Topic 2b – Wildfires and burn scarring

So one of the application of optical remote sensing that's proving increasingly widely used is burn scar mapping. This basically is looking at the area affected by wildfires or any other type of biomass burning, for example, agricultural residue burning that is conducted after farmers have harvested their fields. Here, we can see the recent fires in Alberta. This was actually taken around the area of Fort McMurray by Landsat whilst the fire was still burning. You can see this huge area of brown here in this sea of green. And that's basically like a bruise on the landscape of the Earth caused by this fire, essentially, the burning away of a proportion of the surface vegetation and the laying down of, in this case, low reflectant surface made of ash and to some extent, bare soil, where the vegetation has been burned away.

So the reflectance of that mixture of soil and ash and burned vegetation is obviously very different than the reflectance of the pre-burn vegetation itself. And that's why we see these changing colours so dramatically here. You can also see here, where we've labelled Active Fire, that actually is locations where the fire is still burning. And it's actually burning so hot that it's actually emitting light at the wavelengths used to make this colour composite here. So you can imagine that flames and fires actually emit visible light. That's what we see as flames when we're looking at a fire. And even at the scale of this Landsat image, where each pixel covers 30 by 30 metres on the Earth's surface, there can be so much fire activity within a pixel that you're actually able to pick up that emission of, in this case, shortwave infrared light by the flames themselves. But mostly here, what we're seeing is the changing reflectance of the surface caused by the fire passing through, removing vegetation, and laying down a layer of ash.

So one of the applications of a burn scar mapping is to understand what fires are emitting into the atmosphere because they are responsible, particularly in forested lands, for a reasonable proportion of greenhouse gas emissions to the atmosphere every year that aren't reassimilated the following year by vegetation regrowth. So for that application, you'd have to combine the burned area information with information on how much vegetation has been consumed by the fire per unit area.

They're also very useful whilst the fire still occurring. For example, we can clearly see what area has been fire affected. And if we look at the outermost parts of the burn scar here, that will be potentially the areas where the fire is still burning most strongly, and also for post fire remedial efforts, for example, reseeding an area to try to encourage vegetation regrowth before lots of soil erosion can occur. In burned lands, images like this are very useful.

Biomass burning or landscape fire is an inherent property of the Earth and has been going on ever since vegetation first developed on the land surface. And in many regions of the Earth, for example, the boreal forests such as we see here, fire is entirely natural. Often, it's caused by lightning. And those forests need fire to renew them for a healthy ecological functioning.

In other areas, like savannah, those areas might actually turn into forest, in some cases, if they didn't have very repetitive fire. There are also other areas, for example, the tropical forest, where fire naturally would be largely absent except possibly in extreme drought years. But fire is being used to clear forest for agriculture, for example,

So fire across the Earth is a patchwork of natural and anthropogenically driven. But there are many scientists and policymakers who want to keep a tab on how fire is being distributed across the Earth, whether fire regimes are changing over time, and how much material these fires are releasing that was previously stored in the Earth's surface in the form of plants into the atmosphere because that affects atmospheric composition and can impact on air pollution and air quality, for example.

The capabilities provided by Sentinel 2 with its high spatial resolution and Sentinel 3 by its very frequent imagery are perfectly adapted to identifying areas of the Earth that are being affected by fire and providing very well-calibrated and regularly updated information for use by scientists and policymakers to understand the impact of fire on our planet.