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Landscape from above

Dr Clive Farquhar explores the usage of Remotely Sensed Data for Urban and Rural Landscapes Studies

Today, there is an increased demand for accurate and current geospatial information- important data about a specific geographic area. Having access to this valuable information helps professionals across industries make informed decisions, from where to build a shopping centre to how urban sprawl has affected the plant life. The increased need for geospatial information – usually gathered via satellite imagery - stems from the growing understanding of how much knowledge we can gain by analyzing an image of an area of interest. Increased GIS usage in both and public and private sectors, along with the widespread use of GPS for navigation and mobile devices to provide 'location based services' have equally contributed to the growing number of applications where imagery is a major source of information that aids in critical decision making.. A key component to understanding a geographic area is an assessment of the landscape, which is composed of a series of physical, living and human elements which vary significantly between the urban and rural environments.

To understand how the landscape is relevant to a particular application, it is first important to understand the differences between types of landscape. The urban landscape is dominated by human activities and is characterised by the built environment and high population densities. Its character and changes that take place in it are of particular interest to transport engineers, local and national authorities, the utilities industry and commercial developers.

In contrast, the rural landscape is defined by the lack of built environment and is characterised by low population densities and typically large areas of vegetation. Its health and preservation are important to those involved in the energy industry, agricultural businesses, the transportation and utilities industries, and authorities in environmental protection.

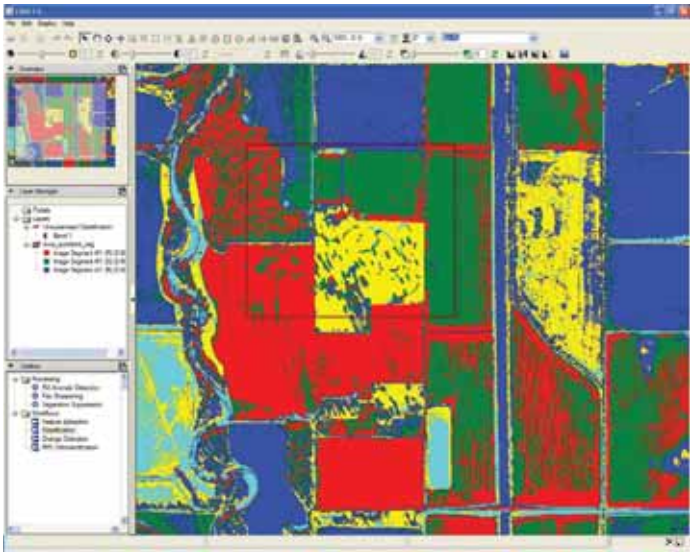
How Remote Sensing Helps in the Monitoring of Landscape Characteristics

There have been significant recent advances in the field of remote sensing and its use in landscape monitoring, particularly within sensor, software and data transfer systems. Advances in sensor technology include the development of satellite sensors with sub-half-meter spatial resolution. This resolution is significantly below the 20m size of a typical urban feature, hence improving the user's ability to identify features using both manual and automated methods.

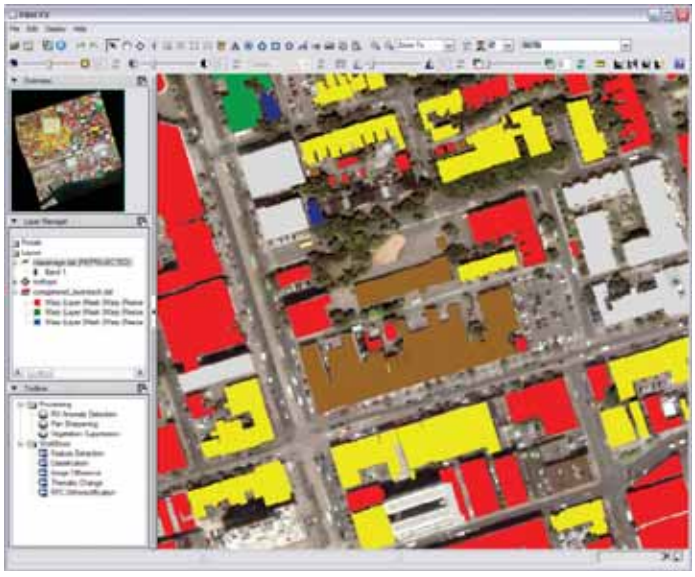
Additionally, improved computational power has increased the ability for individual workstation-based image processing and the easy transfer of imagery via the internet and portable media. Software advances have increased interoperability between what were traditionally scientific remote sensing software and commercial GIS software such as ESRI's ArcGIS®, These advancements are mainly fuelled by the goal of companies like ITT Visual Information Solutions to improve the general user's ability to create 'GIS-ready' data products from imagery.. In recent years software such as ITT's ENVI has included a series of workflows that are focused on helping GIS professionals to obtain useful geospatial information from remote sensed imagery

Because of these advancements, remotely sensed data is highly suited to record landscape characteristics, and thus help professionals determine the correct course of action for their particular application. Knowing the changes that have taken place in an area over time, determining how many buildings are in a particular location, or seeing how deforestation has affected a specific region are just a few examples of how remote sensing can provide information that is otherwise very difficult to obtain. Satellite, airborne or ground-based sensors can quickly provide relevant landscape parameters to help draw conclusions, including information about physical elements (land cover), living elements (vegetation) and human activities (land usage).

Recently-acquired imagery can add value to accepted knowledge by providing an update to existing landscape information. Analyzing the image's non-visible spectra can provide further important information about the landscape, such as surface temperature, mineral type and vegetation



A geospatial image of a rural area is classified based on types of land cover using ENVI EX. Image classification allows decision makers in agriculturally-based industries to map and monitor land use and identify areas of vegetation stress. Image courtesy DigitalGlobe



Using the advanced feature extraction technology found in ENVI EX software, transport engineers, local and national authorities, utilities professionals, and commercial developers can easily identify and extract objects of interest, such as these building rooftops, to aid in the decision making processes. Data courtesy DigitalGlobe and Optech.

condition In addition accurate digital elevation models (DEMs) can be derived from remote sensing source like optical, RADAR or LiDAR. DEMs have great potential in a wide range of applications including civil engineering, government and defence. Today, image analysts have access to modern tools to help them derive the information they need, such as ENVI software, which covers the complete image analysis workflow, from data ingest to reading, processing, and analyzing imagery to achieve results such as those we've highlighted.

Remote Sensing for Urban Landscape Studies

Remote sensing has significant potential in aiding urban landscape studies. Imagery can be used to map the built environment, with software such as ENVI EX's Feature Extraction workflow enabling the automatic extraction of vector layers of urban features such as buildings and vehicles. By exploiting its distinct spectral signature, remote sensing can successfully map urban vegetation, which can be used for a variety of applications including determining subsidence risk. A significant advantage of remote sensing is to obtain time-critical geospatial information. For example, satellite imagery is been currently used to map infrastructure damage caused by the recent Haiti earthquake.

Remote Sensing for Rural Landscape Studies

Remote sensing's inherent usefulness for vegetation and mineral mapping make it also highly suited for rural landscape studies. For example, the European Union uses land cover information derived from remote sensing to ensure correct payment of agricultural subsidies. Non-visible spectra have been used to aid in the detection and mapping of mineral deposits throughout the world. Remote sensing also has potential in locating optimum sites for renewable energy resources, such as determining potential hydrological power or for selecting optimum sites for onshore and offshore wind farms. Remote sensing is particularly suited to the latter cases, where in situ data is likely to be limited.

Future Advances in Remote Sensing

More advances for the use of remote sensing are likely to surface as sensor capabilities improve, and the ever expanding library of imagery increases, while a focus on improving the ease in deriving useful geospatial information from remotely sensed data continues. Hardware advances will certainly continue, as companies deliver sensors that provide improved spatial and spectral resolution, as we use satellite constellations to improve revisit times, as we develop more RADAR and LiDAR sensors, and as the use of UAVs as a remote sensing tool becomes mainstream. Software advances will include increasing automation and use of workflows, both to ensure standardisation of image products and to make it easier to extract useful geospatial information.

This article demonstrates the high potential of remote sensing and its corresponding analysis software to aid extraction of useful geospatial information on both urban and rural landscapes, which can be used by geospatial professionals across industries and disciplines. It is envisaged that continuing future advances within the field of remote sensing will improve both the range of geospatial information that can be derived from imagery and the ease of information extraction by geospatial professionals with a wide range of expertise.