Liar, Liar, House on Fire!

The Relationship Between Trees, Wildland Fire, and Damage to Homes

Glossary

ignition (ig **ni** shun): The act of setting on fire or catching on fire.

forest managers (**för** est **män** ij ürs): Skilled individuals that take care of natural resources.

endangered (en **dan** jürd): Legal term referring to a species whose existence is in danger.

decompose (de käm **poz**): To rot or decay.

combustible (käm **bus** tuh bul): Capable of catching fire and burning.

simulate (**sim** yoo lat): To create the appearance or effect of something for purposes of evaluation.

downwind (down wind): In the direction toward which the wind is blowing.

case studies (kas **stuh** des): Particular events or stories used as a learning tool.

firebrands (**fir** brands): Burning embers that fly out of *intense* fires.

intense (in **tens**): Very strong or great.

nonflammable (non **fläm** uh bül): Not easily set on fire.

data (**da** tuh): Facts or figures studied in order to make a conclusion.

landscape plan (**land** scap plan): A drawn plan to make a piece of ground more attractive by adding trees, plants, shrubs, and flowers.

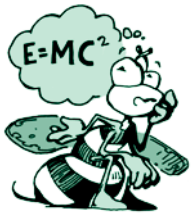
Pronunciation Guide

a	as in ape	ô	as in for
ä	as in car	u	as in use
e	as in me	ü	as in fur
i	as in ice	oo	as in tool
o	as in go	*ng*	as in sing

Accented syllables are in **bold**.

Meet Jack Cohen:

I like being a scientist because I am curious about nature and I like to ask questions. It's great to have a job that pays me to find out how things happen. As a fire scientist, I can explore my lifelong interest in fire. I use my understanding of how fires burn to help solve problems with fire in wildlands. Solving problems with wildland fire helps people to find ways to live in harmony with fire.



Thinking About Science

Scientists are like detectives because they solve mysteries. Like detectives, scientists sometimes follow many different clues and determine if all of the clues lead them to the same conclusion. When a detective follows a clue, he or she plans in advance how that clue will be followed. Scientists also develop plans to solve problems. Their plans are called methods. In this study, the scientist used three methods to find out under which conditions houses might catch fire from forest wildfires. Then the scientist compared the methods to see if all three of the methods (or clues) led him to the same conclusion. Can you think of a time when you do the same thing? Think about the latest movie hit. To determine if the movie is good, you might ask your friends if they liked the movie (clue #1); you might read about the movie in a magazine, newspaper, or on the Web (clue #2); and you might see the movie yourself (clue #3). When you do this, you are like a scientist!

Thinking About the Environment

Sometimes things happen in the environment that people call natural disasters. A natural disaster is a natural disturbance that people judge to be harmful. When injury or harm does not occur, these natural events are recognized as normal environmental events that happen at a large scale. Examples include floods, avalanches, and wildfires. Wildfires are different than floods and avalanches in one important way. Floods and avalanches consist of a mass, such as water or snow, which moves and completely covers everything in its path. Fire does not move in this fuel. Two of these ways play an important role in the life of a wildland fire. Convection (kän **vek** shun) happens when heat is transferred through the flow of liquids or gases, such as when hot air rises above a fire. A fire can spread from the ground to shrubs and into treetops by convection. Radiation (rad e **a** shun) transfers heat by rays, such as from the sun or the flames of a fire. Radiation is the way most of the heat from a wildland fire is transferred to unburned fuel.

Fire Facts

For a fire to burn, it needs fuel, heat, and oxygen. When forest managers want to control forest fires, they try to reduce or eliminate the amount of fuel, heat, or oxygen that is feeding the fire. For a wildland fire, fuel consists of burnable material such as trees, shrubs, and grasses. Once a fire is burning, it continues to provide heat that supports the fire. Heat is transferred in three ways to nearby unburned

way. Fire spreads from the continual *ignition* and burning of fuel. For a fire to spread, it must have fuel, heat, and oxygen. If any one of these three is not present in a great enough amount, a fire cannot spread. Scientists call this the fire triangle.

Introduction

When lightning or other forms of ignition start a fire in a forest, there is a chance of a wildfire. Wildfires may be started by a natural cause, such as lightning, or they may be started accidently by human activities or on purpose by an ill-meaning person. When wildfires are started by a natural cause, *forest managers* may let them burn if there is no threat of injury to people, to houses or other structures, or to *endangered* wildlife. In the past 10 years, however, wildfires have threatened, damaged, or destroyed hundreds of houses. One reason for this is that more and more houses are being built in what was once large areas of forests and shrubs.

When houses are built close to trees, the trees provide the fuel that wildfires need to spread. (Remember the fire triangle?) If trees and shrubs are close to a house, they can enable wildfires to burn close to the house. The question the scientist wanted to answer was: How close must flames come to a house's outside wooden walls before those walls catch fire?

Reflection Section

- Can you think of another way to ask the scientist's question? (Hint: Think about the trees' distance from the house.)
- If you were the scientist, what is one way that you might answer this question?

Method

The scientist collected information from three places to find the clues he needed to answer his question. First, the scientist used information from another scientist's research to create a computer program. The computer program predicted how much heat is needed before a wooden wall would catch fire. When wood gets hot enough, it begins to *decompose*. As wood decomposes, it releases *combustible* vapors into the air. The computer program helped the scientist to determine how close flames would have to come to a house to heat the wood hot enough so that it might be ignited by a little spark.

Second, the scientist set up an experiment. In his experiment, he built three wooden walls that were meant to *simulate* the walls of a house (figure 1). The walls were built in a field near a forest. The walls were built 10, 20, and 30 meters *downwind* of the forested area. (To determine number of feet, multiply the number of meters by 39.37 and divide by 12.) Into each of the three walls, the scientist placed an instrument that measured the amount of heat reaching the wall. The scientist then set fires in the forest to simulate a forest wildfire (figure 2).

Figure 1. *One of the wood walls built by the scientist for his experiment.*

Third, the scientist was concerned that the computer program and the experiment did not include all of the factors present during an actual wildfire. He went to the library and read about two other wildfires and how they destroyed houses. These *case studies* gave him actual stories of homes being destroyed by wildfire. The scientist was able to compare the case studies with the computer program and the experiment.

Reflection Section

- Think about each of the three ways that the scientist used to find clues to answer his question. Name a rea-

Figure 2. *The experimental fire.*

son why each way alone might not give the scientist the right answer.

- If each of these three ways that the scientist used gave him three very different answers to his question, do you think the scientist could draw a conclusion about how close trees must be to a house to set the house on fire? Why or why not?

Findings

The computer program taught the scientist that even very large wildfires will not cause wood structures to ignite if the fire is farther than 40 meters away. (How many feet is that?) The farther a source of flame is from wood, the less heat the wood receives (figure 3).

In the scientist's experiment, flames never swept very far beyond 10 meters from the forested area. When the flames got close to—but did not make contact with—the wall built 10 meters away from the forested area, the wall was scorched but did not ignite (figure 4). When the flames made contact with this wall, it ignited and began to burn. When the flames extended just beyond 10 meters, the wall built 20 meters away was only lightly scorched but did not ignite. The wall built 30 meters away was not scorched at all and did not ignite. The scientist found that *firebrands* contribute to the ignition of wooden walls during wildfires.

By reading the case studies, the scientist learned that between 86 percent and 95 percent of the houses with a *nonflammable* roof and trees no closer than 10 to 18 meters (How many feet is that?) survived the wildfires (figure 5).

When the scientist compared the amount of heat predicted by the computer program for a distance of 10 meters with his experimental *data*, he found that the program predicted greater heating than he actually found. However, the scientist found that all three ways of determining ignition distances generally agreed. When trees, which serve as fuel for a wildfire, are between 10 and 40 meters away from a wooden structure, even intense wildfires will not ignite the structure 90 percent of the time.

Reflection Section

- The scientist's experiment showed that walls located 20 meters away from flames will not usually ignite in a wildfire. The computer program predicted that trees burning 40 meters away will not ignite a structure. The case studies mentioned

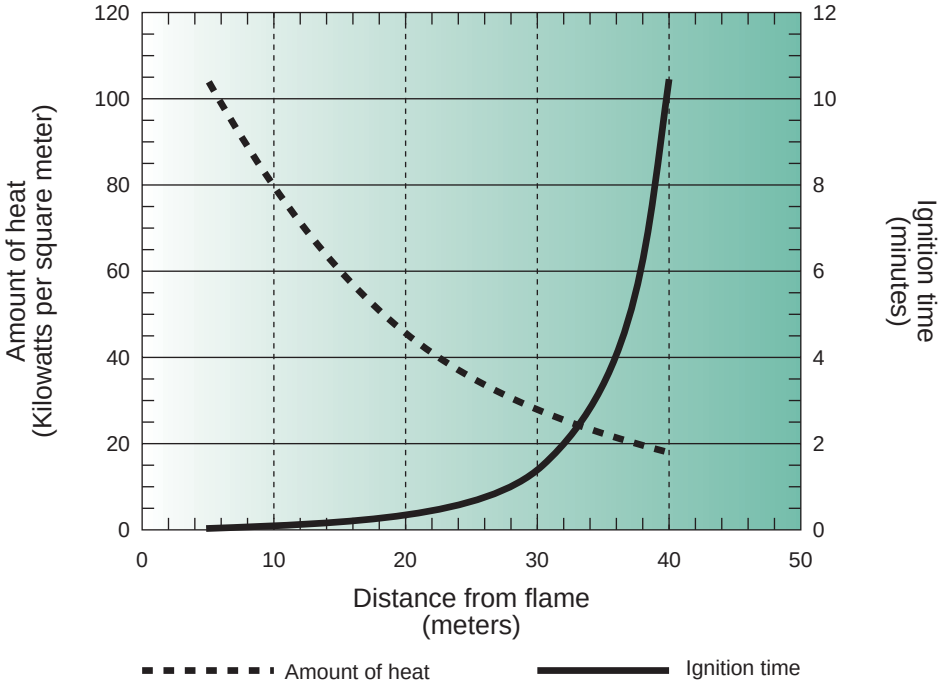


Figure 3. *The relationship between the amount of heat, ignition time, and distance from the flame.*

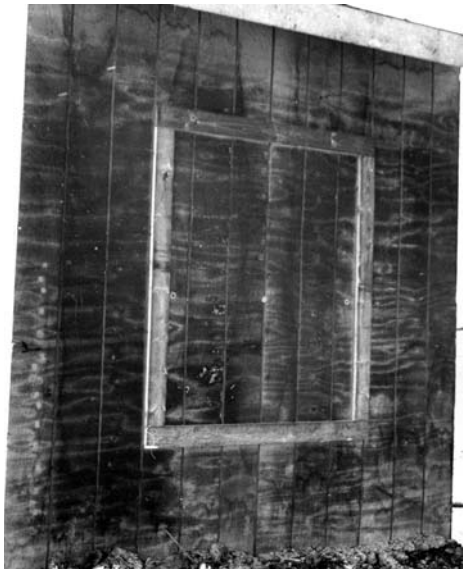


Figure 4. *When flames did not make contact, the wall built 10 meters away was scorched but did not ignite.*

a distance of 10 meters. Why do you think the scientist used a range of 10 to 40 meters when reporting his results?

- If you were the scientist, what would you recommend as a result of this research?

Implications

The scientist reported that the condition of the house and its surroundings, within 40 meters, are responsible for the house catching fire during intense wildfires. The area of land around a house is usually owned by the homeowner.

Figure 5. *Almost 9 out of 10 houses that were at least 18 meters away survived a wildfire.*

The scientist concluded that people who own houses should take responsibility for making their houses safe from wildfires.

Reflection Section

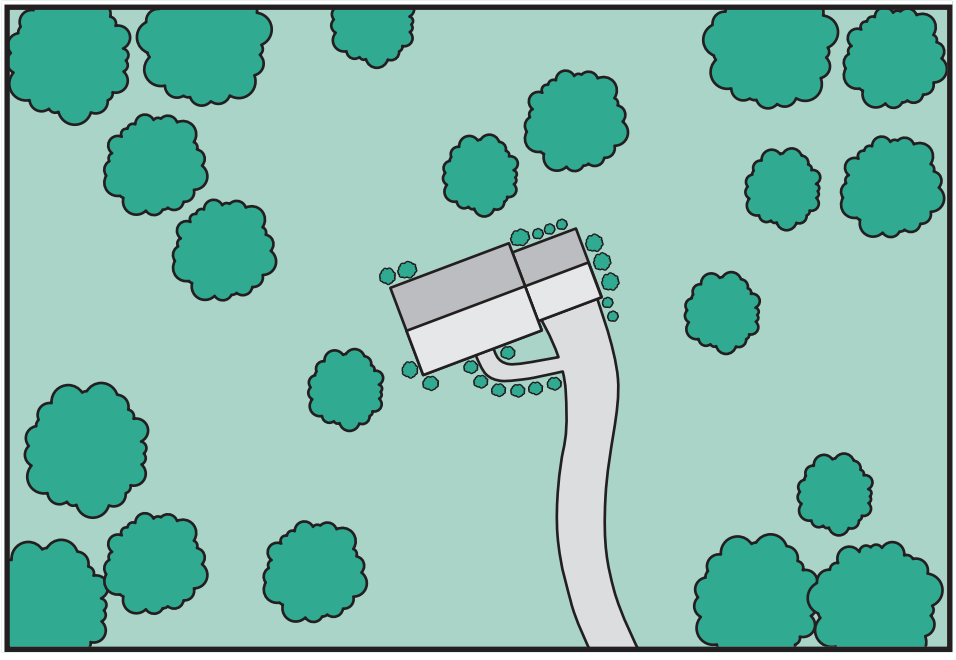
- Do you think that people should take responsibility for making their houses safe from wildfires? Why or why not?
- Based on this research, how could people make their houses safer from wildfires?

Discovery FACTivity

The problem you will solve with this FACTivity is: What are the potential wildfire problems with a particular home's *landscape plan*? How can you change the landscape plan to make the home safer from wildfires? The method you will use to solve this problem is: Look at the landscape plan on the next page. This plan is drawn from a bird's eye view. Using a ruler, you will need to determine which trees and other vegetation are too close to the house to protect it from wildfires. You can determine this distance from reading the "Findings" section of the article above. The symbols for the house, trees, shrubs, and the driveway are shown. Then, get a blank piece of paper, 8 inches X 11 inches or larger. Using your

ruler and a pencil, develop a landscape plan that places trees, shrubs, and other vegetation close to the house, but not so close as to cause a danger from wildfires. To do both of these tasks, you will need to convert the measurement of meters to inches using your ruler. For your own landscape plan, 1 inch equals 20 meters. Compare your landscape plan with your classmates'. Discuss why you designed the home's landscape the way that you did, and how your landscape plan will help to protect the home from wildfires but still provide the benefits of trees and other vegetation.

From: Cohen, J. D. (2000). Preventing disaster: Home ignitability in the wildland-urban interface. *Journal of Forestry*, March 15-21.



Legend:

Large Tree

Bushes

Scale:

1/2" = 20 meters

For your landscape plan, use this scale: 1 inch equals 20 meters.

Fire Safety Tips from the Firewise Communities Program

Do you live in or near a forest? If so, ask the adults in your household if they have protected the house from a forest fire. Here are some things you can do to protect your house from fire:

1. Establish a space around your house that does not have any combustible materials. This space should be at least 30 feet or 9 meters across. The larger the space, up to 130 feet or 40 meters, the better protected your house will be.

2. Reduce the amount of vegetation close to your home.

3. Remove or thin overcrowded or weak trees near your home.

4. Cut your grass and other plants regularly.

5. Move wood piles and building materials away from your home.

6. Keep your roof and yard clean. Clean your gutters regularly. Remove dead limbs and branches from your yard, and from the base of your chimney and deck.

7. Make sure your address is easy to read from the road, and that your driveway is large enough for emergency vehicles.

8. If you have a wood shake roof, replace it with a material that is more fire resistant.

9. Recycle your yard waste.

10. Listen to your local radio and TV stations for fire reports and instructions.