

The National Consortium on Remote Sensing in Transportation – Environmental Assessments

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Abstract – The National Consortium on Remote Sensing in Transportation – Environmental Assessments (NCRST-E) is one of four consortia established by NASA and the US Department of Transportation to lead in the application of remote sensing and geospatial technologies in the transportation industry. The primary mission of the consortium for Environmental Assessment is to develop and promote the use of remote sensing & geospatial technologies, and requisite analysis products by transportation decision-makers and environmental assessment specialists to measure, monitor, and assess environmental conditions in relation to transportation infrastructure. The consortium is composed of university (Mississippi State University, Auburn University, University of Alabama in Huntsville, University of Mississippi), government (NASA Marshall Space Flight Center and Global Hydrology and Climate Center), and commercial (Intermap Technologies, Inc, & EarthWatch Incorporated) partners. The purpose of this paper is to increase the awareness of the remote sensing community of this new consortium and its mission and goals aimed at a better utilization of geospatial technologies for planning an environmentally sound transportation infrastructure.

I. BACKGROUND

Urban growth and sprawl have been attributed to a number of cultural and economic conditions, one of which is highway development. The question of whether highway development initiates urban growth or sprawl, or whether urbanization and the concomitant expansion of suburban “bedroom” communities into rural areas, which in turn precipitate transportation improvement or development, is a conundrum. Regardless, the growth of transportation networks associated with urban growth and sprawl translates into a host of environmental impacts ranging from deforestation, impacts on local and regional hydrology, and accentuation or enhancement of such land-atmosphere factors as the urban heat island phenomenon. Remote sensing allows the synoptic observation and analyses of urban growth, but this has been at a relatively coarse level (e.g., > 30m) via satellite platforms. With the advent of current or soon to be launched satellite-based imaging instruments that provide spatial resolutions of 4m, it is now possible to obtain a much clearer picture of both what the environmental impacts of urban growth and highway improvement/development are at landscape scales. Moreover, anticipated hyperspectral sensors will provide increased radiometric resolutions that

can be used to potentially further the analyses of the state of environmental conditions, and how urban sprawl and associated highway development exacerbate these conditions. Opportunities exist for exploiting remote sensing imagery with increased spatial, radiometric, and temporal resolutions for analysis of transportation network development on the environment. However, analytical techniques need to be developed and verified to demonstrate the viability of this kind of observational and quantitative information.

Since the passage of the National Environmental Policy Review Act of 1969 (NEPA), the Clean Air Act, the Clean Water Act, the Intermodal Surface Transportation Efficiency Act, and other related legislation, transportation agencies have been obligated to put transportation projects through an often rigorous and time-consuming environmental review process. A need for expediting the approval process was voiced in TRB A1F02's millennium paper entitled – Environmental Analysis for Transportation Projects. However, when the author of the paper listed several technologies that have had a “profound effect in the area of environmental analysis”; remote sensing was missing from that list. NCRST-E has a goal to help increase awareness and interest in utilizing remote sensing to expedite and standardize the environmental review process among transportation agencies, to make the process part of the early stages of project development and design, and to do so in a more cost-effective manner. However to accomplish this goal, the utility of remote sensing imagery needs to be examined to see if it in fact provides information that is a significant improvement to sources already available for use by planners, decision-makers, and other members of the transportation community.

II. MISSION AND GOALS

The primary mission of the consortium for Environmental Assessment is to develop and promote the use of remote sensing & geospatial technologies, and requisite analysis products by transportation decision-makers and environmental assessment specialists to measure, monitor, and assess environmental conditions in relation to transportation infrastructure. To accomplish this mission it has four goals:

- Develop innovative remote sensing technology solutions for assessing the implications of transportation on the natural environment and protecting and enhancing the environment.
- Assess and plan, in particular the capabilities of new high resolution, multispectral sensors, and develop the tools necessary to extract information content from remote observations in an efficient manner.
- Streamline and standardize data processing for information necessary to meet federal and state environmental regulations and requirements.
- Increase the awareness and understanding of remote sensing technologies and products through workshops and educational materials.

III. PARTNERS

The NCRST-E is a consortium of academic, government, not-for-profit, and commercial partners including:

A. MISSISSIPPI STATE UNIVERSITY

Mississippi State University (MSU) established the Remote Sensing Technologies Center (RSTC) focusing on applications of remote sensing in the areas of agriculture, forestry, transportation, and environmental assessment. The overall goal is to produce a robust research process that bridges the gap between remote sensing science and commercial applications. The RSTC has over 70 faculty members throughout MSU working in the areas of remote sensing and geospatial technologies. As a result of the university's commitment to basic research in developing the understanding of phenomenology within a broad range of disciplines, MSU has developed a highly characterized field laboratory analysis capability. Through its programs of research, teaching, and service, MSU supports human resources development, economic and community advancement, science, and technology at the local, state, national, and international levels.

B. GLOBAL HYDROLOGY AND CLIMATE CENTER

The Global Hydrology and Climate Center (GHCC) is a partnership among organizational elements from NASA Marshall Space Flight Center, the University of Alabama in Huntsville, and Universities Space Research Association. The primary focus of the Center is to understand Earth's global water cycle, the distribution and variability of atmospheric water, and the impact of human activity as it relates to global and regional climate. The GHCC brings together in one enterprise a community of about 180 scientists, engineers, and educators with a common focus on the global hydrologic cycle and its interaction with climate variation. Our mission is to provide unique, key measurements of the Earth system, particularly from the perspective of space, and to improve and validate predictive

models of the Earth system. The GHCC has a history of developing aircraft- and space-based remote sensing instruments, and expertise in development of remote sensing retrieval algorithms.

C. UNIVERSITY OF MISSISSIPPI

The primary focus of the Center for Advanced Infrastructure Technology (CAIT) is to develop and implement advanced computer simulations and remote sensing technologies for building longer lasting airfield pavements and intermodal facilities, monitoring and preserving transportation infrastructure, and developing cost-effective procedures for improving anti-terrorism readiness, mobility through assessment and airfield suitability analysis, and security evaluations for troop and personnel deployment during emergency, humanitarian and war operations. CAIT uses advanced computer simulations, airborne laser mapping, and spaceborne satellite imagery in this research.

D. INTERMAP TECHNOLOGIES, INC.

Intermap Technologies, Inc. is a public company wholly owned by Intermap Technologies Corp. that provides mapping services. Intermap Technologies Inc. owns and operates the STAR-3i interferometric synthetic aperture radar airborne sensor worldwide on a commercial basis. Intermap focuses on the acquisition and provision of precise digital elevation models (DEM) and digital terrain models (DTM), and the generation of cartographic mapping products.

E. EARTHWATCH INCORPORATED

EarthWatch Incorporated is a leading-edge information content provider developing and selling a wide variety of remote sensing-based imagery and geospatial information products. EarthWatch's high-resolution satellites (QuickBird 1 & 2) produce products that will provide cost-effective solutions for a variety of application areas. EarthWatch provides high spatial resolution (0.82 m panchromatic, 3.28 m multispectral) satellite imagery to the consortium partners. EarthWatch also has one of the most efficient orthophoto production lines in the country. They support satellite and aerial orthophoto production, SAR, and digital multispectral/hyperspectral fusion products.

IV. NEEDS ASSESSMENT

One of the initial task of NCRST-E was to work with the Transportation Research Board of the National Academy of Sciences in determining areas in which remote sensing could be used by the transportation industry. The following list summarizes the environmental subject areas identified by the user groups:

- Regulatory Streamlining
- Watershed Assessment
- Wetlands

- Water Quality / Stormwater
- Land Use Change
- Air Quality
- Species
- Floodplain Management
- Environmental Justice
- Cultural Resources

There were also several environmental process issues identified by the group:

- Regulatory Acceptance of remote sensing data
- Accuracy
- Real Time Data
- Data Directory
- Metrics / Measurement
- Benefit Cost Information
- Education / Outreach

V. FIELD STUDIES

NCRST-E has a suite of ongoing field studies to ascertain and demonstrate the viability of remote sensing in environmental assessments, integration, and streamlining. Two of these projects are detailed below:

A. Regional Scale Assessment

The study area (dark outline in Figure 1) includes 55 counties of the southern Appalachian region of northeastern Alabama, northwestern Georgia, and south-central Tennessee. This region includes the metropolitan regions of Atlanta, Birmingham, Chattanooga, and Huntsville. The objective of this study is to determine the effect transportation development over the past 25 years has had on the regional-scale environment, including land cover/land use change, runoff, streamflow, socio-economic variables, etc.

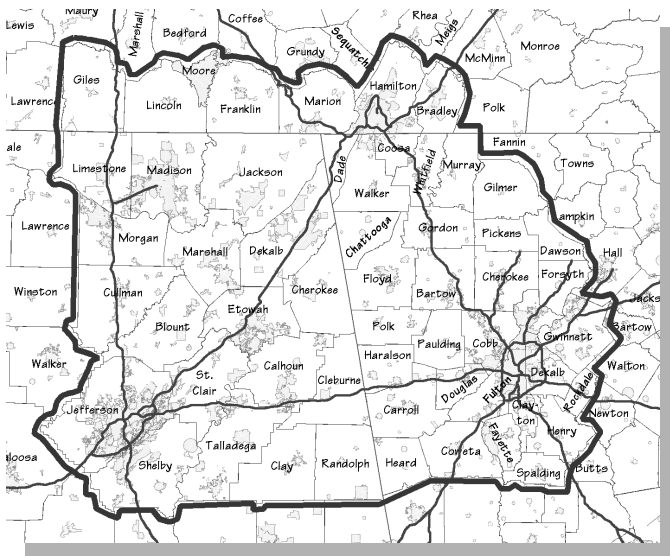


Figure 1 Regional scale assessment study site.

The consortium expects to gain valuable insight into the relationship between transportation development and long-term environmental changes and possibly even rates of change from this study. Causal factors will not be defined.

B. Wetlands Identification

Several state Departments of Transportation are interested in identifying wetlands with remote sensing imagery. One typical project is with the state of Iowa. A map of a potential field site with projected high spatial resolution imagery scenes is shown in Figure 2.



Figure 2. Wetlands identification with high spatial resolution satellite imagery.

IV. ACKNOWLEDGEMENT

The authors of this paper would like to acknowledge the US Department of Transportation for its funding of this research through USDOT Other Transactions Agreement #DTRS56-00-T-001.

V. CONCLUSIONS

The National Consortium on Remote Sensing in Transportation for Environmental Assessments is a multi-year research and education center funded by the US Department of Transportation to facilitate the use of remote sensing and geospatial technologies. NCRST-E has developed partnerships with several state Departments of Transportation for the utilization of imagery in a variety of environmental subject areas and processes.