Topic: *A Decision Support System for Monitoring, Reporting, and Forecasting Ecological Conditions of the Appalachian National Scenic Trail*

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Background: The 2,175 miles of the Appalachian Trail (A.T.) traverse most of the high elevation ridges of the eastern U.S., from Mt. Katahdin in central Maine to Springer Mountain in northern Georgia. The A.T.'s gradients in elevation, latitude, and moisture and north-south alignment represent a continental scale transect of eastern U.S. forest and alpine areas, and offer a setting for collecting scientific data on the health of the ecosystems and species that inhabit them. The A.T. provides an ideal landscape for the early detection of undesirable changes in the natural resources of the eastern U.S.; for example, development encroachment, acid precipitation, exotic species invasions, and climate change impacts.

The Appalachian Trail decision support system (A.T. DSS – Figure 1) is an Internet-based dissemination toolset accessible at http://www.edc.uri.edu/ATMT-DSS. The A.T. DSS is designed to aid organizations tasked with A.T. resource management and conservation decision making to monitor, report and forecast ecological conditions, and convey meaningful information to the public. The A.T. DSS integrates remote sensing data and models from NASA's Terrestrial Observation and Prediction System (TOPS), *in situ* measurements from the USFS Forest Inventory and Analysis (FIA) program, and geospatial data from other sources (Figure 1. Interface components and some of the associated data: MODIS - Moderate Resolution Imaging Spectroradiometer, GIMMS - Global Inventory Modeling and Mapping Studies, NACP - North American Carbon Program, NED – National Elevation Dataset, NWI – National Wetland Inventory, NLCD – National Land Cover Database). LANDFIRE data products are among data incorporated (Figure 2) in the A.T. DSS. LANDFIRE products enhance the A.T. DSS by providing geospatial information on vegetation structure, composition, and condition across the A.T. corridor.

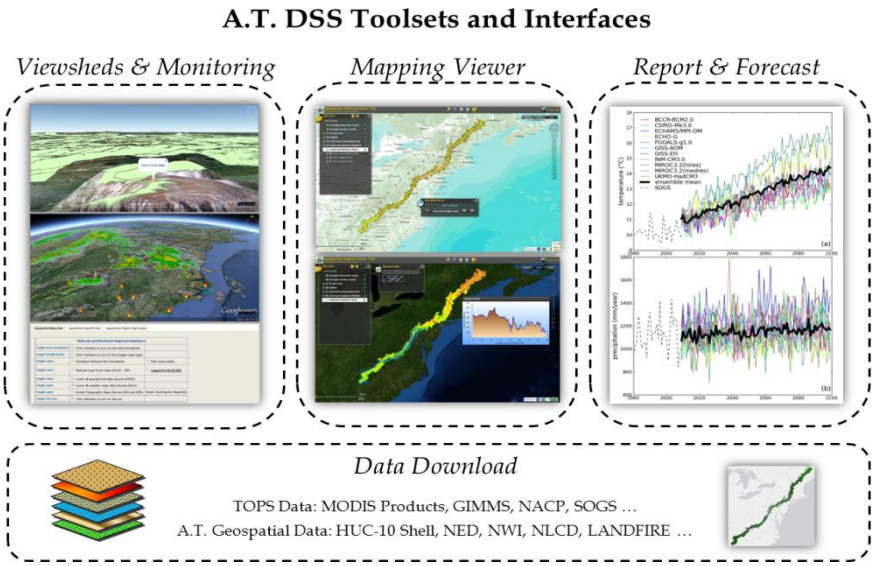

Figure 1: Appalachian Trail Decision Support System (A.T. DSS) Tool-sets and Interface components.

- *Canopy Cover (CC)*
- *Canopy Height (CH)*
- *Existing Vegetation Cover (EVC)*
- *Existing Vegetation Type (EVT)*
- *Existing Vegetation Height (EVH)*
- *Biophysical Settings (BpS)*
- *Environmental Site Potential (ESP)*
- *Disturbance (1999-2008)*
- *Vegetation Condition Class (VCC)*
- *Vegetation Departure (VDEP)*
- *Succession Class (SCLASS)*

Table 1: LANDFIRE Products incorporated into the A.T. DSS

Key points: The A.T. is an open and complex system. The A.T. DSS spatial extent is defined by the NPS and USGS. It was established by selecting all 10-digit Hydrological Unit Code (HUC-10) watersheds within five statute miles of the A.T. land base, termed the A.T. HUC-10 shell. The shell provides an ecologically relevant boundary around the trail to distinguish the data and area of concern most relevant to the A.T.

The LANDFIRE Data Access Tool facilitated data acquisition and preparation across the large A.T. spatial extent. For each data product, six individual tiles were downloaded, mosaicked, projected, and clipped to the A.T. HUC-10 shell extent. The LANDFIRE products were integrated into the A.T. DSS and used by the project team for various reporting and forecasting activities.

Data Coverage –
LANDFIRE data products, in particular those listed (Table 1), provide a gapless data coverage across all lands and are ideally suited to answer questions about vegetation within the A.T. landscape. LANDFIRE data products also provide spatial context for ground-based FIA data because they were derived from FIA and other ground plot data. Linking detailed vegetation records from FIA with along with TOPS data and broad scale remote sensing observations are an essential component of regional forest health monitoring. Vegetation condition, departure, and disturbance analysis helps identify areas of concern for in-depth analysis of forest health. Vegetative succession and disturbance history provide insight on the pattern and processes of landscape dynamics along the A.T.

The NPS Inventory and Monitoring (I&M) program is designed to develop and implement long-term natural resource monitoring and create a targeted decision support system aimed at selecting a suite of reliable and representative metrics, or Vital Signs, to provide long-term data to support change detection in ecosystem health. Among the Vital Signs defined by the I&M program, the A.T. DSS targets *phenology and climate change*, *forest health*, and *landscape dynamics* for system development, data preparation, and modeling.

Invasive Habitat Suitability & Risk Assessment –
A prototype habitat suitability model was developed for the invasive species Tree-of-Heaven (*Ailanthus altissima*- Figure 2) to demonstrate A.T. DSS capabilities. The current and projected distribution of suitable habitats for the species were estimated using geospatial data from the A.T. DSS, climate projections from TOPS, species presence data from FIA, and Maximum Entropy modeling.

Ailanthus is a problematic invasive species due to its high tolerance for environmental stress, aggressive dispersal capacity, tenacious establishment, and competitive advantage over native species. It is particularly successful in disturbed landscapes where vast quantities of airborne seeds are able to colonize forest canopy gaps. LANDFIRE data helps identify patches in the landscape where openings in vegetation canopy may allow *Ailanthus* to colonize. The LANDFIRE Disturbance 1999-2008 layer may also provide an historical context for the observed distribution of existing *Ailanthus* stands.

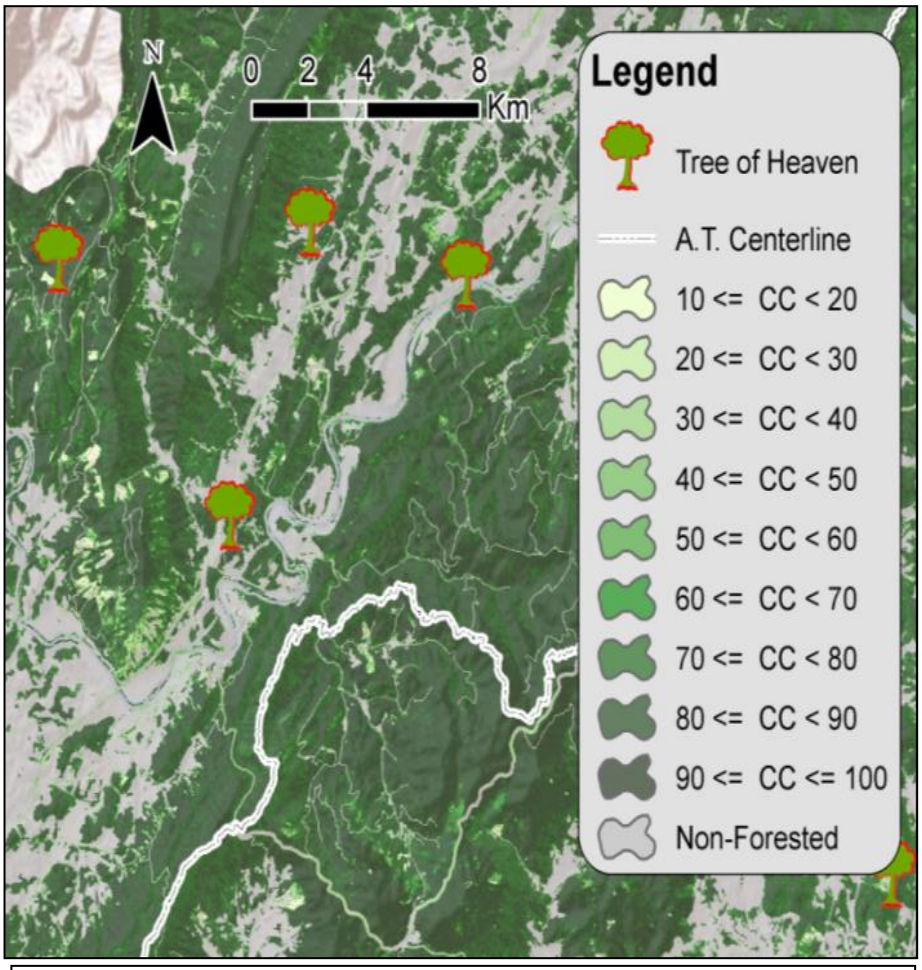

Figure 2: LANDFIRE Canopy Cover and Tree of Heaven Observations from perturbed FIA plot data.

Interactive Data Visualization –
The A.T. DSS allows users to visualize a large collection of geospatial information ecologically relevant to the A.T., including LANDFIRE products. The interactive mapping tool (Figure 3) allows users to pan and zoom to areas of interest, turn data layers on or off, and integrate data in combinations that meet their data exploration needs. Specific tools were added to the viewer to aid in decision-making, such as the time-series slider for visualizing land cover change, and an elevation surface profile mapping tool. The Mapping Viewer capitalizes on the latest web-mapping technology and was developed using the ArcGIS Viewer for Flex. Users may also download the gapless data directly from the Geospatial Data Gateway for further analysis.

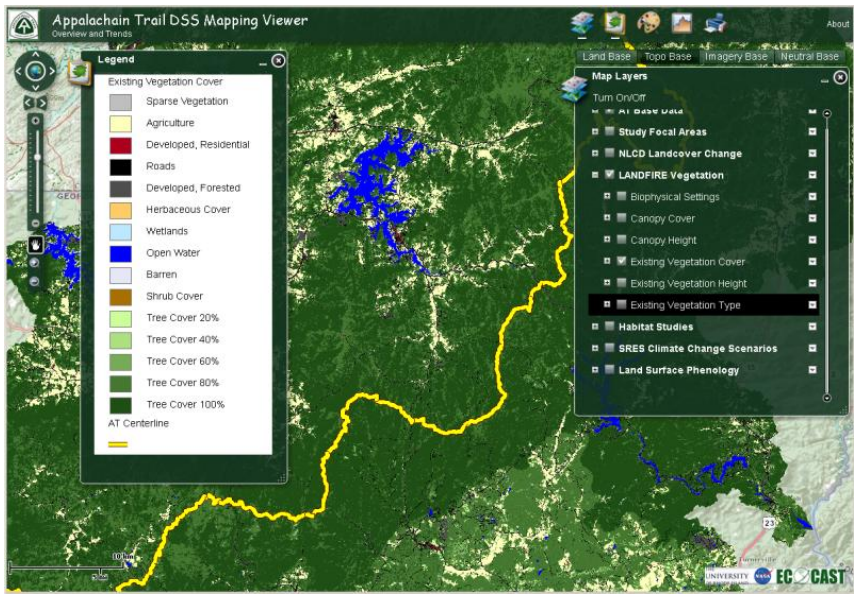

Figure 3: The A.T. DSS Mapping Viewer Interface

Results: LANDFIRE products were acquired and integrated within the A.T. DSS framework. These gapless layers greatly enhance the utility of the A.T. DSS and provide users with detailed vegetation data. Access to this data helps inform decision makers and increases the overall effectiveness of management and conservation within the A.T. corridor. The A.T. DSS can be accessed at http://www.edc.uri.edu/ATMT-DSS.

Recommendations: The temporal frequency of data is critical when monitoring changes across the landscape. The LANDFIRE program should continue to prioritize timely updates for these valuable data products, and continue to consider the importance of time-series and change oriented products.

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