

Product solution for: Centre for Geographical Analysis (CGA)/Soil Salinity



Imagery aids researchers in measuring soil salinity

Researchers estimate that nearly one billion hectares, the equivalent of seven percent of the earth's continental surface, is affected by high salt accumulation. Although salt is a natural element of soils and water, excess levels of salinity are taking a toll on both the environment and agricultural production around the world. While researchers have long studied the problem, today high-resolution satellite imagery is providing new insight into the identification of affected areas.

A growing need to control salinity

The presence of salt is a natural occurrence in soils. It is naturally flushed or leached out of the land in areas with sufficient amounts of precipitation. However, a number of human practices are interrupting the natural process and the consequences are significant, including detrimental effects on plant growth and yield, damage to infrastructure such as roads, cables and pipes, reduction of water quality and increased levels of soil erosion.

Centre for Geographical Analysis salinity study

The Centre for Geographical Analysis (CGA) is a self-funded research and service institution of South Africa's Stellenbosch University. Using GIS, satellite remotely sensed data and other geographical analytical techniques, the CGA conducts basic and applied research on environmental, urban and regional development problems for private, public and academic institutions. In 2013 the CGA undertook a study of soil salinity throughout South Africa.

"As a prestigious research institution, the CGA has very specific requirements for its projects," says Dillon Panizzolo, production manager for DigitalGlobe partner GEO Data Design of Cape Town, South Africa. According to the CGA director, Adriaan Van Niekerk, soil salinity can vary significantly over very short distances. "High-resolution imagery was essential to the success of the project," say Van Niekerk. "WorldView-2's blue, green, red and infrared spectral bands proved to be ideal for our needs."

Company information

The Centre for Geographical Analysis (CGA) is a self-funded research and service institution of the University of Stellenbosch, South Africa. The CGA conducts basic and applied research on environmental, urban and regional development problems through utilization of geographical-analytical methods.



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CGA procures WorldView-2 imagery for project

Between 2011 and 2012 the Centre procured both WorldView-2 and GeoEye-1 high resolution imagery covering 350 square kilometers in the Northern Cape and Western Cape regions of the country. Affordable and accurate land cover maps were crucial for the project and previously unavailable.

The CGA combined several methods for monitoring salt accumulation. The first uses a salinity index based on WorldView-2's blue, green, red and near infrared spectral bands. The second uses multi-temporal imagery and vegetation indexes to identify crops that are stressed over a period of three seasons. The final approach uses a digital surface model extracted from DigitalGlobe stereo images to identify areas where surface and groundwater will likely accumulate.

“The end result is a composite map that identifies areas where field-based observations will be required,” explains CGA's Professor Adriaan Van Niekerk. “This methodology has proven to be highly successful at a number of sites.”

This research using a range of tools and techniques including the high-resolution satellite imagery identified irrigation as the chief culprit of increased salinity.

Imagery presents a platform for moving forward

The CGA study proves that remote sensing is an ideal solution for monitoring salt accumulation. Large areas can be surveyed on a regular basis to build a record of historical land cover changes, including climate change, urban and regional analyses, agricultural economics and ecological studies. The integration of satellite imagery with GIS and spatial statistics produces accurate models that can predict the distribution, presence and patterns of soil salinity.

“High levels of soluble salts in soils not only has a negative effect on agricultural production, but if not addressed can eventually lead to permanent loss of agricultural land. DigitalGlobe’s very high resolution imagery is ideal for highlighting areas that are potentially affected.”

ADRIAAN VAN NIEKERK, DIRECTOR, CENTRE FOR GEOGRAPHICAL ANALYSIS

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Challenge

Develop a cost-effective, repeatable methodology to measure salt accumulation in soils, a severe environmental hazard that impacts crops, damages infrastructure, and reduces quality of drinking water.

Solution

GEO Data Designs provided researchers with high-resolution satellite imagery covering 350 square kilometers to use as a basis to develop a broad solution.

Results

The study proved that integrating cost-effective satellite imagery with GIS and spatial statistics produces accurate models that can predict the distribution, presence and patterns of soil salinity.



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