

Slide 1 – Title Slide

Hello and welcome to Week 12, part 4 of EGM310: Archaeology applications. In this lesson, we will learn about how we can use remote sensing to locate and study archaeological sites.

Slide 2 – Recall

At the beginning of week one, I showed this example from a site in southern Mexico called Aguada Fénix. It was built between 1000 and 800 BC, and abandoned around 750 BC. This study is an example of using LiDAR to map ruins that are obscured by vegetation – this region is covered in thick forest cover, which makes most mapping attempts much more difficult. While full study of sites like this still require field work, remote sensing can help narrow down the search for these sites, showing us where to start digging.

Slide 3 – Surface features

One of the ways that remote sensing can help us discover lost sites is by enabling us to see surface features in remote areas. These can take the form of visible ruins, mounds indicating burial sites or the covered ruins; rock piles indicating human activity, or surface markings that are difficult to discern from ground level. One of the more famous examples of this is the “rediscovery” of the Nazca lines, or markings, in Peru. In the early 20th century, airplane pilots noticed these markings, created sometime between 500 BCE and 500 CE, which depict geometric patterns and shapes, as well as designs of animals and plants. Many of the markings are difficult to see from the ground, but from the air, the designs and patterns are clearly visible.

Slide 4 – Subsurface features

Remote sensing can also help us find features that have been buried or are otherwise obscured by vegetation. These can be revealed due to subtle differences in crop growth, soil moisture or chemistry, surface temperature, or topography. One example, shown here, is the ancient city of Tanis, once the capital of Egypt. In the image shown here, the ancient city occupied much of this barren hill. While a number of ruins have been found and explored, the use of remote sensing has helped to expand and map much of the ancient city, even though most of the features are not visible from the ground surface. Small-scale differences in near-infrared reflectance show the outlines of the foundations of ancient buildings and streets. There are links at the end of this lesson that you can follow to learn more about a lot of these discoveries. Another example is this one, showing the foundation of a Roman villa beneath a grain field in northern France. Directly above the foundation of the villa, the soil is thinner, and the root systems of crops are unable to grow as deep as in the rest of the field. As a result, plants directly over the buried foundation are more easily distressed, or they are unable to grow to the same heights – these differences, difficult to see from the ground, are clear when seen from a different perspective.

Slide 5 – LiDAR

A LiDAR pulse, or signal, will ‘see’ different parts of vegetation – the signal returned will have peaks corresponding to thicker parts of the vegetation cover, and to the ground. Using this, we can ‘remove’ the vegetation from elevation models, leaving only elevation of the ground – known as a digital terrain model. As we’ve discussed, this can reveal objects that are obscured, or covered, by vegetation, such as the ruins at Aguada Fénix and other Maya cities in Central America. Even where vegetation cover is more sparse, however, subtle differences in topography revealed by high-resolution lidar scans can reveal the presence of human structures, such as the roads or field boundaries dating to colonial New England shown here.

Slide 6 – Underwater shipwrecks

As you covered in the underwater remote sensing part of this module, currents can create scour pits around partially-buried shipwrecks and other underwater structures. During slack tides, these scour pits can fill with loose sediments. These sediments can then become re-suspended during flood and ebb tides, creating sediment plumes. In shallow enough water, these sediment plumes can be seen in satellite images, enabling us to map shipwreck locations. An example of this is shown here, off the coast of Belgium. If we zoom in on this area, we can see the sediment plumes created by two ships that were sunk during the second World War. These locations were previously known, but by applying this technique to areas where shipwreck locations are less well known, we can potentially find other shipwrecks in relatively shallow waters.

Slide 7 – Summary

In this lesson, we have discussed how remote sensing can help us to identify or discover archaeological sites, both ancient and modern.

We can map surface features using the same elements of visual interpretation that we have discussed – using shape, texture, patterns, and other features to find archaeological sites.

Subsurface features can be detected in a number of ways, including through the use of multispectral imagery to enhance subtle differences in plant health or soil moisture and chemistry; we can also use thermal bands, as underground structures and cavities can have a different thermal signature than the surrounding area; finally, we can use LiDAR to and high-resolution digital elevation and terrain models to ‘see through’ vegetation and map topographic features.

And, we’re not necessarily limited to terrestrial sites – we can use remote sensing to locate certain underwater features, as well.

Slide 8 – Additional resources

I’ve included a few different links to a project led by Sarah Parcak. The first is a short TED talk that introduces some of the same concepts we’ve discussed here – how we can identify and map archaeological sites using remote sensing. The next link is to a project called GlobalXplorer, where you

can actually apply the skills we've discussed in this module to help map sites around the world, and learn more about remote sensing archaeology. Finally, I've linked to a few articles which go into a bit more detail about the different things we've discussed here. 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!