

## **Slide 1 – Title Slide**

Hello and welcome to Week 11, part 1 of EGM310: Band Combinations. In this lesson, we will learn about how we can use different band combinations to highlight different landcover types in multispectral satellite images.

## **Slide 2 – Week 11 Outline**

In the rest of the lessons this week, we'll cover how we can use software to enhance images, to make them easier to interpret; we'll talk about the elements of visual interpretation, how we can transform images to make them easier to interpret; and finally, we'll talk about different classification methods and how we can assess the accuracy of classified images.

## **Slide 3 – Using multispectral imagery**

We can view with remotely-sensed images as either single band, grayscale images, or as multi-band composites. As you've seen in the practicals so far, composite images can help to highlight different features and aid in visual analysis. In this lesson, we're going to look at Landsat 8 OLI images in a number of different band combinations, to see how these band combinations highlight different areas or features. You can use this presentation as a guide for your own work, such as in the TRS assignment, but feel free to try out your own combinations, too.

## **Slide 4 – Grayscale (OLI Band 5)**

We'll start with a grayscale image of OLI band 5, the Near Infrared band. Of course, you've seen this before when we looked at spectral properties. In the upper right panel here, we have our spectral signatures for different objects, with the band highlighted as a vertical gray bar. Underneath that, I've also included a table which shows the different band names, numbers, and bandwidth or wavelength ranges. So here, we're looking at light between 850-880 nanometers, in the near infrared. As we noted in week 9, healthy, chlorophyll-producing vegetation is quite bright in this wavelength range – it reflects quite highly - while water is nearly black owing to its near-total absorption of near-infrared wavelengths.

## **Slide 5 – True-colour**

Another image that we've seen before, this is a true-color composite, with the red wavelengths recorded by the sensor displayed as red on the computer screen; green wavelengths displayed as green; and blue wavelengths displayed as blue. You can see lots of green in the image – most of the different agricultural crops in the region reflect more strongly in visible green and blue than they do in the red wavelengths, cities/urban areas are gray, and shallow water appears blue to green, depending on the depth and sediments in the water.

## **Slide 6 – False-colour Infrared – vegetation**

In the false-color infrared vegetation image, the near-infrared recorded by the sensor is displayed as red on the computer screen; red is displayed as green; and green is displayed as blue. As we noted last time, everything looks read now, owing to much stronger reflection of vegetation in the near-infrared than in the visible wavelengths. We can also see that the water appears mostly black, blue, or green – again, because water reflects very little in the near-infrared. In this color combination, urban areas appear mostly blue-gray, indicating that they're fairly bright across the three bands, but maybe a bit higher in the green.

## **Slide 7 – False-colour Infrared – urban**

This color combination uses the shortwave infrared band 2 at around 2200 nanometers for the red channel, shortwave infrared band 1 at around 1600 nanometers for the green channel, and the visible red band for the blue channel. In this combination, we can see that the vegetated areas are mostly green - most healthy, chlorophyll-producing plants reflect more at around 1600 nanometers than at 2200 nanometers or in the visible red wavelengths. We can also see the different urban, or built-up, areas in a sort of purple color. This contrast, the purple with the green vegetation, is what helps make this a useful combination for visually identifying urban areas. Additionally, the use of longer wavelengths helps reduce the influence of atmospheric pollution, such as smog or smoke – helping to discern features in often polluted urban environments.

## **Slide 8 – Agriculture**

Next up, we have a false-color composite that is useful for monitoring agriculture. In this composite, most healthy vegetation appears bright green, while bare Earth appears more of a pink/magenta color. You can also see that urban areas are a deep purple, again helping to distinguish them from vegetation.

## **Slide 9 – Atmospheric penetration**

This false-color composite is useful for minimizing a number of atmospheric effects. It uses both shortwave infrared bands and the near infrared band, all of which have longer wavelengths. As we saw with the urban false color composite, both Rayleigh scattering and Mie scattering occur when the wavelength of the electromagnetic radiation is small relative to the size of the scattering particle. Most particles in the atmosphere – things like smoke, smog, or dust particles – are much smaller than the wavelengths detected in these bands, meaning that there's very little atmospheric scattering that occurs – thus, the picture is typically much sharper than false color composites that use shorter wavelengths. This color combination can also be useful for geologic mapping, as certain minerals can be easier to discern in using this color combination.

## **Slide 10 – Land/water**

A combination of the near-infrared band in the red channel, the shortwave infrared band 1 in the green channel, and the visible red band in the blue channel provides a better definition of land-water boundaries, especially for inland lakes and streams. Water appears almost entirely black in this color combination, while most other surfaces are shades of green, blue, or orange. This color combination can also be used to map differences in soil moisture, as a lot of the differences we see in various vegetation and soil covers are due to differences in water content – wetter soil will appear darker in this color combination, while drier soil will appear brighter.

## **Slide 11 – Bare Earth**

This color combination is used to distinguish differences in bare earth – that is, landcovers without significant vegetation cover. This is more difficult to see here, where most of the image is covered by vegetation. It can also be used to distinguish cloud cover from snow and ice – while clouds appear bright across most all of these wavelengths, snow and ice are especially bright in visible and near-infrared wavelengths, but appear very dark in shortwave infrared wavelengths. In this band combination, then, snow/ice will appear blue/green, while clouds will still appear mostly white and gray.

## **Slide 12 – Additional resources**

Once again, you can read more about the concepts we've covered in this lesson in Chapter 4, section 6 of Campbell & Wynne. I've also included some different links to more information on interpreting false-color images, including a page where you can try your own color combinations. Finally, I've re-linked a video that talks about the different Landsat bands, as it covers some of the material we've discussed today. That's all for this lesson – I hope you found it interesting, and if you have any questions, please don't hesitate to e-mail me or post in the discussion forum on blackboard. Bye!