Topic 2c - Biodiversity and conservation (part 1) - overview

As we look around, we can see some of the amazing examples of the diversity of trees that we have here at Kew. And of course, biodiversity is one of the key applications of optical remote sensing. Satellite data are a key tool that are allowing us to explore, measure, and understand the sheer range of diversity of life that we have on earth.

Biological diversity is not doing very well. All the information we have is telling us that we are losing species at quite a fast rate. Now, what can we do about this?

To protect, to retain, biological diversity, we'll need to understand what is shaping those losses and where, and, more importantly, predict where further losses are going to happen. This mechanistic understanding of the relationship between threat and state of biological diversity is of paramount importance for us to be able to design efficient conservation action.

Now, to do this, we need data. But we could monitor a lot of things, and it costs a lot of money. And so, therefore, there's a real need to prioritise key information for being able to predict further loss of biological diversity.

And that's exactly what the discussion on the essential biodiversity variable is about. That is, can we identify a set of metrics that can be monitored from space, and that can allow us to understand and predict change in biological diversity? If we can identify those metrics, then we can make sure that those data are collected and processed in a sustainable and consistent way for the years to come, ensuring that we have a global observing system to support our conservation effort.

From an economical point of view, there's also a lot of reason to try to protect biological diversity. A lot of species actually provide a lot of services to us for free. Think about clean air. Think about clean water. Think about pollination. All of these services are done by wildlife for free. If those species that are responsible for doing those services were to disappear, we would have to pay a lot of people to do the same thing, and that would cost our society a lot of money.

So to try to address those challenges at a global scale, we need data. And to monitor all kinds of species in all kinds of environment for sufficient amounts of time is quite challenging. And this is why, and where, the satellite data really coming into light and can help conservation biologists find solutions, management solutions, to try to help safeguard this biological diversity.

So what can you do with satellite remote sensing? Typically, you can help on three big types of area. The first thing has to do with monitoring the state of biodiversity.

So you can do this, for example, by using optical data to try to monitor the extent of ecosystems. Where are the forest? Where are the mangroves? Where are the savannas and the grasslands? All of this can be monitored from space, and we have the data to monitor this for the past 30 years or more. So trying to provide a global view, or a local view, of our planet and see how those ecosystem changes in distribution is something that we can do from space.

Another thing that you can do with satellite remote sensing is to monitor the condition of those ecosystems, particularly degradation, which is generally looked at by monitoring the level of fragmentation. Again, this is something that you can do quite well with satellite remote sensing, looking, for example, at patches of forest and how well they connect or they do not connect. Fragmentation tells us something about the health of the ecosystem and its capacity to withdraw multiple challenges, such as climate change, or a change in anthropogenic pressure.

Third thing that you can do with satellite remote sensing is to have a look at phenology, the phenology of those ecosystems. When do things start? When does vegetation start? When does green up happen? How long does the vegetation stay green for? When does it peak? All of this information, the spatial, temporal distribution of biomass is something that help us a lot understand cycles, and actually is used by many species for starting to migrate, for example, or fitting their reproduction pattern to the best moment, in terms of resource availability.

This is something that we can do using satellite information that has been collected for over 40 years. Phenology is something that we can definitely track from space using satellite platforms, such as MODIS or Lansat.

An exciting development, in terms of what you can do with satellite data to monitor biological diversity, is the ability to track the distribution of plants and animals using satellite data. So what's interesting is that the technology that you're going to use to track plants or animals is slightly different.

For plants, it's all about using hyperspectral data. Now, a hyperspectral sensor on board satellites are sensors that capture optical information in a myriad of very narrow bends searching for a spectral signature. And it turns out that many plant species have their own spectral signature, so that you can use this information to track their distribution on the surface of the Earth.

When it comes to animals, it's all about using very high resolution data, that is, the type of data that you typically see in Google Earth. Those data can be used to find the distribution of large animals, whose spectral signature contrasts quite a lot from the background.

So typically, very high resolution data have been used to try to map the distribution of penguins. And that's based on the fact that penguins generally live in colonies. Colonies produce a lot of poop. And the poop can be contrasted from the ice using those very high resolution data. And that's how you assess the distribution of penguins.

Another type of example is trying to spot whales from space, or spot big antelopes from space, elephants from space. So all of this is at the top of the research. It's just happening right now. And we are starting to find a lot of different animal species that can be mapped from space using that technology.