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Evaluating Fire Temperatures During a Prescribed Burn of a Restored Tallgrass Prairie

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Introduction

Wildfire is recognized to have shaped the great prairies of the central US. While the vast majority of these grasslands have been lost, there remain significant remnants as well as sites under active restoration. Prescribed fire is often used in these systems in order to maximize the success of the native grasses. Beginning in 1999, Cedarville University established a prairie restoration site and have used disturbances, such as fire, to maintain the system. Without this regular burn, the prairie would likely show decreased grass growth and increased growth of forb species. The Cedarville Prairie Restoration site has a variable topography, with several small hills and valleys. Such variations can affect the distribution of fuel and ultimately the fire behavior and intensity.

Objective

We set out to investigate the relationships between prairie topography and fire temperature. Additionally, we sought to determine the efficacy of using temperature sensitive paints to determine fire intensity across the landscape.

Methods

We established a 25 x 25 meter grid within the Cedarville Prairie, using GIS software to map out the area. We painted numbered stainless-steel tags with 6 shades of thermo-sensitive paint. Each paint melted at a specific temperature: 510°, 593°, 677°, 816°, 982°, and 1068°C. We attached the tags to metal stakes and placed each stake close to the center of each established grid-square, recording each on the GIS software. On April 1, 2014, Cedarville Township Volunteer Fire Department facilitated a complete burn of the prairie. After the burn, we collected the stakes and analyzed the tags to determine the maximum fire temperature at each location. We recorded this data into ArcMap software and created a map of the prairie using the data, comparing it to topographical maps of the site.

Results

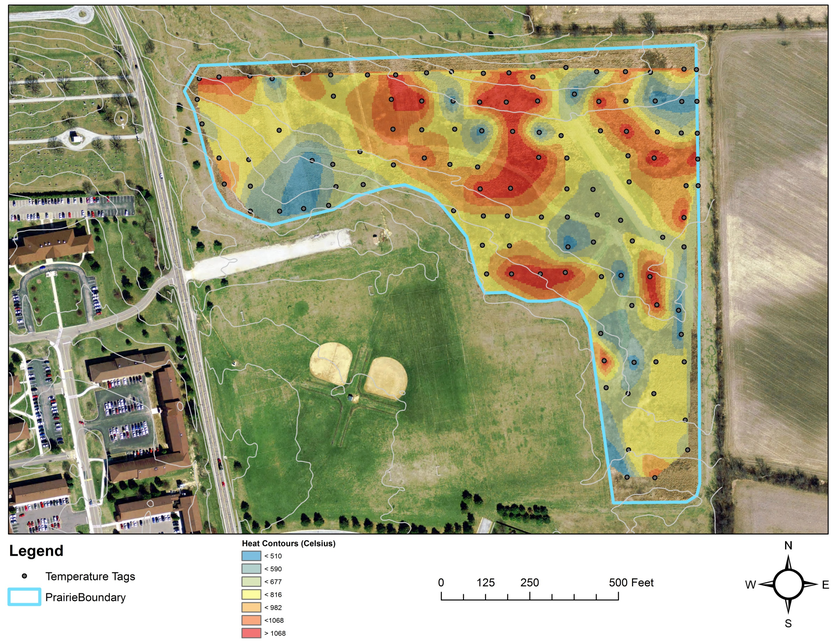

Figure 1 is a map made using Natural Neighbor analysis on ArcMap software. Blue coloring indicates areas where temperatures were less than 510° C or areas where the stakes were not collected. Light blue and yellow represents areas where temperatures ranged between 590° and 677°C. Orange represents areas where temperatures reached between 820° and 943°. Areas of dark orange and red represent locations where temperatures exceeded 943°. The highest temperature measured was 1068°.

We were able to collect 116 of 154 stakes following the fire. The collected stakes came from locations spread throughout the prairie, and indicated that temperatures exceeded 1068° C in several locations. There were also some locations where the temperature did not exceed 510° C. The heat contours correspond well to previously measured biomass distribution as well as the edge influences of the cross-country course and trails.

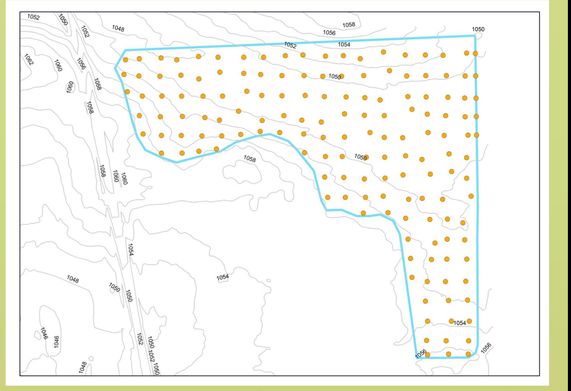

Figure 2 is a topographical map of the Cedarville Prairie,. Black lines indicate topographical differences, each representing a 2 ft. change in elevation. Red dots represent placement of stakes in experiment.

Conclusions

Consistent with our objective, we determined that areas of the prairie located at higher elevations burned at hotter temperatures, whereas areas at lower elevations tended to burn at cooler temperatures. We believe this was because moisture collected in areas of lower elevation, and because areas of higher elevation contained a more dense source of fuel. We were only able to collect 75% of our stakes, and thus our data were not complete; nevertheless, we were still able to obtain a representative picture of the prairie as a whole.

Acknowledgements

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