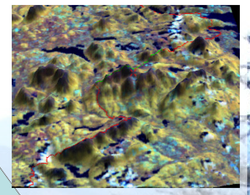
Appalachian Trail Decision Support System (A.T. DSS)

NASA Earth System Science Data: Observation from Space:
- Landsat
- MODIS
- ……

Managing A.T. Land from Field and Space

On-demand, predictive regional scale models and maps
Integrated access to biological field data and NASA Earth System Science Data



Primary Vital Signs:
- Forest Health
- Phenology
- Landscape Dynamics

Secondary Vital Signs:
- Mountain & Migratory Breeding Birds
- Water Quality/Quantity
- Alpine & High Elevation Vegetation
- ……

- **Database Management**
- **Archiving**
- **Assessing**
- **Disseminate**
- **Sharing**
- **Viewing**
- **Mapping**
- ……

→

- **Monitoring Trend and Conditions**
- **Visualization**
- **Simulation Modeling**
- **Forecasting**
- **Early Warning**
- ……

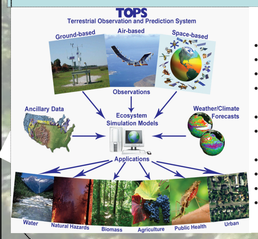
→

Decision Support And Decision Making

- Provide a basis for understanding and identifying meaningful change in natural systems characterized by complexity, variability, and surprises
- Determine trends of ecological conditions
- Assess I&M efforts and data sharing
- Early warning of impending threats, undesirable conditions or trends
- Enhance data management, reporting, and public education.
- Public understanding through integrated analysis and modeling
- Science-based decisions

NASA Data Products, Models, Research Findings for A.T.

High-speed data sharing via internet



- Imperviousness
- % Canopy cover
- LCLUC
- Landscape Config.
- NDVI
- Hydrological Model
- Carbon Cycle
- Simulation
- Visualization
- .....

Participating partners:
- National Atmospheric and Space Administration (NASA)
- National Park Service (NPS)
  - Appalachian National Scenic Trail (APPA)
  - Northeast Temperate Network (NETN)
- Appalachian Trail Conservancy (ATC)
- University of Rhode Island (URI)
- U.S. Forest Service (USFS)
- U.S. Geologic Survey (USGS)

Decision Support System for Monitoring and Managing the Appalachian Trail

Y.Q. Wang1*, Fred Dieffenbach2, Rama Nemani3, Ken Stolte4, Glenn Holcomb5

1. Dept. of Natural Resources Science, University of Rhode Island, Kingston, RI 02881
2. Northeast Temperate Network, National Park Service, Woodstock, VT 05091
3. NASA Ames Research Center, Moffett Field, CA 94035
4. Southern Research Station, USDA Forest Service, Research Triangle Park, NC 27709
5. Northeast Region, U.S. Geological Survey, Kearneysville, WV 25430

Background/Question/Methods

This project is a collaborative effort to improve decision-making and management of the Appalachian National Scenic Trail (A.T.) by providing a framework for data integration, status reporting and trend analysis.

Funding is provided by the National Aeronautic and Space Administration (NASA) Applied Sciences Program, which is part of their Science Mission Directorate's Earth Science Division. The project integrates NASA multiplatform sensor data (LandSat & MODIS), NASA's Terrestrial Observation and Prediction System (TOPS) models, and in situ measurements from A.T. MEGA-Transect partners to address resource priorities throughout the Appalachian Region. The system improves upon the traditional decision-making system that relies on coordination between staff working for the Appalachian Trail Park Office, the Appalachian Trail Conservancy, the National Park Service (NPS) Inventory and Monitoring (I&M) program, and the U.S. Forest Service. The objectives are to:

1. Develop a comprehensive set of seamless indicator data layers consistent with the Appalachian Trail "Vital Signs";
2. Establish a ground monitoring system to complement TOPS models;
3. Assess historical and current ecosystem condition, and forecast potential trends using TOPS and established habitat models;
4. Develop an Internet-based information dissemination system for data visualization, sharing, and management.

Results/Conclusions

The A.T. MEGA-Transect-DSS is not complete. However, we fully expect that it will improve resource monitoring, and reporting and forecasting capabilities; will provide managers with data, models and tools designed to detect changes, disturbances and responses within environmental systems; and, will facilitate dissemination of data products to both land managers and the general public. The project will focus on the three primary Vital Signs (Phenology and Climate Change, Forest Health, and Landscape Dynamics) and four supplementary Vital Signs (Mountain Birds, Migratory Breeding Birds, Water Quality and Quantity, and Alpine and High Elevation Vegetation), and key features will include:

1. Geospatially accurate 3-D scenes of the A.T. corridor;
2. A series of pre-selected analytical routines that will give managers the ability to rapidly assess current and future resource condition and trends;
3. Quick access to key information from which educated decisions may be made;
4. Improved situational awareness; and,
5. Improved conservation and enhancement of species biodiversity

The current DSS relies on the NPS to establish management goals and objectives, while the responsibility to execute those management objectives is delegated to partner agencies and organizations. Under the current framework, geospatial information is used to support management decisions, but little of that information is available to agencies and organizations that perform the desired task. Following implementation, the new DSS will promote data sharing throughout the resource management continuum.

Appalachian Trail MEGA-Transect: An Introduction

Background

The Appalachian National Scenic Trail is a unique and fragile resource that extends from Georgia to Maine. Nearly 2,180 miles long, the A.T. traverses over the highest ridgelines of the Appalachian Mountains, passes through 14 states, 8 National Forests, 6 other units of the National Park System, one National Wildlife Refuge and 287 local jurisdictions. The Appalachian Trail is managed by the National Park Service in partnership with the Appalachian Trail Conservancy (ATC) and its 30 affiliated Trail-maintaining clubs. This partnership brings together more than 5,000 volunteers who annually contribute nearly 200,000 hours of their time to preserve this important resource.

The Appalachian Trail 'MEGA-Transect' initiative seeks to unite new and existing partners to monitor, understand, and communicate the ecological health of the Appalachian Region. The MEGA-Transect coordinates a diverse range of scientific activities, designed and facilitated by agencies, institutions and individuals interested in learning about the environment of the Appalachian Trail. Federal, state, and local agencies; organizations; research universities; schools and youth groups; and even individuals can all participate in the MEGA-Transect and contribute valuable information about the Appalachian Trail environment.

Goals

- Monitor – Collect and synthesize existing and new data on key indicators of environmental health from agencies, organizations, researchers, and citizen scientists.
- Understand – Transform data into knowledge about the status and trend of ecological health through analysis, synthesis, and modeling.
- Communicate – Engage, educate, and involve decision makers, stakeholder organizations, researchers, agencies and citizens.

Citizen Science

The Appalachian Trail is grounded in volunteerism, from its founding and construction by Benton MacKaye, Myron Avery, and the thousands of outdoor enthusiasts they enlisted, to its continued maintenance by their followers. To this day, volunteer Trail Clubs collectively contribute nearly 200,000 hours of labor each year toward maintaining the Trail.

After seeing the entire 2,000+ mile treadway established in the 1930s, MacKaye prophetically suggested amateur naturalists could lead an investigation of Trail ecology. Some 75 years later, the A.T. MEGA-Transect initiative takes this vision a step further.

Education

A Trail to Every Classroom (TTEC) is a three-season, multi-disciplinary professional development series for educators aimed at providing the inspiration, knowledge, and skills to transform classroom teaching into effective and exciting place-based education. At the heart of TTEC is the belief that students who are immersed in the interdisciplinary study of their own "place" are more eager to be involved in the stewardship of their communities and public lands.

As a teaching strategy that promotes volunteerism by linking curriculum with community service and fulfilling education goals as well as the needs of community organizations, we believe service-learning will promote civic engagement in Trail communities, ultimately sustaining volunteer management of the Appalachian Trail.

Contacts:
Fred Dieffenbach, Env. Monitoring Coordinator, Northeast Temperate Network
Roger Moore, Director, Appalachian Trail MEGA-Transect
Laura Belleville, Conservation Director, Appalachian Trail Conservancy
Casey Reese, Phys. Scientist/GIS Specialist, Appalachian National Scenic Trail
Rita Hennesy, Trail to Every Classroom, Appalachian National Scenic Trail

A.T. Vital Signs

Rare Plants and Exemplary Communities

Between 1989 and 2001, a series of inventories documented rare plants and exemplary communities in all 14 states through which the A.T. passes. Many of these rare plants and community occurrences have been monitored by volunteers since the inventories were finished, and will continue to be monitored in the future.

Water

The A.T. follows some of the highest ridgelines in the eastern United States. Waters that typify the A.T. region are sensitive to environmental stress and offer an opportunity to study the impacts of air pollution that are not possible by monitoring lower in the watershed.

Phenology

Phenology is the study of the seasonal timing of cyclical biological events, such as 'budbreak,' flowering, bird migration, insect emergence, and amphibian breeding. Because the Appalachian Trail crosses much of the East's mid-to high-elevations from Georgia to Maine, it provides a unique opportunity to detect and document climate-driven changes in the seasonal life cycles of sensitive high elevation species all along the East coast.

Invasive Plants

Non-native and invasive species have been introduced to areas along the A.T. and other natural areas by humans, animals, wind, and water. Understanding this issue requires knowledge of the species involved and the habitats most at risk. New observations drive efforts to prevent and detect new invasions and control those that are underway.

Wildlife: Mountain Birds

The A.T.'s 250,000 acres of protected lands are home to countless animal species, including game species like the black bear and wild turkey, non-game species from frogs and salamanders to skunks and coyotes, and rare species like the timber rattler and peregrine falcon. In some cases, little suitable habitat remains outside of A.T. lands. For example, bird surveys indicate a cause for concern about several high-elevation bird species such as the Magnolia Warbler and Bicknell's Thrush.

Forest Health

Scientists have documented substantial declines in forested land in the Mid-Atlantic States from the late 1980's to the early 2000's, as well as increased fragmentation in the northeast. Tracking trends in the increase or decrease of forested lands is important to safeguard the scenic values and ecological services these forests provide, and to preserve the economic importance of forests for communities.

A.T. Landscape Dynamics

Existing satellite, aerial remote sensing, and field data show that the landscapes surrounding the A.T. have changed in past decades due to both natural forces and human activities. We plan to develop landscape monitoring projects using remote sensing information and GIS data available from various agencies, universities, states, and other organizations, and work with volunteers to identify sensitive segments where landscapes are most susceptible to change.

Partnerships Make It Possible

Cooperative efforts from these organizations make the Appalachian Trail MEGA-Transect innitiative possible: