

DEVELOPMENT OF A WEB-BASED SYSTEM FOR VISUALIZING REMOTELY SENSED SPATIAL DATA

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The advent of the Internet and powerful home computers has made a significant amount of information previously difficult to obtain - digital imagery, remotely sensed data, and historical records, for example - reasonably accessible. Yet, the delivery of these often large, complex data sets to users over the Internet presents a series of challenges - especially when the intended users are non-researchers unskilled in the methodologies relevant to the data. These challenges - delivery of complex information quickly and understandably - are familiar to the cartographer, however. This paper examines a particular approach to solving this sort of problem by describing the development of a web-based Remote Sensing Visualization System (RSVS) aimed at providing land managers, ranchers, and others untrained in remote sensing the ability to make decisions about land use based on viewing land cover change data over a typical "dial-up" low-speed Internet connection.

The target users for this project consist of ranchers and a group of federal, state, and local land managers with significantly varying degrees of familiarity working with remotely sensed data. The users require a RSVS that will enable them to examine recent changes to the land under their control and use that understanding as a basis to make future decisions. The data available for the project includes daily SPOT4 VGT images. These files, at approximately 30 megabytes of data per file, are too large for the users to make use of in their "raw" form. The RSVS system, responding to requests from the users, pares down these files so that only the data relevant to the user's request is delivered to the user's browser. In this way, multiple imagery dates can be loaded and animated chronologically in the user's browser without the long delays typically associated with downloading remotely sensed imagery and data over a low-bandwidth connection.

Although animations of satellite imagery are not new, their simplistic nature offers minimal quantitative information for users. Changes can be seen, through shifts in pixel intensities and colors, but assessing the true causes of change in the land cover can be difficult. The RSVS web-based visualization engine goes beyond animation into "image understanding" by giving users some basic analysis tools - tools that can be customized to suit their specific research needs. Users have the ability to select a location on an image and track the spectral changes over time. A collection of predefined ecological variables that are derived from spectral signatures (NDVI, LAI, and percent forage cover for example) can be selected, calculated, and displayed graphically for the selected location. Users can follow changing variable values in sync with each image in the

animation. By enabling users to explore remotely sensed data in a new way - using clear, intuitive interface design, efficient delivery of data over low-speed Internet connections, and simple data analysis - this visualization system encourages knowledge discovery.