N5 Sensors

HOW GROUND-BASED SENSOR NETWORKS CAN BE USED FOR RISK MITIGATION DURING PRESCRIBED BURNS

Prescribed fires, also known as controlled burns, are one of the most effective fire threat management techniques, and has been used for centuries. It has been shown that prescribed fire can reduce the average fire line intensity of a wildfire by 76% and the burned area by 37%. In a carefully planned prescribed burn exercise, fire crews plan to burn a portion of the forest or wildland with well-defined starting and ending points or lines. This process reduces the available "fuel" – e.g., dead trees and other dry vegetation that can ignite during a real fire.

While prescribed burning has many benefits, it also has certain disadvantages, namely: it carries a risk of escape; is dependent on favorable wind conditions (hence unpredictability is an inherent part of the prescribed burn planning); it is a cause for public concern as smoke and particulates released during controlled burns can negatively affect air quality. In addition, under certain conditions, prescribed burns may reduce long-term soil fertility; and can be costly. The table below lists the number of fires and acres of prescribed burns in the year 2019 throughout the US conducted by various agencies.

	Bureau of Indian Affairs	Bureau of Land Management	US Forest Service	US Fish and Wildlife Service	National Park Service	State/Other	Total
Fires	340	195	3,103	579	176	177,155	151,542
Acres	77,637	74,786	1,232,145	227,835	209,223	4,236,882	6,058,508

Source - National Interagency Fire Center

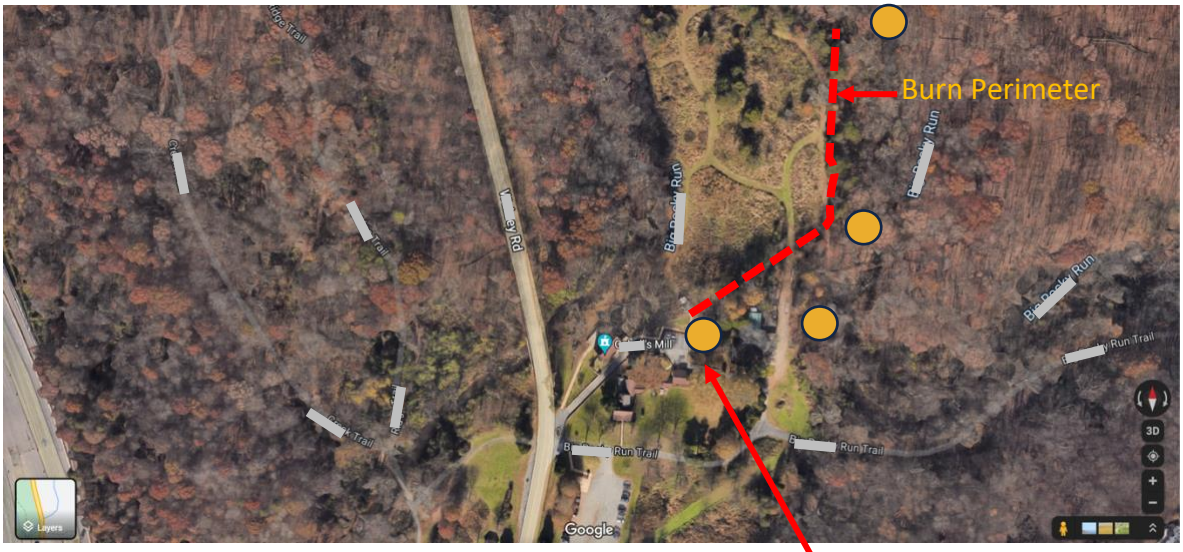
About 99% of the prescribed burns are successful and controlled, which is indeed an excellent record, especially given the elements of risk and uncertainty associated with fires. Although just **1 percent** of these prescribed fires have escaped nationally, many emergency managers remain reluctant to utilize prescribed fire. Burn managers are faced with the need to balance public safety with actual tangible ecosystem benefits, while managing budgets for such activities. More states are taking actions to make prescribed burns accessible. In the state of California, State Senator Bill Dodd introduced State Senate Bill 332, which adds legal protections for fire crews and managers, in cases where a prescribed burn escapes and causes damage.

The question is: how can we provide even greater protection to burn managers, fire crews and communities during prescribed burns?

A new ground-based sensor technology, which can establish an "electronic fire fence" effectively in few hours can be a game changer for prescribed burn management. Such "intelligent" fire line management can do two things –

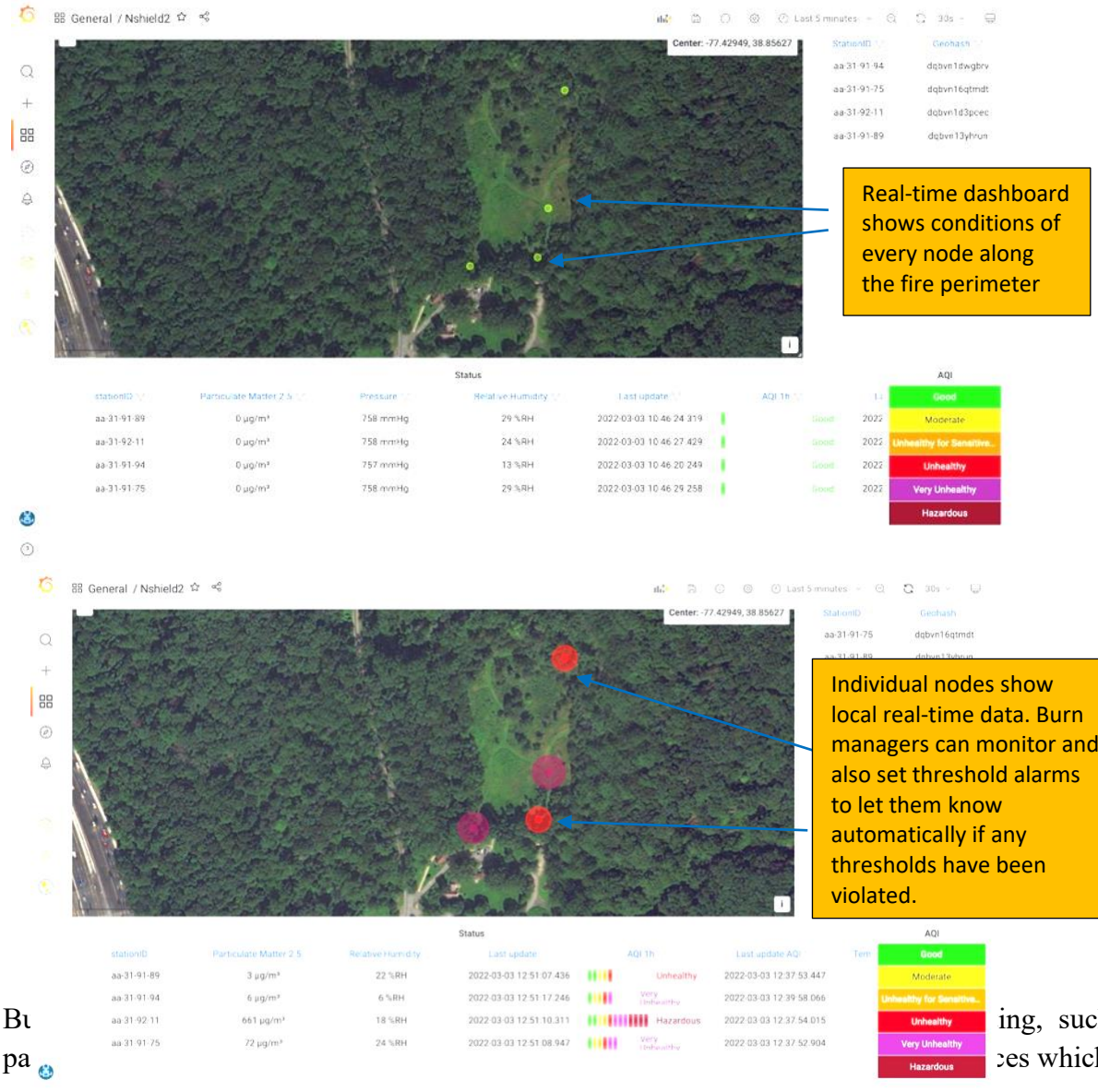
1) It can allow burn managers to remotely monitor the progress of the burn both during and after the active burn is complete.
2) Terminate the burn if certain thresholds are violated, e.g., poor air quality, fire "jumping" or escaping the perimeter.

Each light-weight node as shown above contains multiple sensor modalities (chemicals, smoke/particulate, and infrared heat sensors), along with edge-AI, communication, and solar power. The sensor nodes can be deployed on a heavy tripod, a pole, or on existing infrastructure frames.Each node can be deployed in a specific location under 5 minutes. Each node is fully autonomous and automatically connects to a cloud-infrastructure which provides integrated device, data, and decision management tools.



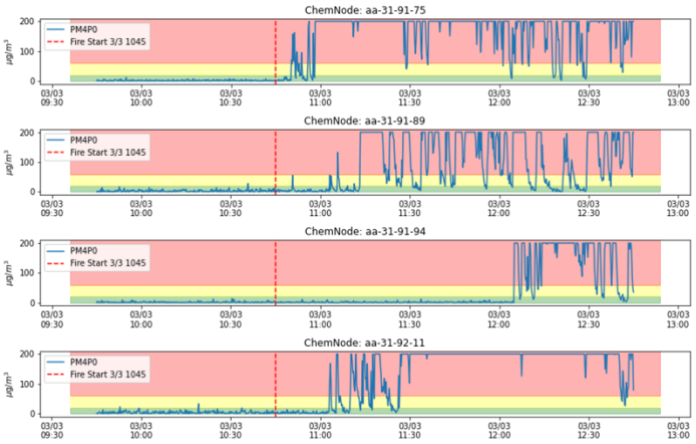
Actual prescribed burn plot with burn perimeter shown by the dotted red line. Sensors were placed along the fire perimeter in four locations as shown by the yellow dots. Each sensor node sits on a tripod and can be deployed under 5 minutes per node. Once all the nodes are setup, they form an “electronic fire boundary”.

Once the fire perimeter is up, a real-time web-based dashboard can allow burn managers to monitor the fire perimeter, along with other relevant on-ground data such as air quality. In addition to providing real-time fire data, this solution can also improve public perception related to the prescribed burn safety concerns.
The figures below are screen grabs from N5’s prescribed burn support tool, **N5SHIELD™**. The electronic fire perimeter is established by the green dots where each sensor node is mounted on a tripod. Each node has edge-AI for sensor fusion and is also connected via LTE or LoRa to a web server for processing of the data. The intuitive, interactive dashboard provides for data visualization and customization of alert settings.



Bu ing, such as pa ces which are

outside the burn perimeter. This way burn managers can be notified immediately via SMS or email if thresholds are violated and they can decide to terminate the burn.



Individual nodes capture data. Plots show particulate matter measurement from 4 different spots shown in the prescribed burn map.

iven the small size and ease of installation the Such units can be kept in a storage facility and can be deployed right before the prescribed burn providing the maximum protection to the crew and the community.

By combining innovations in low-power sensing, AI, and cloud based tools, we can indeed provide burn managers and fire crews with an practical tool to conduct precribed burns more effectively.

Disclaimer – The information presented here represents N5's own research and interpretation of data.

Contact Information: info@n5sensors.com