and Landsat

From the flat, rich soil of western Tennessee to the Appalachian Mountains in the east, and rolling hills in between, “the Volunteer State” enjoys a wealth of natural resources.

The Tennessee, Cumberland, and Mississippi Rivers supply economically crucial navigation routes, along with recreation for residents and visitors. Additionally, 14 million acres of hardwood and softwood forests cover roughly one-half of the State, contributing an estimated $24 billion and nearly 100,000 jobs to Tennessee’s economy (Tennessee Department of Agriculture, 2017). Within a span of more than 400 miles, the State’s diverse agricultural products include cotton, corn, soybeans, poultry, horses, cattle, goats, hay, vegetables, nursery crops, and tobacco.

Energy production is important to Tennessee and the region, and power sources range from coal and nuclear to hydroelectric sources. Tourism also is a key industry, and music attractions and historical sites are balanced by natural features such as the Great Smoky Mountains National Park, which recorded 14.1 million visits and ranked second for most visited National Park Service site in the United States in 2021 (National Park Service, 2022).

Landsat imagery’s broad geographic scale and rich historical archive have proven useful to land managers and State agencies for monitoring natural resources. Here are several ways Landsat has benefited Tennessee.

Helping with Crop Estimates

Landsat data form a crucial component of the U.S. Department of Agriculture’s Cropland Data Layer, which maps crop type, acreage, and yield for fields in Tennessee and other States. The annual Cropland Data Layer reveals what is planted, how much, and its location and land use change. This information helps agricultural producers and others in the industry make prudent decisions (U.S. Department of Agriculture, 2022). University researchers also demonstrated the ability of Landsat to model predictions of cotton yield based on greenness and wetness indices in a study of an irrigated western Tennessee field (Haghverdi and others, 2018).

A 2021 Cropland Data Layer map of Tennessee (stretching across the middle) includes cotton (red) in the western part, along with corn (gold), soybeans (dark green), grass and pasture (light yellow green), and forest (medium green). Gray and dark blue represent developed areas and water, respectively. Image credit: U.S. Department of Agriculture.
Monitoring Water Safety

Landsat’s ability to assess and monitor resources extends to waterbodies; for example, satellite data can support public safety measures by helping to identify harmful algal blooms. Researchers from the University of Tennessee at Chattanooga and the Hamilton County Geospatial Technology Department recently used Landsat surface reflectance data to estimate turbidity in the Tennessee River, an important water supply for residents of cities such as Chattanooga. Turbidity is an indicator of water clarity and quality. Storm water runoff can carry excess nutrients and chemicals from urban areas like Chattanooga into the river. A turbidity estimation model can help city officials continually and effectively monitor water quality (Hossain and others, 2021).

Mapping Forest Trends

With its 30-meter resolution and 50 years of imagery, Landsat is ideal for viewing changes in landscapes such as forests over time. To help understand trends in forest cover change for southern yellow pine forests in a swath of east-central Tennessee, Tennessee State University researchers analyzed Landsat data from 1988, 1999, and 2016. Mapping and monitoring Pinus taeda L. (loblolly pine), Pinus echinata Mill. (shortleaf pine), and Pinus virginiana Mill. (Virginia pine) over several decades yielded information about gains and losses that can help with the management of these commonly harvested species (Akumu and others, 2021).

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