



**RESEARCH**

# Christmas Tree Fires

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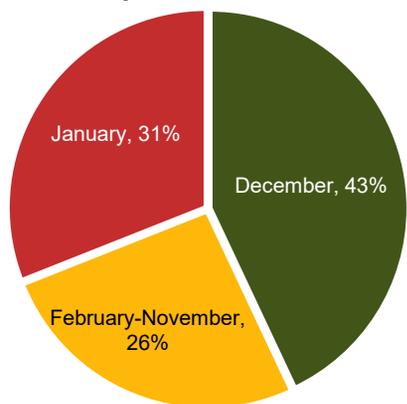
## Christmas Tree Fires

From 2014 to 2018, US fire departments responded to an estimated average of 160 home<sup>i</sup> structure fires per year that began with Christmas trees. These fires caused an annual average of two civilian deaths, 14 civilian injuries, and \$10.3 million in direct property damage.

Fires that begin with Christmas trees are a very small, but notable, part of the US fire problem. These fires account for less than 0.1 percent of reported home fires, and 0.1 percent of home fire deaths, home fire injuries, and direct property damage resulting from home fires. Although the number of home fires beginning with Christmas trees is small, it is important to remember that these items are generally in use for a short time each year.

Not surprisingly, three-quarters of Christmas tree fires occurred in December or January. See Figure 1. The longer a natural tree is kept up

**Figure 1. Home fires that began with Christmas trees, by month, 2014–2018**



<sup>i</sup> Homes include one- or two-family homes and apartments or other multi-family housing.

after Christmas, the more likely it is to dry out and ignite. Some January fires may have occurred after the tree was taken down.

Figure 2 shows that Christmas tree fires are more common during the hours when people are awake, peaking between 6:00 p.m. and midnight.

**Figure 2. Home fires that began with Christmas trees by time of alarm, 2014–2018**

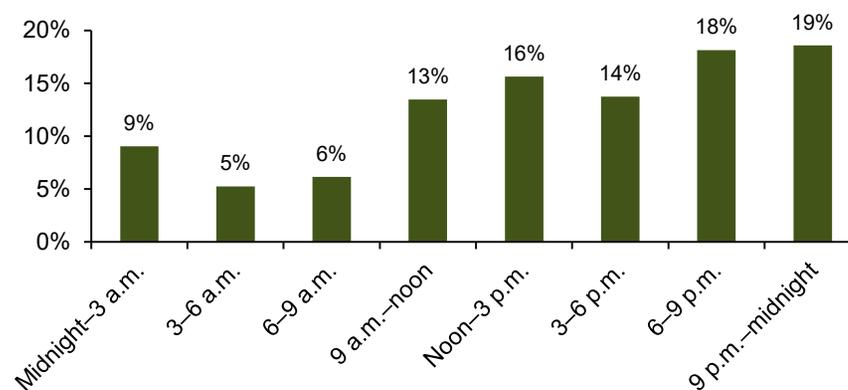
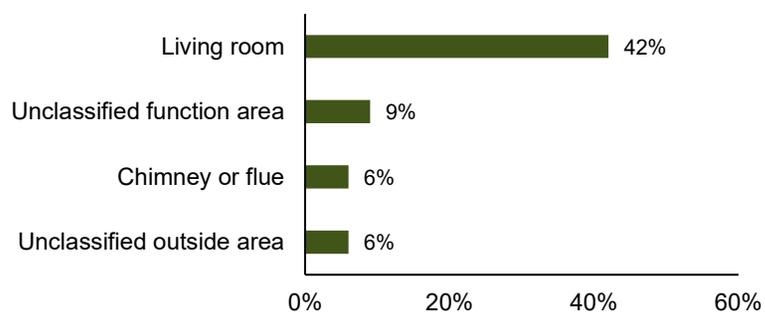


Figure 3 shows that more than two of every five home Christmas tree fires started in the living room, family room, or den. The fires in chimneys or flues suggest that people may be burning the tree to dispose of it. The US Forest Service cautions:

“Never burn your Christmas tree in a fireplace or wood stove! Pines, firs and other evergreens have a high content of flammable turpentine oils and burning the tree may contribute to creosote buildup and risk a chimney fire.”<sup>1</sup>

**Figure 3. Home fires that began with Christmas trees, by leading areas of origin, 2014–2018**



### Leading causes of Christmas tree fires

Electrical distribution or lighting equipment was involved in almost half (45 percent) of home Christmas tree fires.

- Decorative lights were involved in 17 percent.
- Wiring or related equipment was involved in 15 percent.
- Cords or plugs were involved in 7 percent.
- Other lamps, bulbs, or lighting were involved in 6 percent.

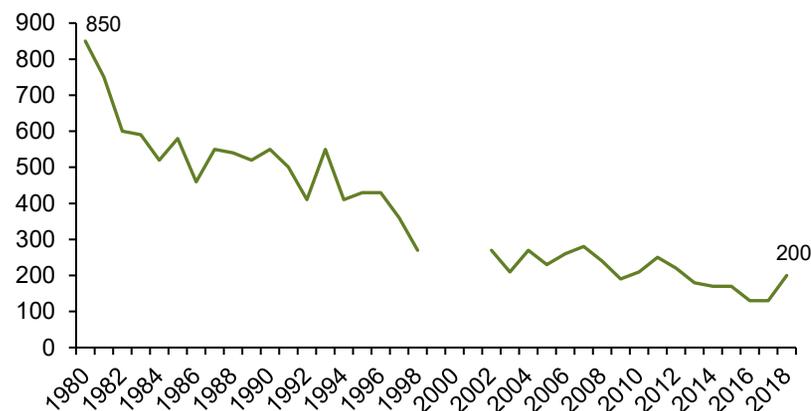
Electrical failures or malfunctions were factors in almost one-third (thirty-one percent) of Christmas tree fires. Any type of equipment that uses electricity can experience an electrical failure. Many of the electrical distribution and lighting fires resulted from electrical failures.

- Fifteen percent of Christmas tree fires were intentional.
- Heating equipment was involved in 13 percent of Christmas tree fires.
- Candles started 7 percent of home Christmas tree structure fires.
- In more than one-fifth (22 percent) of Christmas tree fires, some type of heat source, such as a candle or equipment, was too close to the tree.
- Seven percent of the Christmas tree fires were caused by open or outdoor fires created for debris or waste disposal.

### Trends

The estimated numbers of Christmas tree fires showed a fairly steady decline from 1980 through the late 1990s. Figure 4 shows that these fires fell a total of 76 percent from a high of 850 in 1980 to 200 in 2018, the highest estimate since 2012. The two previous years had the lowest estimates seen. Home structure fires overall fell 54 percent from 1980 to 2018.<sup>2</sup>

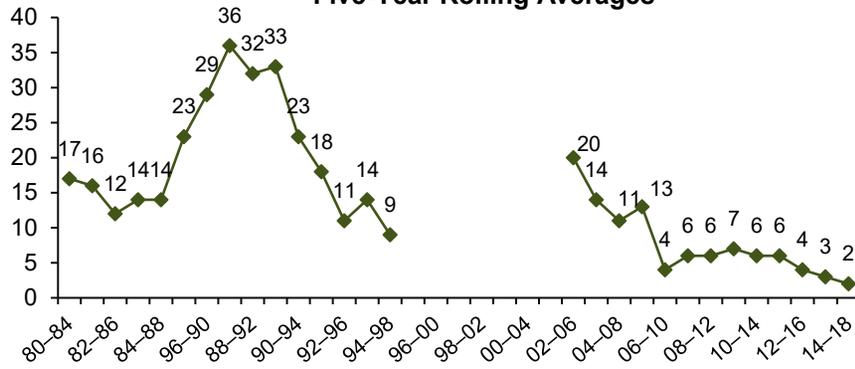
**Figure 4. Home structure fires in which Christmas trees were first ignited, by year**



Note: From 1999 to 2001, participation in the National Fire Incident Fire Prevention System (NFIRS) Version 5.0 was low, which means estimates for these years are highly uncertain and are not shown here.

Deaths from Christmas tree fires peaked in the mid-1980s to early 1990s. Over the 39-year period of 1980 to 2018, the estimated number of annual Christmas tree fire deaths ranged from zero to a high of 54 deaths. Figure 5 shows five-year estimated annual averages of deaths, beginning with the period of 1980 to 1984, and ending with 2014 to 2018. The two deaths per year seen in 2014 to 2018 is the lowest average since the data collection began.

**Figure 5. Deaths in Home Structure Fires in Which Christmas Trees Were First Ignited Five-Year Rolling Averages**



Note: Because of low participation in NFIRS Version 5.0 in 1999 to 2001, averages with estimates for those years (1995-1999 to 2001-2005) are highly uncertain and are not shown here.

## Research and Context

According to the National Christmas Tree Association, 26.2 million natural Christmas trees were sold in 2019.<sup>3</sup> A survey commissioned by the American Christmas Tree Association found that almost 96 million (77 percent) households had at least one Christmas tree in their home in 2019. Sixteen percent of households had more than one. Only 19 percent of the trees were natural; 81 percent were artificial.<sup>4</sup>

Although the fire experience data does not specifically distinguish between natural and artificial trees, an analysis of the type of material first ignited suggests that an average of 40 Christmas tree fires per year began with the ignition of something plastic, while 80 per year began with some type of wood or “natural product, other.” Using these

<sup>i</sup> The data element “type of material first ignited” provides the best indication of whether the Christmas tree was artificial or natural. The code for plastic implies an artificial tree (although it could also refer to plastic ornaments on the tree)

categories as proxies, fires involving natural trees outnumber fires involving artificial trees by roughly two to one.<sup>1</sup>

A study by the National Institute of Standards and Technology (NIST) shows the importance of proper care of natural trees. It also found that one residential sprinkler can prevent flashover and limit fire spread when a dry Christmas tree catches fire.<sup>5</sup> Twelve Fraser fir trees were purchased in November 2006 after a local harvest 10 days earlier. Recommendations from the National Christmas Tree Association were followed for six trees that were kept continuously in water. The other six were placed in stands without water.

In burn room tests in mid-January 2007, a matchbook placed in each tree was lit by a hot wire. While needles on trees that had been continuously in water did ignite, the fire did not spread and went out within 90 seconds. When the same test was done on dry trees, the fire spread to other branches and the burning continued.

Dry Christmas trees were also burned in a similar manner in two living room type spaces with typical furnishings. The tree was placed in a corner next to a sofa on one wall and a table on the other. Flashover occurred in the non-sprinklered space roughly 70 seconds after the tree was ignited.

Only one sprinkler was present in the sprinklered condition. The sprinkler operated 10 seconds after ignition. The tree did continue to burn, and the heat release continued to grow. The sprinkler prevented fire spread below the ignition point on the tree and minimized fire spread to furnishings. Heat release was less than one-third of the non-sprinkler room. Only a small part of the couch burned. The table lamp still worked. Flashover did not occur.

and the codes for unclassified natural product, unclassified wood or paper, round timber and sawn wood all imply a natural tree. Other codes for wood do not as clearly relate to a natural tree and also make little difference in the share of fires attributable to natural trees.

The potential for disaster when a fire begins with or is fueled by a Christmas tree is very real. An investigation report of a deadly January 2015 Maryland fire by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) and Ann Arundel County Fire Department provides a tragic example.<sup>6</sup>

On January 19, 2015, four children, ages six to nine, and their grandparents died in a fire that began when an electrical failure ignited a plastic sheet and/or a decorative tree skirt or blanket beneath the Christmas tree in the great room of a waterfront mansion. The fire quickly spread to the tree. The fire alarm monitoring company, alerted at roughly 3:29 a.m., called 911 to report multiple smoke detector activations at 3:31 a.m. When firefighters arrived at 3:42 a.m., fire was venting from the windows and the front door. Video footage from across the water showed a sudden glow at the property at about 3:30 a.m., suggesting rapid fire growth. Property loss was estimated at \$16 to 18 million.

Investigators learned that the 15-foot Fraser fir tree in the great room had been cut from a tree farm on November 14 and installed on December 8th. The tree lights were left on 24 hours a day. The tree had started to drop needles and was to be removed the day after the fire. Although the watering schedule was not conclusively determined, it seemed that the tree had been watered about once a week.

Working with the ATF Fire Research Lab, investigators obtained three Fraser fir trees that were similar to the tree in the great room. Two trees were watered once a week and the third was watered continuously. For the fire test, they used an ignition package similar to a small burning wastebasket that could burn for 10 minutes. At the time of the test, the tree that had been continuously watered had a moisture content of 73 percent while the two with weekly watering

had moisture content of 32 percent and 15 percent. One tree that was watered weekly ignited in five seconds and the second ignited in 30 seconds. The continuously watered tree ignited in 421 seconds (seven minutes). All three trees hit peak burning rates within 46 seconds. The heat release rate was roughly four times as high for the trees that had been watered weekly compared to the continuously watered tree.

## Safety tips

NFPA's [Winter holiday safety tips](#) provides tips specifically about Christmas tree safety, safe holiday decorating, and other holiday activities.

## Methodology

Unless otherwise specified, the statistics in this analysis are national estimates of fires reported to US municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. These estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the National Fire Protection Association's (NFPA's) annual fire department experience survey.

Christmas trees were identified by NFIRS 5.0 Item First Ignited code 41. Homes were captured by property use codes in the 410–429 range. Structure fires were identified by incident type 110–129.

NFIRS 5.0 includes a category of structure fires collectively referred to as “confined fires,” identified by incident type. These include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (incident type 113–118). Losses are generally minimal in these fires, which by definition, are assumed to have been limited to the object of origin. Although causal data is not

required for these fires, it is sometimes present. The percentage of unknown data is much higher for confined fires than non-confined fires.

Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Property damage

has not been adjusted for inflation. Fires are rounded to the nearest ten, civilian deaths and injuries to the nearest one, and direct property damage to the nearest hundred thousand. For more information, see "[How NFPA's national estimates are calculated for home structure fires.](#)"

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<sup>1</sup> US Department of Agriculture Forest Service, "Christmas Tree Recycling," <https://www.fs.usda.gov/detail/r2/recreation/?cid=stelprd3826466>. Accessed October 29, 2020.

<sup>2</sup> Marty Ahrens, *Home Structure Fires*, (Quincy, MA: NFPA, 2020).

<sup>3</sup> National Christmas Tree Association, "Statistical Snapshot" from 2019 Christmas season consumer survey by Nielson/Harris poll conducted January 20, 2020. Accessed on October 29, 2020.

<sup>4</sup> American Christmas Tree Association, "Ninety-six million US households celebrated the Christmas holiday with a Christmas tree in 2019." from November 2019 Nielson English Language PanelViews Survey. Accessed on October 29, 2020.

<sup>5</sup> Daniel Madrzykowski, *Impact of a Residential Sprinkler on the Heat Release Rate of a Christmas Tree Fire*, National Institute of Standards NISTIR 7506 with partial sponsorship from the Department of Homeland Security, 2008. Accessed October 30, 2020.

<sup>6</sup> Bureau of Alcohol, Tobacco, Firearms and Explosives and Ann Arundel County Fire Department. *Executive Summary: ATF Investigation #761010-15-0026/AAFD Investigation #15-017, Fire at 936 Childs Point Road, Annapolis, MD*. Accessed at <https://www.atf.gov/file/92771/download> on October 29, 2020.