

HISTORICAL FIRE SEVERITY MAPPING FROM LANDSAT DATA

S. M. Howard, D.O. Ohlen, R.A. McKinley

Raytheon ITSS
EROS Data Center
Sioux Falls, South Dakota

Z. Zhu

U.S. Geological Survey
EROS Data Center
Sioux Falls, South Dakota

Jim Kitchen

National Park Service
Mesa Verde National Park, Colorado

ABSTRACT

Landscape variation is driven by many elements, the fire regime of the ecosystem being one of the dominant elements. Variable fire behavior: variations of intensity and duration, and the resulting patterns of burn severity, strongly influence the species, structure, and composition of the land cover for decades to come. Understanding the fire history of the landscape is an important consideration in any fire or land management planning processes.

The National Park Service and the U. S. Geological Survey have developed a technique to quickly map burn severity at the landscape scale. The process utilizes temporal analysis of satellite data. Near infrared and short wave infrared bands provide the best contrast between healthy vegetation and burned vegetation. Landsat TM/ETM bands 4 (near infrared) and 7 (short wave infrared) are combined in a band ratio transformation called the Normalized Burn Ratio ($NBR = (B4 - B7)/(B4 + B7)$). NBR transformations are computed for a pre-fire scene and a post-fire scene, which are then subtracted, resulting in the Differenced Normalized Burn Ratio (DNBR). Variations of the DNBR within the fire perimeter are related to variations in burn severity. This process, combined with the 30-year archive of Landsat data, permits the development of a 'fire atlas' that reconstructs the fire history of the landscape.

Mesa Verde National Park was selected to prototype a burn severity atlas. This park is located in southwestern Colorado and is characterized by an arid climate with frequent summer thunderstorms. These summer storms cause many fires and the park experienced major fires in 1959, 1972, 1989, 1996 and 2000. While no Landsat data exists for the 1959 fire, its effect upon the landscape is still clearly visible in the 2000 imagery. Landsat data and the DNBR were used to map burn severity of the fires after 1972. Better understanding of the fire history provides park officials the opportunity to better understand and manage the park's landscape.

HISTORICAL FIRE SEVERITY MAPPING FROM LANDSAT DATA

Pecora 15/Land Satellite Information IV/ISPRS Commission I/FIEOS 2002 Conference Proceedings