Case Study - The National Trust (UK)

Protecting Marsden Moor's Unique Ecosystem with Advanced Sensor Technology

Background

Marsden Moor is a large expanse, approximately 2,500 hectares (9.7 square miles, 6,188 acres), of unenclosed common moorland located in the South Pennines in West Yorkshire, England. Marsden Moor is designated as a Site of Special Scientific Interest (SSSI), and is covered by the South Pennines Special Area of Conservation (SPA) and Special Protection Area (SPA), due to its ground nesting rare and vulnerable bird populations and its blanket bog habitat. It is also an important site for archaeology from the prehistoric and classical eras, ranging from settlements to flint scatter, roads, bridges and coins.

It is especially important to protect Marsden Moor from the rampant destruction of wildfires that could easily damage or destroy large sections or even all of this fragile, natural habitat. Wildfires tend to occur in the spring in the United Kingdom, because the vegetation hasn't started growing or has a low moisture content. Unfortunately, spring is also when the ground-nesting birds are laying eggs and rearing young, and wildfires would affect not only birds: Frogs, lizards and small mammals all make Marsden Moor their home.

Fire also exacerbates the problem of purple moor grass, which dominates large sections of Marsden Moor. The National Trust is working to reduce the dominance of this grass, but wildfires disrupt this work because purple moor grass responds well to fire. Wildfires also negatively impact other ecosystem services, including carbon and water storage and water quality. Furthermore, a layer of peat with depths of up to 4 meters underlies Marsden Moor; the peat stores huge amounts of carbon. Wildfires release greenhouse gasses and deplete carbon that has been stored for thousands of years.

Wildfire Detection Sensors: A Possible Solution

To provide the best possible wildfire protection for Marsden Moor, the National Trust is working with Dryad Networks for an ultra-early wildfire detection pilot project using sensors. The pilot project will combine 50 Dryad Silvanet wildfire sensors with a weather station and satellite data to provide near-real-time information on wildfire risk to our ranger team. This is the first time that wildfire detection sensors are being used at Marsden Moor and in this type of habitat under National Trust management.

Silvanet Wildfire Sensor deployed on the Marsden Moor

Fire detection often relies on people seeing or smelling smoke and calling the fire service. One of the downsides of this is that they aren't always able to provide a precise location, especially if they were observing smoke from a distance. The National Trust is keen to explore some novel technological approaches that could help support the suite of other measures we are using to help manage the risk of wildfire.

Anticipated Benefits

The anticipated benefits of using AI-powered sensors for ultra-early wildfire detection include rapid detection in remote areas where people may not see or smell fires quickly and at times when people may not be present. If the sensors detect a fire, rangers and possibly the fire service will receive a notification and a precise location immediately and be able to respond and contain it quickly to avoid a major fire.

Marsden Moor showing deployed Silvanet Wildfire Sensor

Project Goals

One of the primary goals of the pilot project is to determine whether near-real-time (NRT) data can help manage and mitigate wildfire risk. Real-time models of fire risk tend to be developed at large scale, for example, the European Forest Fire Information System and the Met Office's Fire Severity Index. The project proposes to develop and assess simple NRT models of fire risk at a landscape scale, using a combination of remote sensing and static sensor data. The team will use these models to test the premise that finer-grained risk data can be more effective in informing operational risk management decisions.

We project team also wants to determine what kinds of data in what medium help operational management of fire risk. Recognizing that analysis and insight are only effective if delivered in an operationally useful manner, they will work with the property team at Marsden Moor to develop and assess a range of methods and media for delivering NRT risk assessment to inform management. Through this process, they will learn whether wildfire

sensors reduce the time taken to identify fires and help to provide an early detection system.

Measures of Success

In addition to achieving the above project goals and anticipated benefits, success measures of this pilot project include:

- Successfully setting up the network, including getting the border gateways to connect to 4G in areas of relatively poor signal, and getting the sensors to connect to the mesh and border gateways in areas of varied topography.
- Receiving alerts immediately if there is a fire.
- A low number of false alerts to ensure confidence in the system.
- Limited damage and vandalism of equipment.

Technical Aspects

Each Dryad Silvanet wildfire sensor covers a 100-meter radius and can detect fires as small as 2 square meters during their early smoldering phase, i.e., within minutes of ignition. The sensor detects hydrogen, carbon monoxide and other gases at the parts-per-meter level, and avoids false positives with built-in artificial intelligence.

Deployed Silvanet Wildfire Sensor

Each sensor is solar-powered, battery-free, weather- and ultraviolet-proof (IP67 rating). Up to 100 sensors connect to a solar-powered Silvanet Mesh Gateway using LoRa, the open standards long-range radio network for the internet of things (IoT).

Deployed Silvanet Mesh Gateway and Border Gateway

Up to 20 mesh gateways connect to one solar- or mains-powered Silvanet Border Gateway, which connects to the Silvanet Cloud Platform using a built-in LTE radio, Ethernet adapter or satellite uplink where there is no mobile network coverage. The Silvanet Cloud Platform provides comprehensive wildfire monitoring and device management.

Possible Future Projects

If the pilot project is successful, there are a number of sites across England, Wales and Northern Ireland, and sites owned by other conservation organizations and privately owned land, that may benefit from this approach and technology.

Testimonials

"Fires are a major threat to places like Marsden Moor, and we know that climate change is only going to increase their likelihood and severity. It is crucial that we adapt how we work and increase the resilience of our precious habitats to these impacts.

We are pleased to be working with Dryad Networks on this pilot project to reduce the risk of fires damaging this much-loved landscape. Dryad's sensors will help us detect fires earlier and respond quickly, hopefully saving wildlife and habitats."

Tia Crouch, Peatland Ecologist, the National Trust