CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
J1401

Project Title
Project Inferno

Abstract

Objectives/Goals
Wood with a density between 0.6 and 0.8 g/cm^3 will burn hotter than wood with a density above 0.8 or below 0.6 g/cm^3.

Methods/Materials
To conduct this experiment I used small blocks of wood with different densities. A ruler and scale so I could calculate the density of each sample. A barbecue and charcoal chimney to get the fire started, and a thermometer and stopwatch to measure the temperature of the base flame at one minute intervals. Wood samples were cut into three centimeter cubes and dried in an oven at 200oF for two hours. I recorded volume and weight of each piece so I could calculate density. In batches of five, wood samples were placed in a chimney with 27 burning briquettes. Once the samples were lit I took their temperature every minute, for five to seven minutes, depending on if they had turned to charcoal by the fifth minute.

Results
The wood in my experiment had densities between 0.401 and 1.15 g/cm^3. These samples burned at maximum temperatures between 526 and 742 C. When I conducted my experiment, wood with a density higher than 0.6 g/cm^3 took about one minute longer to reach a temperature of 400 C than woods with a density below 0.6 g/cm3. Also, those higher density woods burned at least two minutes longer before turning to charcoal. Generally there was less variation in maximum burning temperature within a species than when different species were compared, even when the densities were similar. California Walnut burned at the highest temperature of 742 C with a density of 0.4 g/cm^3. Cherry burned at the lowest temperature of 526 C and had a density of 0.6 g/cm^3.

Conclusions/Discussion
My results showed my hypothesis was incorrect. There is not a relationship between the density of wood and how hot the base flame gets when it burns. I found that each species of wood can have different densities even amongst different parts of the same tree. The wood that measured more dense, took longer to heat up and stayed burning longer than the less dense wood. Less dense woods excelled to high temperatures quickly, but the flame diminished just as fast, becoming charcoal while the higher density woods, such as African Leadwood, continued to burn. In an interview with Bill Wilkinson, a Senior Forester, I learned that studies similar to mine could also be used to help predict the duration and intensity of wildfires, or evaluate which forests could withstand brush burns.

Summary Statement
The density of wood does not affect how hot the base flame gets, but does affect how long it burns.

Help Received
I designed, and conducted the experiments myself. I got insight into how the results are applicable in the real world by discusing them with Bill Wilkinson, a forester, Charlie Quillman, a contracter, and Jeff Kahn, a fire scientist.