National Land Remote Sensing Education Outreach and Research Activity (NLRSEORA)

AmericaView: A National Remote Sensing Consortium
Grant Award Number G14AP00002

**AmericaView Technical Report
for Grant Year 2013**
Period of Performance from December 1, 2013 through September 15, 2014

Submitted to the
USGS Project Officer and Grant Administrator
AmericaView Consortium Board of Directors

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TABLE OF CONTENTS

Page

AmericaView Technical Report
for Grant Year 2013

I. Introduction and Overview

Report Purpose and Structure

This report summarizes the activities for U.S. Geological Survey Grant Award G14AP00002 to AmericaView (AV) from December 1, 2013 through September 15, 2014 for Grant Year (GY) 2013, which was provided a "no cost extension" from September 15, 2014 to March 15, 2015. This report satisfies the grant year reporting requirement of the award. A detailed description of completed activities for GY 2013 is available on the AV online portal that can be queried by any AV Board or staff member, or authorized USGS employee at www.avportal.org.

This report is organized into the following sections:
  ➢ Section I. provides background about the AV Consortium;
  ➢ Section II. presents the four Grant objectives, aligns those objectives with the AV program areas, and summarizes AV's achievements in completion of grant deliverables;
  ➢ Section III. details the progress made towards completion of the four grant objectives, including numerical summaries and benefits of completed activities; and
  ➢ Section IV. includes the fiscal management information.
Appendix E includes copies of all the Fact Sheets completed by the StateViews summarizing their efforts toward meeting the grant objectives in GY13.

Overview of AmericaView

AmericaView (AV) is a nationwide, university-based, and state-implemented consortium advancing the widespread use of remote-sensing data and technology through education and outreach, workforce development, applied research, and technology transfer to the public and private sectors.
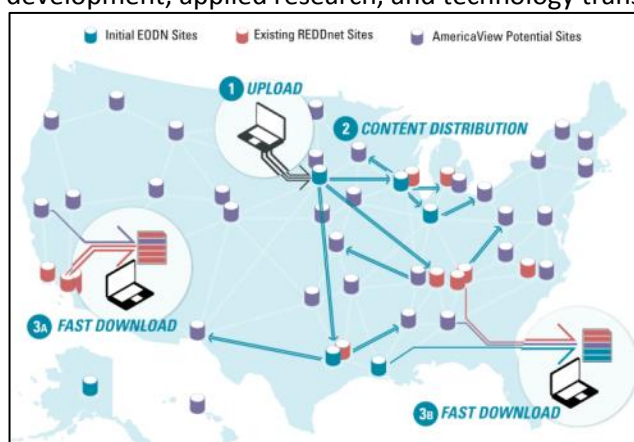
Remote sensing involves gathering information about an object, an event, or a situation without using the sense of touch. AmericaView's intellectual expertise, its networks, facilities, and other technological capabilities are highly leveraged and used for sharing and applying Landsat and other public domain remotely sensed satellite data in a wide range of civilian applications: formal and informal education; ecosystem analysis; natural resource management; urban planning; and disaster response.

AmericaView is a 501 (c) (3) non-profit incorporated in 2003. AV's primary goal is to support the many beneficial uses of remote sensing in service to society. The AmericaView Mission is …*to advance the availability, timely distribution, and widespread use of remote sensing data and technology through education, research, outreach, and*

sustainable technology transfer to the public and private sectors. (AmericaView Charter March 12, 2002)

In September 2014, the AV national consortium comprised 40 individual state consortia (StateViews).
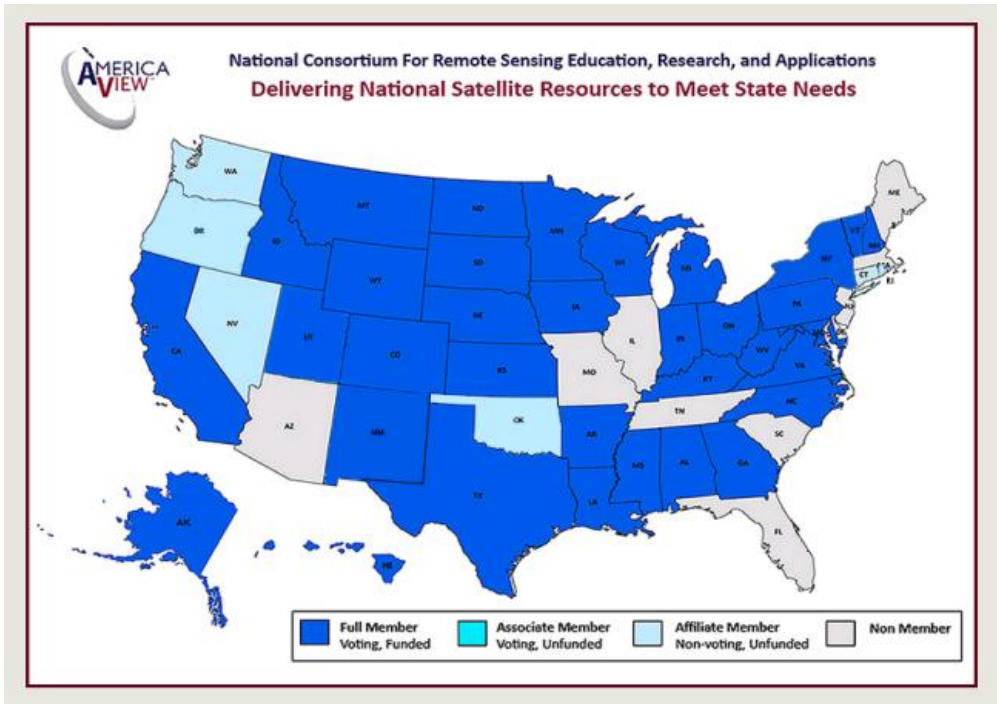
Each StateView is coordinated by a lead academic institution whose partners include academic institutions; local, state and federal agencies; non-profits; and private sector companies. AV has more than 300 StateView consortium partners across the U.S. Continuing in the footsteps of a previous award, during GY13, StateViews continued to cultivate and expand close working relationships with partners at the state and national levels on a wide range of projects within AmericaView's traditional four program areas.

AmericaView Members and Staff at Fall Technical Meeting, University of California, Davis - 2014

The signature success of this consortium recognizes that each state has unique needs as well as regional and national involvement. To address those state focused interests that include varying levels of data access and distribution or education objectives including K-12 or underserved communities or needed research applications, StateViews have requested funding support for high priority projects, formalized and monitored annually through a national peer-reviewed proposal and reporting process. StateViews were also encouraged to work together on projects of mutual interest, often supported by AmericaView's education, outreach, technology, and research committees, and AV staff to maximize the leverage of AV's funding.

Administration and Coordination

As described in the proposal for this grant, during GY13, AV had an active eight-member Board including eight StateView members from California, Kansas, Louisiana, Montana, Nebraska, New Hampshire,

Texas, and Vermont, representing the diversity of the Consortium. The AV Board provided fiscal oversight, approved organizational priorities, monitored grant deliverables, and oversaw organizational outreach efforts. The Board used conference calls at least monthly, met one full day in person during the national meeting, and contributed well over 700 hours to organizational governance annually. In addition, AV held monthly member teleconferences to conduct business and sponsored webinars to share member's remote sensing knowledge. Each of these meetings, as well as copious email communication enabled progress towards completion of the objectives of the current USGS grant.

Planned management for AV's national program in GY13 included an Executive Director, a Program Manager, and a Fiscal Manager. For GY13, the plan included .75 FTE for the Program Manager, who served throughout the grant year. The Program Director was an employee of Montana State University. The Executive Director and the Fiscal Manager were retained as consultants to AmericaView at .25 FTE and .33 FTE in mid-June 2014 and mid-December 2013 respectively. The Executive Director and Program Manager administered the program on a daily basis, and answered directly to the Board of Directors in all matters. The Executive Director served as an advisor to the Board, was responsible for implementing the plans and priorities of the Board, managed external communications, and oversaw AV's programs and staff. The Program Manager was responsible for internal communications, management of day-to-day business and financial affairs, and was the contract officer for AV sub-awards. The Fiscal Manager accomplished the AV level bookkeeping, reviewed invoices, made disbursements, and coordinated with the contracted accounting firm.

AmericaView had no employees.

AV's USGS Liaison for the past year was Sarah (Sally) Cook.

II. Summary of NLRSEORA Grant and Achievements by AmericaView

Scope of Grant

AmericaView was the recipient of a competitive five-year grant titled the *National Land Remote Sensing Education Outreach and Research Activity* (NLRSEORA) issued by the U.S. Geological Survey's Land Remote Sensing Program, effective December 1, 2013. "The National Land Remote Sensing Education, Outreach and Research Activity has funded projects that assure that all users of remotely sensed data have equal, affordable access to the data and can establish the means to conduct research using the data. Additionally, this program has funded projects focusing on K-16 outreach, remote sensing course development for the public, and tailoring of remotely sensed imagery for State and local scientific and public use." https://www.cfda.gov/?s=program&mode=form&tab=step1&id=e87521f8a9d69c45f00dc1e68d17190e Project duration will not exceed five years with grant periods nominally one year in length. The stated objective of the USGS is "to promote the uses of space-based land remote sensing data and technologies through education and outreach at the State and local level and through university based and collaborative research projects. Technologies of interest include multispectral and hyper-spectral electro-optical, thermal, and radar."

NLRSEORA Objectives

AV was funded to achieve the following four objectives identified in its NLRSEORA proposal:

Objective 1 – Nationwide Remote Sensing Data and Information Requirements

AV will seek to improve the nation's capabilities and resources in land remote sensing to meet the needs of users both within its member states and nationally. This will be accomplished through AV's national and state consortia, which will continue to collect information on the ability of existing remote sensing data products to meet the needs of its user constituencies (including academic, scientific, and end user communities), assemble this information at the national level into a consolidated format, and communicate that information to data providers, as appropriate.

Objective 2 – Remote Sensing Applications

AV will identify new and expand existing remote sensing applications nationwide through its distributed national network. Research and development of new technologies will be directed through AV's state-based university consortia, while expansion of the use of these technologies will occur through a targeted combination of education, training, and outreach activities with AV's many partners.

Objective 3 – Undergraduate and Graduate Research

AV will use its strength as a consortium whose StateView members are each led by a university, and whose StateView consortia include over 180 colleges and universities, to provide meaningful remote sensing research opportunities for undergraduate and graduate students. AV members' proven success at generating research grant dollars will enable this objective to be highly leveraged. These student-involved research activities will increase, both quantitatively and qualitatively, the ability of the nation's future workforce to successfully incorporate remote sensing technologies as a basic component of our nation's infrastructure.

Objective 4 – Education and Training, and Technology Transfer, and Outreach

Education and training. AV will seek to increase the remote sensing competency of the nation's current and future workforce.   Quantifiable objectives include supporting remote sensing science instruction in K-12th grades to improve STEM education and to strengthen national science education standards and utilizing AV's academic university network to enable agile use. AV consortia have credibly demonstrated the ability to enrich the quality of instruction at the university and college level. The tools, materials and curricula enhancements, widely distributed and used at all educators' levels, contribute to the employability and effectiveness of current and future employees in the public and private sectors.

Technology transfer. AV seeks to embed remote sensing technologies and data, including some uniquely effective applications, through the targeted transfer of techniques, best practices, and data products to end users. Measurable objectives include data product and tool transfers from AV members to end users, such as providing data to first responders and delivering post-analysis maps to decision makers in communities facing emergencies; providing remote sensing data-based products in easily used formats to end users; working with public land managers in analyzing land status and change; and assisting private land owners/managers with information to assist in such areas as farm and ranch management, water availability and supply, and forest health.

Outreach. AV will continue its decade-long efforts to advance understanding, awareness, and use of remote sensing data and products throughout the United States and to familiarize individuals and groups with the agencies that produce that data. Impacting objectives include conducting annual educational outreach with local, state, and national decision makers; creating and posting displays in public venues and at community events; sponsoring a nationally endorsed and locally sponsored Earth Observation Day; assuring that prospective users know how to access Landsat and other readily available remote sensing sources; and including other sources and derived information throughout AV member states' geospatial consortia and within state data libraries.

Metric Summary of AV's Accomplishments and Impact during Grant Year 2013

Given that GY2013 was the introductory period for this grant, AV established a strong foundation for the remaining years of the grant. To maintain alignment with the previous five year grant and work plans, the AV Portal, identified above, bins the various activities into AV's established program areas: (1) Data Archive and Distribution, (2) Consortium Development and Outreach, (3) Research activities, and (4)Education. Quite clearly, an activity filed within one of these categories may actually address more than one of the NLRSEORA objectives which will be clarified throughout the report. During GY 2013, StateViews reported progress on nearly 220 activities aligned with those four program areas.

As the number of member states grows, the funding share from the fairly consistent grant year value, which is distributed in equal sub-awards, has accordingly been reduced. In GY 2012 of the previous award, at the suggestion of its USGS liaison, AV migrated from myriad small projects to the High Impact Activity (HIA) approach. During this five-year grant period, StateViews have been encouraged to focus, during each performance period, on high impact activities that address one or more of the objectives. In several cases, these activities will be accomplished over multiple grant years with milestone achievements reported at the end of each grant year. This report and the accompanying Fact Sheets from each StateView reflect how effective the HIA focus has been on making a real difference at the local, state, regional, and national levels. One, however, should not diminish the importance of well-chosen smaller initiatives that address the four program areas.

The summary distribution of the efforts follows:

GY2013	High Impact Activities	Other Activities
Data Archive and Distribution	6	25
Consortium Development and Outreach	12	60
Research	27	25
Education	29	32

*The Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Pla*n of May 2013 identified five goals. Those goals are: Improve STEM Instruction; Increase and Sustain Youth and Public Engagement in STEM; Enhance STEM Experience of Undergraduate Students; Better Serve Groups Historically Under-represented in STEM Fields; and Design Graduate Education for Tomorrow's STEM Workforce. Those goals have well described metric objectives toward which the AV accomplishments of GY 2013, while addressing the four objectives of the U.S.G.S. NLRSEORA award, can be counted. AV's metrics for the quantitative impact of the approved activities for GY 2013 follows:

For StateViews

1. Contribution to AV Activities
- Contribution to AV committees: 1,032 hours
- Contribution to AV Board of Directors: 917 hours
- Contribution to AV Outreach Activities: 100 educational visits to decision-makers

2. Web Statistics
- SV Web visitors: 81,733 visitors
- SV Web page views: 416,001 page views
- Remote sensing data archived: 38,225 GB
- Remote sensing data newly added: 4,551 GB
- Remote sensing data downloaded: 6,328 GB
    - Landsat data downloaded: 579 GB
    - MODIS data downloaded: 407 GB
    - Orthophotos downloaded: 1,310 GB
    - Other remote sensing data downloaded: 4,032 GB

3. Education Statistics
- K-12 students trained: 12,032 students
- K-12 minority students trained: 3,518 students
- K-12 teachers trained: 148 teachers
- Higher education students trained: 1,735 students
- Higher education faculty/staff trained: 77 faculty/staff
- Current workforce trained: 500 workforce personnel

4. Research Statistics
- New remote sensing courses or programs started that resulted from AV partnerships/efforts: 9 courses or programs
- Presentations on AmericaView, StateView, or remote sensing : 42 presentations
- Attendees at presentations : 2,657 attendees
- Research papers published or accepted or submitted that reference AmericaView or a StateView's activities : 15 papers

For AmericaView

AV website visitors: 5,924
AV website pageviews: 16,330
AV Blog pageviews: 16,035

AmericaView Highlights in GY2013

Membership Changes

AV membership changes when a new member is admitted or when a StateView PI positions rotates from one individual to another or one lead university to another. AV follows a rigorous policy, reviewing any proposed changes, before the Board gives approval.

- In December, 2013, Dr. Kevin Kane, of Iowa State University, was approved as PI for IowaView.
- In March, 2014, OklahomaView was approved as an AmericaView Affiliate by the AV Board and membership.
- In June, 2014, New Mexico was approved for Associate status and OhioView was aligned with PI, Dr Mary Henry at Miami University.

AV Staff

In mid-December 2013, Terri Benko joined the AV national staff. Terri has over a decade of fiscal management experience as a Grants Budget Manager at the University of Toledo and as the OhioView State Coordinator. The search for an Executive Director was initiated in February 2014, and Roberta (Bobbi) Lenczowski was selected and hired in mid-June 2014.

Annual Meetings

AV, in each calendar year, expects to conduct two annual meetings. One is held in fall and its program is planned around technical presentations from both AV and invited speakers and also includes several short workshops to allow attendees to learn more about new tools, techniques, or programs. The venue of the meeting alternates between the U.S.G.S. Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD, and one of the StateView universities. The second is held in late winter in Reston, Virginia. Typically a day is spent in the USGS footprint to allow both formal presentations and informal exchanges between USGS scientists and AV principal investigators (PIs). Another day of the meeting allows for additional presentations and for an in-person business meeting of all members to elect new members to the Board, to encourage networking among all, and to identify the possibility of some collaborative activities.

Fall Technical Meeting (FTM)
In GY2013, no Fall Technical Meeting was held since the grant funding was not yet in place.

Winter Technical Meeting (WBM)
Participants from both USGS and AV agreed that the sessions were excellent and most informative. A condensed agenda follows to illustrate the range of topics:

Monday February 24, 2014
8:30 am   Check-in at USGS headquarters
9:00 am   Welcome and Introductions – By USGS, AV Board Chair, AV staff
9:10 am   USGS Briefing on Land Remote Sensing Program, Landsat 8 and Landsat Continuity,
            Landsat Applications Survey, Sustainable Land Imaging Architecture Study
10:30am Overview of AV and the highlights of AV's National objectives and StateView High
            Impact Activities planned for the upcoming years
11:30am Poster session with USGS staff invited
1:15 pm Small Group Sessions with USGS staff and AV StateViews with topics:
- Expanding effectiveness of AV's EOD and education efforts (Larry Biehl)
- Assisting the USGS with gathering input on usefulness of USGS imagery and products at the state level. Continuation of Sustainable Land Imaging Architecture Study (Debbie Deagen, Mary O'Neill, Sam Batzli, Ray Byrnes, Sally Cook)
- Developing "best practices" for AV's assistance with provision of data for disaster relief
- AV's and USGS support of citizen scientists
- NC CSC project and how to increase AV's work with other Climate Science Centers (Kevin Dobbs)

3:15 pm   Small Group Sessions with USGS staff and AV StateViews topics:

- International remote sensing educational and outreach opportunities (Tom Cecere, PR Blackwell, Rebecca Dodge)
- USGS efforts with UAVs (Bruce Quirk)
- Research efforts with Remote sensing-focused water resource, climate change, environmental systems (etc.) HIAs for FY13 (Jason Tullis)
- Getting VIIRs imagery to StateViews (similar to Sam Batzli's success with MODIS imagery)
- Continuation of Sustainable Land Imaging User's Forum (Sally Cook)

Tuesday February 25, 2014
8:30 am Welcome, logistics – Rebecca Dodge, AV staff – Monticello West, Westin Hotel
8:45 am Continuation of summary of upcoming year's HIAs by StateView
9:45 am Ideas for collaborative work between StateViews
11:15am Ideas for streamlining, lessening AV reporting and other membership requirements
11:45am Board Elections, Milda Vaitkus, AV Board Secretary
1:15 pm Collaborative endeavors: e.g., veteran's education, online teaching efforts, strengthening AV Education Portal, continue 'Imagery to the Crowd' project discussion with Josh Campbell, research question associated with NC CSC phenocam project, continuation of other topics from break-out with USGS staff on Monday.
3:30 pm Updates of Committee activities for upcoming year
4:30 pm AV Congressional Education and Outreach: Guidelines for Approach
5:00 pm Adjournment

As a direct beneficial outcome of this meeting, AV was invited by USGS to attend the Landsat Science Team (LST) meetings. AV member Dr. Rick Lawrence (MontanaView PI) attended the LST meeting on July 22nd and kept AV members up to date on LST activities and pertinent communication. Lawrence will vet AV's planned research activities with the LST to avoid duplication and foster complementarity of research efforts.

AV Member Teleconference Presentations:

During the monthly Member meeting, often one of the StateView PI's, an associate, or an invited speaker was requested to make a presentation to those attending. Description of three with immediate impact to members and their own StateView work included:

Imagery to the Crowd
Josh Campbell, U.S. Department of State, presented "Imagery to the Crowd" a presentation that described building a framework to support sharing high-resolution satellite imagery with the volunteer technical community for improved disaster response and development projects. Examples of how this application could be used as a teaching tool were also discussed. Several pdfs were subsequently provided to members. This information was immediately relevant to StateViews like KansasView and LouisianaView, which have related initiatives.

AmericaView Multi-State Server
Sam Batzli (WisconsinView) provided a demonstration of the AmericaView Multi-State Server. Each StateView can have its own version of the server or it can send its data to TexasView for staging. Ten StateViews have functional sites.

Use of Landsat 8 Imagery and the METRIC for Evapotranspiration Estimation
Dr. Jeppe Kjaersgaard, who was then the PI for South DakotaView (Aug. 14) addressed this challenging issue with his presentation on the work of researchers at the South Dakota Water Resources Institute. They were employing a satellite-based methodology to compare, side-by-side, the crop water use (evapotranspiration) between fields with and without

sub-surface drainage installed. The use of Landsat 8 imagery with the METRIC model enabled the estimation of the evapotranspiration rates.

Outreach Efforts

At the national level, AmericaView's website and printed materials should leave a positive, professional message. Following the retreat, the Executive Director polled members of the Outreach Committee and others about their use, impression, and recommendations for the AV web pages. That material became part of program plan for the Outreach Committee and was shared at the Fall Technical Meeting for GY14. In addition, templates for fact sheets and slide presentations, as well as discussion about a brochure were all considered as one approach to addressing the "Outreach" part of Objective 4.

Web Site Revisions
Debbie Deagen initiated the first phase of improvement by utilizing the Blacksburg Electronic Village and VirginiaView's assistance to update the AV member map, new StateView contact information and status, new board and staff contact information, re-connecting a broken link to AV's archived new stories, and posting information for NLSEORA sub-awardees (including grant requirements for acknowledgement of research articles funded by this grant).
The second phase will add an easily synchronized calendar, a more inviting appearance and easier navigation.

AV Brochure, Power Point and Fact Sheet Templates
Under Mary O'Neill's leadership the Outreach Committee began efforts to design format and select content for an AV brochure that members and staff can use during informational visits. Similarly, having a consistent professional look to presentations and fact sheets requires templates which ease the burden of preparing the documents on a variety of operating systems. Brent Yantis (LouisianaView) accepted the assignment to initiate the drafts for comments by other committee members. The fact sheet formatting used in this report reflects, in part, guidance coming from Brent's graduate design students.

Participation at the National ASPRS Conference
AV volunteered to lead a Special Session, "Panel discussion on future Landsat data needs at the local and state levels" at the ASPRS 2014 Annual Conference, which was held March 23-28, 2014, in Louisville, KY. Dr. Ramesh Sivanpillai (WyomingView PI) chaired the panel discussion on Landsat data needs at state and local levels. The session provided an overview of Landsat data use by StateViews and then took the opportunity to solicit data needs from the audience. These results were incorporated with a survey of all AV PIS, which Ramesh, in a report to U.S.G.S., which addresses the data requirements gathering in Objective 1.

Educational Efforts

Earth Observation Day
In GY2013, Earth Observation Day (EOD) occurred on 9 April 2014, although the events at various StateView sites may have been earlier or later to coincide with the ability to attract a large audience. The primary purpose was to engage K-12 teachers and their students, with a special focus in GY13, on the use of Landsat data for Land Cover Mapping and Surface Temperature Monitoring. Twelve StateViews (CalView, GeorgiaView, IdahoView, KentuckyView, LouisianaView, North DakotaView, OhioView, PennsylvaniaView, South DakotaView, TexasView,

VirginiaView and WyomingView) participated in EOD efforts reaching 124 teachers, 2647 students, and over 75,000 members of the public. The latter number reflects the CalView 's alignment of their event with a University of California, Davis, Open House.

Adopt a Pixel
Ms. Jeannie Allen was invited to explain her "Adopt a Pixel" initiative with the Education Committee, led by Larry Biehl.   Her articulate and enthusiastic presentation of this citizen science proposal drew specific interest for collaboration with New MexicoView. Others were sufficiently interested so that Ms. Allen was subsequently invited to attend the GY14 FTM in Davis for a session with the Board and a presentation to the members attending.

Data Fusion Webinar
Mr. Jarlath O'Neil-Dunne, (VermontView) hosted a webinar on July 7 titled: *Data Fusion in eCognition.* This was scheduled for AV members as one of his activities for GY2013, based on requests from other members.

Technology Efforts

Earth Observation Depot Network (EODN)
This project has tremendous potential for improving efficiency of moving large amounts of remote sensing   data quickly and efficiently. In addition, it enhances AmericaView's visibility among the larger research community. It is a high impact activity not only for TexasView, but also for AmericaView and the USGS. One of the application areas featured is Landsat 8 data distribution. If additional funding sources can be found, this initiative would place depots at USGS EROS Center and more individual StateViews. The resulting "logistical storage network" will automatically position Landsat 8 data close to the geographic region it represents. On August 22-23, the EODN Team of PR Blackwell (TexasView), Sam Batzli (WisconsinView) and Nancy French (MichiganView) briefed senior management and staff members at the USGS EROS Center.

A planning and coordination meeting was convened at EROS Center to discuss deployment of the Earth Observation Depot Network (EODN) on August 22, 2014. Representatives from MichiganView, TexasView and WisconsinView attended, along with key personnel from the NSF-funded Data Logistics Toolkit (DLT) project, and met with key EROS personnel to discuss issues and develop plans.

Board Retreat in San Francisco in July 25-26

Board members gathered for two days intensely examining the vision, mission, and goals of AmericaView by reviewing the outcome of the SWOT (Strengths, Weaknesses, Opportunities, and Threats) survey that had been completed prior to convening. The opening paragraph of this review's Overview statement includes the redrafted Mission Statement. Among the most important actions recommended was to "Develop a stable and effective management and funding structure that would provide more stability for AV to run as an effective organization thereby allowing the

organization to lean forward and do what it does best in remote sensing education, research, and outreach."

Strengths of the Working Relationships within this Program

The commitment of the AmericaView consortium members to the value proposition of the NLRSEORA grant can only be described as awesome. The return on the investment of the very small sub-grants to each of these PIs is dependent upon their ability to leverage other funded projects at the university, to draw forth the talent and effort of collaborative partners, and to understand the impact they have on their community, their Nation, their Earth.

The new Executive Director has often commented on the collegiality of members, sharing ideas and techniques but always being honest and good humored critics. That collegiality will enable more "cluster" initiatives for other funding opportunities and will strengthen the entire consortium.

AV also finds its USGS liaison, Ms. Sarah (Sally) Cook to be an invaluable asset, attending every meeting of AV that she can and providing a wealth of references for StateView use. Mr. Tom Cecere, the previous liaison, sustains involvement with AV and is frequently consulted on the current activities of the consortium.

Challenges with this Program

The strength of the consortium also presents the greatest challenge. Eager and enthusiastic professionals always imagine what more they could accomplish if they had accommodating resources. Any AV PI asked about the most pressing issues with AV involvement would include funding. Many remember the early years of the program and when the StateView's within-state university membership flourished. At the same time, membership in this elite group is sought by non-member states. AV encourages the interest, advises on the appropriate procedures to submit applications, but is always restrained in promising any immediate sub-award. Another guest at the table lessens everyone's share at that very time when greater individual shares could deliver so much more impact.

AV sees additional award work from other sources, as essential to a strong future for itself. In addition, each additional grant or sub-grant to date has been an opportunity to complement or supplement efforts of this award, an award whose on-going success depends upon leveraging so many things.

III. More Detailed Progress Report towards Completion of Four Grant Objectives and Numerical Summaries and Benefits of StateView Activities

The grant objective and the proposed work plan for AV National activities are identified *in italics* at the beginning of each section. For applicable grant years, a bulleted summary, in plain font, details the progress AV national (board, staff, committees, synergistic SV activities) has made towards that objective. Following a summary of efforts toward objective completion, each section concludes with a numerical summary and a detailing of the benefits of StateView activities.

Objective 1 – Nationwide Remote Sensing Data and Information Requirements

AV will seek to improve the nation's capabilities and resources in land remote sensing to meet the needs of users both within its member states and nationally. This will be accomplished through AV's national

and state consortia, which will continue to collect information on the ability of existing remote sensing data products to meet the needs of its user constituencies (including academic, scientific, and end user communities), assemble this information at the national level into a consolidated format, and communicate that information to data providers, as appropriate.

Workplan for AV National-StateView Partner Initiatives for Data and Information Requirements

GY 2013: AV will strengthen two-way communication with its ~300 current StateView members and partners (including through its online portal) and also establish communication with new end users of Landsat and other USGS data and products in its member states.
- AV updated its online AV portal by gathering the most current name and contact information for all of its SV members.
- Throughout the grant year, nearly monthly communications from Sally Cook, USGS/AV Liaison that included valuable information regarding USGS data and products were forwarded to AV StateViews.

GY 2013-17: AV will solicit prompt responses to requests received from the USGS and its contractors regarding data needs of AV's members, partners, and stakeholders and will consolidate and communicate responses to the USGS.
- In GY 2013, Dr. Ramesh Sivanpillai, to support a request from U.S.G.S. LRS to AV, prepared and distributed a five question "Landsat Future Needs" survey for all .edu members of the consortium. The out-briefing and written report will be submitted in early GY 2014.

GY 2013-17: AV will explore the development of a brief and simple StateView partner survey that could be hosted or linked on the AV website. This survey would collect and aggregate the results of the state's remote sensing product needs by state and would be promoted on each StateView's website and listserv. The survey would be developed by 6/30/2014 and implemented by 12/31/2014. Preliminary results would be summarized by 6/30/2015. The survey would be repeated for 6/30/2016-6/30/2017 (because needs change). The results of each survey will be made available online to serve as a continuous benchmark for the development of remote sensing resources and services within the StateView and national consortia. These results will also drive the development of a preliminary nation-wide catalog of StateView imagery assets, which will, in turn, be tied to benchmarks and service enhancement goals.
- The AV Website improvements in GY 2013 did not advance sufficiently far to create the described benchmark for online use. Dr. Sivanpillai, however, did complete a pilot effort which will be incorporated into satisfying this element of the workplan in GY 2015-2017. AV anticipates that the next iteration of requirements gathering, announced in summer 2014, for the refreshed National Plan for Civil Earth Observations and the anticipated Decadal Study will influence the next survey.

Development of the AV Consortium

AmericaView has been steadily developing its national consortium since 2002. This expansion enables AV to better understand and serve the remote sensing needs of the residents in the states that it serves. Encouraged growth of the national consortium and state consortia strengthened AV's networking, remote sensing expertise, and knowledge sharing collaboration. In GY13, AmericaView accepted an additional Affiliate, OklahomaView, increasing its membership from 39 to 40 StateView members. As of September 15, 2014, AmericaView had 40 StateView members: 32 Full Members,

two Associate Members, and six Affiliates. See Appendix A for a listing of all StateViews, SV website URLs, and Principal Investigators.

Dr. Ramesh Sivanpillai (WyomingView PI) chairs a Special Session on behalf of AmericaView at the ASPRS 2014 Annual Conference, in Louisville, KY.

AV took advantage of several opportunities that promoted its strong, functional, and collaborative national consortium. One hallmark of the perceived value of AV's consortium model is excellent attendance at various meetings. Nearly 98% of Full Members attend the annual Winter Business Meeting and almost 75% of StateView members regularly attend optional monthly membership telecons. Standing university teaching responsibilities affect this percentage. Presentations at both the Winter Business Meeting and the monthly teleconferences in GY2013 were volunteered to and openly share products and expertise. That transparency makes national consortium membership most desirable as evidenced by contact from non-member states. During the grant year AmericaView members contributed more than 1,000 hours to committee   work to strengthen national collaborative endeavors and to share remote sensing information and knowledge. StateView PI's volunteered, at national, regional, state, and local levels, to give presentations, lead panels, and provide advice; these were all well-received efforts that enhanced the reputation of the consortium.

In addition to the host institution in each member state, each state has created state consortia with more than 300 members across the United States. Host institutions pass on pertinent information from the USGS to their state consortium members, and send requests for data delivery or products to the USGS. A number of state consortia assist with activities such as organizing geospatial awareness days in their states or meet regularly to share information regarding education and research activities in their   states. Examples of these were the OhioGIS Conference in September 2014, the Nebraska State Government GIS Day, the Kentucky GeoED '14, and the Louisiana Remote Sensing and GIS Conference each spring.

 Numerical Summaries of AV's StateView's Consortium Building Activities

As a national organization, AV works aggressively to sustain and strengthen the national consortium. The effort, however, extends well beyond that centralized approach. In GY 2013, StateViews engaged in 29 activities, specifically intended to strengthen StateView consortia, renewing and expanding professional connections throughout their states through activities such as:
- Purchasing shareable software licenses for use by state consortium members (3 activities, by MS,OH, WV)
- Training faculty members among consortia members and within their own institution (2 activities by AR, ND)
- Promoting opportunities for collaborative research among consortia members (3 activities by ID, ND, PA)
- Strengthening StateView consortia through mechanisms such as MOUs or hiring a StateView coordinator (2 activities by CA, PA)
- Improving and maintaining in-state remote sensing capacity through regular conference calls and conferences (13 activities by AL, IN, KS, KY, MS, MT, NE, NH, OH, SD, TX, VA)

- Partnering with other institutions that sponsor training (e.g., Space Grant, Extension agents, insurance companies, 4H, etc.) (2 activities by AR, CA)
- Contributing to statewide geographic data committee efforts (4 activities by KS, MN, NE, VT)

<u>Benefits of activities</u>

The collaborative interaction of the AV national and solidly established SV consortia augments impact of multiple other NLRSEORA grant activities and enables articulation of information needs that rely upon remote sensing data access and use. Sharing licenses helped decrease course costs and resulted in more courses offered at partner institutions. Training activities, be they formal or informal, increased the number of faculty who are familiar with and capable of using remote sensing in their disciplines. In addition, the "train the trainers" approach proliferated efforts in university education programs to prepare future teachers and encourage appreciation of remote sensing science and technology. Collaborative research leveraged other research funding to augment NLRSEORA resources, involved other SV and peer professionals, and, consequently, broadened the scope and effectiveness of the AV consortium's research endeavors. Collaborative programs also fostered new research opportunities as consortium members discussed their specific applications that stimulated thought about other possible applications. Regular communication between and within StateViews has resulted in improved consortium activity on both the NLRSEORA and other grants. An example of the improved remote sensing knowledge exchange has been willingness of StateViews to provide webinars and workshops for other AV consortium members. Those successful exchanges have a waterfall effect within StateView consortia.   Similarly, partnerships with state and local government groups encouraged leveraged resources and extended the effectiveness of the state consortia. Participation in statewide geographic data committees has strengthened geospatial capacity at the state level and brought state-wide organizations up-to-date on remote sensing activities occurring in neighboring states and at the national level. In some instances, the work of the StateView introduced decision-makers to remote sensing as a tool for urban planning or environment assessment.

Objective 2 – Remote Sensing Applications

AV will expand new and existing remote sensing applications nationwide through its distributed national network. Research and development of new technologies will be directed through AV's state-based university consortia, while expansion of the use of these technologies will occur through a targeted combination of education, training, and outreach activities with AV's many partners.

AV National Workplan– Support for Research Efforts

The AV Research Committee will identify tools that will facilitate keeping the consortium's research efforts relevant and timely for AV's member states and creating opportunities to share information and techniques within and between state-based consortia.
GY 2013: Develop an AV research expertise database in conjunction with annual reporting (e.g., each PI will be asked to edit (or update) their www.avportal.org professional profile as part of the annual reporting process.)
- As part of the updating of contact information in GY 2013 for each PI on the AVportal, each person was also requested to review her/his professional profile and ensure the most relevant information about specialty expertise, teaching focus, and

outreach audiences was current. A subsequent effort will harvest each StateView's annual report to create a coherent file summarizing research efforts, organized by yet-to-be-defined categories.

- The Education Committee, in GY 2013, initiated work on a Resource Sharing Web Portal at the www.americaview.com website. Initial beta testing was underway and when that portal is activated in GY 2014, an additional goal is to post a list of the AV publications so that both AV members and the public will have access to documents that describe the applications research completed or underway at StateView institutions.

GY 2014: Share in situ and ancillary reference datasets via the AV website at:
(http://www.americaview.org/geospatial-data-resources-accuracy-assessment-0.).
Explore methods to identify priority research needs within each member state.
Begin to establish an AV-wide research group library (e.g., using George Mason University's Zotero project as a model) that allows us to highlight AV participants' remote sensing publications; a specific subset collection will include and properly acknowledge those publications that were partially or fully supported by USGS. Provide consistent links to the research group library from the various state-based and national web pages in order to raise the visibility of AV and the USGS-supported program.
GY 2015-17: Develop action plans for addressing tractable state needs. StateView PIs will first be asked to develop prioritized lists of remote sensing product and research needs in their state; the AV Research Committee will then organize breakout sessions at the FTM and WBM that group StateViews according to prioritized needs in their respective states. Each multi-StateView group will highlight the most important tractable state needs and identify actions that the PIs participating in the group can carry out with existing and/or potential funds.
GY 2013-17: Utilize monthly AV teleconferences for StateViews to share "elevator talk" versions of recent remote sensing activities (e.g., a refereed journal article, book chapter, online spatial decision support system, work in progress, etc.) and utilize the AV research group library to archive these presentations.

- As noted above, in the GY 2013 Highlights, using the monthly Membership Meeting forum, proved to be a successful approach to sharing research work among AV PI's. Similarly the Winter Business Meeting also provided presentation and discussion time (see the condensed agenda above) for more than the "elevator talk" about significant outcomes of the applied research.

Progress towards Objective 2 in GY 2013

AV utilized its expertise to complete applied research projects to assist with pressing decision-making needs at both state and local levels. Activities related to remote sensing research/application projects typically reflect individual state needs and the research expertise of the StateView. Each StateView, therefore, may have a unique research emphasis closely tied to the needs of its particular state. In some instances, however, several states may share a common challenge, like agricultural run-off into major rivers, or the ecological problems created by urban heat islands. The opportunity afforded by AV for StateViews to collegially exchange research ideas, approaches, and outcomes helped ensure some best practices could be cascaded throughout a region or to similar situations across the country.

In few cases, did the funds from the GY 2013 sub-awards, alone or within one year, assure completion of complex application research. Most efficacious research projects, in which remote

sensing is an essential source, are resource intensive from the funding, manpower, and calendar perspectives Thus, *partnership-based research activities* continued to dominate in GY 2013, confronting the shared goals of AV's academic, government agency, and NGO partners. The Fact Sheets of Appendix E briefly describe many of those research endeavors and the impact that work has.

Since the majority of AV's research is applied research, it is critically important that its research findings are shared with decision-makers, environmental monitors, resource managers, and other academic, government, and private company researchers. In GY 2013, AV members made more than 40 technical and scientific presentations on AmericaView's endeavors to more than 42 professional groups and more than 2,650 attendees. Examples follow to illustrate the range of conferences, state planning meetings, and statewide or regional geospatial data meetings at which AV StateViews presented their work, contributed to or led panel discussions, served as organizing principals, and expanded the network of those who do, can, or will use remote sensing data and information.

- AAG 2014 Annual Meeting as part of StateViews' traditional support to AAG's national and regional meetings
- AGU
- 2014 Indiana GIS Conference
- Disaster Risk Management (DRM) Flood Pilot at NASA Goddard
- International Flood Working Group, at the NASA's Earth Science Information Partnership (ESIP) meetings
- Humanitarian Information Unit (HIU) of the State Department
- GeoEd'14 Conference (Kentucky)
- Spring 2014 Louisiana Remote Sensing and GIS Conference
- ASPRS (national and regional meetings)
- Louisiana GeoSpatial and Remote Sensing Committee Sessions
- 2014 Louisiana Gulf Coast workshop on Data Mining for Natural and Man-made Disasters
- OhioGIS Conference
- Utah Geographic Information Council (UGIC)
- Vermont Center for Geographic Information

Numerical Summaries of AV's StateView's Development of Remote Sensing Applications

In GY 2013 StateViews engaged in 23 activities that developed new applications or uses for remote sensing data. Those included the following:
- Collaborated with agency personnel and/or private companies to assess utility of satellite data for monitoring and mapping activities that were not previously performed using satellite imagery (7 activities by the following StateViews)
  - ➤ **AlabamaView** worked with the Southern Research Station of the US Forest Service to map urban tree canopy and create a product that Forest Service employees can utilize and share to promote and maintain urban forests.
  - ➤ **Hawai'iView** worked with the Hawai'i Volcano Observatory to map active lava breakouts at Kilauea volcano using LDCM OLI and TIRS.

- IowaView worked with partner Iowa DNR (Geological Survey) to develop methodologies for mapping agricultural drainage tile systems in the Midwest.
- **MinnesotaView** used multitemporal Landsat TM imagery, other government and commercial satellite imagery, and LIDAR data to map and monitor land and water resources.
- **South DakotaView** collaborated with the South Dakota Department of Game, Fish, and Parks to identify habitat suitable for wildlife. The analysis utilized Landsat 8 imagery, 2013 Cropland Data Layer produced by the US Department of Agriculture's National Agricultural Statistics Service, and 4-band NAIP imagery.
- **VirginiaView** collaborated with the Virginia Department of Forestry to prepare an app for the *InForest* (http://inforest.frec.vt.edu/) Landsat layer to support improved forest management efforts in the field.
- **WyomingView** collaborated with the BLM Rawlins Field Office and used a Landsat 8 image (post-fire) for mapping burn severity on a prescribed burn site.
- Collaborated with researchers within or between other StateViews (1 activity by TX)
- Tested innovative uses for remotely sensed data to address economic, ecological, and environmental issues (9 activities by the following states, with SD completing two activities, and the addition of KY) Examples include:
  - Monitoring Pecan crop yields in **Georgia** to improve the accuracy of its crop maps and achieving a 30% improvement,
  - Evaluating the use of Landsat 8 data, in comparison to previous problematic Landsat sensors, for land and forest cover mapping in **New Hampshire** which completed a first phase but which will not complete until summer 2015,
  - Validating the use of Landsat 8 to map and assess submerged aquatic vegetation (SAV) under coastal waters to meet **North Carolina** regulations,
  - Evaluating the effectiveness of cloud and haze removal using Band 9 of Landsat 8 in **North Carolina** which may have applicability to air pollution in the world's major cities,
  - Undertaking a feasibility study of remote sensing-based soil moisture estimation using Landsat 8 and the METRIC model in **South Dakota** to improve stream flow and flood forecasting and regional climate predictions,
  - Creating a Google Earth-based interactive application to assess forested ecosystems for stand-level management with unprecedented resolution, quantitative rigor, and links to field metrics which supports forest health data for decision support in **Vermont**,
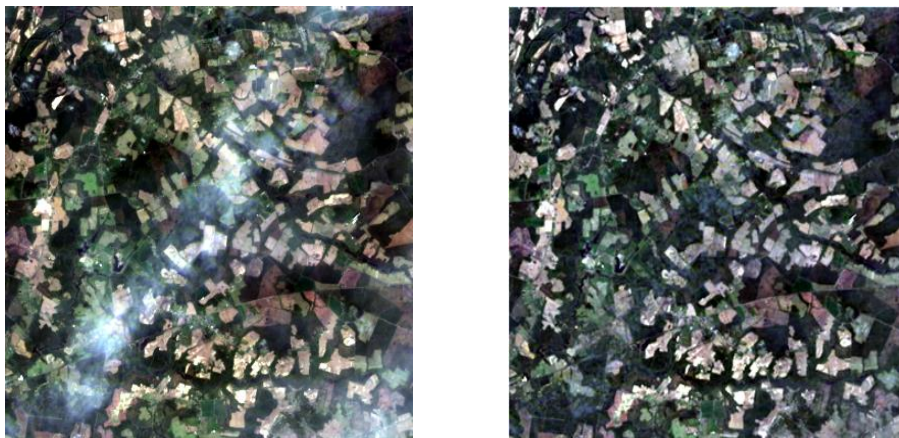
In GY13, North CarolinaView developed a method to remove thin-clouds in visible and near infrared bands of Landsat 8 imagery. The image covering eastern North Carolina was acquired on 17 April 2014 by the Landsat 8 OLI sensor. On left, original data; on right, data after atmospheric correction, removal of cirrus clouds using Band 9, and removal of remaining thin-clouds using QA band. R-Band4, G-Band3, and B-Band2.

- ➢ Forest species mapping of the **West Virginia** Monongahela National Forest using multi-temporal Landsat satellite imagery and digital elevation data to increase forest information in the state and, thus, to improve decisions about a critical economic resource for the state.
- Developed software to support distribution of satellite, airborne, and geospatial data (2 activities by IN and MI)
- Posted methodologies or tools for other StateViews to use or test (1 activity by NH)

Method	Mean accuracy	Times best classifier
Random Forest	73.19%	18
C5.0	72.35%	11
Logistic Model Trees	64.82%	1
Support Vector Machines	62.28%	0
Multivariate Adaptive Regression Splines	58.50%	0
Classification Tree Analysis	50.84%	0

MontanaView developed an accuracy comparison tool that rapidly evaluates the best classification methods for different land classification projects.

Benefits of Applied Research Activity

During GY 2013, the work on applied research, whether as an HIA or other activity, was heavily supported by the StateViews. Applied research, using remote sensing in a university environment has multiple beneficiaries. It builds upon the taxpayer investments in remote sensing imagery by practicably using the Landsat collections. These projects helped to move satellite data into the hands of government, industry, and university partners as well as raise public awareness about the effective use of this asset. These efforts reduced some past inefficiencies, offered alternative solutions to other costly approaches, evaluated different methodologies (see adjacent table), leveraged limited funding resources, and resulted in improved productivity by AV consortium members. Technology transfer of methodologies, developed or nurtured in the academic sector, to the public and commercial sector demonstrated approaches to strengthen the nation's economy and productivity with actual observations, information and analysis. Furthermore, by occurring within the university environment, students had the opportunity to learn, use, and improve techniques that better prepare them for their positions in the future workforce. That point will be discussed further in the Objective 3 section.

Objective 3 – Undergraduate and Graduate Research

AV will use its strength as a consortium whose StateView members are each lead by a university, and whose StateView consortia include over 180 colleges and universities, to provide meaningful research opportunities for undergraduate and graduate students. AV members' proven success at generating research grant dollars will enable this objective to be highly leveraged. These student-involved research activities will increase, both quantitatively and qualitatively, the ability of the nation's future workforce to successfully incorporate remote sensing technologies as a basic aspect of our nation's infrastructure.

AV National Workplan– Student Engagement

GY 2013-17: AV will encourage presentations by StateView PIs that highlight remote sensing and

other geospatial careers to encourage more high school and college students to consider these careers.

- Training K-16 educators, in both pre-service and in-service programs, has been evaluated by pedagogy experts as among the most effective ways to encourage future generations of college students and workforce entrants to seek careers in STEM disciplines. AmericaView PIs have provided leadership establishing strong "train the trainers' programs. Both **PennsylvaniaView** and **TexasView** are exemplars with well-established approaches that in GY 2013 added enhanced materials.
- Several StateViews ensured that their students were given opportunity to make presentations during visits to K-12 schools, at state-sponsored GIS events, and for oral class reports. As one example of the AV workplan, **KentuckyView** used its Earth Day/ Earth Observation Day event to highlight student work.

GY 2013-17: AV will promote research publications by students, including introducing AV-funded students to AV's Research Publication Library described in the workplan for Objective 2.

- Information about AV PI publications, that often included student authors, were provided to AV membership at meetings or by email. As the Resource Sharing Web Portal advances in content, such information will be found there also.

GY 2013-17: AV will support interdisciplinary research projects that would involve AV college students.

- In GY 2013, North DakotaView developed an extensive geodatabase for the Fort Berthold Indian Reservation which is the pilot first step toward an interdisciplinary collaborative project to create layers representing the physical, administrative, socio-demographic, economic, industrial, and other aspects of like on the reservation. Two undergraduate students are active participants in the project intended to expand the oil-shale producing areas for several Indian reservation.

GY 2014-17: AV will endeavor to measure the impact (i.e., increased numbers and visibility of graduating students with R.S. skills) through methods such as: (1) obtaining testimonials/feedback from entities providing internships; (2) monitoring DOI online initiatives for tracking students (labor market statistics), tracking alumni; (3) tracking number of students funded by AV that take the "next step" (undergraduate students entering graduate school); (4) tracking number of internships established by StateViews; and (5) tracking the number of publications and presentations by AV funded students.

GY 2014-17: AV will inquire about the USGS's interest in strengthening AV's student interaction with USGS scientists through exploring: (1) the identification of USGS research priorities that might result in meaningful student research projects, (2) the creation of podcasts or other instructional media to introduce USGS research to students, potentially to be distributed via AmericaView University, and (3) the creation of electronic "classrooms" in which AV advanced remote sensing students could interact with USGS scientists and other AV graduate students.

GY 2015-17: To promote student research presentations, AV will explore the possibility of working with ASPRS's GeoLeague program or other groups to establishing research competitions with the student winner(s) funded to present at national conferences and the possibility of supporting AV college-level student's making electronic presentation at AV's FTM.

Overview of AV's Undergraduate and Graduate Research Accomplishments

A majority of AV's research projects, including those that were discussed above in the Objective 2 section, support undergraduate or graduate students' education and professional preparation. Through these efforts, students gained valuable work skills, improved their theoretical

understanding of the field of remote sensing, and learned the value of putting theory into practice against thorny issues.

Ten StateViews reported hiring 14 students during GY 2013 (through 4th quarter federal FY 2014). AV completed required reporting for the DOI Youth Hired by Partners Program; this assisted the USGS in its performance towards attaining the DOI High Priority Performance Goal (HPPG) for Youth in the Great Outdoors. In March, 2014, this reporting requirement was redirected to meet the Secretarial priority *Engaging the Next Generation* aligned under that Order's " Work" goal to provide 100,000 work and training opportunities to young people and veterans. Accomplishments were accordingly reported quarterly to the Deputy Secretary at the Department of Interior.

- **WyomingView** One student worked with the BLM Rawlins Field Office to map one of their prescribed burn sites. The student gained valuable experience learning about satellite image analysis and real-world work experience with a federal agency. The student was a first generation college student and also a war veteran.
- **New HampshireView** One graduate student intern was hired to provide geospatial technical support for the University of New Hampshire's newly created Geospatial Services Center.   The Center serves students, faculty, and the surrounding communities with consulting help on remote sensing and other geospatial questions and issues.   This experience helps to strengthen the student's class room educational experience, in geospatial technologies, through teaching and assisting others.
- **AlabamaView** One graduate assistant maintained the AlabamaView server, helped manage its data archive and assisted with AV research projects.
- **Hawai'iView** One undergraduate student analyzed the archive of Landsat 4/5 TM, Landsat 7 ETM+, Landsat 8 OLI and TIRS, and Terra ASTER to document spatio-temporal patterns in lava flow breakouts at Kilauea volcano between 1984 and the present. The student is geophysics major, but is learning about remote sensing and data processing (basic IDL programming) for the first time.
- **IdahoView** One female graduate student designed and tested remote sensing lesson plan to engage K-12 students in Science Technology Engineering and Mathematics (STEM) fields.
- **LouisianaView** One graduate student and four undergraduate students (including two females) participated in a transdisciplinary team consisting of science, information technology, sociology, and design professionals from the University of Louisiana at Lafayette and partnering research centers to use design as a framework to effectively utilize geospatial information to make-informed systemic land-use management proposals for the Windy Hills, Coastal Community Resilience Studio project. Students utilize geospatial data including satellite imagery and aerial photography.
- **VermontView** One student processed state LiDAR holdings using cutting-edge techniques to make the data more accessible to stakeholders.
- **West VirginiaView** One female undergraduate student mapped deciduous forest types throughout the Monongahela National Forest using multi-date Landsat 5 Thematic Mapper (TM) imagery, terrain data, and the random Forest machine learning algorithm.
- **MichiganView** One undergraduate student used simple user-accessible software tools based on open
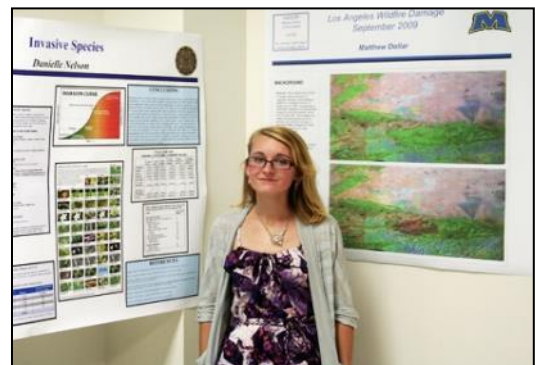
KentuckyView sponsors a semi-annual geospatial-themed poster session for undergraduate students.

source resources to provide a free resource to Geospatial data users that come to MichiganView for help. The tools that were developed facilitated integration of a feature to rapidly and easily compare two overlapping images by "swiping" the screen to view the two images.

➢ **IowaView** One undergraduate student downloaded and processed Landsat 5, 7 and 8 images of Iowa for IowaView users. The student gained experience with creating color composites and mosaics.

Presentations at state, regional and national conferences, summarized under Objective 2, typically involved StateView-sponsored graduate student research or research accomplished by the PIs and their graduate students. Academic merit accrued to the StateView PIs and their students. AV and USGS, as sponsor, received public acknowledgement from the larger and more diverse national geospatial community in attendance, with recognition for the critically important task of developing the future US work force.

Numerical Summaries of AV's Undergraduate and Graduate Research

In GY 2013, StateViews engaged in 15 activities that aligned research efforts with educational opportunities to motivate or excite remote sensing and GIS interest among university students. Those include:

• Awarding scholarships to students to promote remote sensing research including students in under-represented groups (women, ethnic minorities and first generation college students) (5 activities by IA, MS, ND, WY, KS))

• Promoting use of StateView archived or easily-accessed remote sensing data in classroom, laboratory, and field research term projects, affording students an opportunity given the availability of free data (2 activities by AL and WV)

• Supporting student publications or presentations in university forums (3 activities by MS, UT, WY)

  o These publications assisted in advancing the science of remote sensing analysis, applications, and the usage of public and emerging remote sensing imagery.

• Encouraging research competitions (2 activities by IN and OH)

• Serving on MS/PhD committees or otherwise advising, guiding, and encouraging students to use remote sensing approaches, all professional support responsibilities that enable AV's PIs to introduce the utilization of remote sensing technologies to diverse disciplines throughout their universities. (3 activities by AL, AR, LA)

Benefits of AV's Undergraduate and Graduate Research Activity

Each StateView's annual report, related to Objective 3, reinforced the commitment of the participating universities to advance the STEM national goals, by exerting extra efforts to include traditionally under-represented groups in those fields and by cultivating the interest and talents of the next generation of remote sensing scientists and decision makers who will protect our national interests into the future. Education for university students also improved through: a) creation or discovery of internships (and possible future job opportunities) located within natural resource management agencies and private businesses that are StateView consortium partners, b) direct interaction with USGS and other agency scientists, and c) shared remote sensing scientific knowledge within the AV Consortium as PIs discussed ideas and techniques learned from other members.

Objective 4 – Education and Training, Technology Transfer, and Outreach

In the NLRSEORA proposal for GY 2013, Objective 4 was split into three sub-objectives. This section of the report follows that approach:

    4a) Education and Training
    4b) Technology Transfer
    4c) Outreach

Sub-Objective 4.a Education and Training

AV will seek to increase the remote sensing competency of the nation's current and future workforce. Quantifiable objectives include supporting remote sensing science instruction in K-12th grades to improve STEM education and to strengthen national science education standards; utilizing AV's academic university network to improve the quality of instruction at the university and college level; and increasing the employability and effectiveness of workers by introducing remote sensing skills into the existing workforce.

    Sub-Objective 4.a (Education and Training) at the AV national level has four categories of effort.

        1. Serve the future workforce (including K-12 and college level) with a focus on EOD
        2. Support K-12 (and 13+) through the AVRSCP
        3. Support college education through focusing on AV University
        4. Serve the current workforce (with a specific focus on veterans)

4.a.1. *AV National Workplan– Future Workforce (pre college) – Earth Observation Day (EOD)*

The AV Education Committee will focus on the following activities:
<u>*GY 2013:*</u> *The current Google Earth Lesson Plans will be updated to the current Google Earth Edition and converted to be compatible with ArcGIS Online. A brief evaluation form (for K-12 teachers) will be tested for one of the EOD lesson plans.*

- Both PennsylvaniaView and CaliforniaView made progress in GY 2013 with the Google Earth Lesson Plan updates and attaining compatibility with the ArcGIS capabilities. PennsylvaniaView completed the Land Use/Land Cover lesson plan for ArcGIS Online.
- Several StateViews became more familiar in GY 2013 with the use of Google Earth Engine, which allows researchers, educators, students, and the general public to easily access, view and analyze the complete record of Landsat. Tyler Erickson, a developer advocate at Google, formerly from MichiganView, helped consortium members master the new tools.

<u>*GY 2014:*</u> *Corporate sponsors for EOD will be cultivated so that the scope and effectiveness of the event can eventually be extended nationwide. The evaluation form for all EOD activities will be expanded and electronic implementation of the evaluation process will be evaluated.*
<u>*GY 2015:*</u> *EOD will be expanded to include community organizations such as Boy Scouts, Girl Scouts, 4H, and other educational communities. National education standards will be correlated with EOD lesson plans. StateViews will be encouraged to tie EOD activities to their individual state standards.*
<u>*GY 2016-2017:*</u> *With additional funding support from corporate sponsors, EO Day will be implemented at the national level. StateViews will be encouraged to evaluate lesson plan effectiveness via teacher feedback and testimonials. A feedback mechanism will be generated so that teachers will be able to indicate the geospatial knowledge and tools they need to acquire to be*

able to introduce geospatial topics into their classrooms. AV will evaluate and potentially implement recognition tools for teachers and students.

The other specific activity to this category of the National Plan for education is Earth Observation Day. Earth Observation Day (EOD) is an AV consortium-wide event designed to highlight the use of remote sensing as an effective, exciting, and powerful educational tool in K-16 educational and informal environments. EOD http://americaview.org/earth-observation-day was first launched by AV and the USGS in 2007. This initiative, from its outset, has also addressed some of the outreach objectives of the AV program, by   attracting lifelong learners to its publicly open activities as well as the K-12 students.

EOD was officially celebrated in GY13 on 9 April 2014. 124 teachers, 2,647 students, and 75, 245 members of the general public participated.   A summary of the highlights follow, full details can be found in Appendix C.

❖ **Louisiana View** hosted more than 50 high school students and their instructors at the Regional Application Center.   These students toured the GIS museum and the *Earth is Art Exhibit* which was produced by LouisianaView to celebrate the 40 Years of satellite imagery acquisition of Earth and was recently displayed in the Lafayette Art Museum.

❖ **Ohio View** supported the SATELLITES Conference, at which students presented their research projects that were judged by members of the community and awards were given to the top projects in grade bands of K-6, 7-9 and 10-12.

❖ **Texas View s**tudents in the "Introduction to Remote Sensing" class, a junior-level course at Midwestern State University, classified the region surrounding Wichita Falls using MultiSpec tutorials developed by GeorgiaView.

❖ **Idaho View** hosted activities with 6th graders at the McCall Outdoor Science School for 4-5 days. The lesson plans were designed and taught by their graduate student's field instructors. The lessons introduced the students to the use of remote sensing for change detection through hands on activities.

❖ At **Kentucky View,** Earth Day and Earth Observation Day celebrations were held in a combined meeting at Murray State University (MSU) on April 22, 2014. The event included poster presentations by 18, a keynote speaker from the private sector, and 28 graduate and undergraduate students presented their Term-projects.

❖ **South Dakota View** held the Big Sioux Water Festival on the campus at South Dakota State University on May 13, 2014 in Brookings, SD. 1,136 fourth-grade students from 32 area schools attended along with 56 teachers and 207 members of the public who volunteered their time to help out. During the Water Festival, the students learned about water through age-appropriate and fun activities such as traveling through the water cycle, used aerial imagery to find lakes and rivers, explored how pollution affects the aquatic food systems, saw relationships between land use and water quality, and learned about historical perspectives of water use.

❖ **Virginia View,** with two other partners, provided a large exhibit at Kid's Tech University called "Introduction to Geospatial Technologies". Hands-on remote sensing activities were provided, as well as remote sensing displays. A focus was on meteorology: challenging middle schoolers to look at past remote sensing images to help predict 'future' weather events, and to use ArcGIS to demonstrate the potential impacts of LULC changes on water and air quality.

A Remote Sensing and GIS Symposium was also sponsored by VirginiaView and two additional partners. This 5- hour long symposium included expert speakers and a student geospatial poster presentation / competition.

❖ **North Dakota View** set up a display in their student union including Earth Observation Day, AmericaView, NDView, and the Landsat program. At least 600 students per day passed the display.

❖ **Pennsylvania View** involved its Geography students in completing a Land Use / Land Cover exercise and its Remote Sensing students worked with SATCAM and discussed citizen scientists, and completed an application on Pictometry Online.

❖ **California View** set up various interactive imagery exhibitions (County Landsat State Puzzle, City Arial Photography Matching Game, Google Earth Matching Game) and other educational information on earth observation from air and or space.

❖ **Wyoming View**
Eighth grade students were introduced to remote sensing science and applications as they related to their Electromagnetic radiation chapter (physical science class). Next, students measured the spectral reflectance values of live and dead leaves from deciduous and conifers using ALTA Spectrophotometers. Students calculated percent spectral reflectance values and plotted them. These results lead to a discussion on satellite remote sensing, and how images collected by Landsat and other satellites can be used for monitoring environmental changes.

❖ **Georgia View** celebrated in six different events. A total of 190 K-12 students and 7 teachers participated from one elementary and three high schools. The curricula emphasized the importance of land cover, satellite-based earth observation and the science for our community.

Testimonial from K.B., a 12th grade participant in a GeorgiaView GY13 EOD activity

4.a.2. AV National Workplan– K-12 – Online AV Remote Sensing Curriculum Portal (AVRSCP)

GY 2013:   An online mechanism will be implemented to encourage feedback from educators www.americaview.org/resources.   AV will request assistance from the USGS and other partners to

identify resource gaps and prioritize for curriculum development. "Minimum standards/guidelines" for future curriculum development will be identified.

- The AV Educational Resource Web Portal at http://www.americaview.org/resources completed beta testing in GY 2013 and was launched publicly in October 2014 (during the no-cost extension of GY 2013). The Portal lists 80+ AV educational materials. These resources are searchable by target audience, software requirements, type of imagery (e.g., Landsat, MODIS, or NAIP), and type of resource (e.g., lab exercise, video, or lecture).This project was initiated in GY 2011, when Ms. Milda Vaitkus, NebraskaView State Coordinator, coordinated efforts with the AV Education Committee and inventoried and evaluated more than 200 educational resources produced by AV over the prior ten years. This project has come to fruition after hundreds of hours of work in Grant Years 2012 and 2013 by Dr. John McGee (VirginiaView State Coordinator), the Blacksburg Electronic Village at Virginia Tech, and the Education Committee.

- *GY 2014-2017:   AVRSCP will be promoted through state educational systems, science teacher organizations, college-level educator's networks, and K-12 / higher education conference presentations. Members and partners will be actively encouraged to develop curriculum to fill gaps and explore mechanisms for funding additions to AVRSCP. Suggestions received from educators to improve curricula will be incorporated, as appropriate*

4.a.3. AV National Workplan – College Level – Improving Online Remote Sensing Education through AV University
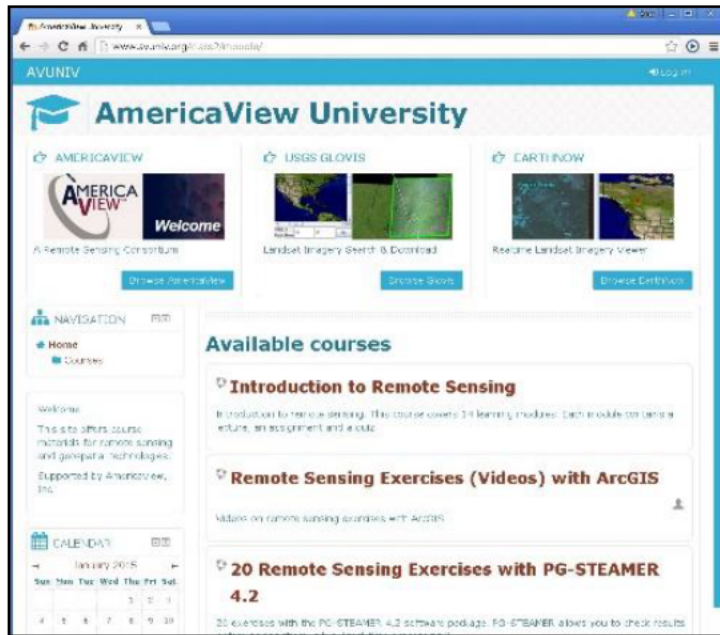
GY 2013: AV University's remote sensing courses will be updated to reflect advances in remote sensing technology and changes in software and imagery availability, and improvements in content management systems.

- In GY 2013 Dr. JC Seong (GeorgiaView PI) updated and stabilized the course management system of AV University, offered at http://www.avuniv.org/ with no charge. Changes were made to courses and new exercises were added. Ten ArcGISTM exercises were created. Lectures were organized as PowerPoint slides with notes. Assignments were also developed and included. Visitors to the site actively explored course contents in order to improve their remote sensing image interpretation and processing skills. Visitors included many instructors who downloaded instructional materials to improve the content of their remote sensing courses

GY 2014-2017: Additional StateViews will contribute lab exercises to the updated AV University using more accessible (from a financial aspect) software packages to increase accessibility by community, tribal, and smaller colleges.

4.a.4. AV National Workplan – Current Workforce – Geospatial Education for Veterans

GY 2013-17: AV will undertake a new collaborative initiative, supported by several StateViews, to recruit and train veterans for tomorrow's geospatial workforce. AV will build upon its expertise in offering remote sensing certificate programs (CalView), educating veterans at the undergraduate and graduate level (MontanaView), and advising veterans who are just commencing their undergraduate programs (VermontView). AV will seek to partner with external organizations to advance this particular initiative.

- In GY 2013 limited progress was made on this element of the Workplan. Contact was established with Osa Brand, the Director of Project Development at the National Council for Geographic Education who was leading an NSF-funded initiative called iGETT (integrated Geospatial Education and Technology Training). AV hoped to establish a partnership with iGETT, given its focus on two year programs for GIS technician education, which seemed a reasonable first step for veterans just beginning an undergraduate program but already seasoned with work experience. Funding for iGETT is short term so in GY 2014 more effort will involve the GeoTech Center which is assuming responsibility for the two-year community college curriculum. VermontView was also working with its lead university to leverage a veterans-focused program that

was not sufficiently resourced during GY 2013. CaliforniaView was asked by one of its Congressman for more information about its planning for veterans' programs and certification.

Additional comments on AV's Education and Training Accomplishments

AmericaView's education activities have been central to the organization's mission, which should not be surprising given the consortium members leadership. The highest count of HIA activities for GY 2013, as aligned with AV's "binning" approach, was in Education. In GY13, AV completed 46 HIA and non-HIA education activities.   All funded StateViews supported formal education activities of various types, including K-12, higher education, or professional development. Fewer formal education or training efforts are found among the diverse Outreach activities. AV members have leveraged existing education and outreach programs to expand remote sensing research at the collegiate level, utilized their expertise to develop new programs for K-16 students that include basic STEM education through advanced remote sensing and allied geospatial technology education, and facilitated long-term and current workforce development.

StateViews continued to train numerous sectors of the current and future workforce.
- University students and faculty
- K-12 teachers and students
- Tribal college students and faculty
- Community college students and faculty
- National Guard personnel
- U.S. Forest Service and Bureau of Land Management staff
- State natural resource managers
- State extensions agents
- Urban planners
- City managers

Training and teaching mechanisms utilized during the grant period include:

- Research mini-grants
- Online remote sensing tutorials and curriculum
- Earth Observation Day activities
- Students And Teachers Exploring Local Landscapes to Interpret The Earth from Space (SATELLITES) Conference and Program in Ohio
- Seminars and workshops
- Art Gallery Exhibits of the USGS Earth as Art Imagery in Louisiana

Numerical Summaries of StateViews' Education and Training across the Four Categories

In GY 2013, StateViews engaged in **18 activities that improved STEM education and geospatial technologies in K-12 schools**:
- Preparing and delivering guest lectures or demonstrations to highlight remote sensing applications (3 activities by GA, ID, WY)
- Developing education workshops (4 activities by CA, HI, NE, VA)

- Organizing activities targeting 4-H, Boy/Girl Scouts, related youth organizations (1 activity by SD)
- Supporting state educational standards (1 activity by TX)
- Providing training for teachers during summer months to enable them to incorporate one or two RS lesson plans in their classroom during the school year (2 activities by AL and OH)
- Developing lesson plans for remote sensing classes or modules or to incorporate remote sensing in other disciplines (Geography, Botany etc.) (7 activities by CA, ID, IN, MI, PA (2), VA)
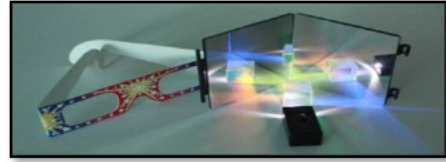
Hawai'iView's science kits contain mirrors, prisms, diffraction glasses, and LED lights to illustrate how the Landsat 8 Operational Land Imager makes multi-spectral measurements of the Earth's surface.

For that same grant period, StateViews completed **12 activities that strengthened general remote sensing university education**:
- Sharing licenses for image processing software (2 activities by ND and UT)
- Sharing course materials developed at one university with other universities (2 activities by GA and KS)
- Encouraging/enabling use of data from the StateView archive for teaching purposes (2 activities by TX and WV)
- Funding short courses in some aspect of remote sensing (2 activities by VT and VA)
- Delivering guest lectures in other disciplines to promote the utility of remote sensing (3 activities by IA, MN, NH)

StateViews also supported **8 activities that provided training programs, anticipating the future workforce,** for students in universities and colleges:
- Offering hands-on training opportunities for students in government agencies, the private sector, or other educational institutions (1 activity by PA)
- Funding stipends to encourage students to pursue a remote sensing component of their education (2 activities by MT and WV)
- Developing training programs that address topical ideas tailored for specific state and discipline needs (5 activities by AR, KS, KY, NH and VA)

In addition to classroom or special event education and training, StateViews addressed **11 activities proposed for GY 2013 that trained current workforce in the use of remote sensing data and applications**:
- Preparing and delivering short courses for government agencies, private companies, extension agents, private citizens and students (7 activities by KS, LA, NH, OH, TX, VT and WY).
- Providing periodic follow-on support (answering questions through telephone, e-mails etc.) to those trained via the above short courses (1 activity by MS)
- Developing web-based tutorials, FAQs and 'how-to' materials (3 activities by IN, MI, MN)

Benefits of Education and Training Activity across the Four Categories

As identified in the lead paragraph of this section on Education and Training, there were four categories of education and training focused on during this grant period:

1. The nation's future workforce
2. The K-12 classrooms
3. College programs
4. The nation's current workforce

Several of the activities described in this report employed similar approaches for each of the focused learning groups.

Guest lectures provided an important outreach element to K-12 educators and administrators through informing the audience about the benefits of remote sensing education, why it is relevant to students, and how it can assist teachers with meeting education standards. Those same guest lectures were sometimes condensed for overview presentations at professional conferences, during state education commission discussions, or in community meetings. In addition, guest lectures provided an important outreach element to non-geospatial disciplines, creating increased opportunities for interdisciplinary applications for remote sensing technologies. AV PIs accepted

A Remote Sensing and GIS Symposium, held in GY13, was sponsored by VirginiaView, the VT Office of GIS, and the Virginia Space Grant Consortium.

invitations and also volunteered to address various audiences. Some lectures were prepared as a webinar to reach a geographically distributed audience.

The online webinar approach in GY 2013 adapted well to the rapid expansion of online education AmericaView also responded with initiating and maintaining the multi-state sponsored 'AmericaView University' web-based project, offering a model for multi-state, collaborative online education that was launched in 2008. The appeal for online education for college students, as well as workforce members seeking to update technical skills, reflects concern about the increasing cost of traditional education, offers less rigid time requirements, and overcomes the inflexibility of being tied to a specific geographic location. Web-based tutorials and materials were critically important to teachers preparing K-12 curricula, to curious K-16 students, to lifelong learners, and to individuals in their workplace. This enabled many non-remote-sensing savvy users a means to circumvent some of the technology (software) and analysis barriers whenever in the day it was needed. In addition, many authors of the materials accepted additional responsibility to answer questions.

K-16 teachers have access to a plethora of Earth science education websites and materials but little guidance about how to build the appropriate curricula. Teacher workshops, conducted in GY 2013, were an essential element of introducing remote sensing and related geospatial technologies into the classroom. Summer workshops by AV PIs and some graduate students have become one of the most effective ways to reach teachers and provide professional development.

- Because of their heavy workloads, teachers are much more willing to adopt and implement educational resources that are closely tied to their state standards. AlabamaView, North CarolinaView, and CaliforniaView were very attuned to state standards in their workshop endeavors.

- StateView prepared remote sensing lesson plans to help teachers and students understand the application of remote sensing and related geospatial technologies to other disciplines and how these lesson plans assist them with meeting state and national STEM education standards. The literature stresses the importance of introducing and exciting students about STEM topics by middle school or significant educational opportunities will be lost. This "window" for STEM education is one of the main reasons that AV focuses on introducing remote sensing science into K-12 education.

AV also responded to the critical training shortage for the technical skills needed in the 21st century by offering updated or new short courses that provide professionals with a quality educational experience in a limited time-frame. Accompanying that effort AV also provided ongoing technical support. Because of their academic positions, StateView PI's and coordinators have been available to answer questions, provide feedback, and otherwise provide follow-up support. The willingness on AV's part to sustain contact with participants resulted in added effectiveness, and strengthened the partnerships that are the basis of successful professional development and training

AV has improved remote sensing teaching opportunities at the university level through sharing lesson plans and lab materials for annually changing remote sensing software analysis packages so that our graduates are competitive and more effective in their new jobs. In addition, shared materials in GY 2013 saved valuable time, reduced duplication of efforts, collaboratively strengthened existing course offerings, and led to the development of new courses that could not have been provided otherwise.

- Support shared among the AV Consortium has resulted in the establishment of 9 new university-level remote sensing courses or programs at AmericaView member universities that will advance remote sensing education throughout the country.
- Several StateViews have provided teaching resources for community colleges that have limited accessibility to expensive satellite imagery processing software.
- Utilization of archived and free data for teaching purposes strengthened course content and advanced college-level remote sensing image processing and analysis skills across the United States.
- Free data were used in a wide range of student-developed project applications across the country, focused mostly on natural resources management issues such as forest and range management, agricultural productivity assessment, drought monitoring, land use/land cover change analysis, and coastal zone monitoring.

Remote Sensing in an ArcMap Environment

Tammy Parece
James B. Campbell
John McGee
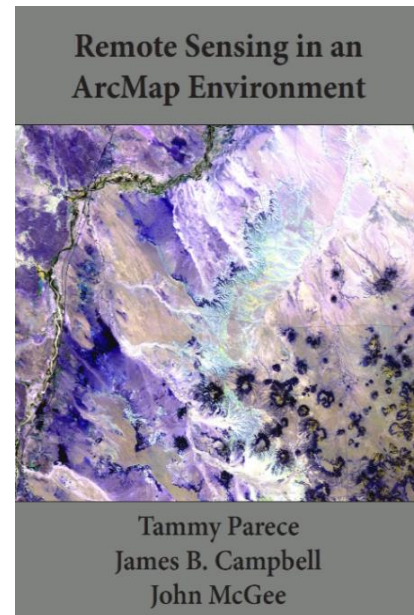
In GY13, VirginiaView prepared and published educational tutorials to support the needs of educators.
http://www.4shared.com/office/2mJ4P1RA/Remote_Sensing_Analysis_in_an_.html.

Internships in GY 2013 offered invaluable learning experiences for students, strengthened the employment marketability of graduates, and often supported a critical remote sensing need within

partner agencies and organizations. Because many students experience financial challenges, stipends and scholarships often fill a critical need in their remote sensing educations and allow them to pursue minors or develop remote sensing analytical skills that they would not otherwise be able to complete in the normal course of their college education. Training programs focused on specific needs also enhanced students' marketability in the rapidly changing geospatial work sector.

Sub- Objective 4.b Technology Transfer

AV will seek to improve the utilization of remote sensing technologies and data through the targeted transfer of techniques and data products to end users. Measurable objectives include data product and tool transfers from AV members to end users, such as providing data to first responders and post-analysis maps to decision makers in communities facing emergencies; providing remote sensing data-based products in easily used formats to end users; working with public land managers in analyzing land status and change; and assisting private land owners/managers with information to assist in such areas as farm and ranch management, water availability and supply, and forest health.

Sub-Objective 4.b (Technology Transfer) at the AV national level has two categories of effort.
1. Enable the current workforce by supporting disaster analysis
2. Implement the AmericaView MultiState data Server (AVMSS)

4.b.1. *AV National Workplan– Disaster Analysis*

GY 2013-17: *AV members will continue to share their expertise in disaster analysis with others via AV telecons, the AV listserv, AV annual meetings, and in regional/national conferences. The shared information will include training opportunities offered by the USGS, suggestions for how to manage data flow and data provision to first responders, research results, and approaches to post disaster land and water cover analysis.*

LouisianaView's June 5, 2014, GeoSpatial Emergency Responders Workshop.

AmericaView members in Kansas, Louisiana, and Mississippi each provided support to their states and the surrounding regional area during GY 2014.

*   KansasView focused on flood threat participating in the International Flood Working Group. They were also active advisors for the Kansas Division of Emergency Management.

*   LouisianaView coordinated the June 2014 Louisiana Gulf Coast workshop on Data Mining for Natural and Man-made Disasters, including Hurricane Response involving 45 geospatial first responders.

*   MississippiView published papers and helped regional teams on using remotely sensed data to help with the Gulf's restoration efforts.

4.b.2. *AV National Workplan– AmericaView MultiState data Server (AVMSS)*

GY 2013-17: Many AV states maintain state-specific archives of airborne and spaceborne

The AmericaView Multi-State Server (AVMSS) provides thumbnails of Landsat 8 acquisitions over the contiguous United States for October 1, 2014 via a Web Mapping Service. AVMSS displays daily acquisitions as Landsat 8 data is loaded into the Earth Observation Depot Network by an automated ingest system developed and operated by TexasView.

33

remote sensing imagery designed to support the needs of state and local governmental agencies, environmental and agricultural consulting firms, emergency managers, and many others. In 2010, ten StateViews pooled financial resources and technical expertise to develop a shared web-based data visualization and distribution system based on AlaskaView's successful efforts and hosted by TexasView called the AmericaView Multi-State data Server (AVMSS). The workplan for the AV Technology Committee for the next five years is as follows: (a) establish a simple protocol and documentation for StateViews to upload collections and utilize visualizations in education, (b) publish NAIP aerial photography collections and selected Landsat 8 scenes as WMS data services for GIS access and use, and (c) provide novice users with the ability to subset and download imagery directly from the viewer.

- AV, in cooperation with public data providers In GY2013, continued to ensure access to public remote sensing imagery by making the imagery available in standard, ready-to-use formats to public agencies, educational institutions, and commercial entities in member states. Data provision has greatly enhanced the ability of decision makers, educators, scientists, and the general public to utilize and understand remote sensing data and analytical tools.
- Free access to Landsat data through USGS GloVIS and Earth Explorer remained a relied-upon asset for remote sensing educators and researchers. Those needing large quantities of data on a recurring basis remained hampered by limitations of existing data discovery and download. TexasView and WisconsinView, in GY 2013, initiated efforts to partner with the Data Logistics Tool Kit (DLT) development team to implement a data logistics-based distribution system. The demo installation was completed in this grant year.
- Substantial progress was made on the AVMSS project. "Real Earth" technology developed by SSEC at the University of Wisconsin became functional on the AVMSS. Development progressed to the point that data from additional states could be loaded into the server which continued to be housed in GY 2103 at the Stephen F. Austin State University.
- In August, 2014 AV representatives from TexasView, WisconsinView, and MichiganView met with USGS EROS Center to discuss implementation of the prototype EODN system.

Numerical Summaries of StateViews' Technology Transfer across the Two Categories

In GY 13, StateViews facilitated disaster response training and planning in 2 activities that received, processed, and distributed satellite imagery, including real-time collection and distribution of data in collaboration with emergency responders and field operations. MODIS and Landsat imagery predominated, but other data continued to become more widely available as partner-operated reception and processing infrastructure increased in demand.

Also in GY 2013, StateViews engaged in 31 activities that improved ease of access to geospatial imagery (such as Landsat, ASTER, MODIS, and various aerial datasets including LiDAR and orthophotography) by end users through activities such as:

- Making remote sensing imagery publicly available at low or no cost on StateView websites (20
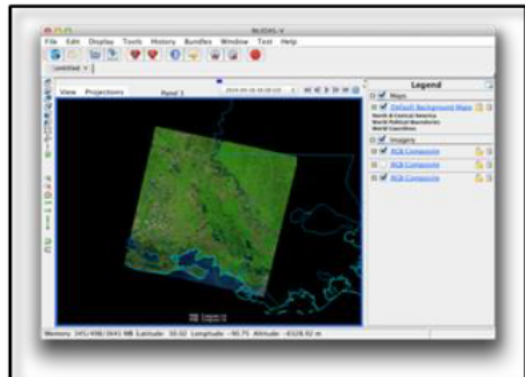
Landsat 8 color composite image viewed in McIDAS-V meteorology software. WisconsinView is working with researchers and computer scientists to enhance access to "real-time" Landsat 8 imagery for use by atmospheric scientists and meteorologists.

activities by AL (3),GA,IN, IA, KY,MI,MN,MS,NE (2),ND,OH,PA,TX (2), WV,)

- Making the processing, distribution, and user interfaces easier so more residents and data users could access data (4 activities by ID, ND, PA)
- Structuring data sharing arrangements within or among StateViews or StateView partners (2 activities by NE and ND)
- Hosting data sets for StateView partners (e.g., NAIP for USDA-FSA), and brokering or otherwise encouraging data acquisition for a research or education project (5 activities by AL, IN, ND, TX and WI)

Benefits of Technology Transfer Activity across the Two Categories

The disaster analysis support, whether conducting workshops for emergency responders or for assisting with the oversight of restoration efforts or developing tools to predict or plan for flooding events are priceless applications of remote sensing and GIS expertise that this grant has enabled.

The preliminary testing, demonstrations, and prototype recommendations for the AVMSS using EODN and DLT in GY2013 are anticipated to deliver desired capabilities during the remainder of the NLRSEORA grant period.

1. Large raw datasets can be quickly moved between researchers.

2. Value-added products can be redistributed easily.

3. Depots located in areas of poor network connectivity can be configured to store caches of relevant data and to reach underserviced areas.

4. Depots located at schools can provide ready access to curriculum dependent data.

5. Researchers studying climate change or other temporally-driven phenomena can configure local depots to pre-stage needed data.

6. Researchers or other users can be notified when new data is available in their study area.

7. Multiple data discovery tools can be developed targeting specific user groups.

Sub-Objective 4.c   Outreach

AV will continue its decade-long efforts to increase United States' citizens understanding, awareness, and utilization of remote sensing data and products, and the agencies that produce that data. Measurable objectives include conducting annual educational outreach with local, state, and national decision makers; creating and posting displays in public venues and community events; and through StateViews' continuing efforts to include satellite data in member states' geospatial consortia and data libraries.

AV National Workplan - outreach with decision makers and general public

GY 2013-2017: In February of each grant year, AV's Outreach Committee and AV staff will compile handouts and key talking points explaining the many uses of remote sensing science in the context of geospatial skills at the national level. The USGS will be requested to provide any updated fact sheets or program information that can be publicly shared.   Each year, each StateView will produce "fact sheets" that describe their research, educational, and outreach activities. These handouts will be used in educational visits made by AV to decision makers during the upcoming year.

- In GY 13, AmericaView members met with more than 100 decision makers (or their staff persons) to conduct educational visits to share the importance of remote sensing imagery and products to the residents of their states.
- Fact sheets prepared for GY 2013 are found in Appendix E and will be used for various GY 2014 educational visits and meeting fora. These fact sheets cover the period December 1, 2013 through December 31, 2014.

GY 2013-2017: AV will maintain and update its website and blog.

- With the combined StateView's web sites, along with the AV web site and blog, AmericaView hosted more than 87,657 visitors and more than 448,366 page views during GY13. The information provided via AV's electronic venues enhanced the ability of decision makers, educators, scientists, and the general public to utilize remote sensing data and analytical tools.
- AV has maintained its blog site since 2010.   In GY13, AV's blog hosted 16,035 page views. MichiganView hosts the blog site and Jarlath O'Neil- Dunne (VermontView PI) is a major contributor to the site.

<u>Numerical Summaries of StateViews' Outreach</u>

GY 2013, StateViews increased the public's awareness of remote sensing imagery and technologies with ten activities:

- Promoted understanding of geospatial data among public through activities such as Earth Observation Day (6 activities by LA, NE, OH, SD, WI and KY)
- Participated and used remote sensing imagery in museum and other public venue displays (2 activities by WI and CA)
- Utilized social media, initiated mass mailings, created posters, StateView screen savers, etc. (2 activities by WY and VT)

LouisianaView's "Earth as Art" exhibit toured the state of Louisiana in GY13 featuring more than 30 satellite images and a 9x20 foot "Earth at Night" canvas.

<u>Benefits of Outreach Activity</u>

The public is often overlooked as an audience for informal educational programs on remote sensing, but many members of the public are interested, and given the right "hook" can often become fascinated by this area of science. Displays can be expensive and may require significant effort (and partnerships), but have the potential to reach a large number of people in an environment that is non-technical and conducive to learning. Public venues have the potential to: reach larger and more diverse audiences, and in some cases to reach a "captive" audience. The LouisianaView example above ties remote sensing into the art genre that could interest a broader sector of our citizenry. Images capture imagination and satellite images intrigue viewers, who always want to see their own homes, but those images also illustrate the value of the wider view and perhaps awaken awareness of the broad contributions that remote sensing science makes to many facets of everyday life. Presentations made by AV members to service organizations are usually very effective because the "messenger" is a trusted member of the community.

IV. Budget Summary

Grant funding for GY 2013 was $960,000. All funds for GY13 were expended. See summary of expenditures in Appendix D.

Nearly ¾ of the grant went directly to support StateView Full Member sub-awards, mini-grants to Full Members, Associates, and Affiliates, and to Associate and Affiliate travel. Sub-Awards for each of the 29 fully funded members* for GY 2013 was $24,673.

*   Three Full Members either chose not to submit an RCA, or did not meet requirements for filing, content, or satisfactory progress on the prior year's sub-award.

Appendix A – List of StateViews and Principal Investigators

As of September 15, 2014, AmericaView had 40 StateView members: 32 Full Members*, two Associate Members and six Affiliates. AV's StateView members were:

FULL MEMBERS*
* AlaskaView, ColoradoView, and MarylandView were not funded in GY13

AlabamaView
http://www.alabamaview.org
Dr. Luke Marzen
Department of Geography
Auburn University

AlaskaView
Mr. Tom Heinrichs
Geographic Information Network of Alaska
University of Alaska Fairbanks

ArkansasView
http://www.cast.uark.edu/cast/arkansas_view
Dr. Jason Tullis	Mr. Bruce Gorham
Center for Advanced Spatial Technologies (CAST)	Center for Advanced Spatial Technologies (CAST)
University of Arkansas	University of Arkansas

CaliforniaView
http://cstars.metro.ucdavis.edu/education-and-outreach/californiaview
Dr. Susan Ustin	Pia van Benthem
Center for Spatial Technologies and Remote Sensing (CSTARS)	Department of Land, Air and Water Resources
University of California at Davis	University of California at Davis

ColoradoView
http://coloradoview.org/
Dr. Wei Gao
USDA UV-B Monitoring and Research Program
Colorado State University

GeorgiaView
http://gis.westga.edu/gaview/
Dr. J.C. Seong	Dr. Mark Patterson
Department of Geosciences	Geographic Information Science Service Center
University of West Georgia	Kennesaw State University

HawaiiView
http://hawaiiview.higp.hawaii.edu/
Dr. Robert Wright
School of Ocean and Earth Science and Technology
University of Hawaii

IdahoView
http://www.idahoview.org/
Dr. Jan U.H. Eitel
Geospatial Laboratory for Environmental Dynamics
University of Idaho

IndianaView
http://www.indianaview.org/
Mr. Larry Biehl
Purdue Terrestrial Observatory
Purdue University

IowaView
Dr. Kevin Kane
College of Design
Iowa State University

James Giglierano
Extension GeoSpatial Technologies Program Manager
Iowa State University

KansasView
http://www.ksview.org/
Dr. Steve Egbert
Kansas Applied Remote Sensing Program (KARS)
University of Kansas

Kevin Dobbs
Kansas Applied Remote Sensing Program (KARS)
University of Kansas

KentuckyView
http://www.kentuckyview.org/
Dr. Haluk Cetin
Director, Hyperspectral Laboratory
Murray State University

LouisianaView
http://www.rac.louisiana.edu/
Mr. Brent Yantis
Regional Application Center
University of Louisiana

MarylandView
http://marylandview.towson.edu/
Dr. John (Jay) Morgan
Dept. of Geography and Environmental Planning
Towson University

MichiganView
http://wiki.americaview.org/display/miview/Home
Dr. Nancy French   K. Arthur Endsley, GST
Michigan Tech Research Institute (MTRI)   Research Scientist
Michigan Technological University   Michigan Tech Research Institute (MTRI)

MinnesotaView
http://minnesotaview.gis.umn.edu/
Dr. Marvin Bauer   Dr. Joseph Knight
Department of Forest Resources   Department of Forest Resources
University of Minnesota   University of Minnesota

MississippiView
http://www.msview.olemiss.edu/
Dr. Greg Easson   Mr. Hal Robinson
Enterprise for Innovative Geospatial Solutions   Geoinformatics Center
University of Mississippi   University of Mississippi

MontanaView
http://www.montanaview.org/
Dr. Rick Lawrence
Land Resources/Environmental Science Dept.
Montana State University

NebraskaView
http://nebraskaview.unl.edu/
Dr. Brian Wardlow   Ms. Milda Vaitkus
Center for Advanced Land Management   Center for Advanced Land Management
Information Technologies (CALMIT)   Information Technologies (CALMIT)
University of Nebraska-Lincoln   University of Nebraska-Lincoln

New HampshireView
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Dr. Russ Congalton
Department of Natural Resources and the
Environment
University of New Hampshire

North CarolinaView
http://www.ecu.edu/cs-cas/geog/ncview/
Dr. Yong Wang
Department of Geography
East Carolina University

North DakotaView
http://www.und.nodak.edu/org/ndview/
Dr. Brad Rundquist
Department of Geography
University of North Dakota

OhioView
http://www.ohioview.org/
Dr. Pete Clapham
Department of Biological, Geological, and
Environmental Sciences (BGES)
Cleveland State University

PennsylvaniaView
http://www.paview.psu.edu/
Dr. Tom Mueller
Department of Earth Science
California University of Pennsylvania

South DakotaView
http://sdview.sdstate.edu/
Dr. Jeppe Kjaersgaard   Ms. Mary O'Neill
Ag & Biosystems Engineering   Water Resources Institute
South Dakota State University South Dakota State University

TexasView
http://www.texasview.org/
Dr. P.R. Blackwell   Dr. Rebecca Dodge
Columbia Regional Geospatial Service Center   Department of Geosciences
Stephen F. Austin University   Midwestern State University

UtahView
http://earth.gis.usu.edu/
Dr. Douglas Ramsey
Department of Wildland Resources
Utah State University

VermontView
http://www.uvm.edu/vermontview/
Mr. Jarlath O'Neil-Dunne
Spatial Analysis Laboratory
University of Vermont

VirginiaView
http://virginiaview.cnre.vt.edu/   Dr. John McGee
Dr. James Campbell   Department of Forest Resources and
Department of Geography   Environmental Conservation
Virginia Tech   Virginia Tech

West VirginiaView
http://www.wvview.org/
Dr. Tim Warner
Department of Geology and Geography
West Virginia University

WisconsinView
http://www.wisconsinview.org/
Dr. Sam Batzli
Environmental Remote Sensing Center (ERSC)
University of Wisconsin

WyomingView
http://www.uwyo.edu/wyview/
Dr. Ramesh Sivanpillai
Wyoming Geographic Information Science
Center (WYGISC)
University of Wyoming

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New MexicoView
http:/Newmexicoview.Nmsu.edu
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Center for Applied Spatial Ecology
New Mexico State University

New YorkView
Dr. Jungho Im
Department of Environmental Resources and
Forest Engineering
State University of New York

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ConnecticutView
Mr. James Hurd
Center for Land use Education and Research   Dr. Daniel Civco
(CLEAR)   Director of CLEAR
University of Connecticut   University of Connecticut

NevadaView
Mr. Ronald H. Hess
Nevada Bureau of Mines and Geology
University of Nevada at Reno

OregonView
Dr. Michael Wing
Department of Forest Engineering, Resources
and Management
Oregon State University

OklahomaView
Dr. Xiangming Xiao
Department of Microbiology and Plant Biology
University of Oklahoma

Rhode IslandView
Dr. Y.Q. Wang
Dept. of Natural Resources Science
University of Rhode Island

Mr. Greg Bonynge
Dept. of Natural Resources Science
University of Rhode Island

WashingtonView
Dr. Mark Swanson
Department of Natural Resources
Washington State University

Appendix B: AV Board of Directors during GY 2013

AmericaView Board of Directors March 2013- March 2014

AmericaView is a national consortium comprised of individual state consortia. The national consortium is governed by a Board of Directors, elected to staggered multi-year terms of office by the membership. Board members serve on a voluntary basis and receive no compensation beyond travel support.

Directors

Chair:
Dr. Rebecca Dodge
Associate Professor
The Department of Geosciences
Midwestern State University
3410 Taft Blvd
Wichita Falls, Texas 76308
Term: Mar 2012 – Mar 2015

Vice Chair:
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Professor of Remote Sensing and GIS
MS Graduate Program Coordinator
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Term: Mar 2012 – Mar 2015

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Center for Advanced Land Management Information Technologies (CALMIT)
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Term: Mar 2012 – Mar 2015

Treasurer:
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Webpage
Term: Mar 2011 – Mar 2014

Director:
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Term: Mar 2011 – Mar 2014

Director:
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Professor
Land Resources and Environmental Sciences Department
Director, Spatial Sciences Center
Montana State University
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Bozeman MT 59717-3490
Webpage
Term: Mar 2012 – Mar 2015

Director:
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Appendix C – Summary of Earth Observation Day Activities for GY13

Number of Teachers Participating	124
Number of Students Participating	2,647
Members of the Public Participating	75,245

❖ **Louisiana View**

At the University of Louisiana at Lafayette the Geographic Information's Program celebrated 2014 Earth Day, by inviting high school students to visit the GIS research department at Abdalla Hall in Lafayette, Louisiana. Over 50 high school students and their instructors visited the Regional Application Center to part take in the LouisianaView sponsored 2014 Earth Day celebration. These students toured the GIS museum and the Earth is Art Exhibit which was produced by LouisianaView to celebrate the 40 Years of Satellite Imagery acquisition of Earth and was recently displayed in the Lafayette Art museum. Zachary Gauthier, a junior at the Avoyelles Public Charter High School, stated "I enjoyed looking at the different pictures from the art exhibit. It was amazing to see our earth photo-graphed that way." This exhibit will continue touring the state of Louisiana to excite the imagination and entertain the public's creative fancies. We hope everyone will have the opportunity to join LouisianaView as we display images from across the globe that depict the science of the region and invoke the art of the earth's natural landscape.

❖ **Ohio View**

At the SATELLITES Conference, students presented their research projects that they had been working on over the last few months. Projects were judged by members of the community and awards were given to the top projects in grade bands of K-6, 7-9 and 10-12. One project used lidar to map caves on Kelley's Island in Lake Erie. Another used change in Landsat images to detect illegal plant growth.

❖ **Texas View**

Students in "Introduction to Remote Sensing", a junior-level course at Midwestern State University, have classified the region surrounding Wichita Falls using MultiSpec tutorials developed by GeorgiaView. The students began with the unsupervised land cover tutorial, including accuracy assessment. The following week they re-classified the same are using the Supervised Landcover Classification tutorial, and compared accuracy assessment values.

Students used local imagery to perform supervised and unsupervised classification of local imagery, including accuracy assessments and comparison of results. The EODay tutorials developed by GAView were used.

Satellite imagery can be used to teach in multiple disciplines, but access to usable images and lessons has been an issue. Learn to find the imagery you need, along with learning activities you can modify for your location and discipline. Discover resource-rich websites and hear about future workshops to extend your abilities to integrate imagery into your science classroom!

❖ **Idaho View**

We did a total of two activities with some of our 6th graders that stay with us at the McCall Outdoor Science School for 4-5 days. The lesson plans were designed and taught by some of our graduate students field instructors.

The intent of the lesson was to introduce 6-grade students to remote sensing in particular the use of remote sensing for change detection. For this, we changed items (e.g., pine cones, twigs, removed flowers) within a 5x5 meter area while students closed their eyes and after opening their eyes students had to use their sense of sight to detect changes within the area. We then discussed with students that satellites are used by scientists and land managers as "eyes" to detect changes on the landscape.

❖ **Kentucky View**
Earth Day and Earth Observation Day celebrations were held in a combined meeting at the Curris Center of Murray State University (MSU) on April 22, 2014. The event started at 10:00AM with poster presentations of 18 MSU students (six graduate and 12 undergraduate posters). At 11:00 AM, the Keynote speaker, Mr. Lewis Graham, President and Chief Technical Officer of GeoCue Corporation, gave a talk entitled "Enhancing the GIS Desktop with Light Detection And Ranging (LiDAR)" and followed by the poster session. Between 1:00 and 2:00PM, six graduate students of the Advanced Remote Sensing class of Dr. Haluk Cetin presented their Term-projects. Between 2:00 and 4:00PM, one Directed Studies class undergraduate student and 19 Introduction to Remote Sensing class undergraduate students of Dr. Cetin presented their Term-projects.

❖ **Georgia View**
GeorgiaView celebrated the 2014 Earth Observation Day on 2/17, 2/19, 2/29, 3/27, 4/2 and 4/14. A total of 190 K-12 students and 7 teachers participated from one elementary and three high schools. Organized by J.B. Sharma, Mark Patterson, JC Seong, Brandon Forrest, and six volunteers, GeorgiaView emphasized the importance of land cover, satellite-based earth observation and the science for our community. Testimonials show students really appreciate the EOD event.

I enjoyed the whole experience, Particularly the Information on Landsat Satellites. The lecture, for the most Part, was helpful and very Informative. My interest in this field may be a bit lacking, but my interests In attending a University are even greater. I would also like to thank Dr. Seonge for his time and generosity.

A.R.,12th Grader

Today was an Awesome experience. It was fun taking pictures and observings the earth haha Earth Observation day. Seeing the land cover and learning about the Land Sat was Intresting. im really glad I got to come on this trip and it does seem like Something I'd like to Lookinto in the future.

L., 12th Grader

This activity made me understand. more what the Geospatial engineering field will be like. I am in the National Guard as a Geospatial Engineer. This field trip probably helped me more than anyone else.

K.B, 12th Grader

I really enjoyed the EOD program. It showed me how our technology helps us with our land and satalite. I think the the app we used was pretty cool, and i liked that a student created it.

D.C., 12th Grader

EOD was a great experience. I enjoyed learning about the geography of Ga. The UWG campus was very beautiful & I hope many more students will be able to participate in this event

M.M., 12th Grader

❖ **South Dakota View**
  We held the Big Sioux Water Festival on the campus at South Dakota State University on May 13, 2014 in Brookings, SD. 1,136 fourth-grade students from 32 area schools attended along with 56 teachers and 207 members of the public who volunteered their time to help out. During the Water

Festival, the students learn about water through age-appropriate and fun activities such as traveling through the water cycle, the use of aerial imagery to find lakes and rivers, explore how pollution affect the aquatic food systems, see relationships between land use and water quality, and learn about historical perspectives of water use.

❖ **Virginia View**

VirginiaView, in partnership with the Virginia Geospatial Extension Program and the Geography Club, provided a large exhibit at Kid's Tech University called "Introduction to Geospatial Technologies". Hands-on remote sensing activities were provided, as well as remote sensing displays. One of the highlights of our exhibit was a meteorology display that used remote sensing tools to discuss relevant weather patterns. Middle schoolers were challenged to look at past remote sensing images to help predict 'future' weather events. We also used ArcGIS to demonstrate how local landscapes in our region change over time and worked with students to discuss the potential impacts of those LULC changes to water and air quality.

The Remote Sensing and GIS Symposium was sponsored by VirginiaView, the VT Office of GIS, and the Virginia Space Grant Consortium. This symposium provided students and faculty from across the Virginia Tech community with the opportunity to participate in a 5 hour long symposium and a student geospatial poster presentation / competition. Eight speakers shared their remote sensing related research with faculty, staff and students. Thirty-three undergraduate and graduate students participated in the poster session. VirginiaView provided student (undergraduate and graduate) student poster awards. The remote sensing Interdisciplinary Graduate Education Program (IGEP) provided support for a post-symposium / poster session social.

Photos from the VirginiaView OGIS Symposium

❖ **California View**

We set up various interactive imagery exhibitions (County Landsat State Puzzle, City Arial Photography Matching Game, Google Earth Matching Game and other educational information on earth observation from air and or space

❖ **Wyoming View**

Eighth grade students (4 sections) were introduced to remote sensing science and applications (March 31) and WyomingView PI related these materials to what they learned in Electromagnetic radiation chapter (physical science class). Next, students measured the spectral reflectance values of live and dead leaves from deciduous and conifers (April 1 and 2) using ALTA Spectrophotometers. Students then entered the measured values in MS Excel, calculated percent spectral reflectance values and plotted them. We compared the plots for different leaves (May 19) and this followed by a discussion on satellite remote sensing, and how images collected by Landsat and other satellites can be used for monitoring environmental changes.

❖ **North Dakota View**

A display was set up in their student union through April 21. It includes information on Earth Observation Day, AmericaView, NDView, and the Landsat program. It has URLs that people can use to find more information. The display is in an area near a heavily used entrance and also near the food court. I asked about traffic, and there is no good estimate, although the best guess is at least 600 students per day pass that spot.

❖ **Pennsylvania View**

Introduction to Geography students completed the Land Use / Land Cover exercise. Remote Sensing students worked with SATCAM and discussed citizen scientists, and completed an application on Pictometry On – line.

Appendix D
AmericaView Expenditures for GY 2013
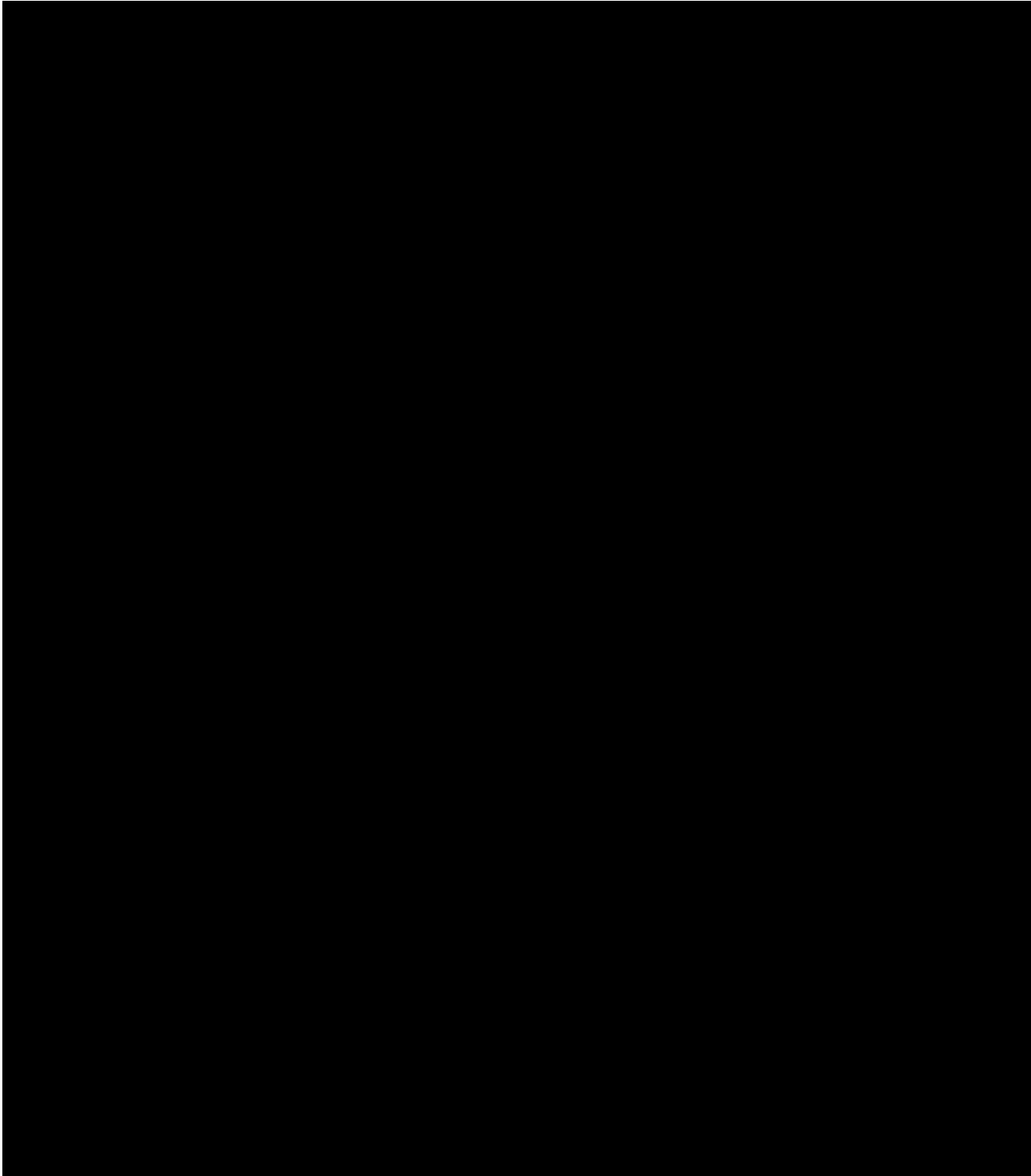
APPENDIX E – StateView Fact Sheets for GY 2013 (in alphabetical order)

These fact sheets cover the period December 1, 2013 through December 31, 2014.

AlabamaView

Remote Sensing Activities

2013 - 2014

Improving Utilization of Remote Sensing Resources

Airborne LiDAR Processing
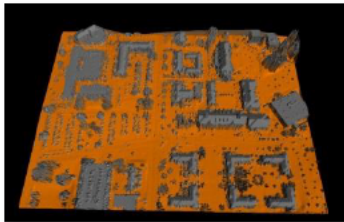
Example of ground classification of urban airborne LiDAR point cloud data represented as a triangulated irregular network (TIN)
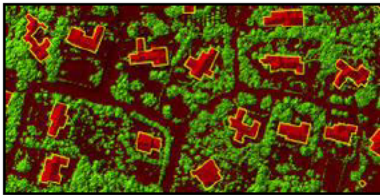
Geographic Object Based Image Analysis (GeOBIA) classification of point cloud data greatly assists in quantifying urban tree cover

One of the previous year's AlabamaView activities involved the processing of statewide airborne LiDAR products. Those were used during this reporting period. AlabamaView has established a strategic partnership with the Southern Research Station of the US Forest Service to map urban tree canopy and create a product that Forest Service employees can utilize and share to promote and maintain urban forests. This multi-year effort is important to the state of Alabama as urban trees and forests provide essential ecological, economic, and social benefits to a large part of the population. A graduate student partially funded by AlabamaView used the LiDAR data and CIR NAIP imagery to map urban tree cover using GeOBIA methods in combination with Landsat 8 Leaf-off imagery to separate deciduous and coniferous tree cover. The end product will be GIS layers of forest trees and canopy available to the public and Forest Service users as enterprise geodatabases.

Benefits to Alabama

The AlabamaView vision is to benefit the economic development of the state through the use of satellite, aircraft and ground based remote sensing information and technologies and their application to pressing issues in the state. To this effect, AlabamaView continues to work with public and private organizations at the state, county and local levels, through partnerships, to provide training and access to remote sensing data as well as access to products from remotely sensed data, and fostering workforce development. It is also supporting K-12 learning experiences in collaboration with the Alabama Science in Motion (ASIM) program and the Alabama Math, Science, and Technology Initiative (AMSTI) which will utilize satellite imagery in modules developed to train middle and high school teachers to bring remote sensing into the classroom.

Providing Remote Sensing Education

Training AMSTI Teachers

Another significant effort builds on last year's urban heat island (UHI) activity investigating UHI intensity using remote sensing and GIS techniques. Landsat 8 imagery (thermal bands) was used to measure UHI magnitude of urban areas in Alabama. A Co-PI employed by AlabamaView developed a module using remote sensing to help understand UHI. In the module, the factors contributing to specific location based UHI intensities are measured and analyzed. Thermal IR heat guns and temperature data sensors are then used to measure and monitor changes in temperature patterns. All of these data help educate state and local governments and other related organizations to ameliorate the impacts of UHI. To further extend education and outreach activities AlabamaView has prepared modules on UHI intensity and impacts using Landsat images to train AMSTI (Alabama Math, Science, and Technology Initiative) teachers. The teachers will use the modules to teach students the benefits of remotely sensed images and its various uses for years to come.

A module developed for the Alabama Math, Science, and Technology Initiative (AMSTI) engages Alabama middle school students in an activity illustrating the principles of thermal remote sensing and how it relates to Urban Heat Islands.

AlabamaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

GEOSPATIAL DATA PORTAL

This past year a student was employed by AlabamaView to develop an entirely interactive map interface for searching and downloading data. This was done through the deployment of server based Geographic Information System.

All data are now viewable with selected attributes that can be queried such as data type or the county in which the data are located. This new feature eliminates the need for users to visually parse through hundreds of data titles looking for what they need. As one of the few state resource for geospatial data, the portal provides a centralized site to access data for the citizens of Alabama.

UNMANNED AERIAL SYSTEMS

Small, lightweight, and inexpensive drone technology represents part of the future of remote sensing. These aircraft have interactive high resolution cameras mounted onboard that allow the user to visualize and photograph large or inaccessible areas. Given the high expense associated with traditional aircraft imagery this technology represents a significant cost saving measure. In the photo below, a student and collaborating geologist are using a drone to photograph the Wetumpka Impact Crater to further their geological understanding of this structure. The crater is being used as a shallow marine analog to help understand the environmental history of Mars.

3D MAPPING OF URBAN FORESTS

A portion of this year's funding was used by the PI and a graduate student are using to scan several Nuttall Oaks using a terrestrial LiDAR system. The trees were comprehensively scanned into datasets containing hundreds of millions of points. Each point represents a location on the surface of a tree which, when combined, can create precise surface models with an accuracy of 2 mm. These models are being used by urban foresters and land managers to accurately and remotely measure the surface area and volume of standing trees without the need for time-consuming manual measurements or destructive sampling. These trees are an important resource of many urban forests in the South.
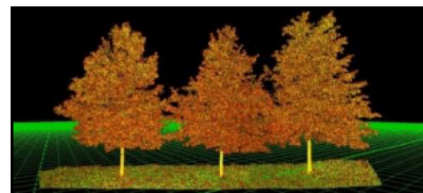
AlabamaView Consortium Membership

Auburn University

Jacksonville State University

Troy University

Alabama NRCS

University of Alabama at Birmingham

Auburn University at Montgomery

Alabama Cooperative Extension System

Tuskegee University

Alabama A&M University

Alabama Space Grant

AlabamaView partners develop, leverage, and disseminate remote sensing resources and applications. A great example is the AL NRCS sharing LiDAR data with AlabamaView who then trains students to process the data for Partners and the public to use in real world applications.

www.alabamaview.org
Follow us on Twitter @alabamaview

ArkansasView

Remote Sensing Activities

2013 - 2014

Providing Online Education in Remote Sensing and Geospatial Applications

Design of New Online Course for Stackable Certificate

Many Arkansas students are unable to attend a university in person to obtain remote sensing-related training for the job market. With a proposal and leadership from ArkansasView and faculty from the Center for Advanced Spatial Technologies (CAST), the University of Arkansas Global Campus (http://globalcampus.uark.edu/) launched the University of Arkansas' first ever undergraduate certificate (http://online.uark.edu/programs/certificate-proficiency-geospatial-technologies.php) in August 2014.

Website for online undergraduate certificate titled "Certificate of Proficiency in Geospatial Technologies" launched (with co-leadership from ArkansasView) by University of Arkansas Global Campus in August 2014.

Building upon the certificate's introductory remote sensing content, ArkansasView developed a proposal and design for an online course titled "Geodata Sources and Access" that highlights Landsat and other remote sensing data sources. Pending approvals from University of Arkansas Global Campus and the Arkansas Department of Higher Education, this 2-5 credit course will be part of new second and third "stackable" certificates beyond the "Certificate of Proficiency in Geospatial Technologies" and provide skills for remote sensing applications in energy, government, and business.

To prepare for course delivery, ArkansasView leveraged the skills of two graduate students (PhD and Masters) who researched existing online remote sensing tutorials, remote sensing data warehouses, and data access procedures. The five sections of the course include 1) introduction and motivation, 2) geodata, metadata, and provenance specifications, 3) government and non-government geodata sources, 4) commercial geodata sources, and 5) directions in geodata access and interoperability. Major laboratory highlights include the use of the USGS Global Visualization Viewer (GloVis) and other Federal remote sensing gateways.

Benefits to Arkansans

According to the Department of Labor's Employment and Training Administration (ETA), while overall the geospatial technology (including remote sensing) market is growing very rapidly, there is a real deficit of skills and training, and there are misconceptions about what skills are required. Many students in Arkansas benefit from online stackable certificates because they cannot relocate to a major university campus. There has been a steady stream of applicants to the first "proficiency" certificate. As ArkansasView continues to develop remote sensing materials for the additional certificates, Arkansans and others will increasingly have online access to this valuable training through their flagship university.

ArkansasView-supported graduate students demonstrate remote sensing-assisted silviculture workflows using the NSF-funded RazorVue collaborative display at the Center for Advanced Spatial Technologies (CAST) at University of Arkansas; ArkansasView's 2013-2014 course design allows many aspects of this same remote sensing learning environment to be transferred to online delivery.

ArkansasView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

Other ArkansasView Activities

In 2013-2014, ArkansasView presentations (e.g., at the 2014 AAG Annual Meeting in Tampa, Florida) focused on the emerging field of *geospatial provenance*. Provenance will allow remote sensing methods to be captured, analyzed, curated, and easily replicated. On this topic, ArkansasView PI Dr. Tullis was the lead author of the following book chapter, scheduled to be published in September 2015:

> Tullis, J.A., J.D. Cothren, D.P. Lanter, X. Shi, W.F. Limp, R.F. Linck, S.G. Young and T. Alsumaiti, 2015, "Geoprocessing, Workflows, and Provenance", in *Remote Sensing Handbook* (P. Thenkabail, editor), Vol. 1, Boca Raton, FL: CRC Press, in press.
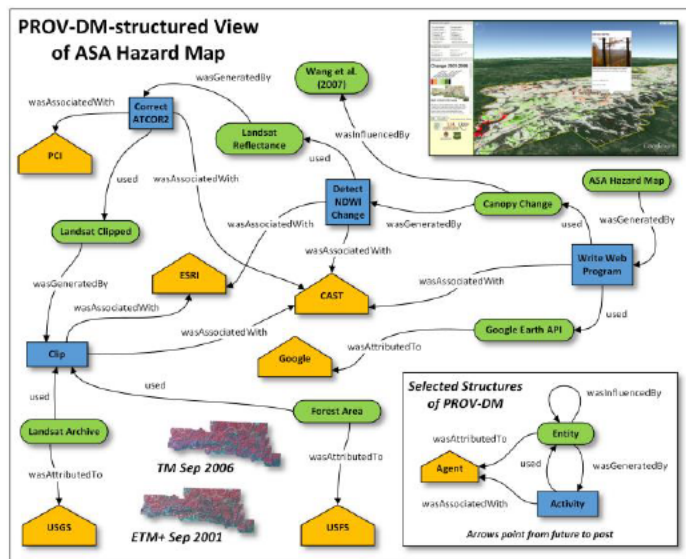
Selected provenance of ASA Hazard Map co-developed by ArkansasView and structured according to W3C's PROV Data Model; arrows (relationships) point from future to past, allowing reconstruction of remote sensing methods.

In 2014, ArkansasView began discussions with Communities Unlimited (www.communitiesu.org), a nonprofit, serving communities in Arkansas and six neighboring states. An important part of this organization's work addresses persistently poor rural communities' access to basic water infrastructure. ArkansasView provided geospatial support and participated in a workshop to develop a Communities Unlimited geospatial internship beginning in January 2015.

Along with the work on *Remote Sensing Handbook*, ArkansasView published the following refereed journal articles led by graduate students who were mentored with AmericaView support:

1. Young, S.G., J.A. Tullis and J.D. Cothren, 2013, "A Remote Sensing and GIS-assisted Landscape Epidemiology Approach to West Nile Virus", *Applied Geography* 45:241-249.

2. Jones, J.S., J.A. Tullis, L.J. Haavik, J.M. Guldin and F.M. Stephen, 2014, "Monitoring Oak-hickory Forest Change During an Unprecedented Red Oak Borer Outbreak in the Ozark Mountains: 1990-2006", *Journal of Applied Remote Sensing* 8(1):1-13.

ArkansasView Vision and Goals

ArkansasView Vision: Build educational partnerships in Arkansas to increase the skilled geospatial and remote sensing workforce, and to train students in effective remote sensing-assisted problem solving.

ArkansasView Long-Term Goals:

1. Develop partnerships with faculty, staff, students, and employees in university, state agency, and nonprofit organizations to build remote sensing and geospatial capacity in Arkansas.
2. Improve Arkansans' access to remote sensing and geospatial training both on university campuses as well as through online delivery.
3. Facilitate student interaction, including through paid internships, with organizations developing remote sensing and geospatial workflows that help improve quality of life.
4. Strengthen research at University of Arkansas (Fayetteville) and other campuses within the University of Arkansas System through a robust exchange of remote sensing and geospatial data and workflows.

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ArkansasView
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the ArkansasView Consortium

Graduate and undergraduate students in Principles of Remote Sensing develop a basic understanding of field spectroscopy; ArkansasView funds augment the remote sensing learning environment for a growing number of students from K-12 through PhD studies, and for both on-campus and off-campus students

ArkansasView, established in 2002, is a consortium of faculty, staff, students, and employees in university, state agency, and nonprofit organizations building remote sensing and geospatial capacity within Arkansas. This work is being accomplished primarily through educational, targeted research and outreach, and other remote sensing endeavors that benefit Arkansans. With support from ArkansasView, a new PhD degree in Geosciences with a geoinformatics track began in August 2014. This program allows doctoral students at the state's flagship University of Arkansas to focus more directly on remote sensing research questions. For undergraduate students, an ArkansasView-supported proposal to the Arkansas Department of Higher Education led to the August 2014 launch of an undergraduate certificate at University of Arkansas titled "Certificate of Proficiency in Geospatial Technologies," offered completely online. In a new partnership with Communities Unlimited (www.communitiesu.org), a nonprofit serving communities in Arkansas and six neighboring states, ArkansasView is facilitating student intern development of remote sensing-assisted workflows that address persistently poor rural communities' access to basic water infrastructure. Finally, ArkansasView is committed to object-based image analysis (OBIA) and geospatial provenance research that simplifies and strengthens remote sensing workflow design and innovation. Through grants received, ArkansasView is expanding remote sensing education, research, and geospatial applications in Arkansas and America.

Consortium Membership

ArkansasView activities are coordinated by the Center for Advanced Spatial Technologies (CAST) in the J. William Fulbright College of Arts and Sciences at University of Arkansas. Since 2002 a number of organizations have worked directly with CAST in realizing ArkansasView goals and initiatives. For example, the Arkansas GIS Office provides access to statewide remote sensor data; the EAST Initiative trains high school students in remote sensing techniques; and Communities Unlimited trains remote sensing students in applications that directly benefit the infrastructural outlook of underbuilt communities in Arkansas and six other states.

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CalView

Remote Sensing Activities

2013 - 2014

Promoting Remote Sensing Resources	Providing Remote Sensing Education

Public Outreach

Visitors were made aware of the CA drought situation using Landsat 8 imagery. At the same time water saving tips were made available.

Left: Visitors were able to locate the State counties on a magnetic Landsat imagery map.

CalView's outreach activities were displayed at the annual University of California Davis Open House (**Picnic Day**) in April 2014. Over 70,000 visitors attended the 100th **Picnic Day**. With GY 13 funding CalView offered a variety of hands-on activities. A water management area with irrigation and water-savings tips accompanied a change-over-time drought poster; a State mosaic puzzle map; a city of Davis magnetic puzzle; a wooden puzzle map and a geospatial activity corner for kids, including quizzes and art supplies were set up for interactive display.

Left: A wood puzzle tested the knowledge of the city's features and their locations on the map.

Training Workshops

Several activities completed in 2013-14 included a teacher-training workshop introducing Earth Observation Day lesson plans to high school teachers and educators from across the nation. The workshop was hosted at the National Science Teacher Association Conference in December of 2014. Over 15 teachers actively participated in the workshop.

Left: Co-presenter Tobias Spencer, a Rio Americano High School science teacher is working closely with CalView to integrate the workshop materials into the next generation science standards.

CalView partnered with the California Spacegrant Consortium offering geospatial education workshops to professionals and educators from northern California.

Right: Katherine Acord, UC Davis undergraduate student together with Pia van Benthem at the annual education workshop at NASA Ames Research Center.

Benefits to California

CalView's activities reach out to the general public in the State of California to educate about the benefits and applications of remote sensing imagery. The information provided helps the public to make better-informed decisions on pressing environmental issues like, for instance, the drought in California.

Education efforts such as the National Science Teacher Training Workshop informs teachers about the accessibility and potential applications of geospatial data sets and remote sensing imagery for subsequent dissemination to students in the classroom.

CalView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

Other CalView Projects

Use of RS Imagery at Public Venues

CalView was invited to present a poster on the drought situation in CA. Changes in water levels over time at a nearby reservoir were displayed using Landsat 8 Imagery at the "2014 Extreme Precipitation Symposium" at the University of California, Davis.

Above: The photograph shows the poster displayed at the conference attended by researchers from all over California.

Outreach

During the past year CalView presented a Landsat 5 state mosaic wall art as outreach materials to various audiences. The mosaics' color code corresponded with different legislative districts

Right: CalView State Coordinator Pia van Benthem presented the State Mosaic map to Senator Feinstein's office.
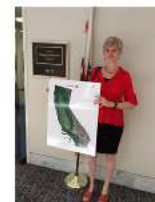
Above: Student Team is celebrating the final Lego map after a total of 180 hours of construction work.

Application of Geospatial Data Sets

CalView provided internships to undergraduate students at UC Davis with the goal to enhance their geospatial education. A group of students had the opportunity to build an elevation map of the state of CA out of Lego pieces. The map was then displayed at the San Francisco Exploratorium Science Museum demonstrating the impact of coastal fog patterns.

Below: Museum visitors got a hands-on demonstration of coastal fog flow distribution patterns.

CalView Consortium Membership

CalView is housed at the University of California Davis, and is part of the Center for Spatial Technologies & Remote Sensing (CSTARS), promoting the use of Landsat data for public education, outreach and research projects.

During the past grant year CalView expended its consortium to include members of the California GIS Council Working Group, as well as local industry partners.

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ColoradoView
Consortium Overview
2013 - 2014

General Overview of the ColoradoView Consortium
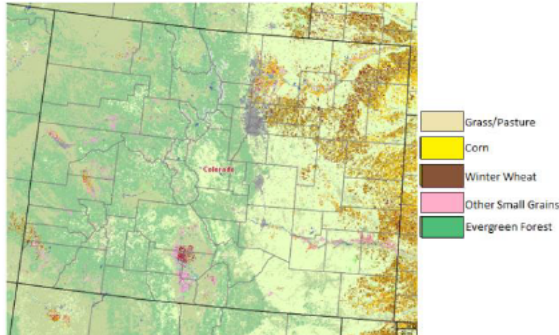
USDA's CropScape landcover classification for Colorado, based upon Landsat imagery.

Grass/Pasture
Corn
Winter Wheat
Other Small Grains
Evergreen Forest

In 2014-2015 ColoradoView (hereafter CV) will continue to focus on high impact tasks pertinent to Colorado stakeholders and will continue to carry out tasks that build upon our core strengths and interests. CV's broad objective is to facilitate innovative uses of Landsat and other USGS remote sensing data by educators and researchers in academia and government agencies who are working on issues that are important to the citizens of Colorado. CV promotes the use and integration of GIS and remote sensing data and derivatives for education, research, and decision-making.

CV activities will include the following: 1. Collaborate with agency personnel to assess the utility of satellite data for research on Colorado's grazing lands. CV will assess the utility of satellite data for: a) improved, spatially explicit assessments of grazing lands. 2. Facilitate the use of remote sensing and other geospatial data for modeling and predicting the spatial distributions of invasive species. 3. Work with the UV-B Monitoring and Research Program to improve its methodology for reporting UV and solar radiation according to land use-land cover types across the state of Colorado. 4. Add information, functionality, and data to the CV web site. 5. Facilitate the use of Landsat and MODIS data products in GIS and remote sensing (RS) courses taught at CSU within the Department of Ecosystem Science and Sustainability.

Consortium Membership

CV works to foster communication with partners and consortia members who are current or potential end users of Landsat and other USGS geospatial data. These currently include educators and researchers at Colorado State University, the UV-B Monitoring and Research Program, the Natural Resource Ecology Laboratory, and the Geospatial Centroid. USGS partners include grazing land and invasive species researchers. The CV consortium aims to expand further to include researchers at USDA, the USGS Northern Climate Science Center, and other agencies concerned with natural resources in Colorado.

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GeorgiaView

Remote Sensing Activities

2013 - 2014

Improving Utilization of Remote Sensing Resources

Analysis and Monitoring of Crops in Georgia
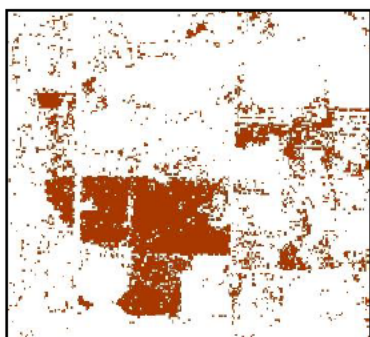
Pecan fields before improving accuracy

Pecan fields after improving accuracy

During this year GeorgiaView used Landsat imagery to identify and monitor crops in Georgia. Specifically, pecan fields were analyzed using the spectral and phenological characteristics. The accuracy of a current pecan map was examined. An outcome of the research was development of an algorithm that improves the accuracy of crop mapping from remotely sensed data. Evaluation indicates that the new algorithm can improve map accuracy by 30 percent. During the 2014 AmericaView Fall Technical Meeting at the University of California, Davis, research results, as well as applicability to other crops, were discussed. The improved pecan map can be found at: http://gis.westga.edu/gaview.

Benefits to Georgia

- Remote Sensing is a very important discipline of Geographic Information Science that is critical for urban and environmental planning/management for the State of Georgia into the future.
- The workforce development for STEM disciplines like GIScience and remote sensing are critical to the economic and environmental well-being of Georgia
- The rapid development and deployment of remote sensing technologies that are dynamically changing has the promise of developing into a large economic opportunity in the near future for a growing State like Georgia.
- In summary, GeorgiaView projects benefit Georgia significantly by improving planning methods, promoting safety and preparedness, educating our workforce, and facilitating information delivery.

Providing Remote Sensing Education

Remote Sensing K-12 Outreach

Again this year, GeorgiaView conducted several remote sensing outreach activities targeting K-12 schools. GeorgiaView promoted the importance and value of remote sensing to approximately 500 students and twelve teachers at K-12 institutions. Brandon Forrest and Dr. J.B. Sharma, University of North Georgia faculty, and their students held discussions at McEver Arts Academy and West Hall High School, both in Oakwood. Dr. Mark Patterson at Kennesaw State University gave AP Geography course students at Woodstock High School an overview of the utility of satellite imagery for exploring, mapping, and understanding the Earth. Dr. Seong also hosted high school students at the University of West Georgia.

This activity made me understand. more what the Geospatial engineering field will be like. I am in the National Guard as a Geospatial Engineer. This field trip probably helped me more than any one else.

A testimonial by a 12th grade student at Coweta Performance Learning Center after the 2014 Earth Observation Day event

Brandon Forrest promotes remote sensing with young students during an interactive session in Oakwood, Georgia

Other GeorgiaView Projects

A Long-Term Simulation of Chattahoochee River Migration

Dr. Tien Yee, Prof. Samuel Beadles and Dr. Sung-Hee Kim studied Chattahoochee River migration pattern using aerial photos taken in 1968 and 2010. The study concluded that the river may shift by as much as 40 meters by 2060. This movement may directly affect safety and the residential buildings near the river bank.
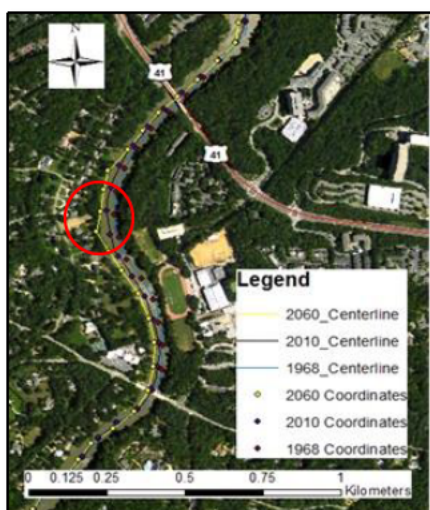
A simulation of Chattahoochee River Erosion

Online Remote Sensing Course Materials in AVUNIV.ORG

Dr. Seong has revised the online "Introduction to Remote Sensing" course materials offered free of charge at: http://AVUNIV.ORG The online course management system (i.e., Moodle) was upgraded from Version 1.8 to Version 2.8 in order to improve the performance and security. ArcGIS™ exercise videos were developed. Sixteen lecture materials and fourteen
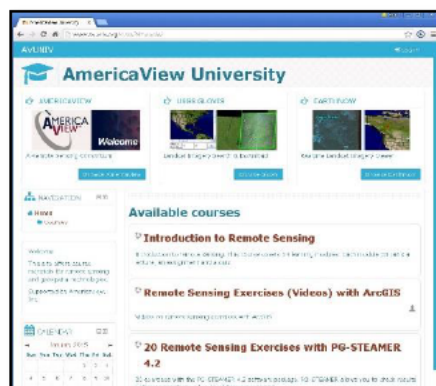
The new look of the online remote sensing courses at http://avuniv.org.

Mosaic of 1938 Chattahoochee National Forest Imagery

Dr. J.B. Sharma's students at the University of North Georgia have completed a 1-meter resolution ortho-photo mosaic of the 1938 Chattahoochee National Forest (CNF). Hardcopy photos of 1938 aerial imagery of this region were scanned and mosaicked. Lower resolution layers were made of the mosaic and then uploaded onto a website using Google Earth API. They are available at: https://web.ung.edu/gis/hallco/historic/index.html The orthophoto images are served through the Google Earth™ interface that is embedded in web browsers.
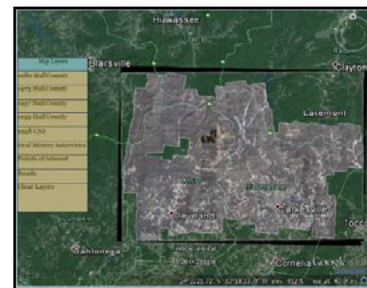
1938 orthophoto mosaic, Hall County, GA

GeorgiaView Vision and Goals

GeorgiaView Vision:

Develop a collaborative geospatial user community in the state of Georgia, within which remote sensing datasets are practical sources for applications and research.

GeorgiaView Long-Term Goals:

1. Prepare the future workforce for the dynamic field of geospatial technology
2. Facilitate access to remote sensing data for Georgia
3. Support K-12 STEM (science, technology, engineering and math) education with remote sensing and geospatial technologies
4. Tackle state-wide environmental challenges by supporting remote sensing research
5. Develop the GeorgiaView consortium such that it meets the needs of Georgia and participates synergistically within AmericaView

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GeorgiaView
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the GeorgiaView Consortium

Celebrating the 2014 Earth Observation Day with Coweta County Performance Learning Center students

Founded in 2003, the GeorgiaView Consortium is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. GeorgiaView's vision is to develop a collaborative geospatial user community in the state of Georgia, within which remote sensing datasets are practical sources for applications and research. GeorgiaView members have significantly impacted the State of Georgia through education, remote sensing and geospatial data sharing, research projects, and outreach efforts. GeorgiaView's mission will continue to prepare the future workforce for the dynamic geospatial technology fields, by supporting K-12 STEM (science, technology, engineering and math) education, by addressing regional environmental challenges, and by developing collaborative outreach efforts.

Consortium Membership

The GeorgiaView Consortium is open to the public, governments, institutions, universities and industries. The current GeorgiaView Consortium members are Kennesaw State University, Georgia State University, Georgia Southern University, The University of Georgia, Atlanta Regional Commission, University of North Georgia, Rotorworks LLC, Georgia College, Skidaway Institute of Oceanography, and University of West Georgia. GeorgiaView envisions expanding consortium memberships to include more industries and K-12 institutions.

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HawaiiView
Remote Sensing Activities
2013 - 2014

Providing Remote Sensing Education

Landsat 8 Science Kits

Overview

The reliable performance of the 2013-launched Landsat 8 satellite continues the USA's 40 year program of monitoring the Earth from space. To encourage understanding the impact of the data, Hawai'iView developed self-contained "Landsat 8 Science Kits". This year, glasses and prisms were added.

The Land sat 8 spacecraft prior to launch (left) and an artist's impression of the satellite in orbit (right). Images obtained from http://landsat.gsfc.nasa.gov

Success with this project continues to provide a "lesson in box" that is being used in K-16 programs. Hawai'iView's hands-on exercises introduce students to the technology of the Landsat 8 mission and demonstrate how the measurements made by a complex and space-hardened satellite can be replicated on the desktop.

Learning about Light and Heat in Classrooms and Hawai'iView Workshops
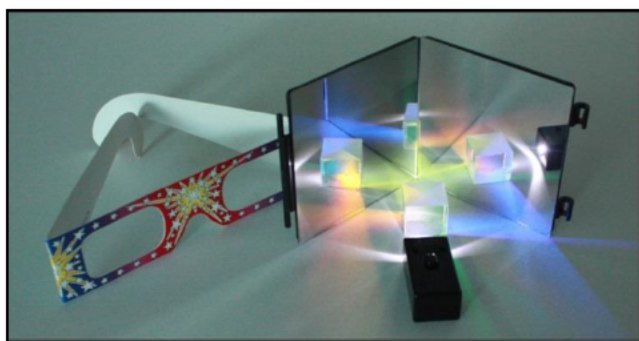
The science kits contain mirrors, prisms, diffraction glasses, and LED lights to illustrate how the Landsat 8 Operational Land Imager makes multi-spectral measurements of the Earth's surface

Landsat 8 has two instruments onboard that make measurements of the amount of light and heat reflected and emitted from Earth's surface. Scientists use these measurements worldwide to evaluate how healthy our forests are, how clean our lakes and rivers are, how the crops we eat respond to drought, how the cities we live in heat up during the day and cool down at night. In workshops, designed by Hawai'iView to explain how these instruments work, participants are introduced to concepts of light and heat using some simple and fun experiments.

The Science Kits, used in January for 21 8th graders at Roosevelt High School in Honolulu, are also included for educational workshops, such as the two conducted during the 2015 Astronaut Ellison Onizuka Science Day, in Hilo. All 4th-12th grade students, parents, and teachers of any grade level were eligible to attend.

Replicating OLI and TIRS on the Desktop

Landsat 8 carries the Operational land Imager (OLI) and Thermal Infrared Sensor (TIRS). Although these instruments are orbiting at an altitude of 705 kilometers above the Earth's surface and moving with a velocity of 7.5 kilometers per second, students can replicate the sensor' measurements on the desktop using a low cost instrument set. They more easily grasp the underlying sensor technology principles deployed on a sophisticated launch- and space-durable satellite system. Each HawaiiView Science Kits contains a handheld reflectance spectrometer and a hand held infrared radiometer. Students make measurements using these instruments and plot the data themselves.

Left: The reflectance spectrometer and infrared radiometer included in the science kits to replicate the measurements made by the Landsat 8 spacecraft.
Right: examples of leaf spectra made by a student during one of Hawai'iView workshops

Fun with the Self-Contained Educational Resource

The HawaiiView Landsat 8 science kits contain everything needed to conduct the experiments, including stationery that changes color using the heat from your hands.

Benefits to Hawaii

Lesson plans, focused on Earth observation science, explore aspects of physical science, technology, engineering, and mathematics that can be applied to solve real world problems, in disciplines such as geography and environmental science. However, providing students with the hands-on experience of making remote sensing measurements in the classroom is beyond the budget of the majority of classroom teachers. The Landsat 8 Science kits are available free of charge, and have been successfully used at several workshops in the State of Hawaii to introduce the next generation of scientists to the science and technology behind the Landsat 8 mission.

HawaiiView Vision

HawaiiView Vision: Increase public appreciation for the contribution that Earth observation makes to our nation's ability to monitor its natural resources, by hosting exciting, hands-on educational workshops for school children, their teachers, and their parents.

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HAWAI'I VIEW

IowaView
Remote Sensing Activities
2013 - 2014

IowaView

Improving Utilization of Remote Sensing Resources

Remote Sensing Business Plan

In 2014, a new geospatial business plan was completed for three statewide GIS data layers, including high-resolution remote sensing imagery. These layers, plus six existing datasets, make up the Iowa Geospatial Infrastructure or IGI. Business plan development was led by IowaView staff. Previously, local governments and state agencies completed their own planning and implementation of imagery projects with little coordination or sharing of resources between sectors. The new business plan compares the cost of each sector doing their own projects, with new options for state agencies supporting local government projects and the federal National Agriculture Imagery Program (NAIP).

Recent County Aerial Photography Projects
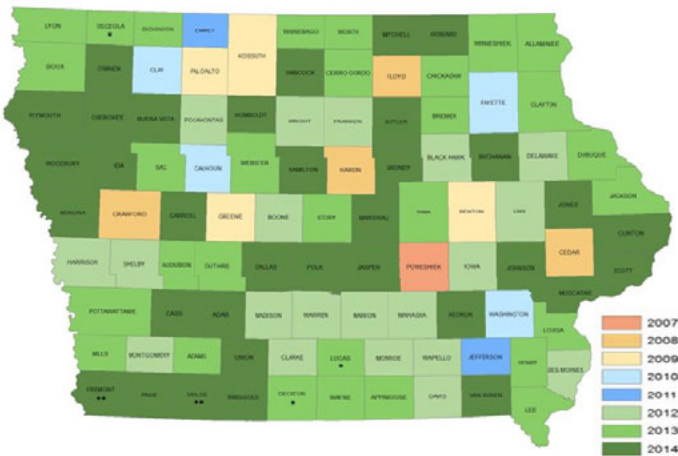
Map showing the status of county orthoimagery programs. Currently, counties receive little support from the state, nor do they coordinate among themselves to reduce costs. The last state-led program was in 2007-2010.

Benefits to Iowa

The remote sensing business plan led by IowaView staff identified a different kind of collaboration where state agencies financially assist local governments as they collect new imagery over the next five years. While this option will cost about the same as a single statewide one foot resolution orthoimagery collection, by supporting local higher resolution projects and the USDA NAIP program, four separate acquisitions of statewide imagery can be collected and made available to all users. All sectors will save money, and users will have more and better imagery from which to choose.

Providing Remote Sensing Research

Agricultural Tile Mapping Project

In collaboration with the Iowa Department of Natural Resources and US EPA Region 7, new methods for mapping agricultural drainage tiles with remote sensing imagery were developed by IowaView. This research will lead to a business plan for mapping the extensively tiled areas of central Iowa.

The purpose of the tiles is to remove excess water from the soil profile so that farmers can efficiently plant their corn and soybean fields in the spring. The location of the tiles becomes apparent after a soaking rain. The surface dries more quickly over the tiles, especially a few days after a one-inch or greater rainfall. Research into timing of aerial photography flights and interpretation of imagery and GIS mapping of features have shown that a large-scale program to map tiles over a wide area is possible, but requires more resources than a standard aerial photo campaign due to timing of flights to insure all areas have the desired visual characteristics.

Drainage tiles are visible on this CIR photo of central Iowa from 2014. The soil profile dries more quickly directly over the tiles, creating the lighter, linear patterns. Criss-crossing patterns indicate that more than one set of tiles was installed in the same field.

Remote Sensing Education

Several remote sensing education activities were supported by IowaView in the past year. Two undergraduate technical assistants were trained to search, download and process Landsat imagery for our clients to use in various classroom and research projects. A GIS Day event was hosted on the ISU campus and the Remote Sensing Business Plan was presented to stakeholder groups.

Using Mapgive training materials made available by other states, IowaView developed a program for training youth and university students to use Open Street Map for service projects. Mapping events are planned for MLK Day, Earth Observation Day and a 4H Leadership Camp in 2015.

OpenStreetMap
The Free Wiki World Map

Remote Sensing Archives

Since 1998, the Iowa Geographic Map Server (aka the Ortho Server) has provided a public viewer for many statewide collections of Iowa imagery, including 2004-2013 NAIP; historical imagery from the 1930s, 50s, 60s, 70s, 80s, and 90s; and two recent color infrared (CIR) projects. In addition to the viewer, the data sets are available as web services.

Using AmericaView funding, Landsat imagery was downloaded and added to the archive. Several new web services are being made available, including derivative products for monitoring crops, crop residues and cover crops. This will support the development of yearly land cover time series on a field-by field basis.
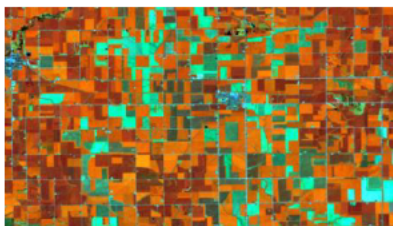
New collections of Landsat imagery are being added to the Iowa Ortho Server.

Mapping Conservation Practices

In partnership with the Iowa Nutrient Reduction Center, new methods were assessed to map the use of conservation practices that reduce soils erosion and nutrient loss from farm fields. These practices include installing permanent vegetative buffers and grassed waterways, leaving crop residues on fields, and planting cover crops in the fall. Remote sensing from a variety of platforms such as Landsat is well suited to monitoring these practices and will be critical for state programs to reduce the amount of nutrients entering streams and reaching the Gulf of Mexico. Leadership is being provided by IowaView to build data archives, conduct research and educate stakeholders about the utility of remote sensing technology.
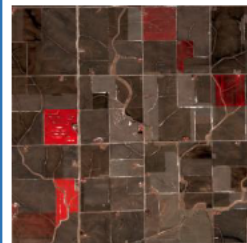
February satellite photo showing cover crops in red. Imagery in other seasons is needed to distinguish these fields from pasture or hay.

IowaView Consortium Membership

The mission of the IowaView consortium is to increase the knowledge and use of remote sensing and other geospatial technologies for the benefit of the citizens of Iowa, through education, research and service. IowaView supports the collection and management of publicly accessible remote sensing data archives, including the Iowa Geospatial Infrastructure (IGI), Iowa's contribution to the National Spatial Data Infrastructure (NSDI).

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IdahoView

Remote Sensing Activities

2013 - 2014

Improving Remote Sensing Products

Calibrating Satellite Data with Ground-Based LiDAR
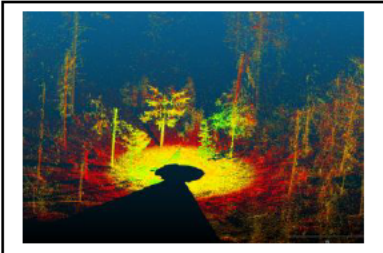
Lidar image acquired with autonomously operating terrestrial LiDAR (ATLS)

Autonomously operating terrestrial LiDAR (ATLS)

To minimize costly ground truth measurements of vegetation biomass for calibrating satellite imagery, IdahoView funded a project to test the suitability of a low-cost, autonomously operating terrestrial LiDAR (ATLS) scanner developed at the University of Idaho for calibrating satellite imagery.

Preliminary results show that the ATLS provides reliable ground truth measurements of vegetation biomass.

Benefits to Idaho

- **Improved Natural Resource Management**
  The research promotes the development of novel tools and techniques that allow translating remotely sensed data into information that is meaningful for decision makers in natural resources and beyond.

- **Engage K-12 students in STEM**
  The four, 5-day STEM summer camps served a total of 90 K-12 students. The main objective of the summer camp was to engage students in STEM.

Providing Remote Sensing Education

STEM Education

In 2014, IdahoView again helped fund Science, Technology, Engineering, and Mathematics (STEM) summer camps at the University of Idaho's McCall Outdoor Science School or MOSS.
http://www.uidaho.edu/cnr/moss

A total of 90 K-12 students were introduced to the basics of remote sensing during the STEM summer camps.

In addition, a remote sensing lesson plan that introduces students to LiDAR technology was developed and pilot-tested. A low-cost ($320) LiDAR instrument was developed for the lesson plan. The photograph below shows the working instrument.
http://ecosensing.org/research/k-12-education-outreach/affordable-lidar/

K-12 students and instructor working with low-cost ($320) LiDAR

IdahoView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

IdahoView Consortium

Idaho's three major universities are actively involved in IdahoView activities and share its leadership responsibilities. Camp participation and STEM programs continue to expand.

Remote Sensing Summer Camp for K-12 students across Idaho

Earth Observation Day

Earth Observation Day is STEM educational outreach event of AmericaView. IdahoView celebrates Earth Observation Day every year by introducing students from across Idaho to the basics of remote sensing.

Students participating in Earth Observation Day

Geospatial Data Access

IdahoView continues to assist researchers and stakeholders to access imagery, including Landsat data, via the Interactive Numeric and Spatial Information Data Engine (INSIDE) Idaho geospatial repository.
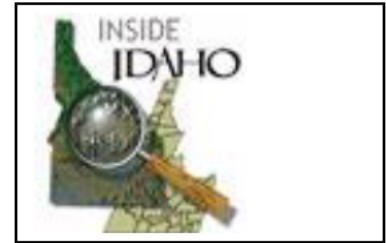
INSIDE Idaho, the state's main geospatial data repository

IdahoView Consortium Membership

IdahoView partners:

- Promote the development of novel tools and techniques that allow translating remotely sensed data into information that is meaningful to decisions makers
- Use remote sensing as a means to promote STEM interest and learning
- Seek to expand involvement to incorporate all higher education institutions in Idaho and any other interested parties
- Advance the availability and timely distribution of data by maintaining links to archives of publicly available satellite imagery for Idaho.

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http://idahoview.org/

IndianaView
Remote Sensing Activities
2013 - 2014

Providing Remote Sensing Education

Geospatial Lesson Plans for Middle School

IndianaView, in partnership with the Geography Educators' Network of Indiana (GENI), developed geospatial lesson plans, student tutorials, and on-line educational inter-actives directed towards middle school students built around the theme of natural hazards. The activities introduce GPS, Remote Sensing and GIS to students in grades 6-8, but can be adapted for younger and older students. The lessons are tied to the Indiana Academic Standards: Social Studies, Science English/Language Arts, and Math. This project was a result of a need identified by several IndianaView consortium members for education and outreach materials that use and highlight the state geospatial data initiatives. This project follows a previous duo of geospatial lesson plans that were generated for high school students. That material is available from the GENI web site (www.iupui.edu/~geni). The middle school lesson plans will be available from the same site after testing has been completed.

Path of a tornado, a natural hazard, near Washington, IL on November 16, 2013 is illustrated in this natural color image.

Benefits to Indiana

Geospatial lessons, developed by IndianaView and its partners, introduce middle school students to GPS, Remote Sensing and GIS by exposing them to state resources such as IndianaMap which incorporates over 270 layers of maps, the state climate web site (iClimate) for drought maps, Indiana Geological Survey data about earthquakes in Indiana and USGS sites for maps of forest forest fires (MODIS data).

Supporting Remote Sensing Projects

Mini-grant: Assessment of Tree Canopy Change at Indiana University, 2008 - 2012

Mini-grants are used to fund projects conducted by the consortium partners to promote the use of remote sensing image data. The most recent mini-grant funded an Assessment of Tree Canopy Change at the Indiana University - Bloomington campus (IUB).

Trees on the IUB campus are an integral component of the character, health, beauty and distinction shared by visitors, students, and life-long residents near campus (www.indiana.edu/~spea/pubs/woodland.pdf). Construction of new facilities and infrastructure and natural processes have resulted in recognizable declines to campus trees and forests. This project mapped canopy cover in 2008 and 2012 on campus and in surrounding neighborhoods. Results suggest canopy cover has declined in the study area by approximately three percent.

The tree canopy change study results are being used by the Indiana University Office of Sustainability's Environmental Quality and Land Use Committee to address one of their four focus areas (Land) and a specific campus goal "To ensure sustainable open space planning."
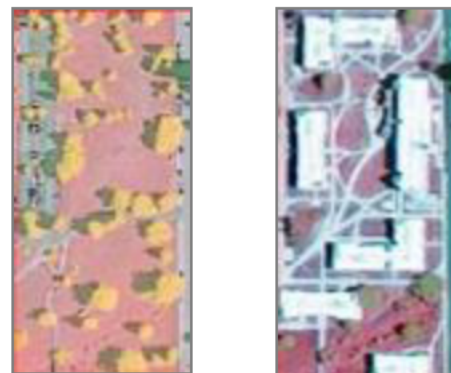
Example of an area within the Indiana University Bloomington Campus study area with significant tree canopy change from 2008 (left) to 2012 (right).

MultiSpec

MultiSpec is a free remote sensing software application that is used for education and research. Features added in 2014 allow users to easily combine the individual Landsat 4 band files provided by USGS into a single GeoTIFF image file similar to what can be done for Landsats 5, 7 & 8 and the ability to mosaic two images side by side or top to bottom. Another feature is the ability to specify "no data" or "fill data" values for statistics calculations.

A new tutorial made available on the MultiSpec web site illustrates how to use the "Change Image File Format" processor to manipulate the channels in an image file. The tutorial uses an accumulated daily growing degree day image file, one image channel for each day of the year, as an example.

GDDs	
■	< 0
■	0 - 500
■	500 - 1000
■	1000 - 1500
■	1500 - 2000
■	2000 - 2500
■	2500 - 3000
■	3000 - 3500
	>= 3500
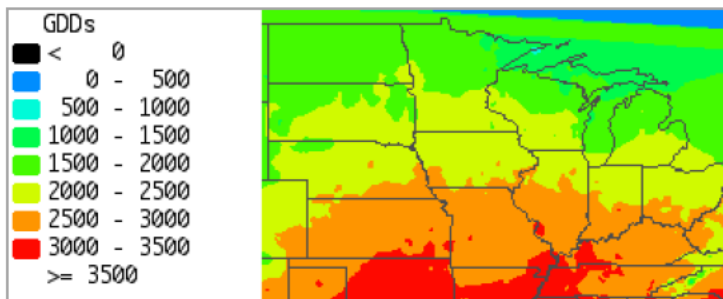
Illustration of growing degree days (gdd) for the Midwest accumulated from May 1 to September 7, 2014 that was created using MultiSpec.

engineering.purdue.edu/~biehl/MultiSpec/

IndianaView GloVis

The IndianaView portal provides easy access to analysis-ready images of Indiana including Landsat, ASTER and other image data such as MODIS Leaf Area Index (LAI) products and USDA National Agriculture Statistics Service crop data layers. Links are provided to a portal operated by a consortium member, Indiana University, which provides the aircraft acquired orthographic image data and to IndianaMap which provides many geospatial layers of information operated by consortium members IGIC & the Indiana Geological Survey. A link is also provided to a subscription service called PRESTIGE for near-real time MODIS data from Purdue's Terrestrial Observatory.

www.indianaview.org/glovis/

gis.iu.edu/

www.indianamap.org/

www.purdue.teragrid.org/prestige

IndianaView Consortium

Researchers and educators at partner institutions Indiana State University, Indiana University, Martin University, University of Notre Dame, the Indiana Geographic Information Council and CUSIS have participated in the IndianaView mini-grant program with projects involving K-12 education, general public outreach, research studies and educational lab development. Fact sheets are available at: www.indianaview.org/fact_sheets.html

Partners have used the Landsat data available from the IndianaView GloVis portal and have shared image data from their own research libraries to be added to the portal.

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KansasView
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Creating Synergies between Remotely Sensed Data and Inundation Libraries

Since 2007, KansasView has played a key role in flood response efforts in Kansas. Among other things, AmericaView and the Kansas GIS Policy Board have sponsored the production of a Segmented Library of Inundation Extents (SLIE), which is used to estimate areas that may be inundated during flooding events and has proven to be of great value to emergency planners and responders. KansasView Coordinator Kevin Dobbs works closely with the Kansas Division of Emergency Management (KDEM) and the USGS Disaster Response Coordinator.

To further its flood disaster support efforts, KansasView has secured a commitment from NASA to create a template for a Kansas version of the NASA Flood Dashboard. The Flood Dashboard delivers event-specific satellite imagery to end users along with image processing tools and algorithms for flood extent determination. AmericaView and the Kansas GIS Policy Board are supporting efforts to build upon the template to create a fully functioning Kansas version of the Flood Dashboard which will closely emulate the other dashboards that NASA maintains - see the Namibian Flood dashboard, for example). The Kansas dashboard will be customized to include major Kansas streams from the current Kansas SLIE database. The data flow of the Dashboard is represented schematically, below.

Providing Remote Sensing Education
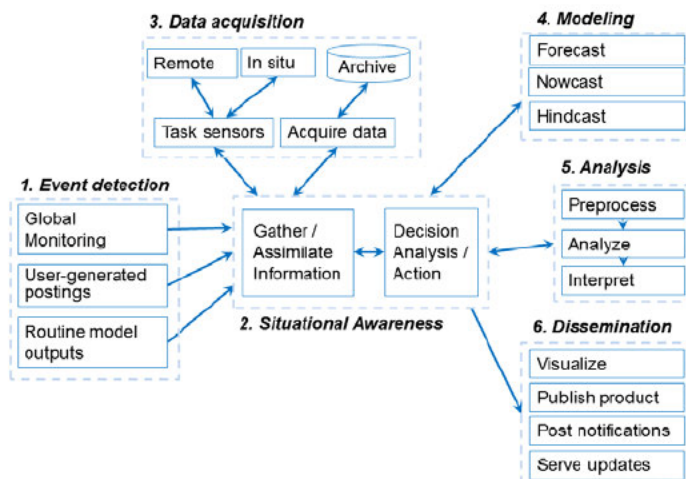
Introducing Remote Sensing at the HERS Summer Institute

KansasView Principal Investigator Stephen Egbert introduced remote sensing in an intensive three-module overview to the interns of the Haskell Environmental Research Studies (HERS) Summer Institute in June 2014. Conducting the laboratory portion of the short course was Joshua Meisel, a graduate of Haskell Indian Nations University in GIS and a graduate student at the University of Kansas.

HERS is sponsored by the National Science Foundation, the Kansas Technology Enterprise Corporation, the Kansas Board of Regents, and Haskell Indian Nations University and draws Native American student participants from tribes throughout the U.S. The HERS curriculum includes introductions to climate change science, GIS, remote sensing, and research methods.

Figure 1 KansasView PI Steve Egbert presenting remote sensing instruction to HERS Interns - June 2014

Goals: "The Haskell Environmental Research Studies (HERS) Summer Internship program is dedicated to preparing tribal college students for scientific and technical careers to help meet the challenges of climate change. The goal of the HERS Institute is to promote indigenous research and methodologies drawing on knowledge from Native locales and peoples to develop broad understandings and strategies for responding to climate change in Indigenous communities."

KansasView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. www.ksview.org

Land Cover Mapping

The Kansas Applied Remote Sensing Program (KARS), the lead agency in the KansasView Consortium, has mapped the land cover of Kansas since the beginning of the Landsat era in 1972.

The map shown below displays the land cover of Kansas and the watershed of the extended Kansas River Basin. It was created using Landsat and MODIS satellite imagery and a hybrid approach to mapping. Dana Peterson of KARS led the mapping team.
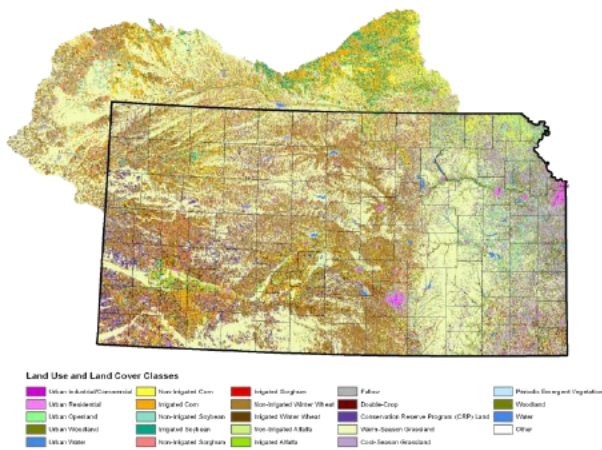
Figure 2 Land Cover Map of Kansas and the Greater Kansas River Basin

Lesser Prairie Chicken Habitat Modeling

The Southern Great Plains Crucial Habitat Assessment Tool (SGP-CHAT) was created at the Kansas Biological Survey under the direction of Mike Houts and Gina Ross to assist in conservation efforts focused on the Lesser Prairie Chicken. It provides a tool ~~that~~ "that prioritizes conservation actions while assisting with the siting of industry development." The SGP-CHAT tool may be viewed at: http://kars.ku.edu/geodata/maps/sgpchat/
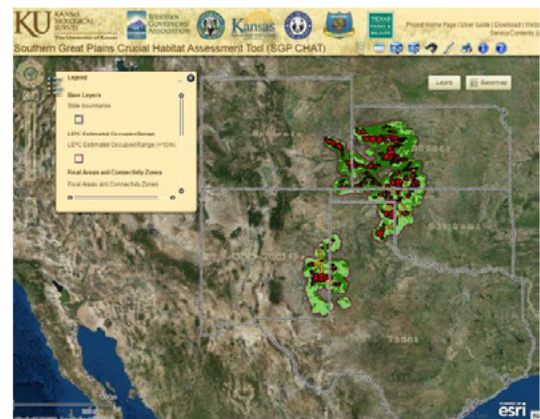
Figure 3 Screen shot of SGP CHAT Mapping Application

KansasView Consortium Membership

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KentuckyView
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Kentucky Spectral Library

One of the high-impact studies being conducted is the "Kentucky Spectral Library" (KSL) project - the key step in establishing a statewide spectral database of different natural and man-made materials in support of environmental planning and modeling activities. The KSL project encourages collaboration among institutions within Kentucky as well as interested institutions from surrounding States and the Federal government, which should improve collaborative efforts, such as invasive species mapping and forest health studies, which started in 2014.
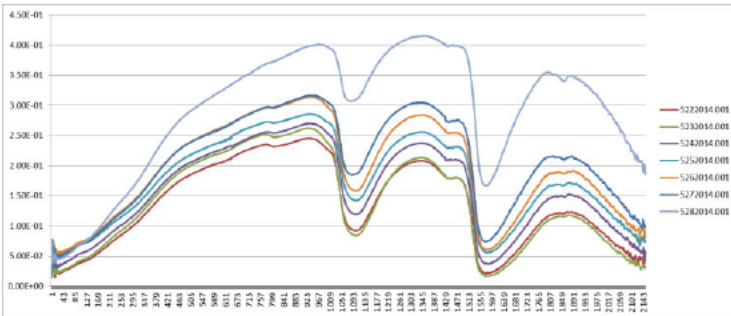
Reflectance spectra of soil samples collected in Calloway County, KY.

Field sample collection.

Sample analysis and spectral measurements in the lab.

Benefits to the Commonwealth of Kentucky

The primary focus of KentuckyView is on the use of images collected from spaceborne and airborne sensors, as well as other geospatial technologies, to support K-16 education, applied research, and public outreach. The Kentucky Spectral library has been utilized to help process satellite data, such as Landsat 8.

Remote Sensing Research

Soil Moisture Monitoring Program

Information on soil moisture conditions is critical for the prediction of precipitation, and evapotranspiration (ET), runoff generation and flooding, contaminant movement through soils, ground water recharge, irrigation scheduling, and mobility or trafficability of vehicles and agricultural machines. The problem of understanding regional soil moisture distribution should not be trivialized. No methodology has been developed to date that is fully capable of reliable soil moisture measurements over large regions. Seasonal soil moisture maps of Kentucky from Surface Energy Balance Algorithm for Land (SEBAL) provide valuable information on a variety of water resources issues such as: evaluating water distributions, water use by different land surfaces, and better management of ground and surface water resources. This research project will help KentuckyView further develop SEBAL for use in sub-tropical humid watersheds. The project will also aid in understanding whether relationships exist between land cover and temporal changes in soil moisture. For the state of Kentucky, this project will inform the water research community and improve understanding the environmental conditions which allows Kentucky to manage the water resources more efficiently.

Contact: Dr. Sung-ho Hong, shong4@murraystate.edu
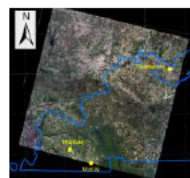
Landsat 8 image of Western Kentucky April 25, 2014.
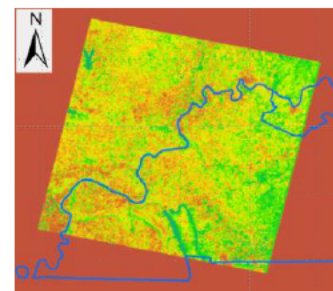
Evapotranspiration (ET) map of Western Kentucky using Landsat 8 Operational Land Imager and Thermal Infrared Sensor April 25, 2014.

ET (mm/d)	
	0.0
	< 1.0
	< 2.0
	< 3.0
	< 4.0
	< 5.0
	< 6.0
	< 7.0
	< 8.0
	< 9.0
	> 9.0

Earth Observation Day

Date of Event: April 22, 2014

Title of Event: *Earth Day and Earth Observation Day Meeting*

Organizer: Dr. Haluk Cetin

Teachers: 7

Students: 32

Others: 2

Earth Day and Earth Observation Day celebrations, organized by Dr. Haluk Cetin, were held in a combined meeting at the Curris Center of Murray State University (MSU) on April 22, 2014.

Keynote speaker, Mr. Lewis Graham, CTO, GeoCue Corporation.

The event started at 10:00AM with poster presentations of 18 MSU students (six graduate and 12 undergraduate posters). At 11:00 AM, the Keynote speaker, Mr. Lewis Graham, President and Chief Technical Officer of GeoCue Corporation, gave a talk entitled "Enhancing the GIS Desktop with Light Detection And Ranging (LiDAR)." That excellent presentation was followed by more poster discussion.

Earth Observation Day oral session.

In the early afternoon, six graduate students of the Advanced Remote Sensing class of Dr. Haluk Cetin presented their Term-projects to the audience. Concluding the fully scheduled day, one *Directed Studies* class undergraduate student and 19 *Introduction to Remote Sensing* class undergraduate students of Dr. Cetin discussed their Term-projects.

Earth Observation Day poster session.

KentuckyView Consortium Membership

- *Morehead State University – Institute for Regional Analysis and Public Policy*
- *Kentucky Division of Geographic Information*
- *Kentucky Geological Survey*
- *Eastern Kentucky University – Department of Geography*
- *Jefferson Community and Technical College*
- *Kentucky State University*
- *Murray State University - Mid-America Remote Sensing Center and the Department of Geosciences (official member of record)*
- *University of Kentucky – College of Agriculture*
- *Western Kentucky University – Department of Geography and Geology*
- *University of Louisville – Center for Geographic Information Sciences*
- *Northern Kentucky University – History and Geography Department*

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hcetin@murraystate.edu

Websites:
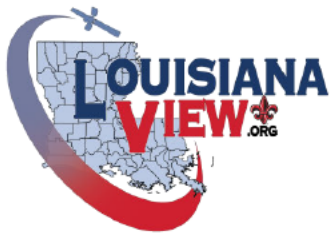
http://www.kentuckyview.org

http://www.kyview.org

LouisianaView

Remote Sensing Activities

2013 - 2014

Louisiana Hurricane Season GeoSpatial Data Mining Workshop

This annual workshop, held in early June each year, is now entering its fifteenth (15) year. Through the cooperation of LouisianaView consortium members and co-sponsored with local USGS representatives, this workshop is offered free to those in Louisiana and surrounding states interested in up-to-date information on data availability for the geospatial emergency responder.

Above: Pictures of Instructors and participants during the June 5, 2014, GeoSpatial Emergency Responders Workshop. Twelve Federal and State Agencies interested in GeoSpatial Disaster Data Acquisition, Management and Distribution gave presentations to more than 45 area, state and regional geospatial data responders.

This workshop highlights geospatial datasets related to hurricane season preparation, emergency response operations, and ongoing recovery efforts. Presentations include an overview of the data clearinghouses, applications, and data acquisitions of federal and state agencies that collect and host geospatial data, as well as operations and planning updates for the upcoming hurricane season. Participants follow along on desktop computers to identify, locate, and view geospatial data and information, all of which are provided by the coordinated efforts of the UL Lafayette Regional Application Center and LouisianaView.

Benefits to Louisiana Higher Education

LouisianaView works alongside higher education within the state by co-sponsoring undergraduate and graduate student poster competitions held each year as part of the Louisiana Remote Sensing and GIS Conference. The pictures above were taken at the May 2014 Conference held in New Orleans, Louisiana.

LouisianaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each

Intimate Science – Intersection of Science, Art and Technology

In much of the work we do, images from Satellites play a large role in the way we study climate change, weather patterns, natural and man-made disasters, timber-stand health and mankind's development and use of the Earth's resources. In studying these images we also find many of the fundamental elements of fine art such as tonal quality, image composition and balance. In this exhibition, working with the USGS "Earth As Art" program and NASA Landsat satellite imagery, we comprised images to excite the imagination and entertain creative fancies. More than 30 images from satellite systems were displayed for multiple gala events and school visitations during 2014, entertaining a host of people with images that depict the science of the region and invoke the art of the Earth's natural landscape. All anyone had to do was bring along imagination!

During the month of November the "Earth As Art" gallery exhibit was on display at the University library and welcomed viewing from more than 500 university students and visitors during that time.

Louisiana Continues Earth As Art Education and Outreach

"Earth As Art" has been a theme for the LouisianaView program over the course of 2014, visiting many areas around south Louisiana. One such endeavor was placing the display at the first annual SMART Festival on October 25th, 2014, engaging high school and university students throughout Acadiana with both technology and art. The "Earth As Art" display consisted of more than 30 images and a 9x20 foot "Earth at Night" canvas. More than 300 students and their families were introduced to images of the Earth and interactive educational games to illustrate landforms on the earth and their relation to art.

Earth Observation Day Ornament Contest
The University of Louisiana at Lafayette's Regional Application Center, working on behalf of LouisianaView, established an outreach program on November 17th, 2014, to local middle schools and their 4-H clubs to participate in an Earth Observation Day Ornament Contest. The participants were asked to make an ornament that reflected their view and understanding of the Earth. LouisianaView volunteer staff members participated by giving classroom presentations about the Earth's geography and the use of remote sensing before the students engaged in creating their masterpieces. The winning ornaments of the contest will be placed on display at our 2015 LouisianaView Earth Observation Day celebration at the University of Louisiana at Lafayette. More than 75 children participated in the event.

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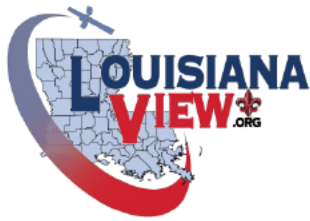
LouisianaView

Consortium Overview

2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the LouisianaView Consortium

The goal of the LouisianaView program, since its establishment in 2002, has been to promote the use of remotely sensed and GIS data by creating a consortium in the state that has facilitated research, data dissemination, education, outreach, and technology transfer in ways that have leveraged federal and private investment in remote sensing instruments and data.

LouisianaView consortium members met in Lafayette , Louisiana, for the 14th Annual Remote Sensing Emergency Response Workshop in June 2014.

LouisianaView activities have been designed to:

1) strengthen a Louisiana consortium of geospatial data users;
2) actively work with consortium members to build an archive of multi-sensor satellite imagery and aerial photography, including a user-friendly dissemination mechanism;
3) provide educational opportunities for students at the University of Louisiana at Lafayette and for public end users;
4) provide technological support and technology transfer to data users; and
5) collaborate in statewide, regional and national remote sensing research.

Consortium Membership

UL Lafayette Regional Application Center, Program Lead
Louisiana Army National Guard – GeoSpatial Center
Louisiana Dept. of Environmental Quality
USGS Louisiana Mapping Partnership Office
USGS National Wetlands Research Center
Corp of Engineers - New Orleans District
Louisiana State University
Louisiana Coastal Community Resiliency Studio
USDA Natural Resources Conservation Service – LA
Louisiana Dept of Agriculture
Louisiana State GIS Council
Louisiana GOHEP GeoSpatial Data Division

LouisianaView Principal Investigator:

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MichiganView
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

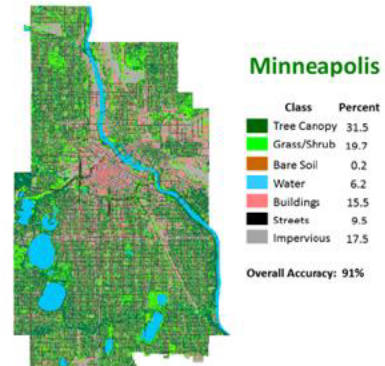### Geospatial Software Tools to Enable Remote Sensing Scientists and Educators

A Michigan Tech Research Institute intern works with the ImageSwipe tool
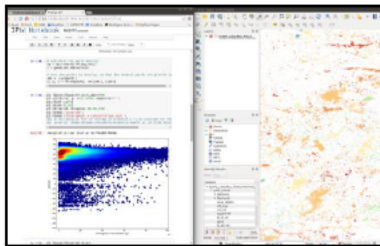
pyGTiff tools allow for advanced geospatial processing within both Linux and Windows environments

MichiganView has worked to develop innovative, user-friendly, and open-source remote sensing software tools that are useful to the remote sensing community. In the past year, two such tools have been made available via the MichiganView website. ImageSwipe is a tool that enables a pair of remotely sensed images with the same geographic extent to be visually compared at the same time. It can be embedded in web pages and used to show, for example, land cover change over time. pyGTiff is a software program that enables robust geospatial analysis tools to be applied within the simple and widely used Python programming language.

Benefits to Michigan

MichiganView provides:

- Collaborative opportunities for remote sensing students and professionals

- Access to Michigan satellite imagery and derived data

- Development of educational remote sensing materials for K-12 students

- Remote sensing software tools and training to students and non-expert professionals

- A conduit between Michigan's government representatives and the remote sensing community

Providing Remote Sensing Education

Exposing K-12 Classrooms to Environmental Remote Sensing Field Validation

For the past several years MichiganView has worked with a local Michigan elementary school to develop an educational program that introduces young students to remote sensing and ecological research. The program, which so far has focused on fifth-grade students, starts with in-class lessons where students are taught the basics of remote sensing and wetland ecology. The classroom-based lessons include learning how to identify common wetland plants, how aerial imagery is collected, and the effects of invasive plants.

A field trip to a local wetland allows students to put their newly acquired knowledge to use. Students use GPS units and cameras to record information about their study sites and, upon returning to the classroom, are able to upload their data to an online database where it can be viewed in conjunction with satellite imagery. This year's program took place in late October and included almost 100 participants.

Other MichiganView Projects

Remote Sensing Outreach and Education

MichiganView hosts workshops to promote new technology and foster collaboration between researchers.

In June 2014, MichiganView co-hosted a meeting at the University of Michigan to discuss the forthcoming ICESat-2 satellite for land and vegetation applications. The meeting was attended by leaders of the satellite project team and dozens of researchers from around the country.

Dr. Laura Bourgeau-Chavez gives a presentation at the ICESat-2/Landsat Vegetation workshop at the University of Michigan

Data Holdings

MichiganView maintains a large archive of imagery that is available for download from michiganview.org.

In the past year, archive additions included:
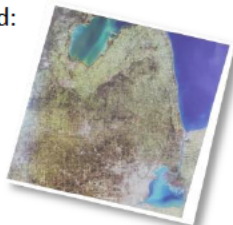
A selection of Landsat 5 and 7 covering the state from 1987-present

Updated MODIS Clear Sky Archive
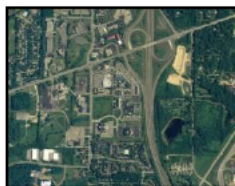
2012 National Agriculture Imagery Program (NAIP) Data

Data Distribution

MichiganView has partnered with other AmericaView members to spearhead the implementation of the Earth Observation Depot Network (EODN). The EODN is a nationwide remote sensing data distribution system that employs cutting edge technology in data logistics to deliver imagery to end users. In 2014, the Michigan Tech Research Institute became one of many data depots located around the country.
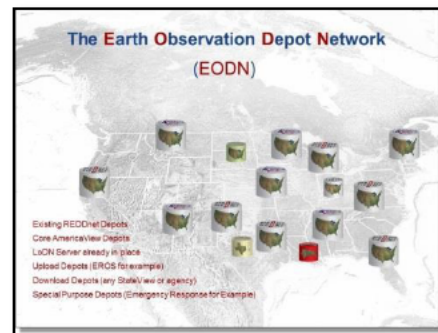
MichiganView Consortium Membership

MichiganView is a statewide consortium of academic member institutions. As a state member of the USGS sponsored AmericaView program, its mission is to promote the use and further the science of remote sensing technologies in Michigan schools, governments, and industries.

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MinnesotaView
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Development of Satellite Remote Sensing for Mapping and Monitoring Minnesota Land and Water

In collaboration with Minnesota agencies, the University of Minnesota is actively involved with research on satellite data, particularly Landsat, for mapping land cover and water quality. Examples are shown below. A new project this year will update the land cover classification of the state at 30 meters and at $1 - 2$ meters for selected urban areas.

Minneapolis

Class	Percent
Tree Canopy	31.5
Grass/Shrub	19.7
Bare Soil	0.2
Water	6.2
Buildings	15.5
Streets	9.5
Impervious	17.5

Overall Accuracy: 91%

Minneapolis land cover classification of QuickBird and LiDAR data by Object-based image analysis at 0.6 meter resolution

Twin Cities Metropolitan Area

Overall Accuracy: 91%

Land cover classification of the seven-county Twin Cities Metropolitan Area with multi-temporal Landsat and LiDAR data by Object-based image analysis at 30-meter resolution

Minnesota Lake Clarity

Water Clarity
SDT (m)
> 4
2 - 4
1 - 2
0.5 - 1
< 0.5
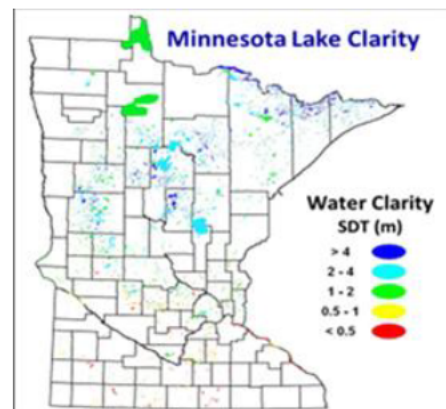
Landsat classification of lake water clarity, an indicator of water quality, for more than 10,500 lakes

Benefits to Minnesota

MinnesotaView supports the development, distribution and application of geospatial information derived from remote sensing data for mapping, monitoring and analysis of land and water resources in Minnesota. Classifications of land cover, impervious surface area and lake water clarity are being used for management and planning by Minnesota agencies at state and local levels.

Remote Sensing Core Curriculum

http://www.r-s-c-c.org/

This year development of the new underlying structure of the Remote Sensing Core Curriculum (RSCC) website was completed. The site was converted from a plain HTML format with varying layout, fonts, and organization for each lesson to a consistent organization and appearance.

The goal of the Remote Sensing Core Curriculum (RSCC) hosted by the University of Minnesota is to provide resources to support a state-of-the-practice educational experience. The RSCC is primarily geared toward university level education, but some lessons may be suitable for K-12. The RSCC is composed of contributions from authors from academia, government, and industry.

The RSCC was developed along the model of the NCGIA GIS Core Curriculum, to "augment the nation's supply of experts in remote sensing technology by providing a set of readily accessible, adaptable teaching materials." The RSCC is intended to provide a knowledge base of theory and techniques to advance the understanding and use of remote sensing and geospatial science.

The site offers lessons in Introductory Photo Interpretation and Photogrammetry, Remote Sensing of Environment, Digital Image Processing, and Applications of Remote Sensing. Between January 1, 2014 and September 24, 2014 the site received 112,801 unique visitors from countries in every continent but Antarctica.

Data Archival and Dissemination

An important part of the mission of the UMN Remote Sensing and Geospatial Analysis Laboratory and MinnesotaView is to archive and disseminate geospatial data, particularly maps, statistics and analyses that have been derived from remote sensing.

Examples of the holdings, which draw interest from Minnesota agencies and citizens, include land cover data and periodic lake water clarity assessments. Data and project results are posted on the RSGAL website, as well as at land.umn.edu and water.umn.edu.

During the past year work was initiated with MinnesotaView support to create new geospatial portal for downloading maps and data.

Imaging and Geospatial Information Spotlight Event

MinnesotaView was a co-sponsor, with the ASPRS Western Great Lakes Region, for the first Imaging and Geospatial Information Spotlight Event at the University of Minnesota. June 4, 2014 offered a day of presentations and networking with geospatial professionals.

MinnesotaView Consortium Membership

MinnesotaView was established in 2008 and is working with state agencies and universities in Minnesota on remote sensing research, education and outreach. The Consortium is led by the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory, and includes the Minnesota Geospatial Information Office and Minnesota Department of Natural Resources.

University of Minnesota

Minnesota Geospatial Information Center

Minnesota Department of Natural Resources

MinnesotaView Principal Investigator:

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WEBSITE minnesotaview.umn.edu

MississippiView

Remote Sensing Activities

2013 - 2014

Utilization of Remote Sensing Resources

Mapping and Monitoring Coastal Change in the Mississippi Gulf Coast

With the advent of funding for coastal restoration projects in the Gulf of Mexico, it is imperative that new ways be investigated, tested and evaluated for monitoring coastal change. There are two major goals of this high impact activity for MississippiView: use the recurring and consistent Landsat data to baseline and map changes in the Mississippi Gulf Coast and investigate, test and evaluate methods to use remote sensing as a tool to monitor the status of restoration projects. It is important that policy- and decision-makers thoroughly understand the changes that have occurred along the coast and the effectiveness of funded restoration projects. Landsat data is the only remote sensing product with a sufficiently long temporal range to detect land use and land cover changes over the past 40 years. With its moderate resolution and revisit periodicity, Landsat 8 will be a key tool for monitoring the success or failure of restoration projects.

Landsat 8 imagery from January 2014 of the Mississippi Gulf Coast

Benefits to Mississippi

As a result of the Deepwater Horizon oil release and the resulting legal settlement, the RESTORE Act was passed by Congress. This legislation requires 80% of the fines from the parties responsible for the oil to be dedicated to restoration of the gulf ecosystems. Mississippi and other gulf coast states will be purchasing land for conservation, constructing coastal marshes and other activities as a result of this legislation. Remotely sensed data will provide the historical perspective and serve as a monitoring tool.

Remote Sensing Education

Demonstrating the Effectiveness of Monitoring with Remote Sensing

Monitoring restoration changes in the Gulf of Mexico is only the initial step. One of the most difficult tasks in restoration of ecosystems along the Gulf Coast is gauging the effectiveness of restoration projects. The need for that analysis, derived from the monitoring, was expressed by federal, state and non-government officials at a March 2014 conference on the status of the Gulf of Mexico, held in Houston, Texas. Using data from the Landsat archives, MSView could readily demonstrate the use of remotely sensed data for monitoring both change and process effectiveness. The results of this research have been presented at the Mississippi Association of Spatial Technologies (MAST) meeting in September, 2014.

Bay St. Louis, MS Landsat 5 data from March, 1984 above and January, 2014 below.

Benchmark for Mapping Coastal Change

A key question in the restoration of the Gulf of Mexico has been to establish the benchmark for measuring the success of ecosystem restoration. MississippiView has documented and analyzed changes in the land cover of coastal Mississippi for the past 70 years using Landsat data and early aerial photography. The outcome of this applied research will benchmark the on-going image collections and analysis.
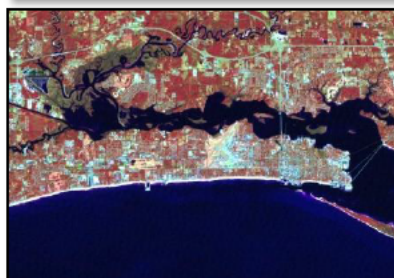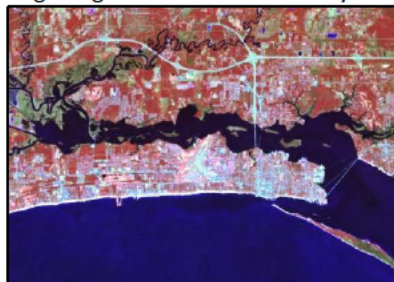
Changes in land use in Biloxi, MS in 1984, 1999, and 2014 (from top to bottom).

Statewide Landsat 8 Mosaic

Among other activities of MississippiView is included **a** task to complete a statewide mosaic of Landsat 8 data and change detection sub-scenes for selected, high-growth portions of Mississippi.

In 1999, the University of Mississippi Geoinformatics Center (UMGC) produced a statewide Landsat 7 mosaic that was distributed to and extensively used by all science teachers in all high schools in Mississippi. An update is needed and will have high impact. The use of Landsat 8 for mapping land use and land cover statewide will visualize change over the past fifteen years for the teachers and students.
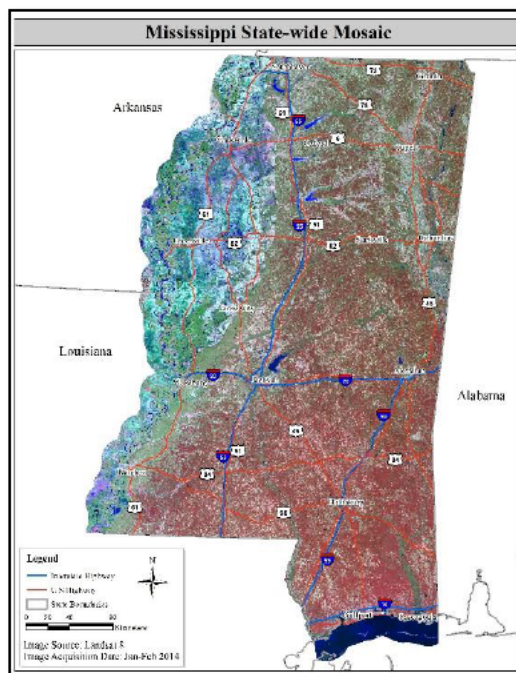
MississippiView Vision and Goals

MSView Vision:

Build partnerships to promote the application of Geospatial Information Science and Technology (GIS&T) and remote sensing to natural resources problems of local, state and national importance.

MSView Long-Term Goals:

- Build partnerships with state and local government entities that promote the utility of remote sensing data products for practical applications

- Facilitate access to remote sensing data for Mississippi

- Expand the knowledge and utilization of remote sensing via courses, workshops and other educational opportunities for K-12 educators, university students and the existing workforce

- Support remote sensing research through access to data and, as funding becomes available, through grants and contracts

MississippiView Principal Investigator:

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MISSISSIPPI VIEW
THE UNIVERSITY OF MISSISSIPPI

MONTANAVIEW

Remote Sensing Activities

2013 - 2014

Providing Remote Sensing Education

Supporting Service-Learning Opportunities for College and University Students
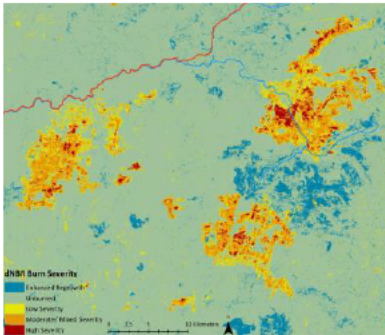
This map is from a student project on wildfires. The map is of the Selway-Bitterroot East Complex of 2012. 'High severity' (red) represents areas with the largest positive change in spectral response following the wildfire. Areas with negative spectral change indicate 'Enhanced Regrowth' (blue), where photosynthetic biomass has increased between pre-and post-fire image acquisitions.

MontanaView has supported service learning projects for students at Montana State University, The University of Montana, Montana Tech, and Salish Kootenai College. Projects this year included studies related to the effects of fertilization on winter wheat, mountain goat impacts near Yellowstone, permafrost in Alaska, riparian restoration on the Upper Flathead, improved forest fire mapping, land management by the Maasai in Kenya, mapping grasslands in the Upper Yellowstone basin, and mapping changes in the timing of early season vegetation.

Benefits to Montana

MontanaView's education efforts are fulfilling a critical goal for remote sensing in Montana. Last year, eight students at four institutions had the opportunity to complete real-life remote sensing projects with tangible results for government agencies and non-profit organizations. As a result, Montana is gaining an experienced, well-prepared workforce.

MontanaView's classification comparison project will help guide remote sensing applications in Montana for years to come. As a result of this project, Montana remote sensing practitioners (and others throughout the nation) will be able to navigate the maze of methods available to them to produce the best remote sensing-based maps they can.

Improving Remote Sensing Applications

AmericaView Classification Methods Accuracy Comparison Project

MontanaView has identified improved land cover classifications specific to Montana land managers as a high priority, and MontanaView members are actively involved in projects to provide such classifications. With the growing abundance of classification methods available, however, members require greater guidance as to the best methods to accomplish these projects. The project developed a program that used a large number of datasets to rigorously compare the most promising and widely used state-of-the art methods. The table below demonstrate that the CART algorithm was never preferable, while the Random Forest algorithm was on average best.

Method	Mean accuracy	Times best classifier
Random Forest	73.19%	18
C5.0	72.35%	11
Logistic Model Trees	64.82%	1
Support Vector Machines	62.28%	0
Multivariate Adaptive Regression Splines	58.50%	0
Classification Tree Analysis	50.84%	0

MONTANA STATE UNIVERSITY

MontanaTech THE UNIVERSITY OF MONTANA

SALISH KOOTENAI COLLEGE
GROUNDED IN TRADITION. CHARGING INTO THE FUTURE.

The University of Montana

Montana Association of Geographic Information Professionals
MAGIP

Geo Essentials

PARA
Precision Agriculture Research Association

MONTANA Natural Resource Information System

NRCS Natural Resources Conservation Service

USGS science for a changing world
Northern Rocky Mountain Science Center

MontanaView Vision and Goals

MontanaView Vision: Identify and seek to address the most pressing remote sensing needs in Montana for management of agriculture, range, forest, wild lands, and urban landscapes.

MontanaView Long-Term Goals:

1. To advance remote sensing through education and outreach in the public and private sectors.
2. To advance remote sensing and sustainable technology transfer through research.
3. To build the MontanaView consortium through development activities that increase the organization's visibility and draws new members.

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MONTANAVIEW

MontanaView.org

MONTANAVIEW

AMERICA VIEW

Consortium Overview

2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the MontanaView Consortium
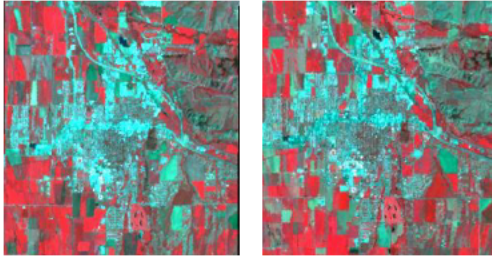
These two images of Bozeman, Montana, from 1995 and 2013 demonstrate the power of remote sensing. Using infrared sensing, the red colors show vegetation, so that these images demonstrate urban growth and the impact on agriculatural lands.

MontanaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. The vision for the MontanaView Program is to identify and seek to address the most pressing remote sensing needs in Montana for management of agriculture, range, forest, wild lands, and urban landscapes.

MontanaView became a member of AmericaView in 2005. The MontanaView consortium includes a wide range of organizations involved in remote sensing in the State of Montana, including universities and colleges, state and federal governmental agencies, and non-profits. MontanaView regularly uses this wide range of expertise to evaluate the current pressing needs of Montana citizens that relate to or can be addressed with remote sensing technologies. The consortium has been involved in education at the K-12 and higher education levels. Workshops and institutes have been held to train K-12 teachers in how remote sensing can be incorporated into their classrooms and used to meet educational needs and requirements. Undergraduate and graduate students have been supported, adding critical members to Montana's workforce with expertise in the most modern geospatial tools. Another priority for MontanaView has been to train Montana's current workforce, and especially agency personnel, in the most recent developments. Researcher members of MontanaView have used their expertise to address some of the most pressing natural resource issues facing Montana in the past decade.

Consortium Membership

MontanaView is currently leveraging its resources with support from the U.S. Department of Agriculture to address the impacts of bark beetles on the State's forest resources. Using Landsat satellite imagery provided by the U.S. Geological Survey, the progression of the bark beetle infestation in Montana is being mapped and evaluated in ways never before attempted. Among other things, this project will enable the evaluation of whether the beetle-killed trees can be used in a process that will convert them to biofuels to address our nation's energy needs.

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Improving Utilization of Remote Sensing Resources

Removal of Thin Clouds Using the Cirrus and Quality Assurance Bands of Landsat 8

Clouds present in the atmosphere influence solar radiation and affect the reflectance of ground targets measured by an optical remote sensor. The reflectance from the clouds is not desirable and needs to be corrected. After atmospheric correction, an algorithm developed for the removal of thin cirrus clouds as well as alto-thin clouds, or thin clouds, within visible and near infrared bands (Bands 1–5) of Landsat 8 was applied. In a two stage process, the algorithm first removed cirrus clouds using Band 9 and then the remaining thin clouds using quality assurance band. The effectiveness of the algorithm was evaluated using a Landsat 8 sub-image of eastern North Carolina acquired on 17 April 2014. Thin clouds were removed within Bands 1–5. The reliability of the algorithm was validated by comparing its outcome to a nearly cloud-free image acquired on 14 April 2014.
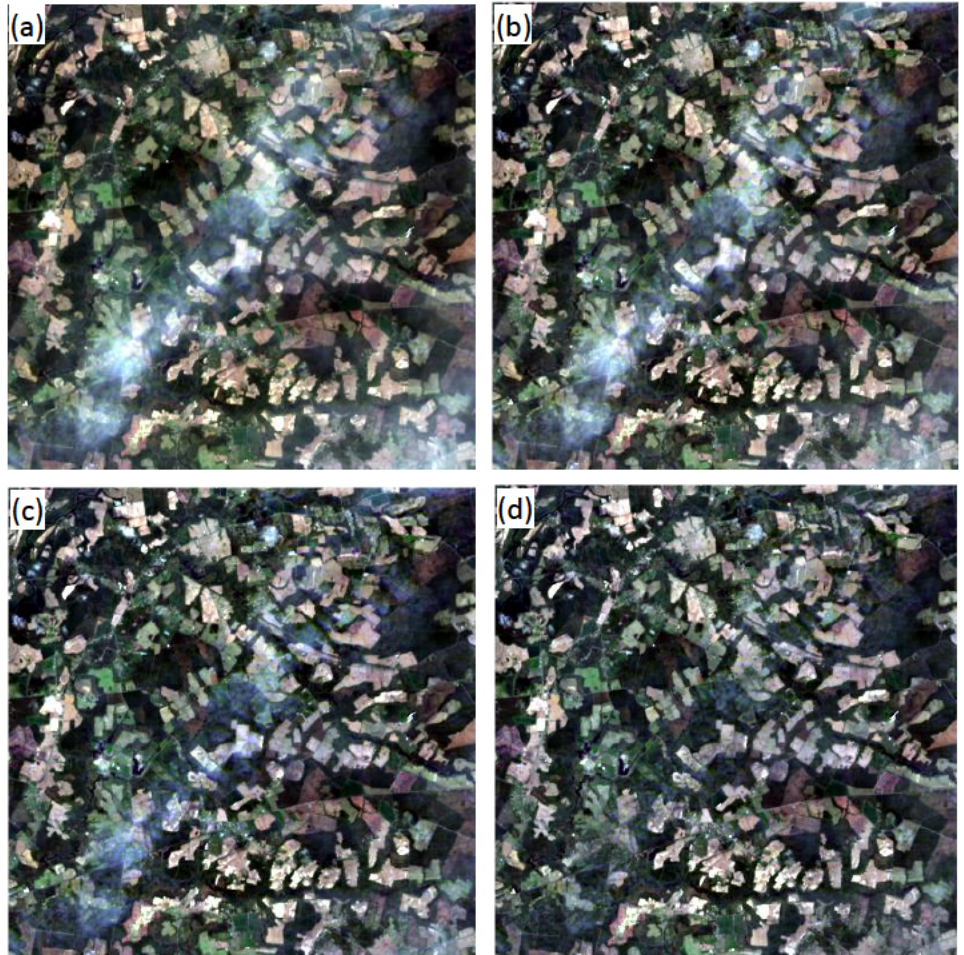
Thin-cloud removal in visible and near infrared bands of Landsat 8 imagery. The image covering eastern North Carolina was acquired on 17 April 2014 by Landsat 8 Operational Land Imager (OLI) sensor. (a) Original data, (b) data after atmospheric correction, (c) data after the removal of cirrus clouds using Band 9, and (d) Final image after the removal of remaining thin-clouds using QA band. R-Band4, G-Band3, and B-Band2.

Benefits to North Carolina

With the success in removal of thin clouds, the pool for usable Landsat 8 data for North Carolina as well as other locations is enlarged. This high impact project can serve the data needs of North Carolina, as well as users in other states.

North Carolina View (NCView) is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

Improving Utilization of Remote Sensing Resources

Submerged Aquatic Vegetation Mapping in NC Estuary Using Multi-temporal Landsat 8 Data

Submerged aquatic vegetation (SAV) is a valuable natural resource in North Carolina's estuaries. The State's Coastal Habitat Protection Plan (CHPP) has stated a need to monitor SAV coverage over time. The SAV coverage in Core Sound, NC was mapped using multi-temporal Landsat 8 data acquired between April and November of 2013. The mapping algorithm consisted of the principal component analysis (PCA) to separate the SAV from background noise caused by turbidity and iterative self-organizing data analysis technique (ISODATA) unsupervised classification. The overall accuracy level was 81% or higher. Given the no-cost access to Landsat datasets, the developed algorithm and remotely sensed data from Landsat family will be continuously available for the State's SAV coastal resource management. The characteristics and temporal trends of SAV distribution at five or ten year intervals can be monitored and studied into the future.
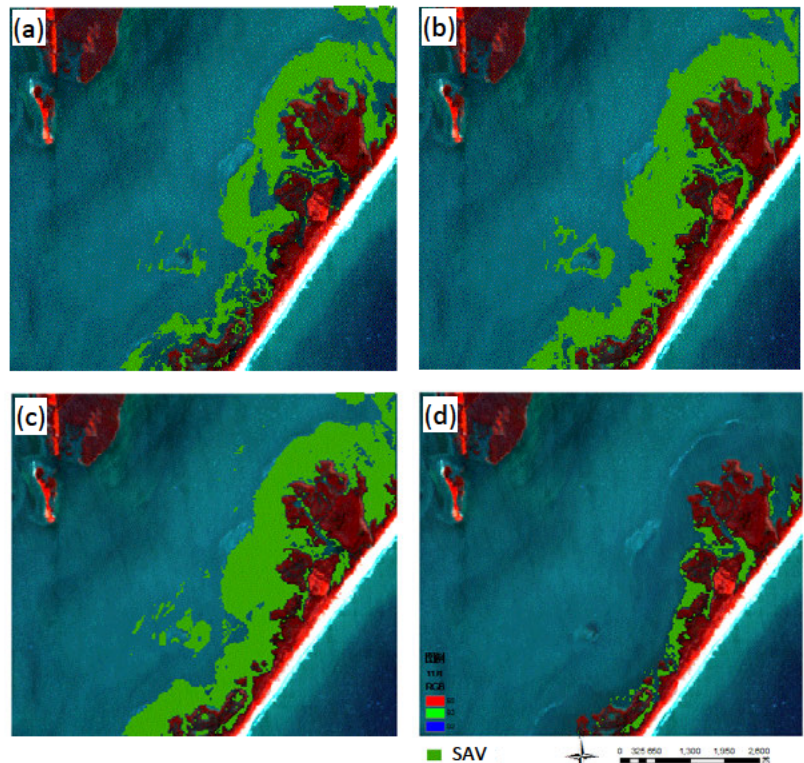
Spatial and temporal assessment of SAV using multi-temporal Landsat 8 data. The annual phenological coverage variation of SAV in the Core Sound, North Carolina on (a) 14 April 2013, (b), 19 July 2013, (c) 20 August 2013, and (d) 24 November 2013.

Benefits to North Carolina

The State of North Carolina has regulations through the Coastal Area Management Act to control human induced impacts on the SAV (15A NCAC 07H .0209 (d) (4)). The State is interested in identifying the location and extent of SAV within the State's estuaries. This high impact activity will improve monitoring requirements of the State.

NCView Vision and Goals

NCView Vision:
- Remove barriers between willing cooperating providers and users
- Promote and expand the further development of applied remote sensing for local issues and problems
- Nurture the intellectual and technical capacity of users and the public through higher education and outreach activities

NCView Long-Term Goals:
- Develop and enhance collaborative relationships of academic, federal, state, county, city, and public and private sector users
- Implement more efficient and effective methods to locate, access, and retrieve existing and future remotely sensed data and applications statewide
- Further the use of remote sensing in North Carolina to address critical issues facing the state, with emphasis on landuse and land cover (LULC) type change, and environmental and coastal resources

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North Carolina View (NCView)
Consortium Overview
2013 - 2014

Overview of the North Carolina View (NCView) Consortium

Mapped seagrass, dark patches along shorelines of Jarrett Bay, Core Sound, NC. The image was acquired by WorldView-2 sensor on 18 September 2010.
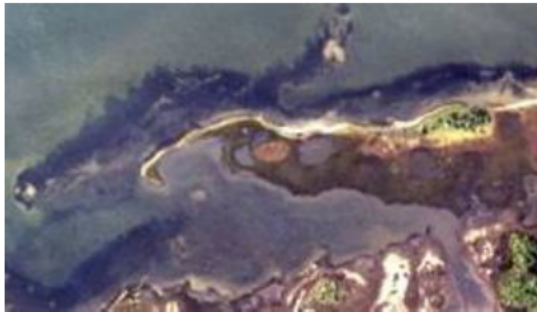
North Carolina View (NCView) is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. Since the inception in 2009, the NCView consortium has been a network of North Carolina remote sensing users made up of universities, community colleges, and local governments. The primary goal of the NCView consortium is to foster and promote the uses of remotely sensed datasets and technologies in educational institutes, state, county, and local governmental agencies, and the private sector and coastal resources.

NCView Objectives

- Increase consortium membership
- Enhance remote sensing educational opportunities in North Carolina
- Implement improved location, access, and retrieval methods for remotely sensed data and applications
- Develop and enhance collaborative relationships of academic, federal, state, county, city, and public and private sector users
- Further the use of remote sensing in North Carolina to address critical issues facing the state

Consortium Membership

- East Carolina University (Lead Institution)
- Appalachian State University
- University of North Carolina at Chapel Hill
- University of North Carolina at Pembroke
- University of North Carolina at Wilmington
- Central Piedmont Community College
- Davidson County Community College
- Information Technology Services of the City of Wilson, NC
- Pitt County Management Information Systems

Thin-cloud removal in visible and near infrared bands of Landsat 8 imagery. The image was acquired on 16 December 2013 by Landsat 8 Operational Land Imager (OLI) sensor. Left, The image before the removal; and right, the image after the removal. Band4(R), Band3(G), and Band2(B). Fewer clouds permit better study of forest growth.
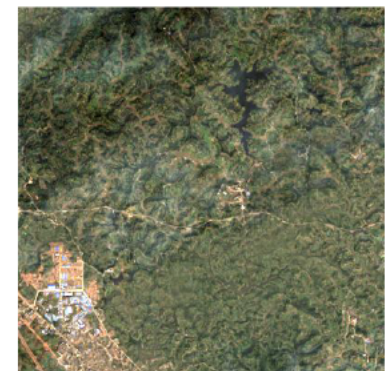
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North Dakota View
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Community Mapping at Fort Berthold

Oil extraction sites dot the landscape of west-central ND near Lake Sakakawea
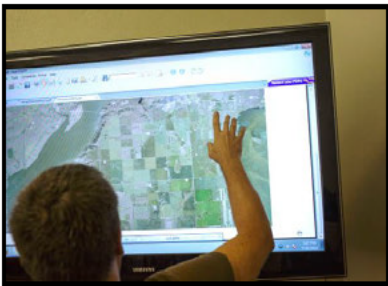
USDA aerial photography and USGS Landsat imagery are used to monitor landscape impacts of the Bakken oil boom on native lands

This year, NDView worked to provide access to geospatial data for the people of the Three Affiliated Tribes on the Fort Berthold Indian Reservation. NDView created a spatial database with Landsat imagery along with other raster and vector spatial layers representing physical, administrative, socio-demographic, economic, industrial and other aspects of life on the reservation. The goal is to provide the capability to use geospatial data in support of planning on the reservation; this is especially important in view of the ongoing activity related to the Bakken oil shale, which is rapidly changing the landscape.

Benefits to North Dakota

NDView works to raise awareness about how remote sensing and other geospatial technologies can contribute to solutions to the complex issues facing the citizens of North Dakota. For example, NDView has developed tools to put remotely sensed data related to flooding in the Devils Lake Basin more easily into the hands of anyone interested. The group is also engaged in a similar effort related to monitoring the impacts of oil production development in western North Dakota. The consortium reaches its goals by providing formal and informal training, developing tools for data dissemination, conducting and supporting basic and applied research, and promoting the professional development of students in North Dakota with interests in geospatial technologies.

Providing Remote Sensing Education

Impacts of Flooding in the Devils Lake Basin

NDView uses Landsat data to monitor and map impacts of land and wetland flooding in the Devils Lake Basin, which spans 3,300 square miles and is particularly sensitive to climatic variation. An ongoing wet cycle that began in 1992 has led to massive increases in the surface water extent of the terminal lakes and wetlands in the basin, negatively impacting agricultural production and transportation while enhancing regional recreation and tourism. Data are available at http://undgeography.und.edu/apps/ndview/.
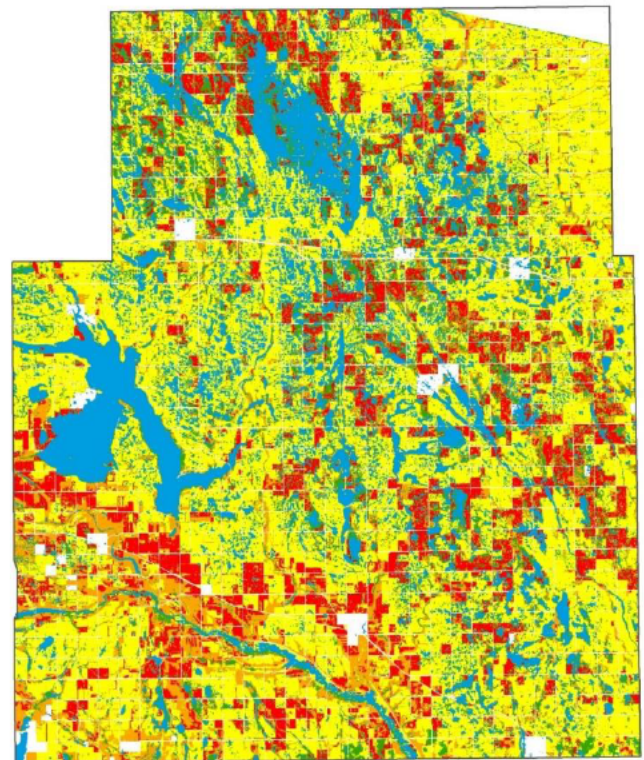
Land cover in Nelson County, ND, 2011, showing the impact of lake and wetland flooding on the agricultural landscape

Other North Dakota View Projects

Scholarships

NDView annually awards four $500 scholarships to students at member academic institutions to promote professional development in remote sensing and other geospatial technologies. The scholarships support field work that complements a student's research, travel to a professional meeting, data purchases, software purchases, minor equipment purchases, professional society membership, journal subscriptions, and/or book purchases.

Informal Education

NDView regularly participates in informal science education events for K-12 students, primarily in eastern North Dakota. It sponsors awards at regional and statewide middle- and high-school science fairs. In addition, NDView sponsors workshops for teachers to facilitate the adoption of remote sensing, geographic information systems (GIS), and Global Positioning Systems (GPS) in fourth and seventh grade geography classrooms, and it provides GIS consulting free of charge.

Research

NDView participates in basic and applied research projects. For example, the consortium supported a graduate student to assist with installation of a solar-powered phenology camera on a prairie research area managed by the University of North Dakota. NDView leveraged its resources to assist in a study using unmanned aerial systems to inventory large mammals on Sully's Hill National Game Preserve. NDView continues to monitor the flooding in the Devils Lake Basin with Landsat 8 data.

North Dakota View Vision and Goals

NDView Vision: To support the successful acquisition and use of remotely sensed data and geospatial technologies at minimal to no cost for training, education, and applied research within North Dakota's higher education institutions and bring these technologies into the hands of the public.

NDView Long-Term Goals:

1. Leverage the strength of NDView's partnerships to enhance and expand remote sensing and geospatial technologies education in North Dakota
2. Better prepare the students of today for the geospatial industry workforce of tomorrow
3. Participate in applied research into important drivers of landscape change, when appropriate, and share findings as a service to the citizenry of the state
4. Develop an NDView-branded community mapping / community geography center that would use remote sensing and other geospatial datasets to engage communities in North Dakota

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North Dakota View
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the North Dakota View Consortium

NDView assisting with the mapping of leafy spurge using GPS on Standing Rock Sioux lands

North Dakota View (NDView), led by the Department of Geography at the University of North Dakota in Grand Forks and established in 2004, is dedicated to promoting remote sensing and geospatial technologies within North Dakota. The emphasis is on establishing and assisting with education and training curricula within colleges and universities throughout the state and enhancing technology transfer, applied research efforts, and workforce training. NDView's partners include several of the state's academic institutions, as well as two of its tribal colleges.

The mission of NDView is to support the successful acquisition, distribution, and use of remotely sensed data at minimal to no cost for training, education, and applied research within North Dakota's higher education institutions, and to bring these data and technologies into the hands of the public. The consortium engages students at member institutions through the awarding of scholarships for professional development, the purchase of software and sharing of software licenses, and informal and formal remote sensing education offerings. NDView also facilitates the teaching of geography and geospatial technologies in K-12 classrooms and teacher training workshops. Finally, NDView conducts applied remote sensing research projects that improve monitoring and understanding of landscape changes in the state related to Bakken oil boom impacts, Devils Lake flooding, and agricultural and conservation land-cover change.

Consortium Membership
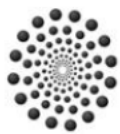
NDView's partners work together to improve remote sensing and geospatial technology education at all levels within the state of North Dakota. It seeks to effectively educate students for the geospatial workforce of the future. The consortium works together on applied research projects to benefit the citizenry of the State of North Dakota.

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NebraskaView

Remote Sensing Activities

2013 - 2014

http://nebraskaview.unl.edu/

Promoting Understanding of Geospatial Technologies

Public Outreach Activities

Nebraska State Office Building display describing remote sensing and how Landsat satellites are used in land use and water resource management.
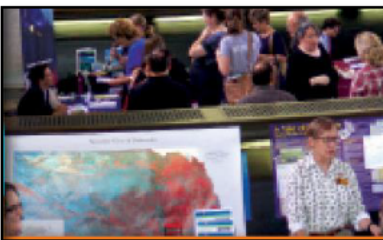
Over 2000 K-12 teachers attended the 2014 Durham Museum Teacher's Night Out in Omaha, NE and had the opportunity to learn about remote sensing and its classroom applications.

In 2013-14, NebraskaView utilized a number of public venues to promote understanding of geospatial technologies among the general public, state government agencies, K-12 educators and students. Over 4000 individuals had the opportunity to see displays, engage in outreach activities or attend presentations that focused on remote sensing and its applications. **Weatherfest** attracted over 1500 attendees who had the opportunity to test their skill identifying regions of the state from satellite images. The **Nebraska State Office Building Geospatial Technologies Display** introduced remote sensing concepts and Landsat data applications to both government workers and the general public. The annual **Durham Museum Teacher's Night Out** showed almost 2000 K -12 teachers how to use geospatial imagery in their classrooms.

Benefits to Nebraska

Since the early 1970's, hundreds of geospatial datasets portraying elevation, land use, water, soils and other resources have been developed from satellite-based Earth observing systems. NebraskaView High Impact Activities serve to educate current and potential users about these technologies and products, and the variety of ways they can be used in Nebraska by local government agencies, as well as State policy makers.

Remote Sensing Technology Transfer

VegDRI Drought Monitoring

NebraskaView is actively working to increase the use of a satellite-based drought monitoring tool among major stakeholders in Nebraska. **The Vegetation Drought Response Index** (VegDRI) can be used for proactive decision-making related to the management of agricultural and natural resources during periods of drought. VegDRI integrates MODIS observations of vegetation conditions with climate and biophysical (land cover and soils) information to produce 1-km^2 spatial resolution maps that monitor the impact of drought stress on vegetation. It was developed by the National Drought Mitigation Center (NDMC) in collaboration with the U.S. Geological Survey's (USGS) Center for Earth Resources Observation and Science (EROS), and the High Plains Regional Climate Center (HPRCC) and with sponsorship by the U.S. Department of Agriculture's (USDA) Risk Management Agency (RMA) and NASA. From among the many drought-monitoring tools, VegDRI is unique in that it integrates satellite-based observations of vegetation conditions with climate and land cover and soils information to reveal vegetation conditions as plants respond to solar energy, soil moisture and other limiting factors.

NebraskaView developed a Fact Sheet describing the VegDRI tool and its applications, and disseminated it to ranchers, Natural Resource District Directors, and other private and public stakeholders involved in the management of agricultural and natural resources during periods of drought. Feedback is being solicited and will be used to refine the tool.
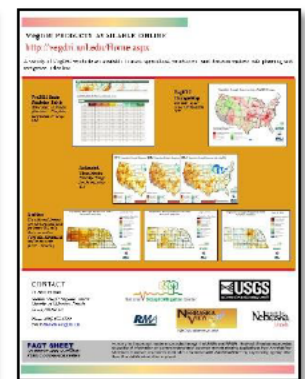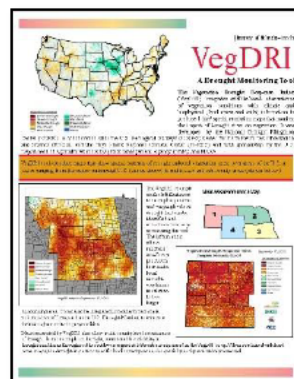
The VegDRI Fact Sheet describes and promotes a valuable satellite-based tool for drought-related planning and response.

NebraskaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

Geospatial Technologies for Natural Resources

NebraskaView presented a half-day workshop to Nebraska high-school students participating in the University of Nebraska's Big Red Camp - Natural Resources. The workshop presented introductory materials on Geographic Information Systems (GIS), Global Positioning Systems (GPS) and Remote Sensing, and gave students hands-on experience in working with satellite data to explore natural systems.

High school students learn how remote sensing imagery is used to study Earth's physical, chemical and biological systems during 4H Big Red Camp.

State-Wide Geospatial Data Efforts

NebraskaView works closely with the Nebraska Information Technology Commission's GIS Council and its member agencies, comprised of representatives of all levels of government, local through Federal, to coordinate the development and application of geospatial information technologies in Nebraska. 2014 activities included developing plans for state-wide LiDAR acquisition and incorporating satellite imagery into the state's data portal found at: (http://www.nebraskamap.gov.)

Nebraska's state data portal allows citizens, as well as government agencies, easy access to up-to-date geospatial information for the state.

NebraskaView Website
http://nebraskaview.unl.edu

NebraskaView maintains an archive of pre-processed historical Landsat imagery for Nebraska and also serves as a gateway to other sites for acquiring current Landsat imagery, MODIS imagery, statewide orthophotos and digital raster imagery. The site also provides Landsat program updates and serves as a resource for geospatial educational resources.
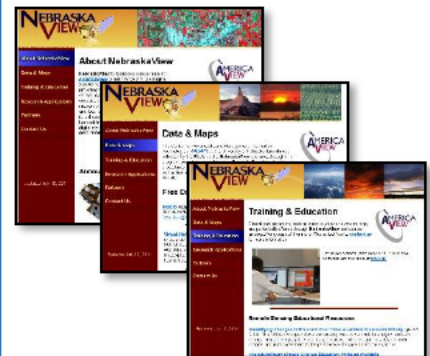
NebraskaView's website serves as a resource connecting geospatial data users in the state with imagery resources, training opportunities and other members of the NebraskaView consortium.

NebraskaView Consortium Membership

Nebraska View's Consortium members include universities, as well as national and state entities involved in geospatial technologies and natural resource management:

- Center for Advanced Land Management Information Technologies (CALMIT)
- Nebraska Department of Natural Resources
- University of Nebraska-Omaha, NASA Nebraska Space Grant Consortium
- Creighton University, Department of Biology
- Nebraska Game & Parks Commission
- National Drought Mitigation Center
- University of Nebraska-Omaha, Department of Geography and Geology

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New Hampshire View
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the New Hampshire View Consortium
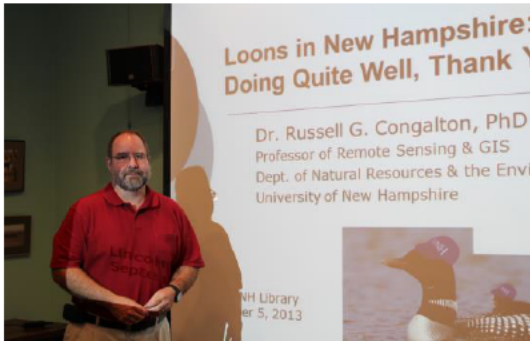
Dr. Congalton presenting at the Lincoln, NH, library on the use of remote sensing and GIS to study loon habitat

New Hampshire View (NHView) based at the University of New Hampshire (UNH) provides a means to bring many groups that use remotely sensed imagery and other geospatial data together in a formal way to aid communication and the pooling of resources. In addition, the consortium provides a single point of access for anyone in the state needing imagery or wishing to learn more about geospatial technology resources within New Hampshire. For its members, the consortium provides networking and collaboration infrastructure, educational support, and outreach.

Specifically, NHView Provides:

Education / Outreach:
- Guest Lectures and webinars on Remote Sensing & Geospatial Technologies
- Presentations at AmericaView, American Society for Photogrammetry and Remote Sensing (ASPRS), and other conferences
- Workshops on remote sensing technologies remote sensing technologies including Accuracy Assessment and Object-Oriented Image Classification
- Support for a Geospatial Services Center on the UNH Campus

Applied Research:
- Support for Undergraduate Research Internships & Graduate Student Research
- Software Tools for Accuracy Assessment & Fragmentation on the NHView website

Data Provision / Support:
- Faculty support by sharing software licenses and survey-grade GPS units
- Geospatial data and remotely sensed imagery archived by our partners

Consortium Membership

Department of Natural Resources & the Environment, UNH
The Basic and Applied Spatial Analysis Lab (BASAL) conducts basic research on spatial data uncertainty/map accuracy and applied research applying the tools of remote sensing, GIS, and spatial data analysis to solve natural resource problems.

NH GLOBE Partnership, UNH
Carries out GLOBE teacher training in atmosphere, land cover, hydrology, soil and earth system science with a focus on land cover mapping and geospatial technologies.

EOS-EarthData, UNH
A digital library of Earth science data that serves scientists, educators and the public.

NH GRANIT GIS Repository, UNH
A cooperative project to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers.

Civil Technology Program, UNH
The Thompson School of Applied Sciences provides a 2-year Associates Degree in the geospatial technologies.

Diamond Library, UNH
The library maintains an extensive map and aerial photo collection for NH.

Forest Watch, UNH
A New England-wide environmental education activity using field, laboratory, and satellite data analysis methods for assessing the state-of-health of local forest stands.

Cooperative Extension, UNH
Offers short courses in geospatial technologies including GIS, GPS, and field mapping.

Dartmouth College
Department of Geography and others

NH Planning Commissions
NH GIS Conservation Collaborative
NH Fish and Game Department

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New Hampshire View

Remote Sensing Activities

2013 - 2014

Improving Utilization of Remote Sensing Resources

Evaluating WorldView-2 Imagery for Forest Mapping

Pawtuckaway State Park, NH
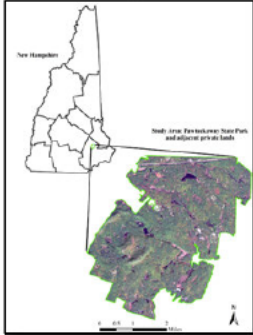
This project evaluated the use of WorldView-2 high spatial resolution imagery for mapping forest cover in New England. A graduate student conducted research to determine if the new imagery, with its eight wavelengths provided improved accuracy over results generated from the traditional four-wavelength imagery.

The analysis also evaluated Landsat imagery to see if the Landsat wavelengths would improve the results. The results showed that the eight-wavelength imagery was better than the traditional four-wavelength imagery. However, the Landsat data when merged with the WorldView-2 data did not improve map accuracy. Therefore, WorldView-2 is useful for improving forest mapping.

Map of forest cover created using WorldView-2 8 band imagery.

Benefits to New Hampshire

Both the mapping project and the Geospatial Services Center (GSC) project provide substantial benefits to the people of New Hampshire:

- Given that the state is more than 80 percent forested, the continued mapping and monitoring of forests is a high priority for resource managers and the public. Tourism is one of the top industries and is dependent on continuing the balance between forests and development around the state. New methods to more accurately map forest resources allow for better knowledge, planning, and use of these important resources.
- The GSC promotes the use of remote sensing and other geospatial technologies not only to the students, staff, and faculty at the University of New Hampshire, but also provides these services to the public to increase awareness of these valuable techniques.

Providing Remote Sensing Education

Geospatial Services Center – Pilot Study

As a result of a needs assessment by the New Hampshire View (NHView) Consortium, it was determined that the development of a Geospatial Services Center (GSC) on the University of New Hampshire (UNH) campus was a high priority. A pilot study was initiated in 2013 with major support from the UNH Library, NHView, and other NHView partners to establish the GSC. A room in the main campus library with two computers and the appropriate geospatial software was designated to house the GSC. Two interns were hired to provide geospatial consulting to faculty, staff, students, as well as the surrounding community. An evaluation of the GSC was conducted through user surveys and the results were used to improve and formalize the existence of the GSC. The Center has been an immediate success and it is anticipated that support will continue into the future.

Students and staff gather in the Geospatial Services Center (GSC) during GIS Day.

Other New Hampshire View Activities

NHView was a cooperator in a project to study the first-stage invasion into forest and urban habitats by the exotic invasive tree *Kalopanax septemlobus*.

NHView supported an undergraduate student intern to aid in collection of the field data as well as technical advice for conducting the geo-spatial analysis used to plot the spread of this invasive plant at two locations in and around Durham, New Hampshire.

DISTRIBUTION and ABUNDANCE

Urban Durham
- 3,803 juvenile plants in ca. 100 ha
- Maximum distance of juveniles from parent was 775 m
- Plant density declined with distance from the purported parent tree

URBAN DURHAM

KEY

symbol	# of plants
	1-9
	10-99
	100-249
	≥250
	'parent' tree
	search area

Thompson Farm
- 270 plants in ca. 20 ha

THOMPSON FARM

KEY

symbol	# of plants
	1-2
	3-9
	10-19
	≥20
	search area

The graphic shows the distribution and spread of the invasive tree *Kalopanax septemlobus* at two locations on UNH property; the first is on the Main Durham campus and the second is on a nearby research farm. It is discernable that two parent trees can cause a significant impact.
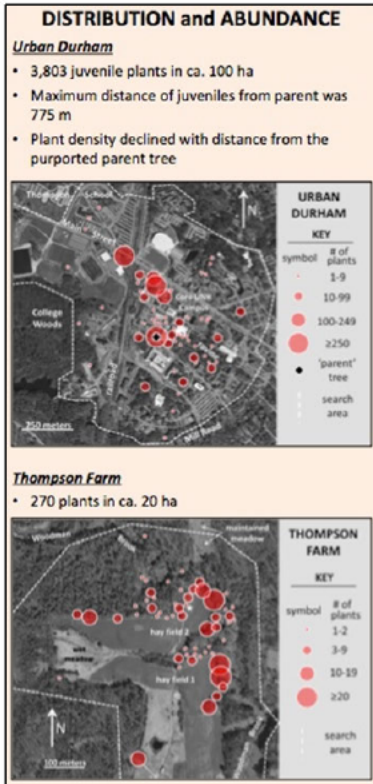
NHView Director, Dr. Russell G. Congalton, has presented numerous workshops, webinars, and presentations on how to assess the accuracy of maps generated from remotely sensed data. In addition, the NHView website contains a presentation on these methods as well as a series of software tools that are freely available to anyone wishing to use them. These tools include software programs to statistically analyze the results of an accuracy assessment.

Further information as well as additional presentations and software tools can be found at the NHView website at: www.nhview.unh.edu

Assessing the Accuracy of Remotely Sensed Data: Doing It Right!

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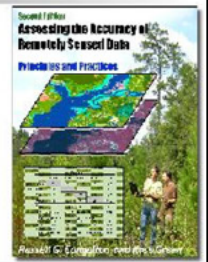
New Hampshire View Vision and Goals

New Hampshire View Vision: To continue to develop and expand activities that will increase awareness among and collaboration between users of remotely sensed and other geospatial information in NH and to continue to document and demonstrate the benefits of remote sensing education, outreach, and research activities throughout the state.

New Hampshire View Long-Term Goals:

1. Bring together all those in New Hampshire interested in using remotely sensed data to solve real-world problems
2. Develop a collaborative relationship among all academic institutions in the state that may benefit state and local agencies, the private sector, and the public
3. Increase awareness and foster opportunities to work together among all remotely sensed data stakeholders in New Hampshire
4. Expose those who may not know about the uses of remote sensing and other geospatial technologies to their many benefits and possibilities

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New MexicoView
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources

General Overview of the New MexicoView Consortium

New MexicoView consortium members presenting research on biodiversity to stakeholders in 2013

NMView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. New MexicoView (NMView) seeks to advance the use of remotely sensed data through education, research, outreach, and technology transfer to the public and private sectors in New Mexico. NMView funding has provided training to current and future land managers and natural resource managers in remote sensing basics and use of satellite imagery.

Remotely sensed data are used in New Mexico by state and federal agencies, universities, private entities and non-profit organizations. Uses have focused on natural resource management activities including fire and range management and species and biodiversity conservation. A challenge for the New Mexico remote sensing community is to get mapping and monitoring applications into the hands of managers in a format that can be applied on the ground. These applications have been developed by USGS, USDA, and NMView partners. The NMView consortium is working on methods to bring the research and application communities together in New Mexico.

An example of community building is the recent collaboration of NMView with The Wildlife Society (Southwest Section and New Mexico Chapter) to create a geospatial advisory team to provide expert input to professional biologists seeking to address ecological questions with remotely sensed data and geospatial technologies.

Consortium Membership

NMView has been building a consortium of public, private, and non-profit organizations that are promoting remote sensing in New Mexico through sharing of resources, developing a remote sensing infrastructure and supporting remote sensing research and education in the state. Collaboration with the New Mexico Geographic Alliance and NASA provide the foundation for education and outreach opportunities across the state.

NMView partners develop, leverage, and disseminate remote sensing resources, applications, and research. NMView's programs, supported by other AmericaView members, have the capacity for national and international reach.

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OhioView
Remote Sensing Activities
2013 - 2014

Providing Remote Sensing Education

Partnership with Air Force Research Lab – Discovery Lab

Dr. Shellito, as an avatar, conducted his Virtual World remote sensing short course to/with his students.

Dr. Shellito utilized Google Earth imagery streamed across the internet during his Virtual World remote-sensing short course.

OhioView partnered with the Wright Patterson Air Force Base - Air Force Research Laboratory (AFRL) – Discovery Lab to creatively address the educational needs of Ohio by using geospatial technologies in a cutting-edge, virtual world platform. OhioView's Director, Dr. Bradley Shellito, conducted a remote sensing and geospatial technologies short course in a Virtual World setting to first and second year undergraduate students. Students created virtual avatars to participate in this web-based, Virtual World class. For more information, see: (http://wbi-cc.com/centersservices/discovery-lab)

Benefits to Ohio

- Enhanced the Assurance of Public Health and Protection of Aquatic Tourism Opportunities – by Geospatial Monitoring of Water Quality

- Introduced Cutting-Edge, Virtual World Platform approach to Educational Needs at ALL Levels – through partnership with AFRL Discovery Lab

- Supplied Access to & Use of Geospatial Data - Landsat plus other imagery

- Increased K-12 Teacher Knowledge - in geospatial technologies and STEM

- Increased K-12 Student Engagement – hundreds of students were given the opportunity to use geospatial technologies and present their projects

- Increased University-Level remote-sensing courses, student enrollment, and new faculty – products of OhioView's Software Pool

- Continued Workforce Development through workshops held at OhioGIS Conference

Remote Sensing and Water Quality

Harmful Algae Blooms (HABs) in Lake Erie

During the spring and summer of 2014, OhioView partnered with the NASA Glenn Research Center, NOAA–Great Lakes Environmental Research Lab, Naval Research Lab, MichiganView, and multiple State agencies to monitor as a collective team the Harmful Algal Blooms in Lake Erie.

This effort intensified when the Toledo Water Plant shutdown Aug 1-3, 2014. Team response was immediate. Increased NASA flights, using their S-3 Viking research aircraft equipped with a hyperspectral camera, were coupled with field observations from multiple teams of OhioView researchers, who were equipped with spectrometers. Together they provided near, real-time data about the status of the blooms. Timely information was delivered to water plants managers and other stakeholders to help ensure community access to clean water.

During the fall and winter of 2014 this comprehensive and highly collaborative team continued to share and analyze all data collected, with a coordinated plan to publish the results. During a January 2015 in-person meeting, the entire team will share experiences, discuss status of analyses, and plan for the months and years ahead.

Picture shows comprehensive, collaborative effort from OhioView and MichiganView field-based research teams to NASA GRC HSI aircraft to ISS HICO satellite imagery for Harmful Algal Blooms Research.

Other OhioView Projects

SATELLITES K-12 Program

The OhioView SATELLITES (Students And Teachers Exploring Local Landscapes to Interpret The Earth from Space) Program continued to provide K-12 teachers and students with hands-on, inquiry-based science, and STEM education using geospatial technologies.

Over 100 students and teachers across Ohio attended the annual SATELLITES Conference held in April at the Penta Career Center and presented their research projects. One team's project won the GLOBE international Learning Expedition competition to represent the USA in India.

OhioView Software Pool

OhioView successfully negotiated a bulk-purchase of software at a considerably reduced cost for its members to continue their mission of remote sensing research and education. The software included ERDAS IMAGINE, ENVI, IDRISI, and eCognition.

The cooperative pool is the vehicle that has enabled OhioView to execute and expand its educational and research programs. It has resulted in more publications, growing enrollment of undergraduate and graduate students, and increased visibility of OhioView throughout Ohio and the nation.

Ohio GIS Conference

OhioView was actively involved in the 2014 Ohio GIS Conference, a collaboration of the Ohio Geographically Referenced Information Program, the County Engineers Association and the Ohio chapter of URISA (Urban and Regional Information Systems Association).

For the 2014 Ohio GIS Conference, the consortium hosted several substantive remote sensing sessions under the banner of "Geospatial Analytics: The OhioView Experience" such as: Big Data, Using LiDAR and eCognition to Identify Trees, and Using the Cloud with Satellite Imagery.

OhioView Consortium:

14 College and University Members

Bowling Green State University	Ohio University
Central State University	University of Akron
Cleveland State University	University of Cincinnati
Kent State University	University of Dayton
Lakeland Community College	University of Toledo
Miami University	Wright State University
The Ohio State University	Youngstown State University

Associated Partners:

Air Force Research Labs
NASA Glenn Research Center
Old Woman Creek - ODNR
Wright Brothers Institute
The GLOBE Program

OhioView Targets:
Ohio's Needs by Focusing on
Local Research,
Statewide Education at ALL Levels, and
Data and Knowledge Access and Transfer.

OhioView State Coordinator:

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419-277-1434
vppm33@gmail.com

http://www.ohioview.org

http://satellitesk12.org
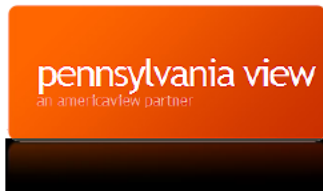
PennsylvaniaView

Consortium Overview

Goals and Value of the PAView Consortium
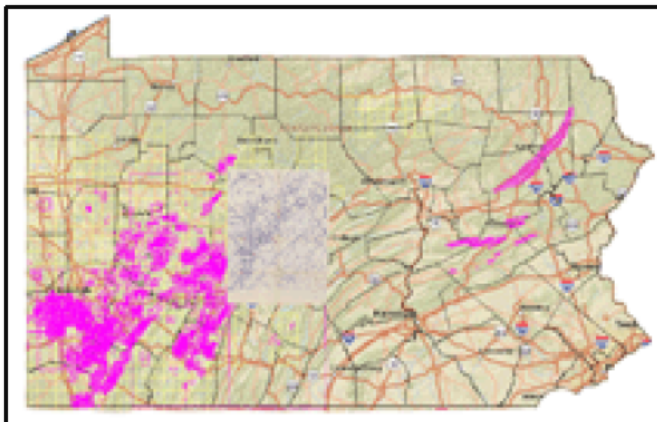
Pennsylvania Mine Map Atlas – Location of Mines Digitized

PAView is a collaborative effort of a consortium of members throughout the Commonwealth of Pennsylvania. PAView was established in September of 2005 and is a full member of the AmericaView program. PaView, as part of the AmericaView—program, focuses on public domain remotely sensed data and technologies in support of applied research, K-16 education, workforce development, and technology transfer. AmericaView (AV) is administered through a partnership between the U.S. Geological Survey and the AmericaView SM Consortium. The Consortium is the federal government's primary partner in achieving the AV Program vision and goals. PAView was developed to further one of the primary goals of the AmericaView program—educating the public about remotely sensed imagery and to provide an additional portal to data and information in a public forum. (http://www.paview.psu.edu)

The **goals** of PAView are:

- To build partnerships within the Commonwealth to support interests in public domain remotely sensed data.
- To create resources for K-12 teachers to utilize in their classrooms to educate students about imagery.
- To promote the sharing of data through connections with existing resources and acquisition of new data.
- To work with undergraduate educators and institutions through the Commonwealth to enhance access to satellite data and encourage its use in their courses.

The value of the PAView consortium to Pennsylvania rests with its ability to further one of the primary goals of the AmericaView program-—educating the public about remotely sensed imagery and enhancing public access to data and information.

PAView Consortium Membership

Our consortium members work on a wide variety of efforts related to remotely sensed data at their universities.

California University of Pennsylvania
Pennsylvania State University
Clarion University of Pennsylvania
Bucknell University
Villanova University

PAView Website: http://www.paview.psu.edu

Co-PI: Dr. Thomas Mueller, Professor,
E-Mail: Mueller@calu.edu **Phone: 724-938-4255**

Co-PI: Dr. Maurie Kelly, Director of PASDA
E-Mail: mck4@psu.edu **Phone: 814-863-0104**

PennsylvaniaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

AmericaView Web Site:
www.americaview.org

AV Executive Director:
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Pennsylvania View
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Social Media and Imagery Assisting Public Safety
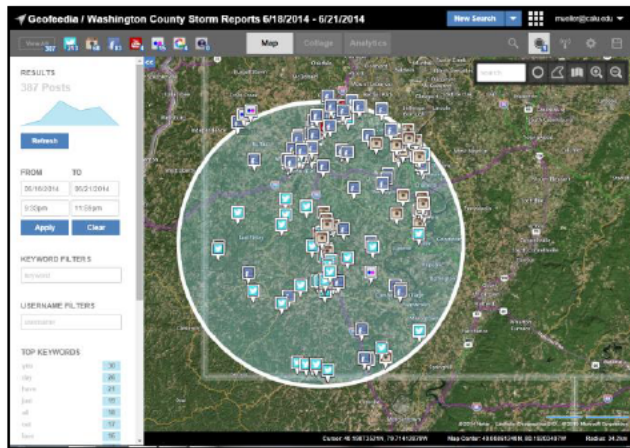
Number and location of storm reports in Washington County, PA

"Geofeedia provides users a location-based social media monitoring, analysis and engagement platform. Businesses, media companies, and government agencies use Geofeedia to understand events happening and being commented about at locations important to them. Geofeedia's patent-pending technologies allow anyone to search and monitor areas as large as a city or as small as a single building." See: http://corp.geofeedia.com/resources/faq/.

The first package was installed at California University of Pennsylvania to be used for educational purposes and the other was installed at the Washington County Department of Public Safety. This established a service learning project between the university and the department in creating exercises for an emergency situation. Students taught the department the software while the department explained to the students how to utilize this data collected from Geofeedia in various emergency and responder situations.

Pike Run Watershed and Wells

PAView collaborated with Washington County Watershed Alliance representatives and scientists from the Washington County Conservation District to develop a spatial database of residential water supply wells. Over the past several years, Washington County has been one of the most active regions for natural gas drilling. This activity has generated interest and environmental concerns regarding water withdrawals, wastewater disposal, and potential contamination issues associated with the fracking process for natural gas extraction. This project involves the acquisition of well data, along with the construction of a dynamic geodatabase for cataloging and analyzing spatially distributed ground- and surface-water chemistry with imagery. One key indicator of stream health, that is both simple and cost-effective, is Conductivity. As a proxy for dissolved solids and salinity, conductivity values demonstrate potential negative impacts to streams from several possible sources. Analysis of conductivity data, and determination of chemical contributing to this bulk parameter, can be evidence for specific sources. Identifying these sources is critical in ameliorating the problems and protecting stream health.
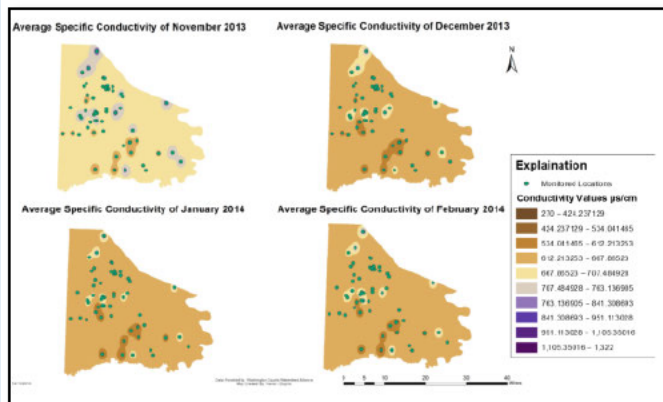
The map shows the average monthly specific conductivity for November 2013 through February 2014.

Other PAView Projects

State Deforestation Study

Villanova University introduced geospatial technologies to students through an examination of deforestation. Satellite imagery was used to delineate deforestation in the Amazon Forest in Brazil. However, deforestation can also occur in areas where housing developments take over farmland. Villanova students evaluated historical aerial imagery against current satellite imagery to determine if this phenomenon was occurring in Chester County.

Urban Vegetation Cover

Clarion University evaluated urban vegetation cover using LiDAR and high-resolution imagery. In this study, methods of LiDAR point cloud data manipulation combined with traditional multi-spectral image classification were applied in order to investigate the natural versus non-natural elements in the town of Clarion. Extracting those features helps quantify permeable and non-permeable surfaces and assess the current built environment in Clarion. In addition, these methods **assist with the** estimation of the tree density cover in town.

Land Use and Land Cover Change

Bucknell University worked with imagery in the Sudan that can be used in research and teaching. The objective of this work was to use the U.S. Geological Survey's Landsat satellite imagery to quantify and visualize land-use change and land-cover change in South Sudan from 1985 to 2011. The imagery also provided information on the location and distribution of different habitat types. The students were able to classify habitat types and will use the images to "ground-truth" or verify habitat classifications while they are on-site.
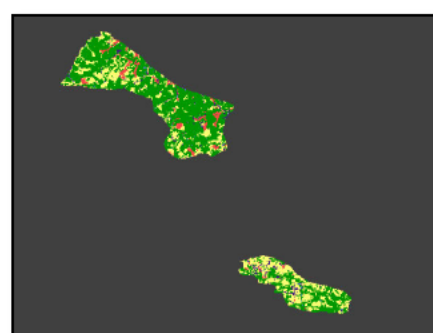
PAView Vision and Goals

PAView Vision:

Focus on public domain remotely sensed data and technologies in support of applied research, K-16 education, workforce development, and technology transfer.

PAView Long-Term Goals:

1. To build partnerships within the Commonwealth to support interests in public domain remotely sensed data.
2. To create resources for K-12 teachers to utilize in their classrooms to educate students about satellite imagery.
3. To promote the sharing of data through connections with existing resources and acquisition of new data resources.
4. To promote the annual Pennsylvania Workshop on Remote Sensing.
5. To work with undergraduate educators and institutions through the Commonwealth to enhance access to satellite data and encourage its use in their courses.

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PAView Website:
http://www.paview.psu.edu

South Dakota View
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Landsat-Based Land Cover Map for Roberts County
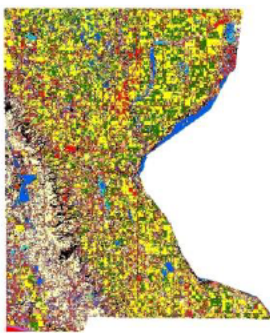
- □ Grassland
- ■ Urban/Barren
- ■ Trees/Forests
- ■ Corn
- ■ Wheat
- □ Harvested Wheat
- ■ Oats
- ■ Alfalfa
- ■ Soybeans
- ■ Open Water
- ■ Harvested Alfalfa
- ■ Wetlands

Land cover map of Roberts County, South Dakota, and cover-type legend. Landsat 8 imagery acquired on 13 August 2013 was used for the project.

With this year's funding, South Dakota View (SDView) provided assistance to the South Dakota Department of Game, Fish, and Parks (SDGFP) in the creation of a land cover map for Roberts County. This county is located in the extreme northeastern corner of South Dakota. The SDGFP has a special interest in the identification of woody habitat within the county suitable for wildlife. The project used Landsat 8 imagery acquired on 13 August 2013 and various image processing and classification techniques to create the land cover map shown on the left. A similar project was completed during the previous year using USDA's 2010 National Agriculture Imagery Program (NAIP) 4-band digital imagery. A comparison of the results concluded that although the NAIP imagery shows much more detail, the Landsat imagery classification results compare favorably with the NAIP-data classification. Additionally, the volume of Landsat data is significantly less than the volume of the NAIP data for the county, and the required amount of data processing is reduced.

Benefits to South Dakota

The information about the Earth that is captured in remotely sensed imagery has great potential value to South Dakota citizens in all walks of life as well as to scientists, researchers, and educators. **Educating the current workforce as well as the workforce of tomorrow (K-16 students) about the benefits of remote sensing and related geospatial technologies (such as GIS and GPS) is a major area of emphasis for SDView.** The Roberts County Land Cover Mapping Project and the Statewide Geospatial Conference are examples of SDView's efforts to create awareness of remote sensing products and assist in their use for practical application and education purposes.

Providing Remote Sensing Outreach

South Dakota Statewide Geospatial Conference

The South Dakota Statewide Geospatial Conference, sponsored by SDView, was held 14-15 October 2014 in Mitchell, SD. A total of 112 individuals attended the conference, including 29 students from Mitchell Technical Institute and South Dakota State University. The general purpose of the conference was to share information related to Remote Sensing, Geographic Information Systems (GIS), and Global Positioning Systems (GPS). Conference attendees learned about the latest advances in these geospatial technologies, met folks from around the state and region who use them, identified opportunities for collaboration, found out how geospatial technologies can be used in all levels of education, and became acquainted with various data processing tools and sources of geospatial data. The conference format included presentations, vendor displays, and poster displays. Featured speakers included:

- Dr. Bruce Quirk - USGS, Reston, VA
  "Unmanned Aircraft Systems (UAS) Applications in the Department of the Interior"
- Shane Swedlund - Raven Industries
  "Geospatial Technologies in Precision Agriculture"
- Dr. Tom Loveland – USGS/EROS
  "EROS and a Changing Earth"
- Roberta Lenczowski – AmericaView
  "The Exponential Impact of Collaboration"

A complete conference agenda can be found at http://www.sdstate.edu/abe/SDView/conference/agenda.cfm.

One of the many workshops presented at the South Dakota Statewide Geospatial Conference on 14-15 October 2014.

South Dakota View is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

Other South Dakota View Projects
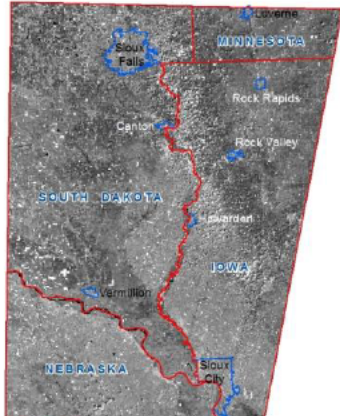
Flooding in Southeast South Dakota

28 May 2014 Landsat image

Heavy rain in southeast South Dakota, southwest Minnesota and northwest Iowa in the first half and middle of June caused widespread flooding and damage to fields, roads, houses and other structures. During two storms on June 15 and 17 alone, areas in southeast South Dakota reported receiving up to 13 inches of rainfall. The extent of flooding along the Vermillion and the Big Sioux Rivers is apparent by comparing the Landsat images shown on the left and right. The image on the left shows portions of South Dakota, Nebraska, Iowa and Minnesota before (28 May 2014) the heavy rainfall while the image on the right shows the same area immediately after the rain storms (21 June 2014). Flood waters are shown in black.
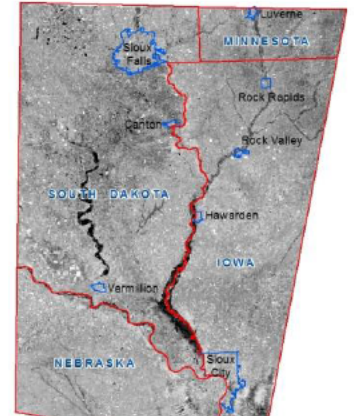
21 June 2014 Landsat image

Precision Ag Conference Presentation

An SDView presentation entitled "Elevation Data – LiDAR, NED and More" was a part of the 2014 Precision Ag Conference held 12 February 2014 in Aberdeen, SD. Approximately 200 producers, agronomists, vendors and students attended the event to learn about the latest in precision agriculture research and technology and the new challenges facing farming today. The SDView presentation was relevant because of the need for very precise elevation information in precision ag technologies.

Big Sioux Water Festival

The 22nd annual Big Sioux Water Festival was held 13 May 2014 on the campus of South Dakota State University. At the event, approximately 1200 fourth graders and their teachers from northeastern South Dakota participated in a variety of hands-on water education activities. SDView participated in the Festival with a remote sensing activity named "A View from Above." In addition to learning about water in South Dakota, the students also enjoyed seeing their homes from space.

South Dakota View Consortium Membership

South Dakota State University

SD Bureau of Information and Telecommunications

City of Sioux Falls

SDSU Extension - STEM

SD Department of Education

SD Dept. of Environment and Natural Resources

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TexasView
Remote Sensing Activities

2013 - 2014

Earth Observation Depot Network (EODN)
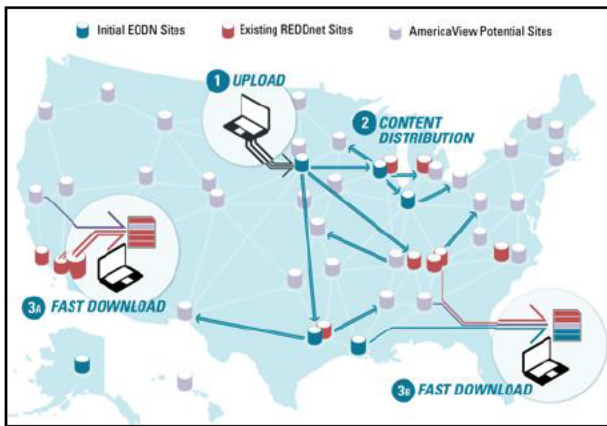
Prototype EODN System Map showing initial depots, source depots and user nodes. EODN will grow as interested institutions install local depots using the NSF funded Data Logistics Toolkit. EODN provides faster, more robust access to remote sensing data for everyone.

The Earth Observation Depot Network is the culmination of over ten years of research and work by TexasView to adapt cutting-edge technology for distribution of remote sensing data. Based on a concept called "Logistical Networking", EODN is a user owned and operated, distributed cloud, content distribution system for remote sensing data.

Large data providers such as USGS can upload data to EODN where the data are replicated and distributed across servers known as "depots" located across the country and around the world. Data logistics insures data are available where needed, when needed.

This year saw the inauguration of a prototype EODN with the deployment of a customized USGS GloVIS instance core set of depots at principle locations in Michigan, Tennessee, Indiana, Texas and Wisconsin (see image on left). Initially, the most current 30 days of Landsat 8 data from USGS EROS Center was loaded and distributed through a customized USGS GloVIS instance (http://tvdlnet4.sfasu.edu/glovis/index.html/).

Watching Over Texas From Space

Watching Over Texas From Space **(WOTFS)** is part of TexasView's continuing K-12 educational effort to tie remote sensing technology to the Texas Essential Knowledge and Skills (TEKS) for secondary Earth Science and Environmental Studies students.

Additions to the project this year include a poster featuring USGS Landsat imagery that challenges students to identify specific patterns and impacts of natural events and human activity (see image on right). New exercises using satellite imagery from Texas State Parks engage students with geography, change-detection and vegetative mapping skills. Exercises are linked to State Park websites including ground video allowing students to correlate remote sensing imagery with conditions on the ground.

Watching Over Texas from Space introduces Texas high school students to space age technology without the requirement for expensive hardware or complicated software. Combined with a focus on important Earth Science issues and alignment with the TEKS, *Watching Over Texas from Space* is an important contribution to Texas high school curriculum.
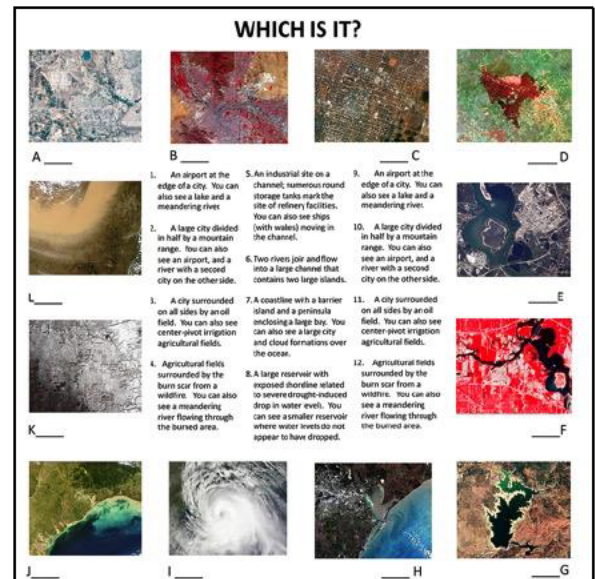
Answer sheet for the WOTFS "Which is Which" poster. "Which is Which" challenges students to recognize ground features from USGS Landsat Imagery.

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TexasView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

AmericaView Web Site:
www.americaview.org

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TexasView
Remote Sensing Activities

2013 - 2014

TexasView Fundamentals of Image Processing Workshop

Participants in the TexasView Introduction to Image Processing Workshop learn how to mosaic images using state-of-the-art technology during the 2013 Texas GIS Forum. Each year dozens of Texas GIS professionals get an introduction to remote sensing through the workshop.

The *TexasView Introduction to Image Processing Workshop* is a one or two day, hands-on seminar intended to introduce GIS professionals to remote sensing software and methodologies. Targeted at state agencies, local government, and industry GIS personnel, the workshop uses professional image processing software such as ERDAS Imagine and state-of-the-art methodology to encourage professional GIS personnel to expand their geospatial repertoire to include remote sensing image processing. The workshop was developed by personnel at the University of Texas Center for Space Research and is offered annually during the Texas GIS Forum as well as on-line.

This year, TexasView funds were used to expand and update the workshop to take advantage of new software versions and develop new exercises featuring up-to-date, Texas-centric satellite imagery.

Other StateView Projects

TexasView Archives – free GIS and remote sensing data made available to all through the TexasView Web Portal.

TexasView Earth Observation Day Website – An online Web Mapping Service for K-12 teachers linking satellite imagery with Texas State Parks.

AmericaView Multi-State Server – A shared Web Mapping Service resource for AmericaView members.

MODIS Today – Daily MODIS satellite imagery over Texas.

Teacher Training – Workshops for Texas High School Teachers through Texas Education Regions.

Consulting – remote sensing consulting services provided through the University of Texas Center for Space Research and the Columbia Regional Geospatial Service Center at Stephen F. Austin State University.

The TexasView Multi-State Server (AVMSS) provides a Web Mapping Service test bed for AmericaView members. Here we see thumbnails of Landsat 8 acquisitions over the contiguous United States for October 1, 2014. AVMSS displays daily acquisitions as Landsat 8 data is loaded into the Earth Observation Depot network by an automated ingest system developed and operated by TexasView.

TexasView
Consortium Overview

Goals and Value of the TexasView Consortium

TexasView in a Nutshell

TexasView is a statewide consortium dedicated to promoting remote sensing technology through education, research and outreach. TexasView provides educational outreach to K-16 students through various projects such as *Connecting Earth Observation Day to Texas Landscapes*, *Watching Over Texas From Space*, the *Earth Observation Depot Network* and the *TexasView Introduction to Remote Sensing Workshop*. In addition, TexasView maintains archives of free remote sensing imagery for public access, providing a convenient location for students and researchers to obtain Texas-centric remote sensing data.

TexasView plays an active role in broader, technology-based AmericaView projects such as the AmericaView Multi-State Server (AVMSS) and the Earth Observation Depot Network (EODN). These initiatives are designed to broaden and enhance access to remote sensing data for everyone around Texas, the United States and the world.

Data about Earth and its processes are observed by remote sensing. Information and knowledge derived from remote sensing and use of GIS technologies supports education and research and offers many local government applications. TexasView facilitates free and public exchange among its members.

Established in 2002, the TexasView Remote Sensing Consortium consists of fourteen university partners distributed across the state. Members include universities large and small, public and private. TexasView members work closely with state, regional and local agencies to promote remote sensing at all levels.

TexasView Consortium Membership

Stephen F Austin State University

The University of Texas at Austin

Midwestern State University

Texas Tech University

Texas A&M University

The University of Texas at El Paso

Lamar University

Texas A&M at Corpus Christi

Texas State University

The University of Texas at San Antonio

Sul Ross State University

Texas A&M International University

The University of North Texas

Rice University

TexasView Website: http://www.texasview.org

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TexasView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

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UtahView

Remote Sensing Activities

2013 - 2014

Improving Utilization of Remotely Sensed Data

Landsat Data Development and Enhancement

Over the past year, UtahView developed software to analyze historic Landsat 5 and current Landsat 8 data that covers Utah. These data include 15 separate scenes captured over the regional growing season. Images are converted to percent reflectance using the gain/bias values and solar elevation parameters contained in the metadata files of each image. Results consist of temporal paths generated by selecting the pixel with the highest index value across time. Spectral indices, such as Normalized Difference Vegetation Index (NDVI), can be used to generate temporal mosaics. The output of this pixel "sifting" process consists of a yearly temporal mosaic of Utah made up of only those pixels that meet the specified criteria.
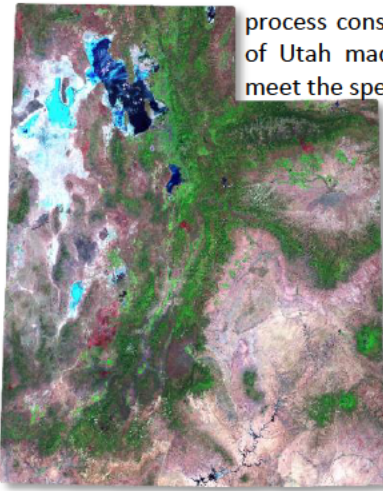
These results will benefit natural resource managers in Utah by providing data on historic as well as current landscape disturbances. It will also benefit students by allowing them to better visualize landscape-level changes and impacts from wildfire. – *Dr. Douglas Ramsey, Utah State University*

Providing Remote Sensing Education

Geospatial Curricula Development

UtahView is dedicated to improving the use of geospatial curricula in K-12 schools throughout Utah. UtahView, in cooperation with the Utah State University Remote Sensing/GIS Laboratory and the Edith Bowen Laboratory School, developed introductory curriculum that supports newly adopted Common Core teaching standards. Initial work focused on the use of Google Earth and basic GIS data to provide students with a way of enhancing and exploring topics being taught. Using newly developed curricula, lessons were taught at the Edith Bowen Laboratory School in Logan, Utah. – *Lisa Langs Stoner, Utah State University*

Undergraduate Research Projects

Undergraduate research is a high-impact activity supported by the UtahView consortium. Students work with advisors to submit a fully developed research proposal that is aligned with key goals of the UtahView program. Proposals are reviewed by UtahView researchers and funded based on quality and potential.

Decadal analysis of aspen-conifer succession using remote sensing and GIS

Quaking aspen (*Populus tremuloides*) is considered a keystone species in many higher-elevation western ecosystems. Stands of aspen provide habitat and forage for wildlife and livestock, as well as providing a unique indicator of local forest ecosystem health. Research has shown that aspen populations may be in a state of decline due to management challenges, conifer encroachment, grazing, and climate change.

This study used remotely sensed imagery and GIS analysis to determine successional pathways in aspen and conifer stands on a decadal scale. Historic imagery, provided by the U.S. Department of Agriculture Aerial Photography Field Office (USDA APFO) was digitized and analyzed to evaluate patterns of growth or loss of large aspen stands in northern and central Utah. – *Thomas Thompson, Utah State University*

The effects of cheatgrass on black-tailed jackrabbit relative abundance at Dugway Proving Ground, UT

Cheatgrass (*Bromus tectorum*) is an invasive species known to compete with and displace native species in lower-elevation, dry western ecosystems. This project evaluated the effects of cheatgrass on the black-tailed jackrabbit, a habitat generalist that prefers succulent vegetation as forage. It was hypothesized that the increase in the occurrence of cheatgrass would negatively influence black-tailed jackrabbit abundance.

Using cheatgrass occurrence and GIS data developed through remotely sensed methods, ground surveys of existing vegetation and jackrabbit populations were conducted. Using generalized linear mixed models, data were analyzed. The findings did not support the initial hypothesis that increased cheatgrass cover would negatively impact black-tailed jackrabbit populations. – *Victoria Holman, Utah State University*

Student Presentations

The Utah Automated Geographic Reference Center (AGRC) sponsored the annual *Maps on the Hill* (MOTH) event at the Utah State Capitol building in Salt Lake City on January 29th, 2014. The event showcases mapping and research projects completed by educational, private, and government agencies working in and around Utah. Held on the opening day of the 2014 legislative season, maps and posters were presented to state legislators and staff members. UtahView supported five student and researcher poster presentations at the 2014 MOTH.
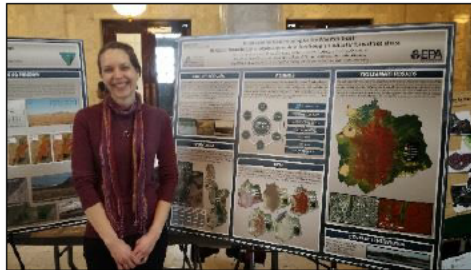
Ms. Ellie McGinty, representing UtahView at Maps on the Hill.
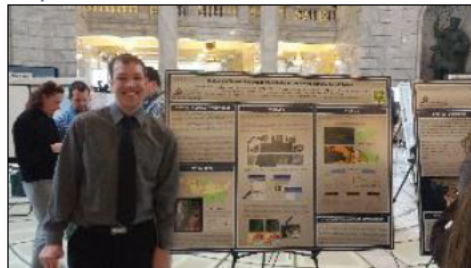
Mr. Thomas Thompson presenting undergraduate work at Maps on the Hill.

Left, work presented by Ms. Victoria Holman at Maps on the Hill in Salt Lake City, UT.

Right, the Utah Capitol Rotunda in Salt Lake City.

Website & Social Media

UtahView announced the development and release of the new UtahView website (http://utahview.usu.edu) as well as social media outlets through Facebook @utahview (www.facebook.com/utahview) and Twitter @UTView (http://twitter.com/utview). The UtahView website will host links to completed and ongoing projects as well as provide project data access and download.

UtahView Vision and Goals

UtahView Vision: The primary mission of the UtahView consortium is to facilitate and promote the availability, distribution, and use of geospatial technology and data in the public and private arenas; encourage use of geospatial data in higher education and among K-12 schools and educators; and to facilitate advanced geospatial research and understanding at all levels.

UtahView Long-Term Goals:

1. To foster a growing and dynamic consortium of statewide partners that includes educational institutions, state and local governments, and the general public in order to support and promote the AmericaView and UtahView mission and goals
2. To establish remote sensing and geospatial curricula that are available for use by K-12 schools throughout Utah as well as templates that are publicly available to any educator
3. To facilitate the distribution, use, and understanding of remote sensing data in Utah
4. To provide opportunities for undergraduate students to conduct research using geospatial tools
5. To continue to enable free, simple, useful, and value-added access to remotely sensed data and information

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UtahView
Consortium Overview
2013 - 2014

Improving Utilization of Remote Sensing Resources in Utah

General Overview of the UtahView Consortium

UtahView researchers and instructors working with students at Edith Bowen Laboratory School in Logan, Utah, 2014.

UtahView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. AmericaView receives its primary funding from the U.S. Geological Survey, which in turn supports the AmericaView mission of advancement, availability, distribution, and use of remotely sensed data and technology through education, research, outreach and technology transfer.

The UtahView consortium includes researchers and instructors from Utah State University, Utah Valley University, and the University of Utah.

The 2013-2014 year was a successful and busy year for the UtahView consortium. Projects completed by consortium members included 1) working with elementary students to explore their local environment using Google Earth and basic GIS data; 2) development of tools to process and add value to remotely sensed Landsat imagery; and, 3) a trip to the annual *Maps on the Hill* (MOTH) event at the Utah Capitol Building in Salt Lake City to present work completed by students and researchers to Utah State Legislators. UtahView also announced the release of three new sites that will be used for project and data sharing and social media interaction. The UtahView website is now available at http://utahview.usu.edu. The site features completed and ongoing projects, project report and data downloads, and links to UtahView consortium members. UtahView also established a Facebook account (http://www.facebook.com/utahview) and a Twitter account (http://twitter.com/utview) to better support public interaction. The sites are regularly maintained and updated with UtahView and AmericaView related information as well as data and tools for public use.

UtahView Consortium Membership

Dr. R. Douglas Ramsey, Professor and Director of the Utah State University Remote Sensing/GIS Laboratory, Dr. Phoebe McNeally, Research Associate Professor and Director of the University of Utah DIGIT Laboratory, and Dr. Sowmya Selvarajan, Assistant Professor of Geomatics and ASPRS Intermountain Region President, are the primary UtahView research investigators. The goals and missions of all three institutions are unique and bring a wealth of scientific, outreach, and technical experience to urban, rural and wildland regions of the state.

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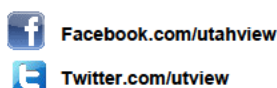
VirginiaView
Consortium Overview

Goals and Value of the VirginiaView Consortium

General Overview of the VirginiaView Consortium

VirginiaView provides workforce development opportunities to an array of stakeholders.

VirginiaView is a statewide consortium for cultivating state and local applications of satellite remote sensing through education, research, and geospatial applications. Our consortium includes universities, state agencies, and nonprofit organizations with interests in promoting applications of geospatial data. Many of our activities support STEM education, and outreach to K-12 and community college instruction.

VirginiaView as a member of the AmericaView consortium, supports AmericaView program goals by further expanding educational networks, providing regional workforce development opportunities, developing analytical resources, and extending capabilities for acquiring and using remotely sensed data among AmericaView members, state, and local stakeholders.

Billions of dollars have been invested by the federal government and private sector on satellite-based earth observing systems since the early 1970's. In that time, the research community has identified and developed practical applications for mapping, monitoring, and managing natural and environmental resources. Potential uses for remote sensing technology have been widely recognized for years. The distribution of real-world applications has been, and continues to be, challenging issues for both the federal government and the academic research community.

The VirginiaView consortium works to bridge the gap between the research and application communities across the Commonwealth. We work closely with other institutions of higher education, as well as precollege educators, local governments, state agencies, and others. Our consortium supports development of targeted educational resources to facilitate STEM education, workforce development initiatives, student and community engagement opportunities, and research. Many of our activities focus upon applications of Landsat imagery, distributed without charge by the U.S. Geological Survey (USGS). Landsat data and USGS goals shape key components of VirginiaView's mission.

VirginiaView Consortium Membership

VirginiaView partners develop, leverage, and disseminate remote sensing resources and applications. VirginiaView's programs, supported by other AmericaView members and the National Geospatial Technology Extension Network (NGTEN), have the capacity for efficient national and international reach.

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VirginiaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.
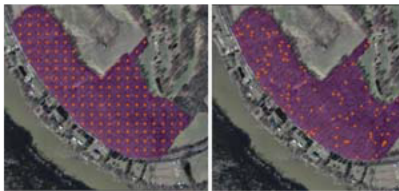
VirginiaView
Remote Sensing Activities
2013 - 2014

Delivering Remote Sensing Education

Pre-college Workshops for Virginia Educators

During 2013-2014, VirginiaView (VAView) provided geospatial education to 55 individuals through three separate programs. Our participants include: pre-college educators, local, state, and federal government employees, higher education faculty, other nonprofits, and the private sector.

VAView also advances pre-college STEM educational programs, and directs geospatial and remote sensing programs for the pre-college community through school visits, curriculum enhancement, demonstrations, and training.

VAView remote sensing workshop held for government employees in Richmond, Virginia (June 2014).

Impact of ArcMap Tutorials

VAView's tutorials are having significant impacts on educators teaching geospatial analysis. To date, VAView has received requests for its ArcMap tutorials from community college faculty, higher educational faculty, and the U.S. private sector. Currently, the resource has been made available to the public through the VAView Website (attracting over 30,000 visits to date) at http://virginiaview.cnre.vt.edu/education.html.

...what a great resource! I just started looking at the on-line chapters and tutorials yesterday and they are amazing - our iGETT participants will be so excited to have access to them.

-Osa Brand, NCGE Educational Outreach Director

Providing Remote Sensing Education

Educational Resources for Educators

Many educators do not have access to specialized remote sensing software to support remote sensing education. Virginia educators, however, do have access to ArcGIS software through Virginia's statewide educational license agreement. This is the case not only in Virginia, but also in some other states as well.

In response, during the past year, VAView prepared and published educational tutorials to support the needs of educators. Through this resource, to be published as an e-book, educators learn how to integrate introductory facets of remote sensing to support both their education course development and instructional needs and their research.

Remote Sensing in an ArcMap Environment
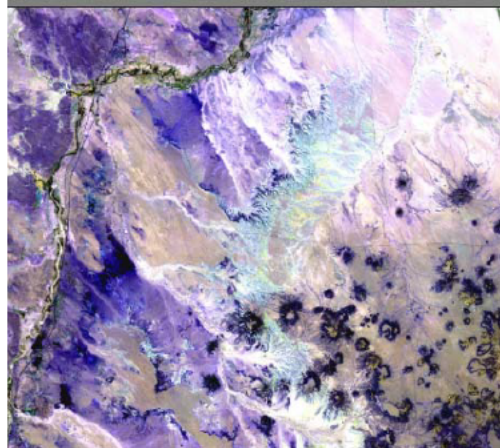
Tammy Parece
James B. Campbell
John McGee

VAView developed geospatial educational resources for workforce development (image source: USGS/NASA).

Other VirginiaView Projects

Community Outreach: On a regular basis VirginiaView participates in local activities that highlight the significance of geospatial data, including Landsat and related forms of remotely sensed imagery. During the past year, our exhibits for Kid's Tech University, and for the Virginia Science Festival, attracted and engaged both children and adults, and were among the most popular activities at these events. Our exhibits present a range of geospatial topics, usually as they apply to local regions. Because we recruit our students as volunteer assistants, these activities nurture their service ethic and engage their interest in geospatial outreach.

InFOREST: The InFOREST ecosystem calculator, developed in collaboration with the Virginia Department of Forestry, provides an image-based toolkit (including Landsat imagery) that permits estimation of variables such as biodiversity, runoff, nutrient balance, sediment losses, and carbon balance, for any delineated parcel within Virginia. During the past year, VirginiaView has added a GPS capability to InFOREST to permit delineation of parcels by accepting real-time entry of locational data in the field, increasing its functionality for both landowners and scientists. This important modification will enhance the value of InFOREST to support sustainable uses of Virginia's resources.

Spectrometer Activity: During the past year, VirginiaView developed a lesson plan to guide instructors at high schools and community colleges in the design and implementation of student exercises using a lab spectrometer. The lesson plan provides hands-on lab activities to support material usually presented in texts and lectures. The exercise introduces students to the use of a simple spectrometer to collect and analyze basic spectral measurements. The ALTA reflectance spectrometer, designed for laboratory use to illustrate principals of spectroscopy, can be used to compare selected samples of (for example) leaves and soils. A simple spreadsheet provides the basis for calculating and displaying sample spectra so students can compare and analyze differences.

VirginiaView's Vision and Goals

VirginiaView's Vision is to build partnerships within Virginia's public and private institutions to nurture access to geospatial data and to coordinate research and training activities utilizing remote sensing and associated technologies.

VirginiaView's Long-Term Goals:-

VirginiaView's strategy for the next five-year period is:

1. To continue to develop resources to support geospatial instruction across a wide variety of educational institutions, including K-12 schools, community colleges, and higher education, with a focus on workforce development in the K-12 and community college settings. To focus our efforts on providing resources that can be used in a variety of educational environments, and can be distributed electronically in a range of formats that are accessible to a range of students and institutions.
2. To develop instructional resources and capabilities to introduce students and citizens to applications of Unmanned Aerial Systems (UAS). To focus upon civil applications, flight planning, data processing and analysis, training, certification, and related topics to inform and prepare citizens and potential practitioners of the utility and contributions of UAS. VAView works closely with other practitioners, researchers, and institutions within AmericaView and the USGS.

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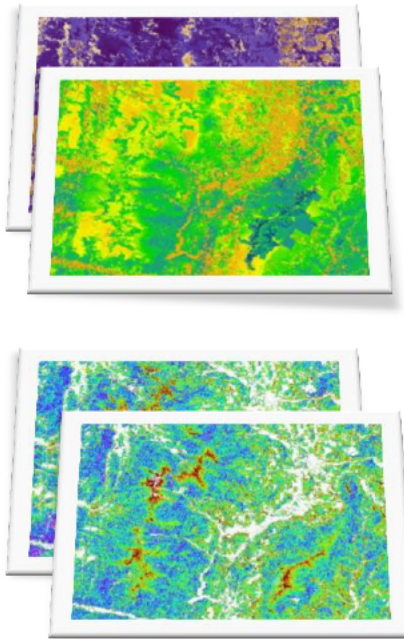jmcg@vt.edu

VIRGINIA VIEW
VirginiaView.net

VermontView

Remote Sensing Activities

2013 - 2014

Monitoring Vermont's Forests From Above

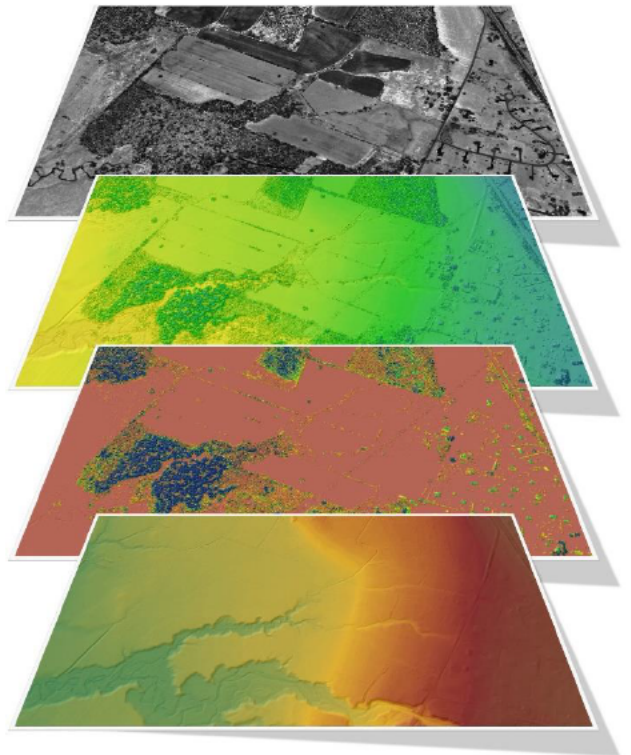### Forest Health Data for Decision-making Support

Vermont's forests are fundamental to the state's identity and a valuable resource, but they face a multitude of threats ranging from invasive species to climate change. How have Vermont's forest changed over the last decades? Satellites can help resource managers answer this question and better adapt to future challenges. VermontView derived forest health and phenology information from decades of Landsat satellite data. Data can be obtained through the Vermont Monitoring Cooperative.

Products derived from Landsat data including critical load and phenology (top) and time series forest health (bottom).

Benefits to Vermont

The VermontView consortium helps to advance remote sensing in the state of Vermont through research, education, and outreach.
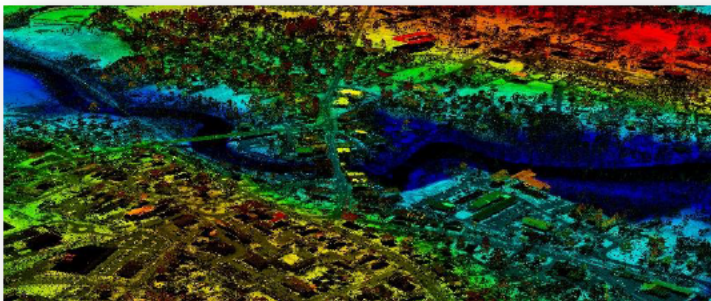
LiDAR data for the Middlebury area was acquired through USGS and state agency funding, and processed by VermontView.

Making Data Accessible

Capitalizing on LiDAR Investments Throughout the State

Accurate, high-resolution terrain data is crucial for a variety of applications from flood modeling to solar potential estimation to biomass mapping. LiDAR technology has resulted in new 3D terrain datasets that are hundreds of times more detailed than ones previously available. Increasing amounts of LiDAR data are being acquired in Vermont, but the datasets are complex to work with and in formats not always compatible with traditional GIS workflows. VermontView has processed terrabytes of LiDAR data in Vermont to make it more accessible to end users. Data can be obtained from VCGI.

Examples of LiDAR products created by VermontView in 2013. Each product highlights different features on the Earth's surface.

Other VermontView Projects

In July 2014 VermontView held its first annual remote sensing workshop at no cost to attendees. 21 participants came from throughout the state, representing all levels of government, non-profits, and the private sector. The workshop was held over two days at the University of Vermont's state-of-the-art geospatial teaching facility in the Rubenstein School of Environment and Natural Resources. Participants advanced their skills and knowledge by working with a broad range of remotely sensed data and carrying out advanced analyses such as change detection and 3D modeling.
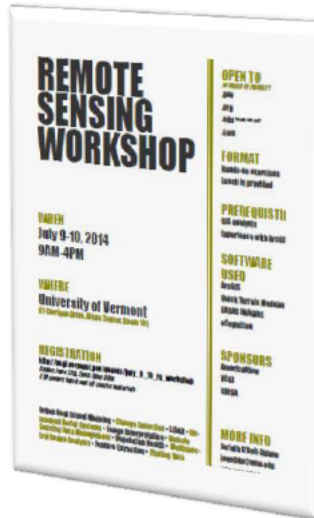
Much of the work for VermontView carried out in 2013-2014 was done by undergraduate students. VermontView technician positions are highly coveted and go to some of the best and brightest undergraduate students in the state. These students gain access to cutting-edge technology and mentoring from faculty and staff. The undergraduate technicians who worked on VermontView projects in 2013-2014 have graduated and are gainfully employed in the environmental consulting sector and geospatial software industry.
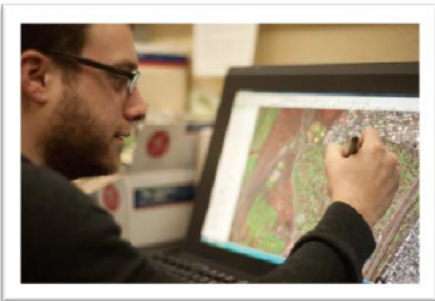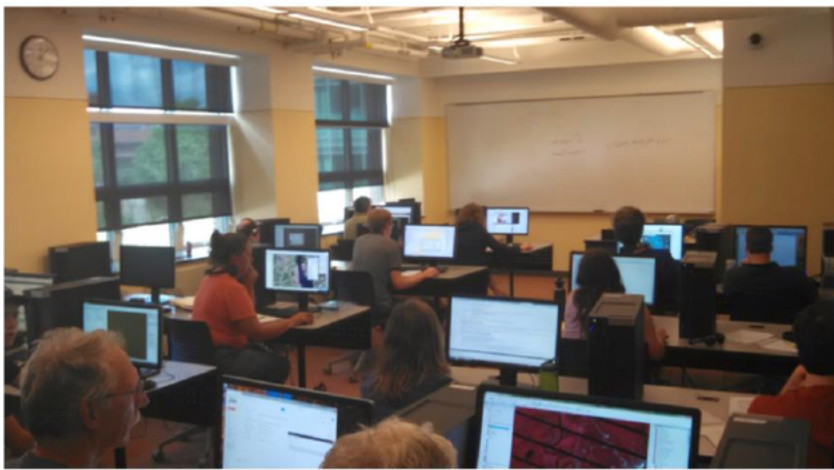
VermontView Consortium Membership

VermontView Principal Investigator:

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WisconsinView

Remote Sensing Activities

2013 - 2014

Improving Utilization of Remote Sensing Resources

Enhanced Access to Landsat 8 Imagery

In an effort to improve and expand use of satellite imagery, WisconsinView is working with researchers and computer scientists to enhance access to Landsat 8 imagery. The goals of this effort are to:

- Introduce Landsat 8 imagery to atmospheric scientists, meteorologists, and the public.
- Reduce the delays that exist between Landsat 8 acquiring an image and the image being available to researchers and the public.
- Provide mobile-ready access to near real-time imagery (see image of iPhone, right).

Landsat imagery viewed on an iPhone.

To accomplish these goals, WisconsinView has arranged for direct access to Landsat 8 imagery from the U.S. Geological Survey as soon as it has been acquired.

Both programmers and computer scientists then transform the imagery and data into formats that work in the systems and software used by weather scientists. The imagery is also viewable in mobile devices.
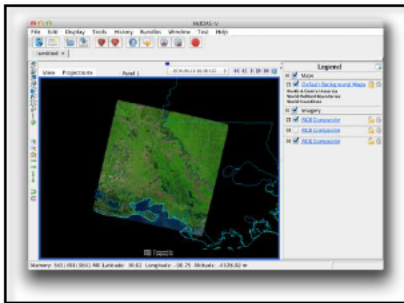
Landsat 8 color composite image viewed in McIDAS-V meteorology software.

Benefits to Wisconsin

Landsat 8 imagery is important to Wisconsin for agricultural, forestry, and land cover mapping. Enhancing access to Landsat 8 imagery benefits all of these activities.

Providing Remote Sensing Education

Public Interfaces for Viewing Wisconsin Imagery

In 2014, WisconsinView participated in a number of education and outreach events in Wisconsin. Using complex server software, researchers have developed web browser interfaces to simplify access to satellite imagery and make it easy for the general public to use.

WisconsinView Director Dr. Sam Batzli demonstrates the value of infra-red imagery to visitors at a campus outreach event.
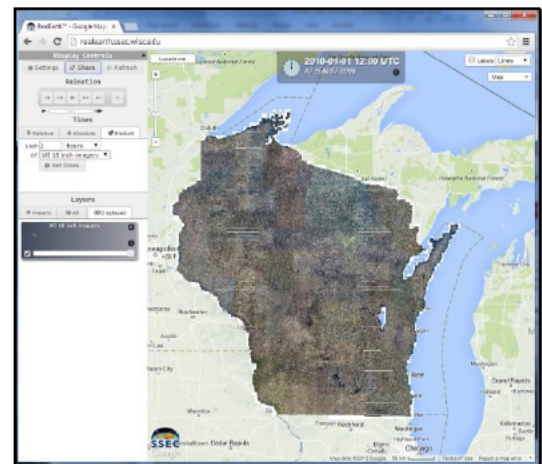
This browser interface called "RealEarth™" was developed in part with support from WisconsinView. To view the above statewide imagery, go to: http://realearth.ssec.wisc.edu/s/f1IDh

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WisconsinView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.
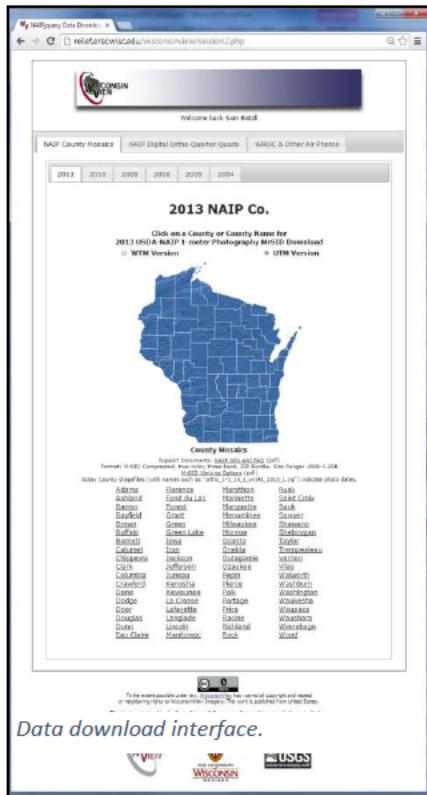
Other WisconsinView Projects

Data Download

WisconsinView serves over 15TB of data every year and is one of the only online sources for remote sensing imagery of Wisconsin.
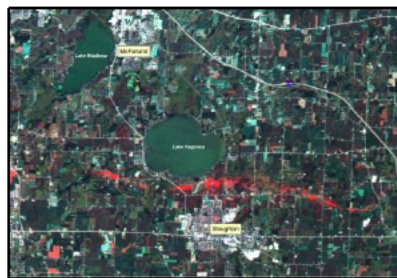
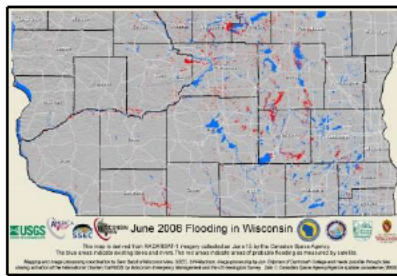

Data download interface.

Hazard Support

WisconsinView supports emergency management in Wisconsin by providing remote sensing data and expertise during times of need.

*Stoughton tornado, seen from Madison.*


Track of the Stoughton tornado.

Flood map from remote sensing data.

Web-Mapping Research

WisconsinView participates in a web-mapping research group at the University of Wisconsin-Madison. Programmers are developing techniques to merge different types of data. The goal is to improve visualization methods and expand access to remote sensing imagery and related data.
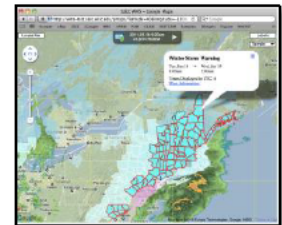
Example of merging different data types.
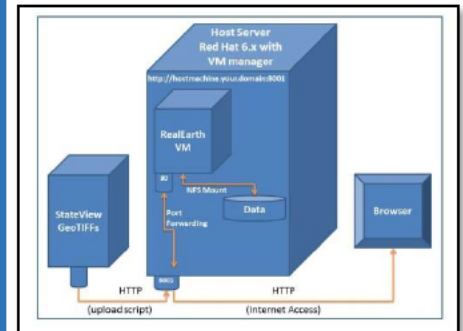
Design of web-mapping server.

WisconsinView Vision and Goals

WisconsinView Vision: coordinating remote sensing imagery access and use in Wisconsin.

WisconsinView Long-Term Goals:

1. Enhance the coordination of remote sensing imagery access and imagery use across the state.
2. Facilitate access to remote sensing data for Wisconsin.
3. Support remote sensing education and outreach in Wisconsin through public events and displays.
4. Support Wisconsin Emergency Management with remote sensing data and expertise in times of need.
5. Develop the WisconsinView consortium such that it meets the needs of Wisconsin and participates synergistically within AmericaView.

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West Virginia View
Remote Sensing Activities
2013 - 2014

Mapping forest types in the Monongahela National Forest with Landsat satellite imagery

Location of the Monongahela National Forest in West Virginia
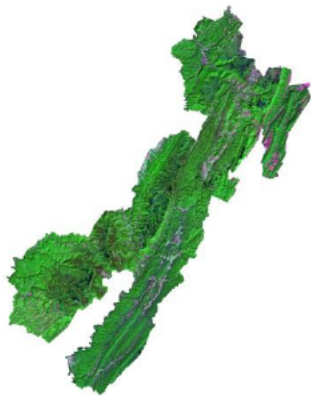
Example natural color Landsat 5 TM image of the Monongahela National Forest, collected on September 2, 2010.

Background
This West Virginia View project was carried out by an undergraduate student at Alderson Broaddus University, under the supervision of Prof. Aaron Maxwell.

Aim
The aim was to map the forest stand types within the Monongahela National Forest using satellite imagery and advanced machine learning classifiers and probabilistic models.

Data
1. Five Landsat 5 TM scenes capturing the seasonal range of vegetation coverage.
2. Digital elevation data.
3. Forest stand data from the West Virginia Division of Forestry (WVDOF)

Results
The study showed that accurate forest type maps could be produced from advanced machine classification methods combined with probabilistic models. The multi-seasonal Landsat imagery was able to distinguish most vegetation types, especially when supplemented with variables derived from digital elevation data.

Significance
Forestry is a major economic resource in West Virginia, and is key to both the timber and tourism industries. However, only limited state-wide or regional information is available about West Virginia's forests. Landsat imagery offers the potential to fill this gap and thus support management and planning.

Legend
- Pine-Oak
- Oak
- Northern Hardwood
- Mixed Mesophytic/Cove Hardwood
- Evergreen
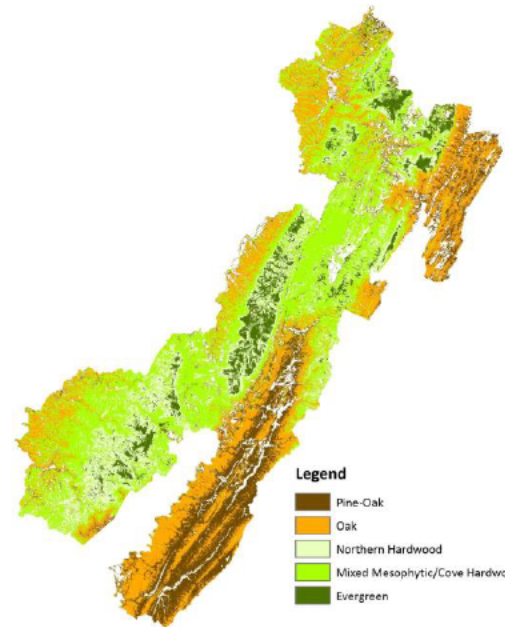
Forest types mapped using multi-seasonal Landsat imagery and machine learning algorithms

Benefits to West Virginia

- Mapping West Virginia forests for improved management of timber and recreational resources
- Workforce development through supporting students in their pursuit of geospatial and remote sensing skills
- Increasing the high-tech research capacity of West Virginia colleges and universities through enhancements of research facilities
- Development of advanced methods for remote sensing classification of forests from satellite imagery

Development of a remote sensing laboratory at Alderson Broaddus University


http://maxwellae.wix.com/abgsl

The Alderson Broaddus Geospatial Laboratory (ABGL) was developed at Alderson Broaddus University in Philippi, WV, with funding provided by West Virginia View.   The lab comprises two advanced image processing workstations and remote sensing software from the West Virginia View shared licenses.

The development of the ABGL and the associated funding has facilitated:

- An undergraduate research project on forest mapping in West Virginia
- Faculty research on mapping mine reclamation landcover
- The development of the first remote sensing course offered at Alderson Broaddus University
- Integration of the geospatial sciences in the Environmental Science bachelor degree program
- Development of a GIS Minor
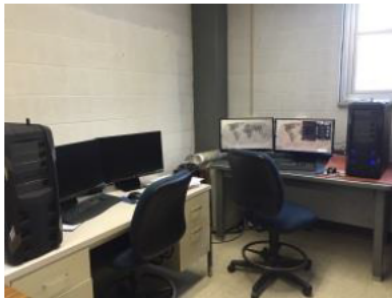
The Alderson Broaddus Geospatial Laboratory comprises two advanced workstations

West Virginia View has supported the mapping of surface mine landcover from satellite imagery and lidar data. Blue areas in this map show areas of active mining; reclaimed areas are shown in pink and purple, forests in red.

West Virginia View Vision and Goals

West Virginia View Vision: Develop remote sensing as a key contributor to the economic and research infrastructure of West Virginia through the coordination and enhancement of remote sensing efforts by educational, Federal, State and non-profit organizations in the Mountain State.

West Virginia View Long-Term Goals:

1. Establish formal ties between the major remote sensing organizations in West Virginia to promote coordination and facilitate cooperation.
2. Enhance workforce development by strengthening remote sensing and geospatial educational opportunities for faculty and students in remote sensing.
3. Promote theoretical and applied research in remote sensing relevant to the needs of West Virginia.
4. Develop remote sensing-based community outreach programs for the broad benefit of the state.
5. Expand the remote sensing infrastructure in the state through sharing existing resources and providing support for the acquisition of new resources, including hardware, software and data.
6. Maintain a web site as a focus for West Virginia View activities.

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West Virginia View
Consortium Overview
2013 - 2014

## General Overview of the West Virginia View Consortium

West Virginia View is a state consortium of geospatial science, education, and natural resource management organizations that work together to advance remote sensing and related geospatial technologies in West Virginia.

West Virginia View promotes workforce development through a variety of programs, such as educational workshops for professionals, teachers and students.

West Virginia View promotes remote sensing in the Mountain State through:

- Educational workshops on remote sensing for teachers
- Grants to students to enhance educational experiences, with a particular focus on undergraduate and graduate research
- Theoretical and applied research of relevance to West Virginia
- Coordination of shared resources, including state-wide purchase of remote sensing software for participating colleges and universities
- West Virginia View website as the largest source for free imagery and lidar data in the state of West Virginia
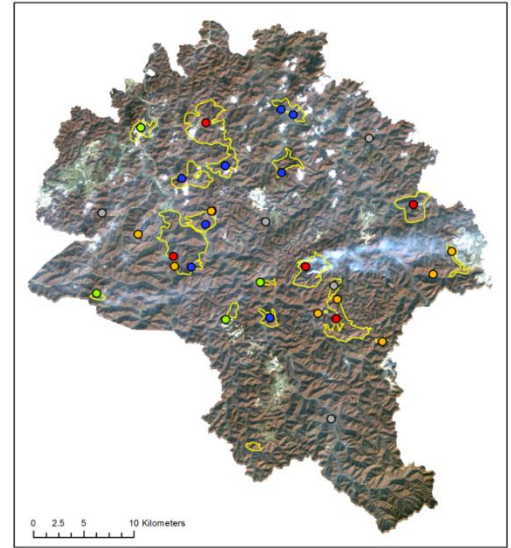
This 14 November 1999, Landsat 5 satellite image of Boone County shows burning fires. Note the smoke from the fire in the center of the image. White spots are clouds. Dots show locations of fires from the WV Division of Forestry, yellow outlines indicate extent of fires mapped from the satellite imagery.

Consortium Membership

The consortium comprises a complementary range of organizations:

- Colleges and universities
- Federal agencies
- State agencies
- Non-profit organizations

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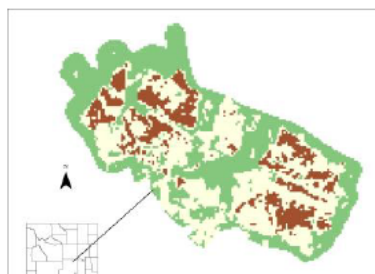# WyomingView
Remote Sensing Activities
2013 - 2014

Improving Utilization of Remote Sensing Resources

Mapping Burn Severity for the US Bureau of Land Management (BLM) with Landsat 8 data

BLM Rawlins Field Office implemented a prescribed fire treatment in Oct 2011. Post-fire is shown here.

Burn-severity map derived from the Landsat 8 image acquired on June 20, 2013

WyomingView, through its existing partnership with the US Bureau of Land Management (BLM) Rawlins Field Office, generated a **burn severity map** for the *Ferris Mountain Prescribed Fire.* In the previous year, a similar project was completed in the Marking Pen Creek area.

BLM provided field data and pre- and post-fire field photos (left above). WyomingView obtained a Landsat 8 image from *USGS EarthExplorer* and trained an undergraduate student intern to process the Landsat 8 data.

The intern calculated the *Normalized Burn Ratio Index* (NBRI) values for the field data points and used them for generating a burn severity map (left below). Brown and yellow colors represent medium- and low-burn areas, respectively, whereas green represents no-burn areas.

Benefits to Wyoming

WyomingView continues to leverage its resources and those of USGS for generating information from Landsat and other remotely sensed data and then provide it to land management agencies in Wyoming.

"I would like to thank [WyomingView] for the recently provided imagery of the 2011 Ferris Mountain managed wildfire. The map you provided the Rawlins BLM Field Office, based on data acquired from Landsat 8, will be very helpful in prioritizing future resource monitoring and management needs for the disturbance area."

- Mike Murry, Rangeland Mgt. Specialist, BLM, Rawlins, WY
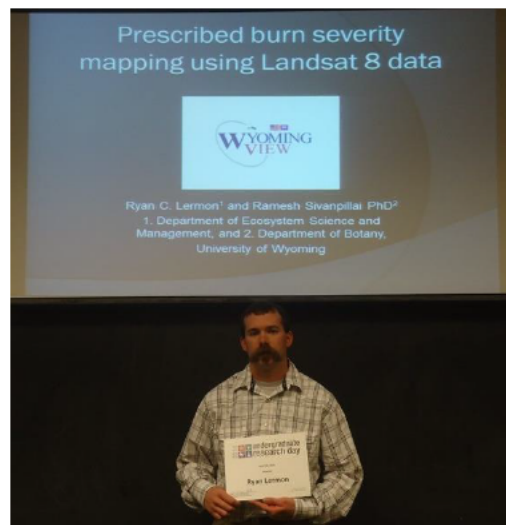
Remote Sensing Education

Training the Next Generation of Remote Sensing Scientists

WyomingView **trained two undergraduate student interns** in 2013-14 in the applications of remotely sensed data for natural resource management.

WyomingView interns often work on projects identified by WyomingView consortium members (federal and state government agencies). Consortium members provide field data and background information about the project.

By working on these projects, WyomingView interns gain *"real world"* experience and insights into how remote sensing concepts and techniques they learned in class are applied to address natural resource management.

Ryan Lermon generated a burn-severity map from Landsat 8 data and presented his findings (*photo below*) at the 2014 Undergraduate Research Day in Laramie, WY. Emily Richardson the other student intern, who studied aspen phenology using MODIS data, also presented her research during this event.

"Getting the opportunity to work with more remote sensing data after I took the class.... I am interested to see what remote sensing experiences I will have in the future. – Ryan Lermon, BS Rangeland Ecology & Watershed Management

Workshop to Promote No-cost Landsat Data

WyomingView taught a workshop to highlight the value of no-cost Landsat data for natural resources monitoring and mapping during the 3rd Annual WyGeo Conference in Lander, WY (*Aug 19, 2014*). Participants learned about Landsat data characteristics and applications, and also learned how to search and download data from *USGS EarthExplorer*.

This workshop targeted GIS practitioners interested in incorporating remotely sensed data in their workflow. The eighteen people who attended the workshop received certificates and earned continuing education credits.

State and regional conferences are excellent and cost-effective avenues to promote the value of no-cost Landsat data to geospatial professionals.

Introducing Remote Sensing to Eighth Graders

As part of the Earth Observation Day activities, *81 eighth grade* students at Laramie Junior High School were introduced to remote sensing concepts and applications (*weeks of Mar 31, Apr 7, and May 18, 2014*).

Students measured and compared the spectral reflectance of live, stressed and dead tree leaves using an ALTA II Spectrometer. Students learned about collecting, plotting and analyzing scientific data and interpreting the results.

Students saw how imagery data collected by Landsat and other sensors can be used for monitoring changes in our environment.

"I can definitely say that I learned new information about electromagnetic radiation and how it affects the colors that are visible for different species." - KW

Promoting Remote Sensing through Social Media

WyomingView manages social media sites (Facebook, Google+ and Blog) for promoting remote sensing awareness, new sources of data and products, and major findings and products that are based on remotely sensed data.

News briefs and images, uploaded from USGS, NASA, NOAA, European Space Agency, and a host of other agencies and organizations, are shared on a regular basis at WyomingView's social media sites.

Social media sites allow WyomingView to reach audiences worldwide and gauge their interests in various topics based on the metrics provided by these sites.

Currently WyomingView has more than 100,000 views in Facebook, 98,000 views in Google+, and 5000 page views in Blog. With limited budgets, it would otherwise be difficult to reach this many audiences worldwide who are interested in remote sensing science, technology and applications.

WyomingView Vision and Goals

Vision:

Promote remote sensing science and applications in Wyoming through K-16 education, workforce development, applied research, and technology transfer activities

Goals:

1. Expand remote sensing knowledge and expertise in Wyoming through demonstrations, courses, and workshops for K-12 students, university students and the current workforce
2. Promote remotely sensed data and derived products within Wyoming that are available through the US Geological Survey
3. Identify informational needs and gaps and address them through applied research and technology transfer activities
4. Leverage resources and expertise available through AmericaView to promote remote sensing applications in Wyoming
5. Contribute to AmericaView through service activities and publicizing accomplishments

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Look for 'WyomingView' on

WyomingView
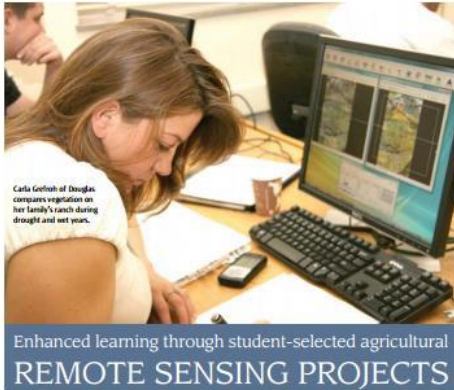## Consortium Overview
2013 - 2014

Enhanced learning through student-selected agricultural
REMOTE SENSING PROJECTS

Benefits of WyomingView activties are described in articles published in Geospatial solutions (2006 - 16:20-25), Geo World (2007 – 20:30-33), PE&RS (2007-73:223-227) and Reflections (2010:56-58 – figure above; 2012:26-29 & 2013:40-42).

WyomingView is part of the AmericaView (www.americaview.org) consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. WyomingView works to fulfill the AmericaView vision and mission in Wyoming.

Over the past several decades the US Government has made substantial investment in remote sensing technology and has been collecting valuable data that can be used for monitoring and mapping Earth's resources. However these data are not being widely used beyond a few government agencies and academia.

WyomingView is working with a diverse set of potential users in Wyoming to promote remote sensing technology and applications so that the investment made by the US reaches out to its citizens.

To accomplish its goal, WyomingView has formed a consortium consisting of federal, state and tribal land management agencies and works with them to identify needs associated with remote sensing data and products. Specific activities include:

1. Teaching courses and workshops for K-12 students, university students, and current workforce personnel to expand remote sensing knowledge and expertise in the state
2. Promoting remotely sensed data and products that are available through the US Geological Survey
3. Conducting applied research and technology transfer activities to address information needs
4. Leveraging resources and expertise available through AmericaView for identifying solutions for Wyoming
5. Contributing to AmericaView through service activities and publicizing accomplishments

Consortium Membership

USDOI-Bureau of Land Management, Cheyenne, WY

USDA-Natural Resource Conservation Service, Casper, WY

USDA-Forest Service, Golden, CO

State Engineers Office, Cheyenne, WY

Wyoming Game & Fish Department, Cheyenne, WY

Wind River Environmental Quality Commission, Ft. Washakie, WY

SkyTruth Inc. Morgantown, WV

Applied research activities conducted by WyomingView are based on needs identified by its consortium members. WyomingView offers internships to UW students and trains them in the application of remotely sensed data for natural resources management. Consortium members provide field data and background information and obtain the products (maps) derived from remotely sensed data.

WyomingView conducts *workshops* in various state- and regional-level conferences to highlight remotely sensed data and products that are available through USGS. This promotes wider use of the data collected by US government agencies in state and local government agencies.

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