Title: Ozone Pollution Monitoring Using Low-Cost Sensors in Colorado Mountain Valleys
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Introduction: Ozone is a criteria pollutant designated by the US Environmental Protection Agency (EPA) that has adverse effects on air quality, climate, and human health. With regard to human health, ozone causes respiratory inflammation and is responsible for nearly 13,000 premature deaths annually in the United States. Ozone is formed from the atmospheric oxidation of volatile organic compounds (VOCs) and nitrogen oxides (NO_X) in the presence of sunlight. Both VOCs and NO_X are emitted by anthropogenic (e.g., traffic) and natural (e.g., wildfires) sources. Ozone, unlike some other criteria pollutants such as carbon monoxide and NO_X, is formed regionally and ozone concentrations are believed to be similar between urban and rural/remote environments. Yet, ozone is measured routinely only in urban areas and ozone concentrations, exposure, and impacts are largely unknown for rural and remote continental regions, including mountainous river valleys. Furthermore, ozone is known to be modulated by wildfire smoke emissions and little is understood how wildfires affect ozone pollution in mountainous regions. **Hence, there is an immediate need to better understand ozone pollution and its impact on regional air quality and in rural mountain communities.**

Prior Work: In Summer 2021, members of our team along with Extension Specialists (Ragan Adams and Dennis Kaan) developed and deployed a network of five low-cost ozone sensors (MOOS for Metal Oxide ozone Sensor; see figure to the left) in Fort Collins, CO and the Colorado Eastern Plains. The study was performed to evaluate MOOS measurements against colocated reference monitors and also to quantify the ozone pollution differences between urban (Fort Collins) and rural (Eastern Plains) regions. Our MOOS were ⅙ the cost of a reference monitor in addition to being fully autonomous (solar powered and connected to the Cloud). **With careful field calibrations, the MOOS measurements were found to be generally within 10% of the reference measurements.** The MOOS network was also able to discover a modest ozone gradient between Fort Collins and the Eastern Plains sites, with the Eastern Plains sites experiencing 25% lower ozone pollution during high-ozone days. Although wildfire smoke during the measurement period likely affected ozone concentrations, the MOOS estimates did not seem to be negatively influenced by smoke.

This Project: As a follow up to our 2021 study, we will deploy two to three of the MOOS to several sites in mountain river valleys in Eagle, Pitkin, and Garfield counties. **Glenda Wentworth as the County Director for Eagle County Extension will facilitate collaboration with local personnel and outreach programs to better understand locations for air pollution monitoring and communication of air pollution datas.** More specifically, the project team will connect with community representatives to learn about the local problems and challenges and their links to ozone pollution, including those connected to wildfire smoke. Both the MOOS and reference monitor will be deployed to each location for 3-4 weeks during the summer of 2022. The student intern (preferably a graduate student) hired on this project will closely interact with the project team and also collaborate with Glenda Wentworth to site the MOOS and acquire additional environmental data (e.g., meteorology). The student will acquire technical skills linked to the calibration, use, and field deployment of environmental sensors (4-6 weeks) and analysis (4-6 weeks) of environmental data.

Expected Outcomes: The field deployments and data gathered during this project will be valuable to our team's research for two reasons. First, these data will add to our growing database and contribute to a better understanding of the ozone levels in mountain regions and their relation to more heavily-monitored urban locations. And, second, these data will help with the translation and communication of the ozone pollution problem in mountain regions to local communities and residents.