pier-and-beam construction with a crawl space. The lawns are not quite as manicured as seen in Area 2. Lots consist of oak and pecan, with intermittent juniper. It is postulated that the large masonry structure of the school compressed the flame front, not letting the heat escape. The reflective heat from the school, and the radiant heat from the structures before it that had already caught fire, created a chain reaction among the houses and structures along Main Street, causing total losses of homes along the block across from the school. The water-manicured baseball field in the northwest side of Area 3 may have played a role in the loss of only one home in the southwest corner of the complex. Perhaps in the future, the community could utilize this field as a maintained safety zone.


Case Study - Area 3
Cross Plains, Texas
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS
Forest Service

Map ID	Foundation	Siding	Roof	Structures Damaged/Lost	Loss of Outbuildings	Value of Losses	Possible X-Factors
37	Slab	Brick	Composite	None	2	$5,002.00	N/A
38	Pier Beam	Wood	Composite	None	1	$450.00	N/A
39	Slab	Brick	Composite	None	1	$400.00	N/A
40	Pier Beam	Wood	Composite	None	1	$600.00	N/A
41	Pier Beam	Wood	Composite	None	2	$2,200	N/A
42	Pier Beam	Wood	Composite	North side of House	0	$8,350.00	Wooden Fence
43	Pier Beam	Wood	Composite	South side of House	1	$5,430.00	Wood Porch
44	Pier Beam	Wood	Composite	None	1	$100.00	N/A
45	Pier Beam	Wood	Composite	Back of House	1	$1,045.00	Wood Deck
46	Pier Beam	Wood	Composite	Lost	0	$2,352.00	Barn
47	Slab	Wood	Metal	Total Loss	1	$35,764.00	Open Porch
48	Slab	Wood	Composite	Total Loss	6	$24,156.00	Undetermined
49	Pier Beam	Brick	Composite	Total Loss	0	$59,566.00	Undetermined
50	Pier Beam	Wood	Composite	Total Loss/Fatality	0	$22,449.00	Open Foundation
51	Pier Beam	Wood	Composite	Total Loss	0	$13,249.00	Open Foundation
52	Pier Beam	Wood	Composite	Total Loss	1	$21,530.00	Open Foundation
53	Pier Beam	Wood	Stucco	Total Loss	0	$35,259.00	Open Foundation
54	Pier Beam	Wood	Composite	Total Loss	1	$25,789.00	Open Foundation
55	Slab	Wood	Composite	Total Loss	2	$49,755.00	Undetermined
56	Pier Beam	Wood	Composite	Total Loss	3	$45,398.00	Open Foundation
57	Pier Beam	Wood	Composite	Total Loss	1	$18,749.00	Open Foundation
58	Pier Beam	Wood	Composite	Total Loss	1	$44,237.00	Open Foundation
59	Slab	Wood	Composite	Total Loss	1	$34,997.00	Undetermined
60	Pier Beam	Wood	Composite	Total Loss	0	$450.00	Undetermined
61	Pier Beam	Wood	Composite	Total Loss	1	$26,657.00	Open Foundation
62	Pier Beam	Wood	Composite	Total Loss	1	$1,150.00	Undetermined
63	Pier Beam	Wood	Composite	Total Loss	1	$37,994.00	Open Foundation
64	Pier Beam	Wood	Metal	Total Loss	3	$21,035.00	Open Foundation
65	Slab	Wood	Composite	Total Loss	0	$41,835.00	Duplex
66	Slab	Brick	Composite	Total Loss	1	$44,583.00	Undetermined
67	Pier Beam	Wood	Composite	Total Loss	1	$57,645.00	Open Foundation
68	Pier Beam	Wood	Composite	Total Loss	2	$25,793.00	Open Foundation
69	Pier Beam	Wood	Composite	Total Loss	1	$16,409.00	Open Foundation/Porch
70	Pier Beam	Wood	Composite	Total Loss	0	$32,814.00	Open Foundation/Porch
71	Pier Beam	Wood	Composite	Total Loss	0	$14,611.00	Open Porch
72	Cinder	Vinyl	Composite	Total Loss	0	$2,486.00	Mobile Home
73	Pier Beam	Wood	Composite	Total Loss	0	$22,665.00	Open Foundation

Table 7– Map location of homes lost or damaged in study Area 3.
Total Value of Lost Structures: $779,377.00
Total Value of Damaged Structures: $ 23,577.00

A Closer Look at Home 37
Home built in 1997
Brick
Composite roof
Wood enclosed soffits
Screened attic vents
Concrete slab
Deck metal post and roofing



The wooden fence that led up to and is connected to the home caught fire after the main fire front had passed, and active flames persisted along the fence line through the night and into the following day. Homeowners put out the fire and monitored the fence for 24 hours. They went through two hoses, due to melting, and during the course of the evening, residents lost electricity to the well and were forced to use onsite water with buckets. Arizona cypress, considered highly volatile, received only minimal scorching due to the speed at which the fire traveled across the landscape.

A Closer Look at Home 53:
Metal roof
Stucco siding
Pier-and-beam foundation

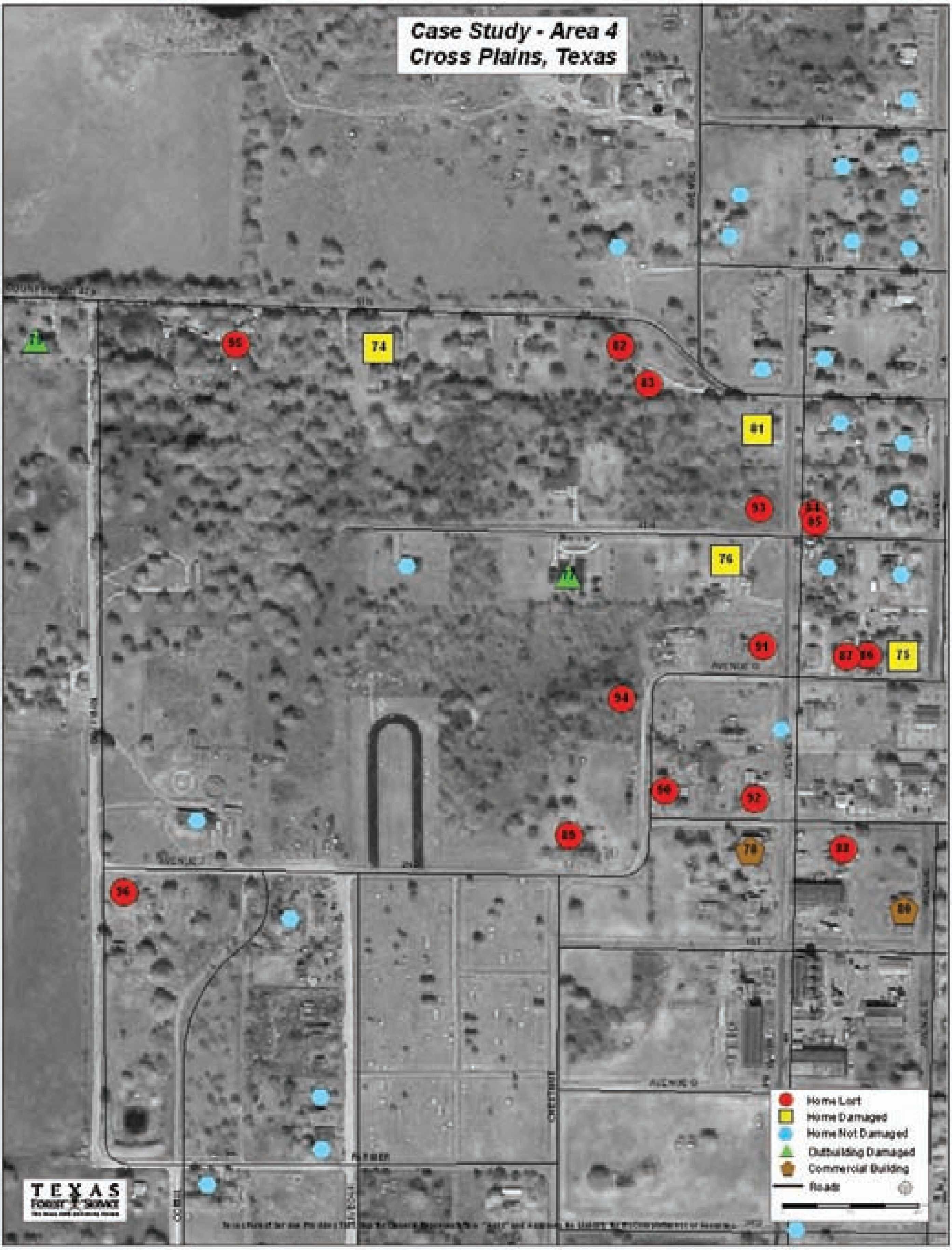
Landscape railroad ties carried the fire to the home and ignited the wooden beam foundation. Also, blown embers under the open foundation resulted in multiple points of exposure. Despite close proximity to hydrants, loss of the home occurred due to lack of manpower.

A Closer Look at Home 45:
Composite roof
Hardy plank siding
Cinder block/slab foundation

Although constructed of primarily non-combustible materials, such as composite siding and roofing, this home would have been lost had firefighters not returned to the home after the initial flame front. Suppression forces had to remove the wooden steps from the front of the home and extinguish the back porch. Both additions to the structure were constructed from combustible materials. Spotting onto flammable material on the porch generated enough heat to compromise the window framing which could have led to interior ignition. Notice that the majority of unconsumed fuel on the lot was near the home. Blowing embers created ignition potentials for the home. The back porch was the only other wood attachment on the structure, becoming a point of ignition; however, the fire was extinguished by fire department. It was noted during the reverse risk assessment that the majority of the fuel on the lot was unconsumed by the fire.

Area 4

Homes in this area were impacted directly by the leading edge of the fire coming out of a Fuel Model 2, which is similar to study Area 2 and is located on the west side of State Hwy. 206. The flame front was still heading from the northwest. Eighty percent of the west side of Area 4, north of 4th Street and between 4th and 3rd along Avenue G, is thick overgrown juniper and mesquite with intermittent oak. Home construction became less slab and brick and was primarily pier-and-beam with wood siding, or mobile homes. Refuse and other debris in the yards and lots increased around these homes. The thick, overgrown vegetation on the west side of the study area is hypothesized to have slowed the flame front, allowing the fire to gain in heat output productions, possibly contributing to a major cause of the higher number of houses lost in this section.


Case Study - Area 4
Cross Plains, Texas
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Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS
Forest Service

Map ID	Foundation	Siding	Roof	Structures Damaged/Lost	Loss of Outbuildings	Value of Losses	Possible X-Factors
74	Pier Beam	Wood	Composite	Porch	2	$1,800.00	Construction Material
75	Pier Beam	Vinyl	Composite	North/East/West Sides	2	$2,100.00	Wood Porch/ Open Eaves
76	Pier Beam	Vinyl	Metal	East/North Sides	1	$3,289.00	Vinyl Siding/Single Pane Windows/Wooden Porch
77	Slab	Brick	Composite	None	3	$3,800.00	N/A
78	Slab	metal	Composite	back	0	$17,933.00	Commercial Building
79	Slab	Wood	Composite	None	1	$410.00	N/A
80	Slab	metal	Composite	None	1	$1,500.00	Commercial Building
81	Pier Beam	Wood	Composite	North/East/South Sides	1	$42,690.00	Open Wood Porch/ Vegetation
82	Pier Beam	Wood	Composite	Total Loss	2	$40,972.00	Open Foundation/Open Porch
83	Pier Beam	Wood	Composite	Total Loss	1	$13,550.00	Open Foundation/Porch
84	Pier Beam	Wood	Composite	Total Loss	1	$42,495.00	Open Foundation
85	Pier Beam	Wood	Composite	Total Loss	1	$22,588.00	Open Foundation/Eaves
86	Pier Beam	Wood	Composite	Total Loss	1	$24,055.00	Open Foundation/Porch
87	Pier Beam	Wood	Composite	Total Loss	0	$21,405.00	Open Foundation
88	Pier Beam	Wood	Composite	Total Loss	0	$23,471.00	Open Foundation/Porch
89	Pier Beam	Wood	Metal	Total Loss	1	$35,996.00	Open Wood Porch
90	Mobile Home	Vinyl	Composite	Total Loss	2	$9,494.00	Mobile Home
91	Pier Beam	Wood	Composite	Total Loss	1	$22,992.00	Open Foundation/Porch
92	Pier Beam	Wood	Composite	Total Loss	1	$652.00	Open Foundation
93	Pier Beam	Wood	Composite	Total Loss	0	$97.00	Vegetation/Open Foundation
94	Mobile Home	Vinyl	Composite	Total Loss	2	$9,182.00	Mobile Home
95	Pier Beam	Wood	Metal	Total Loss	1	$35,576.00	Open Foundation
96	Cinder Block	Vinyl	Composite	Total Loss	0	$2,503.00	Mobile Home

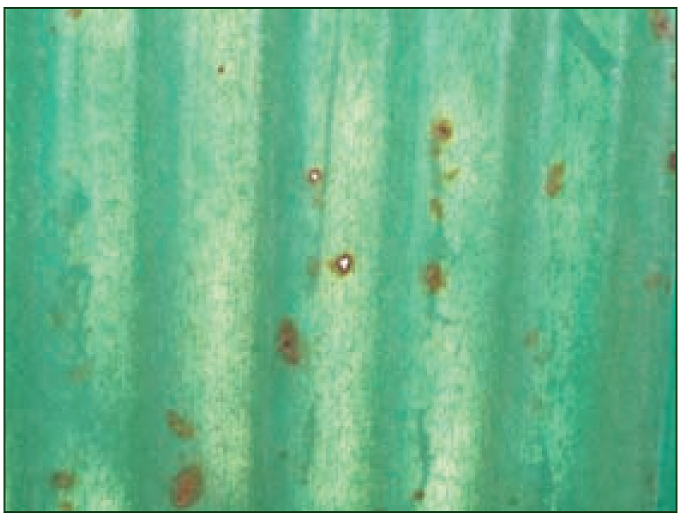
Table 8 – Map location of homes lost or damaged in study Area 4.
Total Value of Lost Structures: $ 305,028.00
Total Value of Damaged Structures: $ 735,220.00

A Closer Look at Home 75
Metal roof with open wooden soffits
Vinyl siding with grass growing under siding
Pier-and-beam foundation
Wooden front porch
Wooden lattice on the back porch
Lost barn and outbuilding




The homeowner stated that wind shifts from west to north brought the fire to the house. The fire department initially started suppression. Observations noted fire brands being carried by the wind to the side of the house and dropping them into the grass. Grass growing up under vinyl siding ignited, and consequently, the heat began to melt the siding and ignited the lattice on the back of the home.

A Closer Look at Home 76
Composite roof with closed vinyl soffits
Gutters had leaf guards
Vinyl siding with single-pane windows
Pier-and-beam foundation
Wooden porch with lattice and wheelchair ramp burned



During the reverse risk assessment, the fiberglass overhang on the back porch suggested the sheer number of firebrands that assaulted this structure during the fire. There was increased risk to this home due to roof construction. Unscreened lattice work around the home allowed for the accumulation of leaf litter and debris. The fire generated enough heat to ignite the back porch and char the pier-and-beam foundation. It would be reasonable to assume that if the lattice work had been screened, this home would not have sustained ignition. Although the screens did not melt, heat from the burning porch compromised the single-pane windows. This structure was retro-fitted with vinyl siding, which when melted, exposed the original wood siding. No barrier protected the exposed wood siding which allowed the home to be vulnerable to radiant and conductive heat. This home was saved due to structure protection after the fire front passed.

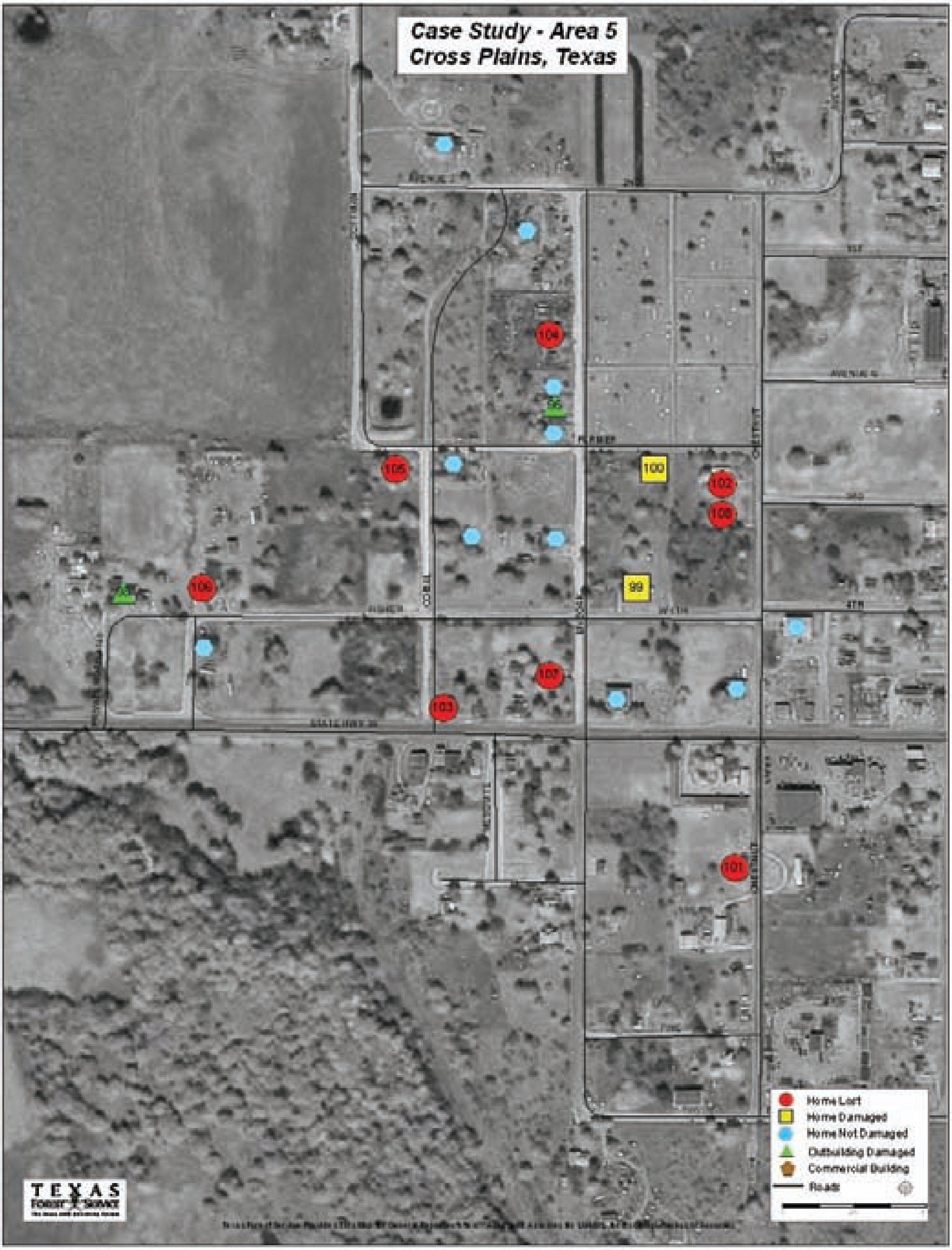
A Closer Look at Home 81

Composite roof
Wood siding
Open wooden soffits

Grass growing under wood siding acted as a fuse for fire to ignite the siding and subsequently ignited the eaves. Note the break in fuels between the yard and the home caused by a dog run. Only a small amount of fuel was left adjacent to home, where fire spotted over the dog run to the grass next to the home. Single-pane windows, once compromised, permitted fire and heat to enter the home.

Area 5

The fire came from the northwest over fields of waist-high native grass into an overgrown oak and juniper field. Coming out of a Fuel Model 9, a quarter mile of Fuel Model GR4 grasslands expanded out in front of the homes in this area, located on the west side of State Hwy. 206. To the east of the native grass field, there are grazed pastures, which perhaps shielded many structures on Live Oak St. Many of the homes in this section were either older pier-and-beam or mobile. Excessive debris at the southern end of the overgrown oak/juniper patch led to the total loss of structures. The socio-economic conditions of excessive debris, lack of landscape maintenance with regard to defensible space and fabricated homes in this section may have led to greater home loss.


Case Study - Area 5
Cross Plains, Texas
104
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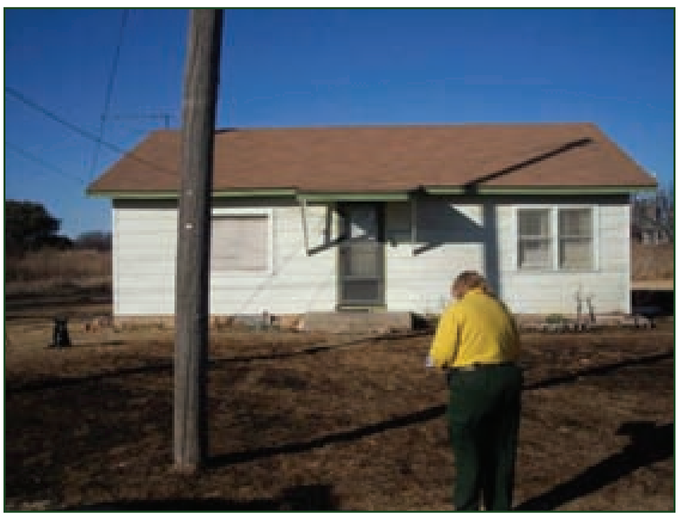
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS Forest Service

Map ID	Foundation	Siding	Roof	Structures Damaged/Lost	Loss of Outbuildings	Value of Losses	Possible X-Factors
97	Pier Beam	Wood	Composite	None	2	$1,200.00	N/A
98	Pier Beam	Wood	Composite	None	1	$100.00	N/A
99	Slab	Wood	Composite	Windows/ Wood Siding	0	$0.00	Single Pane Windows
100	Slab	Vinyl	Composite	Eaves/Siding	3	$0.00	Siding Open Eaves/ Soffits
101	Pier Beam	Wood	Composite	Total Loss	0	$12,125.00	Open Foundation
102	Pier Beam	Wood	Composite	Total Loss	0	$14,430.00	Open Foundation
103	Pier Beam	Wood	Composite	Total Loss	1	$55,323.00	Open Foundation
104	Pier Beam	Wood	Composite	Total Loss	1	$21,522.00	Open Foundation/ Debris
105	Pier Beam	Wood	Composite	Total Loss	1	$32,116.00	Open Foundation
106	Cinder Block	Vinyl	Composite	Total Loss	2	$2,000.00	Mobile Home
107	Pier Beam	Wood	Composite	Total Loss	3	$47,105.00	Open Deck/ Wood Porch
108	Pier Beam	Wood	Composite	Total Loss	2	$38,263.00	Open Porch

Table 9 – Map location of homes lost or damaged in study Area 5.
Total Value of Lost Structures: $ 222,884.00
Total Value of Damaged Structures: $ 1,300.00

A Closer Look at Home 99:
Composite roof with unenclosed wooden soffits
Wood siding
Concrete slab
Suppression conducted by volunteer fire department





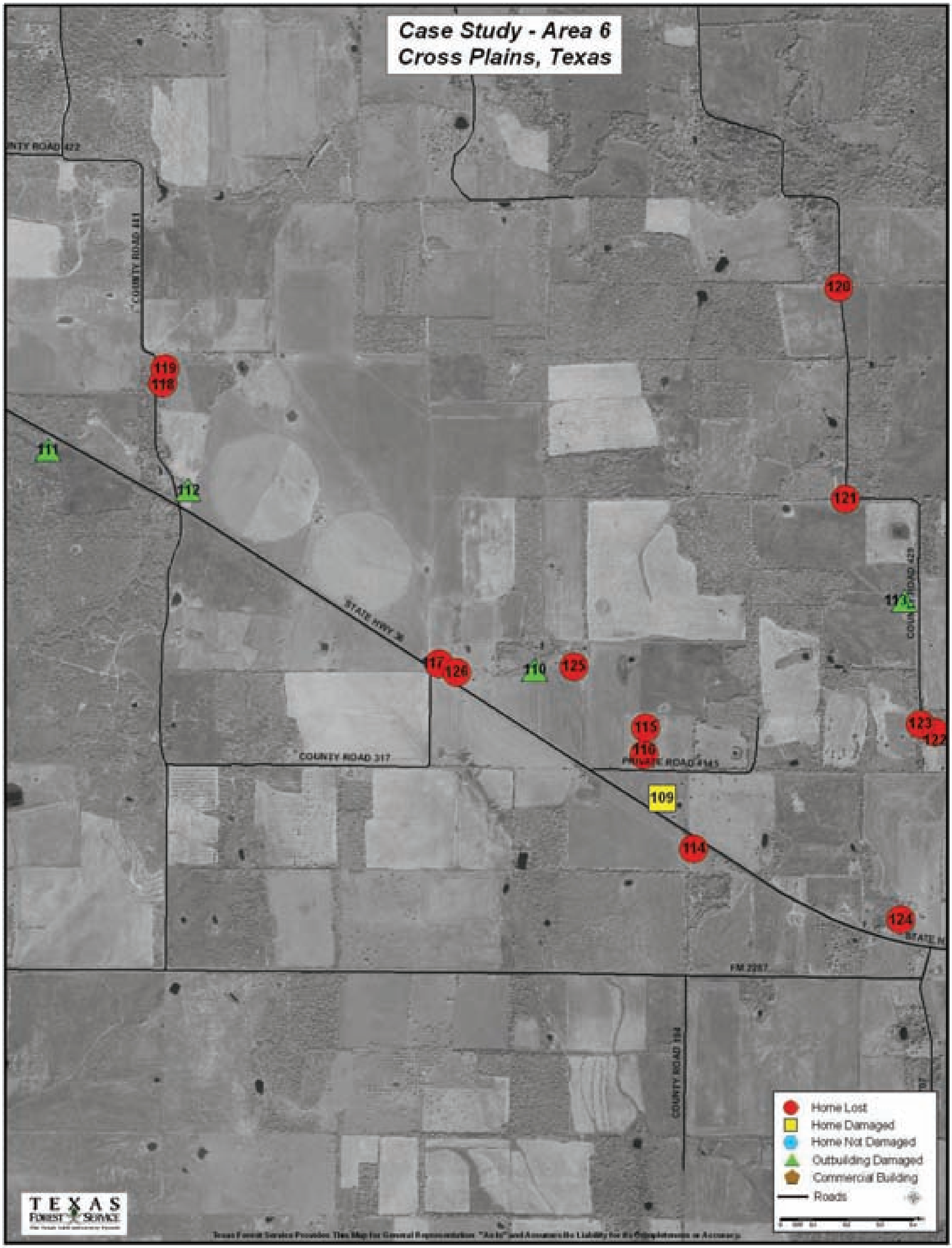

Dog runs on the front and back side of the home created a fuel break, keeping the fire from making contact on three sides of the home. Fire traveled to the side of the home where the dog's movement was restricted, allowing the fire to come in direct contact with the wood siding home. Radiant heat was significant enough to compromise single-pane windows and melted vinyl blinds.

A Closer Look at Home 100:
Composite roof
Vinyl siding
Concrete slab
No hydrants available, homeowner saved house

Fire approached this house from the south and immediately melted the vinyl siding, exposing the insulation and wooden frame. A stone walkway and concrete sidewalks around the remainder of the home protected the sides of the home and prevented the fire from making contact. The lack of a barrier allowed the backside of the home to be compromised and ignitable by the fire. The homeowner provided structure protection and prevented further home ignition. The stone walkway acted as a barrier, preventing the fire from spreading in the grass and along the fence and making contact with the home. The firewood rack, although less than 30 ft. from the home, had scorched grass underneath but did not ignite due to the metal rack preventing direct flame contact from the grass fire. Vinyl siding and soffits melted, exposing insulation and wood overhangs, increasing the potential for the wood frame to ignite

Area 6

Three-and-one-half miles west of Cross Plains was the location for the point of origin for the fire. An assumed discarded cigarette into model GR4 fuels on the south side of State Hwy. 206 resulted in an ignition of dead winter grasses. Despite the quick response of fire departments arrival on scene the fire quickly spread through the grass, which was a GR4 fuel. At the time of ignition, 1-hour dead fuel moistures were calculated at 5%, surface rates of spread were estimated at 2.4 mph, with flame lengths in this grass model observed at 13 ft.



Case Study - Area 6
Cross Plains, Texas
COUNTY ROAD 411
STATE HWY 36
COUNTY ROAD 317
PRIVATE ROAD 4145
FM 2287
COUNTY ROAD 184
COUNTY ROAD 429
120
119
118
111
112
121
113
117
126
110
125
115
116
123
122
109
114
124
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS FOREST SERVICE

Map ID	Foundation	Siding	Roof	Structures Damaged/Lost	Loss of Outbuildings	Value of Losses	Possible X-Factors
109	Pier Beam	Wood	Composite	Car Port	1	$700.00	Car Port
110	Cinder Block	Vinyl	Composite	Back of Home	2	$0.00	Wooden Porch
111	Pier Beam	Wood	Composite	None	4	$1,260.00	N/A
112	Cinder Block	Vinyl	Composite	None	2	$2,850.00	Mobile Home
113	Cinder Block	Vinyl	Composite	None	1	$0.00	Mobile Home
114	Pier Beam	Wood	Composite	Total Loss	2	$36,109.00	Porch on Back of Home
115	Cinder Block	Vinyl	Composite	Total Loss	1	$0.00	Mobile Home
116	Cinder Block	Vinyl	Composite	Total Loss	0	$0.00	Mobile Home
117	Cinder Block	Vinyl	Composite	Total Loss	2	$0.00	Mobile Home
118	Cinder Block	Vinyl	Composite	Total Loss	1	$44,138.00	Wood addition
119	Cinder Block	Vinyl	Composite	Total Loss	1	$15,901.00	Mobile Home
120	Pier Beam	Wood	Composite	Total Loss	1	$0.00	Undetermined
121	Cinder Block	Vinyl	Composite	Total Loss	2	$0.00	Mobile Home
122	Pier Beam	Wood	Composite	Total Loss	1	$0.00	Vacant House
123	Slab	Brick	Composite	Total Loss	0	$0.00	Undetermined
124	Pier Beam	Wood	Metal	Total Loss	3	$32,825.00	Open Porch
125	Pier Beam	Wood	Composite	Total Loss	1	$33,928.00	Open Porch
126	Slab	Wood	Composite	Total Loss	1	$3,203.00	Undetermined

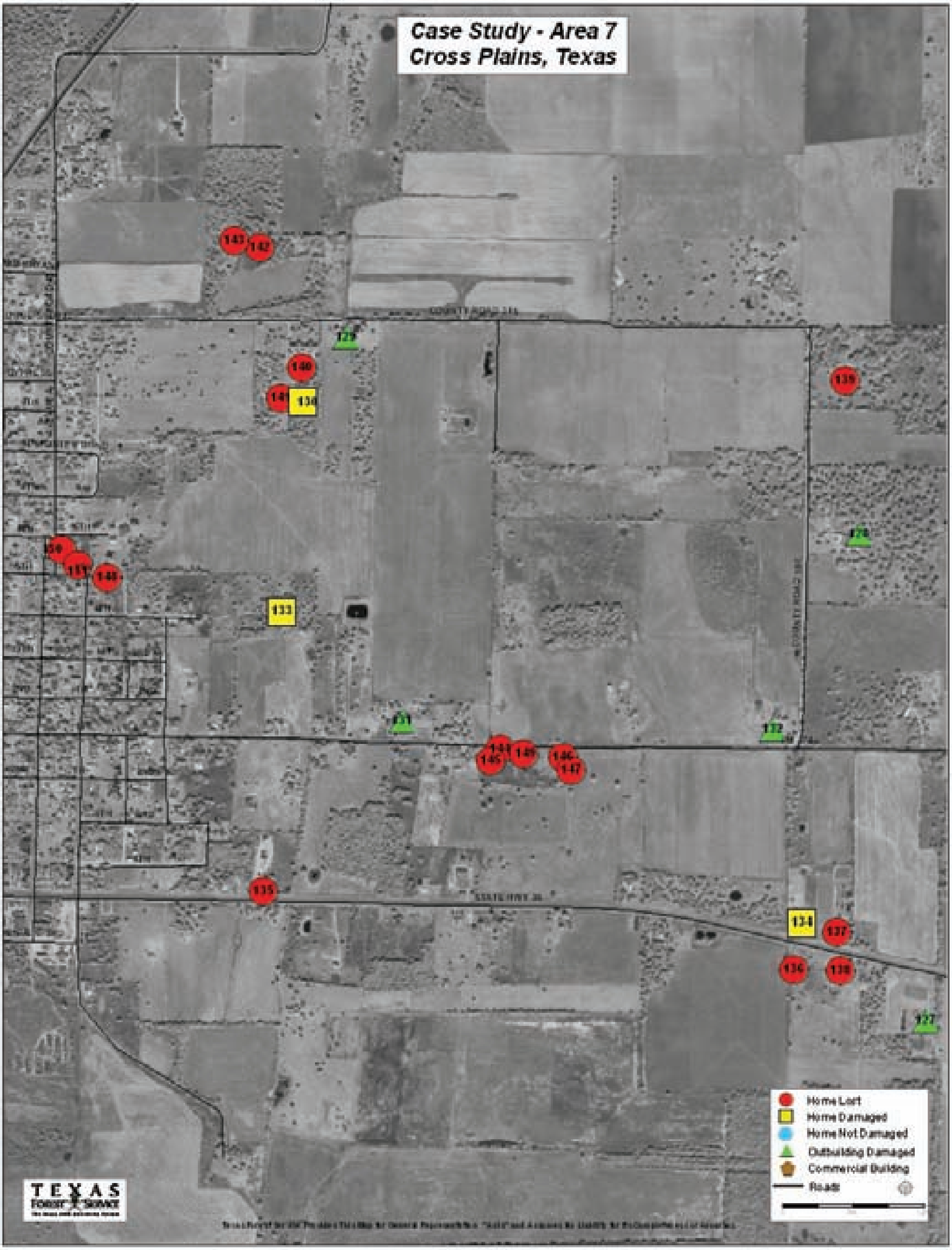
Table 10 – Map location of homes lost or damaged in study Area 6.
Total Value of Lost Structures: $ 166,104.00
Total Value of Damaged Structures: $ 4,810.00

A Closer Look at Home 118
Manufactured home with wood siding
Metal roof
Cinder block foundation
Cattle panel fencing

Vegetation around the entire perimeter of the home was minimal with short grass being dominant. The ignited grass produced enough heat to ignite a wooden walkway leading to the front of the home and wooden deck. The wooden walkway acted as a fuse leading to the home and causing ignition. The wooden front porch and walkway faced the oncoming fire front. This was the first home lost despite suppression efforts.

Area 7

A third wind shift occurred during the evening hours of the event, pushing the fire in a southeasterly direction and causing the fire to turn back on itself, consuming homes on the east side of town and threatening numerous businesses. Despite evening conditions of slightly increased RH and decreased wind speeds, fire behavior was still active in the GR4 grass Fuel Model predominate in this area, along with motts of hardwoods. The fire consumed mobile homes and older pier-and-beam foundation homes.



Case Study - Area 7
Cross Plains, Texas
Home Lost
Home Damaged
Home Not Damaged
Outbuilding Damaged
Commercial Building
Roads
TEXAS Forest Service

Map ID	Foundation	Siding	Roof	Structures Damaged/Lost	Loss of Outbuildings	Value of Losses	Possible X-Factors
127	Pier Beam	Wood	Metal	None	1	$16,500.00	Barn
128	Slab	Brick	Composite	None	1	$200.00	N/A
129	Slab	Brick	Composite	None	3	$2,600.00	N/A
130	Pier Beam	Wood	Composite	Carport	0	$623.00	Carport, Open Porch
131	Pier Beam	Wood	Metal	None	4	$1,500.00	N/A
132	Slab	Brick	Metal	None	1	$130.00	N/A
133	Pier Beam	Wood	Composite	Porch	1	$3,954.00	Open Porch
134	Pier Beam	Wood	Composite	Total loss	3	$39,398.00	Debris
135	Pier Beam	Wood	Composite	Total loss	3	$73,452.00	Open Porch
136	Slab	Metal	Metal	Total loss	0	$450.00	Undetermined
137	Pier Beam	Wood	Composite	Total Loss	6	$35,267.00	Open Porch
138	Cinder Block	Vinyl	Composite	Total Loss	0	$450.00	Mobile Home
139	Slab	Brick	Metal	Total loss	3	$79,185.00	Open Porch, Attic Garage
140	Cinder Block	Vinyl	Composite	Total loss	3	$14,966.00	Mobile Home - Open Porch
141	Pier Beam	Wood	Composite	Total loss	0	$22,464.00	Carport, Open Porch
142	Pier Beam	Wood	Composite	Total loss	2	$23,420.00	Open Porch
143	Pier Beam	Wood	Composite	Total loss	0	$36,447.00	Open Porch
144	Pier Beam	Wood	Composite	Total Loss	0	$25,872.00	Open Porch
145	Pier Beam	Wood	Composite	Total loss	0	$27,699.00	Duplex/Open Porch
146	Pier Beam	Wood	Composite	Total loss	3	$28,040.00	Open Porch
147	Cinder Block	Vinyl	Composite	Total Loss	0	$0.00	Mobile Home
148	Cinder Block	Vinyl	Composite	Total loss	1	$10,742.00	Mobile Home
149	Pier Beam	Wood	Composite	Total loss	0	$100.00	Vacant Home
150	Pier Beam	Vinyl	Composite	Total loss	0	$0.00	Mobile Home
151	Pier Beam	Wood	Composite	Total loss	1	$15,182.00	Undetermined

Table 11 – Map location of homes lost or damaged in study Area 7.
Total Value of Lost Structures: $393,736.00
Total Value of Damaged Structures: $25,507.00

A Closer Look at Home 133:
Pier-and-beam foundation
Wood siding
Composite roof

Despite numerous spot fires observed around the front of the home, ignitions actually occurred on the backside of the home. The large amounts of debris within close proximity to the home are credited with contributing to the ignition of the home.

A Closer Look at Home 134:
Cedar, vinyl, and wood siding
Pier-and-beam /cinder block foundation
Composite roof

The lack of a break in fuels allowed the fire to burn directly to the side of the structure and melt the vinyl siding. The homeowners were forced to evacuate, but family members returned after the initial fire front passed to continue suppression efforts, saving the home.

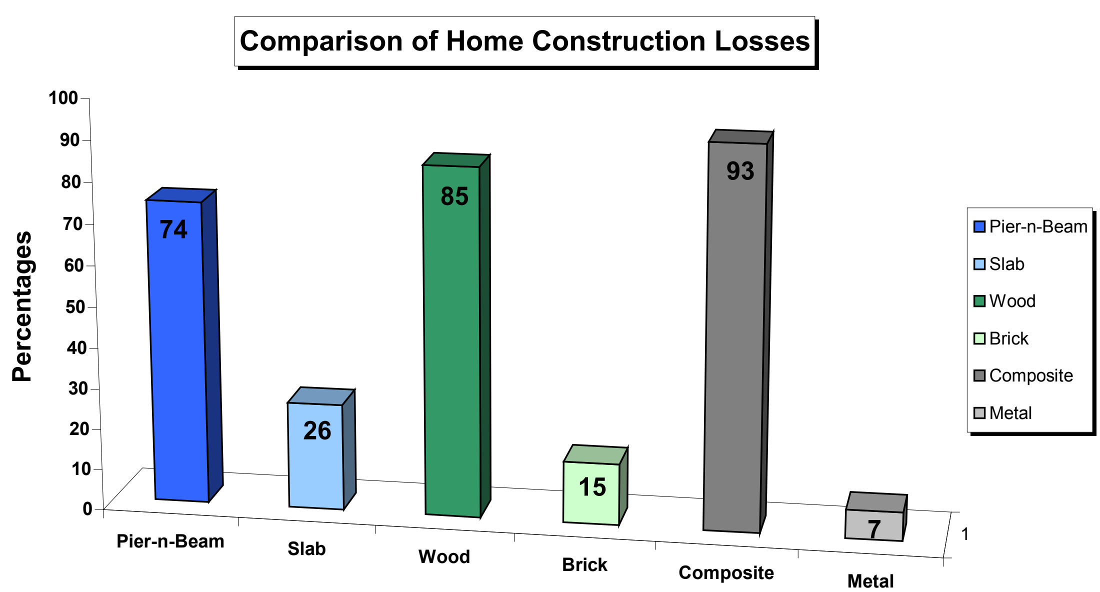
Results

Vegetation as a fuel source for fire is dynamic not static, especially in fine fuels found in rangeland/prairie-type landscapes. In some cases, in just a matter of hours, fine fuel moistures can be altered by relative humidity, temperature and winds, allowing grass-type fuels to be prime for ignition. Stress brought about by heavy grazing and agriculture development have altered the prairie landscape in Cross Plains, creating a risk level of high fire danger in the area under the right weather conditions. Three fuel model types comprised the landscape for the Cross Plains fire. GR4 (104) is a grass fuel model described as a moderate load, continuous dry-climate grass with fuel bed depths of two feet. FM2 is a grass and understory fuel model with fuel bed depths in herbaceous material and leaf litter of one foot. FM9 is a hardwood timber litter model with fuel bed depths of .2 feet. GR4 accounted for 78% of the fuel source over 5,349 acres, FM2 accounted for 6% of the fuel source over 413 acres, and FM 9 accounted for 16% of the fuel source over 1,073 acres.

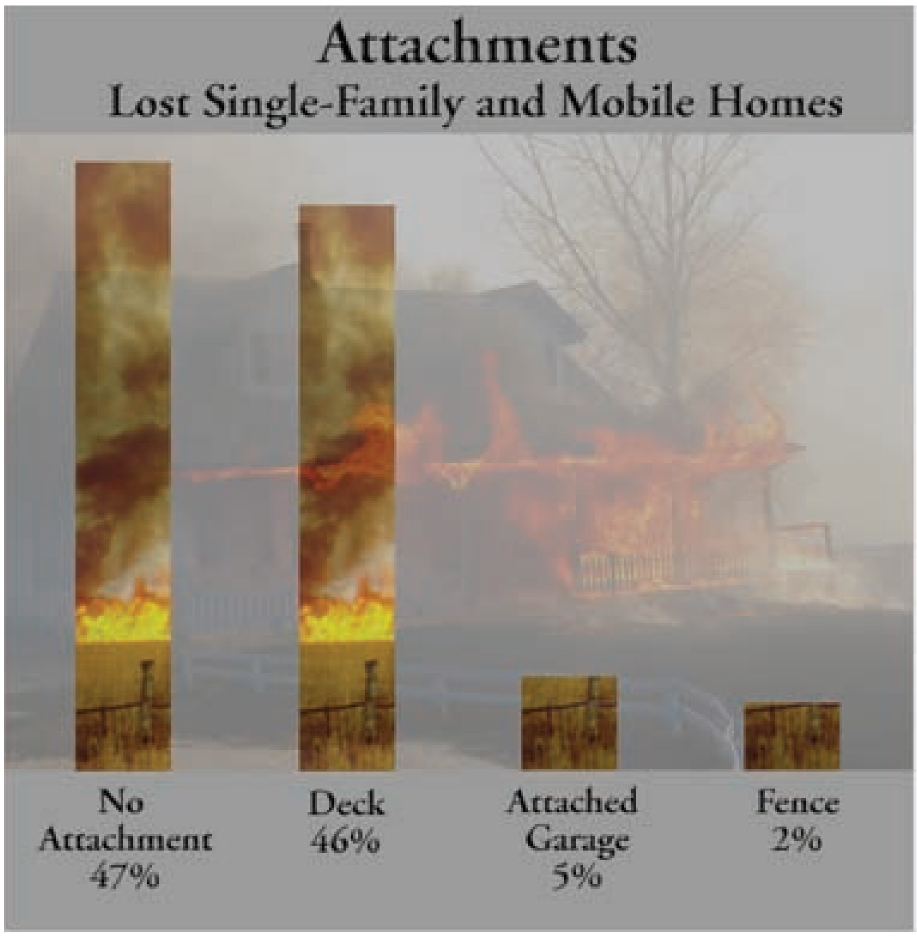
Single-Family Home Losses:

The total number of single-family homes and mobile homes within the fire perimeter before the event was 460. The Cross Plains fire resulted in the loss of 85 single-family homes, 25 mobile homes, six hotel units and the First Methodist Church. Since it is impossible to know for certain the actual cause of the loss of single family-homes, the reverse risk assessment allows us to hypothesize the reasons.

- Based on the examination of the home sites, tax appraisal cards and homeowner interviews, the findings indicate that of the 85 single-family homes, 61 of the homes were constructed in the early 1900s on pier-and-beam open foundations. It is theorized that years of debris and leaf litter accumulated, permitting the grass fire to burn up under the homes, smolder and cause ignitions.
- Of the 61 pier-and-beam homes, 59 were constructed with wood siding. Similar to 100-hour fuels, the wood siding dries out, making the building material parallel dried vegetation and easily ignitable after decades of drought and drying conditions.
- 50 of the 85 homes had some sort of attached wooden porch or garage, another potential ignition source.



- 13 of the homes were of brick construction, and all had wooden decks or attached garages.
- The grassland landscaping revealed overhanging trees not to be a contributor to the potential ignitions. Numbers were undeterminable; however, homeowner interviews revealed that a large number of the homes did have open eaves. The presumption can be made that this contributed to permitting exposure of eaves and vents to fine fire brands.
- The total value of single-family dwellings lost was $ 3,096,160.00 (based on available tax records).



Mobile Home Losses:

The smaller nature of mobile homes allows fire to spread rapidly through mobile home contents, while the structure itself intensifies heat and smoke buildup. In addition, most mobile homes have fewer safe exits than a traditional home. Interior wall and ceiling building materials allow for fast flame spreads. A total of 25 mobile homes were lost during the Cross Plains fire. Through the reverse risk assessment the following observations were noted.

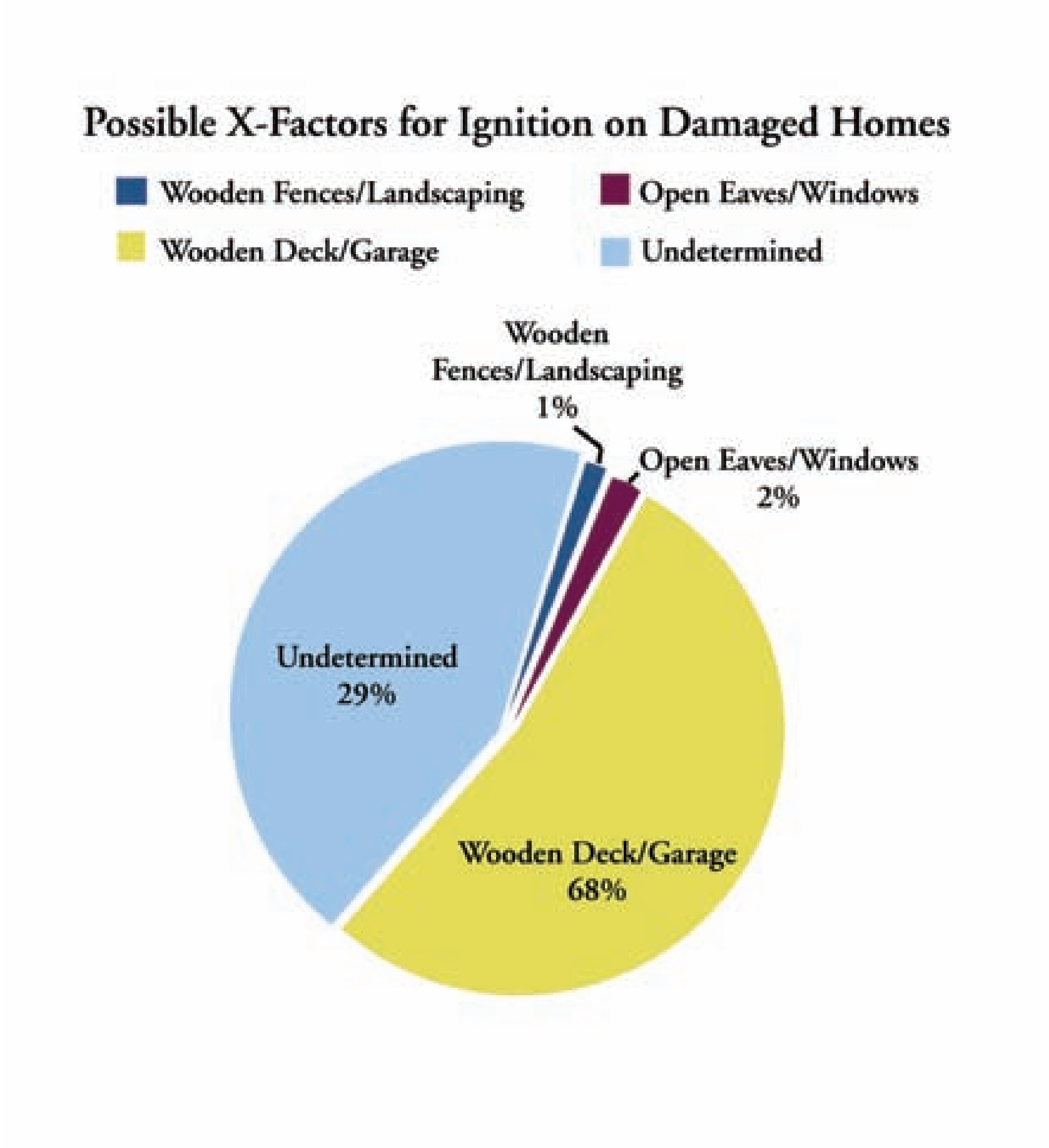
- All 25 mobile homes were of vinyl construction and composite roofing.
- 11 of the 25 mobile homes had some sort of wooden deck or attachment.
- During the assessment, it was established that the mobile homes were on either cinder block or pier-and-beam foundations. Actual numbers could not be determined.
- Whether any of the mobile homes had enclosed skirting could not be confirmed.
- The total value of mobile homes lost was $ 180,855.00 (based on available tax records).

Attachments on mobile homes and single-family homes showed to be a contributing factor for introducing fire to the home structure. Based on debris, tax records and homeowner interviews, the following information was determined in regard to attachments on lost structures.

Single-Family Homes Damaged:

There were countless outbuildings, barns, shops and commercial buildings lost during the fire. Structures of this nature where not examined or counted since they were outside the realm of the study. Thirty-six homes sustained minor or partial damage during the fire but were saved due to homeowner or fire department personnel interventions.

- 21 of the homes were pier-and-beam and wood construction
- 15 of the homes were slab and brick construction
- 15 of the homes had fires start on attached wooden decks or car ports
- 5 of the homes had open eaves, allowing fires to start in the attics
- 1 home had a wooden fence that was attached to the home and ignited after the fire front, according to homeowner observations.
- Rapid re-engagement of fire personnel after the fire front passage contributed to saving homes


Possible X-Factors for Ignition on Damaged Homes
Wooden Fences/Landscaping
Open Eaves/Windows
Wooden Deck/Garage
Undetermined
Wooden Fences/Landscaping 1%
Open Eaves/Windows 2%
Undetermined 29%
Wooden Deck/Garage 68%

CONCLUSION

Protection of human life is the first priority in wildland fire management. Once firefighters are committed to an incident, they are the number one priority. Property and resource values are the second priority, with management decisions based on values to be protected. Where wildland fire cannot be safely reintroduced because of hazardous fuel build-ups, some form of fuels mitigation should be considered, particularly in urban wildland interface areas. Finally, agencies and the public must change their expectation that all wildfires can be controlled or suppressed. No organization technology, or equipment can provide absolute protection when unusual fuel build-ups, extreme weather conditions, multiple ignitions and extreme fire behavior periodically come together to form catastrophic events.

The fires that occurred during this siege effortlessly jumped major highways and interstates. Spotting occurred in many cases thousands of feet ahead of the main fire. In some instances the fires were beyond the limits of control very soon after ignition occurred. In some instances the intensity of fires and other circumstances left fire service personnel attempting structure protection as the only option. Seldom during a major conflagration are there enough resources, even with the best equipped fire departments, to defend every structure threatened by an advancing wildfire. Therefore, the only feasible strategy for preventing losses in the urban wildland interface is utilizing fire resistant building materials and modifying fuels in the home ignition zone.

Fire Departments

- Structure Triage

During a fast moving grass fire like the one that threatened Cross Plains, fire departments are almost always forced to take a defensive stance. These types of fires can very easily exceed the capacity of local responders and force them to make the types of choices that all firefighters dread. Questions arise such as: Do I have the resources to stop the fire? Can I protect every home threatened? How do I ensure that my fellow firefighters remain safe throughout the incident?

The best plan of attack for fire suppression resources is one developed long before a community is threatened. Through conducting risk assessments and developing a strategic plan of attack based on these assessments, fire departments can minimize confusion when determining which homes can be protected in the event a community is threatened by a wildfire. A grim reality faced by many fire departments during the 2005-2006 fire season was determining which homes being threatened had the highest probability of being saved with the assistance of suppression. This information can be derived through conducting urban wildland risk assessments. It is also critical that the information derived from these assessments is shared with mutual aid partners who might not be as familiar with the area. In addition, these assessments can also be an invaluable tool for educating residents about the risks that a wildfire may present to a community. An example of this type of assessment is included in the Appendix.

- Structure Protection Strategies

During a wildfire, the number one priority of firefighters is to protect human life. Firefighters face unique hazards when fighting an urban wildland interface conflagration. Training specific to situations that firefighters will face is critical to the safety of all responders to this type of incident. Routine small fires may not adequately prepare departments for large catastrophic wildland fire events. It would be extremely beneficial if fire departments located in urban wildland interface had training offered at various academies.

Homeowners

- Mitigation Before the Event

The primary responsibility for ensuring that a residential structure survives a wildfire rests with the homeowner. Any other approach would not provide for adequate preparedness on the part of the people that firefighters strive to protect. The best approach available for protecting one's home from a wildfire is to address the factors that increase the potential of homes igniting. Through proper mitigation, a homeowner can feel confident that they have done everything in their power to reduce the likelihood of their home igniting and have provided for the safety of firefighters responding to a wildfire that may be threatening their home. Key factors to consider when mitigating the risk of wildfire are as follows:

- Ensure that there is a break in the continuity of fuels surrounding and leading up to the home. This can be accomplished through the installation of materials that inhibit the spread of wildfire across the landscape. This measure is most effective when implementation is begun directly around the home out to a distance of two hundred feet, or to property lines. The use of pea gravel or river rock within the first few feet of the home's exterior walls and additions such as decks and porches can be an effective means of accomplishing this. Non-combustible walkways such as stone paths can impede the spread of fire. What is most critical in addressing this vulnerability is keeping the flames of a fire from coming in direct contact with any part of the home's exterior that is flammable. This is one of the most critical factors when mitigating a home's risk, but also one of the easiest and most cost-effective to accomplish.
- Install screening over all areas that could allow embers or firebrand access to the homes interior. This would include ridge vents, attic vents, foundation vents and dryer vents. Chimneys should also be fitted with spark arrestors, not only to keep sparks from escaping the chimney, but to prevent them from entering the home through the chimney.
- Enclose decks, porches and walkways with a fine mesh screen or non-combustible material such as metal skirting or stone. Firebrands being deposited under these areas and leading to ignition was a major culprit in home ignition throughout the study area.
- During a wildfire event, things such as wooden fences, support timbers, boardwalks and landscape borders can serve as a fuse leading directly to a home. Minor modifications such as creating stone landings between your home and a boardwalk can reduce this fuse effect. Avoid using landscape timbers that come in contact with flammable aspects of the home, and consider metal fencing or modify fencing to prevent direct contact with the home.

- Enclose eaves and soffits. Heat rising from burning vegetation or fences can get trapped under exposed eaves and generate enough heat to ignite the structure. This can be mitigated by enclosing eaves and soffits with non-combustible materials or removing potential heat sources from below eaves.
- Outbuildings in close proximity to homes pose a serious threat if ignited. The radiant heat can be sufficient to ignite nearby structures. Whether it is a well-house, shed or detached garage, insure that steps are taken so it does not ignite, to prevent it from becoming another heat source. The same practices that would mitigate a home's ignition potential apply to outbuildings.
- Keep up with local conditions so that during periods of fire danger, efforts can be made to keep grass mowed short, yards watered and unnecessary trash removed.
- Homeowner safety factors: If you are forced to evacuate, be cognizant of arriving emergency vehicles and others leaving the scene. Smoke will create a driving hazard.

Communities

Communities in Texas have always pulled together in times of natural disturbances. This was certainly the case on all of the fires reviewed during this case study. If communities throughout the state and nation could approach mitigating the risk of wildfires with this same resolve, significant strides could be made toward making communities more resistant to wildfires.

- Community Wildfire Protection Plans

One of the best tools for accomplishing this is a comprehensive approach to wildfire preparedness. This approach involves all levels of a community, from federal and state agencies to local residents, and is often structured in the context of a Community Wildfire Protection Plan (CWPP). A CWPP provides one of the best tools available to communities to address their unique risk from wildfire.

- Firewise Education

The small time periods throughout the year that present the conditions for a fire risk seem insignificant with regard to decades of no-risk conditions when communities are dealing with their day-to-day lives. However, homeowners need to be educated on the subject of urban wildland interface fires relevant to their particular communities. During time periods of high fire danger and extreme weather patterns which create the potential for wildfires, homeowners need to be educated so they individually can take measures to be prepared. Front line initiatives in monitoring and maintaining vegetation around the home and small details in home construction must be mitigated on a regular basis. The idea of a home being self-sustainable in a fire-prone ecosystem needs to become as widespread a notion as having a home that is energy efficient. There was always some sort of "X" factor that caused buildings to burn, whether an open crawl space, open eaves or wooden attachments to the home; these small details made even the most firewise house vulnerable.

A Year Later

Now dotted with new homes, construction and FEMA trailers, Cross Plains has made an amazing comeback in a short period of time. Some citizens left and some moved a few miles out to the country. Many have rebuilt or are rebuilding. Twenty homes have been rebuilt and others are under construction. At least eight modular homes have been erected and others are expected. As the initial shock of the devastation set in just days after the fire, some predicted the town could never rebuild. But that never crossed the minds of the city officials and volunteers who fumed at the thought and vowed even more vehemently to rebuild. Construction is expected to continue because the city recently received a $286,000 grant from the U.S. Department of Housing and Community Affairs that will rebuild as many as six more homes (Emison).

Three Years Later

Wildfire events in Callahan County are not rare. Each year, local paid and volunteer county fire departments respond to numerous wildfires that occur within the savannah woodland ecosystem. During the 2005 calendar year, local departments in the county responded to 53 wildfires. The most devastating for the county, the Cross Plains wildfire, was followed by four more fire events before the end of 2005. More than 77,000 acres of land burned throughout the year. Wildfire activity increased in 2006. Local department in the county responded to 163 wildfires, which burned 48,026 acres of land. The region experienced fewer wildfire events in 2007 due to widespread wet weather throughout the year. Callahan County fire departments responded to only 45 wildfires in 2007. Less than 1,900 acres burned. Fire activity in Callahan County increase again in 2008 as drought conditions continued to worsen across the state. Fire departments responded to 245 wildfire events, which burned a total of 77,528 acres of land (Texas Forest Service Reporting System). Grass fires may not produce the cinematic display seen by wildfires in forest type ecosystems, but homeowners need to be aware of the threats produced by fast moving and elevated fine ember productions from grass fires.

Determined Economic Losses:
In October 2008, Cross Plains was revisited to evaluate current economic, community and government impacts to the town since the wildfire. Immediately after the wildfire, it was reported that 110 homes had been lost as well as the Methodist church and several rooms in a small hotel. In the months following the event, it was determined that an additional 50 outbuildings, barns and other non-living structures were lost. As of October 2008, only 38 of the 110 homes lost had been rebuilt. The losses of more than 122 individuals and home reconstruction have resulted in an annual tax revenue loss to the town of $3 million a year (Susan McNeely).

For farmers and ranchers, daily operations stopped after the wildfire. While livestock losses were minimal, four calves and six cows, it was estimated that more than 2,000 round bales of coastal hay were lost in the wildfire. Figuring on a conservative market value of $60.00 a bale, approximately $120,000 in hay had to be replaced by donations or other food sources immediate after the fire. However, the largest financial loss for ranchers and farmers came from fencing. An estimated 60 miles of fencing was destroyed. No dollar figures were available for this loss. The United States Department of Agriculture Farm Service Agency provided cost-share assistance through authorized Emergency Conservation Program to ranchers and farmers who lost fences due to the wildfire. To date, 90 to 95 percent of the necessities for every day operations such as agriculture equipment, tools, barns and fencing have been replaced (Robert Frost).

Callahan County had an implement Emergency Management Plan in place since 2003; however, Cross Plains had not adopted the plan. After the wildfire, the city did adopted the counties plan. Even though Cross Plains has adopted an Emergency Management Plan, there is no Citizen Wildfire Protection Plan in place. The city has implemented a city wide clean-up policy – un-mowed grass will be mowed by the city and homeowner charged for the work after initial citations are issued. Burn bans are strongly enforced at all times and citations are written to violators (Caruth and Jereld 2008).

A mutual aid agreement was established between Callahan County and fire departments outside of the county. Seven rural fire departments within the county formed their own association in order to organize training and equipment needs for the departments to better meet the needs of the county. The departments now receive more urban wildland firefighting training and have purchased new radio systems, pumps, fire engines and wildland gear with grant money. A portion of the money comes from Texas Forest Service (Gary Itten).

Appendix

Responding Fire Departments Included (60 pieces of equipment and 200 personnel):

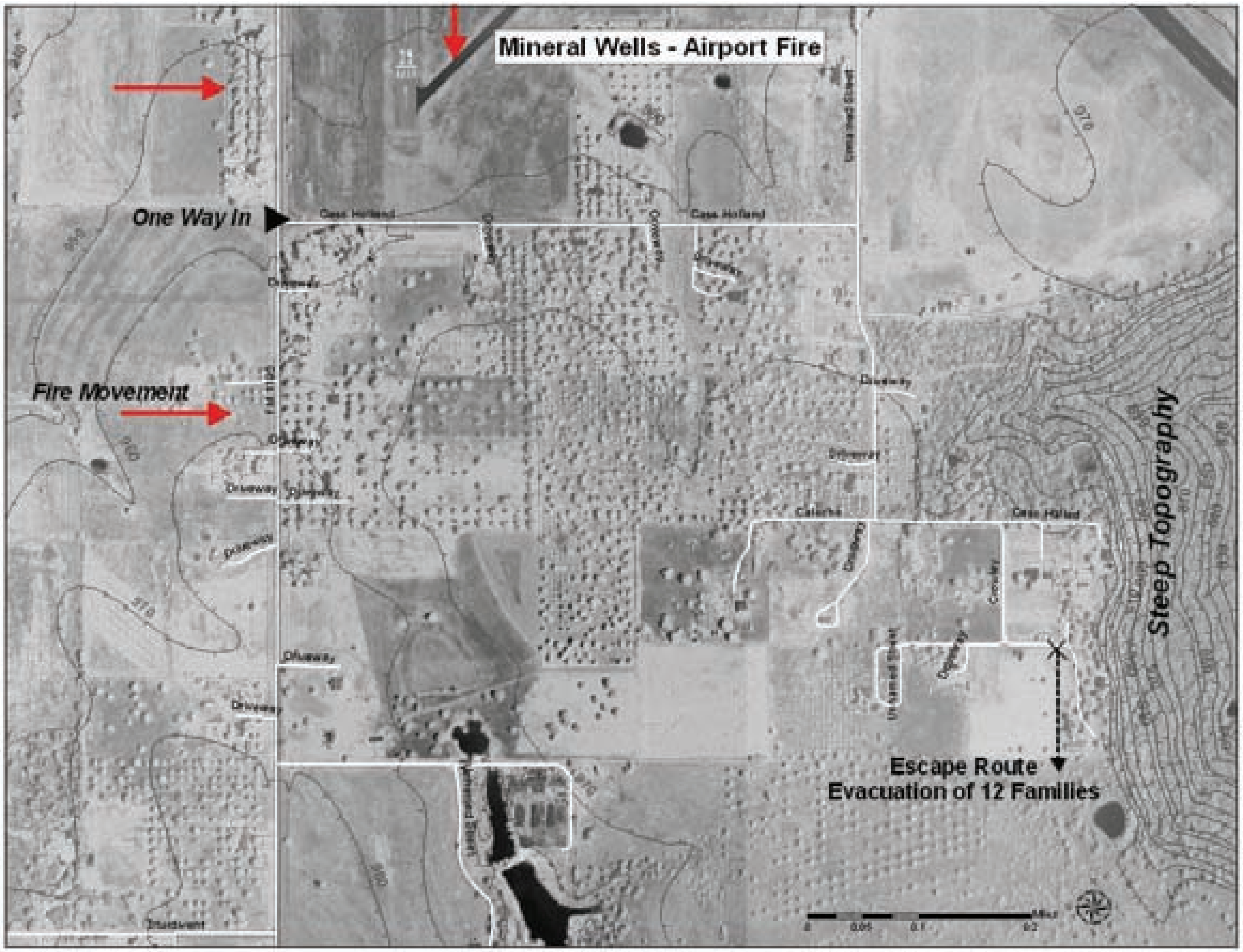
1. Abilene
2. Abilene Airport
3. Anson
4. Baird
5. Brady
6. Brownwood
7. Burkett
8. Cisco
9. Clyde
10. Comanche
11. Cottonwood
12. Cross Plains
13. DeLeon
14. Dublin
15. Dyess AFB
16. Early
17. Eastland
18. Eula
19. Gorman
20. Lake Brownwood
21. Lawn
22. May
23. Merkell
24. Northlake
25. Oplin
26. Potosi
27. Putman
28. Rising Star
29. Santa Anna
30. Sipe Spring
31. Stamford
32. Stephenville

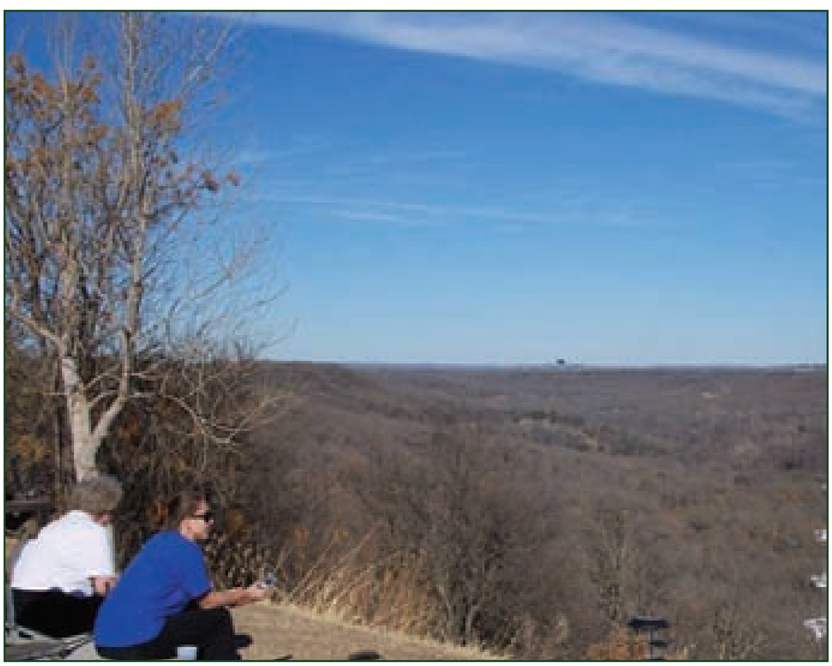
Other Responding Agencies:

1. American Red Cross
2. Anson CERT Team: 10 personnel
3. Department of Public Safety: 1 Regional Liaison Officer, 14 Troopers, 1 Type 3 helicopter
4. Guardian Emergency Medical Services: 6 ambulances and 18 personnel
5. Texas Department of Transportation: 5 trucks, 10 personnel
6. Texas Forest Service: 6 dozers, 1 Type 6 engine, 14 personnel
7. United States Forest Service: 1 fixed wing aircraft, 1 individual
8. Private Companies: 2 dozers, 8 tenders (5000 gal), 13 personnel

Medical Intelligence:

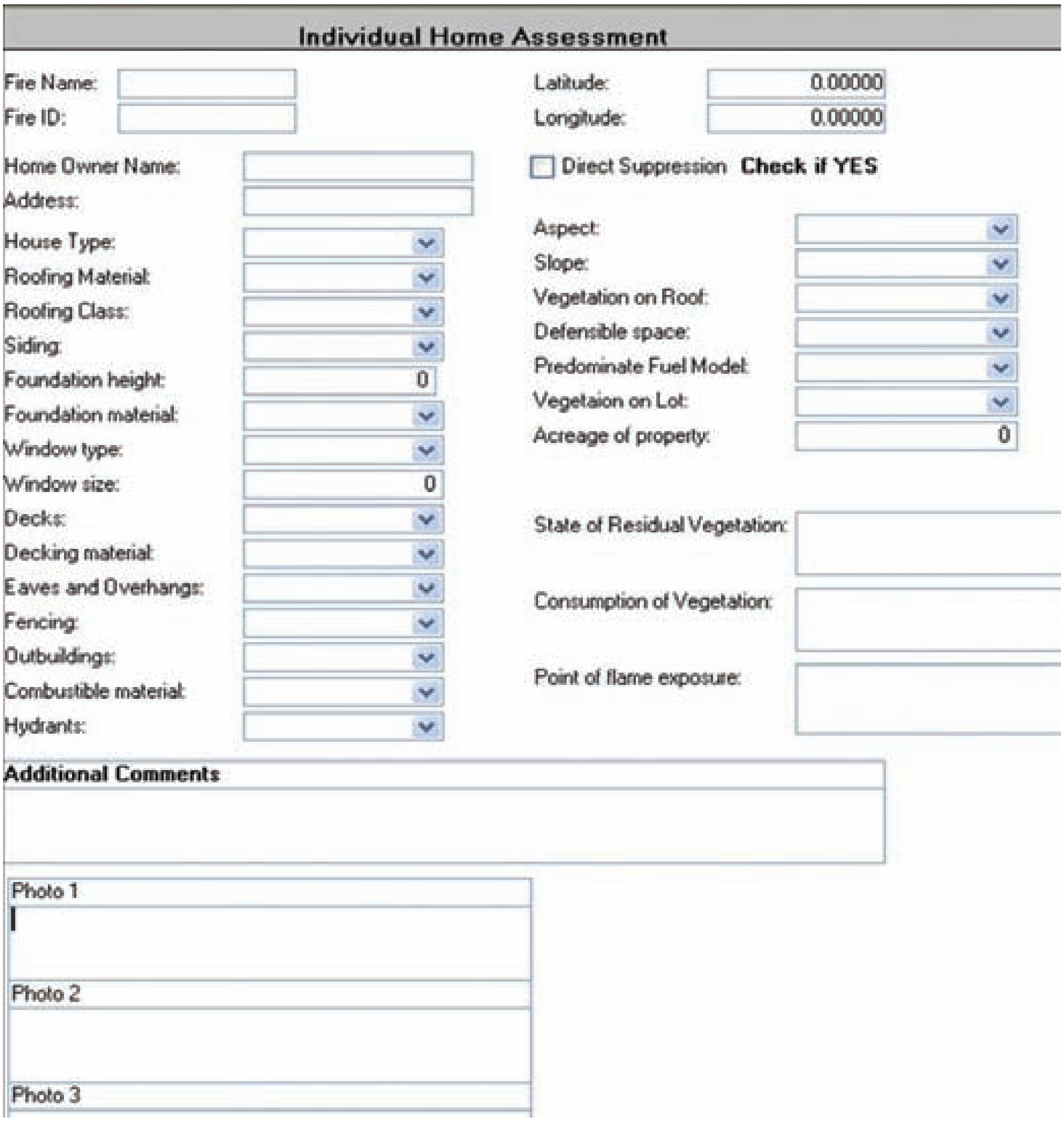
1. 2 civilian fatalities
2. 4 civilians were treated for smoke inhalation and dehydration
3. 1 civilian was treated with 1st and 2nd degree burns to face and hands
4. 19 firefighters were treated for smoke inhalation and dehydration


Mineral Wells - Airport Fire
One Way In
Fire Movement
Steep Topography
Escape Route
Evacuation of 12 Families



Risk Assessment Questionnaire

All data was stored in an Access Database created for the wildfires throughout the area during the 2005-2006 winter fire season. Field data collection sheets were generated from the database to maintain hard copies and add additional notes and comments by the individuals doing the risk assessments.



Individual Home Assessment

Fire Name:
Fire ID:
Latitude: 0.00000
Longitude: 0.00000

Home Owner Name:
Address:
Direct Suppression **Check if YES**

House Type:
Roofing Material:
Roofing Class:
Siding:
Foundation height: 0
Foundation material:
Window type:
Window size: 0
Decks:
Decking material:
Eaves and Overhangs:
Fencing:
Outbuildings:
Combustible material:
Hydrants:

Aspect:
Slope:
Vegetation on Roof:
Defensible space:
Predominate Fuel Model:
Vegetaion on Lot:
Acreage of property: 0

State of Residual Vegetation:
Consumption of Vegetation:
Point of flame exposure:

Additional Comments

Photo 1
Photo 2
Photo 3

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