



STEMBoost Newsletter

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Kennedy Invitational Success

Joseph Lee

In addition to hosting the STEMBoost Invitational in January, a third Kennedy Invitational was held on February 13 with the award ceremony occurring one week later. Several STEMBoost officers helped run the events successfully including Angela Zhang, Aseem Rajopadhye, Arthur Perng, Daphne Guo, David Smith, Deetshana Parthipan, Dylan Yang, Grace Kuo, Iona Xia, Joseph Lee, Ryan Li, Varun Kumaravelu. Thank you so much to all the contributors!

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This year, Science Olympiad competitions have adapted to an online setting via transfer to the Scilympiad website. Invitationals have been successfully run, although device events are occasionally excluded or replaced. This also gives a new and unique experience for students as they can now compete with teams from various states whom they would hardly be able to meet in person. In the Kennedy Invitational, 85 teams from 14 different states competed in the 26 events, totaling over 1000 students. The furthest team that competed was from Bedford, Connecticut – 2990 miles away.

Next month, the Kennedy Science Olympiad teams will attend the last Invitational tournament for this year, and the Gold, White, and Blue teams will participate in the Regional tournament. Good luck to all participants!

Fun Fact

What is causing the different color of flame?

(See answer in the back)

Editorial – California's Fiery Future

Ryan Li

Wildfires are a common natural hazard present within California but can still result in large amounts of property loss. In 2020 alone wildfires were estimated to cost around \$10 billion dollars, eclipsing the average \$2.5 billion dollars spent on CalFire firefighting each year (1). However, both the intensity and duration of wildfires within California are increasing, with the duration of the fire season (typically spanning from May-October) being lengthened as well (2). For example, the destructive Thomas Fire which took place in Southern California in December 2017 shattered previous records of wildfire size, even temporarily taking the title of the largest wildfire ever within the state (3).

What can possibly be playing into the observed increase in wildfire intensity? One answer would be anthropogenic climate change, specifically the rise in surface air temperatures. In fact, research has shown that from the period of 1984-2010, seven out of the ten regions within the western US have had (with statistical significance) an increase in the number of large wildfires (4). This was accompanied by an increase in warmer and drier conditions known to be caused by climate change, leading to the assumption that climate change shares a large bulk of the responsibility in exacerbating the intensity and size of wildfires within the region.

However, there may be another factor which could be playing into the increase in acreage of wildfires within California in recent years: bark beetle infestations. Bark beetles are tiny insects naturally present within forest ecosystems and reproduce by laying eggs within the bark of a tree, causing internal damage -- and ultimately death -- to the tree. This is normally not damaging to the forest itself for older trees are naturally more

susceptible to bark beetles while younger trees are not. Thus, the bark beetles are effectively clearing out the weaker trees, making room for newer and healthier ones to grow. However, stressors such as a lack of water available (brought on by drought) can weaken a young, healthy tree, allowing bark beetles to take advantage of both young and old trees (5). This can devastate a forest ecosystem, leading to an increased spread of bark beetles as well. For example, from 2012-2018 around 142 million trees (mostly pine) succumbed to bark beetle infections, which correlated with the severe drought within California endured from 2012-2016 (6). It turns out that the increased prevalence of bark beetles within the coniferous forests of Northern California can also be linked to climate change itself. Researchers have found that “warming summer and winter temperatures are major drivers of beetle population outbreaks across the US, and apparent range expansion in some species” (7).

This all relates to increased wildfire severity within the state through the direct correlation found between bark beetle infestations and acreage of wildfires from 2013-2018 within Northern California. This conclusion was drawn by myself as well as Megan Dhingra and Antra Jaj this summer within the Summer Research Academy (SRA) program from University of Santa Barbara. Using a digital mapping tool named ArcGIS, data for bark beetle infections as well as wildfire perimeters was layered on top of one another for each individual year, and a visual count was made to determine how many bark beetle infested trees were present within each wildfire perimeter (excluding prescribed burns and wildfires which burned below 1,000 acres). After repeating this process with each year from 2013-2018, the data was placed into a scatter plot with the number of trees succumbing to bark beetle infestations being plotted against the acreage (size) of the wildfire. The data points within the years 2017 and 2018 were also plotted in separate scatterplots in the same fashion as previously described. The linear trendlines for all three had positive slopes (indicating a direct correlation), with the slope of the scatterplot for 2017 being a lot less than the slope for 2018. Also, the correlation of determination R^2 was smaller in 2017 than in 2018, meaning that the correlation between the two variables had increased from 2017 to 2018. Taken all together, it was concluded that there was a relationship with increasing bark beetle related tree mortality correlating to increasing wildfire acreage in Northern California.

So, what can be done about the issue of increasing wildfire intensity driven by the effects of climate change? State agencies such as CalFire can continue to increase their annual spending on battling wildfires as they continue to increase in size, but this alone can't solve the issue of inevitable damage to property as well as the loss of lives. A more radical (but more practical solution) is to tackle the human origins of anthropogenic climate change itself, implementing more legislation regulating large fossil fuel corporations such as Shell or Exxon Mobil, setting more rigorous standards for gasoline powered vehicles within the automobile industry, as well as encouraging making healthier and more environmentally conscious decisions on an individual basis (driving less, conserving water, eating more plant-based foods, etc.). It is only when individuals, corporations, and the government commit to making the same action -- drastically limiting greenhouse gas emissions -- can meaningful change be made.

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Answer: Oxygen supply influences the color of the flame. A low-oxygen fire contains lots of uncombusted fuel particles and will give off a yellow glow. A high-oxygen fire burns blue.