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

AmericaView: A National Remote Sensing Consortium

Grant Award Number G14AP00002

AmericaView Summary Technical Report
for
Grant Years 2013, 2014, 2015, 2016

Period of Performance
December 1, 2013 to March 31, 2018

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

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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 to March 31, 2018 for all grant periods. This report also puts emphasis on the work accomplished during the fourth and final grant period, which, unlike the prior three periods, does not have a separate technical report. A detailed description of completed activities for any grant period of this award 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.

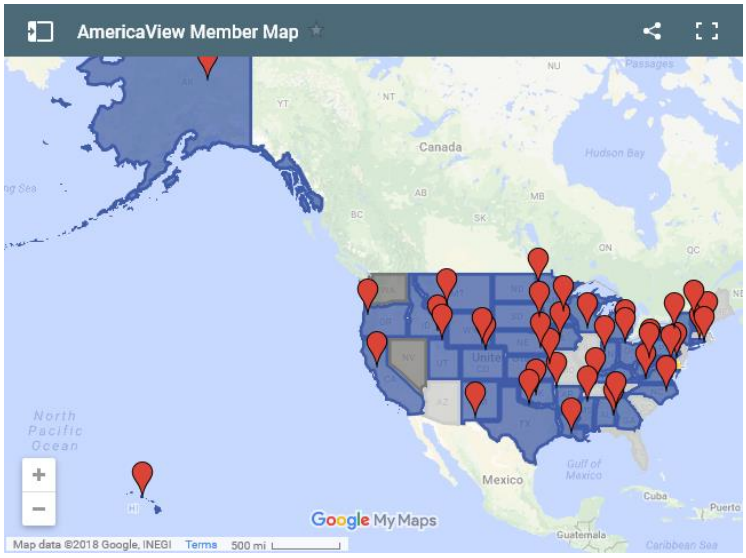
This report is organized into the following sections:

- Part I. provides background about the AV Consortium;
- Part II. presents the four Grant objectives, aligns those objectives with the AV program areas, and summarizes AV's achievements, primarily from a summary metric perspective, in completion of grant deliverables that were described in the Grant *Work Plan*;
- Part III. details the progress made towards completion of the four grant objectives, including descriptive summaries and identified benefits of completed activities;
- Part IV. identifies tasks completed by StateViews who were competitively awarded mini-grants;
- Part V. includes fiscal management information;
- Part VI. is the short summary; and
- Ten Appendices.

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 professional and physical 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 organization 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) The AmericaView web presence is americaview.org.



By the end of the award, the AV national consortium comprised thirty-nine (39) active individual state consortia (StateViews). Thirty-eight (38) retain Full Member status; one (1) is an Affiliate. Two (2) additional StateViews, which never moved past the status as Affiliates, remained dormant at the end of the grant. Promising discussions were initiated in grant period 3, and continued in grant period 4, with one of the two, NevadaView, but without conclusion. No one expressed interest to revitalize WashingtonView. The AV Board of Directors had determined in the third grant period, after adding OregonView, that no additional Full Members could be added, given the lack of increased funding to support more sub-grants. However, during the final grant period, four (4) non-member states (Arizona, Illinois, Massachusetts, and Missouri) had made inquiries to be admitted as non-funded Affiliates. If interests persist, those prospective StateViews could be included in the consortium later in calendar year 2018, expanding the collegial network and reaching closer to an initial vision for AmericaView as far back as 2004. The novice consortium at that time discussed a membership numbering fifty-two (52), to include all states, Washington, D.C., and Puerto Rico.

A lead academic institution coordinates each StateView, whose partners often include academic institutions; government agencies and offices; non-profits; and some business members. AV has more than 300 StateView consortia partners across the U.S. Throughout all award periods, StateViews have successfully built and expanded working relationships with partners at the state and national levels on a wide range of projects within AmericaView's traditional four program areas. The signature success of this consortium recognizes that each state has unique needs as well as regional and national involvement.

AmericaView Members and Staff at Fall 2016 Technical Meeting, University of Louisiana at Lafayette

StateViews have requested funding support for high priority projects, referred to as *high-impact activities* (HIAs), formalized and monitored each grant period through a national peer-reviewed proposal and reporting process. StateViews have been also encouraged to work together on projects of mutual interest, typically supported by AV's education, outreach, technology, and research committees, the special interest working groups, and the AV staff. All efforts optimize leveraging AV's funding. Each grant period, AmericaView has also provided the opportunity for projects competitively selected and funded under its Mini-grant initiative. Part IV of this report summarizes the specific awards and their impact.

Part II of the Final Report contains more detailed information about the Consortium membership, its evolving growth over the four periods, and its periodic change of leadership roles at the member universities.

Administration and Coordination

AV accomplishments, carrying out the conditions of the grant, reflect its progress-committed Board of Directors with their consistent and uncompensated governance support. Those active StateView members are currently from Georgia, Louisiana, Montana, New Hampshire, South Dakota, Texas, and Vermont, representing the diversity of the consortium, and have normally served more than one term of election. During the four periods of this grant, members from California, Kansas, and Nebraska have also been Board Directors. 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 for full days in person during the national Fall Technical and Winter Business Meetings, and contributed over 2,800 hours to organizational governance during this grant. In addition, AV held monthly membership teleconferences to conduct business and share AV information and sponsored webinars to share members' remote sensing knowledge. To improve the value of these meetings, AmericaView replaced audio conference calls with GoToMeeting video-audio capability. Each of these meetings, as well as copious email communication enabled progress towards completion of the USGS grant's objectives.

Programmed management for AV's national program has matured over the course of executing the commitment to USGS. The Executive Director (ED), the Financial Manager (FM), and the Meeting and IT Coordinator (MIC) positions were filled by individuals contractually retained as paid consultants to AmericaView. The Program Manager and the previous Program Director were employees of a consortium member university and paid through a sub grant to the university. AmericaView had no employees during the extent of this grant.

The ED administered the program on a daily basis, and answered directly to the Board of Directors in all matters. The ED 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 members. The PM assumed primary responsibility for the interface and internal communications with principal investigators for each StateView's USGS sub-grant activities, monitored the required reporting and annual work plan development, and shared oversight of day-to-day business and financial affairs. The FM was the contract officer with the universities for AV sub-grants, completed AV level bookkeeping, reviewed invoices, authorized disbursements, coordinated with the contracted accounting and audit firms, supported the external audit effort, and ensured all fiscal reports were submitted on time. The MIC planned and coordinated all activities for AV's Fall Technical and Winter Business meetings. This individual also streamlined several AV information management approaches, served as primary staff interface with the website webmaster, and became an essential fiscal manager alternate.

This report also recognizes the support from the USGS liaison, Sally Cook, who has been excellent in activities ranging from providing guidance on the program, to sharing updates on the Landsat systems, to sending valued reference material to our listserv of members, and to coordinating the details of our Winter Business Meetings at USGS/Reston and our Fall Technical Meetings at USGS/EROS. Thomas Cecere, the previous liaison, has not only sustained his involvement with AV but has kept the organization informed on the status of agreements and procedures to access the European Space Agency (ESA) Sentinel collections, being operated within the European Commission to support the operational needs of the Copernicus program.

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 (LRS), effective December 1, 2013. The grant award describes the project scope as an effort that "involves the development of a U.S. national consortium to expand the science of remote sensing through education, outreach, and research / applications development in areas such as environmental monitoring to include the effects of climate variability on water availability (or lack thereof) and phenology; public health related issues to include identification of potential indicators relating to vector borne diseases; natural resource management, land cover mapping, land use change and disaster analysis."

The NLRSEORA has funded projects to 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. http://bit.ly/2qofLDj

Award Periods and Technical Reports

Grant funding for the entire award totaled $5,000,000. Part V of this Final Report articulates the modifications made over time. The following bullets offer a succinct summary.

- The award initially was to be funded over five (5) grant periods between 1 December 2013 and 30 June 2018. The total value approved was not-to-exceed $5,000,000.
- Modifications 001, 002, and 003 of the award readjusted the schedule and some funding distribution but kept the grant five (5) grant periods with 30 June 2018 as the closing date and with the same not-to-exceed total value.
- Modification 005 explicitly removed Period 5, changed the completion date until 31 December 2017 and revised the total value of the award to $4,621,900.
- AmericaView requested an augmentation of Period 4 with additional funding and an extended completion date. Modifications 006 and 007 provided that additional funding and a No-Cost-Extension until 31 March 2018. The total value of the award was not-to-exceed $5,000,000.

This Technical Report summarizes all four periods, with some emphasis on Period 4, which unlike the preceding three periods, does not have its own report. The original agreement language did not require a separate period report for the last period. AmericaView has submitted the following reports previously for USGS review and acceptance:

- Period 1: AmericaView Technical Report GY2013 — 11 November 2015
- Period 2: AmericaView Technical Report GY2014 — 2 April 2016
- Period 3: AmericaView Technical Report GY2015 — 2 May 2017

Definition of the final report was provided in documentation from USGS when the grant was awarded. "The final technical report shall document and summarize the results of the Recipient's work. The report shall include a quantitative description of activities and overall progress on collaborative work under this Agreement, which documents and summarizes the results of the entire Agreement. The final report shall include tables, graphs, diagrams, sketches, etc., as required to explain the results achieved under the Agreement. The report shall also include recommendations and conclusions based upon both the experience and the results obtained."

NLRSEORA Objectives

AV was funded to achieve the following four objectives identified in its original NLRSEORA proposal to USGS in response to an announced grant opportunity. https://remotesensing.usgs.gov/NLRSEORA_2013.pdf. This report uses the four objectives as its organizing principle, following previous period technical reports and the *Work Plan* initially aligned with these objectives in 2013.

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 landowners/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; ensuring 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 Overview of StateView Summary Accomplishments and Impact during the Four Periods

Funding StateView Requests for Assistance

Each period of the USGS grant required that AmericaView submit a proposal for the *Work Plan* and its budget. Prior to the submission of that funding proposal to USGS for the next grant period, AV Board completed its strategic budget planning for that upcoming period, based upon it fiscal experience to date and the number of StateViews expected to be awarded sub-grants. The proposal preparation process, internal to AV, began by using the anticipated value of the period as identified by USGS in the definition of the grant periods, as described above. With Board approval, the funding distribution, available to be shared equally by each StateView during the grant period, was established. AV Full Members in good standing, confirmed also by the Board, were invited to identify their StateView program needs. Their proposals of Statements of Work (SOW), within that budgeted amount, adhered to a template for submission. The Avportal has been the environment for inserting descriptions of proposed activity and provided text-entry flexibility for tailoring to a StateView's plan. Those SOWs, extracted in a standardized format, subsequently comprised the information for a rigorous national-level, peer-review. (Criteria for proposal submission and acceptance are documented in the AmericaView Request for Continued Assistance (RCA) or Request for Assistance (RFA) guidelines and distributed to each StateView.)

Reporting on Approved Requests for Assistance and the Related Numbers of Activities in AV Categories

AV maintains an online database, accessed by username and password through the AVportal, to facilitate each StateView's period proposal preparation and submittal as well as the final reporting that has been used for the Technical Reports submitted periodically to USGS. (The description for every activity proposed through the requests for initial or continuing funding assistance is archived in that database for both this grant and the prior one.) Detailed guidance was issued by the Program Manager each year about how to complete the entries so that both novices and repeat submitters understood the nuances of each entry.

To sustain reporting continuity with the previous five-year grant and work plans and each period of the current grant, the AVportal bins the various activities into the AmericaView organization's established program categories: (1) Consortium

Development and Outreach, (2) Education, (3) Research activities, and (4) Data Archive and Distribution. The principal investigator for each StateView assigned each proposed activity into one of those categories and then into a coded sub-category. Often the activity, especially in the case of the high impact activities discussed below, aligns with more than one of the four grant objectives explained in the NLRSEORA Objectives section above. This point is made here because Part III of this report has metrics associated with the Objectives and the metrics in this Part II reflect the "binning" process. There could be ambiguity, if one is trying to align counts directly.

Some grant periods also provided the opportunity for competitively awarded mini-grants with funding in addition to the equally distributed sub-grants. They may or may not be included in Table 1 counts, depending on whether the mini-grant intensified effort on an activity already identified in the grant period plan or whether it was a newly initiated activity not already binned.

As the number of AV member states has grown over the years, the funding share per state was accordingly reduced. (Figure 1 offers that graphic view.) The question posed by some was whether the growth in the number of StateViews

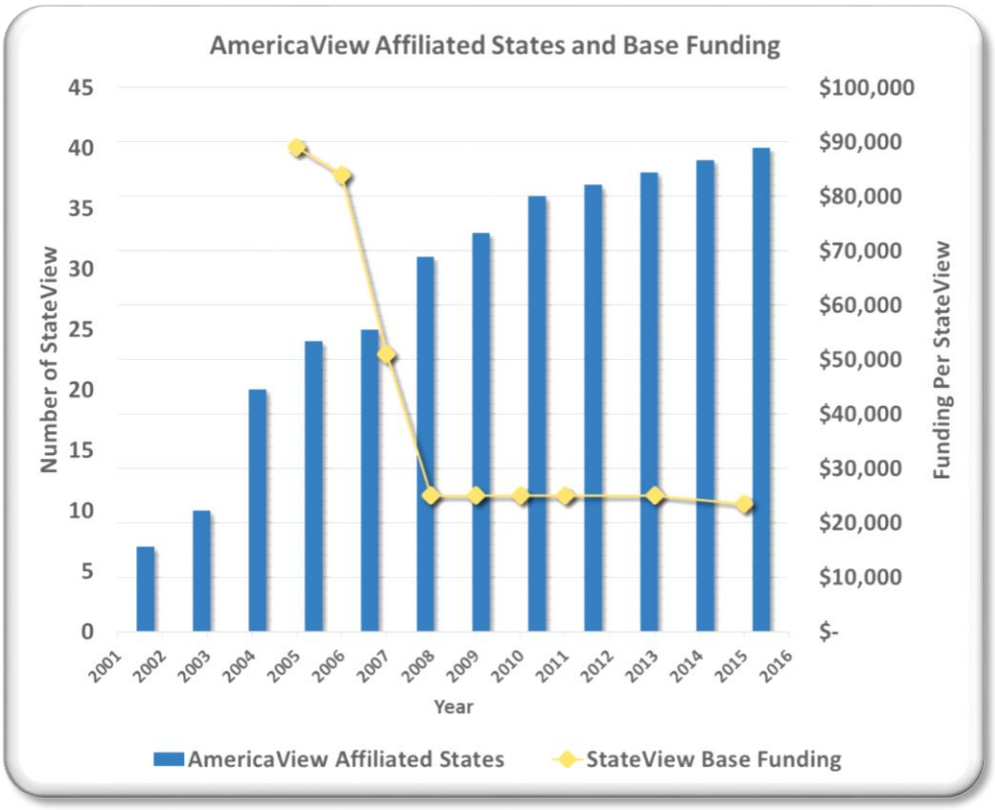


Figure 1. View of StateView Base-funding shares over time

would noticeably increase the number of activities or whether the reduction in each StateViews sub-grants, which has been about $1200 each during this full grant, would dampen that effect. Table 1 provides some insight to answer that question. Because Period 1 was of shorter duration than the other periods, that would account for fewer projects. Similarly, from its outset, Period 4 was longer allowing more time to plan and complete work. The increase in activity in Period 4 also reflects the increase in High Impact Activity (HIA) work. The increase in the counts in Period 4 does not reflect the Augmentation funds since that money was distributed through competitive mini-grants and was not part of the request for assistance routine process.

HIAs are designated by the StateView (SV) itself and distinguished from other activities. Each StateView was advised to focus on one to two HIAs that meet the highest needs of its state, utilize the strengths of its StateView Consortium, and reflect available resources. The StateView would then be expected typically to invest most of its time and financial resources in a given grant period to such activities. The SV would report on 1) the rationale for selecting the project based on state, community, local needs, 2) if any partnerships are used, and 3) the specific deliverables.

Table 1 separates the High Impact Activities (HIA) and the other efforts of the StateViews. The scope of the HIAs, in several cases, were planned for accomplishment over multiple grant years with milestone achievements reported at the end of each grant period. Hence, the same activity may be counted in more than one grant period, although sequential planned tasks for the activity are staged and statistically counted in the appropriate period. The table also confirms the concentration of HIA activities in education and research.

Activity Category	**Activities GY13**		**Activities GY14**		**Activities GY15**		**Activities GY16**	
	HIA	non-HIA	HIA	non-HIA	HIA	non-HIA	HIA	non-HIA
Consortium Development and Outreach	12	62	9	88	4	89	4	91
Education	28	32	35	32	37	37	43	45
Research	27	24	27	27	27	33	28	28
Data Archive and Distribution	6	28	7	32	6	27	9	24
Totals of HIA and non-HIA by Grant Period	**219**		**257**		**260**		**272**	

Table 1. Distribution of Planned Efforts through Request for Assistance Process

Part III of this Final Technical Report will discuss some of the striking impacts of several of these activities over the duration of the grant. It will also highlight some outstanding StateView and Principal Investigator efforts.

Mini-Grant Awards over the Grant Periods

As noted, the activities categorized in the table above may include only part of the efforts expended by many StateViews with funding from this grant. The advance budget planning process for each period ensured that funding for the equally distributed sub-grants, resulting from the "request for continuing assistance" process, were as large as prudently possible. In some grant periods, the budget proposal included a funding line to allow for additional mini-grants for special projects. In addition, during actual budget execution for the period, funds were released from various budget-planning line items. In some cases, expenses were not as large as anticipated, fiscal efficiencies were implemented, and sometimes not all expected RCAs were approved or work completed as approved. Augmentation funds for Period 4 also had not been part of the baseline budgeted process and provided additional available money. Those accumulated funds, in each grant period, were competitively awarded to StateViews as "mini-grants" to ensure as much funding as possible could be directed to the program objectives of the grant. The application, review, award, and reporting process for mini-grants did not use the AVportal. That work is generally not recorded in the numerical counts of the projects in Table 1, unless that work was an extension of a project already identified. Part IV of this report provides details for those activities since they helped AV achieve the objectives of its *Work Plan*.

During the first grant period, some mini-grants were awarded. One, with multiple participants, for the Earth Observation Data Network (EODN) expanded the role of five StateViews (TX, LA, MI, IN, and WI) that were part of the existing AmericaView Multi-State Server (AVMSS) project. Another mini-grant to Wisconsin helped further develop an imagery visualization project, named RealEarth VM, for the StateViews' computing environment, aligned with a common AmericaView web map interface hosted by the AVMSS. RealEarth was also featured in a GY16 min-grant, following the maturation of some technologies over the intervening years.

In GY14, the second grant period, MichiganView, MinnesotaView, OhioView, OklahomaView, and AlabamaView were selected for mini-grants. Those first four originated from within the Water Quality, Quantity, and Utility Working Group discussions:

- Mapping open surface water bodies in Oklahoma, including a pilot study on Landsat algorithm and accuracy evaluations;
- Development of radiometric rectification for regional water quality assessment using two Landsat paths;
- Monitoring and modeling water quality and harmful algal bloom in the inland waters in Southern Ohio; and
- Building an outreach webpage to serve out newly developed remotely-sense derived geospatial Great Lakes water quality data.

The AlabamaView deliverables included evaluation procedures and surveys to assess the impact of AV educational and outreach programs. The delivered tools were used for both Earth Observation Day assessments and by StateViews to evaluate some teacher training programs. MichiganView prepared twenty PowerPoint lecture aids and six lab tutorials as training materials on the fundamentals for using synthetic aperture radar (SAR).

Available funding for mini-grant awards in the third grant period provided some funding for Affiliate DelawareView as well as for IdahoView, IowaView, and New YorkView. Respectively, the explanatory titles for each were:

- Estimating Evapotranspiration using Landsat data and Eddy covariance stations in Delaware;
- UAS Applications for the Geosciences, Promotional and Educational Materials;
- Develop an Image Stitching and Georeferencing Process for FSA Slide Scans using Microsoft Image Composite Editor and ArcGIS; and
- Quantifying change in riparian vegetation in the Genesee River and exploring relationship to seasonal weather patterns and downstream water quality.

Period 4 approached mini-grant proposal requests in two distinct ways. When the proposal for period 4 was submitted in late spring 2016, with its intention to use a no-cost-extension from the original end of the grant period (30 June 2017) until 31 December 2017, StateViews were advised to plan for their work over eighteen months and to fully expend their sub-grant funding. Any mini-grant funding, garnered from savings in other budget lines, was anticipated to be very small. However, with the Augmentation request for the period, mini-grants were an essential feature of the proposal. When the Augmentation request was approved for the final five months of the extended period, immediately AV staff issued a Request for Proposals. StateViews were advised to select from eleven activity areas that had been identified during the preceding Winter Business Meeting. Twenty-one proposals were approved. A cluster of those proposals for teaching videos reflects collaborative discussions within the sUAS Working Group. All final reports were submitted and accepted by the Program Manager before early January 2018. As both the baseline and Augmentation Period 4 program plans neared completion, AV staff were also able to find some additional limited funding to support very small "mini-mini grants" to six StateView Principal Investigators (PI), who extended work on promising activities. Work completed at the end of February 2018.

Volunteered Service

While the SVs were busy with the activities enumerated or described above, many of their members were also voluntarily contributing their time to keep the AV consortium strong. Questions asked each year, during SV reporting provides this tabular information. Each grant period, several individuals augment the value of the consortium by volunteering their involvement that again reinforces the value of the organization. The quick analysis of the statistics in Table 2 shows the reported levels of volunteer participation for committees and working groups in any given period. Not only do the various StateViews leverage other programs, funded by their university or other grant efforts, to accomplish their additional outcomes using the sub-grants, they also leverage their own expertise and volunteered time to advance the objectives of AV and USGS.

- GY14 and GY15 statistics mirror the initiation of the sUAS and the Water Quality, Quantity, and Utility Working Groups, both of which influenced the proposed StateView programs in GY15 and GY16, a desired outcome moving from working group discussion and planning into program activities.
- Decline in the number of hours with the Board aligns with the reduction in the number of Board members.
- The relative stability in the AV Outreach verifies the continuing commitment of SV members to keep their representatives well apprised of the benefits of the AmericaView programs at the state, local, and community levels.

Contributed Hours	**GY13**	**GY14**	**GY15**	**GY16**
Contribution to AV committees and Working Groups	1032	1376	1605	1092
Contribution to AV Board of Directors	917	690	640	465
Contribution to AV Outreach to Policy and Decision-Makers with Educational Visits	100	97	91	108

Table 2. StateView Members Volunteered Hours

StateView Websites

StateViews do not limit their outreach to the educational visits for policy or decision makers. Nearly every SV has established a website, although currency of information does vary, based on varying maintenance schedules and the objective of the website itself. Reaching the end of this grant, currently thirty-six states have oversight for a StateView website. Appendix A lists each of those. Some began as the interface for members of the StateView consortium to readily access and request imagery source that is stored on local servers. Many use the website to share project progress, event invitations and summaries, and calendar planning to strengthen work within the StateView consortium.

Through their required grant period reporting, SVs have provided the statistics about visitors to their sites, the number of page views, and occasionally information about the most frequently visited pages. Many, but not all, SVs continue to archive remote sensing data at their website and to add data each grant period. Table 3 offers the summary data for each period but only as provided by those states that have access to that reporting internally. Furthermore, access to that reporting internally has varied from year to year and from state to state as university IT protocol has been upgraded, so some information is partial, is missing, or may be only an estimate. Caution is advised against drawing any conclusion from this information except that StateView websites exist, that the websites are being used and visited regularly, and that imagery is being archived in many locations, primarily based on the needs of particular StateViews.

StateView Web Statistics	GY13	GY14	GY15	GY16
SV Web visitors:	81,733	71,693	101,081	78,916
SV Web page views:	416,001	220,921	194,319	470,998
Total remote sensing data archived in or accessed through SV websites:	38,225 GB	32,721 GB	54,377 GB	53,536 GB
Remote sensing data newly added in this reporting period:	4,551 GB	14,623 GB	6,348 GB	7, 901 GB

Table 3. StateView Members Website Activity

Websites are simply essential to sharing important information. These statistics point to the interest in what AV and its SVs do. They say nothing about repeat visits or the length of visit and that order of information would help complete the story of visitor persistent interest in and reliability on the information. That would be the next analysis needed.

Educational Capacity Building

Before the term "capacity building" gained such prominence among so many groups concerned about the Earth science training and education of the world's learners, StateViews have been focused on creating awareness and appreciation of the unparalleled value of properly using remotely sensed imagery. As early as 2001, at the initiation of the AmericaView consortium, following and expanding upon a successful pilot project by the original OhioView, the following was written for the award justification: "*The ultimate objective of this association of state consortia is to facilitate expansion of the OhioView pilot concept to a national association of state-based users of remotely sensed data. The national group will help to make possible the increased access to, knowledge about, and use(s) of remotely sensed data for scientific analyses, educational and research studies, and as a readily available tool for governmental policy development, planning and decision-making."*

Since that point, AV and its SV members have not wavered in the commitment to education and actively validate the "cascade" model during each award period. If educators and their students are well prepared, that teaching expands the influence to generations of learners, who themselves become both formal and informal teachers. They may be the managers, who encourage employee training, or the parents, who prod children's natural curiosities about their world, or the employees, who insist on the best information and technology to succeed, or the decision-makers, who recognize the socio-economic benefits that Earth science insight enables.

Again, the StateViews provided the statistics for the teaching outreach, seen in Table 4, as they completed their final reports of each grant period. At best, these are conservative values, especially as more materials are added to websites for easy access or are included in video tutorials on YouTube.

- The impressively higher counts of K-12 students trained in GY13 and GY14 can be traced to the AlabamaView's work with the Alabama Science in Motion and Alabama Science and Technology Initiative modules.
- In the GY14 Technical Report, New Hampshire View had added in approximately 20,000 students and 2000 workforce personnel, known to have participated in at least one of the four mini-training webinars online aligned with presentations at Yale and INECOL (Mexico). To normalize the statistics, that estimate of those students and workforce based on "hits" to the videos was removed from this summary table. In Section III, this report will say far more about the impact on students of the YouTube videos prepared by the StateViews.
- The increase in training workforce personnel in GY15 was spurred by a UtahView outreach to land managers and ranchers, as well as by VermontView's webinars focused on the workforce.

- Neither GY15 nor GY16 statistics take into account the impact on both teacher and student training that was facilitated by the AV participation in the American Geoscience Institute (AGI) sponsored Earth Science Week activities. During those two periods, thirty-thousand (30,000) posters, featuring remote-sensing educational games, were distributed nationwide in the teachers' packets assembled by AGI.

Education/Training Statistics	**GY13**	**GY14**	**GY15**	**GY16**
K-12 students trained:	12,032	11,352	7,783	5,187
K-12 minority students trained:	3,518	3,258	2,072	693
K-12 teachers trained:	148	233	216	221
Higher education students trained:	1,735	1,178	1,115	1229
Higher education faculty/staff trained:	77	226	47	88
Current workforce personnel trained:	500	442	1,154	611

Table 4. StateView Members Education and Training Summary Statistics

Part III of this Report provides more information about the activities addressing the Education objective of this grant. Over the years of the grants from USGS to AV, technology has been a boon, helping with capacity building. Presence within the worldwide web through structured reporting and all social media has dramatically improved AV's ability to bring attention to the value of remote sensing, whether from satellites, airborne platforms – including UAS – and handheld cameras. Russ Congalton of New HampshireView provided eye-opening documentation of his experience linking webinars and YouTube that is seen in Table 5. The audience he has been able to reach with quality material is outstanding. The statistics, of course, do not allow a breakdown of the education level of the viewers, which is not as relevant as the outreach to so many.

Mini-Training Title	Date Presented	Attended Live	Viewed Online as of 12/15/15	Viewed Online as of 11/10/16	Viewed Online as of 2/14/18
Remote Sensing Basics	10/16/14	51	17,125	33,934	58,171
Selecting the Best Imagery	11/6/14	38	2686	5840	8,548
Accuracy Assessment of Remotely Sensed Data	12/4/14	48	1624	3591	4,991
The Power of Near Infrared (NIR) for Mapping	2/19/15	48	428	791	1,354
Totals		185	21,863	44,156	73,064

Table 5. Joint effort between UNH Cooperative Extension, Vermont Center for Geographic Information, and NHView

New Courses, Public Presentations, and Research Papers

Among the deliverables of the SV activities are new and revised courses or even full curricula for teaching remote sensing students, primarily for university undergraduate and graduate students. Sometimes the members and their students use conferences and other meetings to present the work accomplished in those academic classes, their in-lab or in-field exercises and research, or through the collaboration with others. Similarly, much of the research or technology transfer,

funded though the USGS grant, is described in publications. Table 6 contains the statistics provided by the StateViews at the end of each grant period.

Curriculum, Presentations, and Publications	GY13	GY14	GY15	GY16
New remote sensing courses or programs started that resulted from AV partnerships/efforts	9	4	9	7
Presentations on AmericaView, StateView, or remote sensing	34	55	59	93
Attendees at presentations	2,052	2,923	3,437	5,044
Research papers published or accepted or submitted that reference AmericaView, USGS grant support, or a StateView's activities	16	23	14	21

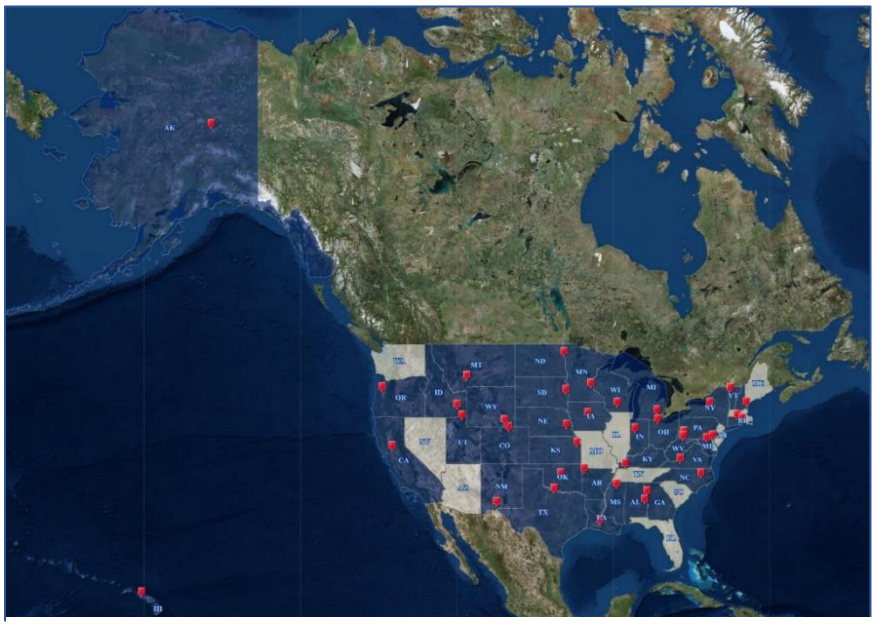
Table 6. Proliferating Remote Sensing Knowledge

- Courses and Curriculum
  - New course work in GY13 included building a GIS Minor program at Alderson Broaddus University (WVView), preparing new lessons for Idaho's McCall Outdoor Science School, developing three courses using remote sensing for conservation practice in Iowa, submitting three geospatial courses to the University of Arkansas, and offering a Remote Sensing for Environmental Applications course at the Haskell Indian Nations University in Kansas.
  - New coursework in GY14 included three program updates at Colorado State and a new course, Spatial Land Data at California University of Pennsylvania. In addition, five lab exercises for the Air Photo Interpretation course at South Dakota State University were introduced.
  - New coursework in GY15 included Coastal Remote Sensing at Oregon State University, a SAR course in Michigan, a RS and GIS for Ecologists at University of Idaho, three program updates at Colorado State, a new UAS course in Arkansas, a UAV environmental data collection and mapping course at Ohio University, and a UC at Davis course on Science and Society.
  - New coursework in GY16 included three program updates at Colorado State, two UAS courses in Arkansas, a Graduate Certificate in Geographic Information Systems Science (*GISc*) certificate class at Auburn, and a new UAS course at the University of Minnesota.
- Presentations
  - The presentations reported during the SV annual reports range broadly in terms of content and audience. In most cases acknowledgement of the USGS grant is made, in addition to a disclaimer about any endorsement of findings or opinions, and the AmericaView logo is used on presentation slides as appropriate.
  - The authors, titles, and occasion for the presentations are all found in Appendix H. of this report and are organized by grant period, alphabetical order of the primary presenter, and date of presentation.
    The counts in Table 5 are not identical to the AVportal information given some confusion about the alignment of dates and grant periods, due to the overlapping periods.
- Publications
  - Seventy-four publications were reported in the Avportal counts summing each grant period independently. Review, however, of the reports indicates that fifty-six distinct publications were completed, which fall into the category of published research documents, whether papers or books.
  - Appendix G of this report presents a bibliography reflecting the work of the entire four periods.

AmericaView Consortium Program Administration Highlights

Development of the AV Consortium

AmericaView has been steadily developing its national consortium since 2002, compliant with stated intent in the award justification documentation in 2003, 2008, and 2013. Promoting carefully managed expansion has enabled the AV consortium 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 has honed AV's networking effectiveness, has highlighted national remote sensing expertise, and – most importantly – has instantiated a very collegial knowledge sharing collaboration.



See Appendix A for a listing of all StateViews, SV website URLs, and Principal Investigators, current as of 31 March 2018.

- ✓ For the first period, twenty-nine (29) StateViews submitted sub-grant proposals as Full Members.
- ✓ As of September 15, 2014, AmericaView comprised thirty-two (32) Full Members, two (2) Associate Members, and six (6) Affiliates of which two (2) were completely inactive.
- ✓ As of June 30, 2015, the end of grant period 2, GY14, AmericaView had thirty-four (34) Full Members and six (6) Affiliates of which two (2) remained inactive.
- ✓ During period 3, GY15, AmericaView added another qualified Affiliate, DelawareView. CTView, RIView and OKView had been determined, during the Board meeting at the WBM in GY14, eligible to submit GY15 Request for Assistance (RFA) proposals. Since they were successful passing through the review process, they each became a Full Member in GY15. OregonView remained as an Affiliate but, following a change in the PI, was requested to submit a proposal for an Affiliate Development Grant (ADG) opportunity to confirm readiness. By completing the grant period 3 (GY15) successfully with the ADG, OregonView was approved by the Board to become a Full member and requested to submit an RCA for grant period 4.
- ✓ As of July 1, 2016, at the beginning of grant period 4, GY16, AV had thirty-eight (38) Full Members, one (1) Affiliate, and two (2) inactive Affiliates.
- ✓ No new StateViews were added in grant period 4. The Board had determined that the equal-share distribution of each period's grant could not be reduced further by adding Full members. However, discussions continue with Illinois, Arizona, and Missouri about establishing StateView Affiliates. The prospect of no funding has not deterred interest in some joining this collegial network.

Regularly Scheduled Meetings

During each period of this grant, AV continued to enjoy excellent attendance at all its meetings. Each month the Board met, usually followed by a Member Meeting the following week. Nearly 75% of StateView members regularly attend the

optional monthly membership telecons. Initially these meeting were simply by telephone conference but by the start of the second grant period, a GoToMeeting subscription was secured, which enabled slide presentations. The Fall Technical Meetings and the Winter Business Meetings (See Appendices E and F to review the "meetings at a glance" versions of the agendas.) included excellent representation from each StateView, including sponsored students. Sometimes, those students gave presentations on their work to the assembled remote sensing experts from across the country. During the grant's four periods, AmericaView members contributed more than 5,100 hours to committee work to strengthen national collaborative endeavors and to share remote sensing information and knowledge. Board members themselves devoted over 2700 hours to provide program governance, administrative guidance, and financial due diligence. StateView PIs 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 effectiveness of the consortium.

Changes within Membership between 1 December 2013 and 31 March 2018

AV maintains membership records, through its Board and Member Meeting approved minutes, for all changes when a new member is admitted as an Affiliate or is invited to become a Full Member. Similarly, approval is required following a review process, when any StateView PI position rotates from one individual to another or when the lead university in any state consortium moves to another university. AV adheres to a rigorous procedural policy, carefully reviewing any proposed changes and directly engaging with the StateView, which has submitted a formal request, before the Board and voting members give approval. (Unlike other instances in this paper, academic titles are retained here and in Appendix A, because the Board carefully reviews academic credentials in approving nominations to the role of Principal Investigator.)

- *December 2013:*
  - Dr. Kevin Kane, of Iowa State University, was approved as PI for **IowaView**.
- *March 2014:*
  - **OklahomaView** was approved as an AmericaView Affiliate by the AV Board and membership.
- *June 2014:*
  - **New MexicoView** was approved for Associate status and **OhioView** was aligned with PI, Dr Mary Henry at Miami University.
- *December 2014:*
  - Dr. Lindi Quackenbush, of State University of New York College of Environmental Science and Forestry, was approved as PI for **New YorkView**.
- *February 2015:*
  - Lisa Wirth, of the University of Alaska Fairbanks, was approved as PI for **AlaskaView**, replacing Mr. Tom Heinrichs.
- *April 2015:*
  - Dr. Rebecca Dodge was approved as PI for **Texas View**, replacing Mr. P. R. Blackwell. The realignment for the TXView consortium-lead university from Steven F. Austin State University to Midwestern State University was also approved.
- *June 2015:*
  - **New York View** and **New MexicoView** advanced from an Associate to Full Member status.
- *July 2015:*
  - Affiliates **ConnecticutView**, **Rhode IslandView** and **OklahomaView** became Full Members.

- *August 2015:*
  - **DelawareView** was designated as an Affiliate. Dr. Byungyun Yang was approved as the PI from the University of Delaware.
- *September 2015*:
  - The lead university for **OhioView** was a Board and Membership approved rotation from Miami University to Bowling Green University, following the procedures of the OhioView state consortium. Dr. Anita Simic replaced Dr. James Lein who served as interim PI in the absence of Dr. May Henry.
- *September 2015*:
  - Dr. Todd Moore was approved as the PI, replacing Dr. Jay Morgan for **MarylandView**. The lead university remained Towson University.
- *May 2016*:
  - The lead university for **IdahoView** changed to Idaho State University from the University of Idaho and Dr. Donna Delparte was approved as the PI, replacing Dr. Jan Eitel.
- *July 2016*:
  - Affiliate **OregonView** became a Full member. Dr. Chris Parrish remained as the PI from Oregon State University.
- *August 2016*:
  - The AV Board and Members approved Dr. Tracy Deliberty as the PI from the University of Delaware for **DelawareView**, following the transfer of Dr. Yang to DePaul University in Illinois.
- *March 2017:*
  - The AV Board and Members approved Dr. Joseph Knight as the new PI for **MinnesotaView**, to replace Dr. Marvin Bauer who become the Co-I. Both are from the University of Minnesota.
- *April 2017*:
  - The AV Board and Members approved Ms. Robin McNeeley as the PI for **IowaView**, replacing Dr. Kevin Kane.
- *May 2017*:
  - The AV Board and Members approved Dr. Chandi Witharana as the PI for **ConnecticutView**, replacing Dr. Dan Civco, who had retired.

Changes within AV Staff

AmericaView has no employees. Staff are compensated through consultant contracts or sub grant agreements with one of the StateView universities.

In mid-December 2013, at the beginning of this grant, Terri Benko joined the AV national staff as the Financial Manager. Terri brought more than 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.

In June 2015, Jeanie Congalton joined the AV Staff as a consultant to serve as the Information Management Coordinator and Conference Planner for the AmericaView national events, the Fall Technical Meeting and the Winter Business Meeting.

In spring of 2016, Debbie Deagen announced her intention to retire as Program Director for AV at the end of the AV fiscal year. In June 2016, Christopher McGinty joined the AV Staff to serve as AmericaView Program Manager for this U.S. Geological Survey Grant Award G14AP00002.

Terri Benko resigned from her position in July 2017 and Debbie Deagen signed a consultant contract to function as a financial manager through completion of this grant.

Annual Meetings AV, in each calendar year of this grant has budgeted for and successfully conducted two annual meetings mentioned above, a Fall Technical Meeting (FTM) and a Winter Business Meeting (WBM). The FTM program was typically planned around technical presentations from both AV and invited speakers and included several short workshops to allow attendees to learn more about new tools, techniques, or programs. Both SV PIs and invited guests offered these workshops. The venue of the meeting alternated between the USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD, and one of the StateView universities. The WBM occurred in late winter in Reston, Virginia. The first day of the meeting occurred in the USGS footprint to facilitate both formal presentations and informal technical exchanges between USGS scientists and AV principal investigators (PIs). The second day of the meeting, usually in hotel meeting space, focused on the consortium's agenda. Invited presentations, in-person Committee and Working Group meetings with time to report out to all WBM participants, and a business meeting of all members characterized that day. Newly elected members to the Board were inducted and Officers for the coming year selected. The day's activities nourished networking among all, permitted exploring possible collaborative activities for the next iteration of sub-awards, and provided the opportunity to discuss strategically the consortium's intended impact. While in the Washington, D.C. area, StateView participants often took the opportunity to visit offices of their elected representatives and to update information about their most recent accomplishments. Some staffers anticipated these annual visits to learn more about achievements in their state. In spring 2018, many AmericaView PIs needed to inform their points of contact that such a visit could not be conducted but that they were available to meet with their representatives and Senators when they visited the state.

Capitol Hill Visits by WyomingView in Washington D.C.
Left to Right: Elizabeth Wirsching, Student; Logan Eicholzer, Student; Dr. Ramesh Sivanpillai WyomingView PI; Senator Barrasso, Wyoming

- *AV Winter Business Meetings (WBM), Locations, and Themes*

February 23-25, 2014	USGS Headquarters and Meeting Rooms	"Launching Our Next Five Years!"
February 22-26, 2015	USGS Headquarters and Meeting Rooms	"Increasing our Effectiveness and Sustainability"
Feb 28- Mar 1, 2016	USGS Headquarters and Meeting Rooms	"Intensifying Effectiveness"
April 2-4, 2017	USGS Headquarters and Meeting Rooms	"Focusing on Key Efforts"

In March 2018, an abridged Winter Meeting was completed at USGS Headquarters in Reston to provide outbriefing on the accomplishments of this grant for senior management and invited guests.

- AV *Fall Technical Meetings (FTM) and Locations*

  October 20-22, 2014 UC Davis and Meeting Rooms
  October 21-24, 2015 USGS EROS Center and Meeting Rooms
  October 16-20, 2016 University of Louisiana at Lafayette and Meeting Rooms
  Nov 12-16, 2017 Pecora Symposium, Sioux Falls Convention Center

  The final FTM, held in conjunction with the Pecora Symposium, ensured that each AV participant assumed some role in the success of the event, as Workshop Director or Presenter, as speaker or panelist, as poster authors, as exhibit participant. AV did not establish the program but AV helped ensure its technical strength. This level of participation was part of the AV proposal to USGS for Augmentation Funding in Period 4 (GY16).

- Appendices E and F contain summary "Meeting at a Glance" agendas and highlights for each of these meetings.

AV Member Teleconference Presentations:

Among the validations made for initiating this Consortium fifteen years ago was to promote cooperation and sharing of expertise regarding geospatial imagery among participating States and within each participating State. The regular monthly meetings, initially conference telephone calls and now GoToMeeting teleconferences, have served the networking objective, as have the annual meetings identified about. In addition, particularly as the technology matured to allow interactive use of presentation materials through internet VOIP connectivity, the monthly meetings became the forum for technical exchange sessions. Often a StateView PI or an invited speaker was requested to make a presentation to those attending. Invitations were extended to non-members, who had professional interest in the topics, to join the meetings.

- Period 1: Invited Presentations
  - "*Imagery to the Crowd*" by Josh Campbell, U.S. Department of State
  - "*AmericaView Multi-State Server*" by Sam Batzli, WisconsinView
  - "*Use of Landsat I Imagery and the METRIC for Evapotranspiration Estimation*" by Dr. Jeppe Kjaersgaard, South DakotaView
- Period 2: Invited Presentations
  - "*Earth Observation Data Network (EODN) and RealEarth™*" by Sam Batzli, WisconsinView, and Ezra Kissel, Indiana University
  - "Landsat Image Service Project (LISA)" by Jan Eitel, IdahoView
  - "*UV-B Monitoring and Research Program at CSU*" by Michael Coughenour, ColoradoView, and George Jansen, UV-B Monitory Network
- Period 3: Invited Presentation
  - "*Landsat Archive Collection: Changes for 2016 & Beyond"* by Kristi Kline, USGS EROS Center
- Period 4: Invited Presentations
  - *"What's New in Earth Engine" by Tyler Erickson, Google*
  - "*Engaging Citizens in Science through Open Innovation*" by Sophia B. Liu, USGS Science and Decisions Center
  - "*Observing land from space: Interacting with land data from NASA's LP DAAC*" by Danielle Golon, USGS EROS Center
  - "*UAS in Research*" by Donna Delparte, IdahoView

- "*A General Aviation Citizen Science Study of Water Quality and HAB Events*" by Rafat Ansari, NASA Glenn Research Center
- "*AmericaView Remote Sensing Water Resource Gateway*" by Chris McGinty, AmericaView PM
- "*Overview of the Land Remote Sensing Program – thoughts on time at the Office of Science and Technology Policy*" by Tim Stryker, USGS
- "*Landsat Derived Cladophora/Submerged Aquatic Vegetation Distribution Maps for the Laurentian Great Lakes*" by Colin Brooks, MTRI
- "*The AmericaView Water Resource Gateway: Moving from concept to implementation*" by Lindi Quackenbush, New York View
- "*Fusion of Landsat 8 and ICESat-2 ATLAS data for shallow bathymetric mapping*" by Chris Parrish, OregonView
- "Story*telling with Maps Workshop for Educators"* by Mary O'Neill, South DakotaView
- "*UAS Training Video Development"* by James Campbell, VirginiaView
- "*The AmericaView Water Resource Gateway: Moving from concept to implementation: Update"* by Lindi Quackenbush, New YorkView
- "*Manual for Remote Sensing Image Analysis in R: Including Agnostic Image Analysis"* by Rick Lawrence, MontanaView
- *"UAS Capacity Building at University of Arkansas"* by Malcolm Williamson and Jason Tullis, ArkansasView
- *"sUAS in Closed Canopy Environments and Extending EOD Activities in Wyoming Classrooms"* by Ramesh Sivanpillai, WyomingView
- *"An Integrated Research-Educational Approach to Support Surface Water Quality Monitoring"* by Anita Simic, OhioView
- *"VermontView's UAS Experience"* by Jarlath O'Neil-Dunne, VermontView

OhioView presentation to the AmericaView Membership discussing efforts to instruct students in remote sensing and water quality

- "*Developing Tutorial Documents for the Conservation Practices Inventory Data Creation Process and Related Datasets*" by Robin McNeely, IowaView
- *"Updates from NASA's LP DAAC"* by Danielle Golon, USGS EROS Center
- *"Landsat Analysis Ready Data (ARD): Understanding Data Organization, Uses, Analysis Strategies, Strengths, and Weaknesses of this Temporal Data Bundle: A Tutorial"* by Doug Ramsey, UtahView

Strengths of the Working Relationships within this Program

Each period AV has reported that the strength of the consortium as a vibrant and collegial network thrives and that the cumulative impacts of all StateView efforts upon the nation are notable. The return on the investment, from the small sub-grants to each StateView Full Member, depends upon each's ability to attract other members to their StateView consortia, to leverage the talent and efforts of collaborative partners or programs, and to articulate clearly the sustained impact they have on their community, their Nation, their Earth. Even the smallest mini-grant delivered tangible effect by enriching appreciation of remote sensing and on expanding use of the data to address a wide range of issues. The next part of this report elaborates on how resources were used and what changed. Yet, that subset of what exists in the AV

archives scarcely unveils how the programmatic expansion of AmericaView since 2003 has prominently changed remote sensing Earth science in the classroom, the research labs, the workplace, and our living space.

During each period the support from the USGS liaison, Sally Cook has been excellent from providing guidance on the program, to sharing updates on the Landsat systems, to sending valued reference material to our listserv of members, and to coordinating the details of our WBM at USGS/Reston. For nearly four years, a standing time for "conversations with Sally" has been visible on the AV Executive Director's calendar. Meetings may be long or short; meetings may be rescheduled earlier or later; but far fewer meetings are cancelled than are completed. That's incontrovertible testimonial to the USGS interest in the grant. Thomas Cecere, the previous liaison, frequently joined those calls.

AmericaView takes pride in the partnership with USGS, Land Remote Sensing Program (LRSP). This Final Report provides the written documentation for the many of the achievements and the national impact resulting from this grant, accomplishments for which USGS can acknowledge credit by funding the AmericaView consortium. On 8 March 2018, the AmericaView Board and staff had the opportunity to present a briefing, that significantly condensed the content of this report to the LRSP coordinator, Timothy Newman, his Outreach and Collaboration Branch chief, Timothy Stryker, and his associate program coordinator, Peter Doucette. The following agenda shows the scope of the presentations, which provided that audience with several examples, which reflect similar activities, echoed throughout the thirty-nine active StateViews. Those briefings will be added to the AmericaView website for others to review and to understand in some way the excellent return on the investment of the taxpayer dollar.

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

Meeting with USGS, Reston Room: BB303
8 March 2018 at 8:30 AM

Agenda

0830 – 0840 am Jarlath O'Neil-Dunne — Introductory Remarks and Moderator for the Morning

0840 - 0900 am Chris McGinty, Bobbi Lenczowski — Overview of NLRESORA from Growth Perspective

0900 – 1130am Board and Staff — Accomplishments against Grant Objectives

Objective 1 – Nationwide Remote Sensing Data and Information Requirements

0900 – 0920am

- Rick Lawrence, PhD — "*AmericaView's Unique Contribution to the Landsat Program*"

Objective 2 – Remote Sensing Applications

0920 – 1010am

- Jarlath O'Neil-Dunne — "*Advancing UAS Technology*"
- Chris McGinty — "*The AmericaView Water Quality Gateway: A National Collaboration*"
- JB Sharma, PhD — "*The Google Earth Engine for Remote Sensing Education, Research and Outreach"*
- Russ Congalton, PhD, New HampshireView — "*Evaluating Landsat 8 for Forest and Land Cover Mapping"*

Objective 3 – Undergraduate and Graduate Research

1010-1035am

- Debbie Deagen — "*Inspiring the Next Generation of Remote Sensing Student Scientists: Internships, Scholarships, and Employment"*
- Rebecca Dodge, PhD — "*Undergraduate and Graduate Research*"

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

1045-1130am

- Mary O'Neill — "*Remote Sensing Education and Outreach in South Dakota"*
- Brent Yantis — "*Training GeoSpatial First Responders"*
- Rebecca Dodge, PhD — "*Earth Observation Day and Earth Science Week"*
- JB Sharma, PhD — "*K12 Remote Sensing Outreach and Historic Imagery Projects"*
- Russ Congalton, PhD — "*Outreach Successes Through Synergies: Some NHView Examples*"
- Brent Yantis — "*Reaching Out with 'Earth As Art'*"

1130-noon

- General Discussion on any topic of interest about this grant and AmericaView

Challenges in the Future

In this space for each of the preceding grant period Technical Reports, the monetary size of the sub-grant to each state was always identified as the challenge most threatening to the StateViews. Each PI always had more possibilities for impactful activities than she or he was given resources to accomplish. As the reader will discover in this report, what has been completed, and the impact felt, is remarkable, even with such minimal financial resources, simply because of the pride of involvement and proactive recognition of and response to need.

At the national level, the Board conceded two years ago that being financially unable to add additional StateViews to the membership dashed, at least temporarily, the aspiration to expand to all fifty states, Washington, D.C., and Puerto Rico. Despite not attaining that goal yet, the influence of the efforts are felt nationally by the distribution of curriculum materials, the presentations and publications in well-established fora, the expanding presence on You Tube and other social media, and access to the website. At the end of this grant on 31 March 2018, the challenge is sustaining the organization itself as a professional network of many of the most-esteemed professors in the remote sensing domain.

At the early part of this century, the impetus to incorporate an organization named AmericaView astutely aligned a Congressional directive and accompanying funds to expand the excellence of a demonstration project under a team called OhioView. The symbiotic relationship between a USGS grant award and a maturing AmericaView developed into a strong commitment on both sides to achieve success for the investing tax-payer.

AmericaView must now sustain itself with a minimum cash reserve and significant support from its members. A survey of all StateViews at the end of calendar year 2017 endorsed the intent to continue the network and to reinforce the established technical sharing. A Board of Directors will meet routinely, Chris McGinty, current Program Manager, will serve as Executive Director with a small monthly fee to ensure continuing operational sustainment. Members will meet approximately every two months for technical exchange meetings. All members will scout for funding opportunities, perhaps preparing proposals as cluster of members. Sam Batzli will be available as webmaster to ensure the site is kept current and operational. The Education and Outreach Committee already has a project underway: planning for the 16 October 2018 Earth Observation Day under the banner of Earth Science Week and its recently announced – and AmericaView resonating - theme of "Earth as Inspiration."

III. Completing the Work Plan Originally Scripted for the NLRSEORA Grant

Introductory Remarks

In February 2014, AmericaView, under the guidance of its Program Director, Debbie Deagen, prepared a document and presentation, entitled AmericaView *NLRSEORA* Proposal Narrative 2013-17 Excerpts for National Work Plan*. The purpose was to provide a framework to guide the AV program in the direction of achieving the grant agreement's goals. This part of the Final Technical Report details the progress.

Italicized text is found at the beginning of each of the following four grant Objective sections to repeat the wording taken from both the ***four grant objectives*** and the ***Work Plan***. Part III of this Final Technical Report follows the organizational structure found in Section III of the Technical Reports for Period 1 (GY14), Period 2(GY14), and Period 3 (GY15). Period 4 (GY16) reporting is integrated within the summary of the Work Plan accomplishment and will be appropriately identified.

Each objective is presented in three sections.

- First, a bulleted summary, in plain font, details the progress that AV at the national level (board, staff, committees, collaborative SV activities) has made towards that objective and its work plan. In many cases, the activity spans multiple years. As done in the prior grant period Technical Reports, references to the presumptive final year of the proposal (Period 5 or GY17) and to any proposed tasks to be completed in that grant period are removed. As explained in Part II above, per USGS direction, a fifth period was not funded under this current grant. However, removal of the fifth period does not automatically preclude having completed the planned activities. Those may simply have been moved into the calendar-extended and funding-augmented fourth period (GY16).

- Readers will see that a numerical summary of StateView efforts toward the grant Objective completion is provided even if not every activity is described. The information for the numerical summaries come primarily from the AVportal, which accommodates counting activities by searching on the keywords. Unfortunately this does not necessarily include every activity in every category since the portal does not include mini-grant reporting. Consequently, a Part IV has been added to the Final Technical Report to describe the impact of that work. When possible those mini-grant activities are given credit in meeting the work plan.

- Finally, each sub-section concludes with a summary of the benefits that accrue to completion of the grant objective.

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.

Work Plan for AV National-StateView Partner Initiatives for Data and Information Requirements

GY13-16: 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.
(This element was originally identified only for the first period in the Work Plan. Fortunately, AV considered this a permanent responsibility, needed to achieve the grant objectives.)

On an annual basis, StateView PIs are asked to review the online AVportal and to correct or enter the most current name and contact information for all of its SV members. In addition, AV's staff continuously monitor email rejection notifications, realizing that some correction is required as quickly as possible. To expedite mail dissemination, americaview.org Groups have been established to allow distribution of information to the appropriate audiences.

- Sally Cook, the USGS liaison to AV, from the outset of this grant has been an unparalleled partner providing current information regarding USGS data and products. She updates the AV ED and PM weekly, by mail and teleconference sessions. That information is quickly distributed to all AV members. She joins both the Board and Members meetings each month and tries to participate in committee and working group meetings or has other USGS individuals represent her. No one can claim that AV is not kept informed of system status. Messages to staff quickly travel to StateViews.
- Rick Lawrence was invited to attend the Landsat Science Team meetings, as the AV representative, which provides immediate access to some of the advanced thinking about existing and future systems. Each day of a meeting, Rich chronicled a journal report and sent it that same evening to the Board and members of his AV Landsat Working Group.
- During GY15, the Landsat Working Group ensured that AV members were made aware of the Land Change Monitoring Assessment and Projection (LCMAP) initiative under development by the USGS EROS Center and invited Tom Loveland to speak at the consortium meetings.
- Over the time of these grant periods, AV has also introduced the use of virtual meetings, through GoToMeeting. Although teleconferencing has been modus operandi for AV Member Meetings for years, adding the capability to do technical slide-based presentations has dynamically strengthened the vigor of that content sharing. Often non-members can be invited, allowing powerful outreach on academic research, technology transfer, and training successes.
- The AmericaView website has been re-hosted and redesigned to encourage visitors for multiple visits. Participation with social media like Facebook and Twitter has also improved communication about the AV profile, Landsat uses, UAS protocols, and events like Earth Observation Day.

GY13-16: 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 GY13, Ramesh Sivanpillai, WyomingView, to support a request from USGS LRS to AV, prepared and distributed a five-question "Landsat Future Needs" survey for all. During GY14, he and the AV Board chair, Russell Congalton, New HampshireView, completed a survey summary and analysis article that was published in the American Society for Photogrammetry and Remote Sensing (ASPRS) Photogrammetric Engineering & Remote Sensing (PE&RS) journal in GY15. In addition, Ramesh Sivanpillai briefed the 2014 WBM attendees on the survey results during a technical session, which also included Timothy Stryker, then-Director of the U.S. Group on Earth Observations

program, White House Office of Science and Technology Policy and Greg Snyder**,** then-Lead, Earth Observation Requirements, Land Remote Sensing Program, USGS.

- In multiple meetings since June 2015, the Landsat Advisory Group (LAG) was supported by the AV Executive Director (ED), emphasizing the need to gather requirements from non-federal users of Landsat for the land observing systems to follow Landsat 9. As a member of a LAG Task Team, the AV ED agreed to invite AV members to provide their response to a LAG formulated survey, as part of an effort to reach a more diverse group of respondents than were directly available to a federal survey of federal agencies. AV response rates, providing the academic perspective, were appreciated by the Task Team. The AV ED assisted the analysis of comments and authored part of a report, delivered to the National Geospatial Advisory Committee (NGAC) during AV's GY15 period.

- In May 2015, AV was encouraged to nominate a qualified individual to be a member of the 2017 NRC Decadal Survey funded by NASA, NOAA, and USGS. The selected experts subsequently prepared consensus recommendations on an integrated approach for future NASA Earth Science missions from 2017 to 2027. Nancy French, MichiganView, was identified to represent AV interests. In addition, she prepared and submitted a white paper providing to the National Research Council regarding the 2017-2027 NRC Decadal Survey in Earth Science and Applications from Space in which she wrote, "One of the key challenges for Earth System Science is the delivery of high-volume data for science, applications, and operations of all kinds. In particular is access to data in places that have challenges in their connection to the part of the global Internet where such data is (sic) generated and stored." Her paper echoed one of the early reasons for establishing an AmericaView. Facile and low cost ability to easily access, rapidly acquire, and confidently use remotely sensed land observation data must be a key requirement considered for any future collection system.
(http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/15647/2289356/66-e66372770cdb586ee86a073588582f55_FrenchNancyHF.docx)

- Throughout calendar years 2015 and 2016, USGS took Federal agency responsibility through the EROS Center in leading an effort called the Requirements Capabilities and Analysis for Earth Observation, or RCA-EO. USGS leaders briefed AV at the Fall Technical and Winter Business meetings on the status of the effort. At a Landsat Science Team meeting in February 2017, Rick Lawrence, MontanaView PI, suggested that AV might be of service interviewing key individuals at the local, regional, tribal, and state levels to garner valued input for needs not typically identified by federal agency users. As a result of that proffered idea and the USGS approved augmented funding for the fourth grant period (GY16), over 100 interviews were conducted by eleven AV PIs and Co-Is. Final analysis of the RCA-EO was not released prior to publication of this report.

*GY13-16**:** 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.*

- In GY14, AV reported that for the remainder of the grant periods, AV would focus on expanding the contact lists within its AVportal to include state, local and regional decision-makers, resource managers, planners, and other USGS data users. A collation across all StateViews provides the names that are included in the extensive email group, who receive frequent communication from AV staff.

- With the submission of the grant period Request for Continuing Assistance (RCA), StateViews have identified the High Impact Activities (HIA), relating to their state needs. Part II of this report explained that process in some detail. At any point, AV staff can readily generate information about what products were developed or what services were rendered to address specific needs. USGS determined that there was no longer a need for an actual survey to be conducted since the RCA process evolved with improvements to the AVportal's functionality. Similarly, no extant catalog of "imagery assets" exists, reflecting the technological advances in the storage of imagery by both the providers and the users. Several StateViews do store and distribute historic imagery, often scanned from film.

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. During all four grant periods, StateViews engaged in 162 activities, specifically intended to strengthen StateView consortia. In the fourth period, GY16, there were thirty-nine (39) such efforts recorded that allowed renewing and expanding professional connections throughout AmericaView states. The metric view over the four periods follows.

- Identifying opportunities for faculty exchange between state consortium members or internship possibilities for graduate and undergraduate students
  - 1st Period (GY2013) 4 activities by GA, IA, LA, NH
  - 2nd Period (GY2014) 4 activities by CO, GA, LA, NH
  - 3rd Period (GY2015) 4 activities by CO, GA, LA, NH
  - 4th Period (GY2016) 4 activities by CO, GA, LA, NH
- Purchasing shareable software licenses for use by state consortium members
  - 1st Period (GY2013) 3 activities, by MS,OH, WV
  - 2nd Period (GY2014) 3 activities, by MS,OH, WV
  - 3rd Period (GY2015) 2 activities by MS, WV
  - 4th Period (GY2016) 2 activities by MS, WV
- Training faculty members among consortia members and within their own institution
  - 1st Period (GY2013) 2 activities by AR, ND
  - 2nd Period (GY2014) 2 activities by AR, ND
  - 3rd Period (GY2015) 2 activities by AR, ND
  - 4th Period (GY2016) 2 activities by AR, ND
- Promoting opportunities for collaborative research among consortia members
  - 1st Period (GY2013) 3 activities by ID, ND, PA
  - 2nd Period (GY2014) 4 activities by CO, ND, PA, VA
  - 3rd Period (GY2015) 3 activities by CO, ND, PA
  - 4th Period (GY2016) 3 activities by CO, ND, PA

- Developing Collaborative programs with certificates of credentials or transfer agreements
  - 1st Period (GY2013) 2 activities by CA, PA
  - 2nd Period (GY2014) 1 activity by CA
- Partnering with other institutions that sponsor training
  - 1st Period (GY2013) 2 activities by AR, CA
  - 2nd Period (GY2014) 2 activities by AR, CA
- Improving and maintaining in-state remote sensing capacity through regular conference calls and conferences (StateViews continued to expand this activity, which was subject of a panel discussion during the Fall Technical Meeting in GY15.)
  - 1st Period (GY2013) 13 activities by AL (2), IN, KS, KY, MS, MT, NE, NH, OH, SD, TX, VA
  - 2nd Period (GY2014) 25 activities by AL, AR, CA, CO, CT, ID, IN, IA, KS, KY, LA, MI, MS, MT, NE, NH, NY, OH, SD, TX, VA, VT, WV, WI, and WY
  - 3rd Period (GY2015) 27 activities by AL, AR, CO, CT, ID, IN, IA, KS, KY, LA, MI, MN, MS, MT, NE, NH, NY, ND, OH, OK, OR, RI, TX, VT (2), WI, WY
  - 4th Period (GY2016) 23 activities by AL, AR, CO, CT, ID, IN, IA, KS, LA, MI, MN, MS, MT, NE, NH, NY, ND, RI, TX, VT (2), WI, WY
- Contributing to statewide geographic data committee efforts
  - 1st Period (GY2013) 4 activities by KS, MN, NE, VT
  - 2nd Period (GY2014) 6 activities by KS, MN, NE, NM, RI, VT
  - 3rd Period (GY2015) 5 activities by KS, MN, NE, NM, RI
  - 4th Period (GY2016) 5 activities by KS, MN, NE, NM, RI

Benefits of Activities

StateView efforts supporting this objective highly correlate to the effectiveness of AV's credentialed trust within local communities throughout each state. Such rapport facilitated gathering requirements for future Earth observation collection systems, as described above with the survey and interview projects. The established networking permitted StateView members to help with rescue, response, reduction of risk, and restoration projects after natural disasters, as respected contributors, trainers, and analysts. As an example, during the fourth period, two ColoradoView student interns collaborated with a researcher from USGS in Fort Collins to carry out an analysis of fire regimes in grazing lands in the western USA. MODIS (NASA's Moderate Resolution Imaging Spectroradiometer) fire data were acquired and processed, and related to data from the Bureau of Land Management for locating and monitoring the invasive plant species *Bromus tectorum* (Cheatgrass). Maturing collaborative collegiality facilitated the transfer of best practice and technology advances throughout the consortium, defying the isolation of defensive intellectual property hoarding. North DakotaView launched an interdisciplinary collaborative project to provide easy access to geospatial data for the members of the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nations) that live on the Fort Berthold Indian Reservation. As an outcome of this consortium building effort, the community will understand how to optimally use geospatial data in support of the reservation's needs, especially important in view of the ongoing activities of the Bakken oil shale play, which are changing the landscape rapidly.

Establishing the agreements with companies to share software and other geospatial use licenses have helped decrease course costs and resulted in more courses offered at partner institutions. **West VirginiaView** reported that a total of fifty (50) Erdas Imagine licenses were renewed in the spring of 2016, using a special agreement that WVView has negotiated

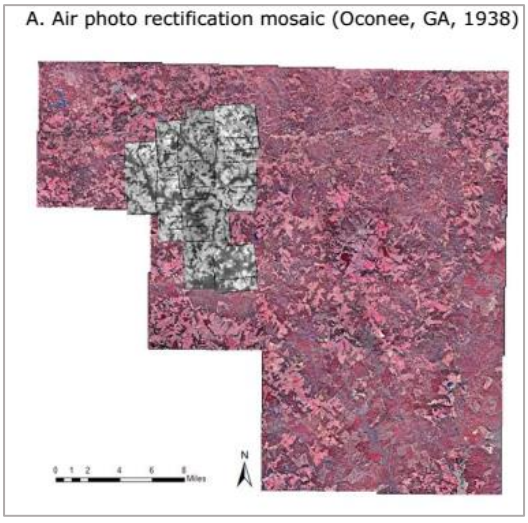
with Hexagon. All licenses are installed on a single license server at WVU and the participating schools tap into the license pool as needed. The licenses support five institutions (Glenville State College, Marshall University, West Virginia Wesleyan College, Alderson Broaddus University and West Virginia University), eight (8) professors and approximately 120 students. Before the West Virginia View license program there were only two courses in the state that provided hands-on training using commercial remote sensing software. 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.

Participation in statewide geographic data committees has strengthened geospatial capacity at the state level and brought statewide 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 applications such as urban planning or environmental assessment.

Clearly, the outstanding effort of the fourth period that highlights the value of a strong AV consortium built on the foundation of collaborating strong SV consortia has been the delivery of the suite of UAS tutorial videos. These were made possible both by the augmentation funding from USGS to AV for GY2016 but also by the leveraging each participating SV upon the equipment of the member universities. AmericaView may not use grant funds to acquire UAS systems but made possible the completion of the tutorial preparation by the SV members of the UAS Committee, under the leadership of James Campbell, **VirginiaView**.

Another approach taken by StateViews to build the consortium has been to provide internships for graduate students as a way to attract interest in remote sensing as a career option.

- In the case of GeorgiaView, the project remained the same although some of the interns were new each year. J.B. Sharma's students at University of North Georgia have completed a 1-m resolution orthophoto mosaic of the 1938 Chattahoochee National Forest (CNF) beginning with hardcopies of 1938 aerial imagery of this region. Two interns, Jacob Nolan and Craig Mitchell worked on the project from January 15 2014 to May 23 2014. Craig continued through the summer. The next set of student interns were Robert Stephens, Emanuel Fisteag, Jared McFarlin and Brandon Carlock, who scanned and processed 443 historical air photos in the area of interest. An ortho-rectified mosaic was created from the 1955-1956 historical air photos. Seventy-nine (79) images were used to make the mosaic covering the Lumpkin County, Georgia, during the summer in 2016. Jared McFarlin and Craig Durden worked as interns during this period. Resulting images will be uploaded to a website for historic imagery of NE Georgia. These pieces of geographic data document a changing landscape and also provide a social history as interviews and information are collected about the areas in these images. Students in the social sciences, history, and the humanities can enhance the spatial data with research which engages questions about the transactional relationship between humans and the landscape, further identifying the processes and narratives which have influenced North Georgia's dynamic landscape. The website was upgraded during the summer of 2017.



- **ColoradoView** has provided internships during the grant periods for both the same project and for changing projects. They awarded six (6) student internships in the second period to provide valuable learning experiences for the interns, who otherwise had very limited exposure to remote sensing data. Three pairs of students worked on three separate projects: 1) using remote sensing and GIS to assess Colorado's grazing lands, 2) using remote sensing data in invasive species modeling, 3) using remote sensing and GIS to enhance the utility of data from the UVB Monitoring and Research Program at CSU. COView expanded their effort in the third period by supporting eight (8) student interns to work under the supervision of two faculty members from CSU and a scientist from The Nature Conservancy. The Colorado Geospatial Centroid at CSU coordinated their activities. As intended, this effort increased the capacity of individuals to employ remote sensing data for a wide range of applications in the future. Continuing with this capacity building, in the fourth period, six (6) students were provided with internships, based at the Colorado Geospatial Centroid and supporting the COView high impact activities.

- In the first period, **IowaView** hired an undergraduate intern to populate the Iowa Ortho Server remote sensing data archive during the summer of 2014. He collected Landsat data for the archive covering the entire state from 2010-2014.

- **LouisianaView** maintains a close working relationship with first responders. In the first period of the grant, the SV provided internships to three (3) graduate students and three (3) undergraduate students working on projects supporting emergency/event response utilizing geospatial data in support of state applications and research. The focus in the second period provided internships to two (2) undergraduates and offered one graduate research scholarship. Students worked with remote sensing specialist and industry leaders in the state. With limited funds, given the other high impact activity plans, LAView was able to support one (1) undergraduate and one (1)graduate student during the third period, working on the Earth as Art project and the LouisianaView website and the 2016 FTM for AmericaView. In the fourth period, LAView awarded two (2) undergraduate and two (2) graduate internships who continued work on the database development for the emergency/event response utilizing geospatial data and on the Earth as Art materials for outreach and education for the public and K-12 levels.

- Throughout the grant, **New HampshireView** hired a graduate intern each period to work in the Geospatial Support Center, a cooperative effort on the UNH campus supported by several groups including NHView. In addition, another graduate intern was hired to work on a specific topic for each grant period. In the first grant period, the intern worked during the summer on Landsat 8 and forest cover mapping. In the second grant period, an intern worked on a mapping project using Landsat imagery to assess damage to Assateague Island as a result of Hurricane Sandy. In the third grant period, the graduate intern helped develop some educational remote sensing material specifically designed for use in NH schools. In addition, during the third and fourth periods, an undergraduate intern was hired to work through the academic year. In period three, that undergraduate worked on methods for evaluating the accuracy of remotely sensed data as well as some image interpretation in the Basic and Applied Spatial Analysis lab at UNH. In period four, the undergraduate worked in the NHView Director's research lab helping with image interpretation for reference data collection for assessing agricultural crops.

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 Work Plan– 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 opportunities to share information and techniques within and between state-based consortia.

Although significant applied research in the use of Earth observing remote sensing has occurred in each of the grant periods and improved outcomes are described throughout this report, that AV Research Committee itself has not been very active. Sharing information, however, both within the consortium and with others, about the AV applied research work has been a persistent effort.

- AV conducted annual Fall Technical Meetings (FTM) each period, alternating the location at the USGS EROS Center in Sioux Falls, SD and a SV member university. For this grant, the University of California at Davis and the University of Louisiana at Lafayette served as hosts in fall of 2014 and 2016 respectively. Invited speakers and guests also joined in the discussions, provoking new ideas among participants.

- In the fourth grant period, given the augmentation funds, the final FTM was held in conjunction with the ASPRS-planned Pecora 20 Symposium, also in Sioux Falls. AV contributed three (3) workshops, eighteen (18) presentations, two (2) panel discussions, and eighteen (18) posters to the success of the event and shared insights into the applied research program of AV with all attendees. Russ Congalton, New HampshireView, served as the Workshop Program Chair for the meeting. As will be described later in this report, AmericaView actively engaged with visiting students for the conference's STEM event.

- AV conducted its annual Winter Business Meetings (WBM) in the Washington DC area during the last three grant periods. (None was held the first period given insufficient lead-time following the grant award.) The first day of each WBM was held at the USGS Headquarters in Reston, VA to allow research discussions with the USGS scientists and to encourage those scientists and other invited guests to learn more about AV's work.

- AV also maintained a segment on the monthly AV all-member teleconference agenda for StateViews to share concise summaries of recent remote sensing activities (e.g., a refereed journal article, book chapter, online spatial decision support system, work in progress, etc.). Some months feature specific topics to elicit others' interest. The cumulative list of the titles of those presentations over the four periods was provided in Part II previously.

GY14: 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.

- If not restricted by publisher, AV-authored research papers can be accessed directly through the Education Portal at the AV website. This was an important step toward the maturation of the research group library concept that was suggested in 2014. All those publications are provided in the bibliography of Appendix G, ordered by primary author. Research publication information, for articles funded at least in part by AV sub-wards, were collected during the StateView annual reporting. USGS research acknowledgement guidelines were developed and distributed to AV PIs in GY14 and are in continuing use. Each author receives guidance about the statement acknowledging grant support from USGS and the disclaimer about USGS responsibility for the content. In each prior Technical Report for the specific grant period, some outstanding publication examples were cited. Although this final report includes everything from the four periods in the appendix, a couple notable publications from the fourth grant period are described below.

- Aaron Maxell and Tim Warner, **West Virginia,** with B.C. Vanderbilt and C. Ramezan published "Land cover classification and feature extraction from National Agriculture Imagery Program (NAIP) Orthoimagery: A review" in the November 2016 *Photogrammetric Engineering and Remote Sensing*. This review discusses the value of the National Agriculture Imagery Program (NAIP) images by exploring strengths and weaknesses. It summarizes how the data are used in land cover and feature extraction tasks in order to provide some recommendations for future research and best practices for working with NAIP orthoimagery, which is an often-overlooked source for remote sensing classification and feature extraction applications. Taking full advantage of this valuable data source requires the analyst to be cognizant of identified concerns and take measures to deal with such inconsistency and minimize its impact on the classification results. The authors recommend future research addressing these concerns that would further enhance the value of NAIP data.

- Ramesh Sivanpillai, **WyomingView**, Brenda Jones, and R.M. Lamb published "Accessing satellite imagery for disaster response through the International Charter: Lessons learned from the 2011 US Midwestern Floods" in the November 2017 issue of Space *Policy*. The International Charter members provided post-flood and pre-flood or archived RS data after the April 2011 floods in the Midwestern US. Multispectral and RADAR images provided valuable information to end users and first responders in the flood affected states for their planning and relief efforts. The paper describes the a) role played by the Charter to acquire and distribute RS data through six of its members, b) value of archived satellite data, c) need for image processing experts to process these near real-time data, and transfer them in a timely manner, and d) data acquisition and distribution policies of the Charter. Lessons learned from this response along with the policy recommendations will be helpful in future activations for maximizing the value of RS data and services.

GY14-16: 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.

As part of the applied research and technology transfer program, AV PIs focused on sensors, platforms, and research topics that benefit or have the interest of multiple StateView groups. The AV Research Committee was effectively replaced by three AV Working Groups, who conducted periodic teleconferenced group meetings and who always provided reports at the FTMs and the WBMs.

- **AV's Landsat Working Group** (LWG) Rick Lawrence led this group and ensured that all news about the status of the Landsat satellites was shared with members. He served as the AmericaView representative to the Landsat Science Team (pictured to the right) and established a well-received practice of preparing daily journal reports, which were shared by email at the end of each day so that the states would be apprised immediately of the latest developments and discussion regarding the Landsat program. During the January 2016 WBM meeting, he shared the insight that for the future of the Landsat Program: "the focus, more than ever, will be on user needs. AmericaView can play an important role in this respect, communicating the needs of our state and local constituencies to USGS and NASA. This applies to all aspects of the Landsat Program, from mission design, to data distribution and product development." The LWG also helped prepare background materials, to be used in Rick's presentation, for the LST meetings.

- **AV's Unmanned Aircraft System Working Group** (UASWG) GY14 was the inaugural year for the AmericaView UAS Working Group. From that time forward, StateViews have been continuing their close collaboration with USGS on technical and operational dimensions of their UAS activities. Bruce Quirk, who is the Unmanned Aircraft Systems (UAS) Liaison for the U.S. Geological Survey's Land Remote Sensing (LRS) Program, has been kept informed of the working group's efforts over the past years. At least 20 StateViews have been engaged in some type of UAS activity, have initiated UAS programs, or are supporting their university's separate efforts to acquire UAS platforms and sensors and to secure FAA certification. (This grant did not allow AV's purchase of those platforms or sensors. Any acquisition was with other university funds.)

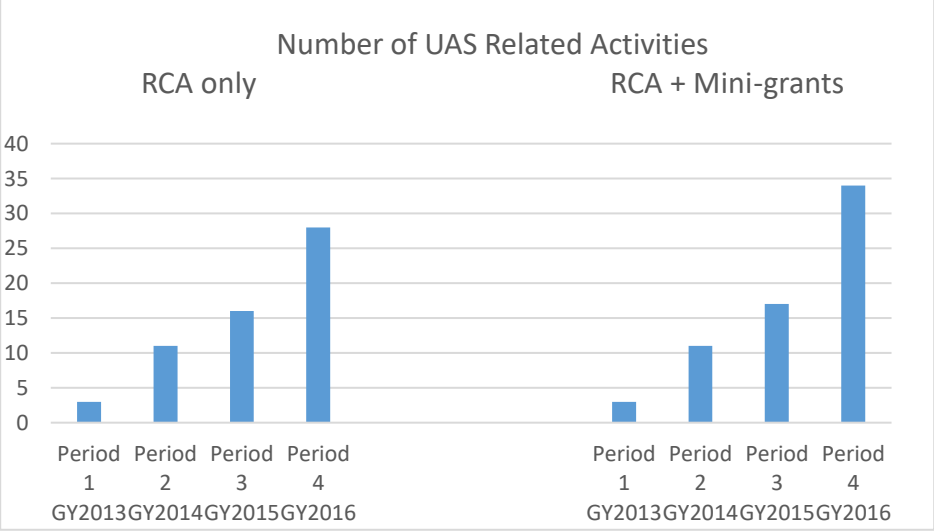


Figure 2. AmericaView UAS Activities

This expansion of UAS interest is reflected in the AV internal proposal process for each period's sub-grant awards. Requests for Continuing Assistance (RCA) submitted over the last several funding cycles of this USGS grant are shown on the left in Figure 2. If the mini-grant awards are included, which are not reported with the RCA annual report, the growth of interest and contribution is remarkable as shown on the right in Figure 2. Work done by StateViews always leverages some investment made by someone else, typically the university, to provide access to the systems since this grant has not allowed the purchase of any drone equipment, including replacement parts. The tutorial videos approved for the mini-grant focus will benefit all SVs with UAS projects as well as the general public eager to learn more about operations and qualifying to operate a UAS platform.

In anticipation that more states would become involved with UAS activity, the UAS Working Group prepared a task list in April 2016 for the GY2016 program. As the end of the fourth period, status in provided.

- ***Proposed Task 1.*** **Inventory AV UAS program and capabilities.**
  Goal: provide an effective, low overhead, strategy for collecting, updating, and accessible information about StateView UAS programs.
  Strategy: Develop on-line forms (e.g., Google forms, or some such) to collect UAS information from StateViews with UAS programs to record, update, and share information.
  Status: This task has been initiated and, despite no further grant funding, is intended to continue.

- ***Proposed Task 2.*** **Share information & perspectives considering university UAS policies/regulations.**
  Goal: Support development of sound university UAS policies and practices within StateView universities.
  Strategy: Collect examples of existing university UAS policies for consideration as other universities discuss and implement their policies.
  Status: VirginiaView began this effort, sharing with other universities.

- ***Proposed Task 3.*** **Continue to support and nurture nascent UAS programs within StateViews.**
  Goal: Encourage StateViews to launch, maintain, and develop UAS programs.
  Strategy: Continue, with modifications as needed, current practice of supporting established programs and advising/guiding new programs.
  Status: Part of objective the video tutorials collaborative effort was to address that need.

- ***Proposed Task 4.*** **Develop two-way communication between AV and USGS National UAS Project Office.**
  Goal: To share practical data and information about UAS operations between AV and USGS UAS teams.
  Strategy: Develop structured communication between AV and USGS UAS practitioners regarding topics such as lessons learned, operational experience with specific UAS models, and insights/vision regarding this rapidly developing remote sensing technology.
  Status: Bruce Quirk is included in all WG meeting invitations, email discussions, and copies of all materials developed by the WG.

- ***Proposed Task 5 (multi-year).*** **In communication with USGS, explore strategies for promoting compatibility between UAS and satellite data.**
  Goal: To investigate opportunities for coordinating scale/interrelationship/complementarity of UAS data with aircraft and Landsat-scale data.

Strategy: (Phase 1) Enumerate and characterize obstacles to harmonizing Landsat and aerial scale data with UAS data of the same region, considering their differing temporal, spatial, radiometric, spectral, and formatting dimensions. (Subsequent phases to build upon findings of these initial steps).
Status: Some activities planned for GY16 centered on that harmonizing effort. **IDView, MNView, NHView, NMView, OHView**, and **UTView** each had activities that studied the use of UAS remote sensing with satellite data from Landsat and/or Sentinel-2.

- **Water Quality Quantity Utility Working Group** (WQQUWG) The topic of water quality was anticipated to be among the work categories for this grant, given that twenty-three (23) activities had been completed in the prior grant covering 2008 through 2012. Fifteen (15) StateViews completed one or more of the forty-three (43) activities spread through the four periods of this grant. Those StateViews were **GAView, IAView, KYView, MIView, NMView, MSView, MTView, NYView, OHView, OKView, ORView, PAView, SDView, UtahView, and VTView**. This working group, begun following the WBM in 2015, continues to look for additional sources of funding to augment efforts on some key issues. The WG has been able to take a unified description of its efforts to national forums, where some of those funding sources have been present that might enable continued applied research as this grant ends. Nancy French from MIView and Terri Benko from OhioView were present at a hosted meeting by the Johnson Foundation at Wingspread in Wisconsin in September 2016. Chris McGinty, AV program manager and interim chair for the working group, provided a presentation at follow-up session, with coordination provided by the Meridian Institute. (Pisces Foundation was the driver behind the entire meeting that featured four presentations selected from the Wingspread agenda of participants.) The AV Water Quality Gateway concept has generated interest, but no overtures for funding. Lindi Quackenbush, **NYView**, used a mini-grant to explore some tooled-approaches. Her outcomes were shared during the January 2018 members meeting and she plans to continue work by finding other funds. Several working group members also participated by phone during a NASA-sponsored "Water Quality Workshop for End Users" in September 2017. Each of these occasions allowed a diverse group of attendees to learn more about the AV intent.

<u>GY13-16</u>: 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.

- Chris McGinty, Program Manager for this USGS grant, initiated an AV Newsletter that began publication in June 2016. Seven issues have been published.
- Sally Cook, the USGS liaison for AV, used the AV listserv to send at least monthly, and usually more often, references, articles, and Landsat updates to AV members.
- Monthly Members Meetings, using GoToMeeting, allow reporting from the Board, the Committees, the Working Groups, and the staff to be discussed by any member. Similarly, Av's Fall Technical Meeting and Winter Business Meeting have included additional agenda time for networking among the active members of the working group and other interested meeting participants. Those agendas also provide both podium presentations and panel discussions time for in-depth discussions about significant outcomes or ongoing efforts. Each StateView PI, during the GY15 meetings, was expected to provide "lightning" talks to highlight the state's primary activities.
- As mentioned previously, brief technical presentations are encouraged at each monthly AV Members Meeting. During the fourth period of this grant, those have increased in frequency. AV plans to continue its members meeting after the grant concludes, specifically for the purpose of encouraging the exchange of information about StateView work.

GY13-16: Support for Conference Presentations (added in GY14)

AV will continue to identify national conferences where remote sensing applications can be shared by members who make presentations on behalf of AV. StateView members are encouraged to participate and describe their work and its impact. When appropriate, the AV Executive Director will provide overview presentations about the history, the current vision, mission, and goals, and the nationwide consortia model of AV.

Over the full grant's duration, 241 presentations at various national and local conferences or meetings were identified by the StateViews in their annual reports. Each gave its audience some insights into the activities of AV and the SV members. A list of those reported can be found in Appendix H. A few of those presented at the national or international level are listed in this section of the Final Report to illustrate, in a quite limited way, the range of topics and locations.

- **ArkansasView**: Tullis, J. A., Shi, X., Cothren, J.D., "The Integrated Geoprocessing, Workflows, and Provenance Cycle", Oral Presentation at the Imaging and Geospatial Technology Forum (IGTF) 2015, 7 May 2015, Tampa, FL
- **CaliforniaView**: van Benthem, P., Lay, M., "Introduction into Geographical Information Systems and Remote Sensing", Oral Presentation at the National Science Teacher Association Conference 2014, 4 Dec 2014, Long Beach, CA
- **GeorgiaView**: Seong, J.C., "AVUNIV - An Online Remote Sensing Course", Oral Presentation at the Association of American Geographers 2014 Annual Conference, 24 Apr 2014, Chicago, IL.
- **MarylandView**: Moore, T., "Detecting Changes in Baltimore, Maryland's Land Cover and Urban Heat Island Using Landsat Imagery", Poster presented at the Annual Meeting of the American Association of Geographers, 31 Mar 2016, San Francisco, CA.
- **MontanaView**: Lawrence, R., Moran C., "Which Classification Method Is Best? An Infrastructure for Rigorous Comparisons of Classification Algorithms", Oral Presentation at the 36th International Symposium on Remote Sensing of Environment, 13 May 2015, Berlin, Germany.
- **New HampshireView**: Congalton, R.G., "Recent Developments in Assessing the Accuracy of Maps Derived from Remotely Sensed Data", An Invited Lecture at the Institute of Ecology, 5 Aug 2015, Xalapa, Mexico.
- **New MexicoView**: Boykin, K.G, "Mobile Apps in the Classroom: Preparing the Next Generation", Oral Presentation at the 24th Annual Conference of the Wildlife Society", 23-27 Sep 2017, Albuquerque, NM.
- **OhioView**: Simic, A., "Large-Scale Monitoring and Spectral Separation of Organic and Conventionally Treated Crops", Oral Presentation at the 2nd Conference on GLOBAL FOOD SECURITY, 13 October 2015, Ithaca, NY.
- **West VirginiaView** and **WyomingView**: Sivanpillai, R., Prichard, M., Warner, T.A., "Quantifying the Influence of Landsat Spectral Index Threshold Values on Mapping and Estimating Changes in Glacier Surface Area", Oral Presentation at the Association of American Geographers Annual Meeting, 29 Mar – 2 Apr 2016, San Francisco, CA.
- **WisconsinView**: Batzli, S., "RealEarth: Access to Real-time and Archive Satellite Data and Derived Products", Oral Presentation at the American Meteorological Society Annual Meeting, 24 Jan 2017, Seattle, WA.

Highlights of Progress towards Objective 2 over the Four Grant Periods

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

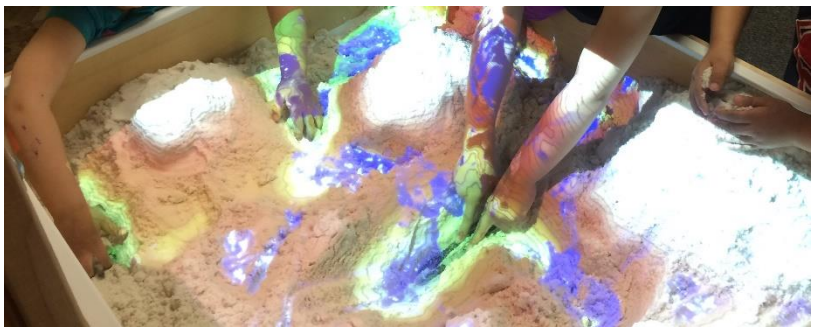
agricultural run-off into major rivers or the ecological problems created by urban heat islands. The opportunity afforded by AV for StateViews to collegially exchange research ideas, approaches, and outcomes helped ensure some best practices could be cascaded throughout a region or to similar situations across the country.

As noted in the Technical Reports for each of the grant periods, quite often the funds from the sub-awards, whether considered cumulatively or annually, could not ensure completion of complex applied research or technology transfer. Partnership-based-research activities, that leverage efforts being supported by awards from other sources, play a significant role in completion of the agenda of work for each StateView and encourage the shared goals of AV's academic, government agency, and NGO partners. The Consortium Overview Fact Sheets of Appendix I, prepared during the third period, show each StateView's wealth of partners. Some examples of collaborative activity within a state consortium, leveraging others' efforts follow.

- **AlabamaView**, in the fourth grant period, announced an applied research partnership with University of Alabama Huntsville and a private company in helping plan for the placement of a hyperspectral sensor on the ISS.
- **ArkansasView**, in the first grant period, successfully launched a partnership with Communities Unlimited, Inc., a nonprofit serving rural underbuilt communities in Arkansas and six neighboring states.
- **KansasView**, in the first grant period and extending into subsequent periods, obtained funding from the GIS Policy Board to create, in conjunction with AmericaView support, a Flood Dashboard for Kansas based on successful NASA templates used worldwide. This leverages years of floodplain data development supported jointly by AmericaView, the GIS Policy Board, and other state and federal agencies.
- **LouisianaView**, during the second period of the grant, initiated a LAView partnership expanding the LAView state consortium, to improve development and use of applied research. The University of Louisiana at Lafayette, Regional Application Center (location of the LAView PI) coordinated with a private company, Global GeoSpatial Solutions, and the Louisiana Geological Survey, to form a non-profit named Louisiana RS and GIS Institute (LARSGIS). From this effort has evolved the current Global Geospatial Institute. http://gginstitute.org/
- **OhioView** developed collaborative efforts with NASA GRC Hyperspectral Harmful Algae Bloom (HAB) research team that lead to some additional funding support.
- **OregonView** continued to make progress throughout grant period four on shallow bathymetric mapping from NASA MABEL and Landsat 8 in Keweenaw Bay, Lake Superior. ORView's activity on accomplishing this work heavily leveraged a project funded by NASA.
- **UtahView** formed a partnership with the Utah State University Remote Sensing/GIS Laboratory in the second grant period that led to an EPA Environmental Education award.
- **VermontView** compiled Landsat derived forest health metrics from 20+ years of data that were assembled through a partnership with the Vermont Forest Ecosystem Monitoring Cooperative (formerly, the Vermont Monitoring Cooperative). Vermont's forests face a multitude of threats ranging from invasive species to climate change. This compilation helped Vermont's resource managers better understand how its forests have changed in the past to better adapt to future challenges. This initiative is but one of many similar land change observation studies VTView has conducted.

Since the majority of AV's research is applied research, it is critically important that its research findings be shared with decision-makers, environmental monitors, resource managers, and other academic, government, and private company researchers. The presentations and the publications identified by the StateViews reflect only part of the larger endeavor to stimulate interest in and use of remote sensing. Demonstrations, technical reports, workshops, and panel discussions characterize part of the methodology used to distribute information in effective, interesting ways.

- **AlaskaView** deployed its version of an Augmented Reality Sandbox at the Arctic Science Summit Week. The sandbox attracts both adults and children, when on display at various venues. This event was held at the University of Alaska Fairbanks campus from March 12-18, 2016 during the third period of the grant. In addition, an educational curriculum for students in grades 6-12, complements materials created through the MapTEACH (Mapping Technology Experiences with Alaska's Community Heritage) program. As an activity extending from the previous grant period, AlaskaView was able to complete the deployment of the Augmented Reality (AR) Sandbox at the Fairbanks Children's Museum, based on some refinements to the initial installation. A specialized cart was built to accommodate the appropriate height of children. Other safety features that were recommended during the first year of the project were incorporated. Another improvement to the GY16 activities was the creation of a topographic map display to accompany the AR sandbox, explaining how to interpret a topographic map. **New MexicoView** incorporated its version of the Sandbox in its education and outreach program, using the experience of AlaskaView. That StateView worked with groups ranging from New Mexico School for the Deaf preschoolers to attendees at the New Mexico State Department of Agriculture's AgDay at New Mexico State University.



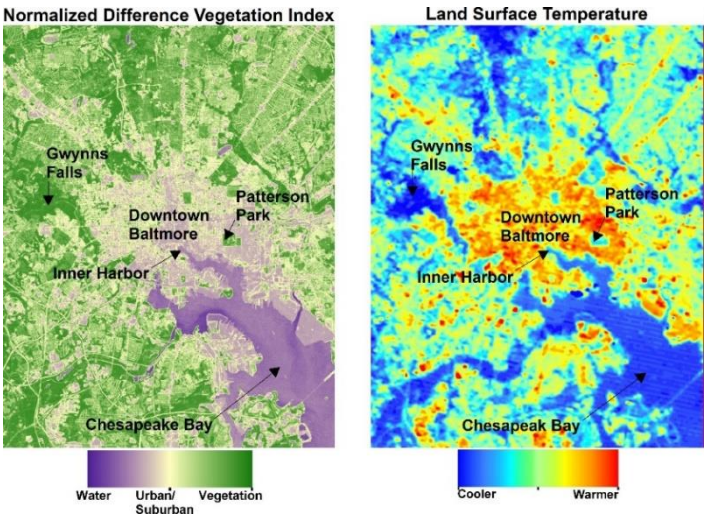
- **ArkansasView** established a research collaboration between Mohamed Aly (University of Arkansas) and Haydar Al-Shukri (University of Arkansas at Little Rock) to investigate ground stability in Central Arkansas. Aly and Al-Shukri were able to detect areas of ground subsidence and active landslides using synthetic aperture radar interferometry (InSAR) techniques. Graduate students from both collaborating institutions were involved and gained insight into innovative geospatial techniques. This collaboration stimulated a successful research proposal to NASA EPSCoR to study ground stability in the entire state of Arkansas. That research added four additional faculty and researchers. Detailed Earth surface deformation maps will be generated in the future and will be used to make informed decisions regarding sustainable development of the study area.

- The 2008 Gulf Hypoxia Action Plan aimed to reduce nutrient loads to the Gulf of Mexico by 45%, which is a priority initiative in Iowa and other upper Mississippi River Basin states. The Mississippi River/Gulf of Mexico Watershed Nutrient Task Force was established in the fall of 1997. The 2008 Action Plan from the Task Force is a revision of a 2001 Action Plan. A reassessment in 2013 endorsed continuing the plan, expecting that "state nutrient strategies" for all states in 2014 would be a significant step in reducing the nutrient loads. Iowa is among the states with a plan. **IowaView** participated by refining the remote sensing processes used to inventory and to monitor nutrient reduction management practices. Data for six specific conservation practices were digitized by students and served as ground reference data for semi-automatic conservation practice extraction from imagery. This statewide project is ongoing until 12 watersheds covering Iowa are processed. Although funding from AmericaView has ended, local and state partners are contributing funding with an expected project completion date for the baseline inventory of June 1, 2018. With project partners (Iowa State University Extension and Outreach; ISU Nutrient Research Center; USDA-ARS National Lab for Agriculture and Environment; USDA NRCS and FSA offices in Iowa; Iowa Dept. of Natural Resources and Dept. of Agriculture and Land Stewardship), existing USGS NAIP photography in the time period coinciding with a statewide lidar flight from 2007-2010 and spring CIR

imagery were used to interpret occurrence of 4 structural and 2 management practices commonly used in Iowa to reduce sediment and water runoff from agriculture fields.

- For the past 5 years, **KansasView** and the Kansas GIS Policy Board have jointly funded research to develop a Segmented Library of Inundation Extents (SLIE) for the State of Kansas using lidar and other elevation datasets. SLIE datasets for most of the state have been delivered to the state GIS data warehouse, housed with other geospatial data at the Kansas Data Access and Support Center, after being tested and validated using satellite and other data. In GY16, KansasView proposes to use the SLIE data to create an analysis of critical infrastructure that might be vulnerable to flooding events in Coffey County, Kansas, an area that has experienced severe flooding in the past. Cara Mays completed the GIS database of critical infrastructure using maps of flood stages derived from the Kansas SLIE. She briefed emergency managers in the county and obtained their feedback for creation of the final map products.

- Todd Moore and Jay Morgan of **MarylandView** mapped and analyzed spatiotemporal changes for the Baltimore Urban Heat Island project with the help of two graduate students and one undergraduate student at Towson University. The students familiarized themselves with some previous research and methodology. USGS researchers had documented the biological response of an herbivore to urbanization and the Urban Heat Islands (UHI) in the southeast United States and the effect of UHI on stream temperature in North Carolina. The MDView project used Landsat imagery to detect spatiotemporal changes of the UHI in the Baltimore region and to analyze the association between land surface temperature and land cover over space and time. This project illustrated the spatial variability of Baltimore's UHI, tracked changes in Baltimore's UHI over space and time, and quantified the association between land surface temperature and land cover in the Baltimore region. These results can be used to verify the importance of implementing green space in urban settings to mitigate the UHI by tracking the surface temperature changes that correspond to land cover that has transitioned from an urban cover to a vegetative cover. Portions of this work became a poster for the Annual AAG Meeting in the spring, 2016. Todd led a detailed discussion with the audience during his oral presentation at the Seventh Annual Environmental Conference at Towson University, also in the spring of 2016. During the fourth grant period, the activity was expanded. Todd Moore supervised a research project for which students from Towson University utilized Landsat images and US Census data to explore the relationships between the land surface temperature and socioeconomic characteristics of neighborhoods in Baltimore. Four of the students presented their work at the Mid-Atlantic Division of the American Association of Geography Annual Meeting in fall, 2016.



- In GY13, MississippiView funded a graduate student to begin investigating the use of Landsat 8 data for production of images of lake water clarity for the seven large lakes in Mississippi. The lakes in Mississippi are used for both flood control and summer recreation for many thousands of Mississippians. The MississippiView team worked

with the Mississippi Department of Environmental Quality (MDEQ), the state agency tasked with monitoring lake water quality, to refine the imagery to meet their needs.

- North Carolina has regulations through the Coastal Area Management Act to control human induced impacts on submerged aquatic vegetation (SAV). The State is interested in identifying the location and extent of SAV beds within the State's estuaries. **North CarolinaView**, in cooperation with an on-going research project at the East Carolina University, mapped the SAV coverage in Core Sound, NC using multi-temporal Landsat-8 data. The research team also received SONAR data. The SONAR echoes were converted into the absence or presence of SAV. Preliminary analysis indicated a high level of agreement in the delineation of the SAV comparing the two data sources, the SONAR data and the multi-temporal Landsat 8 imagery. An article describing this research was published in *The Proceedings of the International Geoscience and Remote Sensing Symposium, 2016 (IGARSS'2016) in* July 2016.

- **OhioView**'s Anita SImic joined a one-day workshop, held in Cincinnati in June 2016 and organized by the Confluence Water Research Consortium, a grassroots coalition of private and public sector leaders from the region. Confluence's program is supported with funding from EPA and the U.S. Small Business Administration (SBA). The meeting focus was water quality and protection of the Ohio River. Anita Simic's attendance was to advance her participation, and, thus, OhioView's, in the networking platform seeking to identify, educate and facilitate solutions to current and emerging water challenges in the community. http://events.r20.constantcontact.com/register/event?llr=jgnmremab&oeidk=a07ecms2931aff6beec

- Under the guidance of the Washington County Watershed Alliance, **PennsylvaniaView**-sponsored students of the PI, Tom Mueller, assumed a research and data management task for a countywide database of stream and ground water monitoring sites. Along with the acquisition of well observation and the construction of a dynamic geodatabase, students catalogued and analyzed spatially distributed ground- and surface-water chemistry with imagery. Students used GIS mapping techniques to understand spatial relationships and analyze the measured parameters with respect to proximity to drilling activities, agricultural land use, and other land use and development to assist the alliance.

- On November 3, 2015, Douglas Ramsey and Christopher McGinty **(UtahView**), and Thomas Thompson (graduate student) presented a short lecture on the uses of ultra-high resolution remote sensing in rangeland management as part of the Beaver River Watershed Tour and Pesticide Training to roughly 60 local ranchers, land managers, agency personnel, and university extension agents. The presentation focused on the use of course- and moderate-resolution remotely sensed imagery, such as MODIS and Landsat, as well as the use of ultra-high resolution imagery acquired from UASs to support rangeland management and monitoring.

A Metric Perspective and Summary of the StateViews' Development of Remote Sensing Applications

Over the four grant periods, StateViews engaged in 220 activities that completed some applied research and developed new applications or uses for remote sensing data. Some of those efforts are described in this section of the report. Descriptions without specific years reflect work that was not confined to one grant period. Bullet descriptions reflect the category-code binning of activity when StateViews submit their RCA and complete their grant period report.

- Collaborated with agency personnel and/or private companies to assess utility of satellite data for monitoring and mapping activities that were not typically performed using satellite imagery (36 activities were completed by fourteen states: AL (3), CO (3), HI (2), IA (6), MD (2), MN (4), MS (4), NH (1), OK (1), OR (1), SD (1) VT (2), VA (2), WY (4)). Summaries of fourteen activities, one from each state covering the four periods, follow:

    - For 2015, a graduate student partially funded by **AlabamaView** used the lidar data and CIR NAIP imagery to map urban tree cover using GEOgraphic-Object-Based Image Analysis (GeOBIA) methods in combination with Landsat 8 Leaf-off imagery to separate deciduous and coniferous tree cover. (OBIA, in the simplest sense, is an image data set segmentation process that groups similar pixels into objects.) Alabama continues to partner with the Southern Research Station of the US Forest Service to map urban tree canopy and produce a product that helps Forest Service employees promote and maintain urban forests. AlabamaView will track how often the data are downloaded by state residents and will research applications developed by the Forest Service.

    - **ColoradoView** has partnered with the Natural Resource Ecology Laboratory at CSU, The Nature Conservancy, and the Colorado Geospatial Centroid at CSU to assess grassland health and sustainability throughout the grant periods to assess grazing-land forage productivity. During the third period, rather than evaluating the utility of MODIS data, COView was explore the potential for using National Agriculture Imagery Program (NAIP) data. The next grant period, NAIP was used in conjunction with Landsat for health classifications over larger areas. The assessment products are being used to carry out assessments of the distribution of grassland health in relation to livestock herbivory and drought stress. In turn, improved rangeland management practices, based on observations of health or stress and existing management approaches and consequences, can be developed to improve grassland sustainability. The project also provided educational opportunities for two students, working under the supervision of a scientist from TNC.

    - **Hawai'iView** The USGS Hawaiian Volcano Observatory expressed increased interest in the availability of moderate resolution imaging data sets for mapping the location of new lava flows and estimating their advance rates. The Hawai'iView FY13 effort consisted of (1) determining a processing recipe for retrieving active flow area versus total flow area using Landsat 8 OLI and TIRS data sets and (2) cross correlating variations in this "breakout metric" with field reports compiled by the Hawai'ian Volcano Observatory to check whether this metric makes sense in terms of changes in volcanic activity observed in-situ. The preliminary work by a graduate student organized a 20-year data set in normalized spatial, spectral and radiometric units.

    - **IowaView** and the ISU GIS Facility developed methodologies for mapping agricultural drainage tile systems in the Midwest using conventional aerial photography and photo-interpretation techniques. Previous research indicated that tile systems become visible due to differential drying patterns after a one-inch plus rainfall event in the late spring when tillage is high and before crop canopy hides the soil. IowaView employed an ISU undergraduate to continue the work begun in 2014 by a graduate student to develop educational materials

to explain how to map tile lines using aerial imagery. The student also finished line digitizing from aerial photography in the test areas. The student then helped IowaView staff write the report on the process, contributing descriptive text and imagery examples. As her final contribution to the project, she created a poster outlining the factors necessary for successful tile line mapping in aerial imagery and considerations for choosing flight times in relation to rain events.

- The Maryland Environmental Trust (MET) is a statewide land trust that works with landowners and citizen land trusts to protect Maryland's most treasured landscapes and natural resources. The **MarylandView** consortium developed a mapping application for the Maryland Environmental Trust (MET) that uses Landsat 8 imagery to identify land cover changes--such as forest to bare ground or urban--warranting on-site investigation by MET staff.

- **MinnesotaView**, in the fourth period, initiated an activity in collaboration with the Minnesota Pollution Control Agency to update the Minnesota statewide lake clarity layer. This work is fundamental to understanding how MN lakes are changing in response to anthropogenic and natural forcings. Although the project will be completed after this AmericaView project period ends, it benefitted significantly from efforts undertaken as a part of the MinnesotaView project.

- **MississippiView** completed its Tree Canopy Investigation and delivered maps to the City of Oxford's Tree Board to inventory the tree canopy in Oxford and the surrounding region. The study updated a previous mapping effort and provided the City Planner with information about the rate of tree loss due to development, the extent of the tree canopy and the regions of most change. The city was working on an update of its tree ordinances and used the data to assist in its evaluation.

- **New HampshireView** collected UAS imagery to evaluate edge habitat/characteristics and as a potential source of reference data when assessing the accuracy of maps created from moderate resolution imagery such as Landsat. Edge habitat is especially important to wildlife and invasive species. During GY16, the analysis of UAS imagery as a source of reference data was completed. The work on edge habitat was accomplished by two graduate students and one undergraduate. Partners in this research included the GRANIT (New Hampshire's Statewide GIS Clearinghouse) Program and Cooperative Extension. Funding at the University of New Hampshire with some summer support from AmericaView funded the graduate students. The undergraduate was supported as an intern on AmericaView funding. The methods used in this project were to collect UAS imagery over a number of forest properties owned by the University of New Hampshire. Other data including multispectral imagery and lidar were also obtained. Detailed ground measurements/forest inventory were available for these properties allowing direct comparison with the UAS imagery. The potential for using the imagery as a substitute for these ground measures was evaluated and it was determined that there was reasonable agreement between the information obtained from the UAS and the ground measurements.

- **OklahomaView** contacted KansasView and TexasView to explore a collaboration for mapping open surface water bodies in Kansas and Texas with what had already been completed in a previous grant period in Oklahoma. The effort generated Oklahoma-Kansas-Texas maps of open surface water bodies at 30-m spatial resolution using Landsat 8 images in 2014-2015. Open surface water bodies are important for livestock, wildlife and humans, but they are also sensitive to drought and pluvial conditions. OKView leveraged the previous period's internal mini-grant by further advancing the use of its self-developed simple and robust

algorithms in Google Earth. Two papers completed share the improved algorithms through publication in *Science of the Total Environment* and the *Proceedings of the National Academy of Sciences of the United States*.

- In July, 2016, an **OregonView**-sponsored research team, led by OSU graduate student, Kory Kellum, developed and tested procedures for using Landsat 8 (L8) TIRS bands and in situ data for generating water surface temperature data products for the Iron Gate Reservoir, impounded by the Iron Gate Dam on the Klamath River. Water temperature is a driver for a number of physical and biological processes and is known to damage fish health and water quality from organic and inorganic contaminants. The final water surface temperature map for Iron Gate Reservoir on July 20, 2016 was made available to those interested, by providing the option for download on the OregonView website: http://research.engr.oregonstate.edu/parrish/landsat-8-klamath-river-project. Since the completion of this OregonView project, the team has given multiple briefings on the work to scientists working on water quality and salmon health projects in the Klamath River Basin.

- During the first grant period, **South DakotaView** collaborated with the South Dakota Department of Game, Fish, and Parks (SDGFP) in the use of NAIP imagery to classify land cover in Roberts County in northeastern South Dakota. The identification of habitat suitable for wildlife was the primary interest of SDGFP. The Roberts County landcover project was successfully completed by an undergraduate student intern.

- As part of the Vermont Center for Geographic Information's webinar series, **VermontView's** Jarlath O'Neil-Dunne provided a webinar on the automated building extraction techniques. The premise was that "It won't be too long before Vermont is completely covered by lidar, but what are we going to do with billions of points of data?" The USGS and state partners have invested over one million dollars in lidar collections within Vermont. Jarlath's webinar shows how the University of Vermont is using automated feature extraction techniques to map existing buildings using a combination of lidar, orthophotos, and E911 points. https://www.youtube.com/watch?v=iuN2XBiIGU0&feature=youtu.be

- **VirginiaView** updated the InForest mapper (www.inforest.frec.vt.edu) GPS Toolkit. This InForest Mapper GPS Toolkit provides users with the ability to generate and export GPS waypoints using the InForest mapping viewer. The InForest mapping viewer is used as a backdrop, or reference for generating the waypoint selection set. Users can create waypoints through manual entry or by automatically generating waypoints for a user-defined area. Those areas are selected by forestry, game, fishery, and agriculture assessors to help evaluate air quality, biodiversity, carbon sequestrations, nutrient and sediment runoff, and open lands.

- **WyomingView** recognized that state agencies were not willing to invest in remote sensing projects because they were not confident whether a given dataset or technique will solve their information needs. Additionally they lacked the human capital to conduct remote sensing pilot studies. Students enrolled in UW undergraduate courses, who were interested in supporting a community effort, contacted their parents or relatives or employers, who were producers, and obtained crop growth information (what was planted, harvest dates, any known problems etc.). These WyView interns were provided images and they processed them to obtain crop growth information for each field. The Wyoming Coop Extension Service provided part of the scholarship money to the interns, who generated crop growth information using multi-year Landsat images. These map products were provided to the crop producers. One of the producers (Robert Balzan, a

student parent) provided feedback about the utility of this product and how he can use this information for future management activities.

- Collaborated with researchers within or between other StateViews (10 activities were completed by six states: AR (1), NY (1), TX (3), VT (1), WV (2), WY (2)) A summary for four of those projects over the four periods follows:

  - In the first period of the grant, **New YorkView** reinvigorated its StateView consortium to encourage research collaboration within the state's universities and other organizations. New York State has a wide range of public and private academic institutions that support study and research in remote sensing and related fields and expressed interest, including Rochester Institute of Technology, Cornell University, and the State University of New York at Fredonia. Potential collaborations were also encouraged with researchers at not-for-profit groups, such as the Upstate Freshwater Institute and state agencies, such as the Department of Environmental Conservation and the Adirondack Park Agency.

  - During the second grant period, **TexasView** was a key member of a proposal team with WisconsinView and MichiganView in two submissions, seeking funding to leverage the AV Earth Observing Data Network. TexasView also participated in the AmericaView-lead proposal to NASA titled, "Holistically Advancing Formal and Informal Earth Science Education through Effective and innovative Curricula, Educator and Student Development" along with GeorgiaView, IndianaView, KentuckyView, MichiganView, OhioView, OklahomaView and PennsylvaniaView, which would have provided increased funding that AV would leverage to complement and augment the K-12 education goals.

  - **VermontView** has proven that UAS are an effective tool for acquiring remotely sensed data in the wake of a disaster, and recently decided to form a UAS Team (http://www.uvm.edu/~uas) to respond to such events. The Governor's Emergency Preparedness Advisory Committee recently gave their support to the UAS Team. Collaboration and cooperation between the University of Vermont, the State of Vermont, Civil Air Patrol, the National Weather Service, and FEMA has been assured.

  - **WyomingView** and **West VirginiaView**, in a project extending over the periods of the grant, planned and executed a multistate collaborative project on calibrating Landsat index-based methods for classifying glacier extent. Important to Wyoming and several western states along the Colorado River basin, glaciers play a vital role in water resources for the state and region. Previous studies classifying glaciers have used an ad hoc and subjective approach to classifying glacier ice from Landsat imagery. The two StateViews established an objective approach for setting an appropriate threshold to classify glaciers and to quantify the sensitivity of the threshold on the resulting estimates of glacier area.

- Found and tested innovative uses for remotely sensed data to address economic, ecological, and environmental issues (42 activities were binned over the four periods into this aspect of applied research by seventeen states: CO (3), GA (4) ID (1), KY (1), MD(1), MN (1), MS (3), MT (2), NC (8), NH (2), NY (2), OK (2), OR (1), SD (4), VT (2), and WV (5)). Again, activities from each state are described that were completed sometime within the four periods.

  - **ColoradoView** is based at the USDA's UVB Monitoring and Research Program (UVMRP) at CSU. UVMRP spatially interpolates data from a sparse monitoring network across the USA to develop maps of UVB radiation and Erythemal (skin damage) dosages. In GY15. COView developed a process to use remote sensing data to

refine the spatial interpolations of UVB, using data from the Ozone Monitoring Instrument (OMI) on the Aura satellite. The end products of this year of work, supported by a student intern, included: 1) a methodology for acquiring and processing large volumes of OMI data, 2) a database of daily and weekly OMI data for the USA in GIS raster format that is relatively easy to access compared with the original data, 3) a database of daily and weekly UVB maps covering the USA that is consistent with data obtained by the UVMRP, also in GIS raster format.

- During the fourth period**, GeorgiaView's** Jidong Yang at Kennesaw State University studied highway bottlenecking using real-time travel data and high-resolution aerial images. Imagery and real-time traffic information from Georgia Department of Transportation (GDOT) Navigator System helped identify spatial and temporal distribution patterns of highway congestion in the Atlanta Metro area. Approximately 66 days of traffic data were downloaded collected at 5-minute intervals from the GDOT Navigator System. Monitoring the geographical location of congestion revealed that many congestion points were at the ramp locations, where traffic merges, diverges, or weaves. The identified congestion patterns helped pinpoint the issues and potential solutions for GDOT.

- The research of plant function indicates that the reflectance signal near 531 nm is quite sensitive to rapid changes in the relative concentration of the three leaf pigments, violaxanthin, zeaxanthin, and antheraxanthin. The "xanthophyll cycle" serves to protect plants from damage during periods where light levels exceed what can be used in photosynthesis, which often occurs in the presence of environmental stress such as lack of water. During that time, light is dissipated by the leaf, which leads to a decreasing reflectance at 531 nm. To test whether the inclusion of a narrow spectral band around 531 nm on future Landsat missions would provide additional useful information about plant function during stress, in GY15, **IdahoView** mounted ground based Photochemical Reflectance Index (PRI), one optical metric of plant stress, sensors over plant canopies. Preliminary analysis indicates that PRI is highly variable. In addition, high temporal-resolution PRI information (every 5 – 10 minutes) is necessary to obtain useful information about plant function. The data analysis provided information that could be included in the gathering of future Landsat requirements.

- Extensive new UAS missions were undertaken in 2017 by **MinnesotaView**. Their UAS personnel conducted approximately 100 missions in support of forest inventory, health, and operations. Destinations included the Cloquet Forestry Center (CFC), the Hubacek Wilderness Research Center (HWRC), Madeline Island Wisconsin, and UMN research plantations near Grand Rapids, MN. In addition, the UAS team supported the new lidar and imagery dataset collected in northern MN through contemporaneous UAS missions. The goal of these missions was to evaluate UAS methods in comparison with lidar/imagery based methods for forest inventory and health analysis. The UAS team collected multiple datasets across MN and WI to study the invasive buckthorn species' prevalence and extent in their future research.

- The major goals of this **MississippiView** project was to use historical Landsat data to determine changes over time along the Mississippi Gulf Coast and investigate, test and evaluate old and new methods to use remote sensing to create input data needed to model the impact of LU/LC change on water quality in the Mississippi Sound. Research work continues with this undergraduate student.

- **MontanaView** identified the significant threat that bark beetles pose to Montana forests. With AmericaView support during the first two periods of this grant, MTView created temporally robust models that allow, for

the first time, mapping of infestations by percent mortality. The ability to apply these models to different locations or for multiple years will greatly enhance the ability to efficiently track bark beetle infestations and design management prescriptions to address the infestations. The project involved a partnership with the Bioenergy Alliance Network for the Rockies (BANR), USDA NIFA, USFS, and Montana State University and working in collaboration with a commercial enterprise evaluating converting beetle-killed trees to biofuels. Further analyses has been funded by a USDA NIFA grant.

- **New HampshireView** continued to evaluate and compare the capabilities of the new Landsat 8 sensor with previous Landsat sensors (e.g., Landsat 5 TM or 7 ETM+) for mapping land cover and especially forest land cover in New Hampshire. The results of this activity showed that there were no significant improvements in using Landsat 8 imagery over using Landsat 5 at least for the forest map classes used in this study. Both Landsat sensors provided adequate information to make the forest cover maps. In addition, there was no significant benefit to using the object-based approach over the pixel-based approach. Some previous studies have shown the object-based approach improves classification accuracy for moderate resolution imagery while other studies, including this one, have not.

- **New YorkView** sought to determine an efficient way to integrate spatially and temporally limited lidar data with widely available Landsat data to enhance derivation of forest metrics. New York State (NYS) researchers heavily utilize a range of remotely sensed data. The GY14 survey with the AV sub-grant identified a frustration with access to some of the local products that were collected on an irregular basis and that only covered limited areas. The study focused on forest metric assessment, in particularly above ground biomass, with the intent that this could serve as an illustrative example of the value of such data integration for a broader array of land cover applications. Access to local lidar datasets require interaction with NYS agencies and other data users/suppliers within the state. The project results were shared through local (NYGeoCon, Lake Placid, October 2017) and national (Pecora, Sioux Falls, November 2017) conference presentations.

- **North CarolinaView** completed two published manuscripts in the fourth grant period to document their years of developmental work on an algorithm for the removal of thin clouds in visible bands using collected visible and IR data. (A third is in preparation.)The algorithm targets operational optical sensors consisting of only multiple visible bands and one IR band. The researchers assessed the simulation of the thin clouds using Band 9 of Landsat-8.

- Because drought has substantial socio-economic impacts, **OklahomaView** used two grassland sites in El Reno, OK for which they collected soil moisture data from COSMOS, plant and soil hyperspectral data from ASD FieldSpec@3, and surface reflectance data from a time series of Landsat 8 OLI images. In GY15, data analysis of those data and the review of several analytical tool algorithms by graduate students was underway. In the fourth period, a manuscript was prepared and was under review for publication.

- During FY15, in this **OregonView**-sponsored project, researchers investigated synergistically fusing the L8-derived bathymetry with NASA MABEL (green, photon-counting lidar) data to produce dense, accurate bathymetry for Oregon's Keweenaw Bay project site, with lake-bed elevations referenced to the International Great Lakes Datum of 1985 (IGLD 85). In future work, these procedures, if evaluated as useful, may be extended to fusion of Landsat 8 and ICESat-2 ATLAS derived bathymetry.

- **South DakotaView** sponsored a study to compare actual crop evapotranspiration (ET_a) estimated from the satellite (Landsat 8 and Landsat 7) scenes and from atmometer in-situ measurements at three locations in eastern South Dakota. Researchers from South Dakota, Minnesota and Iowa worked together with graduate student support. Results showed a good relationship between the METRIC model and atmometers. The study concluded that differences between ET_a values using METRIC and those reported by the atmometers were related to high wind speed values (>3 m s^{-1}). As the wind speed increased, the ET_a difference increased.

- **VermontView** proposed to use Landsat data to generate products of forest characteristics and abiotic landscape characteristics of interest to forest managers, make these data publicly available, and explore the use of web-based mapping techniques to make them easily accessible. Forests play a key role in the economic health, ecological function, and character of Vermont. Data projects were documented with appropriate metadata and made available through the Vermont Center for Geographic Information's (VCGI) on-line data portal. Members of the VermontView consortium designed a prototype web-based mapping system to provide this information to managers in a way that is easily accessible. Team members also developed a Google Earth-based interactive application. They trained end-users on the use of these products at a remote sensing workshop held at the University of Vermont in the summer of 2014. The data were also passed along to the Vermont Monitoring Cooperative (VMC) for long-term storage and dissemination. Collaborators on this project included the University of Vermont, VCGI, VMC, USDA Forest Service, the Vermont USGS geospatial liaison, and the Vermont Department of Forests, Parks and Recreation.

- During the fourth period, **West Virginia View** built upon the applied research of mapping the palustrine wetlands accomplished in the previous grant period. DEMs of different spatial resolution, created using photogrammetry and lidar, were used for probabilistic mapping of palustrine wetlands within two study sites in West Virginia. The study found that the DEM source and resolution does not have a large impact on the accuracy of the wetland predictions. Photogrammetrically derived data, such as the National Elevation Dataset, may be adequate for predicting the location of wetlands. The research for this project was completed. WVView completed grant work but were editing a manuscript, planned for submission to a peer-reviewed journal by February 2018.

- Developed software to support distribution of satellite, airborne, and geospatial data (Nine activities were reported in the four periods by three states: GA (1), IN (4), and MI (4)). Summaries follow.

  - **GeorgiaView** developed a software tool to generate solar zenith angles and sun azimuths. This application allows scientists to calculate the sun's position parameters at any pixel of Landsat imagery, which Jeong (JC) Seong thought would promote applications in climate research, topographic correction, and atmospheric correction. He published a research paper, titled "Sun Position Calculator (SPC) for Landsat Imagery with Geodetic Latitudes" in *Computers & Geosciences.*

- MultiSpec (© Purdue Research Foundation) is a processing system, freely available for interactively analyzing multispectral Earth observational image data such as that produced by the Landsat series of Earth satellites and hyperspectral image data from current and future airborne and space borne systems such as AVIRIS. **IndianaView's** Larry Biehl is a co-developer (with David Landgrebe) of the software. Its associated tutorials and sample data sets are also made freely available on the MultiSpec web site. INView**,** in the first grant period, addressed a specific request from K-12 educators for a version with just a basic set of menu items and parameters for the students to use. This version intentionally limited the directions (options) that students could try and thereby helped the teachers more readily guide the students' learning. The design was completed in that period but was not operational. The changes made during the second period included implementing the menu options for using only basic capabilities to satisfy the earlier request. Also added were the capabilities to handle image data with very small and very large ranges, GeoTiFF images with tie points defined with longitudes from 0 to 360 degrees in addition to -180 to 180 degrees, and some bug fixes. During grant period three, the project was able to leverage work being done as part of a NSF funded project, to develop a web-enabled version of MultiSpec. The changes made during the fourth period include adding the ability to handle non-Roman characters in the path and file names. The BiPlot and Image Statistics processors were also added to Windows and Online versions. Ten tutorials were made available for users, which help describe how to do many tasks with MultiSpec. Users have created Greek and Hungarian versions of some of the tutorials. INView's development and support of this software has helped realize the vision of those who initially proposed and sponsored AmericaView in 2003 as an effort to make Landsat collections accessible and useable.

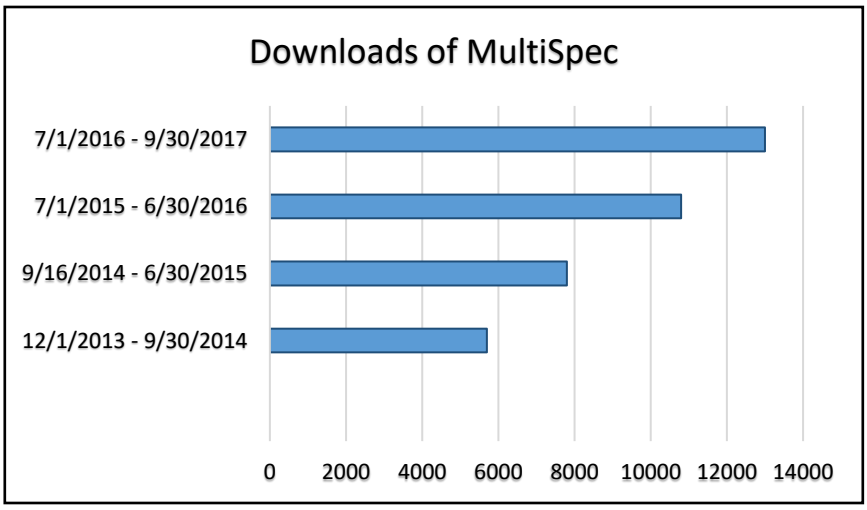


Figure 3. Downloads of MultiSpec

- **MichiganView** proposed, in the first grant period, to develop software tools for remote sensing in Python and JavaScript using established, robust geospatial libraries to support remote sensing scientists and convey key remote sensing and geospatial science knowledge to secondary and post-secondary students. User-friendly tools based on free and open-source software (FOSS) that can be deployed on a variety of systems will be developed to help scientists extract and convey information from Landsat and other remote sensing data and/or to expose high-level students of remote sensing to best practices. That initial commitment continued throughout the grant periods.
  - A summer intern in 2014 developed an "ImageSwipe" tool for quickly creating a web page that showcases change detection. The code was made available online under a non-restrictive license for others to freely obtain and modify. Python based tools to manipulate and analyze GeoTIFF images were also developed at the Michigan Tech Research Institute and made available for downloading.
  - In the second grant period, a web-map was developed for the K-12 students and other users. These web-based tools were made available in the data and imagery section of MichiganView.org. Additionally, useful

software tools such as code designed to automatically extract the sun angle from Landsat imagery were developed.

- In GY2015, a web-based tool was generated for a project coordinated with the University of Michigan's School of Public Health. The goal of the project was to determine vulnerability to climate change on a neighborhood level. Approximately 20 community members were trained in the use of the tool. Another tool included a story map used to teach third grade students about bird migration and the dangers migratory birds face with the increased construction of wind farms. A tool created for a previous outreach activity was revamped to provide 7th grade students a means to learn about invasive wetland plants near their school in Ann Arbor. Approximately 100 students were able to use the tools.
- Upgrades to MichiganView's website have allowed geospatial tools developed by the MichiganView Consortium to be uploaded. In GY16, the Great Lakes Water Quality tool, the MI-Environment tool, and a variety of educational tools were posted to the MichiganView website.

Benefits of Applied Research Activity

Applied research, as promoted by the StateViews activities, continues to deliver a high return on the taxpayer investments for the continuous Landsat collections. These projects helped to move derived information from satellite data into the hands of government, industry, and university partners and heighten public awareness about the effective use of this asset. Because this research work occurs 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 Work Plan– Student Engagement

GY13-16: AV will encourage presentations by StateView PIs that highlight remote sensing and other geospatial professions to encourage more high school and college students to consider these careers.

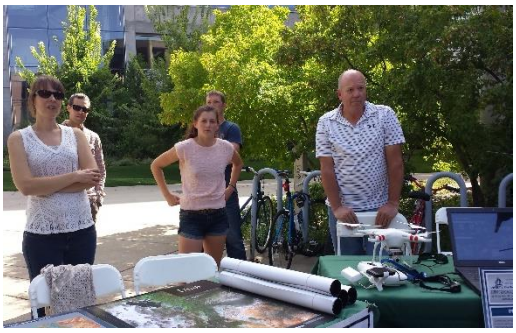
- Nearly every project described above in the section on the development of remote sensing applications involved undergraduate and/or graduate students. The annual reports contain explicit StateView statements that the motivation and outcome for involving students was to expose them to the significance of Earth-science endeavor. Most satisfying are those activities that describe work done in an earlier period by an undergraduate that subsequently became part of that individual's graduate thesis program. **New HampshireView**'s applied research is particularly representative of that growth and transition.

- The annual Earth Observations Day (EOD) is a hallmark AV commitment to the public, especially to K-16 STEM programs and to the Next Generation Science Standards implementation nationally.

- Several StateViews ensured that students were given opportunity to assist in outreach events, to make presentations during visits to K-12 schools, at professional meetings, at state-sponsored GIS events, and to deliver oral in-class reports. Some examples include:

  - **NDView** and UND Geography & GISc hosted a MapGive Map-A-Thon in both grant periods three and four, open to the University faculty, students and staff, on November 19, 2015 and November 17, 2016 to map humanitarian projects. Twenty-five students from various departments volunteered their time in 2015 and 30 in 2016. The event drew some media attention through UND's website as well as local TV news reports. NDView added additional effort in 2017 to involve local high school students in similar activities, either in the UND Geography GIS lab or at the schools.

  - As part of a student event in September 2015, university research laboratories, student clubs and groups, and faculty are invited to interact with undergraduate and graduate students. **UtahView** and the Remote Sensing/GIS Laboratory set up a table with research and cartographic posters, unmanned aerial systems, and GPS equipment. Several undergraduate technicians presented to and interacted with students, familiarizing them with geospatial technologies and resources on campus.



  - Occasionally one of the SV PIs would bring students to the Fall Technical or Winter Business meetings. At the WBMs in Reston, it was quite usual for **PennsylvaniaView** students of Tom Mueller to spend the day listening to presentations and engaging with some outstanding academicians, who have written their textbooks and assigned articles, designed their curriculum, or taught their own professors. Some have given excellent presentations about their academic work, including one **WyomingView** undergraduate, Logan Eicholzer, as seen in the photo as she engages the audience. A direct consequence of this opportunity was an accepted summer research internship with **CaliforniaView**. AV delights in the academic lineage of Jim Campbell (VirginiaView), Russ Congalton (New HampshireView) and Jarlath O'Neil-Dunne (VermontView).

<u>GY13-16:</u> AV will promote research publications by students, including introducing AV-funded students to AV's Research Publication Library described in the work plan for Objective 2.

As noted above, AV did not build a *Research Publication Library*, per se. The Educational Resource Portal at the AV website became the alternate approach. All the publications completed during the four periods of the grant and

identified by the StateViews in their reports are listed in primary author alphabetic order in Appendix G of this report and have been given to the webmaster to add to the website portal. The StateViews used multiple approaches to encourage and to acknowledge the work completed by students in research activities. Some were awarded competitive grants; others benefitted from student employment. (See the summary of youth employed by AV provided near the end of this section under the Overview of AV's Undergraduate and Graduate Research Accomplishments.) Throughout this grant period, many were also mentored to complete posters and presentations for meetings and conferences. This was particularly true for the ASPRS conferences, which also allotted to students with posters an assigned presentation window of time to explain their work and to talk with attendees. Ten activities specifically address supporting student publications or presentations in university forums. (MD (1), MS (3), UT (2), WY (4)) Fourteen activities had a similar focus by encouraging the submission and/or publication of research results in peer-reviewed journals. (AL (4), AR (4), GA (1), OH (1), WV (4)) These metrics, however, do not represent several other activities, entered into the Avportal database under a different category and code, which also identified presentations and publications as part of the positive outcome from an applied research project.

Peer reviewed journals include, but are not limited to, *Photogrammetic Engineering and Remote Sensing, GIScience and Remote Sensing, International Journal of Remote Sensing, Applied Geography, Journal of Applied Remote Sensing, Aerospace Proceedings, AIMS Geosciences.*

<u>GY13-16:</u> AV will support interdisciplinary research projects that would involve AV college students.

Five interdisciplinary activities were completed during this grant. Three are described here.

- One is a **North DakotaView** program that has extended over the four periods and will doubtlessly continue into the future although perhaps without the same vigor, lacking AmericaView funding. The interdisciplinary collaborative project delivered geospatial resources and workshops to the students, staff, and faculty at the Fort Berthold Community College, as well as to tribal government employees and other community members of the Fort Berthold Indian Reservation in western North Dakota. The involvement of NDView provided easy access to geospatial data for the people of the state and members of the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nations) that live on the Fort Berthold Indian Reservation. Creation of a spatial database based upon Landsat imagery along with other raster and vector spatial layers, which represent physical, administrative, socio-demographic, economic, industrial and other aspects of life on the reservation, continues to be populated. The first period of this grant continued work initiated in the last period of the prior grant. NDView worked with the chair of the UND Department of American Indian Studies and with faculty at Fort Berthold Community College. Two undergraduate students downloaded and processed Landsat, NAIP, and historical aerial photography for the reservation. In addition, the students compiled and organized secondary data on the geography of the reservation.

In the second period of the grant, one undergraduate and one graduate student at UND, employed by NDView, continued to assemble a spatial database for the Fort Berthold Community. The students worked to update map layers, add information about oil and brine spills associated with oil extraction, to improve the digital maps cartographically, and to improve the user interface. The students also moved the spatial database to the online NDViewer server. NDView students finished adding information about oil and brine spills associated with oil extraction and made significant improvements to the functionality of the user interface during the third grant period. With the database population successes, NDView viewed this effort as a springboard to the development of a community-mapping center on the UND campus. The breakthrough during the fourth period of the grant was the transfer of the Fort Berthold web GIS from the Flex Viewer for ArcGIS Server to the ArcGIS Online Web Application Builder. The data and tools are now hosted locally and that technological step forward has substantially increased the performance of the site for interested North Dakotans and others studying this industry. The reader should visit http://arcgis.und.edu/webmap/fortberthold/

- **CaliforniaView** improved an existing 'GIS and Society' undergraduate student class at UC Davis by including an introduction to satellite imagery (predominantly Landsat imagery) and its various applications that address societal issues. Thirty-six students, with majors in environmental science and management, environmental policy, hydrology, atmospheric sciences and human development enrolled in this class. Presenters ranged from federal agencies, non-profits, higher education faculty to industry members. Presentations ranged from disaster mapping, land cover change, and environmental research to environmental impact assessment. As an outcome, students will be well prepared to become involved in the upper division remote sensing courses and research projects offered by Professor Ustin. A product of this activity was newly developed curriculum materials and presentations, housed on the AV Education Portal website. The curriculum has been developed utilizing Bradley Shellito's, **OhioView**, *Introduction to Geospatial Technologies* textbook series.

- In **ArkansasView**, Jason Tullis and Mohammed Aly provided examples of remote sensor data processing and related techniques to faculty, staff, and students in biological sciences, geosciences, environmental dynamics, and from the Center for Advanced Spatial Technologies.

GY14-16: 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.

- This part of the Work Plan was very ambitious about measuring the "impact" by collecting key information from StateViews about the graduating students. The "tracking" methods # 3 and #5 identified in the work plan have no AV formalized capture. Tracking the trends in internships (#4) has also been complicated by changes over the years in how universities characterize funding for students. Often there are differences in what is allowed for undergraduate or graduate students, although the intended outcomes are the same. Some StateViews offer stipends but others only internships or scholarships. Some have a combination of approaches to offer funding that will advance student involvement in remote sensing activities. Some of the internships, used to strengthen the state consortium, were discussed near the beginning of this Part III of the report. Many testimonials to the impact of the internships and scholarships have been saved in the AVportal database. That information is often anecdotal

but should be highly valued as indicative of resulting increased interest in remote sensing as a career choice. Only some of the comments from the fourth period are quoted. Specific names are removed. Comparable remarks are available for the other three periods and were reported in those period-focused Technical Reports.

- ColoradoView

  Student 1: *Working with ColoradoView provided absolutely critical, realistic experience in team-based project completion. The skills and familiarities you have won't be enough, communication will take longer than you are used to, and progress will come in inches. Beyond a wonderful, self-driven learning experience, this internship has prepared me for how real-world career interactions operate.*

  Student 2: *Being involved with ColoradoView has given me confidence in my ability to learn completely new programs to get a job done. ColoradoView has given me an idea of how communication is an important key in team-based projects and has prepared me for my next experience in this career of GIS and remote sensing.*

  Student 3: *ColoradoView allowed me to design and implement research regarding the local grassland areas and helped me develop the necessary skills to work with spatial data. I started with decent knowledge of remote sensing and never having worked with spatial data before. I was able to successfully manage and analyze spatial data and improve my knowledge of GIS and Remote Sensing.*

- ConnecticutView

  Student 1: *This project was very interesting to me; it allowed me to use Landsat 8 image data to look at urban heat island effect in portion of Connecticut. I was able to use skills and knowledge I learn in class to examine a topic of interest to me. It gave me more interest in remote sensing.*

- IdahoView

  Student 1: *Thanks to AmericaView and IdahoView for the opportunity to participate in developing learning resources and materials for UAS applications in the Geosciences. After I complete my degree I plan on teaching at the college level and this experience has been tremendously inspiring!*

- IndianaView

  Student 1, Ball State University*: The scholarship helped pay for the National Park Service GPR Workshop, which was from May 15 to the 19. Professionally, a specialization and certification in GPR will make me very marketable to future employers.*

  Student 2, University of Notre Dame: *The scholarship that I received benefited positively my professional geospatial development. ... Part of the funds were used to support laboratory experiments. Laboratory results confirmed the oceanic observations detected by the geospatial instrumentations and supported the formulated hypothesis. I plan to use the rest of the funds to pay my travel expenses to attend the Ocean Science Meeting in Portland (February 2018). The conference will be an ideal venue to present my experimental results and to discuss the hypothesis that I proposed with leading experts in the ocean sciences.*

  Student 3, Indiana University Purdue University - Indianapolis: *I was very excited when I learned of the IndianaView scholarship …. It was a chance to expand my narrow focus and reach beyond my comfortable bounds. In preparation for the application, I met with the Emergency Management Agency (EMA) Director for*

District IV in Indiana and inquired if there might be a need for a project that would fit with the scholarship topic. She responded that there was a need for a cost analysis of a worst-case scenario tornado event in the Crawfordsville community. … Excitedly, I met again with the EMA director to finalize the specifics. It was determined that the project scope would include a cost analysis of a F-5 rated tornado moving through the urban city of Crawfordsville, in Montgomery County, Indiana. . ... The experience has enlightened me, broadened my scope, and inspired me to step outside of my comfort zone. I am honored to have been chosen as a recipient and am enormously grateful for this opportunity.

Student 4, Indiana University Purdue University - Indianapolis: *The Indiana View Scholarship was immensely helpful in my thesis project, 'Refugee Resources in Indianapolis, Indiana.' The funds helped me pay for gas to travel as I mapped out resources and continued my internship duties with Catholic Charities Refugee Resettlement Services. The funds also helped me pay for a poster on my project that I presented at the Social Justice Symposium: A Home for Awareness, Advocacy, and Action at IUPUI on Saturday, April 8, 2017. Thanks to the Indiana View scholarship, my resource map can help newly arrived refugees integrate into society and become more familiar with their new home quicker and more efficiently.*

Student 5, Indiana State University: *The Indiana View Scholarship allowed me to give me the tools needed and to go collect data at the research station. The GIS batteries allowed me to gather GPS points necessary for my research. This opportunity helped me get further into my dissertation work and allowed me to succeed in my geospatial biological research.*

- <u>New HampshireView</u>

  Student 1: *Thank you for the opportunity to work for you in the Basic Applied Spatial Analysis lab (BASAL) again during the fall and spring semesters of 2016 and 2017 as an AmericaView intern. I continued to help with the ongoing research project with your PhD student Kamini Yadav as I did the year before. The research project was a NASA funded project with the objective of creating accurate reference data to map global cropland to help with a number of issues including food security. All of my time was spent working on this project, most of which was using photo interpretation to delineate cropland areas from not cropland areas using Google Earth. The areas that I was instructed to look at and interpret were mostly in China and Africa and the information that was collected were then put into the respective files for further analysis.*
  Other tasks that Kamini had me complete in order to assist her with her research were done in ArcMap. These included generating random samples from the data and then extracting information from these files to create the reference data. Developing these skills that I have was very crucial during my time in the BASAL lab and will surely be important in my future career as well.
  Towards the end of my spring semester I, again, participated in the University of New Hampshire's Undergraduate Research Conference. Since this was my second year participating in the research conference, it was easy to create the poster that I needed and convey all the necessary information to help the reader understand more about the research. Thank you again for the great opportunity to work for you and your staff.

  Student 2: *I began my internship at the GSC four semesters ago, in the fall of 2015. I was a relative newcomer to the field of GIS, and working at the GSC challenged me, and provided the opportunity to finesse my skills. Initially I was worried that my skill level would not be at the caliber necessary to answer the questions of the GSC patrons. Since then, I have gained a lot of confidence in my ability to help others, and have looked forward*

to being able to do so. Over these two years, I've had the opportunity to do a lot of diverse things through my internship; I assisted a geography professor with an in-class introductory lesson to ArcOnline. I gave a presentation at GIS day about georeferencing the Carrigain Map, and I conducted a workshop on data acquisition and GRANIT. The open GSC hours also allowed me to work with students from the Into to GIS call that I TA'd on a one on one basis, which was helpful to them as they worked to complete their final project. My time at the GSC has helped me to become more proficient in GIS, which I anticipate will serve me well as I pursue a career in wildlife conservations.

- <u>WyomingView</u>

  Student 1: *This WyomingView internship opportunity gave me hands-on, real-world experience with scientific research. My research project utilized remote sensing technology to analyze patterns of crop growth and variability. I learned that the process of scientific research is challenging. However, seeing this project through to completion was rewarding and made the difficulties well worth it. I am thankful for this opportunity and I look forward to applying the knowledge I have gained here to future work and studies.*

  Student 2: *Over the course of this project, I have learned to process remotely sensed images to make them more useful for various applications. One of the things I have learned, however, is how to connect real world experience to lab based applications. Many times in school we isolate the project and ourselves from the application. From figuring out which types of images to use, either satellite or drone, to trying to understand how the other analysts thought, reality had to be constantly brought back into view to guide the progress of the project. I also learned time management and tips for professional presentations.*

  Student 3: *After taking my first remote sensing class in the fall of 2016, I was immediately sparked with curiosity in learning the applications and uses that could be applied to my own research. Completing an independent study allowed for me to examine my research site over a temporal scale by looking at landcover changes with time. I hope to continue to refine my skills in using remote sensing software to better aid in assessment of landscape scale studies in hard-to-access or remote areas.*

  Student 4: *My project was research on the use of satellite imagery to map changes in the area of water bodies over time. I had done a small project before on mapping surface area changes of water, but that was much less involved than this project. It was interesting to see how this is still an evolving area of research and how scientists are still trying to find the best methods to map water volumes via satellite imagery. This project was very valuable to me in that I wasn't just given a formula to follow, so it taught me how to look at a developing area of science and make decisions based on the parameters I had available.*

<u>GY14-16:</u> 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.

- As noted earlier, some students have attended the AV fall and winter meetings. They were afforded the opportunity to engage informally with the USGS scientists and researchers, who join those meetings.

- Sally Cook, the USGS liaison to AV, frequently identified speakers from USGS for the monthly members meeting, in which any StateView student is welcome to participate. Although not an "electronic classroom," the GoToMeeting use for all AV Board, Members, Committee, and Working Group meetings, which have been publicly posted on the website calendar, allows up to 100 participants, who can listen, watch the presentation, and easily ask questions. Part II of this report identified all the speakers and their topics.

GY15-2016: 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 students making electronic presentation at AV's FTM.

- One of the state consortium members for **New MexicoView** is the New Mexico Forest & Watershed Restoration Institute, New Mexico Highlands University (NMHU). During the ASPRS IGTF'16 meeting, NMHU sponsored a GeoLeague Challenge Group. Since that time, the GeoLeague challenge has changed format.

- Since the third period, AV provided both Webex and GoToMeeting connectivity for the FTM and the WBM. Faculty and students from the StateViews' consortia members have been invited to attend sessions of interest but none have yet made an electronic presentation in that forum.

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 and practical understanding of the field of remote sensing, and learned the value of putting theory into practice against thorny issues. Reading through the comments from the interns and scholarship winners reveals the insights gained in comprehending the complexity of many issues. There are many grateful expressions about being better prepared for entering the workplace or continuing with their advanced education.

- Reporting to DOI

  The Department of the Interior (DOI) had been collecting youth employment information from its related agencies and their partners on a quarterly basis. As the recipient of a USGS award, AV was required to report its data. Former Secretary of the Interior, Sally Jewell, made the "Engaging the Next Generation" initiative among her highest priorities. Her goal resonated with the AV commitment to educate young people about Earth observation using remote sensing and GIS. Her vision was "getting America's youth to play, learn, serve and work outdoors." Most recently, in the final call for the AV report, DOI changed focus to citizen science activities, an initiative of keen interest to several StateViews and the Education and Outreach Committee. Detailed information about the work for the first three grant periods is included in the prior Technical Reports. Only detailed information for the final grant period is included here.

  - In the first period, GY2013, ten StateViews (**AlabamaView, Hawai'iView, IowaView, IdahoView, LouisianaView, MichiganView, New HampshireView, VirginiaView, West VirginiaView, WyomingView**) reported hiring fourteen students. Four were graduate students and ten were undergraduates.

  - In the second period, GY2014, five StateViews **(Hawai'iView, IdahoView, IowaView, KentuckyView, VermontView)** reported hiring one graduate student, one graduate assistant, and three undergraduates.

- In the third period, GY15, ten StateViews (**AlabamaView, ConnecticutView, IowaView, KentuckyView, NebraskaView, North DakotaView, South DakotaView, TexasView, VermontView, VirginiaView**) reported hiring twelve undergraduate students, four graduate students, two cooperators, and 41 affiliated undergraduates.

- During the fourth period, GY16, there were only three reports required by DOI about hiring youth. Seven StateViews (**ColoradoView**, **IowaView, KentuckyView, MichiganView, NebraskaView, TexasView, VermontView**) employed both graduate and undergraduate students to work on nine of their high impact activities.
  - ColoradoView hired five students as part of their active internship program.
  - To advance a historical digital archive, IowaView hired a student to use the MS Image composite editor and ArcGIS to mosaic and georeference digital scans of FSA slides for sections of Iowa land from the 80s to early 2000s.
  - IowaView also employed a youth to help with the Earth as Art Exhibit that LouisianaView loaned.
  - The KentuckyView student learned to download Landsat-8 data, use and process them. He also learned how to use different image processing techniques and data import/reformatting.
  - MichiganView hired an intern during the summer of 2017 to help update the MichiganView website, update the NAIP and MODIS Clear Sky archive data and to download interfaces.
  - The NebraskaView student explored lidar software, analysis techniques and data sources in preparation for an introductory users' guide and a lab exercise for an introductory remote sensing class.
  - Two VermontView students were hired to carry out UAS flight operations and process UAS data into geospatial products.
  - Vermont View also employed an additional four students as part of its Unmanned Aircraft Systems Team.
  - *Watching over Texas* developed teacher resources for Earth Science teachers to use in bringing satellite imagery into their classrooms. Student is learning how to develop outreach and training materials for Earth Science education.

- During the fourth period in December 2017, still GY16, five StateViews (**GeorgiaView, OklahomaView, PennsylvaniaView, VermontView, VirginiaView**), following the new guidance for reporting, identified the *Mapping with MapGive*, *Global Geo-Referenced Field Photo Library*, *HAZUS and SW Pennsylvania*, *Humanitarian Mapping to End Malaria*, *Drone data capture*, and *Virginia's New River Valley Master Naturalist Program* projects as their citizen science efforts. All involve students.

- Presentations at state, regional and national conferences, summarized under Objective 2, and articles published in peer-reviewed journals mentioned above and included in the bibliography appendix, 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 the grant sponsor, received public acknowledgement from the larger and more diverse national geospatial community attending conferences or reading journals, with recognition for the critically important task of developing the future US work force.

A Metric Perspective and Summary of AV's Undergraduate and Graduate Research

StateViews engaged in activities that aligned research efforts with educational opportunities to motivate or excite remote sensing and GIS interest among university students. Examples included in the report only sample the mentoring events or guidance sessions, encouraging student-involved academic research.

Many StateViews, within their annual RCA submissions identified ways to stimulate student interest in remote sensing and GIS research and they have reported each grant period on the outcome of their proposed programs. Reviewing the metrics within the Avportal database indicates that often a StateView has identified a best practice for itself and continues that effort each grant period thereafter, if it had been deemed successful. The actual activity details, however, often change period by period. In addition, since StateViews sometimes choose different types and codes for similar activities, the metric is less significant than the actual descriptions of work, several of which are provided later.

AmericaView has provided many opportunities for students to improve skills in areas of remote sensing applications and geospatial data use. **UtahView** described one special example of its program designed to work with students, offering undergraduate and graduate research opportunities. From time to time, there are students who enter these research opportunities under special circumstances or come from unique backgrounds. Encouraging their eagerness to learn benefits this remote sensing community as this story illustrates.

Thomas Thompson is one such student, and this report is presented with his knowledge and permission. As a high-risk student who served time at the Utah State Prison, Tom started an undergraduate degree after completing his sentence. After taking a remote sensing and GIS course, Tom applied for, and was granted, a technician position working the USU Remote Sensing/GIS Laboratory. The position allowed Tom to use remote sensing skills to evaluate imagery and apply his keen eye and knowledge of the natural world in a productive and constructive manner. Tom excelled and became the lead geospatial technician, managing 15 undergraduate employees. Tom worked closely with UtahView PI, Doug Ramsey and UtahView State Coordinator, Chris McGinty. Tom applied for two UtahView mini student grants which allowed him to work closely with a USU professor interested in mapping the changes in *Pando*, a grove of quaking aspen trees, and one of the world's oldest and largest living organisms.

Mr. Thomas Thompson, UtahView, demonstrating UASs and remote sensing tools to 3rd grade students at the 2016 *Maps on the Hill* event in Salt Lake City, Utah.

On the heels of this work, Tom applied for and was accepted into graduate school in geography at Utah State University. He specifically became interested in the use of UASs and thermal imagery for the purpose of wildlife management. He developed programs and presentations through UtahView funding that he then shared with hundreds of K-12 students. He also conducted remote sensing and UAS workshops for land managers and owners in Utah. Tom has since completed his graduate program and is now employed by the State of Utah as a geospatial and remote sensing specialist.

Tom is one of many students who have had the opportunity to work with an AmericaView StateView program. His story illuminates his personal success and the successes of the UtahView and AmericaView programs.

This summary report over the periods of the grant identifies the range of some of the activities involving StateViews and their university students.

- Awarding scholarships to students to promote remote sensing research, including students in under-represented groups (women, ethnic minorities and first generation college students)
  - GY13 (4 activities by IA, MS, ND, WY)
  - GY14 (4 activities by IA, MS, ND, WY)
  - GY15 (4 activities by IA, MS, ND, WY)
  - GY16 (6 activities by IA, MS, NC, ND, RI, WY)
- 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
  - GY13 (2 activities by AL, WV)
  - GY14 (2 activities by AL, WV)
  - GY15 (2 activities by AL, WV)
  - GY16 (2 activities by AL, WV)
- Supporting student publications or presentations in university forums. These publications assisted in advancing the science of remote sensing analysis, applications, and the usage of public and emerging remote sensing imagery
  - GY13 (3 activities by MS, UT, WY)
  - GY14 (3 activities by MS, UT, WY)
  - GY15 (2 activities by MS, WY)
  - GY16 (2 activities by MD, WY)
- Encouraging research competitions for funding mini-grants within a StateView consortium
  - GY13 (2 activities by IN, OH)
  - GY14 (1 activity by IN)
  - GY15 (1 activity by IN)
  - GY16 (1 activity by IN)
- Serving on MS/PhD committees and 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
  - GY13 (3 activities by AL, AR, LA)
  - GY14 (4 activities by AL, AR, LA, NY)
  - GY15 (5 activities by AL, AR, LA, MS, NY)
  - GY16 (4 activities by AL, AR, LA, NY)
- Promoting the value of the consortium to attract research dollars which can be effectively leveraged by the StateViews
  - GY13 (3 activities by ID, NH, WV)
  - GY14 (2 activities by ID, WV)

    In this second grant period, two successful grant proposals were submitted to USDA and US Department of Energy. These proposals drew upon **West Virginia View**'s success with synergistic activity, and emphasized the WVView.org portal as a focus of outreach activities.
  - GY15 (2 activities by ID, WV)
  - GY16 (2 activities by ID, WV)

    IdahoView was part of a selected proposal for *USDA Specialty Crop Grant* Implementing Unmanned Aircraft Systems to detect crop viruses using hyperspectral remote sensing and machine learning. Award Period: Oct 2017 to Sept 2019. (PI: Delparte) They were also successful with *NASA – Idaho Space Grant Consortium* Undergrad STEM Engagement Grant.

It's a Bird, It's a Plane! Unmanned Aircraft Systems as Agents of Innovation in Undergraduate Geoscience Education. Award Period: Sept 2017 to Sept 2018. (Delparte, Co-I)

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, or STEAM if Art is added as it has been in a growing number of StateViews, state and national Earth science goals. Many invested in efforts to include traditionally underrepresented schools and groups in those fields and cultivated the interest and talents of the next generation of remote sensing scientists and decision makers. Properly trained and prepared, they will protect our national interests into the future. With AV's broad and deep remote sensing expertise, its PIs, Co-Investigators (Co-I), and members offer motivated students the opportunity for excellent training and thorough preparation. Prospects for related careers in the remote sensing disciplines for university students has been enhanced by identifying internship opportunities with private business and government agencies, as they are identified. Announcements are distributed to AV members for their use within the state universities of their consortium. Some StateViews, like OhioView work closely with agencies, companies, and job development organizations to find these intern openings. Another commended initiative has been that of New MexicoView by offering a Spanish translator for several of our web-posted STEM lesson modules. UtahView has asked a Spanish-speaking professor, with strong remote sensing credential, to join AV Member Meetings when AmeriGEOSS representatives join for one of the technical sessions.

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

In the NLRSEORA proposal for GY13, Objective 4 was split into three sub-objectives. This section of this 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)
2. Support K-12 (and 13+) through the AVRSCP
3. Support college education using online materials or curriculum as with the AV University
4. Serve the current workforce (including those planning for career transitions)

4.a.1. AV National Work Plan– Future Workforce (precollege) and Earth Observation Day

The AV Education Committee will focus on the following activities:
GY13-16: AV will work with the SATELLITES and GLOBE programs over the next five years to identify joint curriculum development and train-the-trainer opportunities with/for StateViews and partners.

- The SATELLITES (Students And Teachers Exploring Local Landscapes to Interpret the Earth from Space) program was started at the University of Toledo in 1999 and expanded to include multiple scientists and **OhioView** members. During the second period of this grant, twenty-two teachers attended the SATELLITES Summer Institute at the Lake Erie Center in Toledo, OH, on April 14, 2015. Kevin Czajkowski, member of the OhioView consortium, led teachers and students in experiential and inquiry-based learning. Teachers learned how to take water quality observations using GLOBE (http://www.globe.gov) protocols. Later in the classroom, teachers worked with their students to monitor water quality so that they could understand how their local data relates to values throughout the watershed. This program has made a major contribution to science education at a large number of middle and high schools across Ohio reaching hundreds of K-12 students. OHView members encouraged their undergraduate and graduate students to enter their research projects into the university-level competition. 20 K-12 teachers were trained at the summer 2015 SATELLITES institute, which resulted in approximately 1200 K-12 students trained in turn during the following school year. The SATELLITES conference was held on May 6, 2016, during this grant's third period, at the Penta Career Center in Perrysburg, Ohio, where students whose teachers attended the summer workshop presented their research. In addition, two students presented their research during a poster session at the 125th annual meeting of the Ohio Academy of Sciences at Ohio University in Athens, OH, while three students had their research abstracts published in the Ohio Journal of Science.

- **Since the second grant period, New MexicoView** has been working with the Adopt-a-Pixel (AaP) program to implement AaP with NM high schools and middle schools and provide additional testing of the AaP protocols. This NMView activity provided remote sensing education to secondary students in a predominantly Hispanic school and provided the "Adopt a pixel" program some AmericaView feedback on ways to incorporate this program into more AV states. Delivered products at the end of the second grant period were a teacher tutorial posted on AV's online Education Resource Portal and a classroom lesson with evaluations completed by participants or teachers, and feedback provided to the "Adopt-a-Pixel" program. In GY15, the web version became available at https://adoptapixel.cr.usgs.gov/. The pilot work with the application highlighted the need for the smart phone version. In GY16, NMView expected to modify the draft curriculum when the smart phone version was ready. However, that version, as the outcome of a NASA grant to GLOBE, was delayed. A January 2018 debut was anticipated but no announcement as been released at the time this report was written. The Adopt-a-Pixel collection continues to grow with the volunteered help from citizen scientists, who can share their land cover photographs and participate in the program by visiting the EROS Center's interface. (adoptapixel.cr.usgs.gov) EarthExplorer can be used to search, preview, and download that data under the Land Cover category.

GY15: 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

- This part of the original work plan illustrates how a program often matures beyond the originally determined milestones. Earth Observation Day at the end of the grant is now an established day within the AGI-sponsored

Earth Science Week (ESW) celebrated annually in October. Appendix C provides a tour through this AV activity that was initiated during the prior grant. Originally a spring event, Tom Mueller, **PennsylvaniaView** PI, contacted AGI to discuss how AV might become a part of ESW, which would encourage more international participation. Local events certainly may be directed to scouting groups but have typically been part of StateView STEM outreach and involved pre-K through 16+ students as well as community members of the workforce.

- AV working with USGS and NASA designed posters for EOD events in GY15 and GY16. NASA agreed to print a very large quality of posters. USGS agreed to provide distribution from the EROS center. The large quantity included 16,000 copies sent to AGI to be included in the teachers' packets prepared for summer distribution to the nation's teachers.
- The posters have been used by StateViews for their EOD events that often occur at times other that EOD itself. USGS and NASA distribute them also from their exhibit booths at various national conferences.
- The Pecora 20 Symposium featured a local student program. Nearly every child left with the two EOD posters prepared by AV, USGS, and NASA, safely rolled in their backpacks.

- StateViews have been very attentive to approaches that can help instantiate the Next Generation Science Standards. Earth science is dependent on earth observation, which is facilitated by remote sensing. AV's website contains many tutorials and curriculum modules in the Education Resources Portal with metadata identifying the appropriate grade level targeted and suggests the appropriate Next Generation Science Standards that help teachers meet state education guidelines.

GY13-16 Metrics: AV will compile and report the number of teachers and students that engage in EOD activities. Summaries of teacher evaluations and testimonials will be transmitted to the USGS.

- Tom Mueller, **PennsylvaniaView** PI, has remained the EOD Project Coordinator throughout this grant. After each EOD event, he ensured that participating StateViews responded to a survey used to gather metric, assessment and testimonial information. The questionnaires used in the third and fourth periods were based on the guidelines from Chandana Mitra, **AlabamaView** Co-I, who assembled pedagogically sound questions with mini-grant funds. Tom Mueller's efforts with this program reflect the commitment he had given to remote sensing education and why he won the "Teacher of the Year Award" at California University of Pennsylvania.

4.a.2. AV National Work Plan– K-12 – Online AV Resource Sharing Web Portal

In GY12, during the prior award, John McGee, **Virginia View** Co-I, established a beta web site for AV's Remote Sensing Curriculum Portal (AVRSCP). With a subsequent transition to the new website, serviced by Sam Batzli, **WisconsinView** PI, that portal was more appropriately renamed the Educational Resource Sharing Web Portal (ERSWP). (https://americaview.org/program-areas/education/resources/) Some of the previous tools for searching content required redesign within the Word Press environment in period 3. At that time, "Target Audience" and "Resource Type" were the primary filter windows of the portal with limited selections. In grant period 4, Sam Batzli added additional options to each filter to improve narrowing the search for materials suited to a particular audience or type.

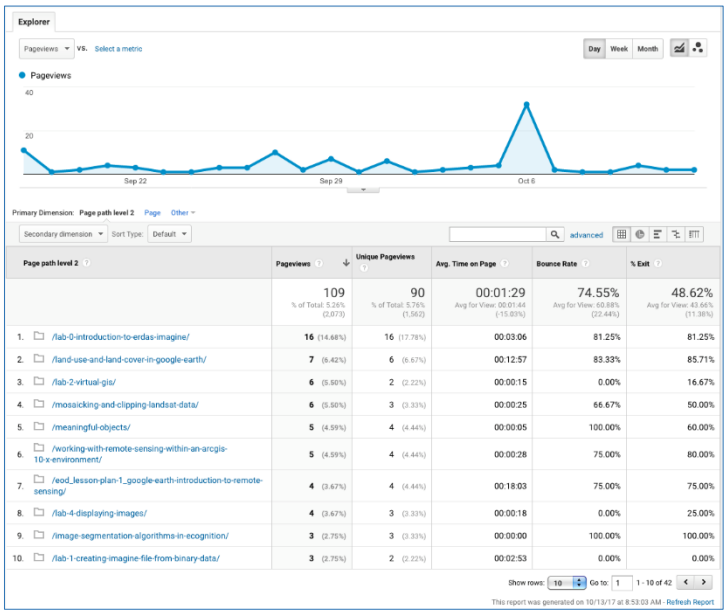
GY14-16: AVRSCP (ERSWP) *will be promoted through state educational systems, science teacher organizations, college-level educator's networks, and K-12 / higher education conference presentations. Members and partners will be actively*

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.

- The Educational Resource Sharing Web Portal has routinely been updated by the webmaster as new materials were provided to the Web Design Support team. In addition, members of the Education and Outreach Committees have been encouraged to make recommendations about ways to improve the utility of the portal, which are reviewed monthly.

Metrics: The number of educators utilizing AVRSCP (ERSWP) *will be compiled and reported. A summary of participant educator's feedback and ratings of educational resources will be compiled and transmitted to the USGS.*

- Each month at the AV Education Committee, graphical reports, like that below, were distributed by Larry Biehl, **IndianaView** PI. He ensured that attendees could track the use of the portal, including international users. A separate graphic identified global activity. Here the peak reflects increased activity around Earth Observation Day. However, no provision has been made to collect educator feedback, as initially in the work plan.



Page path level 2	Pageviews	Unique Pageviews	Avg. Time on Page	Bounce Rate	% Exit
	109	90	00:01:29	74.55%	48.62%
1. /lab-0-introduction-to-erdas-imagine/	16 (14.68%)	16 (17.78%)	00:03:06	81.25%	81.25%
2. /land-use-and-land-cover-in-google-earth/	7 (6.42%)	6 (6.67%)	00:12:57	83.33%	85.71%
3. /lab-2-virtual-gis/	6 (5.50%)	2 (2.22%)	00:00:15	0.00%	16.67%
4. /mosaicking-and-clipping-landsat-data/	6 (5.50%)	3 (3.33%)	00:00:25	66.67%	50.00%
5. /meaningful-objects/	5 (4.59%)	4 (4.44%)	00:00:05	100.00%	60.00%
6. /working-with-remote-sensing-within-an-arcgis-10-x-environment/	5 (4.59%)	4 (4.44%)	00:00:28	75.00%	80.00%
7. /eod_lesson-plan-1_google-earth-introduction-to-remote-sensing/	4 (3.67%)	4 (4.44%)	00:18:03	75.00%	75.00%
8. /lab-4-displaying-images/	4 (3.67%)	3 (3.33%)	00:00:18	0.00%	25.00%
9. /image-segmentation-algorithms-in-ecognition/	3 (2.75%)	3 (3.33%)	00:00:00	100.00%	100.00%
10. /lab-1-creating-imagine-file-from-binary-data/	3 (2.75%)	2 (2.22%)	00:02:53	0.00%	0.00%

4.a.3. AV National Work Plan – College Level – Improving Online Remote Sensing Education through AV University

AmericaView University was developed in November of 2008 by funding from the CaliforniaView sub-grant for that period to GeorgiaView and launched in 2009 after initial development by Jeong (JC) Seong and Rebecca Dodge. (This was a collaborative effort within AmericaView.) Materials have been added over the years. In GY16, VAView contributed its recently developed online lessons for ArcGIS, and other AV instructors contributed materials. Users have included many instructors who downloaded coursework materials to improve the content of their remote sensing courses.

GY14-16: 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.

- During the spring in 2016, Jeong (JC) Seong revised the Introduction to Remote Sensing Course in the http://www.avuniv.org website. The Moodle content management system was upgraded from Version 1.8 to

Version 3.6 and course materials were revised. In addition, the course structure was re-organized based on the recommendations by the Quality Matters (http://ww.qm.org) online course guidelines.

Metrics: The number of educators/students accessing and utilizing AV University curriculum will be compiled and reported.

- Jeong (JC) Seong has been monitoring the use logs since March 2016 when a revision to the site occurred. He maintains those logs for each segment of the curriculum to monitor the use of AV University.

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

GY13-16: 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.

- **CaliforniaView** described its program goals and activities with a focus on the Landsat mission to staffers of California's elected Representatives, in GY14. Follow up emails resulted in the first steps of a collaborative effort focusing on geospatial education for veterans and underrepresented high school youth.

- **OklahomaView** awarded a fellowship in the second period of the grant to a disabled veteran in their selection of participants for their online fellowship program. The curriculum introduced STEM students to remote sensing and GIS instruction, providing support to eight eligible universities in Oklahoma that lack remote sensing classes.
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- During GY15, AV signed a Memorandum of Understanding with the National Geospatial Technology Center of Excellence ("GeoTech Center") agreeing "to work together on a best efforts basis for the purpose of seeking opportunities of cooperation that will support the above stated objectives of both organizations and the geospatial and remote sensing communities as a whole." Among the common interests is the training of veterans, preparing them for a workplace eager to hire those with geospatial skills. AV provided presentations and participated in GeoTech's annual June GeoEd meeting.

- As part of its fourth period program, **Rhode IslandView** successfully designed and completed a unique new undergraduate summer research opportunity to collect and utilize remote sensing data. Offered in partnership with the University of Rhode Island Coastal Fellows Program, Rhode IslandView hired a minority veteran undergraduate student who a) learned how to effectively collect remote sensing data using a small-unmanned aerial system (sUAS), and b) process the raw remote sensing data into usable products using Pix4Dmapper and Esri ArcGIS Full Motion Video software.

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' academic roles. All funded StateViews supported formal education activities of various types, including K-12, higher education, or professional development. 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, transitioning, and future workforce, including:

- 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 periods 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 and Iowa

A Metric Perspective and Summaries of StateViews' Education and Training

StateViews engaged in ninety-one activities, as recorded in the Avportal under the bulleted titles below. These were completed to improve STEM education and geospatial technologies training in K-12 schools. Some of those are described below. Descriptions below provide some examples of the activities completed by StateViews over the course of the full grant.

- Preparing and delivering guest lectures or demonstrations to highlight remote sensing applications for teaching activities such as Earth Observation Day (EOD) (20 activities by CA (2), CT (2), GA (3), ID (4), NM (3), UT (2), WY (4))
    - **CaliforniaView's** Earth Observation Day (EOD) activities were celebrated during a lunch seminar hosted for faculty and students within the John Muir Institute of the Environment. The 2016 and 2017 Earth Sciences Week AmericaView EOD remote sensing game posters were showcased at this event engaging participants in discussions on local as well as national environmental topics. Fifty-two posters were given to two UC Davis elementary school 4th Grade science teachers. As a result of this activity, CalView was asked to visit these two classrooms in spring 2018, teaching elementary students about environmental changes.
    - **ConnecticutView** provided a presentation titled "An Introduction to Remote Sensing: With Applications to Latin America", on three separate occasions (Nov 19, 2015, Feb 28, 2016 and May 26, 2016) for a sixth grade class at Hall Memorial School in Willington, CT. The presentation was created specifically to provide a basic overview of the remote sensing process and images of the Latin America region that helped reinforce the geographical concepts and terminology the students are learning.

- Jeong (JC) Seong, **GeorgiaView,** hosted the 2016 EOD event at University of West Georgia (UWG) on November 16, 2016. JC brought six undergraduate students to help display twenty-five large image posters and promoted remote sensing with an image matching game and drone flying demonstrations. About 150 undergraduate students visited the display area, and more than 30 comments were collected.
- During spring of 2015**, IdahoView**, for EOD, taught "Echo the Bat", a lesson from the NASA website, to a group of thirteen K-12 students. IdahoView also delivered a series of small lectures to 267 K-12 students. The lectures focused on the use and utility of remote sensing for natural resource management.
- **New MexicoView's** activity for EOD in the second period of the grant provided remote sensing education to secondary students in a predominantly Hispanic school, using the "Adopt a pixel" program, which would be repeated the following years as the program matured.
- **UtahView participated** in several educational and public outreach events during GY16 for the purpose of fostering geospatial knowledge and skills. These events involved a variety of audiences and focused on a number of topics, such as UAS, GIS, remote sensing, online mapping, global positioning systems (GPS), and natural resource planning and management. Eleven events were described in their annual report.
- **WyomingView's** PI has been working with several K-8 teachers in Laramie for the past several years to identify potential remote sensing topics and applications that are suitable for presenting in their classrooms. His goal is to introduce only materials that are related to what the students are learning in their classes, rather than using the same set of images. Landsat, MODIS, and declassified satellite images were used in these demonstrations.

- Developing education workshops (15 activities by CA (1), HI (4), KY (1), MD(1), OH (1), OR(1), NE (1), RI (1), SD (2), VA (2))
  - **CaliforniaView** presented at the National Science Teacher Association conference in December 2014 in Long Beach, CA. Twenty teachers attended the workshop on the introduction to geographical information systems and remote sensing education for high school students. Presentation materials included Earth Observation lesson plans as well as activities for teachers to incorporation remote sensing science into the Next Generation Science Standards
  - **Hawai'iView** supported nine workshops, including seven held in public school classrooms. 401 K-12 children (including students in grades nine and ten enrolled in the Upward Bound Program), 15 teachers, and 22 parents were introduced to the science of Landsat. The Hawai'iView Science Kits were featured.
  - **KentuckyView** conducted workshops for pre-service teachers and undergraduate students during GY16. Existing teaching material and software, such as Multispec, ArcGIS and ArcGIS Online, and AV games and online material was used and a drone exercise was developed for undergraduate students.
  - **MarylandView** collaborated with the GIS and Environmental Informatics Special Interest Group of the School of Emerging Technologies at Towson University to host Visualize Baltimore—a workshop geared toward introducing students and faculty from Towson and nearby institutions to geospatial technologies. Twenty-two students and faculty attended the event.
  - **OhioView** with a mini-grant awarded to Anita Simic, entitled "SPatial LITeracy (SPLIT) Remote Sensing: An integrated research-educational approach to support surface water quality monitoring" conducted a workshop on 30 November 2017. This workshop was held for the students of Huron High School as well as other local high school teachers to introduce them into the field of remote sensing and other aspects of spatial literacy.
  - **OregonVIew** provided two middle school remote sensing workshops in CY2016 in which students learned about thermal remote sensing, Earth-observing satellites, and unmanned aircraft. In 2017, OregonView

extended this work to training of K-12 teachers, participating in multiple education events. On March 21, 2017, Chris Parrish gave an online webinar entitled “Drones in Education: Research Perspective,” as part of a workshop series co-organized by Oregon State University (OSU) and the Oregon Department of Education. The information from this workshop was then passed on at an Oregon Science Teacher Association meeting. OregonView is currently engaged in discussions with this group about ongoing and planned remote sensing K-12 education events over the next year.

- **NebraskaView** presented a half-day workshop in June 2014 to Nebraska high-school students participating in the University of Nebraska's Big Red Camp, Natural Resources. (Big Red Summer Academic Camps are residential, career exploration camps held at the University of Nebraska-Lincoln under the Nebraska 4-H educational programs. Camp sessions vary year by year.) The workshop presented introductory materials on GIS, GPS and Remote Sensing and utilized several AmericaView Education Portal Resources as templates for the accompanying hands-on student activities.
- Attended by approximately 35 participants, **Rhode IslandView** conducted a half-day workshop focused on image data resources available via ArcGIS Online.
- **South DakotaView** has conducted workshops in both the third and fourth periods of this grant. In 2016, the South Dakota Technology and Innovation in Education (TIE) organization partnered with SDView to offer a workshop about the utilization of remote sensing and other geospatial data and technologies in South Dakota K-12 classrooms. As a result of this collaborative effort with TIE, responsibility for the statewide Esri K-12 software license was transferred to TIE, and subsequent GIS teacher workshops were conducted in November 2016 in Sioux Falls, SD, and Rapid City, SD. The StateView collaborative workshop, "Storytelling with Maps", in November 2017 is described in Part IV of this report.
- **VirginiaView**, during 2014, provided geospatial education to 55 individuals through three separate workshops. Their participants included pre-college educators, local, state, and federal government employees, higher education faculty, other nonprofits, and the private sector.

- Organizing activities targeting 4-H, Boy/Girl Scouts, related youth organizations (4 activities by SD (4))
  - The 24th annual Big Sioux Water Festival (an annual student science standards supporting event) was supported by **South DakotaView**, each of the calendar years during the four periods of the grant. First held in 1993, this event is attended by an average of 1000 4th-graders each year
    - May 13, 2014, on the campus of South Dakota State University with more than 1200 4th graders, teachers and chaperones in attendance from throughout northeastern South Dakota.
    - For the 2015 and 2016 events, SDView prepared an activity entitled "South Dakota Lakes - A Look from Above." This activity used ArcGIS Online to familiarize students with the location of selected lakes in eastern South Dakota using remotely sensed imagery as a background for the map. 1,151 fourth-grade students, 167 parents, and teachers from 30 area schools attended in 2016.
    - The 25th Annual Big Sioux Water Festival was held May 9, 2107. Again the exhibit was entitled "South Dakota Lakes: A Look from Above" but several other layers of information for the state such as roads, railroads, cities, and rivers were also included in the ArcGIS Online map display.

- Supporting state educational standards (8 activities by CT(1) TX (4), UT (2), VA (1))
  - **ConnecticutView** personnel reviewed available documentation regarding the Next Generation Science Standards (NGSS) and Social Studies Frameworks. Two lessons are being developed under a mini-grant and described in Part IV of this report.

- **TexasView** continues to develop its outreach program for K-12 Educators in Texas by creating additional activities in the new series of tutorial materials for high school and middle school teachers called: Watching over Texas from Space. The project builds on work completed over the last several years aimed at providing resources for the "Texas High School Earth and Space Science and Environmental Systems" program teachers as well as middle school Earth science teachers that focus on integrating remote sensing with the Texas Essential Knowledge and Skills standards (TEKS.)
  - Work began on this effort in the first period of this grant. Rebecca Dodge completed correlating remote sensing educational material for Texas high school teachers with the Texas Essential Knowledge and Skills (TEKS) (http://www.texasview.org/default.aspx?id=203)
  - Texas Essential Knowledge and Skills (TEKS) standards for Earth and Space Science (ESS) explicitly require that high school students be able to *"describe and interpret Earth surface features using a variety of methods including satellite imagery"*, and to *"use a wide variety of additional course apparatuses, equipment, techniques, and procedures as appropriate such as satellite imagery and other remote sensing data."* Watching over Texas from Space (WOTFS) activities "Which is Which" and "How is Texas Changing" focus on these TEKS standards, as well as other ESS standards related to: change over a range of time scales; interactions among Earth's subsystems; the roles of erosion and deposition in reshaping Earth's surface; changes caused by natural disasters; effects of resource usage on Earth's subsystems; and, the dynamics of surface water movement.
  - Two modules of the project "Find It" and "Measure It" were used in two teacher-training workshops during GY15 at the Regional Education Service Center in Fort Worth, Texas. One of these workshops was offered in conjunction with the annual ASPRS Conference in Fort Worth.
  - Watching over Texas from Space is intended to be a low-threshold mechanism to expose students to satellite imagery applications without requiring computers and software that are not always accessible. During the last period of this grant, Rebecca Dodge updated four standards-based tutorials and prepared a new standards-based tutorial: "You Figure it out: Galveston Island State Park."
- **UtahView** continued to work on developing geospatial material that fits within the needs of Utah K-12 curriculum. While previous K-12 efforts had focused on partnerships with institutions, such as the Edith Bowen Teaching Laboratory at Utah State University and Stokes Nature Center, efforts during GY16 focused on working with middle school and high school students
- **VirginiaView** placed Virginia Atlas materials online, which effectively supported K-12 education and assisted teachers in addressing Virginia's Science Standards of Learning. In GY14, they delivered the atlas materials as ArcGIS Online documents, which will greatly improve effectiveness of delivery, especially to classrooms, and to the general K-12 environment.

- Sponsoring programs for high-school students during summer (2 activities by AL, ID)
  - **AlabamaView**'s Summer Science Institute (SSI) at Auburn University was held in early summer science program for rising 11^{th} - 12^{th} grade students with a high aptitude and interest in the fields of science and math. The program partners students with experienced AU Science and Math research faculty to explore topics more advanced than what is typically taught in a public or private high school environment.
  - In the second period of the grant **IdahoView** developed and pilot tested a lesson plan designed to engage high school and middle school students in the ecological applications of remote sensing. Students set insect pitfall traps around vegetation features with different dimensions and counted the number of total insects as well as the number of insect species they captured. The students took digital photos of the different vegetation features in which the insects were trapped and converted the data to 3-D point clouds using structure-from-

motion (SfM) software in order to get metrics of habitat structure and complexity. The students compared the habitat structure data to the insect species abundance and diversity data to find patterns. The lesson plan was pilot tested during the summer and fall of 2015 and published in 2016.

- 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 (11 activities by AL (4), KY(1), MT(1), OH (3), TX (2))
  - A**labamaView** prepared modules on urban heat island (UHI) intensity and impacts using Landsat images and trained AMSTI (Alabama Math, Science, and Technology Initiative) teachers to teach students the benefits of remotely sensed imagery and its various uses. Work carried forward from the first period into the second with a published teacher tutorial, a completed training workshop, a classroom lesson with participating teachers' evaluations, and a peer-reviewed journal article.
  - **KentuckyView** offered classes or workshops for in service and pre-service teachers. In grant period three, a five-day workshop was offered at Murray State University, using the Department of Geosciences and Mid-America Remote Sensing Center's facilities. Eleven pre-service students attended the workshop. A GIS class, GIS and Remote Sensing for teachers, was offered in the spring and the fall semesters.
  - **MontanaView** participated in the Watershed-to-Wetland Institute on the Flathead Indian Reservation, organized by CNL World through an EPA Education Grant, and held from 19-21 June 2017. The MontanaView PI participated by providing relevant Landsat imagery and leading remote sensing sessions for the Institute. The Institute was offered for grades 5-12 tribal educators. Six teachers participated in the Institute, and it is estimated that these teachers will interact with a minimum of 20 students each year.
  - **OhioView** has been offering summer institutes for K-12 teachers since 1999 followed by the spring conferences for students to present projects, completed under the oversight of the trained teachers. The OhioView-supported SATELLITES workshop in summer 2013 led to the successful spring 2014 conference with 47 projects from 5th grade students. The cycle repeats each year and in the next two grant periods another 22 and 20 teachers attended the institute. For every teacher trained, it is estimated that 60 students are reached.
  - In GY14, **TexasView** expanded its teacher-training partnership with Texas Regional Educational Service Centers (ESC) beyond Region 9 (which serves 12 counties) to include Region 10 (the State's second largest ESC, serving 10 counties including Dallas County). Since then Rebecca Dodge only continued to expand her teacher training commitments. During GY15, she was also able to engage with additional ESCs, to arrange offerings of the Earth's Landscape Features workshop. Workshops were scheduled for delivery at the Region 17 ESC in Lubbock, Texas and at the Region 13 ESC in Austin, Texas. Teacher training workshops (*Earth's Landscape Features: Identification and Change Analysis*) were held, and surveys administered in October 2016 in two new ESCs: the Regional Educational Resources Center 17 in Lubbock, Texas (14 teachers) and the Regional Educational Resources Center 13 in Austin, Texas (20 teachers). A third training workshop was held in June 2017 at the Regional Education Center 9 in Wichita Falls, TX with 21 teachers attending.

- Developing lesson plans for remote sensing classes or modules or to incorporate remote sensing in other disciplines (Geography, Botany etc.) (22 activities by CA (4), GA (1), ID (2), IN (1), KS (1), MI (4), NM (1), PA (4), SD (1), UT (1), VA (1), WV (1)) Some activities from each grant period are described.
  - **IndianaView,** in the first grant period, partnered with the Geography Educators' Network of Indiana (GENI) to develop 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.

- One of the key objectives for **KansasView** for this four period grant has been to provide remote sensing training for Native American students at a local Native American University. The creation of lesson materials based on tribal areas was planned to provide specific training materials that will be familiar to Native American students. The goal, pursued through all the grant periods, was to create multi-source datasets for up to 10 tribal areas in the Great Plains region. To date, KSView has assembled datasets for the reservations of the four Native American Tribes with reservations in Kansas: the Kickapoo Tribe in Kansas, the Prairie Band Potawatomi Nation, the Iowa Tribe of Kansas and Nebraska, and the Sac and Fox Nation of Missouri in Kansas. Partners include the University of Kansas, Department of Geography Atmospheric Science, the Environmental Studies Program and the Geography program of a local Native American University.
- **MichiganView** connected with the directors of MI-Star, an initiative that is seeking to transform Michigan's K-12 science education programs into a new integrated science curriculum 6-8 that is aligned with state and national science standards and assessments in hopes of providing students with the skills and knowledge necessary to pursue careers in science and technology. MichiganView provided a short video to MI-Star curriculum developers. Approximately 100 students and 5 teachers participated in GY15 activities.
- **PennsylvaniaView**'s goal in the second period was to create a crisis-mapping lesson to be used in a World Regional Geography class. The PI assessed the class, attended by ninety-seven students as "slightly successful." The students did understand the connection of geolocation services and maps; however, they seemed to have trouble understanding some of the central issues of the Sudan crisis. An independent evaluation commented that while the students struggled with some of the geographic themes, it was clear that they learned a lot from the assignment. He noted, "Oftentimes, American students are not aware of issues occurring in Sub-Saharan Africa so it is wonderful that they had the opportunity to conduct this research using ArcGIS and Twitter."
- In the fourth period of the grant, **West VirginiaView** developed lesson plans for K-12 classes that draw on Landsat thermal data. The focus of the lessons was on physical properties that affect surface radiation, including heat capacity, thermal conductivity, albedo and emissivity. Students used infrared thermometers to measure radiant temperatures of different surfaces, and related the temperature differences to physical differences of the surfaces.

During this grant period, StateViews also completed several activities that strengthened general remote sensing university education:

- Sharing licenses for image processing software done by **North DakotaView** and **UtahView** throughout the grant. ERDAS and Esri licensing were the tools needed.
- Delivering guest lectures in other disciplines' classes to promote the utility of remote sensing were activities identified for all four grant periods by **MinnesotaView** and **New HampshireView** into their annual reports. **AlaskaView** and **IowaView** each reported on their similar guest lectures for two periods.

StateViews also supported activities that provided training programs, anticipating the future workforce, for students in universities and colleges:

- Funding stipends to encourage students to pursue a remote sensing component of their education (18 activities by CT (2), IN (3), MT (4), NE (1), SD (2), TX(2), WV(4))
  The seven StateViews over the four grant periods made over seventy-four awards directly to students to participate in activities that might encourage them to learn more about remote sensing and its value to their future career choices.

- To encourage the use of remote sensing technology and to provide additional learning experiences for students, **ConnecticutView** offers two scholarships through the University of Connecticut's Department of Natural Resources and the Environment (NRE), the home department of ConnecticutView. The Department works to provide opportunities to help students improve their learning and skillsets with the goal of "producing graduates who are competent in their fields and ready to become productive, valuable employees". The purpose of these project-based scholarships is to increase student's knowledge of and skills in remote sensing by undertaking a project of their choosing that uses remote sensing technology on a study area within Connecticut.
  - In GY13, grants were made to two students, both females. One grant was for conference-related travel, another for software for enhancing research.
  - In GY16, one student project was funded entitled: "Assessment with Landsat 8 Data of the Urban Heat Island Effects in Connecticut"
- **IndianaView** provides opportunities for undergraduate or graduate students to conduct remote sensing projects that are relevant to the state and/or their community. Four to six projects each grant period were awarded in the $1000 to $1500 range. The use of the Landsat data was encouraged for the project but other remote sensing data of all scales were also used as best fits the project to be conducted.
  - In the second grant period, students from Indiana University (2), Indiana State University (2), and Indiana University - Purdue University Indianapolis (1) participated in the program along with two students from Purdue University. Examples of activities that the students completed include:
    - a summer project titled "Improving Global Models of Remotely Sensed Aquatic Chlorophyll Content",
    - research on developing soil property and landscape feature maps from crop production fields, and
    - attendance at geospatial conferences such as Kentucky's GIS Conference and the Association of American Geographers Annual Meeting.
  - In GY15, students from Ball State University (1), Indiana University (1), Indiana University - South Bend (1), and Indiana State University (1) participated in the program along with two students from Purdue University. Examples of activities that the students conducted include:
    - Google street view as a remote sensing tool for urban street tree data collection and benefits analysis,
    - high-resolution carbon modeling and monitoring using remote sensing technologies in Indiana State Forests,
    - calibration of phenomobile lidar System,
    - locally and globally applied classification algorithms for urban land cover detection using Google Earth Engine, and
    - Estimating surface moisture in urban areas; and use of drones for documenting urban green spaces.
  - An additional group of scholarships was for students representing four of the educational institutions in the **IndianaView** consortium. This GY16 activity provided the selected students with a remote sensing application experience that they might not have been able to have otherwise. In GY15, students from Ball State University (1), Indiana University (1), and Indiana University - South Bend (1) and Indiana State University (1) participated in the scholarship program along with two students from Purdue University. Examples of activities that the students conducted include:
    - do laboratory experiments to simulate Rossby waves and study formation of anticyclonic eddies,
    - study the economic impact of a tornado event using remote sensing,
    - create a geo database of local resources that case managers at Catholic Charities and refugees can use in Indianapolis,
    - study the spatiotemporal dynamics of impervious surfaces in Marion County, IN,

- develop a model to predict the maps of nest sites for the White Throated Sparrow, and
- Participate in a ground penetrating radar (GPR) workshop to learn about how GPR can be used in geospatial analyses.

- Through a survey and consortium discussions, **MontanaView** has identified the lack of practical, hands-on experience for recent graduates entering the Montana geospatial workforce as one of the highest priorities for Montana remote sensing.
  - In GY13, eight students completed service-learning projects and were given awards (four at Montana State University, two at University of Montana, one at Montana Tech, and one at Salish Kootenai College). Projects in this first grant period 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.
  - In GY14, five student service-learning projects were successfully completed during the reporting period. Their projects were entitled:
    - "A Study of the Effect of the Reintroduction of Bison to Grazing Unit Vegetative Heterogeneity on Fort Peck Reservation using NDVI",
    - "Willow Response to Beaver Reintroduction in the Absaroka-Beartooth Wilderness",
    - "Remote Sensing and Land Use Study of Flathead Lake",
    - "Estimating Detection Probability for Botrychium sp. in Lincoln County, MT", and
    - "An Analysis of Socioeconomic Influences on Health Care Seeking Behavior in Humla, Nepal".
  - In GY15, Montana State University, the University of Montana, Salish Kootenai College, and Montana Tech selected six undergraduate students for hands-on, practical training in remote sensing by conducting service-learning projects. Their work included:
    - Montana Research and Economic Development Initiative evaluating methods for optimal spectral band identification using the PIKA II hyperspectral sensor,
    - comparing the use of NAIP and Landsat OLI imagery for wetland mapping in the Gallatin Water Quality District,
    - assessing riparian vegetative health on the North Fork of the Flathead River using NAIP imagery,
    - evaluating socio-economic reorganization in response to climate change in Vietnam's Mekong Delta with the aid of historical Landsat imagery,
    - studying aeromagnetic exploration of the rare earth element (REE) deposit sites in New Mexico using high-resolution airborne gravity and magnetic and hyperspectral data, and
    - Working with the Flathead Lakers non-profit to evaluate channel migration of the Upper Flathead River with historical NAIP imagery.
  - In GY16, five students at three institutions successfully completed projects, as select students given hands-on, practical training in remote sensing by conducting service-learning projects. The topics were:
    - "Water Body Extraction: Algorithm Inter-Comparison and Optimization",
    - "Determining Application Efficiency of Irrigated Areas Using Various Methods",
    - "Net Ecosystem Carbon Budget Model Comparison for the Alaska North Slope",

- "The Potential Benefits and Actual Challenges of Using SNOTEL Data with Remotely Sensed Images",
- "The Greater Yellowstone Ecosystem, Whitebark Pine, and Canopy Cover".

- **NebraskaView** supported an incoming graduate student who developed a new lab exercise for an introductory remote sensing course and also produced an elementary guide on how to analyze lidar data. The lab exercise is now being used in an undergraduate/graduate level remote sensing course and the guide is being finalized for potential use in workshops. The student is now enrolled in a remote sensing PhD program.
- **South DakotaView** ensured that the announcement regarding the StateView-funded scholarships was made with all of the universities in the state, the tribal colleges, and the technical institutes. This contact was useful for creating awareness of the geospatial services and data available from SDView and AmericaView.
  - In the second period, GY14, two applications were received and both were funded. One submitted a project proposal entitled "The Integration of UAS (Unmanned Aircraft Systems) Data into Geographic Education." The other was awarded to a graduate student for the purchase of three tiles of GeoEye imagery in support of a project entitled "Mapping and Estimation of Water Storage Capacity of Small Water Bodies in the Limpopo River Basin (Southern Africa)."
  - SDView awarded funds to students at South Dakota State University (SDSU) during GY2016. The first award went to a graduate student in the SDSU Department of Geography, for support of a project entitled "Trends of Land Use and Land Cover Change in the Big Sioux River Watershed: 2007-2015." The second award was also given to an SDSU Geography Department graduate student, for a project involving the use of an Unmanned Aerial Vehicle (UAV) to acquire imagery of soybean fields, create orthomosaics of the fields, and calculate normalized difference vegetation indices (NDVI) to observe soybean health and phenology over the growing season.
- **TexasView**
  - Five projects were supported, in the third grant period, from four different consortium partner institutions. They were entitled:
    - "Sea ice freeboard and thickness study from IceBridge ATM and DMS data",
    - "Dallas Fort-Worth Metroplex: Thirty Years of Urban Core Expansion",
    - "LULC Change of I-35 Corridor in Central Texas",
    - "Biodiversity Response to Industrialization and Human Expansion as seen in Land Cover Change within the Western Ghats in the Hassan District", and
    - "Watching over Texas from Space".
  - TXView used both sub-grant and mini-grant funds in GY16 to support remote sensing research and learning and to encourage use of ArcGIS Storymaps. Ten Storymaps were the outcome and they are all posted to the AV website.
- **West VirginiaView** recognized the need of providing support to individual students in West Virginia because many students are the first generation in their family to attend higher education. This SV gave grants to students to enhance a remote sensing component in their education or research. The grants were available for conference travel, data purchase, or fieldwork support for graduate or undergraduate students. Based on previous experience with such student grants, student grants have a very large effect on student educational experience.
  - In GY13, grants were made to two students; both students were females. One grant was for conference-related travel, another for software for enhancing research.
  - In the second period, three grants were made to students to facilitate travel in order to present research at professional venues. Two grants were made to male students and one to a female student.

- In the third period, two graduate students received funds. One received travel funds to present research at the Association of American Geographers Conference. Another was provided with travel funds to attend the GEOINT conference in Florida.
- A graduate student was supported through travel funds to present research at the Association of American Geographers Conference in the fourth period of this grant.

In addition to the attention given to university students by the AmericaView professors in each StateView consortium, many of those professors also direct attention to the surrounding community with training programs directed to local, regional and state needs, as well as to its workforce.

- Developing training programs that address topical ideas tailored for specific state and discipline needs (15 activities by AR (4), IA (1) KS (2), KY (1), NH (4), VA (1), VT(1))
  - Three StateViews sustained specific programs over more than one period of the grant.
    - **ArkansasView** considered that the Department of Labor has identified *Geospatial Technologies* as one of the three fastest growing job areas over the next decade. Employers - especially county and local governments - in rural areas in Arkansas have found it difficult to recruit qualified employees and the lack of those employees is retarding economic development. During GY15, Jason Tullis
      - a) continued support for an undergraduate certificate and geospatial science and technology curriculum;
      - b) developed proposal materials for the University to offer a similar certificate to graduate students; and
      - c) funneled the vision of the certification training into a partnership with Communities Unlimited including the creation of a new geospatial internship.

      In the final period of this grant, ARView concentrated on correcting workforce preparation void. There was no University of Arkansas curriculum to introduce students to the safe and legal operation of sUAS, or to sUAS geodata collection and processing. In a short time, many students will take positions in the state government or private sector companies and will be prepared by the new coursework.
    - Tukuh Technologies of Kansas City, Missouri, a tribally owned business operates UAS vehicles for resource and land use mapping. **KansasView** invited Tukuh personnel to visit the campus of Haskell Indian Nations University to conduct educational demonstrations using UAS vehicles (drones) for collecting high-resolution aerial data. Personnel from Tukuh Technologies visited the campus of Haskell Indian Nations University on June 24, 2016. The group presented a demonstration to approximately 25 students and staff and then flew a demonstration route over part of the campus to collect sample data. After processing the data, Jeff Krecic, who is Tukuh's chief UAS pilot, forwarded the data to Haskell GIScience staff and faculty for use in the classroom and campus planning.
    - Because of a needs assessment of many of the **New HampshireView** partners, a GeoSpatial Support Center (GSC) was initiated on the University of New Hampshire campus. A pilot study was begun in the fall 2013 and continued through the spring 2014 with major support from the UNH Library, NHView, and other NHView partners. Given the pilot's success, the Center continues to be operated at the UNH DImond Library with financial support from the library and NHView. Other support comes from other NHView partners including the GRANIT GIS repository and Cooperative Extension. Two graduate students operate the Center throughout the academic year to provide geospatial consulting for UNH faculty, staff, and students as well as the surrounding community members who use the library. The Center meets the needs

of the traditional geospatial users but also introduces new users - including faculty from history, sociology, and economics – who have come for help on how to use these technologies in their classes

- Ease of collection, quality and utility assessment, and historic or current maintenance of land observations challenges many state departments. The following three activities indicate the unique level of support StateViews can provide.
  - Since 2015, a process has been developed and refined at the Iowa State University GIS Facility with collaboration from the Iowa Department of Natural Resources (IDNR)) to complete a baseline dataset (2007-2010), the *Iowa Conservation Practices Inventory*, which provides a meaningful record of commonly used in-field and off-field conservation practices for reducing soil erosion and nutrient loss. The GY16 grant to **IowaView** funded an ISU staff member for roughly three months to develop tutorial documents to enable states with appropriate input data to plan and implement their own conservation practices inventory.
  - As one of the HIAs for **VermontView**, in the fall of 2015, students, faculty, and staff researchers from Middlebury College and the University of Vermont conducted four flights over wetlands in Addison County Vermont to assess the utility of using Unmanned Aircraft Systems to acquire accurate and timely images to support wetland vegetation identification. Wetlands provide a host of important ecological functions, yet mapping them is challenging as overhead imagery is often acquired at the wrong time or is lacking in detail. The students found that both the spatial resolution of the imagery and the timing of the acquisition allowed them to detect wetland vegetation communities that were not easily identifiable in other types of imagery. Deliverables consisted of orthophoto mosaics and 3D point clouds. These were shared with the state's interested and collaborating agencies.
  - **VirginiaView** confronted a similar challenge in support of its state's Forestland Conservation Program. On May 10, 2017, a UAS demonstration was conducted on the 183-acre easement property known as the Conway River Timber Farm. The mission included a UAS flyover and photography of 100% of the property. This UAS mission presented two main challenges: (1) Topography limited the line of sight, and (2) The forested nature of most of the property complicated image processing. In addition to providing the processed information to the conservation program, VAView will prepare case studies and training programs to guide instruction and training to prepare students and practitioners in practical applications of UAS. These materials will be prepared as teaching/training resources to support educational and workforce development activities.

This latter account leads to the description of several other efforts to properly train the existing workforce. In addition to classroom or special event education and training, StateViews completed 10 activities in GY14 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 (23 activities by AR(1), KS(1), LA (4), NM (3), OH (2), TX(4), VT(2), VA(2), WY(4)
  - **ArkansasView**'s Bruce Gorham led a two-day short course in the second grant period entitled "Intermediate Object-based Image Analysis Workshop with eCognition" for invited government and NGO employees, academic research staff, faculty, and university students (both graduate and undergraduate). A focus of the workshop was examining the strategies for extracting valuable forest life cycle information.
  - **KansasView** PI Stephen Egbert taught a four-module introduction to remote sensing as part of the geographic information science portion of the Haskell Environmental Research (HERS) program in June 2014. 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 20 – 25 Native American student participants from tribes throughout the U.S. each summer. To promote and highlight remote sensing for environmental research among student representatives of Tribal Colleges and Universities was the KSView objective.

- **LouisianaView,** during each period of this grant, has co-sponsored a workshop for local and state government, private agencies and educators interested or working in emergency response. Each of those meetings has also had some correlated adjunct activity. The meeting, going back to 2002 is known as the *Louisiana Hurricane Season National and Local Geospatial/Imagery Data Availability, Data Mining Workshop,* only altered by adding the current year as the lead-in, distinguishing each year's program. This event is held each year prior to Hurricane Season on the Gulf Coast with presentations by Federal and State Agencies working in Emergency Response data archive, acquisition, and distribution. LAView PI, Brent Yantis emphasized in the fourth period report, "This workshop has proved for 16 years how a cohesive network of geospatial data responders can aid the inhabitants and economic base of the state of Louisiana as it responds to Natural Disasters and Emergency Events." The AmericaView funding has been critical for LAView's active leadership with the event.
  - The outreach workshop, in this grant's first period, was co-sponsored on June 5, 2014 with the USGS National Wetlands Research Center. Additionally that year, a special workshop was sponsored by LAView in conjunction with the National Ocean Service, National Geodetic Survey to present a hands-on workshop, which was attended by twenty-two invited guests, ranging from local land surveyors to wetlands research biologist, working on OPUS Project Managers Training.
  - The following year, the data-mining workshop was held June 4, 2015, was attended by 45 local and state government, private organization, and academic professionals interested or working in emergency response. This workshop has allowed for the establishment of strategic partnerships both at the state level and nationwide to develop and deploy remote sensing technology and applications through collaborations involving university research teams, Federal agencies, state and local governments, non-governmental organizations and commercial enterprises. At the 2015 workshop, consortium members along with state and federal participants were able to convene on the spot to address the activation of the International Charter in response to flooding along the Red River in Northern Louisiana. This may have been the first time International Charter representatives, federal clients and state and local government were in the same room at the activation and data response to an event.
  - LAView collaborated with Navigational Electronics Inc., the local Trimble representative, to create an emergency response course using GPS technology for representatives from professional organizations attending the annual event, which was held on June 9, 2016. This event was noteworthy since the training from the workshop lead immediately to the deployment of geospatial data response to the flooding in Louisiana and Texas, which had already, began the previous month. Representatives of the International Charter https://www.disasterscharter.org were on hand to respond to questions presented by geospatial first responders of the state agencies responding to the events and the coordination of imagery data acquisition and dissemination which aided with the disaster response.

- During the June 2017 workshop, a FEMA mock disaster was identified and workshop participants were able to work as a team in response to the disaster under FEMA and DHS representatives. LAView consortium members attending the Workshop included: Louisiana National Guard, Louisiana Governor's Office for Homeland Security and Emergency Preparedness, Corp of Engineers, Louisiana Governor's Office on Oil Spills, Louisiana Department of Transportation, Department of Environmental Quality, and federal agencies including USGS, NOAA, FEMA and USDA. This opportunity reinforced the value of meeting face-to-face with counterparts in state and federal response agencies and provided an irreplaceable mechanism for forming alliances and establishing needed contacts before disasters strike.

- **New MexicoView** has a relationship, unique among AV members, with The Wildlife Society (TWS). TWS is an international professional society focused on wildlife management and conservation. NMView continues to work with the New Mexico Chapter of TWS and the Southwest Section of the society in support of a wildlife conservation Geospatial Advisory Committee with members from University research teams, K-12 schools, Federal agencies, tribal, state and local governments, nongovernmental organizations, and commercial enterprises.
  - A workshop was held at the Joint Annual Meeting of the Arizona and New Mexico Chapters of TWS in February 2016 on "Incorporating Climate Change Data." Twenty people attended this workshop. Additional webinars, short courses, workshops, fact sheets, and white papers were planned to assist these managers in their conservation efforts.
  - During the fourth period of the grant, NMView assumed an ever more active role to organize, and participate in the Geospatial Advisory Committee. NMView provided a webinar on basic geospatial concepts and other requested topics. Conference calls were held in coordination with the President of the Southwest Section and the New Mexico Chapter members. The committee sponsored two symposiums at the 24th Annual Wildlife Society Meeting in Albuquerque, NM in September 2017. NMView provided a Mobile Apps symposium, which was well received. That success led to development of a similar symposium for the Texas Chapter of TWS's meeting in February 2018. Over 1,800 wildlife professionals and students registered for that annual meeting.
- **OhioView** for years has sponsored special workshops on a variety of remote sensing and GIS topics, prepared for all levels of lifetime learners. That pace has been sustained throughout this grant and two activities are described here but several others are peppered throughout this report.
  - In summer 2014, an OhioView Geospatial Technologies short course in a "Virtual World" setting was conducted. This short course met 6 times for 2 hours in duration at each course. This course consisted of both lecture and hands-on applications using the book written by Bradley Shellito (OhioView Member from Youngstown State University) Introduction to Geospatial Technologies. The course was attended by 1st and 2nd year undergraduates, as well as K-12 educators and members of the Air Force Research Labs. The AFRL members were particularly interested in this short course as a way to help evaluate the effectiveness of the "virtual world" application that had originated with them.
  - During the fourth grant period, an initiative was undertaken to develop and deliver a series of workshops introducing recent advances in Geospatial technology targeting select audiences in Ohio. Activities toward this objective at Ohio University focused on UAS technologies and fine resolution image analysis. To this end, detailed materials were collected and workshop notes and lecture materials were assembled to support classroom and web-based instruction. Information on flight-planning, software and data

assembly/mapping capabilities formed the bulk of the materials collected during this phase of the task. In addition to teaching materials software was acquired and customized to support hands-on application

- **TexasView,** like LouisianaView, conducts a workshop each year with the same focus for its participants. The TexasView *Fundamentals of Image Processing* workshop is offered each October during the Texas GIS forum and attracts a consistent number of GIS professionals eager to understand the most recent updates to standard data processing and analysis tools.
  - During GY13, personnel at the University of Texas Center for Space Research (CSR) completed revisions of the TexasView Fundamentals of Image Processing workshop to reflect software updates from ArcGIS 10 to ArcGIS 10.2 and ERDAS Imagine 2011 to ERDAS Imagine 2014. All exercises were tested and instructions revised. Six of the nine lessons for the one-day workshop were revised and all workbook lessons were reformatted to a more modern font and updated for consistency. Web links were tested and updated where needed. The TexasView Fundamentals of Image Processing workshop is offered each October during the Texas GIS forum. On October 21, 2014, twelve GIS professionals were introduced to Image Processing including two from state government, six from local government, two educators and two from the private sector. The workshop was conducted by Teresa Howard with the University of Texas Center for Space Research and Gayla Mullins from the Texas Natural Resources Information System (TNRIS), a Texas state agency.
  - Rather than sending attendees home with only printed materials and their notes, at the 2015 event, for the first time, data, exercises, and class presentations were distributed to students on portable USB flash drives
  - In October 2016, ten GIS professionals participated, including six from state government, two from local government, and two from the private sector.
- **VirginiaView**, in the second grant period, began its commitment to prepare instructional and informational materials as guidance for interested parties, who were considering the proper uses and applications of UASs in Virginia. Depending upon the status of the project, the Virginia Tech team readied tutorial training materials and offered to deliver on-site workshops or on-line webinars. During the third grant period, they also prepared and delivered three remote sensing and one UAS webinars.
  - June 3, 2015: Selecting, Downloading, Displaying, and Understanding Landsat Imagery (recording is available from here - https://learn.extension.org/events/1871#.VW8vAEa06kk
  - September 9, 2015: Displaying Landsat Imagery Using Band Combinations Using ArcGIS Desktop (recording is available from here - https://learn.extension.org/events/1873#.VfMsP5da2Io
  - October 15, 2015: Subsetting and Enhancing Landsat Imagery Using ArcGIS Desktop (recording is available from here - https://learn.extension.org/events/1875
  - December 15, 2015: Looking Down is Looking Up: Unmanned Aviation Systems. (recording is available from here - https://virginiatech.webex.com/virginiatech/ldr.php?RCID=689ff7e997eedae7a8a7ebef4267e7ab
- **WyomingView**' PI has conducted a ½-day short course or workshop each grant period either in conjunction with WYGeo or GIS in the Rockies. The focus is on using Landsat data for natural resource monitoring and mapping. Participants learn about Landsat data characteristics (spatial, spectral and temporal resolutions) and its potential uses through lecture and demonstrations. They also receive an interactive demonstration on how to the search for Landsat data with the USGS EarthExplorer. Participants received a completion certificate. The workshops were:
  - Part of the WyGEO Conference held in Lander, WY on August 19, 2014

- Part of GIS in the Rockies held in Denver, CO on Sep 22, 2015
- Part of GIS in the Rockies held in Denver, CO Sept 20, 2016

- Developing web-based tutorials, FAQs and 'how-to' materials (12 activities were completed by CT (3), IN (1), MI (1), MN (4), VA (2), WI (1))

  Many tutorial activities were completed during the fourth period of the grant with the mini-grant emphasis on the YouTube videos that are described in detail in Part IV. To avoid repetition of reporting, those videos completed under mini-grant awards are not repeated here.

  - **ConnecticutView,** in conjunction with the University of Connecticut's Center for Landuse Education and Research (CLEAR) webinar series (http://clear.uconn.edu/), developed an hour-long webinar titled "More Than Just a Picture? The Basics of Remotely Sensed Imagery". The webinar was presented on July 28, 2015. http://clear.uconn.edu/webinars/CLEARseries15/remote_imagery.htm Another webinar providing a basic overview of the Landsat satellite and imaging sensors, where and how to acquire the freely available data, how to prepare Landsat data for use in ArcGIS, and how to calculate some derivative information was presented on November 2, 2015. Pre-registration totaled 87 with another 67 signed in during the webinar. Its link is http://clear.uconn.edu/webinars/CLEARseries15/landstat.htm
  - **IndianaView** made available a new tutorial on the MultiSpec web site to illustrate how to use the "Reformat - Change Image File Format" processor to manipulate the channels in an image file. There were over 2600 downloads of the current MultiSpec tutorials between December 1, 2013 and September 15, 2014, the first period of this grant.
  - **MichiganView** took responsibility in the first period to post bi-monthly tutorials, short but informative pieces meant to make the remote sensing community aware of new and existing remote sensing algorithms or tools, how they work, and what applications they can be used for. Posts to the AmericaView Blog are automatically cross-posted to Planet Geospatial (planetgs.com) so a wide audience was anticipated. In May 2014, a summary of an article on the Tasseled Cap Transformation for Landsat 8 was posted. In January of 2015, a posting about PyGTiff was created. In GY15, MIView acknowledged the demise of planetgs.com.
  - **MinnesotaView** began the first period of this grant by continuing on its updating and development of the Remote Sensing Core Curriculum (RSCC). The RSCC is composed of submissions from a variety of authors from academia, government, and industry.
    - During the second period, GY14, the primary activity was creation of new in-class exercises, incorporation of YouTube videos into lessons, preparation for expanded/improved lecture content, and solicitation of new contributors for the Remote Sensing Core Curriculum. Between January 1, 2014 and September 24, 2014 the site received 112,801 unique visitors from countries on every continent but Antarctica.
    - In the third period, GY15, over 50% of the new content had been added to its new website, https://rscc.umn.edu/ . The next topics added were: Classification and Modeling, Accuracy Assessment and Validation Applications, and Laboratory Exercises. The link with partial completion was made available for access to the curriculum segments that could be used at whatever update point. There were 132,489 website visits during GY15.
    - The Remote Sensing Core Curriculum (RSSC) was expanded to include new content related to UAS applications during the fourth period.
  - **VirginiaView** ascribes to a program continuing over several years, to strengthen resources available to encourage interest in, and educational support for, geospatial sciences. By providing access to a curriculum in remote sensing and image analysis based upon ESRI software (already widely available within Virginia's educational institutions), community college and K-12 institutions can now teach these subjects without

incurring costs of the more specialized software previously required for teaching this content. This activity contributes to Virginia's broadly-based efforts to strengthen STEM education as part of workforce development initiatives.

- During GY14, the ebook version of Remote Sensing Analysis in an ArcGIS Environment has been published as a Kindle ebook, listed at an inexpensive price on Amazon in both the Science/Education and in the Education and Teaching categories. See http://www.amazon.com/Remote-Sensing-Analysis-ArcMap-Environment-ebook/dp/B00VGE0464
- VAView used funding from both the third and the fourth grant period plans to develop the "Getting to Know Lidar with ArcGIS Desktop" tutorial workbook. VAView published this lidar text, currently consisting of 18 separate tutorials, beginning at the novice level, with on-line links to screen-capture videos. It is available at https://www.amazon.com/Working-Lidar-using-ArcGIS-Desktop-ebook/dp/B01K57CNE8.

- **WisconsinView** recognizes the potential to use RealEarth™ in classrooms and through informal education. WIView developed a series of “How-To” lessons for applying the RealEarth™ visualization and data discovery tools where weather and land data come together. Examples include combining satellite detected floods and precipitation forecast products; satellite detected active wild fires and wind/smoke forecast products; and land use and land cover change examples with both daytime and night imagery (such as areas of oil shale fracking). The target audience is high school and college aged students. Lessons will be archived in the AV Education Resource Portal.

Benefits of Education and Training Activity

The highlighted activities selected for this Final Report give only a condensed version of the extensive efforts AV’s professional educators. Although StateViews offer insight into their specific efforts and this report can organize that information into categories and counts of activities, the full recognition of impact is in the cascading value of education when information and knowledge are shared with others and are applied to the complex issues related to decision making. Many of the activities described in the previous section could as easily be reported as applied research or outreach. The “binning” decisions made by those preparing the Request for Continuing Assistance can be subjective and not consistent among the PIs. The AmericaView PIs, Co-Is, and State Coordinators are primarily academicians whose efforts always include influencing education and training.

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 Work Plan– Disaster Analysis

GY13-16: 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.

The initial description of this role for AV members in the National Work Plan for this USGS grant resonated with the accomplishments of the prior USGS grant. Debbie Deagen, the previous Program Director, has been working on a manuscript that traces the AV involvement in disaster analysis back to 2003, the inaugural year for incorporating AmericaView and the year of the first of three awards from USGS. During the four periods of this specific grant, StateViews have responded to an increasing number and impact of natural and man-made emergencies. Not only has AmericaView improved its own readiness to support but it has also extended its outreach more effectively to community, state, regional, national and even international first responders, recovery efforts, and readiness drills. In some cases, the shared expertise of the AV remote sensing and GIS members contributes to catastrophe prevention.

Immediate and qualified response to a crisis is certainly a dramatic example of AmericaView support and expertise sharing but it is hardly a singular example. The StateViews have:

- ✓ Served as Project Managers for the International Charter,
- ✓ Stood up emergency headquarters as their state command centers have succumbed to storms,
- ✓ Cooperated with all levels of government,
- ✓ Reached out to colleagues for the expertise needed for satellite imagery interpretation,
- ✓ Advanced utilization of the newest platforms, imagery, and software:
    - (sUAS) for real-time assistance,
    - meteorological software for storm forecasts,
    - hyperspectral imagery to analyze harmful algae blooms,
    - radar imagery for hurricanes and floods,
- ✓ Explored ways to deliver very large data sets in real-time,
- ✓ Developed methods to assist decision-makers regarding pre and post disaster preparedness, and
- ✓ Engaged its citizenry in understanding the scope and capability of remote sensing to assist in time of need.

For this grant, the Avportal includes descriptions of thirty activities related to a specific search for “disaster analysis.” Eleven states were in some way involved using grant funding. Some additional examples follow.

Emergency Response

- The Gulf of Mexico has suffered both natural and manmade disasters with hurricanes and flooding and oil spills. As described previously, **LousianaView** fortuitously conducted its Disaster Recovery Workshop as part of the larger annual *Louisiana Hurricane Season National and Local Geospatial/Imagery Data Availability, Data Mining Workshop.* Training was immediately converted to actual practice with an existing flooding emergency in Louisiana and Texas.

- The gravity of the Gulf states situation, during that spring, invoked response from the International Charter "Space and Major Disasters," which is a worldwide collaboration among space agencies, through which satellite-derived

information and products are made available to support disaster response efforts. (Several AV members are trained Program Managers, some as a consequence of a special training session at the 2015 Fall Technical Meeting, which was offered by Brenda Jones, then the Disaster Response Coordinator for USGS.) **LouisianaView** PI, Brent Yantis, served as the International Program Manager (PM) for the March and May 2016 Louisiana/Texas floods and Teresa Howard, **TexasView** Co-I, served as PM in August. LAView and TXView team members coordinated the activation of the International Charter as the state responded to each of these events.

- When the Winooski River flooded Route 100 in Middlesex, VT in February 2016 **VermontView** mapped the damage. VermontView used sUAS to capture imagery of ice jams and floods. The information was available immediately after the flights, enabling emergency managers to use the imagery to assess risk, direct response efforts, and document high-water marks. These data provided geo-positionally accurate images allowing integration with other mapped data in a Geographic Information System (GIS).

- **WyomingView**'s PI explained the role he accepted as an International Charter Program Manager for the 2011 Midwestern US floods while attending the 2014 AGU Meeting in San Francisco. Approximately 30 people stopped by his poster and inquired about the Charter and its role, how satellite images from multiple nations were provided to first responders, and the data distribution system created by the USGS to facilitate the international efforts.

<u>Documenting and understanding weather</u>

- **South DakotaView** worked with the South Dakota Agricultural Heritage Museum to plan a traveling exhibit that includes satellite imagery and aerial photography to document extreme weather events in South Dakota such as fires, tornados, blizzards, droughts, hailstorms, and floods.

- **WisconsinView** believes there is great potential to use RealEarth™ in classrooms and through informal education by developing lessons for applying the visualization and data discovery tools where weather and land data come together. Examples include combining satellite-detected floods and precipitation forecast products; satellite detected active wild fires and wind/smoke forecast products; and land use and land cover change examples with both daytime and night imagery.

<u>Better Understanding Drought</u>

- **OklahomaView** has been expanding its evaluation of the algorithms that use Landsat 8 images to evaluate the impact of drought on tallgrass prairie and croplands in Oklahoma. Drought has substantial socio-economic impacts in Oklahoma as well as other states. Improved algorithms, better descriptions of their use, and more reliable predictive models is expected to improve risk management. The severe drought in summer 2012 resulted in a loss of billions of dollars in the livestock industry and crop production in Oklahoma.

- The lakes in Mississippi are used for both flood control and summer recreation for many thousands of Mississippians. However, during drought conditions the quality of the water in these lakes may become eutrophic and/or turbid, as a result of both algal blooms and suspended sediment. Completed research used machine-learning techniques to use MODIS data and lake clarity indicators to understand the impact of drought. Another **MississippiView** supported graduate student investigated the use of higher resolution Landsat 8 data for images of lake water clarity for the seven large lakes in Mississippi. The MississippiView team began work in GY14 with the Mississippi Department of Environmental Quality (MDEQ) to refine the imagery to meet their needs.

MapGive Marathons

A mapathon is a coordinated mapping event. The public, sometimes referred to as citizen scientists, is invited to make online map improvements in their local area or other global locations to improve coverage and to help disaster risk assessment and energy management. StateViews have sponsored these mapathon events both a training efforts and outreach to motivate others to make corrections or additions to Open Street Map (OSM), which is used extensively by safety, emergency, and policing organizations during a threat, crisis, or disaster.

- During the first three periods of this grant, **KansasView** has sponsored several events.
  - On Saturday, April 19, 2014, a MapGive Mapathon was held at the University of Kansas. The space available was filled to capacity with about 45 participants. The GIS coordinator from the Kansas Division of Emergency Management, part of the Kansas Adjutant General's Department, was also on hand with the Kansas GIS disaster response vehicle. In addition to targeting students in the KU Department of Geography, other programs were also invited to provide participants, including the KU International Student Services program, Haskell Indian Nation University, and the regional OSM – Kansas City Meetup.com group, which bought in excellent OSM expertise.
  - The following year, KansasView conducted a variety of MapGive mapping activities in coordination with the US Department of State's Humanitarian Information Unit (HIU), other StateViews, and local participants. In collaboration with the Kansas Division of Emergency management and ShelterBox, KansasView coordinated a Mapathon at Humanitarian Games event in Kansas City, with a focus on mapping Ebola affected areas in West Africa. KansasView also supported students who participated directly in MapGive Mapping activities related to the Nepal Earthquake and the West Africa Ebola outbreak.
  - To share understanding of such events and to encourage use of them as part of Earth Observation Day, at the AV FTM, KansasView conducted a workshop for approximately 22 AmericaView participants on the "how-to" of hosting a MapGive Mapathon. This coordination with other StateViews was continued the following grant period.
  - Kevin Dobbs also coordinated with the HIU and the USAID Office of Foreign Disaster Assistance to establish an AmericaView/USAID effort that focuses on USGS/USAID Volcano Disaster Assistance Program (VDAP) priority area. That effort aimed to align AV MapGive efforts with USGS priorities.
- **North DakotaView** and UND Geography & GISc hosted a MapGive Map-A-Thon open to the University students and faculty on November 19, 2015, for any period of time during the day to map humanitarian projects. On November 17, 2016, the event was repeated.

4.b.2. AV National Work Plan– AmericaView MultiState data Server (AVMSS)

GY13-16: Many AV states maintain state-specific archives of airborne and space-borne 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 work plan 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.

- Since the original work plan was written, technological changes in IT management, in data archive and data distribution have changed and that has been captured in the modifications to the earlier expectations. For this report on Technology Transfer during the entire grant, extracts for each grant period are extracted from the Avportal that archives all the grant period reporting. At the end of GY13, Paul R. Blackwell, then the TexasView PI, wrote that TexasView would continue to host and maintain the AmericaView Multi-state Server (AVMSS). TexasView provided rack-space in a state-of-the-art cold room as well as electricity, cooling and Internet connectivity. TexasView also provided technical expertise necessary to maintain the system and assist with troubleshooting activities as required.
- "Real Earth" technology developed by SSEC at the University of Wisconsin was then functional on the AVMSS, and 2012 NAIP data for the state of Texas was being served. Development was to the point that data from additional states can be loaded into the server.
- In GY14, Stephen F. Austin State University continued to host the AVMSS but the funding responsibility became that of AV National, removing the sub-grant drain on TexasView.
- As technology advanced, the objectives of this AVMSS concept were improved and AV developers introduced the Earth Observation Depot Network (EODN), which was scalable with high performance. By GY15, the support from Stephen F. Austin State University was limited to minimal technical assistance and on-site maintenance and continued to host 10TB of IBP storage for EODN, providing rack space, power, cooling and network connectivity as well as technical assistance and routine on-site maintenance as required.
- The project description for EODN is provided in Part IV of this report but the node sites for the network presented difficulty for most participating StateViews.
- WisconsinView now offers map services for NAIP imagery. The RealEarth API permits adding these map services in ArcGIS Online and any desktop GIS that supports "tile" layers.
- During GY16, WisconsinView built map services from several datasets. WIView data users have increasingly expressed an interest in utilizing map services for streaming this imagery in addition to more traditional downloads. Building on previous work with PR Blackwell, TexasView, MichiganView and others involved with the EODN and the AVMSS (AmericaView Multi-State Server), it is now possible to offer stable and reliable map services.

A Metric Perspective and Summaries of StateViews' Technology Transfer

When the first USGS grant was awarded to AV, imagery was not readily accessible in large quantities to academics, researchers, or the general public. With the open and free availability of the EROS Center holdings, remote sensing experts

have seen an exponential growth in use of imagery. However, that growth has required improved infrastructures to distribute the imagery data and any derivative products, better tools to make identification and retrieval of needed imagery easier. AV has been both advocate and active contributor to the development of the needed tools and the training of those who use remote sensing in the workforce.

Over the grant, 19 StateViews engaged in 51 activities that improved ease of access to geospatial imagery by end users through activities such as:

- Making remote sensing imagery publicly available at low or no cost on StateView websites (21 activities by AL (4), CO (3), IN (1), KY (1), MI(1), MS (1), NE (1), RI (1), SD (2), TX (2),UT (1), VT(3))
    - **AlabamaView** aims to process high resolution airborne lidar into Digital Surface Models and Digital Terrain Models to be shared with the public. Three counties were finished in the fourth period and one in the third period.
    - **ColoradoView** realized that remote sensing and GIS data are downloaded from USGS and NASA servers by ColoradoView members to utilize in analyses and models pertaining to grazing lands, invasive species, and UVB radiation. While other end users can follow the same download procedures, it would be easier for them to access data that have already been downloaded, organized, sub-setted, cropped, and/or formatted in ways that might be more useful for end users focusing on areas in Colorado. The data have been archived at the Colorado Geospatial Centroid. We are working to make some of the data available to other users and the public.
    - **MichiganView** has data hosted at the Great Lakes Water Quality website, which was built under an AmericaView mini-grant in GY15, was piloted for implementation using Google Earth Engine (GEE). (http://spatial.mtri.org/static/greatlakeswaterquality/) Due to data sharing issues with Google the data could not be hosted within the GEE, however a process for using data hosted on GEE to develop water quality products similar to those hosted by the Great Lakes Water Quality website is being worked on. Once the protocol is completed, a fact sheet/tutorial will be generated to inform others of how to utilize remote sensing data available on GEE for water quality assessment.
    - The joint effort between Utah State University, iUtah, and **UtahView** to develop the Searchable Spatial Research Database (SSRDb) was successful in making strides towards completion during GY13, although the beta release was expected in late CY 2015. Programmers established the process and methodology of uploading, storing, searching, and downloading data using CKAN, a powerful data management, storage, and retrieval system that makes data available through a series of tools that allow users to publish, share, and search data using keyword and geographic search parameters. The UtahView consortium developed specific website tools that provide the ability to easily examine and download remotely sensed imagery and data. Educational exercises for K-12 institutions are also proposed on the searching for, downloading, and use of remotely sensed data.
- Adding new images by a sharing arrangement among StateViews (6 activities by NE(4), ND (2))
    - **NebraskaView** added approximately 8GB of MODIS data acquired from WIView. Links to additional national data portals were added to the NebraskaView website to aid visitors in finding additional geospatial data.
    - **North DakotaView** added Landsat OLI data, MODIS, and a variety of vector layers to both of its web GIS applications.
- 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 (20 activities by AL(4), IN (3), MI (3), ND (2), TX (4), WI(4))
    - **AlabamaView** maintains a server that hosts the AlabamaView archive. NAIP data are hosted on an interactive web service

- **IndianaView** reported that Purdue's EODN continues to be available during this reporting period although there were periods with problems of keeping the depot active due to software changes at the home site at Indiana University. The system engineers at Purdue installed scripts to periodically check for tasks that had stopped running and automatically restart them. The current plan is to keep Purdue's Depot running beyond the end of this project period but it is not known how long that may be.
- In addition to several county lidar collections, **WisconsinView** posted the 1-meter resolution 2015 NAIP imagery for Wisconsin online for free download. A map service for the imagery is also available for viewing or streaming. It can be reviewed by visiting this url. http://re.ssec.wisc.edu/s/9aSw1

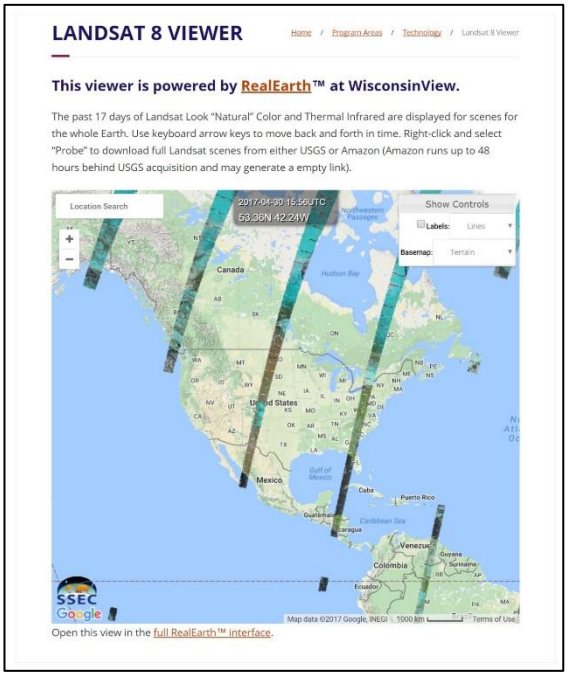
- Tracking web usage (4 activities by AL, MD, OR, WV)
  - **OregonView** made substantial enhancements to its website over the past year. The first change was to add a visitor tracker to provide metrics on the number of visitors to the site.
  - **West Virginia View**, as but one example of the various approaches used by most states, used the NIHUO Log Analyzer web log analysis program to generate statistics on the volume of data downloaded (number of Gigabytes of data per data directory and estimated number of scenes), including: 1. Total Number of visits per month and per reporting period 2. Total Number of page views per month and per reporting period.

Benefits of Technology Transfer Activity

Technology transfer, as experienced or effected by AV members, is not applied to this report as typically associated with universities bringing technologies to the marketplace. The Council on Government Relations (COGR) has defined technology transfer as "the handing off of intellectual property rights from the university to the for-profit sector for purposes of commercialization." This report does not address that aspect of the term. Perhaps, "technology insertion" might have been better phraseology. This report follows the Work Plan language, as have the first, second, and third periods Technical Reports. It describes technology transfer as it relates to the ways technology improves the classroom and field teaching experiences, the interplay between academics and the surrounding community with the various programmed activities, the focused efforts to avail others of remote sensing data and products, and the use of expertise in disaster response or environmental threat monitoring and mitigation.

EODN, described briefly above and in more detail in Part IV, is an excellent example. It results from the integration of the AVMSS effort with the DLT development. "Real Earth" technology developed by SSEC at the University of Wisconsin is now functional within that AV environment. Of benefit to both the disaster support and day-to-day applications that require agile access to remote sensing images and products, EODN, in comparison to traditional data distribution methods, has provided:

- Open and free access to everyone
- Reduced latency – faster collection to desktop
- *FAST* downloads – multiple streams from many depots
- User owned – stakeholders own depots
- User operated – stakeholders set policy
- Distribution – push value-added data to community
- Volume users – offloads network traffic



Other less far-reaching, yet important, technology transfer activities in the grant period include the following.

- Despite the technical challenges and steep learning curve, **ConnecticutView** was able to successfully install and configure the ArcGIS Server software that will provide the basis for serving imagery through a Connecticut Landsat image mosaic viewer. ConnecticutView will work with partner organization, CLEAR, to develop a viewer that is consistent and compatible with other image viewers found on the Connecticut Environmental Conditions Online (CTECO) website. The Landsat viewer is in the initial stages of development and work will continue, albeit at a slower pace without the grant funding.
- **IdahoView** conducted a study to assess the suitability of a low-cost, autonomously operating terrestrial laser scanner (ATLS) to (i) monitor crop growth dynamics and (ii) calibrate satellite imagery for estimating crop biomass.
- **MichiganView**'s introductory technology transferring project with third graders included providing lessons and a web-based tool to aid in their module on bird migration. The web-tool allowed students to explore how different species of birds took different migration patterns, and enabled exploration of major migration corridors and their relationship to existing wind farms. The goal of the project was for students to understand the balance between sustainable energy and ecosystem health.

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.

It is worth noting in this Final Report that the "efforts" mentioned in the Work Plan now have a fifteen-year legacy with AmericaView but extend back to the initial pilot project with Ohio in the late 1990's. The Committee on Appropriations wrote, on 25 May 2000, these key words:

The Committee has maintained the Gateway to the Earth--Ohio
pilot at the enacted level…. With the inclusion of these groups, the Survey is
taking the first steps in transforming the gateway to the earth
from a pilot project into a national program.

AV National Work Plan - outreach with decision makers and general public

GY13-2016: 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.

- Since this grant began in December 2013, AmericaView has embraced its responsibility to keep its Congressional representatives well informed about the progress they have made against the original charter with the intent to foster awareness, appreciation, and use of remote sensing to address the StateViews' impact on multiple needs and issues. Typically, visits are held after the Winter Business Meeting but they may also be conducted at local

staff offices. Each period nearly thirty StateViews provide an informational summary report, with factsheets and other AV outreach materials, in over one-hundred visits contacting annually nearly two-hundred individuals.

- AV's website affords its visitors an opportunity to access both the NASA and USGS published Fact Sheets for Landsat Applications. These are also used by AV members for K-12 visits, community events, and educational outreach at the local, state, and national levels.
- Fact sheets prepared by the AmericaView StateViews to describe their high impact activities for each grant period since 2011-2012 are also found at the AV website and will continue be used for future educational visits and meeting fora. For this Final Report, the consortium overview Factsheets with a listing of each StateView's partners are found in Appendix I.
- In GY15, the AV Outreach Committee helped design and write a small trifold, based on work completed in grant period two on an eight-page brochure. In both grant periods, the design and assembly was completed by LouisianaView students employed under the supervision of Brent Yantis. The brochures and trifolds have been used with the factsheets during visits to decision-makers. In addition, the website has the printable .pdf versions so any PI can easily and inexpensively print quality copies for distribution at StateView-sponsored Earth science events.

GY13-2016: AV will maintain and update its website and blog.
GY2014 Addition: This includes existing High Impact Activity fact sheets, Annual Reports/accomplishments, new compelling imagery (including Landsat mosaics and time series), research endeavors, partners, recent news, and program area achievements. Once content is augmented and updated, the website will be re-designed to attract its visitors for longer and more frequent visits. An appealing website that is more easily read and conveys the dynamism of the organization and its activities will be an effective outreach tool for AV. AV will also maintain the currency and accuracy of its blog.

- A mini-grant was awarded in GY14 to WisconsinView (Sam Batzli, PI) to update the underlying architecture, design, and content of the AmericaView website. His efforts resulted in a Word Press templated new site. Because he chose a contemporary template, several StateViews are considering a similar design that would reinforce the effort to build a consistent thematic appearance to the public. In both the third and fourth periods of the USGS grant, Sam has served as the webmaster and has met with the AV staff on a routine basis to incorporate requested changes, navigation improvements, and additional content. During calendar year 2017, AV had been able to augment significantly the new content prepared by StateViews. Esri Story Maps and close-captioned YouTube tutorial videos are featured at the site for easy access and use.

- AmericaView expects each StateView to report statistical information about their own consortium's website traffic. That information was provided in Part II but inserted here also to draw attention to the interest in what is posted. The numbers are most likely quite conservative, since several StateViews acknowledge that they do not have access to that information within their university IT system management. In other cases, universities changed their servers and tools and lost old statistics. Since December 2013, the sum total of StateViews' web sites hosted more than 330,000 visitors and experienced more than 1.3 million webpage views. Although AV lacks information about repeat visitors and time spent on a page, this conservative estimate underscores the wisdom of a consortium model where reliable and readily-available information has surely enhanced the ability of decision makers, planners, conservationists, ranchers, farmers, educators, scientists, students, and the rest of the public audience to utilize remote sensing data and analytical tools and to garner an appreciation of these resources.

GY14-16: AV will link to social media resources and promote national level material created by two of its StateView members: a) Ramesh Sivanpillai (WyomingView) will share his Facebook page and Google+ page, and b) Sam Batzli (WisconsinView) will retweet WisconsinView's tweets via AV's webpage. He attended the Landsat 8 launch in May 2013 and tweeted throughout. He also posted a summary article about the launch of Landsat 8 (for Facebook, Twitter, and Google+ also) for the Wisconsin Space Science & Engineering Center at: https://twitter.com/uwssec
Metrics: Visitor statistics for AV's website and social media sites will be compiled and reported.

Since the original work plan was prepared in 2013, the social media presence of AV and the StateViews has grown. AmericaView has its own Facebook page for which the Program Manager, Chris McGinty, has taken the responsibility to periodically add new posts. Tom Mueller, **PennsylvaniaView PI**, established a **Facebook** page for EOD at https://www.facebook.com/search/top/?q=americaview%20earth%20observation%20day. In the last month of this grant, these two Facebook accounts will merge to be more effective in the messaging and more efficient in the time management.

The following StateViews have their own Facebook page.

- Along with doing in classroom and STEM community outreach, **Hawai`iView** has also made it a priority to set up and post to a Facebook page (https://www.facebook.com/AVHawaiiView/) and share events that they have attended, AmericaView posts, articles about Earth Observing, and other interesting STEM related facts to reach a broader online audience.
- Jay Morgan, former PI, created a Facebook page for **MarylandView** (https://www.facebook.com/MarylandView/) to reach new potential users, and to promote remote sensing science and technology to Towson University students, and others.
- Ken Boykin established a **New MexicoView** Facebook page at https://www.facebook.com/NewMexicoView/
- **UtahView** continued to promote events and projects through Facebook (https://www.facebook.com/utahview/). These include events, such as Earth Observation Day and Maps on the Hill, and presentations, such as the Logan Summer Citizen Program and the Box Elder Middle School Life Skills Conference.
- **WyomingView** has an active social media presence: https://www.facebook.com/pages/WyomingView/ with 340 followers. WyView also has a Google+ page. https://plus.google.com/+WyomingView

Several StateViews also use Twitter to exchange short bursts of information sharing or commentary.
At the **americaview**.org website, the social media "Follow us" line includes Facebook, Twitter, Vimeo, YouTube, and the AV Blog (blog.ameicaview.org

- **VermontView**, in the third period, assisted in maintaining the AmericaView blog by compiling statistics and generating these posts; however, interest in reading or updating the blog has greatly declined.

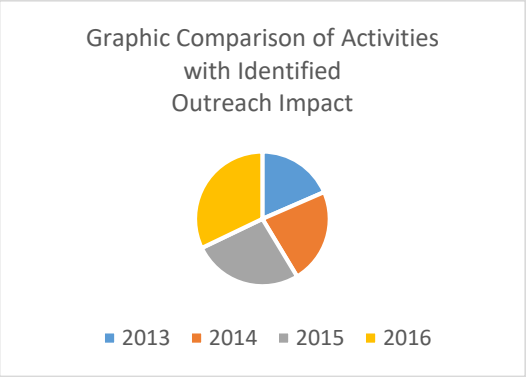
A Metric Perspective and Summaries of StateViews' Outreach

In GY15, StateViews increased the public's awareness of remote sensing imagery and technologies with multiple activities:

- Promoting understanding of geospatial data among public through activities such as Earth Observation Day, which during the course of this grant has changed its national presence from being only AV-sponsored to being aligned with the American Geosciences Institute's Earth Science Week. Appendix C provides detailed reporting on participation metrics.

- Participating in statewide geographic data committees (19 activities by KS (4), MN (4), NE (4), NM (2), RI (3), VT (2))
    - KansasView was regularly represented at Kansas GIS Policy Board by staff scientists from the Kansas Applied Remote Sensing Program, including Dana Peterson, Gina Ross, and Jude Kastens. KansasView coordinator Kevin Dobbs also participated in Policy Board Meetings when available to lead discussions on flood prediction mapping. KansasView was able to obtain funding from the GIS Policy Board for a second year of funding for a land cover update map of Kansas
    - MinnesotaView includes the Minnesota Geospatial Information Office and Minnesota Department of Natural Resources within its state consortium and will continue to lead and coordinate acquisition of statewide data sets, particularly NAIP imagery and lidar data.
    - NebraskaView works closely with the Nebraska GIS Council (http://nitc.nebraska.gov/gisc/) 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.
    - New MexicoView continues to participate as member of the Desert Landscape Conservation Cooperative GIS working group.
    - Rhode IslandView is a member of the Rhode Island Geographic Information System (RIGIS) Executive Committee.
    - VermontView serves on the Vermont Center for Geographic Information (VCGI) board of directors. VCGI is the state's geospatial data clearinghouse.

StateViews characterized 249 of their activities as having some explicit outreach intent throughout the periods of this grant. Many of those efforts have been previously described under the other objectives and range from the massive events like the University of California at Davis open house "Picnic Day," where **CaliforniaView** takes advantage of a preplanned event to set up its annual interactive exhibit for a wide range of participants.



- In spring 2014, the university open house event was visited by over 75,000 visitors. A drought exhibition using change over time Landsat imagery of a local reservoir engaged the public into discussions with researchers on the importance of satellite imagery to analyze the long-term effects of water scarcity in California. The children activity corner provided hands on coloring and games for preschool to higher education students on the importance of the preservation of water. A puzzle of the CA StateView Landsat Mosaic guided people through the demographics of the State. A city puzzle translated aerial imagery to photographic locations throughout Davis, CA.
- April 2015, over 75,000 visitors came to campus; CalView introduced geospatial technologies and remote sensing imagery with hands-on activities to a wide range of citizens. Three interactive Landsat and aerial imagery matching games, a middle school geospatial art exhibition and educational posters around water management and irrigation were created and presented.
- In spring 2016, CalView was able to showcase three newly developed interactive activities, which built on the usage of Landsat 5, 8 as well as aerial imagery. Six undergraduate students enrolled in an internship with CalView to develop these educational activities for the public over a six-month period. The four activities showcased at the event were a land cover change discovery game of the UC Davis campus, a matching game enabling visitors to discover different plants, their properties in association with their respective growing zones in the UC Davis

arboretum, the third activity was a game using Landsat 8 imagery of the US state capitals dominant landmarks. Over the past four years, CalView expanded its exhibition from two interactive activities to a total of seven. In GY16, the exhibition consisted of:

- 1. An aerial map of the campus arboretum engaging visitors to match plants to their respective growing zones,
- 2. A citizen science data collection mapping project on campus showcasing quantitative data of dog sightings on campus,
- 3. An aerial map of the campus asking visitors to find Leadership in Energy and Environmental Design (LEED) certified buildings on campus and to match to their respective locations to the map,
- 4. An aerial map inviting visitors to find and match photographs of campus drinking water fountains to their respective locations,
- 5. A Landsat mosaic map of California divided into individual State counties challenging visitors to find the counties and match these to the respective Landsat State map locations,
- 6. A manipulated aerial map of the incorporating items like the Star Wars Death Star challenging visitors to spot the difference,
- 7. With this year's funding in collaboration with the California Spacegrant Consortium CalView presented an undergraduate student's hands-on research project. He built, out of over 32,000 Lego pieces, an 8x4 feet topographical map of the landcover types throughout California. (See photo to the right.) Via a hand-made fog machine, visitors at the Open House were able to observe fog expansion within the state and learn more about its underlying atmospheric sciences.

Another annual event worth noticing is that of **South DakotaView** with the Big Sioux Water Festival, which focuses on a 4th grade audience. In May 2016, nearly 1200 students with teachers and parents were exposed to GIS Online as a free tool to see their school or home from above and to recognize some of the other neighborhood or community features. Outreach experiences never need to reach that scope of audience to be effective. Descriptions in the report have included very effective impact when fewer than a dozen students or local leaders are the audience that takes the new knowledge into places where it affects others' appreciation of the beauty of planet Earth or insights into the local space or resolve to take action to remedy some social, environment, economic, or political issue.

Benefits of Outreach Activity

Outreach programs exist throughout varied communities-of-interest. From its inception, the AmericaView objective has been to advance the understanding of remote sensing among individuals and their affiliated groups. Among the benefits of the community-of-interest approach has been the information-sharing and issue-addressing service efforts to many, who either lack awareness of capability or lack access to needed resources. The public might be overlooked as an audience for informal educational programs on remote sensing without the proactive effort that AV members contribute with programs, presentations, exhibits, and other general assistance. AV has demonstrated that professional conferences, public venues, social media, YouTube videos have the potential to reach larger and increasingly diverse audiences. The LouisianaView example above ties remote sensing into the art genre that attracts and delights all by its beauty and

complexity. Images capture imagination and satellite images intrigue viewers, who always want to see their own homes, but those images also illustrate the value of a broader perspective and perhaps awaken awareness of the possible contributions that remote sensing science makes to many facets of everyday life. When Brent Yantis, LouisianaView responded to Robin McNeeley and Amy Logan, IowaView, and delivered his Earth as Art exhibit to Iowa, he not only facilitated another 300 people enjoying those Landsat scenes in a museum setting, he also provided stimulus for people to ask questions about Earth observing satellites and to think about how they might benefit from that asset in practical ways. That AV members are distributed across the nation is a treasured value for outreach. That very distribution itself has value promoting the transfer of documented positive impact from one part of the country into another area. Presentations made by AV members to local educational, government and service organizations are usually very effective because the "messenger" is a trusted member of the community.

In closing this Part III of the Final Report, AV is testimonial to the unequalled value of remote sensing expertise applied at the local level. In recognition of the AmericaView participation in the calls for support by International Charter on Space and Major Disasters, this consortium shared in the 2017 Pecora Group Award to that entity. Every trained AmericaView Program Manager received a certificate of appreciation associated with the award. Emergency Response is one of the most effective demonstrations of outreach.

The International Charter on Space and Major Disasters is being recognized for providing free satellite imagery, data and information to the global community during times of crises. The Charter has changed the way civil protection agencies respond to disasters.

IV. Mini-grants, National Project Grants, and Their Impact

Evolution of the Mini-grant and National Projects Program

During the annual budget planning sessions with the Board members and staff consultants, each period included a line item to provide funding for the likelihood of some opportunities for special projects that might not be anticipated by the StateViews or would be needed at the national level. The value of that line item, as projected for each grant period over the course of the full grant, was $10,000. Each actual grant period, however, that line item value changed to reflect the realignment of funds available from other line items when efficiencies were effected or planned work was not executed. The AV Board was kept apprised of available funds by the financial manager at each monthly meeting and made the appropriate decision about how much money could be redirected to StateView or national mini-grant proposals. As is seen in the summary financial reports for each grant period, the funding varies widely. Grant period 4 activity reflects the approved augmentation proposal to USGS, which heavily emphasized the request for mini-grant funding.

Parts II and III of the Final Technical Report are primarily documented in the AVportal, where the StateViews' grant period requests for funding and their reporting reside. The proposals and the reports for the mini-grant program are not archived there and, as noted previously, do not typically contribute to either the statistical summaries or the description of the activities. This Part IV is intended to provide more insight into the other funded work completed by StateView consortia.

Grant Period 1

This grant period was the shortest of the four and used just over $14,000 for mini-grants and national projects. As noted in Part II, the first grant period, a couple mini-grants were awarded. During this grant period, rather than place funds from an under-expended budget line into mini-grant competition, the Board determined that an additional $1000 should be added to each participating StateView sub-grant. This was possible because three full members that period (Alaska, Colorado, and Maryland) did not submit proposals and the money budgeted for sub-grants remained in that budget line item, increasing the equal-share value of the individual StateView's allocation. As a result, funding for mini-grants was not as large as in subsequent periods.

Mini-Grants

In April 2014, AV's Program Director announced the approval of three mini-grants:

1. **VermontView** will develop a program to offer scholarships to support veterans throughout the AV membership in these students' pursuit of a geospatial education.

   ✓ SpatialVets: Veterans' Scholarship Program

   Despite the approved mini-grant proposal, Jarlath O'Neil-Dunne, **VermontView**, was unable to instantiate the scholarship program, given that insufficient university overhead was available and that AV staff was insufficient to manage the program. Recommendations generated by the Veteran's Geospatial Education Thematic Working Group during the previous grant had generated a list of ideas to acquaint veterans with remote sensing and the potential for jobs in that field. This effort and the accompanying discussion was not without merit. Those ideas found their way into several sub-grant proposals throughout the following periods.

2. **TexasView** will support five StateViews in establishing Earth Observation Depots - a continuation of prior Research and Education Data Depot Network (REDDnet) and Data Logistics Toolkit (DLT) efforts - to distribute Landsat and other remotely sensed data.

   ✓ <u>EODN</u>

   Paul R. Blackwell, **TexasView**, led the Earth Observation Depot Network (EODN) proposal, which identified the five participating StateViews (TX, LA, MI, IN, and WI). At the time of the proposal's approval, he noted that "These members were selected on a first come, first served basis and each has agreed to the terms established in the Mini-Grant application."

   EODN was designed to enhance timely access to large remote sensing datasets using the technology developed under the NSF-funded Data Logistics Toolkit (DLT) project. EODN consists of a network of distributed DLT servers, referred to as "Depots" which use advanced "data logistics" to replicate and position data close (in terms of network access) to locations where needed. Depots, hosted by AV members in Indiana, Iowa, Michigan, Texas, and Wisconsin on AV-funded servers, became part of a larger network of storage resources. EODN raised AmericaView's visibility within the larger research community by enabling faster and more robust delivery of data products to everyone, and especially those in areas with poor connectivity or localities experiencing crises.

   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.

   Professor Blackwell reported that as an outcome of this mini-grant, AV elevated the EODN project from being only supported within the TexasView sub-grant funding in GY13 and earlier - under the previous USGS grant - to a national-level effort by the end of GY13. To provide access to data for EODN, Blackwell developed *EODN Harvest,* a Python script to acquire data through the USGS Inventory Service Machine-to-Machine (M2M) interface and upload it to EODN. Harvest, was adopted by DLT and operated and maintained by Indiana University. In order to replace the capabilities developed in 2006 by TexasView for the AmericaView/REDDnet Demonstration Project, the DLT team created the EODN/IDMS Browser. An EODN Workshop during the 2014 AmericaView Fall Technical Meeting focused on installing the DLT and maintaining depots. This work continued into GY14 and 15, described below. An update to the current status, with no mini-grant or sub-grant funding was discussed in Part III of this report.

3. **WisconsinView** will develop the ability for AV StateViews to share imagery of their choice in web browsers and mobile devices. Initially, this will be shared with the AVMSS group, but ultimately (hopefully) with the entire AV membership.

   ✓ <u>Imagery Visualization Access through an AmericaView-branded RealEarth Web Mapping System</u>

   WisconsinView prepared an existing web mapping engine called "AV-RealEarth" for federated deployment among several StateViews to help StateViews share imagery of their choice in web browsers and mobile

devices. It used the existing AmericaView Multi-State Server (AVMSS), a joint-use server, in collaboration with PR Blackwell at TexasView. It allowed StateViews to install the RealEarth VM in their own computing environment and to "publish" their imagery of choice to a common AmericaView web map interface hosted by the AVMSS. AVMSS was originally built by AlaskaView, later shipped to TexasView, and then managed jointly by WisconsinView and TexasView.

TexasView provided a good stress-test environment, offering its statewide 1-meter 4-band NAIP collection. The large dataset allowed testing the software script so it could balance and monitor CPU load, I/O and disk space, and fail gracefully with understandable error messages, if an upload attempt should not succeed. The script also provided a mode for optimized remote uploads and added extended metadata access. Deliverables from this mini-grant included the documentation for VM installation and for the procedures to upload imagery.

RealEarth was also featured in a GY16 min-grant, following the maturation of some technologies over the intervening years. That activity is described later in this Part IV.

National Project

- ✓ AVportal Web Application Development and Maintenance

  Prior to the selection of AmericaView for this particular grant, Jeong (JC) Seong, **GeorgiaView,** had built a database system (SQL environment and user interface) for StateViews, under the previous grant, to enter statements of work and progress reports. When this grant began, the Program Director requested the Board to approve awarding JC, non-competitively, mini-grant funding to improve functionality of the portal. Detailed information about each StateView's presentations and publications, supported in some way by the USGS award, was incorporated. A StateViews was able to add more information about its consortium and website. Testimonials and photos were added. Outreach visits to policy and decision makers were recorded. Security was improved.

Grant Period 2

Nearly $100,000 was awarded to StateViews toward AV-wide Mini-grants and National projects during the second grant period for:

- Additional EODN development,
- Survey assessment for the effectiveness of course, curriculum, workshop and event activities,
- Preparation of introductory level SAR course material,
- Water Quality/Quantity/Utility Working Group initiatives,
- Modifications to the AVportal,
- Relocation and redesign of the AV website,
- Design and development of a Factsheet template, and
- An AV brochure.

Mini-grants

- ✓ EODN

  Paul Blackwell, **TexasView**, retired from Stephen F. Austin State University and became a consultant, contracted with an AV Board approved agreement, to continue work with the EODN throughout the remainder of the second

grant period. In October 2015, during the overlap period between grant periods 2 and 3, he submitted the following status statement:

"EODN today is an operational proof of concept implementation. It has not been advertised outside of AmericaView, USGS and a select number of technical groups such as GENI. The primary reasons it has not been introduced to the general public include concerns that rapid development will introduce changes that confuse and discourage users and the desire to ensure the USGS is comfortable with what we are doing.

Capacity: EODN currently consists of 15 dedicated depots located at four locations, Indiana, Michigan, Texas and Wisconsin. Three of these are AmericaView members, Michigan, Texas and Wisconsin. The other, Indiana, is maintain by DLT PI Martin Swany. In addition, a varying number of depots on the GENI network are available. GENI depots can be added and removed as needed and are the basis of several recent demonstrations (see Demonstrations below.) Because of the GENI depots, the total capacity of EODN fluctuates from day to day. In general, total capacity is in the neighborhood of 24 TB.

Collection: EODN is currently collecting (harvesting) on a continual basis all Landsat8 data over CONUS. A separate instance of EODN Harvest is collecting Landsat8 data over Kenya. The daily average is 37 – 45 unique scenes representing around 80 GBs of data. Three copies, distributed across depots, are maintained for 30 days. Average content of EODN is less than 2TB at this time.

Data Utilization: Testing of EODN download performance relative to the USGS Bulk Download Application reveals a significant advantage. These tests were conducted at a well-connected location using a set of ten Landsat 8 scenes."

In addition, several working group meetings and public demonstrations of capability occurred under Paul's leadership. In October 2014, AmericaView helped organize an EODN All-Hands meeting at Indiana University attended by AmericaView members as well as DLT developers and PIs from Indiana University, Vanderbilt and the University of Tennessee. In spring, 2015, the joint AV EODN and DLT team submitted a response to the USGS Request for Information (RFI), for EROS Enterprise Architecture Study (EAST). A subsequent teleconference occurred but no RFP was released during GY14. To the left is a graphic representation. The text explanation of the functionality described in that RFI explains:

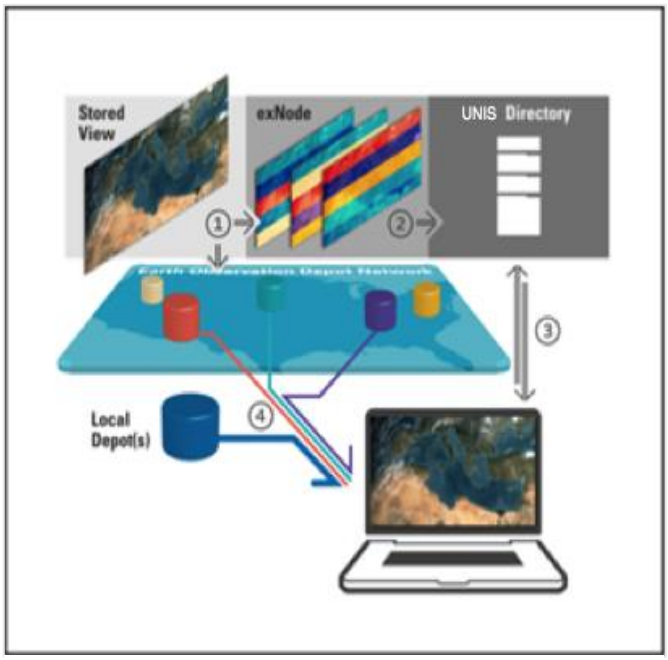


Figure 4. Graphic Representation for EAST

1) A remote sensing image/view is uploaded to EODN depots. Metadata, showing how data are written to the infrastructure, are encoded in an exNode;

2) The exNode is registered with the Unified Information Service (UNIS). The Intelligent Data Movement Service (IDMS) performs further policy-driven replication and/or data movement and updates the exNode;

3) Data can be accessed (e.g., GloVis, Earth Explorer), or an automated process. When a scene is selected for download, the client software retrieves the corresponding exNode from UNIS and; 4) Initiates a multi-threaded (BitTorrent like) download from EODN, pulling segments from the "closest", depots.

The DLT project team gave a demonstration of dynamically allocated depots on Global Environment for Network Innovations (GENI) at its engineering conference (GENI22) on March 23-26, 2015 in Washington DC. Sam Batzli (WisconsinView) teamed up with Ezra Kissel, Principal Software Research Engineer with InCNTRE at Indiana University, to produce a Landsat8-based demonstration using EODN. This demo was selected for a private session for top executives including the NSF Director. The team was asked to reprise the demo for GENI23 at the University of Illinois at Urbana-Champaign on June 15-18, 2015. The EODN/IDMS demo was selected as the Plenary Demo for the conference.

As a result, NSF invited the EODN/IDMS team to participate in the International SmartCity360 Summit on October 12-16, 2015 in Toronto, Canada and at Super Computing 15 (SC15) on November 15-20, 2015 in Austin, TX.

- ✓ Proposal to evaluate America View educational activities Phase 1

  The proposal for the second period mini-grant solicitation was part of a three-phase AV educational impact evaluation plan. Chandana Mitra, **AlabamaView**, proposed in the first phase to develop techniques to access EOD activities. Subsequent phases would adjust the techniques to reflect the experience and would extend the application beyond EOD. The research team prepared to deliver a comprehensive, formative and summative evaluation approach, using a mixed methods approach to inform the outputs of the various education and outreach programs of AmericaView. Evaluation questionnaires were developed and included from eight to 21 questions each, for six different populations: elementary students, middle school students, high school students, undergraduates, teachers, and the general public. Evaluation questions were based on a 5-point Likert-type scale. The methodology was used for the fall EOD event and Appendix C provides some insight into the information collected. Sample sizes were generally too small to draw many conclusions for EOD. However, subsequently, Rebecca Dodge did effectively use the approach for her periodic teacher training sessions in Texas. She found the questionnaires very effective in helping her identify both success and improvement-needed segments of her training. In the following grant periods, AlabamaView did not seek additional mini-grant funding to complete all three phases of the initially proposed work.

- ✓ Development of Materials for Community College Training Phase 1

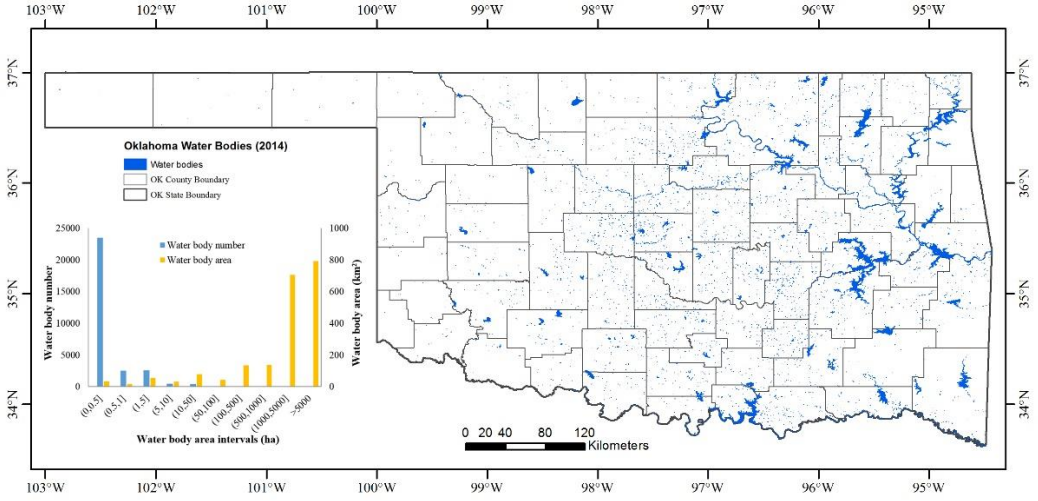
  Nancy French, **MichiganView**, proposed developing training materials on the fundamentals and exploitation of synthetic aperture radar (SAR) for initiatives such as the GeoTech Center's Model Curriculum. In this phase, lectures and hands-on lab tutorials were developed and compiled. The materials were developed for a target audience, who has already completed basic remote sensing coursework and has a strong grasp on high school level mathematics. The goal of the training materials was to provide students with a strong enough foundation in SAR remote sensing so that, upon completion of the course, they would be capable of excelling in a "technician-level" SAR focused remote sensing employment situation. The complexity of SAR systems and SAR exploitation necessitated course building, such that material intended for later in the course would build off principles introduced earlier. However, instructors were provided the flexibility to modify the course to fit their unique circumstances. The delivered materials were presented in three sections: 1. SAR Fundamentals, 2. Image processing and analysis, and 3. Earth Science Applications. Rebecca Dodge, TexasView, was first to incorporate two of the exercises into her spring lab sessions. Her testimonial in February 2018: "I used the exercises to very good effect in my remote sensing class in 2016. They were successful and useful. I have passed them along to the professor who has taken over that class for me. I am teaching a small lab section for that class, and I will be using them again with my students this semester." Professor Curtis Edson at Michigan Tech University also inserted the modules into his remote sensing class. The plan was to use the materials for a full semester class or

training, but this has not yet happened (as of spring 2018). However, Nancy French and Michael Battaglia, with the help of Laura Bourgeau-Chavez, have been working with the School of Forest Resources and Environmental Science at Michigan Tech to teach a full SAR class as part of the Remote Sensing and geospatial certificate curriculum using these materials. In addition, MTRI is working with the US GIF to develop training materials, with the idea to use the SAR course materials in their training.

✓ <u>Statewide maps of open surface water bodies in Oklahoma at 30-m spatial resolution: A pilot study for Landsat image processing, algorithm evaluation, and accuracy assessment</u>

Based on a simple but robust water mapping algorithm and all the available Landsat TM/ETM+ images for Oklahoma in 2014, Xiangming Xiao, **OklahomaView,** with Co-Is, Jinwei Dong and Saleh Taghvaeian, and two graduate students, Michael Menarguez and Zhenhua Zou, generated an annual water body map at 30-m resolution for the state. The map, with a high overall accuracy of 98.3%, allows analysis of the number, area and distribution of open surface water bodies in Oklahoma. Year-long-open surface water bodies covered an area of ~2,033 km^2, accounting for 1.12 % of the entire Oklahoma state area.

Future work was suggested to track the dynamics of open surface water bodies from 1984 to 2014. These water body maps will support water resource management, crop and livestock production, and biodiversity conservation in Oklahoma but also provide an exemplar for other StateViews to compile this information for their policy and decision makers.



Oklahoma open surface water body distribution in 2014

✓ <u>Development of Radiometric Rectification for Regional Water Quality Assessment</u>

Leif Olmanson and Marvin Bauer, **MinnesotaView**, identified their concern that current atmospheric correction methods often remove useful information for water quality measurements from the imagery. In their mini-grant proposal, they suggested evaluating an alternate approach. They used radiometric rectification to normalize all of the images to a consistent absolute surface reflectance. In that way, all the imagery appeared to be collected by the same sensor under the same illumination and atmospheric conditions. They selected 10 clear Landsat 5, 7 and 8 images from paths 27 and 28 and row 27. The base image was an August 22, 2013 Landsat 8 OLI image corrected to surface reflectance using the EROS USGS Provisional Landsat 8 Surface Reflectance product. Using their procedures, which made adjustments along the way, they concluded that once robust water quality models are developed for an area, those models can be applied to any similarly radiometrically corrected images, allowing

historic images without water quality data or metadata, to be used for water quality maps. Additional research and confirmation work was anticipated.

- ✓ Monitoring and modeling water quality and harmful algal blooms in the inland waters in Southern Ohio Region with remote sensing and in situ observations

  Hongxing Liu, Richard Beck, Min Xu, Bo Yang, Song Shu, Richard Johansen, and Shujie Wang (respectively PI, Co-I, Graduate Assistant, and Students), **OhioView**, made comprehensive and multi-temporal measurements on key water quality parameters of Harsha Lake and the Ohio River, and successfully developed algorithms for upscaling water quality parameters using satellite data and airborne hyperspectral images. The information derived from this project improved community understanding of causes and conditions favoring HAB formation and occurrence in inland waters. The knowledge and techniques derived from this project were expected to help research scientists, water resource planners and managers, state and local officials, and local communities to detect cyanotoxins, to track the fate of these toxins in the lakes and rivers, and to design intelligent policies and best management practices to prevent, control, and mitigate the occurrence of nuisance HABs. They were convinced that the preliminary results from this proof-of-concept interdisciplinary project, enabled by the AV mini-grant, would position them to conduct a full-fledged research project. As a related outcome, a manuscript for an article "*Regionally and Locally Adaptive Models for Retrieving Chlorophyll-a Concentration in Inland Lake from Hyperspectral Imagery"* was submitted to IEEE Geoscience and Remote Sensing.

- ✓ Remote Sensing of Water Quality: Phase 1

  Nancy French and Michael Sayers from the Michigan Tech Research Institute (MTRI), **MichiganView**, were able to use their mini-grant award to add value, with two activities, to the research-level data currently available from the MTRI Great Lakes Carbon Monitoring System (CMS) project. They further developed some remote sensing derived Great Lakes water quality products by computing monthly and annual mean images of each parameter from individual daily images for each of the three Lakes. Monthly and yearly (2010-2013) average images of chlorophyll, CDOM, DOC, suspended minerals, Kd490, KdPAR and photic depth were prepared in a GIS-consumable format (GeoTiFF). They also developed a new geospatial webpage so that a user can view and download the data sets described above. The webpage uses the Google Maps API with custom-made overlays for image viewing. http://spatial.mtri.org/static/greatlakeswaterquality/ The Google Earth Engine (GGE) allowed rapid processing of large datasets while simultaneously making them widely available to scientists, researchers, and developers. MTRI prepared a list of proposed activities for the next phase of the effort.

National Projects

- ✓ AVportal Web Application Development and Maintenance

  After using the AVportal for both the reporting for the first grant period and entering the Request for Assistance proposal for the second grant period, the Program Director requested that Jeong (JC) Seong, **GeorgiaView**, submit a proposal and budget for additional improvement and continued maintenance. The proposal was submitted to and approved by the AV Board. Written guidelines for StateViews' use of the portal were reviewed and revised and the tools to help generate the summary reports required at the end of each grant period were modified in January 2015, in sufficient time for the grant period 2 reporting and the RCA for grant period 3 submission.

- ✓ Update and Host AmericaView's Website

  In the first period of this full grant, the Blacksburg Electronic Village (BEV) provided the website services for AV, using Drupal 6 for website design and maintenance. BEV announced it would retire its remaining client services at

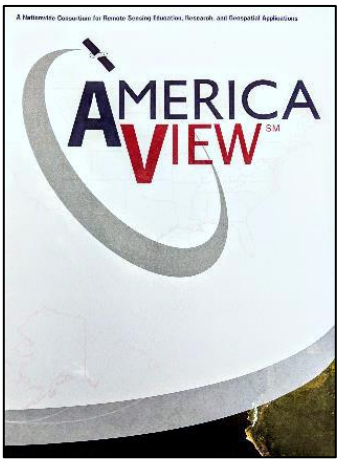
the end of calendar year 2015. AV released a competitive solicitation internally to find a new host - outreach is a key objective of the USGS grant award, as well as to redesign the website. In June 2015, a selection for a mini-grant was made. Sam Batzli, **WisconsinView**, proposed working with the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison to revise the americaview.org website. A new design, employing a Word Press template, was chosen, after some preliminary attempts to create a custom design, which was intended to hierarchically reflect the mission and priorities of AV. SSEC anticipated meeting quarterly by teleconference with the AV Technology Committee and AV staff to ensure an acceptable redesign and a smooth transition. Sam and the SSEC delivered a website, providing agile navigation through the organizational structure and the programmatic priorities of AV and its commitment to remote sensing education, outreach, technology, and research. To bridge the time gap between the end of BEV service and the release of the revised website, the old website was simply moved. In late April 2016, the new website was ready for initial review and content expert updates. In June 2016, the website was publicly launched. Google Analytics tracks website usage and performance.

✓ <u>AmericaView Factsheet Template and Review Procedures</u>

To better support both Windows and Apple operating systems in use by the StateViews, distinct templates were requested to facilitate the preparation of the annual Factsheets and to enable a more standardized format and color presentation. Previously, StateViews were confronted by several formatting issues when Microsoft Office for Windows Word templates were ported to the Microsoft Office for Apple platform. Chris McGinty, UtahView, was selected by the Outreach Committee for a mini-grant to prepare, test, and distribute templates that were compatible between Windows and Apple systems. Additionally, with the input of the AmericaView Outreach Committee, Chris documented a methodology for the factsheet review and approval process, which outlined, in detail, the use of portable document format (PDF) and Microsoft Word document (docx) format for final submission and review by both the AmericaView and USGS reviewers. The end product promoted a consistent view and finished quality appearance for all Factsheets that are distributed to community, state, and national leaders.

✓ <u>AmericaView Brochure</u>

The Outreach Committee recommended that AmericaView should prepare a professional quality brochure that could be used for distribution at various national and state conferences as well as download from the AmericaView website (http://bit.ly/AVPublication). The brochure would provide an overview of AV's mission, objectives, members, and activities. Brent Yantis, **LouisianaView,** submitted a proposal, which involved design students. It was accepted by the committee and subsequently approved by the AV Board. StateViews collected their copies at the Winter Business Meeting in February 2015. Like the other national level efforts, this effort provided excellent outreach communication about the value of remote sensing to a very broad and diverse audience.



Grant Period 3

Around $52,000 was awarded to StateViews toward AV-wide Mini-grants and National projects during the third grant period for:

- EODN continuation
- evapotranspiration estimates with Landsat
- educational materials
- imagery stitching
- downstream water quality
- AV trifold
- AVportal upgrades
- AV website upgrades

Mini-grants

✓ EODN Continuation

At the end of GY15 mini-grant funding, Paul R. (PR) Blackwell, **TexasView**, and asked Sam Batzli, **WisconsinView**, and Nancy French, **MichiganView**, to continue leadership on this initiative for which six StateViews also were using some part of their GY15 funding. The depots, hosted by AV members in Indiana, Iowa, Michigan, Texas, and Wisconsin on AV-funded servers, within a larger network of storage resources, were expected to expand to include New MexicoView, which viewed the system as one way to strengthen its state consortium. In April 2016, PR reported: "EODN priorities for AmericaView GY15 and GY16 key on four areas: 1) Infrastructure, 2) Metrics, 3) Middleware, and 4) Applications. Underlying all of these is the continued search for additional funding." The Av Board approved a small mini-grant with funding sufficient to support PR's activities through June 30, 2016, the end of the third grant period.

No additional funding for EODN was provided in the fourth period of the grant. Nancy French provided a summary status report. Following the GY15 activity that developed the main functionality of the Earth Observation Depot Network (EODN), Sam Batzli and Nancy French continued to seek ways to maintain and advance the EODN and the underlying software and concepts. The EODN remains in operation, although harvesting of Landsat scenes from the USGS has not continued. However, the functionality and some of the depot nodes are still operating and being used by the Indiana University research team for testing of various new ideas and resources. Larry Biehl (IndianaView PI) is not certain how long the operation will continue given the maintenance and update efforts required this past year.

Batzli and French used the EODN concept and supporting software to develop four proposals that were to use the EODN. Two of these were to NASA and two were to NSF; none was selected for funding. In 2016, French worked with Indiana U. and U. Tennessee (developers of the EODN network and software) to write and submit a project proposal to the National Institute of Standards and Technology (NIST) Public Safety Communication Program. The project was to use the underlying software of the EODN (the Data Logistics Toolkit - DLT) for improving access to earth observation data and other large geospatial datasets in wildland fire operations. The Wildland-fire Data Logistics Network (Wildfire DLN) project was awarded to French and collaborators in the summer of 2017. The work continues for another year and a half and will result in a prototype system that employs the DLT and EODN concepts originated by the AmericaView funding effort.

Finally, additional development opportunities are under consideration for the future. Batzli and French are collaborating again with the Indiana and Tennessee partners on a proposal to a new NSF program on Cyber Infrastructure. The EODN and underlying software tools have many applications, and continue to be useful for

advancing data sharing and access to remote sensing data sets. The effort supported by AV has provided an avenue to advance a unique interdisciplinary concept.

✓ Estimating Evapotranspiration using Landsat data and Eddy Covariance Stations in Delaware

Tracy DeLiberty, **DelawareView**, with a Geography graduate student and two Environmental Science undergraduate students, proposed to estimate evapotranspiration (ET) for Delaware's agricultural areas. They prepared a python script to ingest data and to derive an estimate of instantaneous ET using the Surface Energy Balance Algorithm for Land (SEBAL) model. They successfully completed the script to estimate ET and the variables important in the SEBAL model. However, given the effort to develop each component of the SEBAL method into automated python script and adapt it to the humidity of the area, they lacked time to complete conversion of the instantaneous ET to a 24-hour ET estimate and to aggregate these estimates to a monthly and seasonal scale for Delaware. The undergraduates were encouraged to complete internships with the NASA Delaware Space Grant Summer Research program that would allow more work on the issue. Another undergraduate student continued the ET work with support from the Space Grant last summer. He also worked with Tracy Deliberty in the fall on the High School Geography curriculum in which this project is referenced. For future work, Tracy planned to transfer the code for public sharing by posting the script on the DelawareView website, as well as test the estimates against observed fluxes at a station with an eddy-covariance instrument and other stations with edometers.

✓ UAS Applications for the Geosciences, Promotional and Educational Materials

Donna Delparte, **IdahoView**, created and tested a series of four UAS-related modules, based on the academic experience that field based-teaching with geospatial technology such as Unmanned Aircraft Systems (UAS), Global Positioning Systems (GPS)/Global Navigation Satellite Systems (GNSS), Geographic Information Systems (GIS) and remote sensing has been an emerging and very efficacious trend in the education of geoscience and geo-technology students. The modules prepared:

- *Module 1: Introduction to UAS mission planning and field data collection*.
  Overview: Students create a UAS mission plan and conduct a flight with a low cost UAS (3DR Solo or Phantom) with an RGB (camera) sensor.
- *Module 2: NDVI Multiscale Data Analysis – Satellite – Aerial – UAS*
  Overview: Students calculate normalized difference vegetation indices (NDVI) for a selected agricultural field using Landsat Imagery, National Agricultural Imagery Program (NAIP) imagery and UAS collected with NIR band data to measure crop health. NDVI is calculated in ArcMap.
- *Module 3: UAS data mapping of cinder cones*
  Overview: Imagery from UAS flights over dormant cinder cones will be used to generate point cloud data to identify geomorphic features. Students go through the process of using UAS image stitching software to create a digital surface model.
- *Module 4: UAS data analysis of vegetation spectral signatures using hyperspectral imagery*
  Overview: Students extract hyperspectral signatures collected with UAS from three species of sagebrush.

As an outcome of this work, in a subsequent meeting of the AmericaView UAS Working Group, a recommendation was made to create a repository of UAS Training and Educational Materials, to be available through the AV website. It was further recommended that the educational materials would be broadened to include "best

practices." In fact, in the augmentation segment of the fourth grant period, GY16, mini-grants were awarded to accomplish that objective.

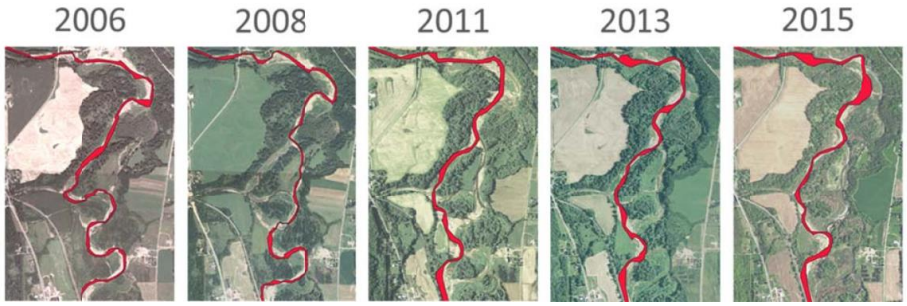
- ✓ Develop an Image Stitching and Georeferencing Process for FSA Slide Scans using Microsoft Image Composite Editor and ArcGIS

  Kevin Kane and Robin McNeely, I**owaView**, were aware that the USDA Natural Resources Conservation Service (NRCS) wanted to have thousands of color slides, which were scanned and saved to .tif format for flights in the 1970s, 1980s, 1990s and early 2000s, available for use in GIS software for historical evaluation of land. They proposed to develop a process that would mosaic and georeference the images in a larger spatial aggregate than two sections of land, which was the coverage of each original slide. An ISU graduate student, was hired to develop a repeatable, reliable, and low cost process to stitch together individual slide scans for Iowa counties by township. Microsoft's free software package called Image Composite Editor (ICE) has many input parameters that affect the output image and each of those were tested. After doing a test county, the student realized that Simple Panorama, Auto Detect Camera Motion and Structured Panorama as the three input settings produced a good mosaic almost every time. The next best option if road mismatch occurred was to change Simple Panorama to Planar Motion with Perspective. The ICE software produced an output .tif that was georeferenced in ArcGIS to produce a geotif. The main goal of the project was to make the color imagery available in a GIS format that could be used by anyone with the proper technology. To that end, ArcGIS Server services were created by decade for the imagery and served through the ISU GISF as REST services, which will be updated as funding is allows for additional work. The link to the REST services is https://athene.gis.iastate.edu/arcgis/rest/services/ortho. The student offered this commentary, underscoring not only his contribution to his community but also the importance of AV's commitment to education: "…due to this experience, I made GIS mapping at the heart of my Master's Thesis. Embedded in my thesis is the argument that GIS mapping technology has a wide array of applications in all disciplines, particularly the social sciences. … With the end result being a public service that not only preserves historic imagery by bringing it into the 21st Century, but also learning how the landscape of our state has changed over time…"

- ✓ Quantifying change in riparian vegetation in the Genesee River and exploring relationship to seasonal weather patterns and downstream water quality

  Lindi Quackenbush, **New YorkView**, completed a project to enable multi-temporal assessment of riparian vegetation extent and condition, as well to take a step toward linking remotely sensed riparian vegetation data with downstream water quality parameters and local weather patterns. This academic research developed a new method to extract time series of riparian vegetation indices directly from satellite image composites. This method was applied to the Genesee River watershed in western New York State and northwestern Pennsylvania. The study team identified the main channel of the Genesee River and delineated riparian vegetation within 90 meters of the channel for 2011, 2013, and 2015 NAIP imagery, and then characterized the vegetation index within the buffers using Landsat 8-day NDVI and EVI products available through Google Earth Engine (GEE). GEE was used with 300 Landsat scenes, extending over five years, which were available preprocessed with derivative products generated. Within a short period, this project was able to delineate the riparian vegetation extent and derive both vegetation index time series values, although there were some issues with cloud cover and gaps that require additional consideration.

In this project, biannual riparian vegetation extent data was produced at very high ground resolution at 1m, and the 30-meter vegetation index data was generated on a very high temporal resolution of 8-days. Higher resolution data from this study will bring many benefits to downstream users, such as easy interpolation and identification of areas, which need riparian restoration. In addition, stakeholders can now be able to prioritize restoration sites based on both spatial scales and temporal scales.



Channel Changes Over Time at One Location along Main Stem of Genesee River

All vegetation extent and riparian vegetation index data were developed into an online web app to be shared though a web portal, with an accompanying detailed step-by step guide. Also included on the web portal is the NDVI and EVI explorer developed using GEE. This tool will give everyone the ability to utilize the convenience of rapid vegetation index extractions from Landsat 5, 7, and 8 imagery.

National Projects

✓ AmericaView Trifold

After completing the publication of the AmericaView brochure, the Outreach Committee recommended that AV should have its own trifold that could be easily printed by any stateveiw, in any quantify, for whatever event. **LouisianaView** was again asked to help with the design, extracting information from the brochure and retaining to "look and feel" of other AV outreach materials. In February 2016, the StateViews were provided with copies printed in bulk by LouisianaView so they could be used for the spring visits to policy and decision makers, as well as the many upcoming professional conferences. The trifold was also made available for download on the AmericaView website (http://bit.ly/AVTriFold).

✓ AVportal Upgrade

Just as the AVportal provides the interface for StateViews to enter their internal grant period requests for continued funding and to report the accomplishment of the grant period, it is also an archival and record retention database environment for activities accomplished by AmericaView for the USGS grants. When it was upgraded to include new features aligned with the grant beginning in December 2013, the upgrades were not sufficient for all possible uses. Jeong (JC) Seong, **GeorgiaView**, acknowledged the inadequacy of the underlying data architecture and resulting "duct tape" repairs. However, more analysis revealed that the most important needs could be accommodated at less resource cost by more fixes than by restarting. The AVportal retains elements (like activity codes) binned into categories, that reflect information used for the previous grant from USGS, rather than the objectives of the current grant. At the Fall Technical Meeting in October 2015, recommendations emerged to alter both the request and reporting requirements for any subsequent grant. The AVportal design should be agile enough to support other grants from sources other than the current USGS LRS award. JC corrected or altered some of the output software, which facilitated the preparation of the Technical Reports.

- ✓ AV Website Improvements, Additions, and Maintenance

  When Sam Batzli, **WisconsinView**, prepared his proposal for the relocation and the redesign of the AV website, he requested funding for site improvements and maintenance, continuing into the third grant period, which was approved with the GY2015 budget. Meeting monthly with the AV staff ensured work progressed aligned with AV needs. Among other efforts, the following improvements were made:

  - Placing all StateView factsheets on the site
  - Building separate webpages for the Education Committee and the Outreach Committee
  - Adding new K-12 tutorials and lesson plans
  - Adding webpages for the Landsat and the Water Quality working groups
  - Create Google accounts for the calendar
  - Improve the "search" interface to the embedded Education portal on the website

Grant Period 4

The fourth period of this grant (GY16) offered an expanded opportunity to promote the mini-grant program, given the USGS approval of the AmericaView request for grant augmentation (See Part II of this report.) Twenty-one StateViews submitted proposals, reviewed following the AV procedures for internal competitive solicitations and approved by the AV Board. Awards, none of which exceeded $7500, were announced in late August for work to be completed in late November and summary reports were submitted by 20 December 2017. In addition, another mini-grant overseen by Rick Lawrence, **MontanaView**, to support USGS's Landsat requirements gathering, was separately approved by the AV Board. To ensure all available funding was aligned with StateView work for the objectives of the grant award, within the last quarter of the award, "mini-mini" awards were made to PI's who were willing to accomplish even more with very limited funding in a short period of time.

Mini-Grants

- ✓ Using Small Unmanned Aircraft Systems to Assess Rainwater Harvesting Potential for Urban Multi-family Housing

  Luke Marzen and Chandana Mitra, **AlabamaView**, and Austin Bush, their graduate student, completed a project focused on examining methods used to derive highly accurate aerial measurements that can be used for further sustainability studies. In their specific case, the application examined rainwater harvesting and determining its potential by using the aerial measurements derived from sUAS imagery. The final deliverables of this project were instructional videos, each part of a 5-part series that details the topics of

  1. Rainwater Harvesting,
  2. FAA & sUAS Laws,
  3. Image Collection process with sUAS,
  4. Image Processing, and
  5. Calculating Rainwater Harvesting potential.

  These videos are intended for a public audience via a video-sharing platform, such as YouTube. These videos are accessible through the AV website also, as addressing part of the sUAS Working Group's strategic plan.

- ✓ ArkansasView collaborative geospatial UAS highlights

Jason Tullis, **ArkansasView**, built upon UAS advances in Arkansas that have been largely supported by the University of Arkansas, USGS and AmericaView, and the UAS Research Center at Oak Ridge National Laboratory. This mini-grant funded two interrelated projects. First, in Sep-Oct 2017 ArkansasView interchanged strategies, techniques, and approaches to UAS capacity building with leading UAS researchers in ArkansasView, UtahView, and OregonView through on-site workshops and presentations within each state. Second, in Oct-Nov 2017 ArkansasView organized, captured, and developed three videos highlighting ArkansasView's UAS-related experience. Each video is between 5-6 min in length and in compliance with ADA requirements. They can also be found at the AV website. Their titles are:

Jason Tullis learning about the senseFly eXom in the laboratory of Chris Parrish at Oregon State University

1. "Creating Thermal Orthomosaics from the FLIR Duo R"
2. "Geotagging Images from the 3DR Solo, Part 1: Downloading Log Files"
3. "Geotagging Images from the 3DR Solo, Part 2: Geotagging in Mission Planner"

✓ <u>Exploring Opportunities to Develop a Web-based Adaptive Learning Environment to Harness Remote Sensing in Connecticut's K-12 Education</u>

Chandi Witharana and James Hurd, **ConnecticutView**, used the mini-grant opportunity to develop web-based educational applications using remote sensing that could potentially address the new NGSS and Social Studies Frameworks currently being developed and implemented in Connecticut and to begin development of prototype educational materials. This mini-grant opportunity allowed ConnecticutView to expand the sub-grant high impact activity (HIA) approved in grant period 4 (GY16), which had the title "Opportunities to Support State Educational Standards." The two investigators determined that new Connecticut Elementary and Secondary Social Studies Frameworks provide an appropriate application for introducing remote sensing as an educational tool to address World Regional Studies, particularly the theme of Human-Environment Interaction. They focused on grades 6-7 as the specific grade level for which the materials are being developed, based on the current working relationship ConnecticutView has with a Middle School near the University of Connecticut campus. They presented the prototype lessons (in a web-based mock-up PDF file) over two days to a classroom of 21 students at Hall Memorial School in Willington, CT to get initial reaction and feedback. The content is intended to be transferred into a web-based interface accessible by teachers and students. Teacher feedback like the following is critical to this work: *"I am intrigued by the technology and find much of this information is new for students, therefore, grabbing their interest right away. Most have never heard of remote sensing and begin asking questions right away. I understand the ultimate goal is for teachers to utilize an interactive webpage to engage students using these lessons. There is still work that needs to be accomplished on the prototype lessons, but, as an educator, I look forward to the opportunity of having access to these types of lessons for use in future classes. I feel this provides me with another resource to excite the students about learning."* Student reactions are comparably important: "*Liked the pretty images*." "*Liked the spectral reflectance quiz*." "*Liked learning about remote sensing*."

✓ <u>Enhancing Delaware's High School Geography Curriculum with Remote Sensing and Digital Imagery</u>

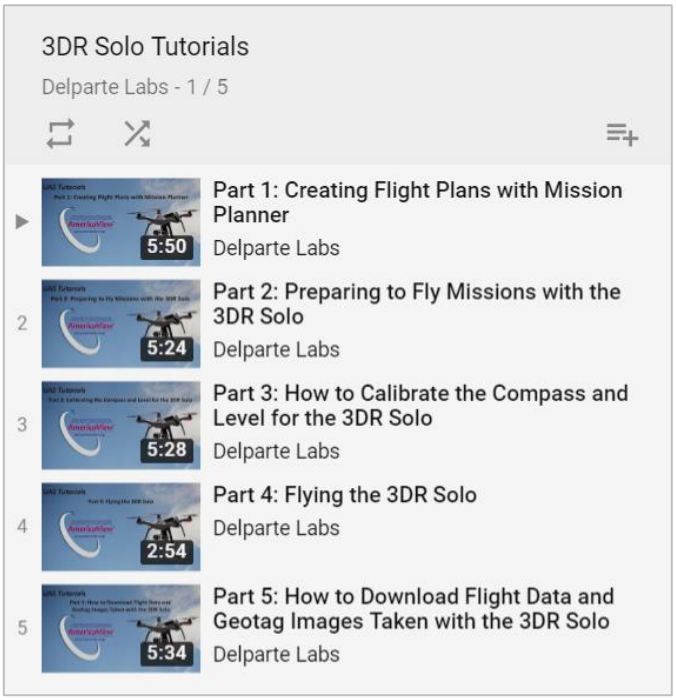
Tracy DeLiberty, **DelawareView**, made a proposal to link the remote sensing, GIS and K-12 teaching expertise within the University of Delaware Department of Geography and the Delaware Geographic Alliance (DGA) to establish new instructional lessons for the high school geography curriculum that would meet the Delaware

geographic education standards. *Geography in the Modern World* for Delaware's high school students contains five units, each with several lessons and its own unit's performance task. Seven lessons were identified with the potential for enhancement with remote sensing data and technologies. The geography professor built an ArcGIS Online story map - "Remote Sensing our Changing World". Its objective is to introduce remote sensing for Earth science classes to high school teachers.
(https://udel.maps.arcgis.com/apps/MapSeries/index.html?appid=ce2ec2f2d0b94fac94b213e182b1a50a
Maps, photos and images were also developed to support two lessons. One focuses on a very popular music festival and the other the European Union. These two applications support the *Basics of Spatial Analysis Unit*, Lesson 3 "Special Event Planning and Complementarity" and the *Purposes and Uses of Regions* Unit, Lesson 1 "What's so 'formal' about Formal Regions." In addition, a teacher workshop was held on 30 November 2017 at a school district teaching facility in the middle of the state so that all teachers had accessibility to the training. Two additional map applications will be developed based on teacher feedback at the workshop to illustrate Delaware's changing landscape and Everglades.

✓ UAS Education for Geosciences

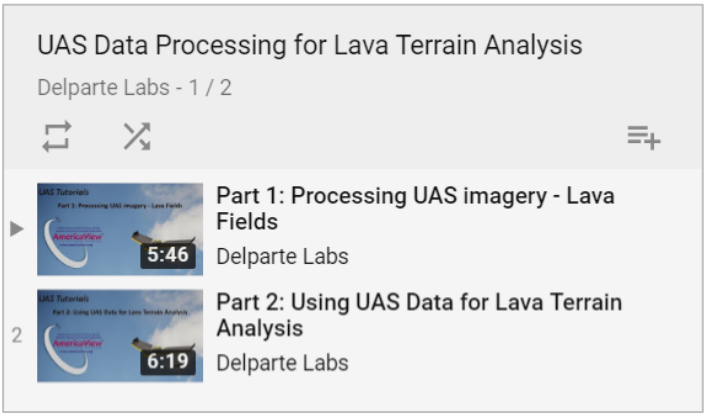
Donna Delparte, **IdahoView**, collaborated with other members of the sUAS Working Group to develop Internet ready video-based educational materials in key UAS application areas. IdahoView leveraged instructional material already developed to make them more accessible through the development of several video tutorials. Originally intending to provide four videos, IdahoView actually released seven.

- Module Series 1: Introduction to UAS mission planning and field data collection for the 3DR Solo.
  This is a collection of **five** videos of approximately 5-6 minutes in length. The 3DR Solo is a UAS platform that is part of the USGS fleet and commonly used by Department of Interior agencies. We anticipate that this sequence of videos will be useful for our partners' training needs.



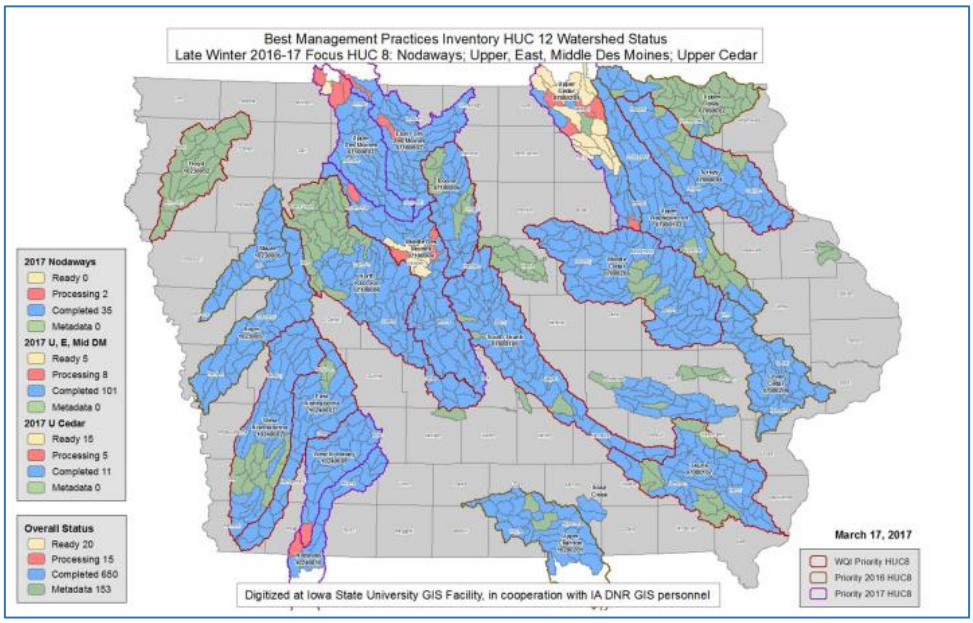
- Module Series 2: UAS Data Processing for Lava Terrain Analysis.

This collection of **two** videos highlights the data processing and analysis of UAS data collected over a lava field. The instruction highlights how to determine a ruggedness index for the Digital Surface Model.



✓ Developing Tutorial Documents for the Conservation Practices Inventory Data Creation Process and Related Datasets

Robin McNeely and Amy Logan, **IowaView**, recognized an opportunity to augment the work of several public agencies and two private organizations. They have funded portions of another project developing methods to inventory and monitor conservation practices that could potentially meet nutrient reduction targets for Iowa watersheds. Since 2015, a process has been developed and refined at the Iowa State University GIS Facility with collaboration from the Iowa Department of Natural Resources (IDNR), which resulted in the development of a baseline dataset (2007-2010), the Iowa Conservation Practices Inventory, which provides a meaningful record of commonly used in-field and off-field conservation practices for reducing soil erosion and nutrient loss. The IowaView staff wrote a program handbook and developed tutorial documents with associated data and file templates to enable other states with appropriate input data to plan and implement their own state's conservation practices inventory. The resulting tutorial documents were created so that they can be used in a workshop format. The inventory dataset creation process is the major focus of the tutorial package; however, three companion projects developed out of the initial work and were covered in their own tutorials as they provide additional value to the base dataset. The first companion project uses historic decadal imagery going back to the 1930s and two funding agencies expressed interest in knowing when practices were implemented or alternately, if they were present in a specific decade. The second project uses recent imagery (2016) to track practice continuity and change and when used in conjunction with baseline (2007 - 2010) and historic information, provides a multi-decade look at conservation practice location, density and alteration. The third effort focuses on identifying agricultural drainage tile lines from aerial imagery, which can provide a clearer picture of water movement than is apparent just from surface elevation data. All the documents, tutorials, datasets, spreadsheets and scripts are part of a complete project zip file that can be found on the IowaView website, https://www.iowaview.org/iowa-conservation-mapping-project/



✓ Training a Tribal Workforce to Integrate UAS Mapping and Monitoring into Environmental Applications

Stephen Egbert, **KansasView**, and PhD student Josh Meisel teach GIS and remote sensing courses at a "local Native American partner university" - who requests that the university's name not be used in reports without prior concurrence - met with representatives of the Kansas Department of Transportation (KDOT) and administrators of that partner university to explore ways for the university to be involved in an initiative by KDOT for Kansas to become a major hub for UAV training and enterprise. The proposal, with the partner university playing a key role, was submitted in December 2017 to the US Department of Transportation. KansasView coordinated with Mark Junker of the Sac and Fox Tribe in Kansas to arrange for UAV aerial mapping contractors to price UAV mapping of portions of four Native American reservations within Kansas, areas that would be used in the courses. An inaugural

course on UAV mapping was taught by Egbert at the University of Kansas during fall semester of 2017. The experience gained and lessons learned from teaching the course will not only result in a refinement of the course taught at the University of Kansas, but also will serve as the foundation for the UAV mapping course to be offered at the partner university. Meisel has already incorporated some UAV imagery into two of his GIS courses taught at the partner university. During the period of the mini-grant, the partner university received notice of substantial funding from the National Science Foundation for enhancing its GIS program. Part of the funding will be used for annual summer training programs referred to as the Haskell Environmental Research Studies (HERS) Program involving Native American students from throughout the US. UAV mapping will be part of the program, as an outcome of the teaching plans developed as part of this KansasView mini-grant.

✓ <u>StateView Program Development and Operations for the State of Louisiana</u>

Brent Yantis, **LouisianaView**, proposed to intensify the outreach impact of his sub-grant "Earth As Art" high impact activity (HIA). Working with the Lieutenant Governor's Office for the State of Louisiana, the Pixus Corporation and Barnels Art and Framing Gallery, LAView produced new Art Gallery Exhibit pieces of "Earth as Art" imagery, including Landsat and Aerial System captured images, to bridge the worlds of Art and Science. Many of these exhibit pieces were based on Louisiana cultural and historical areas. i.e. Poverty Point - located near Epps, Louisiana and the Mississippi River Delta. These became part of the STEAM promotion of Earth as Art within our classrooms, colleges and gallery exhibits open to the public. As a result of this mini-grant, six (6) new images (subdivided into smaller sections, therefore allowing the layout of the canvases to become art itself) were added to the large canvas gallery exhibit and seven (7) new puzzles (digital and physical) for educational outreach were produced. These new additions were able to travel to the national PECORA conference in Sioux Falls, South Dakota in November 2017 for both a panel presentation and exhibit floor interactions. The art images and puzzles were enjoyed by adults and students alike, with over 150 conference participants expressing interest in the puzzles and over 300 students viewing the Art and having hands-on interaction with the puzzles. This mini-grant also enabled participation with a teachers training, career education event, held in Brookings, South Dakota collaboratively conducted by South DakotaView, TexasView, OhioView, and LouisianaView.

✓ <u>MinnesotaView UAS Education Development</u>

Joseph Knight, **MinnesotaView**, observed that, in contrast to the high demand for UAS activities, there are relatively few UAS education programs at higher education institutions. His project developed UAS educational content suitable for delivery in a variety of formats, including traditional lectures, workshops, and online. Content, sufficient for a full-semester UAS course and three-day and five-day UAS operations workshops, will be made available online through UMN, once its web delivery platform has transitioned, and also on the AmericaView-sponsored Remote Sensing Core Curriculum website. The 15-week introductory UAS course is underway, having begun in January2018.

✓ Manual for Remote Sensing Image Analysis in R: Including Agnostic Image Analysis

Rick Lawrence, **MontanaView**, with Shannon Savage, Emma Bode, and John Long prepared this document to describe one approach to conducting image analysis, using the free statistical program R. As Rick has frequently cautioned, processing imagery is "working at the cutting edge of statistics." The analyst is confronted by 141 classification methods and 126 regression methods. The introductory comments in the manual note: "*Every dataset has a distinctive, and often complex, data structure. Each statistical method has explicit or implicit assumptions with respect to data being analyzed. In-depth knowledge of the structure of a dataset and the assumptions underlying the wide range of statistical methods available could enable, theoretically, an analyst to select the best statistical method to apply to a particular dataset a priori. The reality is that neither the necessary knowledge with respect to the data nor the methods are commonly, if ever, fully available. An analyst is, therefore, best served by evaluating multiple methods, if such can be done with acceptable efficiency*." The Manual and the R scripts are available at the AV website. https://americaview.org/program-areas/research/remote-sensing-imagery-analysis-with-r/

✓ The AmericaView Water Resource Gateway: Moving from concept to implementation

Lindi Quackenbush, **New YorkView**, began an initial proof of concept to address the Water Quality, Quantity, Utility Working Group's strategic objective to create pathways to engage the AmericaView consortium with experts from federal or state agencies and water-focused organizations through a "Gateway" concept. The gateway is not simply a data repository. It is an "environment" that aims to build on the strength of the nationwide AmericaView consortium as a starting point to engage water quality and natural resource managers, NGOs, federal and state agencies, foundations, the public, and researchers with the goal of addressing and solving nationally occurring WQQU issues through more efficient knowledge transfer. The project specifically focused on three goals:

1. Research existing data distribution interfaces and approaches to database organization that may provide a template for the water resource gateway;
2. Collect water resource case study information;
3. Develop and launch a test database/interface using the case study data collected.

The project tested two different approaches to launching the gateway: Google and Esri based. The Esri based examined both a "story map" approach and as ArcGIS Online approach. Development and testing aimed to explore the best means to host the gateway, and to determine potential structures for organizing the data that will most readily enable a user to answer the question they are seeking. A part of the testing also aimed to assess the level of interaction and management needed for long-term support of the gateway. The gateway concept will be most successful if it is organized in such a fashion that it is largely self-sustaining, with researchers readily able to add data with minimal external data support needed.

The following three tables from the mini-grant report provide preliminary assessment and should not be characterized as complete. This project involved substantial experimentation and provided a step forward in scoping the requirements for the AV water quality portal and the instantiated Gateway environment. Work will continue and the working group will offer observations and recommendations.

Advantages	Disadvantages
• No cost.	• Require some html coding.
• The entire data structure is completely streamlined once set up. From contributors to portal users, there is minimal effort needed to maintain the backend database.	• Call/data limits: Fusion table 25000 request per day, 250MB per table (ex. excel file of 8 research is around 15kb) Google Maps API 2500 request per day.
• There are clear examples and guidance in using every component of the Google products, as well as the final website building.	• Fusion table functions learning might be a bit involved for first time users, although not impossible.
• Every component in the data stream is completely customizable and open for any modifications.	• Need a place to host final website.

Table 1. Summary of advantages and disadvantages of Google approach to port

Advantages	Disadvantages
• Easy to access remotely.	• No simple method to search projects, e.g. by keyword
• Attractive interface to display data and incorporate new projects.	• No simple means to hyperlink e.g. to associated article.
• Very large server database, enables uploading and storage of a lot of data on ArcGIS webapp.	• Limited control over interface and questions being asked.
• Somewhat prefabricated webapp available that was appropriate for sharing knowledge.	• Limitations with base map e.g. hard to find water bodies on a grey basemap.
• Easy to upload projects and place them on map.	• Limitations with including non-point project markers.
• Huge network of information and resources.	
• Resolution of some issues possible through more advanced programming.	

Table 2. Summary of advantages and disadvantages of Esri Story Maps approach to portal

Advantages	Disadvantages
• Clear user interface.	• Need to have a sole owner and be backed by a user's account.
• Simple to work with for users with some GIS experience.	• ArcGIS is very costly if a subscription is required.
• Huge network of users and technical support.	• Unclear how much data can be on the GIS account.
	• Difficulties with public publishing that may be associated with Institutional license.
	• Most efficient when collector and viewer applications are separated.

Table 3. Summary of advantages and disadvantages of Esri ArcGIS Online approach to portal

- ✓ SPatial LITeracy (SPLIT) Remote Sensing: An integrated research-educational approach to support surface water quality monitoring

  Anita Simic, **OhioView**, teamed with Roger Blevins (Huron High School, Ohio) and Kristin Arend (Ohio Department of Natural Resources, Division of Wildlife) to provide a series of field campaigns and educational events at the Old Woman Creek National Estuarine Research Reserve, Huron High School and Bowling Green State University. A group of three graduate, five undergraduate, 10-15 high school students and several teachers were involved in the program. As part of the project, Anita Simic organized a one-day workshop at BGSU for the students of Huron High School as well as other local high school teachers to introduce them into the field of remote sensing and other aspects of Spatial Literacy. The event consisted of multiple lectures by professionals in the field of remote sensing from BGSU, NOAA and from NASA's Glenn Research Center, some hands-on experience with the remote sensing software, and a panel discussion on Remote Sensing Education. The focus of the panel discussion was centered on attracting students into the field of remote sensing, as well as other STEM fields, early and how to keep them interested throughout high school and university. YouTube videos, local newspaper articles, twitter and Facebook traffic, packets for teachers, and online webinars were tangible outcomes. Interest in forthcoming similar events - a somewhat intangible but significant accomplishment - highlights the importance of such education outreach.

- ✓ Annual maps of open surface water bodies in the Contiguous US (CONUS) at 30-m spatial resolution during 1984 – 2016

  Xiangming Xiao, **OklahomaView**, with his supporting team, developed a simple and novel algorithm to identify and map open surface water bodies through analyses of Landsat images at 30-m spatial resolution. With this mini-grant, that mapping algorithm for open surface water bodies was applied to all pixels with good-quality observations in the ~370,000 Landsat images on the Google Earth Engine platform. For each pixel, the annual frequency of observations classified as open surface water body was calculated by dividing the number of observations identified as open surface water within a year by the total number of good-quality observations in a year. Individual pixels were identified as yearlong if that division outcome was >= .75. The areas of all yearlong water bodies in the entire CONUS were calculated for each of the 33 years (1984-2016), making this the longest historical dataset of open surface water bodies available for the CONUS. The average annual water body area in the entire CONUS was also calculated. The total area of yearlong water bodies at the state- and watershed-scale over the study period was calculated and analyzed for the inter-annual variation of open surface water bodies. The team also compared the annual maps of open surface water body with available datasets of open surface water bodies, including the USGS National Land Cover Dataset (NLCD) 2011, and the European Joint Research Center (Pekel et al., 2016). In addition, a manuscript, entitled "Divergent trends of open surface water body area in the contiguous US during 1984-2016: Dry versus wet states", submitted to the Proceedings of the National Academy of Sciences of the United States of America (PNAS) in late November 2017, has been published.

- ✓ Geospatial Education and Outreach: K-12 Teacher Workshop and Earth Observation Day (EOD) Events

  Mary O'Neill, **South DakotaView**, in conjunction with personnel from OhioView (Brad Shellito), TexasView (Rebecca Dodge), and LouisianaView (Brent Yantis), prepared and delivered a one-day workshop entitled "Storytelling with Maps" to 16 K-12 educators and one higher education pre-service educator. The workshop was held at Mickelson Middle School in Brookings, SD, on November 18, 2017. Topics at the workshop included the

basics of remote sensing, types of remotely sensed imagery, geographic information systems, ArcGIS Online, Storymaps, GeoInquiries, and the five open-source mapping tutorials. The LouisianaView "Earth as Art" exhibit was displayed at the workshop along with the LouisianaView puzzles. Workshop participants could earn one graduate credit for the workshop upon completion of a post-workshop assignment that consisted of an evaluation of each of five open-source mapping tutorials prepared by VAView. Evaluation comments from each of the seven teachers who registered for the graduate credit were sent to Jim Campbell and his cohorts for their use in finalizing the tutorials for publication.

Following that weekend event, Mary O'Neill and Pravara Thanapura visited second-grade classrooms at Hillcrest Elementary School in Brookings, SD, on November 20 and 21. During the visits, the second-graders and their teachers viewed a map of South Dakota using an ArcGIS Online app that included several interactive layers of information for South Dakota such as remotely sensed imagery, highways, rivers, lakes, railroads, and cities and towns. Each student received Earth Observation Day posters for 2016 and 2017. The "Lands of Landsat" game on the 2017 poster was explained as was the online puzzles. The urls for the South Dakota from Space app and the puzzle were sent home with each student so that they could share the information with their parents. The image shows second-grade teachers preparing to distribute the materials for EOD to their students.

✓ <u>Engaging Undergraduate and Graduate Students in Geospatial Technology through Documentation of Natural Hazards in Texas: The ESRI Story Map Approach</u>

Rebecca Dodge, **TexasView**, provided academic leadership on engaging students at Midwestern State University in a Natural Hazards and Disaster course with research projects designed to document the impact of a natural disasters in Texas using satellite imagery. These projects, which covered wildfire, drought, flooding, and hurricane impacts, were done using ArcGIS Story Map templates and included maps, imagery, photographs, and contemporary journalistic and scientific reporting. Developing a Story Map has been demonstrated to be an excellent approach to fostering student geospatial skills development. The Story Maps covered the following events that affected the State of Texas, including several State Parks:

- *Brazos Bend State Park Flooding*, Texas, 2016
- *Hurricane Harvey*
- *Salvinia Coverage over Time, Caddo Lake State Park*
- *Brazos River Flooding*, Texas, 2016
- *Sea Rim State Park on Texas Coast and its Natural Hazards*

Rebecca joined Mary O'Neill, Brad Shellito, and Brent Yantis in Brookings, SD to provide a workshop for teachers, who were trained in the use of the Story Map tool with these examples. She also based image interpretation exercises on her other interesting "Watching over Texas from Space" materials.

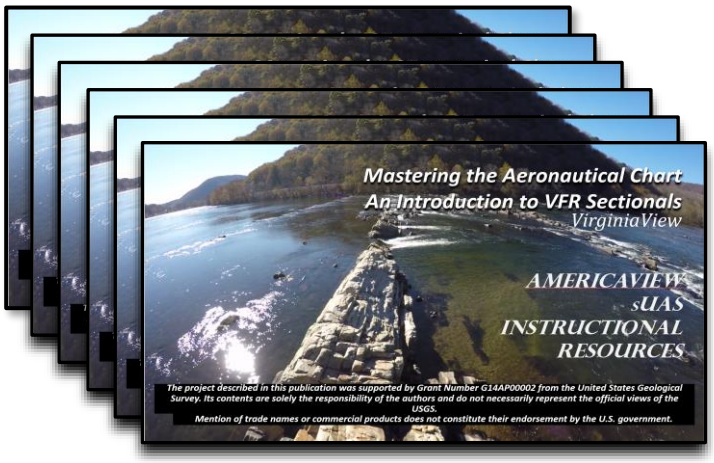
✓ <u>Unmanned Aircraft Systems for Disaster Response</u>

Jarlath O'Neil-Dunne, **VermontView**, in collaboration with members of the UAS working group, developed UAS materials in several key application areas. VermontView led the disaster response portion of this collaborative

effort. The key outcomes of this work was a video, included with those mentioned above, highlighting how UAS were employed in a disaster response exercise along with a fact sheet to help universities seeking to employ UAS for disaster response activities. As part of the mini-grant, VermontView participated in disaster response and after-action planning activities in collaboration with federal and state entities. VermontView also participated in the STARBASE program. STARBASE's mission is to raise interest in and improve the knowledge and skills of youth in science, technology, engineering and math (STEM). VermontView personnel assisted in the STARBASE drone program and Hunt Middle School in Burlington, VT. The Factsheet with the Five Tips for disaster response activities is found in the last appendix of this report.

✓ <u>Videos to support preparation for the FAA's Remote Pilot Airman's Certificate for sUAS</u>

James Campbell, **VirginiaView**, developed brief videos to assist in the preparation of applicants for FAA's Remote Pilot Airman's Certificate for sUAS. This certificate provides UAV pilots with an avenue to use UAV flights for research, commercial, and practical operations beyond the recreational activities of the hobbyist's use of UAVs. Unlicensed UAV operators, although often competent in operation of UAVs within the recreational realm, require extensive preparation and experience to complete the Federal Aviation's Administration's *aeronautical knowledge test,* which include proficiency in reading aeronautical charts. ("Part 107 small Unmanned Aircraft Systems (sUAS) ALC-451" training course.) The VirginiaView aeronautical VFR sectional chart video instructional package includes six videos, each roughly 7 minutes in length, covering key points for understanding the VFR Sectional Chart:



1. What is a Sectional Chart?
2. Sectional Charts - Layout and Ancillary Data
3. Legend and Symbology
4. Airspace
5. Special Use Airspace
6. Reading and Using the Sectional Chart Flight Planning

These videos, provided without cost to those preparing for the exam, through easily assessable media, offer a valuable resource for individuals and institutions focused upon FAA qualification for FAA's Remote Pilot Airman's Certification. They are on YouTube and accessible through the AV website, as part of the UAS Working Group's strategic plan.

- ✓ Tutorials and Examples for Educational Use and Discovery of Landsat and other Remote Sensing Imagery in the RealEarth™ Website and Mobile Apps

  Sam Batzli, **WisconsinView**, extended and enhanced access and use of Landsat and other satellite imagery by leveraging the RealEarth™ visualization software for desktop browser and mobile apps. This effort continues that work for imagery visualization initiated under the mini-grant award to Sam in the first grant period.

  Tutorials are the outcome of this mini-grant with introductory material and "how-to" demonstrations recorded through this project offer users a guide to using this free software. The examples in these tutorials focus on the use of Landsat imagery in combination with other imagery and data. By learning how to use the software and seeing Landsat examples, students and practitioners of remote sensing may discover new uses and applications of Landsat imagery and RealEarth™ software in their own learning, research, and teaching activities. This project resulted in the following video tutorials that are posted on the AmericaView website):

Introduction to RealEarth	Viewing Flooding
Adding Layers to the Map	Land Use / Land Cover Change
Animation Tools and Controls – Basics	Tornado Swaths
Sharing a Map or Animation	Uploading Your Own Imagery
Adding Landsat False Color	Intro to RealEarth iOS
Probing Landsat Footprints	Intro to RealEarth Android

- ✓ Citizen science, remote sensing, and mapping quality of life A West Virginia View citizen science initiative

  Timothy Warner, **West VirginiaView**, and Nektaria Adaktilou developed the planning and infrastructure for a citizen science effort to collect the ancillary data needed to build a comprehensive map of urban quality of life for Morgantown, WV. Involving citizen scientists not only provides valuable data for the urban planning study, but also educates the public regarding the unique value of imagery such as Landsat. A detailed plan for a citizen science-mapping project and the supporting material for recruiting and training citizen scientists, as well as a mechanism for participants to report their results, has been generated. The comprehensive plan and the associated documents are available to potential participants as well as the greater scientific community through the West VirginiaView website, wvview.org. The project has laid the groundwork for future implementation of the project. Seasonal measurement campaigns will be conducted in February, April, July and October for a week around the satellite pass. The areas where the measurements will be taken will be determined on the basis of a Land Surface Temperature map that Nektaria Adaktilou had produced for 2015, identifying hot spots and cooler areas in the broader Morgantown area. The analysis for the thermal comfort mapping will be based on the in situ data collected by the citizen scientists, which will be integrated with the products of the Landsat imagery (LST maps).

- ✓ Video tutorial for flying sUAS in closed canopy environments

  Ramesh Sivanpillai, **Wyoming View,** set as a goal of this mini-grant to acquire two set of videos of target plants, which were strategically placed at several locations among tall trees inside the Williams Conservatory, an enclosed greenhouse. One sUAS flight would be under normal (calm or no-wind) conditions while the second was to be flown under turbulent (when the air vents are operational). WyView PI recorded several videos with a DJIII sUAS that was flown by a UW graduate student. Unfortunately, the second scenario was not possible since the air vents did not operate during the video recording sessions. Lessons were learned, however, about flying in a conservatory and collection continues in an effort to capture some turbulence videos.

✓ Extending EOD activities using change-pair image maps and puzzles

Ramesh Sivanpillai, **WyomingView**, used part of this mini-grant funding to expand Earth Observation Day impact. Ramesh distributes these activities throughout the year as he and his graduate students visit the states' schools. He improved the change-pair card game, used for the 2016 EOD and found on the AV website, with a change-series game featuring Cheyenne, Farson and Eden Valley, and Jonah Field. The change-series were printed as 9x9 photos and several sets were distributed to three schools. WyView also generated six (6) word activity puzzles such as unscramble and word search. Following the lead of LouisianaView, WyomingView also ordered some Jigsaw puzzles (224 total) distributed in January 2018 to the three schools mentioned previously. Some puzzles are held in reserve, as an outreach material while visiting other schools as part of future EOD. With this mini-grant start-up funding, Ramesh was able to secure additional funding from the Wyoming Center for Environmental Hydrology and Geophysics (WyCHEG – an NSF funded project), and Wyoming ESPSCoR to complement the funding received from AV and allowed purchase of 10 iPads. Hard copy image maps, also generated with the mini-grant funding, will be uploaded as digital files (TIFFs and pdfs) in order for teachers to 'zoom-in' to specific parts of the images to obtain detailed information.

✓ USGS Requirement, Capabilities, and Analysis for Earth Observations

Rick Lawrence, **MontanaView**, has been the AmericaView representative to the Landsat Science Team meeting during this full USGS grant. For years, he has supported AV's internal surveys to gather feedback from members about users' needs. In anticipation of the collection system to follow Landsat 9, USGS established an initiative, with contract support known as the Requirements, Capabilities, and Analysis (RCA) for Earth Observations (RCA-EO) to document user requirements for Earth observation data and the benefits that these data provide to Federal programs. The initiative was not configured to reach local community and regional levels, where Landsat data are quite often heavily used. During a side conversation at the January 2017 meeting of the Landsat Science Team, Rick Lawrence suggested an approach that would expand the reach of the requirements gathering, if the RCA Team could train AmericaView members to conduct the needed interviews. At that time, the database of requirements was assessed to comprise 85% federal agency and 15% academic input. To test the concept, an unfunded pilot initiative, led by Rick Lawrence, provided training from Carolyn Vadnais of Integrity Applications to three AV members (Montana, Texas, Wyoming), who completed a few interviews prior to the early April AV Winter Business Meeting (WBM). At the WBM, a session was devoted to discussing the experience and clarifying several points. Several StateViews expressed their interest in supporting this effort, with some funding. The

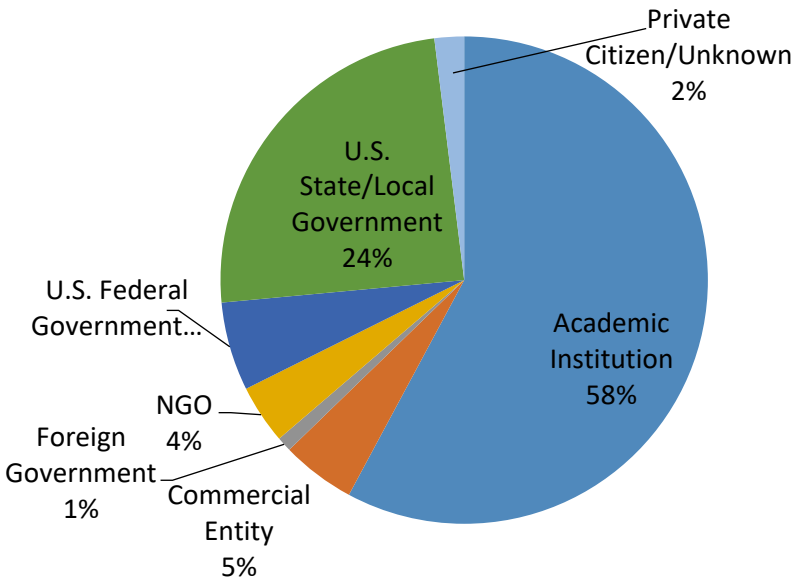


Figure 5. Distribution of AV-Interviews for RCA-EO

augmentation funds approval by USGS allowed one hundred and two interviews to be completed by eleven AV PIs or Co-Is. The graphic shows the distribution of interviews.

National Projects

- ✓ AVportal Revision

  Jeong (JC) Seong, **GeorgiaView**, accepted the task to continue modification of the AVportal. Changes made help ensure the portal remains an accessible and reliable archive of AmericaView's support to USGS for the past two full grants, covering GY2008 through GY2016. (Calendar years from 2008 through 2017.) The changes also posture AV for future activities with USGS and other sources that continue to support the remote sensing objective of the organization. The scope of the work in this fourth grant period include an improvement in the activity input process; better facility to describe, monitor, and report on multi-year activities; a mechanism to incorporated mid-grant period budget modifications; and updates to the keyword search function.

- ✓ AV Website Updates

  Sam Batzli, **WisconsinView**, continued throughout the fourth period of this grant, to have national project funding to add features to the AV website. The sub-grant and mini-grant awards in GY16 resulted in several instructional videos, now accessible through the website. The Esri Story Maps have also been incorporated as an example of a technique that is academically effective as well as material replete with excellent information.

"Mini-mini" Grants

- ✓ A short tutorial on "Mapping of Inland Water Quality Using Remotely Sensed Data"

  Haluk Cetin, **KentuckyView**, prepared a tutorial to show how to map inland water quality, such as turbidity, using satellite remotely sensed data and limited in situ data. Two satellite sensor datasets, Landsat-8 and Sentinel-2A, were downloaded from the US Geological Survey's EarthExplorer website, for two reservoir lakes, Kentucky Lake and Lake Barkley, in western Kentucky. In addition to the satellite imagery, the tutorial used lake-water quality data at several Kentucky Lake Monitoring stations. Simple regression models were used to relate turbidity values to the satellite pixel values for the mapping. This exercise was developed using ERDAS Imagine 2016. The long-term Water Quality monitoring program begun in July 1988 encompassing 12 primary sites and a number of embayments on the lower 30 km of Kentucky Lake. Monitoring sites have been selected based on sampling representations of the main stem and shallower embayment locations. Copernicus Sentinel 2-A data were processed the same way the Landsat-8 data were processed. Sentinel 2-A bands with 10m and 20m resolutions were used for this tutorial.

- ✓ Development of Google Earth Engine-focused Remote Sensing of Environment lab exercises

  Lindi Quackenbush, **New YorkView**, used this funding to develop several lab exercises that can be executed using GEE that will fit within the scope of a planned Remote Sensing of the Environment class at State University of New York College of Environmental Science and Forestry. Such materials are intended to provide useful insights for others developing similar courses. Deliverables for this project include lab exercises:
  - Lab 1 – Fundamentals of Google Earth Engine (GEE) API
  - Lab 2 – Image Preprocessing and Visualization: including image re-projection, image registration, shadow and cloud removal, and spectral index calculation

- Lab 3 – Digital Image Processing: including techniques for contrast manipulation, smoothing, and edge extraction
- Lab 4 – Image Classification and Time-based Analysis: including supervised and unsupervised classifications, spectral mixture analysis, classification accuracy assessment and time series analysis

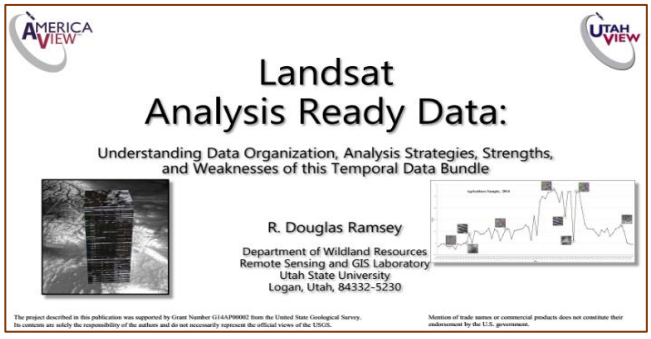
✓ Outreach Webinars and Journal Paper to support the recent project: "An integrated research-educational approach to support surface water quality monitoring"

Anita Simic, **OhioView**, recorded webinar sessions to expand the existing series of webinars on the following topics: a) Landsat b) Sentinel-2, and c) field spectroradiometer data processing. The instructions in the webinars demonstrate how to download, process, and manipulate images. Easing access to imagery will encourage K-12 and university students, teachers, and others to extract various information such as crop status, for instance. In addition, she wrote a summary journal paper about the project, which she has submitted for review. She explained the importance of the cascading pedagogical flow.

✓ Landsat Analysis Ready Data (ARD): Understanding Data Organization, Uses, Analysis Strategies, Strengths, and Weaknesses of this Temporal Data Bundle. A Tutorial

R. Douglas Ramsey, **UtahView**, recognized the immediate need to help those using the recently released ARD format for Landsat collections. He commented: "As an example, a sample of one Landsat-ARD geographic tile shows that the entire data bundle covers 33 years (1984-2017) and consists of 2,876 individual Landsat 4, 5, 7, and 8 acquisitions. Within each acquisition, there are four image products, a jpg overview image and a metadata file (a total of six products). Between the four different image products (Surface Reflectance, Top of Atmosphere Reflectance, Brightness Temperature, and Quality Assurance), there are 12 individual image files. Understanding how these files are processed and their purpose can be somewhat confusing." He prepared a tutorial aimed at college-level students to:

- Dissect the structure and organization of Landsat-ARD data
- Show how to order and download Landsat-ARD data for a specific location
- Discuss how the images were processed to normalize spectral and radiometric differences
- Define the differences between Top-of-Atmosphere and Surface Reflectance
- Provide instruction on various methods to analyze the temporal bundle using point or area data extraction techniques to evaluate shifts in spectral responses indicative of landscape trends



On March 26, AV members and other invitees attended a webinar version of the tutorial, recorded for access from the AV website or You Tube.

✓ Landsat Geospatial Video Tutorial

Jarlath O'Neil-Dunne, **Vermont View,** released a new video tutorial to educate end users on how to download, process, integrate, and exploit Landsat data using ArcGIS Software. A previous tutorial video, he had developed on downloading, processing, viewing, and classifying Landsat data within ArcGIS (https://youtu.be/OXdAq_JtyUs) has been viewed over 11,000 times, but that video became outdated. The web sites for downloading Landsat data (GloVis and EarthExplorer) along with the leading commercial GIS software package (ArcGIS) have all undergone recent, substantial renovations.

- ✓ Exploring our Planet with Open Source Software

  James Campbell, **VirginiaView**, completed tutorial work with Tammy Parece to update written tutorials on Google Earth Web, Google Earth Pro and National Geographic Mapmaker Interactive and to prepare video guides to accompany these documents. This project completes several step-by-step video tutorials (in MP4 format), which can be uploaded to the web. These tutorials introduce both instructors and students to open-source and online software to support student learning in cartography, image analysis, GIS, and map interpretation. These resources have applications appropriate to introductory university courses (such as Virginia Tech's freshman-level Digital Planet), K-12 institutions, and community colleges. The accompanying 162-page tutorial manual "Exploring Our Planet with Open-Source Software" with accompanying video tutorials of this document is available through these websites: http://www.virginiaview.net/education and https://americaview.org/exploringourplanet.

Summary for Period 4

Period 4 approached mini-grant proposal requests in two distinct ways. When the proposal for period 4 was submitted in late spring 2016, with its intention to use a no-cost-extension from the original end of the grant period (30 June 2017) until 31 December 2017, StateViews were advised to plan for their work over eighteen months and to fully expend their sub-grant funding. Any mini-grant funding, garnered from savings in other budget lines, was anticipated to be very small. However, with the funding augmentation request for the period, mini-grants were an essential feature of the proposal. When the augmentation request was approved for the final five months of the extended period, immediately AV staff issued a Request for Proposals. StateViews were advised to select from eleven activity areas that had been identified during the preceding Winter Business Meeting. Twenty-one proposals were approved. A cluster of those proposals for teaching videos reflects collaborative discussions within the sUAS Working Group. All final reports were submitted and accepted by the Program Manager before early January 2018.

As both the baseline and augmentation Period 4 program plans neared completion, AV staff were also able to find some additional limited funding to support very small "mini-mini grants" to six StateView PIs, that extended work on some very promising activities. Work completed at the end of February 2018 and description provided above.

V. Budget Summary

Funding for the Grant Award

Background

Grant funding for the entire award totaled $5,000,000. Part II of this Final Report included a succinct summary of the modifications made over time.

Project duration was initially intended to extend over five grant periods.

However, USGS and AV had discussions and agreed that more funding should be awarded within a period, so that AV could expand the number of Full Members, each of which are awarded the same value sub-award following peer review and approval of a proposal submission. Modifications 001, 002, 003, and 004 of the award supported that approach, reduced the duration by eliminating a fifth period, and revised the award amount of the grant to not exceed $4,621,900.00

AmericaView requested an augmentation of Period 4 so that the full amount of the original award approved in December 2013 would be available. Modifications 006 and 007 provided that additional funding and a No-Cost-Extension until 31 March 2018.

Funding Distribution to the StateViews for the Grant Award

Each grant period, more than 70% of the period's funding went directly to support StateView Full Member sub-awards, developmental opportunity and mini-grants to Affiliates, Full Members or consortia members under contract agreement, and to Affiliate travel. As the AmericaView consortium strengthened its Committees and Working Groups more funding during the fourth period was aligned with the collaborative activities, as described in the previous sections.

		Percent Direct to SVs
Period 1: $724,287 of $ 960,000	Period 1	75.45%
Period 2: $ 914,425 of $ 1,217,400	Period 2	75.11%
Period 3: $ 909,790 of $ 1,217,400	Period 3	74.73%
Period 4: $ 1,146,014 of $1,605,200	Period 4	71.39%
Summary: $3,694,515.65 of $5,000,000	Summary	73.89%

By written agreement, not more that 15% of those distributions was absorbed by universities' indirect costs. No indirect cost (IDC) was claimed by AmericaView. The remaining 26.11% of the grant funds facilitated reaching the objectives of this grant. In supporting the program objectives of the grant, the program manager's and executive director's hours were predominantly expended on program. Additional funds were spent on design activities, materials, and printing for outreach, like the brochures, which advanced the program commitment of AV.

- In Period 1, twenty-nine StateView Full Members received sub-grants of $24,673. Three StateView Members did not submit an approved request for continuing assistance (RCA) during this period. In addition, $14,117 was distributed in various mini-grants during this period.

- In Period 2, thirty-two StateView Full Members received sub-grants of $24,900. Two StateView Members did not submit an RCA during this period. In addition, three Affiliates were provided small grants, and $64,000 was distributed in various mini-grants during this period.

- In Period 3, thirty-seven StateView Full Members received sub-grants of $23,500. In addition, OregonView, an Affiliate, applied for and received an Affiliate Developmental Grant. DelawareView, also an Affiliate, was competitively awarded a mini-grant. During this period, $42,000 was awarded in mini-grants.

- In Period 4, thirty-eight StateView Full Members received sub-grants of $23,500. In addition, the augmentation funding allowed an additional twenty-one mini-grants to be approved, using AV's standard peer-review process for internal proposals. As a result, the one remaining Affiliate, DelawareView, was able to secure some funding for the period. Although some variation in funding level per mini-grant existed, most awardees received about $7500. Nearly $177,000 was budgeted and expended for the mini-grants during Period 4. With close monitoring of grant funds not yet expended, within the first quarter of calendar year 2018, six (6) very small mini-awards, each less than $2000, were awarded for tutorials, a webinar, and more YouTube instructional videos.

The percentage of funding direct to StateViews dropped in the fourth period. That does reflect the increase in grant administrative and financial costs to complete all required reporting for this grant and includes the extended program, administrative, and financial management time for the longer fourth grant period, the preparation of the Final Report, and a second independent audit during the last period (AV Tax Year 2017 and AV Tax Year 2018).

Concluding Financial Statement

AmericaView will submit to the U.S. Geological Survey its final SF425 and any final financial report within ninety days after this grant's expiration date of 31 March 2018, as required by the grant agreement.

AmericaView has been a prudent manager of this $5 million award. From the outset, AmericaView has contracted for both an external accountant and internal staff competent to complete is bookkeeping and interfaces regularly with the accountant. An independent auditor has carefully scrutinized each grant period from a financial management and internal controls perspective and AV has been determined to be handling its revenue and expenditure funds properly.

Budget planning and budget execution are overseen with due diligence by the AmericaView Board of Directors. That Board votes on acceptance of the budget initiating a grant period and on the agreements to make changes to that budget throughout the grant periods. All votes are captured in Board minutes, which receive Board review before approval. All minutes recording those actions are retained in the archival records of AmericaView.

VI. Summary

In 1998 when a pilot award was made to Ohio to identify effective processes that would ease the access to, acquisition of, and use of Landsat's then twenty-five year continuous satellite collection of multi-spectral land imaging, much has been accomplished by a coterie of remote sensing experts. The early AmericaView program of USGS included both EROS funding and an award to a group that grew into the 501 (c) (3) organization, a consortium incorporated under the name AmericaView. The USGS program name itself was modified within USGS but the name remained with the organization, as reflective of its key objective to effect efficacious use of land imaging information through academic education, research, technology transfer, and outreach. This grant G14AP00002 is the third in a series of multi-year awards to AmericaView and this Final Report documents the progress that has been made with impacts ranging from the "farmer in the field" to the "first responder" to the informed decision-maker in the private and public sectors.

Like so many users globally, the "free and open" policy that was extended to include the Landsat collections had a powerful influence on what could be accomplished and somewhat changed the focus of the entire organization and the objectives between the second and this third award. AmericaView is not the first to acclaim that the 2008 release of the Landsat Data Policy must be considered among the most important milestones in the history of the Landsat Program, from the perspective of the user. (http://landsat.usgs.gov/documents/Landsat_Data_Policy.pdf) Simply consider the exponential rise in the use of Landsat data following that decision to verify its wisdom. Having free imagery data distributed upon request from the EROS Center, relieved the need to build multiple and large archives for any specific or general state use. Efforts, like the AV Earth Observing Data Network (EODN) allowed the technology focus to change by creating a network of distributed nodes with so any needed coverage that could be easily accessed and more rapidly distributed, locally or regionally, for specific needs like emergency response or into under-served areas where bandwidths often limit transfer speeds.

Public awareness of AmericaView, as an organization, has also grown over the last fifteen years. More states belong to the consortium and some non-member states have begun to ask about possible affiliation to help reach the goal of having all fifty states involved. Funding has been the primary obstacle to the expansion, based on an AmericaView Board decision not to admit additional members unless more funding was secured by the organization. Since AmericaView has been almost exclusively dependent upon the USGS grant funding, several attempts have been and will continue to be made to secure other grants or donations.

The awareness expanded during the last three years with the quality of the StateView Factsheets, the publication of the Brochure and trifold, the redesign of the website, the participation in several social media, and the extensive development of tutorial videos on YouTube. AmericaView has been more visible in local areas with exhibits like "Earth as Art" and more dominant with it technical presence at national conferences. The Earth Observation Days, initiated before this award began, now reach a much wider audience nationally. Significant community events often receive local news media attention. When AmericaView became one of the sponsoring organizations for the American Geosciences Institute's Earth Science Week, AmericaView was assigned a specific day in the week's event, drawing both national and international attention.

Awareness itself, while important, was not the objective of AmericaView in all those areas. Impact is. Funding to individual states was minimal but all found ways to leverage other efforts within each StateView consortium.

- WisconsinView has participated in collaborative work and applauds, due in part to its leveraging strategy, that Landsat imagery is beginning to be used routinely in scientific disciplines such as meteorology that previously had no practical access to the imagery. That work will make a difference socially and economically by improved forecasting, observing, and alerting.
- Potato virus Y has resulted in significant economic harm to farmers and has, at times, disrupted seed supplies to commercial growers. IdahoView has verified that PVY-infected potato plants in an agricultural production field produce different detectable spectral signatures than neighboring non-infected plants. Using machine learning or machine vision analysis such as support vector machine classifiers can differentiate spectral signature of PVY-infected and non-infected plants at an accuracy of 89.8 percent. That work will make an economic difference.
- Cities implement green initiatives to increase the amount of vegetative surface. These changes tend to mitigate heat islands by increasing albedo, shading, and latent heat flux. MarylandView used Landsat to evaluate change over time of the urban heat islands in the Baltimore area as land use and land cover changed over three decades as populations expanded and contracted. Again, socio-economic benefits will accrue to the continued analysis of that information.
- New MexicoView has introduced some Smart Phone mobile applications into classrooms so students and teachers learn how to document information on local land cover and contribute the data, as "citizen scientists" to research work at NASA and USGS. The science impact, where anyone can be a remote sensor, will have environmental, social, and economic benefit.

The impacts of AmericaView extend far beyond the university classroom and the development of curricula and the work in isolated labs. This Final Report has been an attempt to characterize the extent of that impact across the StateViews and the four grant periods. Only a small percentage of the activities have been reported and those, even with limited descriptive details.

In the bibliography, Appendix G, fifty-six technical publications are identified, each of which acknowledges both affiliation with AmericaView and funding from the U.S. Geological Survey. This impressive body of work contains peer-reviewed articles, sections of textbooks and manuals, and published books. Their importance will be their use as reference for other remote sensing research and education and by individuals in public, private, and academic positions who need reliable information to make beneficial decisions.

What is notable is that the organization has made a commitment to continue its collegial network, without the fiscal support of this grant, while searching for additional solicitation that would benefit from both this model of consortium activity and its well-recognized expertise and experience. Over the years, constructive rapport among the members has melded remote sensing and GIS expertise and facilitated the open exchange of good ideas and best practice.

Appendix A – List of StateViews and Principal Investigators as of 31 March 2018

A. Background

Throughout the four grant periods, both lead universities and their university-nominated and AV Board-approved Principal Investigators (PI) changed for several StateViews. Throughout all four grant periods, both NevadaView and Washington View remained inactive. Promising conversations were held with a potential PI for NevadaView but those discussions were not fruitful.

At the end of the first period on September 15, 2014, AmericaView included thirty-eight active and two inactive StateViews. Thirty-two were Full Members; two were Associate Members, awaiting sufficient AV funding; and four were Affiliates. During that first period, three Full Members were not funded with sub-grants.

At the end of the second period on June 30, 2015 (with a NCE until 31 December 2015), AmericaView remained with thirty-eight active and two inactive StateViews. Thirty-four had attained Full Member status; no Associate Members remained; and four were Affiliates. During that second period, two Full Members were not funded with sub-grants.

At the end of the third period on June 30, 2016 (with a NCE until 31 December 2016), AmericaView comprised had grown to thirty-nine active members, although the inactive members remained inactive. Thirty-seven StateViews were Full Members and two StateViews were Affiliates. All Full Members were funded with sub-grants after a successful effort to reinvigorate their Request for Continuing Assistance (RCA).

As of March 31, 2018, AmericaView comprised thirty-nine active and two inactive StateViews. Thirty-eight StateViews were Full Members and one StateView was an Affiliate.

B. StateView Websites, Principal Investigators, Lead Universities , and Other Key StateView Leaders as of 31 March 2018

FULL MEMBERS

AlabamaView http://www.alabamaview.org Dr. Luke Marzen Department of Geography Auburn University	Co-I Dr. Chandana Mitra Auburn University
AlaskaView http://portal.gina.alaska.edu/projects/alaska-view Ms. Lisa Wirth Interim Director, GINA Program University of Alaska Fairbanks	

ArkansasView https://www.arkansasview.org/ Dr. Jason Tullis Center for Advanced Spatial Technologies (CAST) University of Arkansas	
CaliforniaView http://cstars.metro.ucdavis.edu/education-and-outreach/californiaview Dr. Susan Ustin Center for Spatial Technologies and Remote Sensing University of California at Davis	State Coordinator Ms. Pia van Benthem Department of Land, Air and Water Resources University of California at Davis
ColoradoView http://www.coloradoview.org/ Dr. Wei Gao USDA UV-B Monitoring and Research Program Colorado State University	State Coordinator Dr. Michael Coughenour USDA UV-B Monitoring and Research Program and the Natural Resource Ecology Laboratory Colorado State University
ConnecticutView http://ctview.uconn.edu Dr. Chandi Witharana Natural Resources and the Environment University of Connecticut **GeorgiaView** http://www.gaview.org Dr. Jeong (JC) Seong Department of Geosciences University of West Georgia	State Coordinator Mr. James Hurd Natural Resources and the Environment University of Connecticut
Hawai'iView http://hawaiiview.higp.hawaii.edu/ Dr. Robert Wright School of Ocean and Earth Science and Technology University of Hawai'i at Manoa	State Coordinator Ms. Amber Imai-Hong University of Hawai'i at Manoa

IdahoView http://www.idahoview.org/ Dr. Donna Delparte Department of Geosciences Idaho State University	
IndianaView http://www.indianaview.org/ Mr. Larry Biehl Purdue Terrestrial Observatory Purdue University	
IowaView http://www.iowaview.org/ Ms. Robin McNeely ISU GIS Facility Program Manager Iowa State University	State Coordinator Ms. Amy Logan Iowa State University
KansasView http://www.ksview.org/ Dr. Steve Egbert Kansas Applied Remote Sensing Program (KARS) University of Kansas	State Coordinator Dr. Kevin Dobbs Kansas Applied Remote Sensing Program University of Kansas
KentuckyView http://www.kentuckyview.org/ Dr. Haluk Cetin Director, Hyperspectral Laboratory Murray State University	
LouisianaView http://www.louisianaview.org/ Mr. Brent Yantis Regional Application Center University of Louisiana	
MarylandView http://marylandview.towson.edu/ Dr. Todd Moore Dept. of Geography and Environmental Planning Towson University	

MichiganView http://www.michiganview.org/ Dr. Nancy French Michigan Tech Research Institute (MTRI) Michigan Technological University	State Coordinator Mr. Michael Battaglia Michigan Tech Research Institute (MTRI) Michigan Technological University
MinnesotaView http://minnesotaview.umn.edu/ Dr. Joseph Knight Department of Forest Resources University of Minnesota	Co-PI Dr. Marvin Bauer Department of Forest Resources University of Minnesota
MississippiView Dr. Greg Easson Enterprise for Innovative Geospatial Solutions University of Mississippi	Co-I Dr. Lance Yarbrough University of Mississippi
MontanaView http://remotesensing.montana.edu/montanaview/index.html Dr. Rick Lawrence Land Resources/Environmental Science Dept. Montana State University	
NebraskaView http://nebraskaview.unl.edu/ Dr. Brian Wardlow Center for Advanced Land Management IT(CALMIT) University of Nebraska-Lincoln	State Coordinator Ms. Milda Vaitkus (CALMIT) University of Nebraska-Lincoln
New HampshireView http://www.nhview.unh.edu/ Dr. Russ Congalton Department of Natural Resources and the Environment University of New Hampshire	
New MexicoView http:/Newmexicoview.Nmsu.edu Dr. Ken Boykin Center for Applied Spatial Ecology New Mexico State University	

New YorkView
www.esf.edu/nyview
Dr. Lindi Quackenbush
Department of Environmental Resources Engineering
State University of New York

North CarolinaView
website under work
Dr. Yong Wang
Department of Geography
East Carolina University

North DakotaView
https://arts-sciences.und.edu/geography/nd-view/
Dr. Brad Rundquist
Department of Geography
University of North Dakota

OhioView
http://www.ohioview.org/
Dr. Anita Simic
School of Earth, Environment and Society
Bowling Green State University

OklahomaView
http://okview.org/
Dr. Xiangming Xiao
Department of Microbiology and Plant Biology
University of Oklahoma

Co-I
Dr. Saleh Taghvaeian
Assistant Extension Specialist
Biosystems & Agricultural Engineering Dept.
Oklahoma State University

State Coordinator:
Ms. Melissa Scott
University of Oklahoma

OregonView
http://research.engr.oregonstate.edu/parrish/oregonview
Dr. Christopher Parrish
School of Civil and Construction Engineering
Oregon State University Oregon State University

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

Rhode IslandView
http://riview.uri.edu
Dr. Y.Q. Wang
Dept. of Natural Resources Science
University of Rhode Island

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

South DakotaView
http://sdview.sdstate.edu/
Ms. Mary O'Neill
Agricultural and Biosystems Engineering
South Dakota State University

TexasView
Dr. Rebecca Dodge
Department of Geosciences
Midwestern State University

Co-I
Ms. Teresa Howard
University of Texas at Austin

UtahView
http://utahview.org/
Dr. Douglas Ramsey
Department of Wildland Resources
Utah State University

State Coordinator
Dr. Ellie Leydsman McGinty
Remote Sensing/GIS Laboratory
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. James Campbell
Department of Geography
Virginia Tech

State Coordinator
Dr. John McGee
Department of Forest Resources and
Environmental Conservation
Virginia Tech

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

WisconsinView
http://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
University of Wyoming

AFFILIATE

DelawareView
http://sites.udel.edu/delawareview/
Dr. Tracy Deliberty
Department of Geography
University of Delaware

INACTIVE

NevadaView (inactive)

WashingtonView (inactive)

Appendix B - AV Board of Directors as of 31 March 2018

A. AmericaView Board of Directors Background

AmericaView is an incorporate national non-profit consortium governed by a Board of Directors, elected to three-year terms of office by the membership. Elections are staggered to ensure continuity of governance policy. Board members serve on a voluntary basis and receive no compensation beyond travel support. Elections to fill Board and Officer positions occur during Annual Board Meetings, which have been coincident with the Winter Business Meeting, held in the first quarter of the calendar year. Given the resignation of one Board member in summer 2017 due to health reasons, the Board exercised its judgment to appoint a former Board director to fill the remaining term of office.

At the time of this report, the Board of Directors has not designated a date, time, or place for the next annual Members Meeting to elect new Directors or Officers.

B. AmericaView Board of Directors Membership

Chair: Jarlath O'Neil-Dunne

Spatial Analysis Laboratory, Director
The Rubenstein School of Environment and Natural Resources
University of Vermont
Aiken Center, Room 220
Burlington, VT 05405
Board Term: April 2017 – Present

Vice Chair: JB Sharma, PhD

Professor and Eminent Scholar
Assistant Department Head – Physics
Institute for Environmental Spatial Analysis
University of North Georgia
Gainesville, GA 30504
Board Term: February 2015 – Present

Treasurer and Secretary: Rebecca L. Dodge, PhD

Associate Professor
The Department of Geosciences
Associate Professor
The Department of Geosciences
Midwestern State University
3410 Taft Blvd
Wichita Falls, Texas 76308
Board Term: February 2015 – Present

Director: Russell G. Congalton, PhD

Professor of Remote Sensing and GIS
MS Graduate Program Coordinator
Department of Natural Resources & the Environment
114 James Hall, 56 College Rd
University of New Hampshire
Durham, NH 03824
Board Term: February 2016 – Present

Director: Rick Lawrence, PhD

Land Resources and Environmental Sciences Department
Director, Spatial Sciences Center
Montana State University
PO Box 1733490
Bozeman, MT 59717-3490
Board Term: February 2015 – Present

Director: Mary O'Neill

Water Resources Institute
South Dakota State University
211 Agricultural Engineering
Brookings, SD 57007
Board Term: November 2017 - Present

Director: Brent Yantis

Regional Analysis Center
University of Louisiana at Lafayette
Abdalla Hall
635 Cajundome Blvd
Lafayette, Louisiana, 70506
Board Term: February 2017 – Present

Appendix C – Summary of Earth Observation Day Activities for This Grant

Background

Earth Observation Day (EOD) is a Science, Technology, Engineering, and Mathematics (STEM) outreach event sponsored by AmericaView to celebrate the important of remote sensing and which has a strong focus on the Landsat mission, a joint effort of the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA). EOD introduces students (their teachers and often their parents) to geography and Earth observations using the tools and technology of geospatial science. An EOD web page (***www.americaview.org/earth-observation-day***) provides information on how to engage students in the use and analysis of free remote sensing imagery with mosaicked satellite images of states, free geospatial software exercises, additional materials and interactive games. The AV Consortium uses EOD to highlight the use of remote sensing as an effective, exciting, and powerful educational tool in K-16 educational and informal environments.

EOD 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. This Appendix provides short descriptions of the EOD events completed by StateViews during the four periods of the grant.

April, 2014 Events

In the first grant period, GY2013, Earth Observation Day (EOD) occurred on 9 April 2014, although the events at various StateView sites may have occurred 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 (CaliforniaView, GeorgiaView, IdahoView, KentuckyView, LouisianaView, North DakotaView, OhioView, PennsylvaniaView, South DakotaView, TexasView, VirginiaView and WyomingView) participated in EOD efforts reaching nearly 125 teachers and 2700 students directly, and over 75,000 members of the public. The latter number reflects various StateView special programs but also the CaliforniaView's astute alignment of their event with a University of California, Davis, Open House.

In September 2014, the AmericaView EOD Facebook page and an EOD Twitter account were established that have remained active for the remainder of this grant. In April 2018, to conserve resources, these social media venues will be consolidated with the AV Facebook and Twitter venues.

April, 2015 Events

In the second grant period, GY14, Earth Observation Day (EOD) was celebrated on Wednesday, 8 April 2015. Twelve StateViews (CaliforniaView, GeorgiaView, IdahoView, IndianaView, KentuckyView, New MexicoView, OhioView, PennsylvaniaView, TexasView, VermontView, VirginiaView and WyomingView) prepared special events. Once again, CaliforniaView's alignment with its University of California at Davis Open House provided an excellent opportunity to engage a large number and a wide age range of children and adults. Each participating state submitted a report shared throughout the consortium.

AV's Board of Directors reached a milestone decision, endorsed by the StateView members, to align EOD in the future with the American Geosciences Institute's (AGI) Earth Science Week. The potential to expand the StateViews' influence to more high school and college students, who might be interested in a remote sensing career, was the powerful incentive promoted by initiative organizer, PennsylvaniaView's PI, Tom Mueller.

After successful spring programs, StateViews also began the planning for a fall 2015 inaugural activity in conjunction with the American Geosciences Institute's (AGI) *Earth Science Week,* http://www.earthsciweek.org/about-esw to leverage a well-publicized and acclaimed annual event, which expanded AV outreach to an estimated 16,000 participating educators. The cascade impact on hundreds of thousand K-12 students and the public was anticipated.

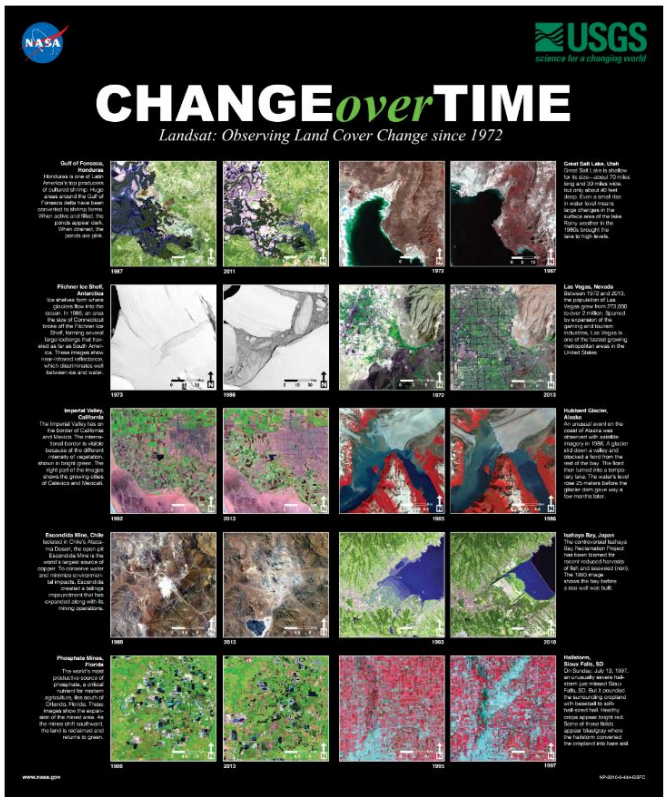
Fall 2015 Events

As a pilot activity, a few StateView sponsored activities in conjunction with Earth Science Week. Most of these involved special programs within K-16 classrooms. As one example, to the right is a photograph of OhioView's Kevin Czajkowski with students at the University of Toledo, on 15 October. Not only did they use the AV web materials but also learned how to collect and evaluate water samples and used Google Earth for a remotely-sensed view of the Ottawa River.

Some states, like North DakotaView and UtahView, involved their university communities. NDView conducted a MapGive Map-A-Thon. UtahView set up sUAS and GPS equipment with several posters and invited students and faculty to familiarize them with geospatial technologies.

October, 2016 Events

During the latter part of the grant's third period, GY15, after completing the last of the spring events in April 2015 and piloting the Fall 2015 EOD, AV's Education and Outreach Committees decided that AV should prepare something useful and appealing to include in the AGI packet for Earth Science Week that would be distributed to educators in summer 2016. During AV's Winter Business Meeting in 2016, a collaborative team from AV, USGS, and NASA initiated discussion for a poster, which could be added to AGI's 16,000 packets. A reduced picture of the poster, printed by NASA and distributed through the EROS Center appears to the left. The poster could be easily separated into segments to allow playing a matching game, similar to what is available for use at the AV website. https://americaview.org/program-areas/education/remote-sensing-imagery-game/



The 2016 Earth Observation Day was a success. It was the first year the day was officially linked with Earth Sciences week. Fourteen StateViews conducted well-planned and attended events. Nearly 80 faculty, over 500 undergraduates, and about 700 K-12 students participated in those activities. Most of these were held on or near Earth Observation Day. Using participant, age-level focused surveys, prepared by AlabamaView's Chandana Mitra, StateViews were able to identify the impact of the events. That feedback helped with the planning for the EOD in fall 2017.

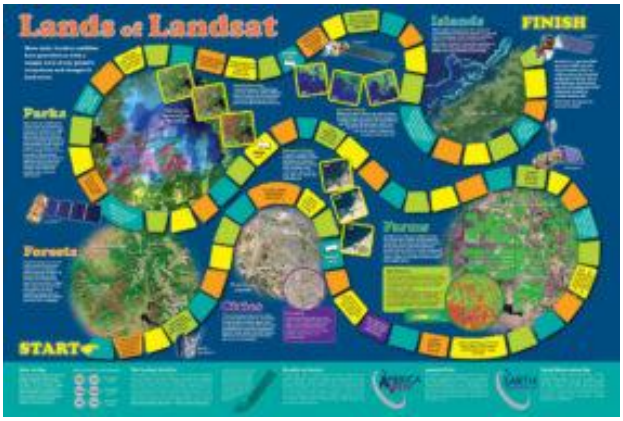
Many states, which sponsor K-12 activities throughout the year, such as visiting classrooms or supporting science days, also requested copies of the posters that could be distributed to teachers and students.

Feedback

Geoff Camphire, the Outreach Programs Manager for American Geosciences Institute, coordinates the efforts of all organizations supporting Earth Science Week. He informed Tom Mueller that *"our independent external evaluation, based on a survey of participants, found that a large majority of participants - 87 percent - rated the AmericaView Memory Game poster for Earth Observation Day as "very useful" or "useful.""*

October, 2017 Event

In the previous Technical Reports, the EOD events have much more detail than in this Appendix and they can be



requested if needed. Since this is the first opportunity to describe the EOD activities during this past year, a more detailed account is provided here. As a reminder, the activities are distributed over several months. In fact, the last for the fourth grand period was held in Wyoming in March 2018.

In 2017, EOD was celebrated officially on Tuesday, October 10**.** Once again, AV's Outreach and Education Committees accepted the challenge to design a new insert for the AGI packets distributed to teachers. Key creative work by Pia van Bethem (CaliforniaView), Rebecca Dodge (TexasView), and Ginger Butcher (NASA, Landsat Communications) delivered another excellent poster design.

As seen above, the poster features a mosaic of Landsat 8 satellite images showing the contiguous United States of America on the front and a board game-style exploration of the history and contributions of the Landsat program. The poster was distributed and used across the United States in a variety of venues from classrooms to conference exhibits, in some cases with the help of StateView PIs and their students and in other cases by teachers who had received one of the 16,000 packets distributed by AGI.

As was the case in 2016, Geoff Camphire, AGI's Outreach Programs Manager, sent us feedback email with the following statement: "In 2017, the AmericaView Memory Game Poster was rated "very useful" or "useful" by 87 percent of program participants surveyed. Thank you again for contributing that material. "

Sixteen StateViews provided stories and/or photographs describing their activity in their GY16 report. In addition, several provided immediate feedback, using a Google Survey to gather information about the category and number of attendees. The graphic chart at the end of the descriptions collects the statistics from the reports. Striking in that graphic are the teachers reached by NebraskaView. If every teacher took back into their classroom of 20 or 25 students only one valuable point, over 10,000 students could be the beneficiaries of that outreach opportunity that was not neglected by those interested teachers.

- In fall 2017, CaliforniaView's Earth Observation Day (EOD) activities were celebrated during a lunch seminar hosted for faculty and students within the John Muir Institute of the Environment. The 2016 and 2017 Earth Sciences Week AmericaView EOD remote sensing game posters were showcased at this event engaging participants in discussions on local as well as national environmental topics. Fifty-two posters were handed out to two UC Davis elementary school 4th Grade science teachers to take into their classrooms. Because of this activity, CalView was asked to visit these two classrooms in the spring of 2018 teaching elementary students about environmental changes. The outcome of EOD exchanges continues to flourish long after the initial encounters.

- For the **GeorgiaView** participation, Dr. Seong hosted the 2017 EOD event at UWG on October 10, 2017. The format was similar to the 2016 EOD event. About 25 image posters were displayed. Students played an image matching game and an image puzzle game provided by IndianaView and WisconsinView. About 50 students and 10 faculty members showed up. Photos were collected.

- During the 2016 Grant Year, the **Hawai`i**View team was able to deploy the Landsat 8 Science Kits in a variety of classroom and community "hands-on STEM" outreach events. During the course of the 2016-2017 School Year, the Hawai`iView coordinator was able to participate in two community outreach events, three classroom visits, one grade level visit, one School of Ocean and Earth Science and Technology (SOEST) High School Science Communicators Lab Tour with Roosevelt High School's Honors Science Classes. Through these visits, 632 students, 10 teachers, and 15 adults were introduced to the Landsat program through the Landsat 8 Science Kit hands-on activity. Around 240 of those students and 3 adults participated in EOD scheduled events.

- On October 27, 2017, **IdahoView** sponsored the High School Earth Observation Outreach event to introduce local students to remote sensing and visualization. The event was held at Idaho State University, Pocatello, ID.

- **IowaView** used Open Street Map and MapGive tools to engage varied audiences about the value and use of remote sensing and other geospatial technologies. A mapping workshop was held for a 4H group on June 28, 2017 and for a group of students and professionals for Earth Observation Day, October 12, 2017. This continues to be a high priority for Iowa since students and many adults don't have exposure to remote sensing or GIS and aren't offered enough opportunities to learn and give back their time to help others both in Iowa and globally.

- The 2017 Earth Observation Day events were held on Murray State University Campus, following a well-established **KentuckyView** model featuring student presentations and a prominent remote sensing and/or GIS expert as a keynote speaker. This year David Jones, who has worked the past 14 years on a Murray State University/US Forest Service cooperative agreement, discussed "How Modern Technology is Rapidly Changing Mobile Data Collection in the US Forest Service."

- For Earth Observation Day 2017, **MinnesotaView** hosted a gathering in the UMN Remote Sensing and Geospatial Information Laboratory focused around highlighting remote sensing science and applications in the state. Approximately 30 people attended. Enthusiasm was high - particularly for water clarity research and UAS operations.

- On October 6, 2017, the **NebraskaView** Coordinator again participated in the Teacher's Night Out outreach event and featured the EOD Lands of Landsat poster, which was well received. All 75 copies of the poster were distributed to eager teachers. Approximately 600 K-12 teachers attended the event. State Coordinator, Milda Vaitkus is seen at the NEView table with her supply of materials.

- **New MexicoView** translated the 2017 Earth Observation Day poster into Spanish and provided it to AmericaView for dissemination. The pdfs of this translation are available from the AmericaView website so the poster can be quickly printed for any event. UtahView also evaluated the Spanish version with a group of students. This effort follows upon an earlier success by New MexicoView to make some of the website's K-12 education materials available to Hispanic students and their families. NMView uses EOD sessions to continue education and outreach for geospatial technologies using tools such as Adopt-a-Pixel (AaP) and Augmented Reality Sandbox.

- To celebrate its EOD observance, **North DakotaView** and UND Geography & GISc hosted a MapGive Map-A-Thon open to the University community on November 17, 2016. Thirty students from various departments volunteered their time to map, learning about remotely sensed imagery and how to digitize from them.

- **OregonView**'s pictorial record of their EOD event.

- **PennsylvaniaView**'s PI requested and then posted the StateViews' comments about their EOD activity and retweeted (or shared via Facebook) other remote sensing news and information.

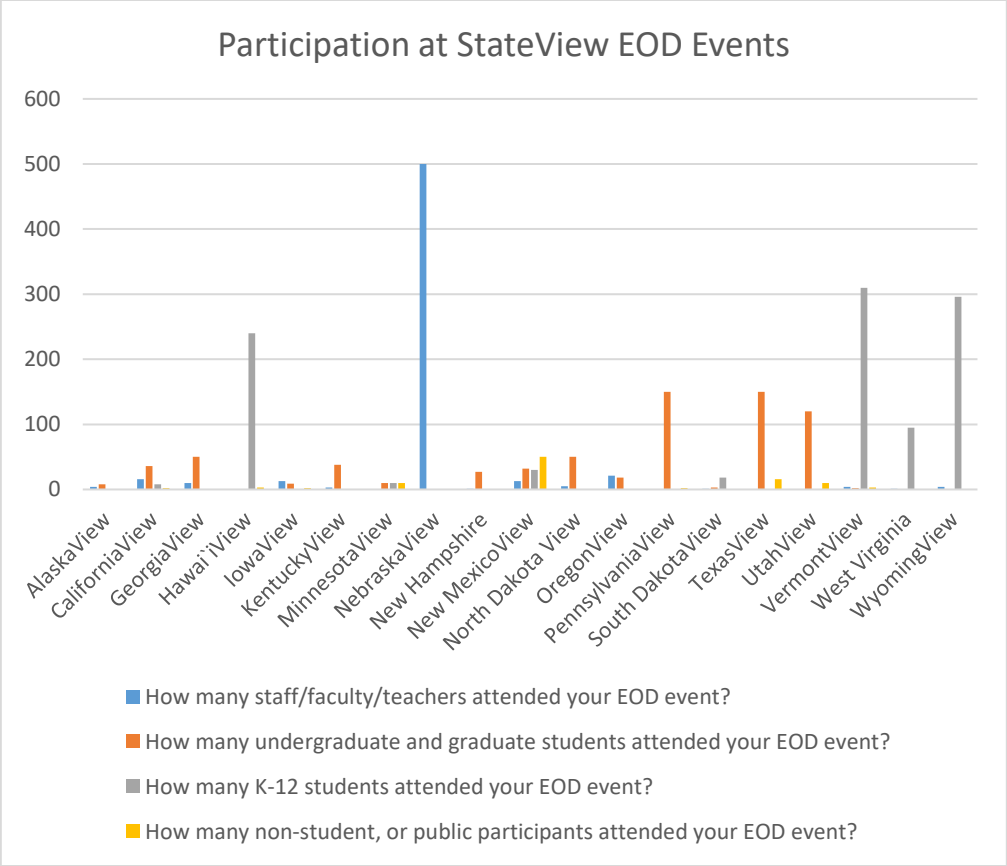
- During February 2018, **South DakotaView** took the EOD activity to 18 kindergarten students at Medary Elementary School in Brookings, SD. The SDView PI expected to open in March 2018 an exhibit at the South Dakota Agricultural Heritage Museum called "Documenting Weather in the Age of Geospatial Technology." The exhibit is designed to be portable so that it can be taken/sent to schools as part of future EOD events.

- **TexasView** reported sponsoring events that drew 150 students and 16 of their teachers.

- Throughout GY16, **UtahView** continued to promote events and projects through Facebook (https://www.facebook.com/utahview/).These include events, such as Earth Observation Day. On October 10, 2017, UtahView and the RS/GIS Laboratory hosted an open house event to celebrate Earth Observation Day. The event was held in the Quinney College of Natural Resources main atrium. During the open house, UtahView and the RS/GIS Laboratory had poster presentations, thermal (FLIR) camera demonstrations, UAS demonstrations (DJI s1000 and DJI Phantom 4), a slideshow presentation of Landsat imagery and Earth as Art images, old stereoscope equipment and manual aerial photographic interpretation equipment, free maps and posters, and drinks and snacks. Nearly 130 people attended the open house and several undergraduate and graduate students inquired about research opportunities.

- Three schools in West Virginia (North Elementary, Suncrest Elementary and Grafton High) and one hundred students participated in Earth Observation Day and related activities. The theme of the activities focused on the urban heat island as observed in Landsat images. The teachers were provided with lesson plans for preparation, and the field and classroom activities were led by **West VirginiaView** instructors. Students used infrared thermometers to measure radiant temperatures of various urban surfaces to understand the underlying physical causes of urban islands.

- The **WyomingView** PI visited five classrooms between December 2017 and February 2018 with an additional classroom scheduled in March. Second, third, sixth and eighth graders in four Laramie schools participated as part of the StateView's success promoting remote sensing science and applications. 296 students were reached through FY2016 EOD activities.



During the fourth period of the grant, **IndianaView** introduced a new element for the EOD experience. Earth image puzzles at https://americaview.org/program-areas/education/earth-image-puzzles/ encourage people of all ages to engage with satellite imagery and learn more about remote sensing by offering a fun challenge. The images used on the poster game board above, the Landsat state mosaics, and some of the "Earth as Art" images are all featured at the website. From the youngest child to oldest adult, these puzzles introduce all to the complexities and beauty of our remotely sensed Earth.

The immediate and enduring value of the specific EOD events, the posters and the puzzles are underscored by two event subsequent to the day itself. These type events will continue to proliferate by StateViews, who recognize the need to ignite the interest in Earth science and are prepared to explain how remote sensing can fan that flame.

- In late October, the posters from both 2016 and 2017were distributed to a specially invited audience for a St. Louis City school and local neighborhood event, focused on building interest in education and training for all ages of those who might be attracted to careers in remote sensing and GIS. This was important outreach beyond AV since no MissouriView yet exists.
- In November 2017, during the Pecora 20 Symposium in Sioux Falls, SD, USGS EROS STEM program leaders invited local area students to visit the Exhibit Hall. Throughout mid-day, the EROS volunteers and the AV PIs interacted with children, using actual Landsat puzzles like those online, to advance some understanding of the images. Each child left with posters, as well as a puzzle provided by the NASA booth. Seeing high-respect university professors on the floor with grade school children was spectacular.
- Teacher comments, captured in the conference's steering committee's "Pecora 20 Lessons Learned" report included the following:
  - *"Thank you very much for having us at the symposium. While much of the material was over the students head, they really enjoyed the puzzles and activities. It opened up a whole new world that they did not know existed"*
  - *"Thank you for all your work and the opportunity to take part in the symposium. The students enjoyed the day and felt that is was a worthwhile opportunity"*

Summary Statement

Attracting all lifelong learners to better understand and appreciate remote sensing has been a continuing objective of AmericaView since its instantiation. During the four grant periods of this award, AV's Education and Outreach Committees, under the leadership of Larry Biehl from IndianaView and Mary O'Neill from South Dakota View, have expanded involvement in the EOD initiative that Tom Mueller from PennsylvaniaView has tirelessly promoted.

Although this grant closes, a recent poll of all thirty-nine active StateViews indicates that twenty-nine are planning to continue involvement in some way, even without this grant support, for the October 2018 EOD. The theme for Earth Science Week is Earth as Inspiration, which is intended to "emphasize artistic expression as a unique, powerful opportunity for geoscience education and understanding in the 21st century." Little exceeds the artistry of medium scale imagery of the Earth, the US Landsat product. AmericaView will again be one of the partners for ESW.

As Professor Mueller coined for AmericaView, *"Every day is Earth Observation Day!"*

Appendix D - StateView Identified Program Challenges

Each grant period, StateViews are asked to provide an assessment of their work and to identify those elements found most challenging in completing their Statement of Work. Thirty-three StateViews provide ninety-one explanations during the four periods of the grant.

Sixteen identified as most problematic trying to build and to maintain their own consortium within their state. Since the transition from Affiliate to Associate or Full Member does require that an Affiliate establish a consortium before being considered, this challenge is clearly critical to one of the foundation objectives of AmericaView. The Technical Reports for the first three grant periods have certainly pointed to that persistent problem, noting in each report that StateViews have been most concerned about limited funding that precludes taking advantage of so many opportunities that would involve sub-grant sharing within their state among the consortium members, especially if those are also universities.

AlabamaView, ConnecticutView, IdahoView, MichiganView, MontanaView, North DakotaView, TexasView, UtahView, and Wyoming View each had some variation of that situation. WyomingView pointed to the very positive realization that the free and open policy for Landsat imagery was wonderful but that the PI simply could not meet the expectations of his consortium members. They now had sufficient data to complete some beneficial field studies but they lacked funding which the lead university do not have. One the original problems that AmericaView was funded to accomplish, namely helping assure more access to imagery, was resolved. Now the challenge was to make efficacious use of that treasure. Unfortunately, the small sub-grants precluded that effort.

Both IndianaView and New HampshireView explained that some of the long time members of their state consortia were retiring and it was difficult to elicit the same level of interest from potential replacements. North DakotaView found that their offers for minor funding were ignored in favor of other priorities at member institutions.

All those who commented on the challenge underscored the lost opportunities for even more achievement because they could not sustain as strong a consortium as they desired.

Another often-noted challenge was the little attention paid to their websites, again one of the criteria to move from Affiliate to Member. In some cases, problems were exacerbated by lack of direct control over their website, since they were inside the information technology system of their university. Sever addresses changed; website favored tools were changed; monitoring visitors was eliminated; security updates invalidated some sites. Again, the issue of too few resources emerged. StateViews often could not afford the service assistance needed and PIs, Co-Is, and state coordinators lacked the time with so much else happening. ColoradoView wanted to keep its student scholarships and internships focus on key research questions rather than have students update their website.

As reported throughout the report, many StateViews have scholarship, internship, and employment opportunities for both undergraduate and graduate students. Nevertheless, there were challenges. IndianaView experienced a drop in the number of applicants and initially linked that problem to the timing of the release of the announcement. South DakotaView similarly learned the lesson about the time for marketing the call for applicants. Initially UtahView thought that was their problem with the scholarship offerings but subsequently determined that offering employment was more effective than scholarships to attack students into remote sensing and GIS activities. North CarolinaView blamed a

lowering of student motivation to work with remote sensing. North Dakota has difficulty finding sufficiently qualified students to employ on some of their data gathering and mapping efforts.

Hawai'iView and South DakotaView found that they had more demands to train teachers and students that they could handle within their time availability. VirginiaView summarized their challenge by recognizing that "training undergraduate students required time and patience."

Appendix E – Highlights of AmericaView Winter Business Meetings

Period 2 (GY14) 2015 Winter Business Meeting at a Glance

AmericaView Winter Business Meeting at a Glance			
Day and Time	**Event**	**Presenter(s)**	**Location**
	02/ 22/15 (Sun)		
9am to 5pm	Board Meeting		St. Regis, Azalea Room
6pm to 7:30 pm	Welcome Reception		St. Regis, Lobby
	02/ 23/15 (Mon)		
Opens 6:30am	Breakfast on your own		Decanter Restaurant
7:30 am to 8:30am	Travel to USGS		Front of St. Regis/Fairfax
8:30am to 9:00pm	Check-in at USGS		
Opening		**Moderator**	**USGS USGS Auditorium**
9:00am to 9:15am	Welcome and Introductions	Congalton/Newman	
9:15am to 10:00am	USGS Keynote - Sarah Ryker, USGS Ass.Dir. CLU		
10:05am to 10:25am	Break		
Session I		**Moderator**	**USGS Auditorium**
10:30am to 11:30am	AmericaView and its Accomplishments: StateView pre-queued power point presentations, two minutes per member for Full Members and Affiliates	Bobbi Lenczowski	
11:30am to 12:30pm	Poster Session with USGS Staff invited	Rebecca Dodge	
LUNCH			
12:30pm to 1:35pm	Lunch and Networking		**USGS Cafeteria**
12:45pm to 1:35pm	Overview of U.S.Geological Servey Climate Science Centers: Update on Phenology Camera Pilot Project	Jeff Morisette, NCCSC Brian Miller, NCCSC	BA-102C and Webex
Session I Completion		**Moderator**	**USGS Auditorium**
1:45pm to 2:00pm	AmericaView and its Accomplishments	Bobbi Lenczowski	
Session II	**Concurrent Sessions**		
2:00pm to 3:00pm	Raising Awareness with Educational Efforts	Holli Riebeek, SSAI at NASA GSFC and Emily Cloyd, USGCRP	Visitor Center
2:00pm to 3:00pm	Strenghtening AV's Outreach Efforts	Chris Trent, USGS	2A-435, LRS Conf Rm

2:00pm to 3:00pm	Advancing AV's Technology with UAS	Jacqueline Jackson, FAA; Mark Jordan, JMA Solutions; Bruce Quirk, USGS; and Jim Campbell	USGS Auditorium
3:00pm to 3:30pm	Break		
Session III	**Concurrent Sessions**		
3:30pm to 4:30pm	Aligning SV Interests with the USGS Science Mission Areas	Greg Snyder, USGS; John Jones, USGS; Dean Hively, USGS; Peter Claggett, USGS	USGS Auditorium
3:30pm to 4:30pm	Update on Landsat 8	Tom Loveland, USGS EROS	Visitor Center and Webex
3:30pm to 4:30pm	Overview of iGETT and GeoTech Programs	Mike Krimmer, GeoTech Center; Osa Brand, NCGE	2A-435, LRS Conf Rm
4:30pm to 5:00pm	Wrap-up - Russ lay out expectations for Tuesday		USGS Auditorium
5:10pm	Board bus for Business Dinner		In front of USGS
5:30pm to 8:00pm	Business and Awards Dinner		Man Ami Gabi Restaurant
8:15 PM	Board bus to return to St. Regis and Fairfax Hotels		
	02/ 24/15 (Tue)		
Opens 6:30am	Continental Breakfast		St. Regis, Carlton Ballroom
7:00am to 8:00am	Committee Meetings		St. Regis, Carlton Ballroom
Opening		**Moderator - Russ**	St. Regis, Carlton Ballroom
8:15 AM	Welcome and Logistics	Russ Congalton	
8:30am to 9:00am	Review of Monday Highlights	Russ Congalton, Debbie Deagen, B. Lenczowski	
Morning Session			St. Regis, Carlton Ballroom
9:00am to 10:00am	Discussion of Strategic Partnerships and "Clustering" for Proposals	Bobbi Lenczowski	
10:00am to 10:30am	Annual Photo Board and Staff - Break		
10:30am to noon	The National Plan for Civil Earth Observations and U.S. Group on Earth Observations - Presentations and Panel	Tim Stryker, OSTP; Greg Snyder, USGS; Ramesh Sivanpillai	
Working Lunch			Decanter Restaurant
Noon to 1:10pm	Formation of AV Water Quality Working Group	Terri Benko and Nancy French	
Board Elections			
1:15pm to 2:00pm	Board Elections	Milda Vaitkus	St. Regis, Carlton Ballroom

Report Outs		**Moderator - Russ**	St. Regis, Carlton Ballroom
2:00pm to 2:15pm	Education	Larry Biehl	
2:15pm to 2:30pm	Outreach	Mary O'Neill	
2:30pm to 2:45pm	Technology	Sam Batzli	
2:45pm to 3:00pm	Landsat Working Group	Rick Lawrence	
Break			
3:00pm to 3:15pm	AV Board Meeting - Election of Officers		
Update			St. Regis, Carlton Ballroom
3:15pm to 4:00pm	Recap of Sunday's Board Meeting	Russ Congalton	
AV Congressional Outreach Guidance			St. Regis, Carlton Ballroom
4:00pm to 5:00pm	Guidelines and Rules	Mary O'Neill	
	Sharing Schedule for Mentor/Mentee		
5:00pm	Dinner on your own		
	02/ 25/15 (Wed)		
8:00am to 5:00pm	Education Visits to Hill		
5:00pm	Optional Dinner to Discuss Day		
	02/26/15 (Thur)		
8:00am	Drive to NASA Goddard Space Flight Center		POV, Taxis
9:00am to noon	Discussion on Joint Educational and Outreach Efforts for the Landsat Program	Jim Irons and other seniors, NASA; Ginger Butcher, JANA; AV Board and Staff	

Period 3 (GY15) 2016 Winter Business Meeting at a Glance

Day and Time	Event	Presenter(s)	Location	Off-site Access
	02/ 28/16 (Sun)			
Opens 7am	Hot breakfast buffet for Sheraton Guest		Syrah Restaurant	
9am to 5pm	Board Meeting		Room 7	GTM
1pm to 5pm	Water Quality/Quantity/Utility Meeting		Room 8	GTM
6pm to 8:00pm	Welcome Reception		Room 5	
	02/ 29/16 (Mon)			
Opens 6:30am	Hot breakfast buffet for Sheraton Guest		Syrah Restaurant	
8:15am to 8:30am	Travel to USGS		Bus at Hotel "Wing" entrance	
8:30am to 9:00pm	Check-in at USGS			
Opening		**Moderator**	**Auditorium**	
9:00am to 9:15am	Welcome and Introductions	Congalton/Newman		WebEx
9:15am to 10:00am	USGS Keynote - Virgina Burkett			WebEx
10:00am to 10:30am	Break			
Session I		**Moderator**	**Auditorium**	
10:30am to noon	AmericaView and its Accomplishments: StateView pre-queued power point presentations, two minutes per member for Full Members and Affiliates	Bobbi Lenczowski		WebEx
Noon to 1:15pm	Cafeteria and Networking		Cafe	
12:15pm to 1:15pm	Lunch Meeting for discussion of NSF opportunities on Geosciences Curricula	Teresa (Terry) Davies and Lina Patino	BA-102A	
Session II		**Moderator**	**Auditorium**	
1:15pm to 1:55pm	Panel Discussion: Ways StateViews Recruit and Retain Consortium Members	Ramesh Sivanpillai		WebEx
Session III	**Concurrent Sessions**			
2:00pm to 3:00pm	*Aligning StateView Interests with the USGS Science Mission Areas*	USGS: Doucette, Kirtland (Jones, Slonecker,Haack possible)	Visitor Center	-
2:00pm to 3:00pm	*UAS Session*	Jim Campbell and Jarlath O'Neil-Dunne	Auditorium	WebEx

2:00pm to 3:00pm	Earth Observation Day and Earth Sciences Week: Coming Together	Tom Mueller	1B-215	-
3:00pm to 3:30pm	Break			
Session IV	**Concurrent Sessions**			
3:30pm to 4:30pm	Landsat and Sentinel Updates	Rick Lawrence	Auditorium	WebEx
3:30pm to 4:30pm	NGA/USGS Centers of Academic Excellence in Geospatial Science Program and NGA Research Opportunities	Kevin Dobbs	Visitor Center	WebEx
4:30pm to 5:00pm	Wrap-up - Russ lay out expectations for Tuesday		Auditorium	WebEx
5:00pm	Board bus for Business Dinner		In front of USGS	
5:15pm to 8:00pm	Business Dinner			
	03/ 01/16 (Tue)			
Opens 6:30am	Hot breakfast buffet for Sheraton Guest		Syrah Restaurant	
Opening		**Moderator - Russ?**	Jr. Ballroom (9 &10)	
8:00am to 8:10am	Welcome and Logistics	Russ Congalton		
8:10am to 9:30am	Future needs and directions: StateView pre-queued power point presentations, two minutes per member for Full Members and Affiliates	Stateviews		
Committees	**Review of Progress and 2 Years Plans + 5**			
9:30am to 10:15am	Technology Committee	Sam Batzli	Jr. Ballroom	
9:30am to 10:15am	Water Quality Working Group	Anita Simic	Room 7	
9:30am to 10:15am	Education Committee	Larry Biehl	Room 6	
10:15am to 10:40am	Break		Outside of Jr. Ballroom	
Working Groups	**Review of Progress and 2 Years Plans + 5**			
10:40am to 11:25am	UAS Working Group	Jim Campbell	Jr. Ballroom	
10:40am to 11:25am	Landsat Working Group	Rick Lawrence	Room 7	
10:40am to 11:25am	Outreach Committee	Mary O'Neill	Room 6	
Board Elections				
11:25am to 11:45am	Board Elections	Rick Lawrence	Jr. Ballroom	
11:45am to noon	Comments from Incoming Chair	Jarlath O'Neil-Dunne	Jr. Ballroom	
noon to 12:15pm	Board Meeting for Officer Elections	Jarlath O'Neil-Dunne	Room 7	
12:15pm to 1:15pm	Deli Lunch for members	Peter Doucette	Room 6	
Report Outs		**Moderator - Russ**	**Jr. Ballroom**	
1:15pm to 1:25pm	Education	Larry Biehl		

1:25pm to 1:35pm	Outreach	Mary O'Neill		
1:35pm to 1:45pm	Technology	Sam Batzli		
1:45pm to 1:55pm	Landsat Working Group	Rick Lawrence		
1:55pm to 2:05pm	UAS Working Group	Jim Campbell		
2:05pm to 2:15pm	Water Quality Working Group	Anita Simic		
Planning		**Moderator-Russ**	**Jr. Ballroom**	
2:15pm to 3:15pm	Discussion of Current Award Progress and Next 2 Years Plans + 5			
3:15pm to 3:30pm	Break		Outside of Jr. Ballroom	
3:30pm to 4:15pm	Continuation of discussion and wrap up of 2+5 year planning			
AV Congressional Outreach Guidance			**Jr. Ballroom**	
4:15pm to 5:00pm	AV's Message and Key Points			
	Hints from prior visits			
	Sharing of "Master Schedule"			
	Arrangement of Mentor/Mentee schedules			
5:00pm	Dinner on your own			

Period 4 (GY16) 2017 Winter Business Meeting at a Glance

Time	04/02/17 (Sunday)	POC or Note	Location
Opens 7am	Hot breakfast buffet for Sheraton Guest	(1 free/room)	Syrah Restaurant
9am - 5pm	Board Meeting	Jarlath	Room 7, Sheraton
6pm - 7:30pm	Welcome Reception (Snyder Video)	Jeanie	Room 5, Sheraton
Time	**04/03/17 (Monday)**	**POC or Note**	**Location**
Opens 6:30am	Hot breakfast buffet for Sheraton Guest	(1 free/room)	Syrah Restaurant
7:40 am	Board Shuttle vans for USGS headquarters	Benko	Vans at "Wing" entrance
8:00 am	Coffee and tea available outside auditorium		
Opening			
8:15am - 8:30am	Welcome and Introductions	Jarlath	Auditorium (1C-111) / WebEx
8:30am - 9:00am	USGS Keynote - Tim Newman	Jarlath	Auditorium (1C-111) / WebEx
Posters			
9:00am - 10:00am	First Poster Session	Bobbi	Auditorium (1C-111)
10:00am - 10:30am	Break		
Mini-Fora Block 1	**Concurrent Sessions**	**Move as you choose**	
10:30am - 12:30pm	Landsat Requirements	Lawrence, Irons, Masek, Newman, Snyder	BB-303 / WebEx
10:30am - 12:30pm	EOD Insert and Events Planning	Mary and Larry	1B-215
12:30pm - 1:30pm	Lunch		Cafeteria
Mini-Fora Block 2	**Concurrent Sessions**	**Move as you choose**	
12:45pm - 3:30pm	Water Quality, Quantity, Utility with Working Lunch	Chris McGinty	Visitors' Center (1C-400) / GTM
1:30pm - 3:30pm	Landsat Requirements Interviewers Training	Rick Lawrence	BB-303 / WebEx
1:30pm - 3:30pm	UAS	Campbell, McGee, O'Neil-Dunne, Delparte	1B-215 / GTM
1:30pm - 3:30pm	Earth Engine Tutorials	JB Sharma	Auditorium (1C-111)
3:30pm - 3:50pm	Break		
Posters			
3:50pm - 4:40pm	Second Poster Session	Bobbi	Auditorium (1C-111) / WebEx
4:40pm - 5:00pm	Special Poster Presentation	Chris McGinty	Auditorium (1C-111) / WebEx
Depart USGS			

5:10 PM	Board Shuttle Vans for Sheraton		In front of USGS
6:00pm - 8:00pm	Business Dinner		Room 5, Sheraton
Time	**04/04/17 (Tuesday)**	**POC or Note**	**Location**
Opens 6:30am	Hot breakfast buffet for Sheraton Guest	(1 free/room)	Syrah Restaurant
Opening Stimulus			Jr. Ballroom (9 & 10)
8:00am - 8:30am	Welcome and Outbrief of Sunday Board	Jarlath	
8:30am - 9:30am	Funding Prospects for the Future	Everyone	
Committees & WG	**Brainstorming the Future**		
9:30am - noon	Education Committee & Outreach	Mary and Larry	Room 6
9:30am - noon	Landsat	Rick	Jr. Ballroom (10)
9:30am - noon	Technology Committee / UAS	Sam/Jim	Jr. Ballroom (9)
9:30am - noon	Water Quality/Quantity/Utility Working Group	Chris McGinty	Room 8
10:15am - 10:45am	Break		Outside of Jr. Ballroom
Board Elections			
Noon - 12:15pm	Board Elections	Russ Congalton	Jr. Ballroom (9 & 10)
12:15pm - 1:15pm	Deli Lunch for members	Jester & Trent	Room 6
Business Sessions			
1:15pm - 1:20pm	Board Meeting for Officer Elections	Jarlath	Room 8
1:20pm - 1:30pm	Comments from Incoming Chair	Board Chair	Jr. Ballroom (9 & 10)
Reports	Out briefs from Tuesday Morning Discussion	Moderator - Jarlath	Jr. Ballroom (9 & 10)
1:30pm - 1:45pm	Technology	Sam Batzli	
1:45pm - 2:00pm	Landsat Working Group	Rick Lawrence	
2:00pm - 2:15pm	UAS Working Group	Jim Campbell	
2:15pm - 2:30pm	Water Quality, Quantity, Utility Working Group	Chris McGinty	
2:30pm - 2:45pm	Education	Larry Biehl	
2:45pm - 3:00pm	Outreach	Mary O'Neill	
3:00pm - 3:30pm	Break		Outside of Jr. Ballroom
Reports	Out briefs from Monday Mini-Fora		
3:30pm - 3:42pm	Landsat Requirements	Rick Lawrence	
3:42pm - 3:54pm	Water QQU	Chris McGinty	
3:54pm- 4:06pm	UAS	Jim Campbell	
4:06pm - 4:18pm	EOD Insert and Events Planning	Larry Biehl	
4:18pm - 4:30pm	Earth Engine Tutorials	JB Sharma	

AV Congressional Outreach Guidance			Jr. Ballroom (9 & 10)
4:30pm - 5:30pm	AV's Message and Key Points	Mary O'Neil	
	Advice from prior visits (from AV Members)		
	Arrangement of Mentor/Mentee schedules		
	Reminder to complete AVportal Update		
	Committee Positions Database	Chris McGinty	
5:30 PM	Dinner on your own		
Time	**04/05/17 (Wednesday)**	**POC or Note**	**Location**
Opens 6:30am	Hot breakfast buffet for Sheraton Guest	(1 free/room)	Syrah Restaurant
8am - 5pm	Hill Visits		
6:30pm	Informal post meeting visit with Chris Trent		Sheraton, Merlot Room

Appendix F – Highlights of AmericaView Fall Technical Meetings

Period 2 (GY14) 2014 Fall Technical Meeting at a Glance

AV Fall Technical Meeting Agenda
10/20/14

Location	**Working Breakfast @ Hallmark Inn Hotel (110 F St., Davis, CA 95616)**	
	Sequoia Room	**Manzanita Room**
7:30-8:30	Research Committee **Chris McGinty** (UtahView)	Technology Committee **Sam Batzli** (WisconsinView)
8:30-8:45	**Walk to Campus**	
Location	**UC Davis, Plant and Environmental Sciences Building (PES) Room 3001**	
8:45-9:00	Welcome & Orientation **Susan Ustin & Pia van Benthem** (CalView)	
9:00-9:15	Welcome & Meeting Overview **Russ Congalton**, AmericaView Board Chair (New HampshireView)	
9:15-10:05	*Keynote Presentation* Sustaining Earth Observations: Continuing the Landsat Legacy **Jennifer Lacey**, Observing Systems Branch Chief (USGS EROS)	
10:05-10:35	**Coffee Break**	
Location	**Concurrent Sessions**	
	PES 2005	**PES 3001**
10:35-12:00	**Sensors, Collectors & Research**	**Education & Outreach**
	Removal of Thin-cloud Removal in Landsat 8 Imagery using Cirrus and QA Bands **Yong Wang** (North CarolinaView)	Outreach Tools **Chris McGinty** (UtahView)
	The Future of Imaging Spectroscopy for Land Cover Mapping **Susan Ustin** (CalView)	The Matrix Arrived Late: Teaching Remote Sensing & Geospatial Technologies in a Virtual World **Bradley Shellito & Teri Benko** (OhioView)
	Data Fusion Approaches to High-Resolution Land Cover Mapping **Jarlath O'Neil-Dunne** (VermontView)	Leveraging Social Media for StateView Outreach Activities **Sam Batzli** (WisconsinView) **& Ramesh Sivanpillai** (WyomingView)
Location	**Lunch Presentations** **(sandwiches for grabs are outside of PES 3001)**	
	PES 2005	
12:00-1:15	Update on AmericaView **Russ Congalton**, AmericaView Board Chair (New HampshireView)	
	And, Four Months in the Job **Bobbi Lenczowski** (AmericaView Executive Director)	
Location	**PES 3001**	
1:15-2:30	UAS Research and Applications Panel Discussion **Jim Campbell & John McGee** (VirginiaView), **Michael Wing** (OregonView), **JB Sharma** (GeorgiaView), **Leo Liu** (UC Davis)	
Location	**PES 2nd and 3rd Floor Hallway**	
2:30-2:40	**Group Picture**	
2:40-3:00	**Coffee Break** **(MapGive workshop attendees need to walk to Hunt Hall (5 min walk))**	
Location	**253 Hunt Hall**	**PES 2005**
	Concurrent Workshops	
3:00-5:00	MapGive **Kevin Dobbs** (KansasView)	International Charter, Space and Major Disasters **Brenda Jones** (Disaster Response Coordinator, USGS EROS Center)
Location	**Indian Restaurant Preethi, 712 2nd Street, Davis, CA 95616**	
	Networking Dinner with Discussions over Coffee and Dessert	
6:00-8:00	Gathering User Requirements for Remote Sensing **Ramesh Sivanpillai** (WyomingView)	

AV Fall Technical Meeting Agenda
10/20/14

Location	**Working Breakfast @ Hallmark Inn Hotel (110 F St., Davis, CA 95616)**	
	Sequoia Room	**Manzanita Room**
7:30-8:30	Research Committee **Chris McGinty** (UtahView)	Technology Committee **Sam Batzli** (WisconsinView)
8:30-8:45	**Walk to Campus**	
Location	**UC Davis, Plant and Environmental Sciences Building (PES) Room 3001**	
8:45-9:00	Welcome & Orientation **Susan Ustin & Pia van Benthem** (CalView)	
9:00-9:15	Welcome & Meeting Overview **Russ Congalton**, AmericaView Board Chair (New HampshireView)	
9:15-10:05	*Keynote Presentation* Sustaining Earth Observations: Continuing the Landsat Legacy **Jennifer Lacey**, Observing Systems Branch Chief (USGS EROS)	
10:05-10:35	**Coffee Break**	
Location	**Concurrent Sessions**	
	PES 2005	**PES 3001**
10:35-12:00	**Sensors, Collectors & Research**	**Education & Outreach**
	Removal of Thin-cloud Removal in Landsat 8 Imagery using Cirrus and QA Bands **Yong Wang** (North CarolinaView)	Outreach Tools **Chris McGinty** (UtahView)
	The Future of Imaging Spectroscopy for Land Cover Mapping **Susan Ustin** (CalView)	The Matrix Arrived Late: Teaching Remote Sensing & Geospatial Technologies in a Virtual World **Bradley Shellito & Teri Benko** (OhioView)
	Data Fusion Approaches to High-Resolution Land Cover Mapping **Jarlath O'Neil-Dunne** (VermontView)	Leveraging Social Media for StateView Outreach Activities **Sam Batzli** (WisconsinView) **& Ramesh Sivanpillai** (WyomingView)
Location	**Lunch Presentations** **(sandwiches for grabs are outside of PES 3001)**	
	PES 2005	
12:00-1:15	Update on AmericaView **Russ Congalton**, AmericaView Board Chair (New HampshireView)	
	And, Four Months in the Job **Bobbi Lenczowski** (AmericaView Executive Director)	
Location	**PES 3001**	
1:15-2:30	UAS Research and Applications Panel Discussion **Jim Campbell & John McGee** (VirginiaView), **Michael Wing** (OregonView), **JB Sharma** (GeorgiaView), **Leo Liu** (UC Davis)	
Location	**PES 2nd and 3rd Floor Hallway**	
2:30-2:40	**Group Picture**	
2:40-3:00	**Coffee Break** **(MapGive workshop attendees need to walk to Hunt Hall (5 min walk))**	
Location	**253 Hunt Hall**	**PES 2005**
	Concurrent Workshops	
3:00-5:00	MapGive **Kevin Dobbs** (KansasView)	International Charter, Space and Major Disasters **Brenda Jones** (Disaster Response Coordinator, USGS EROS Center)
Location	**Indian Restaurant Preethi, 712 2nd Street, Davis, CA 95616**	
	Networking Dinner with Discussions over Coffee and Dessert	
6:00-8:00	Gathering User Requirements for Remote Sensing **Ramesh Sivanpillai** (WyomingView)	

AV Fall Technical Meeting Agenda
10/21/14

Location	**Working Breakfast @ Hallmark Inn Hotel (110 F St.-, Davis, CA 95616)**	
	Sequoia Room	**Manzanita Room**
7:30-8:30	Education Committee **Larry Biehl** (IndianaView)	Outreach Commitee **Mary O'Neill** (South DakotaView)
8:30-8:45	**Walk to Campus**	
Location	**UC Davis, Plant and Environmental Sciences Building (PES), Room 3001**	
8:45-10:05	AmericaView Resarch, Technology, Education and Outreach Committee Reports **Larry Biehl** (IndianaView), **Mary O'Neill** (South DakotaView), **Sam Batzli** (WisconsinView), **Chris McGinty** (UtahView)	
Location	**2nd and 3rd Floor Hallways in PES**	
10:05-10:35	**Coffee Break & Poster Session**	
Location	**Concurrent Sessions**	
	PES 3001	**PES 2005**
10:35-12:00	**Education**	**Applications**
	Resources for Landsat Workforce Development, Education and Citizen Science **Jeannie Allen** (NASA)	The Earth Observation Depot Network (EODN) **Sam Batzli** (WisconsinView), **P. R. Blackwell** (TexasView), **Nancy French** (MichiganView), **Martin Swany** (Indiana University Bloomington) remotely
	The AmericaView Educational Resource Portal **John McGee** (VirginiaView)	
	Bringing Global Climate Change Education (GCCE) to Alabama Classrooms **Chandana Mitra** (AlabamaView)	
Location	**PES 2004**	
12:00-1:15	**Lunch Presentations:** High School Drone Debate Project **UC Davis Senior High School Students** Progress and Ideas on AmericaView Outreach Materials **Mary O'Neill** (South DakotaView) & **Brent Yantis** (LousianaView)	
Location	**Concurrent Workshops**	
	253 Hunt Hall	**PES 1137**
1:15-2:30	Use of R for Image Analysis (Part I) **Rick Lawrence** (MontanaView)	Google Earth Engine **Tyler Erickson** (Google)
2:30-3:00	**Coffee Break**	
Location	**253 Hunt Hall**	**PES 1137**
3:00-5:00	Use of R for Image Analysis (Part II) **Rick Lawrence** (MontanaView)	Object-based Data Fusion Approaches to Feature Extraction using eCognition **Jarlath O'Neil-Dunne** (VermontView)
Location	**Dinner on your own**	

Period 3 (GY15) 2015 Fall Technical Meeting at a Glance

Day and Time	Event	Presenter(s)	Location
	Wednesday 10/21/15		
9am to 5pm	Board Meeting		Boardroom, HI
6pm to 7:30pm	Welcome Reception		Starlight Ballroom, HI
	Thursday 10/22/15		
7:15am to 8am	Travel to EROS		Bus in front of Hotel
8:00am to 8:30am	Check-in at EROS		
Opening		**Moderator Congalton**	**Auditorium**
8:30am to 8:40am	Welcome, Introductions, Logistics	Russ Congalton	
840am to 8:50am	Welcome by USGS	Timothy Newman	
Keynote Presentation		**Moderator Congalton**	**Auditorium**
8:50am to 8:55am	Introduction of Dr. Thomas Loveland	Russ Congalton	
8:55am to 9:30am	USGS Plans for Improving Landsat Land Cover Monitoring, Assessment, and Projection	Thomas Loveland	
Session I	**Ed. Use and Improved Distribution of Landsat**	**Moderator Congalton**	**Auditorium**
9:30am to 10:00am	Tracking Change over Time	Tom Adamson	
10:00am to 10:30am	EODN Status and Plans	Blackwell and Batzli	
10:30am to 10:50am	Refreshments		Outside of Cafe
Session II	**Effective Education Techniques**	**Moderator Lawrence**	**Auditorium**
10:50am to 11:10am	Improving University level Remote Sensing Classroom Instruction: Beyond the PowerPoint	Rick Lawrence, Russ Congalton, James Campbell	
11:10am to 12:15am	Facilitated discussion		
12:15pm to 1:30pm	Boxed lunch for Members		Outside of Cafe
12:30 - 1:25 p.m	Outreach Committee Meeting	Mary O'Neill	Room 1106, Exec. Conf.
12:30pm to 12:55pm	Research Committee Meeting	Doug Ramsey	Training room
1:00pm to 1:25pm	Technology Committee Meeting	Sam Batzli	Training room
Session III	Introduction	**Moderator Lenczowski**	**Auditorium**
1:30pm to 1:45pm	Introductory Comments	Frank Kelly	
1:45pm to 2:15pm	Keynote Presentation	David Applegate	
2:15pm to 3:15pm	Panel of Emergency Response Support	Sivanpillai, Yantis, Dobbs, Danzeglocke, Deng, Mahmood	
3:15pm to3:30pm	Changes in Assateague Island from Hurricane Sandy using Landsat Imagery	Russ Congalton	
3:30pm to 3:45pm	International Charter Video and Highlights	M. Borgeaud and Brenda Jones	
3:45pm to 4:00pm	AV Photo followed by refreshments		Outside of Cafe
Session IV	**Committees' Reports to AV Membership**	**Moderator Congalton**	**Auditorium**
4:00pm to 4:15pm	Education	Larry Biehl	
4:15pm to 4:30pm	Technology	Sam Batzli	
4:30pm to 4:45pm	Outreach	Mary O'Neill	
4:45pm to 5:00pm	Research	Doug Ramsey	
5:00pm	Board bus for hotel		In front of EROS
6:00pm to 8:00pm	International Charter for Space and Major Disaster Recepton and Buffet		Falls Overlook Cafe

	Friday 10/23/15		
7:15am to 8am	Travel to EROS		Bus in front of Hotel
8:00am to 8:10am	Check-in at EROS		
Opening			**Auditorium**
8:10am to 8:20am	Board Meeting Summary	Russ Congalton	
8:20am to 8:30am	Hosting FTm 2016	Pia van Benthem	
Session V	**Earth Sciences (Parallel to session VI)**	**Moderator Sharma**	**Auditorium**
8:30am to 8:45am	The National Map, 3DEP	Karl Heidemann	
8:45pm to 9:05am	Coastal National Elevation Database	Sandra Poppenga	
9:05am to 9:25am	Using Satellite Imagery over State Parks to Teach about Landforms and Landform Change	Rebecca Dodge	
9:25am to 9:40am	Bringing out the Explorer in Students with "Landsat in a Box"	Amber Imai-Hong	
9:40am to 10:00am	GEOBIA Based Landcover Analysis of Hall County Georgia	J.B. Sharma	
Session VI	**Tools in the Toolkit (Parallel to session V)**	**Moderator Mueller**	**Training room**
8:30am to 8:50am	R for Image Analysis	Rick Lawrence	
8:50pm to 9:05am	The use of QGIS in Remote Sensing	Tom Mueller	
9:05am to 9:20am	Web-based Multispec	Larry Biehl	
9:20am to 9:35am	Update on "Adopt a Pixel"	Ken Boykin	
9:35am to 10:00am	Smartphone App "Field Photo" and Geo-Referenced Field Photo Library	Xiangming Xiao	
10:00am to 10:15am	Refreshments		Outside of Cafe
10:15am to 11:25am	Tour of EDC		
11:30am to 1:15pm	Poster Session	AV & IC Posters	
12:10pm to 1:15pm	Catered lunch for Members		Outside of Cafe
12:20pm to 1:10pm	Education Committee Lunch Meeting	Larry Biehl	Training Room
12:20pm to 1:10pm	Water Quality Working Lunch Meeting	Benko / Quackenbush	Room 1106, Exec. Conf.
Session VII	**Workshops A and B**		
1:15pm to 3pm	Preparing to Edit AV New Website with WordPress	Sam Batzi	Room 1106, Exec. Conf.
1:15pm to 3pm	ArcGIS Online	Greg Bonynge	Training room
Session VIII	**Workshops C, D, and E**		
3:00pm to 4:45pm	UAS Integration into Curriculum and Research	O'Neil-Dunne / Sharma	Auditorium
3:00pm to 3:45pm	Comparison of cloud removal algorithms for Landsat-8 data	Yong Wang	Training room
3:45pm to 4:00pm	Refreshments		Outside of Cafe
4:00pm to 4:45pm	Earth Observation Using High Resolution SAR - Recent Development	Yong Wang	Training room
5:00pm	Board for bus (dinner on own)		In Front of EROS
	Saturday 10/24/15		
8am to 5pm	Disaster Preparedness Workshop	Brenda Jones	Cascade Room, HI

Period 4 (GY16) 2016 Fall Technical Meeting at a Glance

Day and Time	Event	Presenter(s)	Location
Sunday	**Sunday October 16, 2016**		Hilton Garden Inn
9a.m. to 5p.m.	**Board Meeting**	Abdalla Hall	Conference Room 208
6p.m. to 7:30p.m.	**Welcome Reception**	Hilton Garden Inn	Evangeline A & B
Monday	**Monday October 17, 2016**		Abdalla Hall
7:45a.m. to 8:10a.m.	*Coffee and Tea*	No drinks or food in the Auditorium	Atrium (1st Floor)
	Opening	Moderator: O'Neil-Dunne	Auditorium (1st floor)
8:15a.m.	Welcome, Introductions, Day Plan, PM Summary	Yantis, O'Neil-Dunne, McGinty	
9:00 a.m.	"Business Cards" Self-introductions	Each StateView	Auditorium
10:00a.m. to 10:30a.m.	*Networking Break (Refreshments, Poster Cruising)*	No drinks or food in the Auditorium	Atrium
	Session I		
Session I-A	**AV Curriculum Building Activities**	**Moderator: Biehl**	Classroom 218
10:30a.m.	MNView, AV University, TXView, …	Knight, Seong, Dodge	
Session I-B	**UAS Working Group**	**Moderator: McGee**	Auditorium
10:30a.m.		Gregory Crutsinger (Parrot, Inc)	
	Session II		
Session II-A	**Poster Presentation Session: Section A**	**Moderator: Bonynge**	Atrium
11:30a.m.	Education Approaches and Resources	Congalton, Dodge, O'Neill, van Benthem, Battaglia, Biehl	
Session II-B	**Virtual Reality**	**Moderator: Simic**	Auditorium
11:30a.m.	GeoVisionary	Michael Ewing, Andrew O'Keefe - Virtalis	
Session II - C	**RCA Procedures for Next Cycle**	**Moderator: Sharma**	Classroom 218
1:30p.m.			
12:15p.m. to 1:30p.m.	*Lunch with Working Meetings below:*	No drinks or food in the Auditorium	Dining Room (1st floor)
12:30p.m. to 1:25p.m.	Joint Education and Outreach Committees Meeting	Biehl and O'Neill	Classroom 218
12:30p.m. to 1:25p.m.	Technology Committee Meeting	Batzli	Computer Lab (153&155)
	Session III		
Session III - A	**AV Website, Word Press and SV Websites**	**Moderator: Batzli**	Classroom 218
1:30p.m.	Template and Guidelines Orientation	Batzli, J. Congalton	
Session III - B	**Tour of Disaster Response Area**	**Moderator: Yantis**	1st floor
1:30p.m.			
Session III- C	**Geovisionary Demo (Virtalis)**	Michael Ewing and Andrew O'Keefe	Conference Room 208
1:30p.m.			
	Session IV		
Session IV	**KEYNOTE PRESENTATION**	**Moderator: O'Neil-Dunne**	Auditorium
2:30p.m.	"Certainties in an Uncertain Future -- a USGS LRS Program update" Cecere		
3:30p.m. to 3:45p.m.	**AV Photo followed by refreshments**		Auditorium
3:45p.m. to 4:10p.m.	*Networking Break*	No drinks or food in the Auditorium	Atrium
	Session V		
Session V - A	**POSTER Session Section B**	**Moderator: Parrish**	Atrium
4:15p.m.	Processing and Interpretation	Coughenour, Moore, Parrish, Seong, Imai-Hong, Wang (2)	
Session V - B	**POSTER Session Section C**	**Moderator: Bonynge**	Atrium
4:15p.m.	Historical to (Nearly!) Real Time	Howard, O'Neil-Dunne, Ramsey, McGee, McNeely, Mitra, Liang	
Session V - C	**Outreach for GY16 and Beyond**	**Moderator: O'Neill**	Auditorium
4:15p.m.	Poster, Trifold, Brochure, Factsheets, Website		
6:00p.m.	*Business Dinner*	Abdalla Hall	Dining room and Patio

Tuesday	Tuesday October 18, 2016		Abdalla Hall
7:45a.m. to 8:10a.m.	*Coffee and Tea*	No drinks or food in the Auditorium	Atrium
Opening		**Moderator: O'Neil-Dunne**	
8:15a.m.	Board Meeting Summary	O'Neil-Dunne	Auditorium
8:40a.m.	WBM 2017	Staff	Auditorium
	Session VI		
Session VI - A	**Landsat Working Meeting**	**Moderator: Lawrence**	Auditorium
9:00a.m.	Landsat Working Meeting	Lawrence, Cook, Loveland, McGinty, Sivanpillai	
10:30a.m. to 10:45a.m.	*Networking Break*	No drinks or food in the Auditorium	Atrium
10:45a.m. to noon	Landsat Working Meeting continued		
Session VI - B	**UAS Workshop**	**Moderator: O'Neil-Dunne**	Computer Lab (153&155)
9:00a.m.	From Flight Planning to Geospatial Products with UAS	O'Neil-Dunne, Lemoine (Trimble)	
10:30a.m. to 10:45a.m.	*Networking Break*	No drinks or food in the Auditorium	Atrium
10:45a.m. to noon	Workshop continuing		
Noon to 1:15p.m.	*Lunch with Working Meetings below:*	No drinks or food in the Auditorium	Dining Room
12:15p.m. to 1:10p.m.	Water Quality Working Group	Simic	Classroom 218
12:20p.m. to 12:40 p.m.	Consideration of Citizen Science Working Group	Xiao, Lenczowski	Computer Lab (153&155)
12:40p.m. to 1:10p.m.	Brainstorming for New Solicitation	McGinty	Computer Lab (153&155)
	Session VII		
Session VII - A	**eCognition Workshop**	**Moderator: O'Neil-Dunne**	Computer Lab (153&155)
1:15p.m.	Data fusion for improved feature extraction using eCognition		
Session VII - B	**Earth Engine Workshop and Working Group**	**Moderator: Sharma**	Classroom 218
1:15p.m.	Earth Engine		(Bring prepared personal computer)
3:15p.m. to 4:00p.m.	Networking Break	No drinks or food in the Auditorium	Atrium
Closing Session	**Out Briefings from Working Groups**	**Moderator: O'Neil-Dunne**	Auditorium
4:00p.m.	Landsat	Rick Lawrence	
4:30p.m.	Earth Engine	JB Sharma	
4:45p.m.	Website	Sam Batzli	
5:00p.m.	UAS	John McGee	
5:15p.m.	Water Quality, Quantity, and Utility	Anita Simic	
5:30p.m.	Wrap-up comments (Survey Reminder)	Jarlath O'Neil-Dunne	
	Dinner on your own		
Avery Island Salt Dome	**Wednesday October 19, 2016**		Abdalla Hall
9:00a.m.	Salt Dome Presentation	**Moderator: Yantis**	Auditorium
10:00a.m.	Travel by bus to Avery Island with commentary	Brent Yantis	Bus
11:00a.m.	Tabasco Plant Tour		
12:30p.m. to 1:30p.m.	*Lunch*		Restaurant 1868
1:30p.m.	Jungle Gardens Tour		
3:30p.m.	Travel by bus to Hilton Garden Inn hotel		Bus
	Dinner on your own		
	Thursday October 20, 2016		Abdalla Hall
9:00a.m. to 4:00p.m.	Optional Workshop on RADAR/SAR	**Moderator: Yantis**	Computer Lab (153&155)
	Dinner on your own		

Period 4 (GY16) 2017 Fall Technical Meeting Participation in Pecora Symposium

Pecora 20 Symposium - AmericaView Participation **November 13-16, 2017**

Workshops	Presenter	Schedule
Object-based, data fusion land cover mapping	Jarlath O'Neil-Dunne	Monday, November 13, 8:00am
Remote Sensing Education, Research and Outreach with Google Earth Engine	JB Sharma	Monday, November 13, 8:00am
The State of Earth Observation Using Synthetic Aperture Radar Technology and Data	Yong Wang	Tuesday, November 14, 8:00am

Presentations	Authors	Schedule
An Overview of the Binational Great Lakes Wetlands Remote Sensing Project	Brian Huberty, Brian Brisco, Sarah Banks, Jennifer Corcoran, Jim Klassen, Keith Pelletier, PaulMorin, Laura Chavez, Mike Battaglia, and Joe Knight	Tuesday, Nov 14, 2:00 pm
Panel: Creating a healthy remote sensing education pipeline: moving from K-12 to university	Lindi Quackenbush, Ken Boykin, James Campbell, Amber Imai-Hong, JB Sharma, Chandi Witharana, Brent Yantis	Tuesday, Nov 14, 2:15 pm
High Resolution Optical and Radar Mapping and Monitoring of Coastal Great Lakes Wetlands to Inform Wetland Management Decisions	Michael Battaglia, Laura Bourgeau-Chavez, Colin Brooks, Brian Brisco, Brian Huberty, Sarah Endres	Tuesday, Nov 14, 2:35 pm
Evaluating the Performance of Various Sampling Strategies Used to Assess the Accuracy of Large Area Crop Maps	Russell Congalton, Linnea Dwyer, Kamini Yadav	Tuesday, Nov 14, 2:45 pm
Monitoring the Breakup of Sea Ice in the Beaufort Sea usi	Tracy DeLiberty	Tuesday, Nov 14, 3:10 pm
Panel: Training the next generation of remote sensing scientists through undergraduate research opportunities	Rebecca Dodge, Larry Biehl, Yong Wang, Ramash Sivanpillai, Jarlath O'Neil-Dunne	Tuesday, Nov 14, 4:00 pm
Land Cover Classification of the Lake of the Woods/Rainy River Basin by Object-Based Image Analysis of Landsat and Lidar Data	Leif Olmanson, Marvin Bauer	Tuesday, Nov 14, 4:20 pm
Active-Passive Data Fusion for Global, Nearshore Bathymetry Retrieval	Nick Forfinski-Sarkozi, Christopher Parrish	Wednesday, Nov 15, 10:30 am
Integrating airborne lidar and Landsat data to quantify forest aboveground biomass amount and uncertainty	Siqi Li, Lindi Quackenbush	Wednesday, Nov 15, 11:20 am
Structure-From-Motion Derived Historical Orthomosaicâ€™s and their Applications	Lisa Wirth	Wednesday, Nov 15, 11:40 am
Tree Height Estimation in Sloped Plateau Area with Dual-Polarization InSAR Techniques and Datasets	Yong Wang, Huimin Li	Wednesday, Nov 15, 11:40 am
Vigor and evapotranspiration of soybean grown under different management systems monitored by Landsat	Anita Simic Milas	Wednesday, Nov 15, 3:50 pm
Using Landsat to Assess the Extent and Severity of Forest Defoliation from Gypsy Moth Larvae in Eastern Connecticut Forests	James Hurd, Chandi Witharana, Daniel Civco, Jason Parent	Wednesday, Nov 15, 3:50 pm

Wavelet-based Multisensor Data Fusion aided by Tempor	Sherin Ghannam, A. Lynn Abbott, Mohamed E. Hussein, Randolph H. Wynne , Valerie A. Thomas, James B. Campbell	Wednesday, Nov 15, 4:40 pm
NAIP orthophotography for land cover mapping tasks: A review with recommendations	Aaron Maxwell; Tim Warner	Thursday, Nov 16, 11:40 am
CropRef: Reference Datasets and techniques to improve global cropland mapping	Jun Xiong, Prasad S. Thenkabail, Russell Congalton, Kamini Yadav, Pardhasaradhi Teluguntla, Adam Oliphant, Murali Krishna Gumma, Richard Massey, Corryn Smith	Thursday, Nov 16, 11:40 am
A 44-year time series of forest structure in northwestern Montana using the entire Landsat archive length from MSS to OLI (M2O)	Shannon Savage, Rick Lawrence	Thursday, Nov 16, 11:40 am
Annual maps of water-related land cover types (open surface water body, natural wetlands, and paddy rice) through analyses of Landsat images in Google Earth Engine	Xiangming Xiao, Zhenhua Zou, Geli Zhang, Jinwei Dong, Bangqian Chen	Thursday, Nov 16, 3:30 pm
Mapping and Quantifying Biodiversity and Ecosystem Services Related to Terrestrial Vertebrates: A National Approach	Kenneth Boykin, William G. Kepner, Anne C. Neale, Kevin J. Gergely	Thursday, Nov 16, 4:10 pm
Using Unmanned Aerial Systems to Evaluate Shrub Community Characteristics in a Semi-Arid Landscape.	R. Douglas Ramsey, Christopher McGinty	Thursday, Nov 16, 4:40 pm

Posters	Presenter	StateView
Assessing Sustainable Urban Rooftop Designs through the usage of Small Unmanned Aerial Systems and Satellite Imagery: A case study in Auburn, Alabama	Chandana Mitra	AlabamaView
Multiuser Perspectives on Experimental UAS Flight Operations	Timmera Whaley	ArkansasView
Mapathon- A Volunteer Geographic Information Mapping for Humanitarian Relief	Pia van Benthem	CaliforniaView
Using Remote Sensing Data to Improve Geographic Assessments of UV-B Radiation and its Climatology from a Sparse Ground Monitoring Network	Michael Coughenour	ColoradoView
Aligning earth observation technologies with next generation science standards	Chandi Witharana	ConnecticutView
All quiet on the northern front: Remote sensing based retrospection of human wellbeing in the armed-conflicted areas of Sri Lanka	Chandi Witharana	ConnecticutView
Working with Time-series Landsat Big Data: A Workflow and Experiences with Open Source Software	Jeong Seong	GeorgiaView
Update on the Iowa Best Management Practice Inventory, Applications and Associated Datasets	Robin McNeely	IowaView
New Methods for Integrating Remote Sensing Imagery and Modeled Inundation Libraries for Rapid Flood Mapping	Kevin Dobbs	KansasView

Integration of Landsat-8 and high-resolution imagery, and LiDAR to improve mapping of water bodies at regional scales	Haluk Cetin	KentuckyView
Incorporating Remote Sensing into K-12 Project-Based Science Curricula	Nancy H.F. French	MichiganView
Google Earth Engine for eigenspace spectral and temporal transforms of Landsat 8 and Sentinel-2 data sets	Lance D. Yarbrough	MississippiView
Multispectral and Texture Feature Application in Mapping Summer Vegetation for Marco Polo Argali in Eastern Tajikistan Pamirs	Kenneth Boykin	New MexicoView
Mapping and monitoring shelterbelt dynamics in the Red River of the North Valley using NAIP and LiDAR data	Bradley Rundquist	North DakotaView
Monitoring chlorophyll-a of the Western Basin of Lake Erie with Sentinel-2A and Landsat 8 imagery	Anita Simic Milas	OhioView
South Dakota LiDAR Factsheet	Mary O'Neill	South DakotaView
Assessing Land Cover Change During Drought Period in a Coastal Area of Binh Thuan province, Vietnam Using High Resolution Imagery	James B. Campbell	VirginiaView
RealEarth: Visualize Your Data	Sam Batzli	WisconsinView

Appendix G – Bibliography of Grant Supported Publications

Publications Made Possible, In Full or Partially, by This Grant

Publications (Articles, Documents, Books) in Full or in Part Funded by USGS Grant for Periods 1 through 4

1. Brawner, E.V., M.H. Aly, J.D. Cothren and J.A. Tullis, 2016, ENVISAT Observations (2005-2010) of Surface Deformation at the Coso Geothermal Site, Eastern California, Arkansas Aerospace Proceedings 3.

2. Bunker, B.E., J.A. Tullis, J.D. Cothren, J. Casana and M.H. Aly, 2016, "Object-based Dimensionality Reduction in Land Surface Phenology Classification", AIMS Geosciences 2(4):302-328.

3. Coughenour, M. 2018. Using Remote Sensing Data to Improve Geographic Assessments of UV-B Radiation and its Climatology from a Sparse Ground-Monitoring Network.

4. Cox, Cody, Wayde Morse, Christopher Anderson, and Luke Marzen, 2014. Using Public Participation Geographic Information Systems to Identify Places of Watershed Service Provisioning. Journal of the American Water Resources Association (JAWRA) 1-15. DOI: 10.1111/jawr.12269.

5. DeWitt, JD, T.A. Warner, and J.F. Conley, 2015. Comparison of DEMS derived from USGS DLG, SRTM, a statewide photogrammetry program, ASTER GDEM and lidar. GIScience & Remote Sensing 52(2):179-197. DOI: 10.1080/15481603.2015.1019708

6. El Garouani, A., Mulla, D.J., El Garouani, S., Knight, J.F. (2017) Analysis of Urban Growth and Sprawl from Remote Sensing Data: Case of Fez, Morocco. International Journal of Sustainable Built Environment, 6(1):160-169.

7. Haritashya, Umesh K., Mark Pleasants, Katlyn Voss, Alexandre Bevington, Marten Geertsema, Andy Kaab, Dan Shugar, Jeffrey Kargel and Gregory Leonard (2015) Landsat shows new hazards arising in Manaslu/Langtang region of Nepal. Scientific analysis done post April 25, 2015 Nepal earthquake. NASA website for public dissemination http://www.nasa.gov/jpl/landsat-shows-new-hazards-arising-in-manaslulangtang-region-of-Nepal

8. Jones, Tyler W., Luke Marzen, and Art Chappelka. "Horizontal Accuracy Assessment of Global Positioning System Data from Common Smartphones." Papers in Applied Geography 1, no. 1 (2015): 59-64

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11. Lawrence, R.L., and C.J. Moran. 2015. The AmericaView classification methods accuracy comparison project: A rigorous approach for model selection. Remote Sensing of Environment 170:115-120.

12. Ledoux, Lindsay, 2015. Evaluating Landsat 8 Satellite Sensor Data for Improved Vegetation Mapping Accuracy of the New Hampshire Coastal Watershed Area. MS Thesis. University of New Hampshire. 97 pp.

13. Lee, M.-K., Mitra, C., Thomas, A., Lucy, T., Hickman, E., Cox, J., Rodger, C., 2015, Bringing global climate change education to middle-school classrooms - an example from Alabama, Handbook for Climate Change Mitigation and Adaptation, 2nd edition. Springer, pp 1-17

14. James K. Lein (2014) Toward a Remote Sensing Solution for Regional Sustainability Assessment and Monitoring, Sustainability, 6, 2067-2086.

15. Lestina, J., Cook, M., Kumar, S., Morisette, J., Ode, P. J., & Peairs, F. (2016). MODIS imagery Improves Pest Risk Assessment: A Case Study of Wheat Stem Sawfly (Cephus cinctus, Hymenoptera: Cephidae) in Colorado, USA. Environmental Entomology, Volume 45, Issue 6, 1 December 2016, Pages 1343-135.

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17. Luo, Xuelian, Yong Wang, and Joseph Luczhovich, 2016. Mapping submerged aquatic vegetation in Albemarle Sound, North Carolina, USA using Landsat-8 and sonar data. The Proceedings of the International Geoscience and Remote Sensing Symposium, 2016 (IGARSS 2016). Beijing, China. 10-15 July 2016. 3802-3805.

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Appendix H - Grant Supported Presentations

Oral, Poster, Panel and Workshop Presentation over the Four Grant Periods

At the end of each grant period, when the StateView submits its report, presenters of various presentations, which totally or in part reflect the work supported by the grant, are identified with the title, time, and location of the presentation. Each StateView makes its own decisions on which events are reported and, although no specific guidelines were established about what should be identified, there is general consistency following academic practice. However, it is clear to the reviewers of this information that many StateViews did not report all presentations. Similarly, because each grant period does have some temporal overlap, StateViews made the judgment about which grant year to credit for the event.

Grant Period	Number of Presentations
1, also called GY13	34
2, also called GY14	55
3, also called GY15	59
4, also called GY16	93

The fourth grant period, with its No-Cost-Extensions was longer than the other periods. That accounts, however, only slightly for the significant increase. AmericaView's participation in the Pecora 20 Symposium with oral presentations, poster presentations, panel discussions, and workshops is reflected in the count seen above.

Abstracts were prepared for nearly every one of the items listed. They would be available upon request but not published here.

Alabama

Grant Period 1:

Jones, T., Marzen, L., Barbour, M., Fowler, S., "Identification and Classification of Geographically Isolated Wetlands in Alabama using Geographic Object Based Image Analysis (GeOBIA)" Oral Presentation at Alabama Water Resources Conference, 5 Sep 2014, Orange Beach, AL.

Shakya, S., Marzen, L., "Correcting wrongly classified wetlands with LiDAR," Oral Presentation at Alabama Water Resources Conference, 5 Sep 2014, Orange Beach, AL.

Grant Period 3:

Johnston, B.C., "Measuring Mesopotamian Marshland Change Using Landsat Imagery From 1986 To 2015", Oral Presentation at the Alabama Water Resources Conference, 9 – 11 Sep 2015, Orange Beach, AL.

Jones, T., "Mapping, Modeling, and Estimating Tree Measurements of Urban Tree Canopy Structure Using Terrestrial Lidar Scanning". Oral Presentation at the Applied Geography Conference, 4 – 7 Nov 2015, San Antonio, TX.

Grant Period 4:

Mitra, C., "Assessing Sustainable Urban Rooftop Designs through the usage of Small Unmanned Aerial Systems and Satellite Imagery in Auburn, Alabama", Poster presented at the Pecora 20 Symposium, 13-16 Nov 2017, Sioux Falls, SD.

Alaska

Grant Period 4:

Wirth, L. "Structure-from-motion derived historical ortho-mosaics and their applications", Oral Presentation at the Pecora 20 Conference, 15 Nov 2017, Sioux Falls, SD.

Arkansas

Grant Period 1:

Gorham, B., "Using your Phone's GPS with Google Earth", Oral Presentation at the Arkansas Master Naturalists Workshop, 4 Oct 2014, Fayetteville, AR.

Tullis, J.A. , "Role of a Geospatial Provenance Store", Oral Presentation at the Department of Geography Seminar, Brigham Young University, 5 Dec 2013, Provo, UT.

Grant Period 2:

Xue, B., Tullis, J.A., "Comparing SVM, Cubist and Random Forest on Estimating Forest Total Biomass at Two Study Sites", Oral Presentation at the AAG 2015 Annual Meeting, 21 Apr 2015, Chicago, IL.

Tullis, J. A., Shi, X., Cothren, J.D., "The Integrated Geoprocessing, Workflows, and Provenance Cycle", Oral Presentation at the Imaging and Geospatial Technology Forum (IGTF) 2015, 7 May 2015, Tampa, FL and http://www.asprs.org/a/publications/proceedings/IGTF2015/6G%5B1%5D-abstract.pdf

Grant Period 3:

Aly, M.H., "Yellowstone Volcanic Unrest from GPS and SAR Interferometric Observations between 1992 and 2015", Oral Presentation at the American Geophysical Union, 14-18 Dec 2015, San Francisco, CA.

Aly, M.H., "Space-Based Monitoring and Characterization of Active Geothermal Reservoirs", Oral Presentation at the Imaging & Geospatial Technology Forum", 11-15 Apr 2016, Fort Worth, TX.

Aly, M.H., Al-Shukri, H.R., "Spaceborne InSAR Monitoring of Geohazards in Arkansas", Oral Presentation at the NASA EPSCoR Annual Meeting, 16 Apr 2016, Hot Springs, AR.

Mueller, T., Tullis, J.A., van Benthem, P., Dodge, R., Sharma, J.B., "Education Tools and Lessons to Improve Remote Sensing and GIS Workflows", Panel Presentation at the Imaging & Geospatial Technology Forum (IGTF) 2016, 11-15 Apr 2016, Fort Worth, TX.

Murch, W.P., Tullis J.A., "A Summer at ESRI: On the Forefront of GIS", Oral Presentation at the 2015 Arkansas GIS Users Forum Training and Symposium, 31 Aug – 4 Sep 2015, Little Rock, AR.

Tracy, B.R., Tullis, J.A., Barnes, A., Polonius, I., "Using GIS for Economic Development in Rural Arkansas" Oral Presentation at the 2015 Arkansas GIS Users Forum Training and Symposium, 31 Aug – 4 Sep 2015, Little Rock, AR.

Tullis, J.A., "Interchange of Provenance in GIS", Oral Presentation at the EROS Data Center, 23 Oct 2015, Sioux Falls, SD.

Tullis, J.A., Linck, R.F., "Capture and Use of Geospatial Provenance in Mainstream GIS", Oral Presentation at the Imaging and Geospatial Technology Forum (IGTF) 2016, 11-15 Apr 2016, Fort Worth, TX.

Grant Period 4:

Liang, L., Tullis, J.A., Aly, M., "Remote Sensing Activities of ArkansasView", Oral Presentation at the AmericaView Fall Technical Meeting, 18 Oct 2016, Lafayette, LA.

Tullis, J.A., "Geospatial Unmanned Aircraft Systems (UAS)", Oral Presentation at the Arkansas Unmanned Aerial System Summit, 27 Oct 2016, Fayetteville, AR.

Tullis, J.A. and students, "Geospatial Unmanned Aircraft Systems (UAS)", Oral presentations at the Mullins Library GIS Day Open House, 16 Nov 2016, Fayetteville, AR.

Tullis, J.A., "Unmanned Aircraft Systems (Drones) and Other Geospatial Advances in Environmental Monitoring", Oral Presentation at the UA Chapter of Sigma Xi, 10 Feb 2017, Fayetteville, AR.

Tullis, J.A., "Unmanned Aircraft Systems and GIS Workflow Interchange", Oral Presentation at the Arkansas GIS Users Forum 2017 Spring Meeting, 22 Mar 2017, Little Rock, AR.

Tullis, J.A., “Practical Interchange of Geoprocessing, Workflows, and Provenance for Enterprise GIS”, Oral Presentation at the AAG 2017 Annual Meeting, 6 Apr 2017, Boston, MA.

Tullis, J.A., “Opportunities in Unmanned Aircraft Systems (UAS) and GIS Workflows”, Oral Presentation at the Department of Geosciences Colloquium, 21 Apr 2017, Fayetteville, AR.

Whaley, T.E, Tullis, J.A., “Multiuser Perspectives on Experimental UAS Flight Operations”, Poster presented at the 20th William T. Pecora Memorial Remote Sensing Symposium, 14 Nov 2017, Sioux Falls, SD.

California

Grant Period 1:

van Benthem, P., Lay, M., “A Satellites View of California's Drought”, Oral Presentation at the 2014 California Extreme Precipitation Symposium, 24 June 2014, Davis, CA.

van Benthem, P., Lay, M., “Introduction into Geographical Information Systems and Remote Sensing”, Oral Presentation at the National Science Teacher Association Conference 2014, 4 Dec 2014, Long Beach, CA

Grant Period 3:

van Benthem, P., “Online Tool for K-12 Using USGS Earthshots”, Oral Presentation at the Imaging and Geospatial Technology Forum (IGTF) 2016, 11-15 Apr 2016, Fort Worth, TX.

van Benthem, P., “Science and Society-How the application of various geospatial technology change our world”, Invited lecture for University of California at Davis GIS and Society undergraduate class, Spring 2016, Davis, CA.

Colorado

Grant Period 2:

Cook, M., Lestina, J., “Invasive species habitat suitability modeling for the Wheat Stem Sawfly in Colorado”, Oral Presentation at GIS in the Rockies, 24 Sep 2015, Denver, CO.

Coughenour, M., Cook, M., “Colorado View and Using Remote Sensing to Improve an Invasive Species Model”, Oral Presentation at GIS Day, 18 Nov 2015, Fort Collins, CO.

Grant Period 3:

Coughenour, M., “ColoradoView Activities 2014-2015”, Oral Presentation at the Fall Technical Meeting Oct 2015, Sioux Falls, SD.

Coughenour, M., “ColoradoView Project Digest - 2015-2016”, Oral Presentation at the AmericaView Winter Business Meeting, 1 Mar 2016, Reston, VA.

Grant Period 4:

Coughenour, M., "Using Remote Sensing Data to Improve Geographic Assessments of UV-B Radiation from a Sparse Ground Monitoring Network', Oral Presentation at AmericaView Members Meeting, 14 Dec 2016, GoToMeeting.

Coughenour, M., "Using Remote Sensing Data to Improve Geographic Assessments of UV-B Radiation from a Sparse Ground Monitoring Network", Poster presented at PECORA 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Connecticut

Grant Period 2:

Hurd, J., Civco, D., "More Than Just a Picture: The Basics of Remote Sensing", Oral Presentation for the Center for Landuse Education and Research (CLEAR) Webinar Series, 28 July 2015, Haddam, CT.

Grant Period 4:

Hurd, J., "Using Landsat to Assess the Extent and Severity of Forest Defoliation from Gypsy Moth Larvae in Eastern Connecticut Forests", Oral Presentation at Pecora 20 Symposium, 15 Nov 2017, Sioux Falls, SD.

Witharana, C., "All Quiet on the Northern Front: Remote Sensing Based Retrospection of Human Wellbeing in the Armed-Conflicted Areas of Sri Lanka", Poster presented at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Witharana, C., "Creating a Healthy Remote Sensing Education Pipeline: Moving from K-12 to University", Panel Oral Presentation, 14 Nov 2017, Sioux Falls, SD.

Delaware

Grant Period 4:

Deliberty, T., "Monitoring the Breakup of Sea Ice in the Beaufort Sea using Multi-Sensor Satellite-derived Time-series Data", Oral Presentation at Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Georgia

Grant Period 1:

Ogle, J., Seong, J.C., "Majority Filtering for the Cropscape Dataset" Oral Presentation at the AmericaView 2014 Fall Technical Meeting, 23 Oct 2014, Davis, CA. [DATE] 10/23/2014

Grant Period 2:

Seong, J.C., "Sun Position Calculator (SPC) for Landsat Imagery", Oral Presentation at the AmericaView 2015 Fall Technical Meeting, 22-23 Oct 2015, Sioux Falls, SD.

Seong, J.C., “AVUNIV - An Online Remote Sensing Course”, Oral Presentation at the Association of American Geographers 2014 Annual Conference, 24 Apr 2014, Chicago, IL.

Grant Period 3:

Seong, J.C., “Landsat Big Data Analysis for Water Quality Analysis”, Oral Presentation at the American Geographers 2016 Annual Meeting and Conference, 1 Apr 2016, San Francisco, CA.

Seong, J.C., “GeorgiaView and Working with Landsat Imagery”, Oral Presentation at the 2016-2017 Georgia State University Seminar Series, 4 Feb 2016, Atlanta, GA.

Grant Period 4:

Seong, J.C., “Analysis of Long-term Landsat Reflectance Data for Monitoring Water Quality”, Oral Presentation at the AmericaView Fall Technical Meeting 17 Oct 2016, Lafayette, LA

Seong, J.C., “Analysis of Spectral Reflectances of Microcystis Aeruginosa”, Oral Presentation at the Association of American Geographers Annual Meeting and Conference, 7 Apr 2017, Boston, MA.

Seong, J.C., “Landsat Big Data Analysis for Detecting Long-Term Water Quality Changes: A Case Study in the Han River, South Korea”, Oral Presentation at the ISPRS Hannover Workshop 2017, 7 Jun 2017, Hanover, Germany.

Seong, J.C., “Working with Time-series Landsat Big Data: A Workflow and Experiences with Open Source Software”, Poster presented at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Sharma, J.B., “Creating a Healthy Remote Sensing Education Pipeline: Moving from K-12 to University”, Panel Oral Presentation at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Hawai’i

Grant Period 2:

Imai-Hong, A., “Bringing Out the Explorer in Students with ‘Landsat in a Box’”, Oral Presentation at AmericaView Fall Technical Meeting, 23 Oct 2015, Sioux Falls, SD.

Grant Period 4:

Imai-Hong, A**.,** “Creating a Healthy Remote Sensing Education Pipeline: Moving from K-12 to University”, Panel Presentation at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Idaho

Grant Period 1:

Eitel, J.U.H., Vierling, L.A., Magney, T.S., Greaves, H.E., Vierling, K.T., Hudak, A.T., Boelman, N.T., Griffin, K.L., Dittmar, G., “ Beyond 3-D”, Oral Presentation at the International Workshop 3D Vegetation

Mapping using Advanced Remote Sensing - Implications for Seamless Modeling of Terrestrial Ecosystems, 25 Sep 2014, St. Oswald, Germany

Grant Period 2:

Eitel, J., "5D LiDAR and its potential to advance phenomics", Oral Presentation at the Advanced in field-based high-throughput phenotyping and data management: grains and specialty crops meeting, 9 November 2015, Spokane, WA.

Grant Period 3:

Delparte, D., "Ecological monitoring with multi and hyperspectral sensors using UAS - conservation and precision agriculture applications", Oral Presentation at the Wyoming UAS Symposium, 17-18 May 2016, Laramie, WY.

Grant Period 4:

Abou Ali, H., Delparte, D., Griffel, L.M., "Utilizing Sentinel-2 satellite imagery for precision agriculture over potato fields in Lebanon", Poster presented at the Pecora 20 Symposium, 13-16 Nov 2017, Sioux Falls, SD.

Delparte, D. M., "UAS Hyperspectral Data Analysis", Oral Presentation at The Drone Revolution in Spatial Analysis at Harvard Center for Geographic Analysis, 28 Apr 2017, Cambridge, MA.

Griffel, L.M., Delparte, D.M., "Assessing Spectral Signatures of Potato Plants Infected with Potato Virus Y", Oral Presentation at the Idaho Seed Potato Grower's Seminar, Idaho Crop Improvement Association, 17 Jan 2017, Pocatello, ID.

Indiana

Grant Period 1:

Biehl, L., Kozenski, K., "Indiana GeoSpatial Education: High School Tutorials, Lessons, Inter-Actives, and MORE", Oral Presentation at the 2014 Indiana GIS Annual Conference, 8 May 2014, Indianapolis, IN.

Biehl, L., "MultiSpec, Future of Remote Sensing, Geospatial Technology Careers & INView/GENI Projects", Oral Presentation during seminar series for the Department of Geography at Indiana University Purdue University Indianapolis, 10 July 2014, Indianapolis, IN.

Grant Period 2:

Biehl, L., "MultiSpec, Future of Remote Sensing & IndianaView Projects", Oral Presentation for the Vincennes University Brownbag Series on Geospatial Technologies, 14 Apr 2015, Vincennes, IN.

Biehl, L., Kozenski, K., "Indiana GeoSpatial Education: Middle & High School Tutorials, Lessons, Inter-Actives and MORE", Oral Presentation at the Annual Indiana GIS Conference, 13 May 2015, Bloomington, IN.

Biehl, L., “Geospatial Technologies”, Oral Presentation at the Purdue High School GIS Day, 6 Nov 2014, West Lafayette, IN.

Grant Period 3:

Biehl, L., Kozenski, K., “Geospatial Technologies”, Oral Presentation at Purdue High School GIS Day, 8 Oct 2015, West Lafayette, IN.

Biehl, L., “Remote Sensing 101 (Is it magic?)”, Oral Presentation for the Indiana Geographic Information Council (IGIC) webinar, 2 Feb 2016, West Lafayette, IN.

Biehl, L., “Geospatial Data around You”, Oral Presentation at TOTAL (Turned Onto Technology & Leadership) Camp 2016, 13 Jun 2016, West Lafayette, IN.

Biehl, L., “Biosphere and Remote Sensing (using MultiSpec Online)”, Oral Presentation at the GLOBE Workshop, 8 July 2015, West Lafayette, IN.

Grant Period 4:

Biehl, L., “Geospatial Data around You”, Oral Presentation at TOTAL (Turned Onto Technology & Leadership) Camp 2017, 12-13 Jun 2017, West Lafayette, IN.

Biehl, L., Kozenski, K., “Geospatial Technologies”, Oral Presentation at Purdue High School GIS Day, 6 Oct 2016, West Lafayette, IN.

Dodge, R., Biehl, L., O'Neil-Dunne, J., Sivanpillai, R., Wang, Y., “Training next Generation Remote Sensing Scientists”, Oral Presentations for Panel at Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Iowa

Grant Period 1:

Giglierano, J., “Mapping Agricultural Tiles with Remote Sensing”, Oral Presentation at the Mid-American GIS Consortium 2014 Conference, 30 Apr 2014, Kansas City, Mo.

Grant Period 2:

Giglierano, J., “Mapping Agricultural Tiles with Remote Sensing”, Oral Presentation at the Iowa Geographic Information Council Biennial Conference, 9 Apr 2015, Pella, IA.

Grant Period 3:

Gelder, B., Wolter, C., “Agricultural Conservation Remote Sensing: Residue Cover, Cover Crops and Structural Practices”, A poster presented at the State Legislators Breakfast Meeting regarding nutrient reduction research, 31 Mar 2016, Des Moines, IA.

Logan, A. “Inventory of Conservation Practices Using Visual Interpretation and Remote Sensing Protocols”, Oral Presentation at the Iowa Water Conference, 23-24 Mar 2016, Ames, IA..

Grant Period 4:

McNeely, R., Logan, A., “Iowa Best Management Practices Inventory and the Use of the Agricultural Conservation Planning Framework”, Poster presented at the Iowa Water Conference, 22-23 March 2017, Ames, IA.

McNeely, R., Logan, A., “Update on the Iowa BMP (Best Management Practices) Inventory, Applications and Associated Datasets”, Poster presented at the Pecora 20 Symposium, 13-16 Nov 2017, Sioux Falls SD.

Kansas

Grant Period 1:

Kastens, J.K., Parr, D., Dobbs, K., and Egbert, S.L., “Dam Breach Modeling for Significant and High Hazard Dams in Kansas”, Oral Presentation at the 22nd Annual Kansas Hydrology Seminar, 22 Nov 2013, Topeka, KS.

Grant Period 4:

Dobbs, K., “New Methods for Integrating Remote Sensing Imagery and Modeled Inundation Libraries for Rapid Flood Mapping”, Poster presented at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Kentucky

Grant Period 1:

Cetin, H., “KentuckyView: Geospatial technologies to support K-16 education, applied research, and public outreach”, Oral Presentation at the GeoEd'14- Geospatial Education Conference, 11 June 2014, Louisville, KY.

Cetin, H. “KentuckyView: K-16 education, remote sensing research, and public outreach”, Oral Presentation at the 2014 Kentucky GIS Conference, 17 Sep 2014, Louisville, KY.

Hong, S., “Soil Moisture Distribution of Western Kentucky using Remote Sensing Imagery” Oral Presentation at the KSEA Southeastern Regional Conference (Future Preparedness: Smart Technologies and Science), 8 Mar 2014, Atlanta, GA.

Hong, S., “Soil Moisture Program using satellite imagery over the state of Kentucky” Oral Presentation at the 2014 Kentucky GIS Conference, 17 Sep 2014, Louisville, KY.

Grant Period 2:

El Masri, B., Pate, M., “Examining the spatial and temporal variability of soil moisture in Kentucky, using a land surface model, remote sensing and observational data”. Oral Presentation at the 2015 Association of American Geographers (AAG) Annual Meeting, 25 Apr 2015, Chicago, IL.

Pate, M., Cetin, H., “A Spectral Reflectance Analysis of Soil Moisture”, Poster presented at SigmaXi Poster Presentations, 13 Apr 2015, Murray, KY.

Grant Period 3:

Lucas da Silva, D., Cetin, H., “Mapping Water Quality in Kentucky Lake and Ohio River using Remote Sensing”, Oral Presentation at the Kentucky GIS Conference, 12 Sep 2015, Owensboro, KY.

Grant Period 4:

Casselberry, A., Cetin, H., “Integration of LiDAR and Imagery to Delineate Water Bodies for Change Detection”, Oral Presentation at the 102st Annual Meeting of the Kentucky Academy of Science, 4 Nov 2016, Louisville, KY.

Cetin, H., “Water Quality and Quantity Mapping in Kentucky Using Landsat Imagery”, Oral Presentation at the 2016 Kentucky GIS Conference, 18 Oct 2016, Covington, KY.

Cetin, H., “Types, Sources, and Use of Satellite Imagery for Government Applications”, Oral Presentation at the Cumberland Chapter of URISA Annual Meeting, 9 Jan 2017, Clarksville, TN.

Cetin, H., “Integration of Landsat-8 and High-resolution Imagery, and LiDAR to Improve Mapping of Water Bodies at Regional Scales”, Poster presented at Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Louisiana

Grant Period 3:

Yantis, B., “Earth as Art”, Oral Presentations and Gallery Exhibit, Manship Art Gallery, Apr – Jul 2016, Baton Rouge, LA.

Grant Period 4:

Yantis, B., “Creating a Healthy Remote Sensing Education Pipeline: Moving from K-12 to University**”,** Panel Oral Presentation at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Maryland

Grant Period 3:

Moore, T., “Detecting changes in Baltimore, Maryland's land cover and urban heat island using Landsat imagery”, Poster presented at the Annual Meeting of the American Association of Geographers, 31 Mar 2016, San Francisco, CA.

[Moore, T., “Detecting changes in Baltimore, Maryland's land cover and urban heat island using Landsat imagery”, Oral Presentation at the 7th Annual Environmental Conference, 15 Apr 2016, Towson, MD.

Michigan

Grant Period 1:

Battaglia, M., French, N., "MichiganView" Poster presented at the Michigan Tech Research Institute Annual Poster Session at Michigan Technological University, 19 Sep 2014, Houghton, MI.

Grant Period 3:

Battaglia, M., "Using Remote Sensing to Understand Climate Change Impacts on Public Health", Oral Presentation at the M-LEEaD Climate Science and Public Health in Michigan Meeting, Mar 2016, Detroit, MI.

Grant Period 4:

French, N., "Incorporating Remote Sensing into K-12 Project-Based Science Curricula", Poster presented at the Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Minnesota

Grant Period 1:

Bauer, M., "Land Cover Classification with Multispectral Imagery, Lidar Data and Object-based Image Analysis", Oral Presentation at the Imaging and Geospatial Information Spotlight Event, 4 June 2014, St. Paul, MN.

Grant Period 2:

Bauer, M., "MinnesotaView: Remote Sensing Education, Research and Geospatial Applications", Poster presented at the Minnesota GIS/LIS Consortium Annual Conference, 2-3 Oct 2014, Rochester, MN

Bauer, M., "ASPRS Western Great Lakes Region Spotlight Series: Dakotas-Minnesota Interstate Technical Meeting", Oral Presentation for the ASPRS Western Great Lakes Region Spotlight Series: Dakotas-Minnesota Interstate Technical Meeting, 19 Sep 2014, Redwood Falls, MN

Grant Period 3:

Olmanson, L., Brezonik, P., Finlay, J., Bauer, M., "Regional Lake Water Quality Measurements Using New Enhanced Satellite Remote Sensing Systems", Oral Presentation at the ESA Living Planet Symposium, 9-13 May 2016, Prague, Czech Republic.

Grant Period 4:

Knight, J., "Remote Sensing Down Under", Oral Presentation at the ASPRS Western Great Lakes Annual Meeting, 2 Feb 2017, Lake Elmo, MN.

Olmanson, L., "Regional Water Quality Measurements of Optically Complex Inland Waters Using New Enhanced Landsat 8 and Sentinel 2 Imagery", Oral Presentation at the Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Mississippi

Grant Period 1:

Arab, S., Hasan, K., Easson, G., "Changes in the Mississippi Gulf Coast" Oral Presentation at the Association of Spatial Technology Annual Meeting, 16 Oct 2014, Biloxi, MS.

Grant Period 2:

Arab, S., Easson, G., Hossain, A., "Soil Moisture Estimation in Vegetated Areas using Optical and Microwave Remote Sensing", Oral Presentation at the IGTF 2015 - ASPRS Annual Conference, 4-8 May 2015, Tampa, FL.

Grant Period 4:

Ricketts, T., "Using Landsat 8 to Map the Geomorphology and Structural Geology of Northwestern Venezuela", Oral Presentation at the PECORA 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Yarbrough, L.D., Easson, G., Dietz, E., "Google Earth Engine for eigenspace spectral and temporal transforms of Landsat 8 and Sentinel-2 data sets", Poster presented for PECORA 20 Symposium, 13 Nov 2017, Sioux Falls, SD.

Montana

Grant Period 1:

Lawrence, R., "AmericaView and Landsat", Oral Presentation at the Landsat Science Team Meeting, 22 July 2014, Corvallis, OR.

Lawrence, R., "MontanaView: Bark Beetle Mapping", Oral Presentation at the Fall Technical Meeting, 20 Oct 2014, Davis, CA.

Savage, S., Lawrence, R., Squires, J., "Mapping Species-Level Conifer Cover with Landsat Imagery", Oral Presentation at the Fall Technical Meeting, 20 Oct 2014, Davis, CA.

Grant Period 2:

Lawrence, R., Moran C., "Which Classification Method Is Best? An Infrastructure for Rigorous Comparisons of Classification Algorithms", Oral Presentation at the 36th International Symposium on Remote Sensing of Environment, 13 May 2015, Berlin, Germany.

Lawrence, R., "AmericaView 2015 Update", Oral Presentation at the Landsat Science Team Meeting, 7 July 2015, Sioux Falls, SD.

Lawrence, R., "Bioenergy Alliance Network of the Rockies (BANR): Sustainable Biofuel Feedstocks from Beetle-killed Wood", Oral Presentation at the Energy Research Institute Day, 13 August 2015, Bozeman, MT.

Long, J., Lawrence, R. "Mapping Percent Tree-Mortality Due to Mountain Pine Bark Beetle-Damage", Oral Presentation at the ASPRS Annual Conference, 4-8 May 2015, Tampa, FL.

Savage, S., Lawrence, R., Squires, J., "Mapping Species-Level Conifer Cover with Landsat Imagery", Oral Presentation at the AmericaView Fall Technical Meeting, 20-24 Oct 2014, Davis, CA.

Grant Period 3:

Lawrence, R., "Landsat and Sentinel 2 Updates", Oral Presentation at the AmericaView Winter Business Meeting, 29 Feb 2016, Reston, VA.

Lawrence, R., "AmericaView 2015 Update", Oral Presentation at the Landsat Science Team Meeting, 7 Jul 2015, Sioux Falls, SD.

Grant Period 4:

Lawrence, R., "AmericaView Classification Methods Accuracy Comparison Project: Revisited", Oral Presentation at the AmericaView Fall Technical Meeting, 13 Sep 2016, Lafayette, LA.

Lawrence, R., "AmericaView: Landsat 10 and ACMAC", Oral Presentation at the Landsat Science Team Meeting, 11 Jan 2017, Boston, MA.

Lawrence, R., "Rigorous Comparison Of Diverse Classification Algorithms: The ACMAC Project Revisited", Oral Presentation at the 37th International Symposium on Remote Sensing of Environment, 11 May 2017, Tshwane, South Africa.

Lawrence, R., "Remote Sensing Applications in Montana: A Sampling", Oral Presentation at the Watershed-to-Wetlands Institute, 19 June 2017, Pablo, MT.

Lawrence, R., "AmericaView Update", Oral Presentation to the Landsat Science Team Meeting, 11-13 July 2017, Sioux Falls, SD.

Lawrence, R., "A 44-Year Time Series of Forest Structure in Northwestern Montana Using the Entire Landsat Archive Length from MSS to OLI (M2O)", Oral Presentation at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Lawrence, R., French, N., "Elicitation of State and Local User Needs for Future Moderate Resolution Earth Observations: The AmericaView Contribution", Oral Presentation at the American Geophysical Union 2017 Fall Meeting, 11-15 Dec 2017, New Orleans, LA.

Nebraska

Grant Period 2:

Poulson, C., "VegDRI and QuickDRI: Multi-input drought indices for long term and flash drought detection", Oral Presentation at the Biennial Nebraska GIS Symposium, 14 April 2015, La Vista, NE.

Grant Period 3:

Stafford, T., Wardlow, B., Vaitkus, M., Leavitt, B., Perk, R., "Comparison of PhenoCam and Landsat greenness signals for two tallgrass prairies", Oral Presentation at the Annual Great Plains/Rocky Mountain Division AAG Meeting, 2-3 Oct 2015, Kearney, NE.

Vaitkus, M., "What Remote Sensing Can Do for You", Oral Presentation for Webinar for Nebraska state and local government organizations, 6 Jun 2016, Lincoln, NE.

Wardlow, B., "Drought Chasing from Space: Advances in Monitoring and Early Warning", Oral presentation at the Geography Awareness Week, 16 Nov 2015, University of Nebraska - Kearney, NE.

New Hampshire

Grant Period 2:

Congalton, R.G., "Assessing the Accuracy of Remotely Sensed Data" An Invited Lecture at Yale, 9 Apr 2015, New Haven, CT.

Congalton, R.G., "Recent Developments in Assessing the Accuracy of Maps Derived from Remotely Sensed Data", An Invited Lecture at the Institute of Ecology, 5 Aug 2015, Xalapa, Mexico.

Grant Period 3:

Grybas, H., Congalton, R.G., "Land Cover Change Analysis for Assateague Island National Seashore Following Hurricane Sandy", Oral Presentation at the ASPRS Annual Conference, 14 Apr 2016, Ft. Worth, TX.

Grant Period 4:

Fraser, B., "Evaluating the Use of Unmanned Aerial Systems for Collecting Thematic Mapping Accuracy Assessment Reference Data in New England Forest Communities", Oral Presentation at the ASPRS Annual Conference, 15 Mar 2017, Baltimore, MD.

Congalton, R.G., "Viewing New Hampshire from Space", Oral Presentation at the AmericaView Fall Technical Meeting, 18 Oct 2016, Lafayette, LA.

Congalton, R.G., "Innovative Methods for Mapping Global Croplands at 30m Resolution", Oral Presentation at the University of California, GeoLunch, 1 Dec 2016, Berkeley, CA.

Congalton, R.G., "Promoting Interest in Remote Sensing Education at the 5-7th Grade Level", Oral Presentation at the ASPRS Annual Conference, 15 Mar 2017, Baltimore, MD.

Congalton, R.G., "Mapping the Earth from Space", Oral Presentation at the Discover Earth Exhibit at Pease Public Library, 18 Apr 2017, Plymouth, NH.

New Mexico

Grant Period 2:

Boykin, K.G. "The View from here: AmericaView and NewMexicoView" Oral Presentation at the Spring Meeting of the New Mexico Geographic Information Council, 24 Apr 2015, Albuquerque, NM.

Boykin, K.G., "The View from here: AmericaView and NewMexicoView", Oral Presentation at the TWS Geospatial Advisory Committee Webinar, 12 May 2015,

Grant Period 3:

Boykin, K.G. “New MexicoView and Adopt a Pixel”, Oral Presentation at the AmericaView Fall Technical Meeting, 23 Oct 2015, Sioux Falls, SD.

Salas, E.A., Boykin, K., Valdez, R., “Employing Moment Distance Index and Texture Components in Object-Based Image Analysis of Summer Vegetation in Eastern Tajikistan Pamirs”, Oral Presentation at the AmericaView Fall Technical Meeting, 23 Oct 2015, Sioux Falls, SD.

Grant Period 4:

Boykin, K.G, “Mobile Apps in the Classroom: Preparing the Next Generation”, Oral Presentation at the 24th Annual Conference of the Wildlife Society”, 23-27 Sep 2017, Albuquerque, NM,

Boykin, K.G, “Mobile Apps in the Classroom: Preparing the Next Generation”, Panel Oral Presentation at the Pecora 20 Symposium, 13-16 Nov 2017, Sioux Falls, SD.

Boykin, K.G., Kepner, W.G., Neale, A.C, Gergely, K.J., “A National Approach to Map and Quantify terrestrial vertebrate biodiversity”, Oral Presentation at the Pecora 20 Symposium, 13-16 Nov 2016, Sioux Falls, SD.

Salas, E.A.L., Seamster, V.A., Boykin, K.G. , Harings, N.M., Dixon, K.W., “Modeling the Effects of Environmental Change on Crucial Wildlife Habitat”, Poster presented at Pecora 20 Symposium, 13-16 Nov 2017 Sioux Falls, SD.

New York

Grant Period 3:

Quackenbush, L., “Understanding a changing New York: Using remote sensing to communicate with the masses”, Poster presented at the NY GeoCon, 29-30 Oct 2015, Albany, NY.

Grant Period 4:

Li, S., Quackenbush, L., “Fusion of airborne lidar and Landsat to quantify forest biomass”, Oral Presentation at the 2017 American Association of Geographers’ Annual Meeting, 5 Apr 2017, Boston, MA.

Li, S., “Integrating Airborne LiDAR and Landsat Data to Quantify Forest Aboveground Biomass Amount and Uncertainty”, Oral Presentation at the NYGeoCon, 19 Oct 2017, Lake Placid, NY.

Pu, G., Quackenbush, L., “Using remote sensing and spatial analysis to assess the trends in riparian vegetation extent and vigor”, Oral Presentation at the GIS Special Interest Group 26th Annual Conference, 11 Apr 2017, Pittsford, NY.

Pu, G., Quackenbush, L., “Remote Sensing of Riparian Vegetation: Using Google Earth Engine to assess trends in riparian vegetation extent and vigor”, Poster presented at the 2017 SUNY-ESF Spotlight on Student Research, 25 Apr 2017, Syracuse, NY.

Pu, G., Quackenbush, L., “Using remote sensing and spatial analysis to assess the trends in riparian vegetation extent and vigor”, Oral Presentation at the 2017 NYWEA Spring Technical Conference and Exhibition, 6 Jun 2017, Rochester, NY.

Pu, G., Quackenbush, L., “Using Google Earth Engine to monitor riparian vegetation extent and vigor”, Oral Presentation at the 2017 Google Earth Engine User Summit, 13 Jun 2-17, Mountain View, CA.

Quackenbush, L., Li, S., “Integrating Airborne Lidar and Landsat Data to Quantify Forest Aboveground Biomass Amount and Uncertainty”, Oral Presentation at Pecora 20 Symposium, 15 Nov 2017, SD.

Quackenbush, L., “Creating a Healthy Remote Sensing Education Pipeline: Moving from K-12 to University”, Panel Oral Presentation at Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

North Carolina

Grant Period 4:

Wang, Y. “The State of Earth Observation Using Synthetic Aperture Radar Technology and Data”, Workshop Oral Presentation at the Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Wang, Y., “Tree Height Inversion in Sloped Plateau Area Using Dual-Polarization InSAR Techniques and Data”, Oral Presentation at the Pecora 20 Symposium, 15 Nov 2017, Sioux Falls, SD.

North Dakota

Grant Period 2:

Rundquist, B., “North DakotaView”, Oral Presentation at the Frozen UAS Tour 2015 , 8 Jan 2015, East Grand Forks, MN.

Rundquist, B., “All Eyes on Geography: The Increasing Importance of Geography Education in a Geo-Enabled World”. An Invited Presentation at the North Dakota Geographic Alliance Summer Teacher Institute, 22 June 2015, Fargo, ND.

Rundquist, B., Niedzielski, M., Braun, S., “Development of North Dakota Viewer for Bakken oil data with a focus on the Fort Berthold Reservation”, Poster presented at the AmericaView Winter Business Meeting 23 Feb 2015, Reston, VA.

Quinlan, M., Braget, A., Braget, M., Burke, M., Skogen, D., Rundquist, B., Niedzielski, M., Braun, S., “Development of a web-based GIS to support decision-making on the Fort Berthold Reservation, North Dakota”, Poster presented at the Association of American Geographers Annual Conference, 24 Apr 2015, Chicago, IL.

Grant Period 3:

Burow, D., Rundquist, B., “Development of Approximating Tornado Damage Using NDVI Change Analysis”, Oral Presentation at the UND Scholarly Forum, 1 Mar 2016, Grand Forks, ND.

Burke, M., Rundquist, B., “Shelterbelt Density Dynamics And Their Driving Forces In Grand Forks County, North Dakota, 1962 To 2014”, Poster presented at the ND GIS 2015 Users Conference, 28 Sep 2015, Fargo, ND.

Klug, E., Burke, M., Rundquist, B., Burkett, L., Braget, M., “Integration Of Ground-Level And Satellite Data For Monitoring Vegetation Phenology At The Oakville Prairie”. Oral Presentation at the ND GIS 2015 Users Conference, 28 Sep 2015, Fargo, ND.

Rundquist, B.C., Niedzielski, M.A., Quinlan, M.R., Skogen, D.J., Burke, M.W.V., Braget, M.P., Braget, A.R., “Web-Enabled GIS For Bakken Oil Boom Data With A Focus On The Fort Berthold Reservation”, Poster presented at the ND GIS 2015 Users Conference, 28 Sep 2015, Fargo, ND.

Rundquist, B.C., “Fundamentals of Remote Sensing”, Oral Presentation for workshop at the ND GIS 2015 Users Conference, 29 Sep 2015, Fargo, ND.

Burke, M., Rundquist, B., Klug, E., Burkett, L., Braget. M., Goodwin, B., “Integration of ground-level and satellite data for monitoring vegetation phenology at the Oakville Prairie”. Poster presented at the Great Plains/Rocky Mountain Division of the Association of American Geographers conference, 1 Oct 2015, Kearney, NE.

Torgerson, E., Rundquist, B., “Land Cover Change due to Oil Infrastructure Development in McKenzie County, North Dakota”, Poster presented at UND Scholarly Forum, 1 Mar 2016, Grand Forks, ND.

Burke, M., Rundquist, B., Todhunter, P., Goodwin, B., “Shelterbelt density dynamics and their driving forces in Grand Forks County, North Dakota, 1962 to 2014”, Poster presented at the UND Scholarly Forum. 1 Mar 2016, Grand Forks, ND.

Klug, E., Rundquist, B., “Census of Shelterbelts in Walsh County, North Dakota, using Digital Aerial and Light Detection and Ranging (LIDAR)”, Poster presented at the North Dakota EPSCoR conference, 19 Apr 2016, Grand Forks, ND.

Grant Period 4:

Rundquist, B., Irby, N., Hefner, A., Niedzielski, M., Burke, M., “A Geography of Oils Spills in North Dakota, 2014-2016”, Oral Presentation at the Great Plains / Rocky Mountains Division Association of American Geographers, 14 Oct 2017, Grand Forks, ND.

Amor, J., Rundquist, B., Jensen, W., Vandeberg, G., Newman, R., Boulanger, J., “An evaluation of elk home range variation in North Dakota”, Oral Presentation at the Society for Conservation GIS Conference, 17 Jul 2017, Monterey, CA.

Hefner, A., Irby, N., Rundquist, B., Niedzielski, M., Burke, M., “Characteristics and Geography of Oil Spills in Western North Dakota, 2014-2016”, Oral Presentation at the Association of American Geographers Annual Conference, 5 Apr 2017, Boston, MA.

Rundquist, B., Burke, M., Klug, E., “Mapping and Monitoring Shelterbest Dynamics in the Red River of the North Valley using NAIP and Lidar Data”, Poster presented at the Pecora 20 Symposium” 14-16 Nov 2017, Sioux Falls, SD.

Ohio

Grant Period 1:

Benko, T., "OhioView - AmericaView - Airborne Hyperspectral Studies of Harmful Algal Blooms", Oral Presentation at the Geospatial Research Center Forum, 21 Nov 2014, Dayton, OH.

Czajkowski, K., "Geospatial Analytics: The OhioView Experience: Tree Canopy ID using Lidar - Applying the Geospatial Cloud", Oral Presentation at the Ohio GIS Conference 2014, 22-24 Sep 2014, Columbus, OH.

Lein, J.K., "Developing satellite-based Land Use Intensity Metrics for Urban Sustainability Monitoring", Oral Presentation at the American Society for Photogrammetry and Remote Sensing Annual Meeting, 24 Mar 2014, Tampa, FL.

Lien, J., "Geospatial Analytics: The OhioView Experience - Big Data: A Geospatial Perspective on Remote Sensing Analytics", Oral Presentation at the Ohio GIS Conference 2014, 22-24 Sep 2014, Columbus, OH.

Shellito, B., "Geospatial Analytics: The OhioView Experience: Applying the Geospatial Cloud", Oral Presentation at the Ohio GIS Conference 2014, 22-24 Sep 2014, Columbus, OH.

Shellito, B., Benko, T., "The Matrix Arrived Late: Teaching Remote Sensing and Geospatial Technologies in a Virtual World", Oral Presentation at the AmericaView Fall Technical Meeting, 19-22 Oct 2014, Davis, CA.

Grant Period 2:

Haritashya, U.K., Hess, T., "Hazards associated with high altitude rain-fed lakes" Oral Presentation at the American Geophysical Union (AGU) Annual Meeting, 18 Dec 2014, San Francisco, CA.

Kargel, J.S., Leonard, G.J., Regmi, D., Haritashya, U.K., Chand, M.B., Pradhan, S., Sapkota, N., Byers, A., Joshi, S., McKinney, D., Mool, P., Somos-Valenzuela, M., Huggel, C., "Glacier Dynamics and Outburst Flood Potential from the Imja and Thulagi Glacier-Lake Systems (Nepal)", Oral Presentation at the European Geosciences Union General Assembly, 12-17 April 2015 Vienna, Austria.

Lein, J.K., "Projecting Regional Sustainability Trends Using Geospatial Analytics", Oral Presentation at the Applied Geography Conference, 16 Oct 2014, Atlanta, GA.

Shellito, B.A., "Teaching in the Virtual World", 29 Apr 2015, Dayton, OH.

Simic, A., "Large-scale monitoring and spectral separation of organic and conventionally treated crops", Oral Presentation at the 2nd Conference on GLOBAL FOOD SECURITY, 13 October 2015, Ithaca, NY.

Simic Milas, A., "International SPatial LITeracy (SPLIT) - SPLIT REMOTE SENSING SUMMER SCHOOL (SPLITRS)", Oral Presentation at the AV Fall Technical Meeting, 24 Sep 2015, Sioux Falls, SD.

Grant Period 4:

Simic, A., **"**Monitoring Chlorophyll-a of the Western Basin of Lake Erie with Sentinel-2A and Landsat 8 imagery", Oral Presentation at Pecora 20 Symposium, 15 Nov 2017, Sioux Falls, SD.

Oklahoma

Grant Period 2:

Taghvaeian, S., "Applications or remote sensing in water resources management", Oral Presentation at the Annual Oklahoma Clean Lakes and Watersheds Association Conference, 2 Apr 2014, Stillwater, OK.

Grant Period 3:

Xiao, X., "Dynamic maps of open surface water bodies in Oklahoma at 30-m spatial resolution during 1984-2014", Oral Presentation at the Governor's Water Conference and Research Symposium, 2 Dec 2015, Norman, OK.

Grant Period 4:

Xiao, X., Zou, Z., Zhang, G., Dong, J., Chen, B., "Annual maps of water-related land cover types (open surface water body, natural wetlands, and paddy rice) through analyses of Landsat images with Google Earth Engine", Oral Presentation at the Pecora 20 Symposium, 16 Nov 2017, Sioux Falls, SD.

Zou, Z., Xiao, X., Menarguez, M., Dong, J., Qin, Y., "Mapping inter-annual dynamics of open surface water bodies in Oklahoma from Landsat images in 1984 to 2015 at 30-m spatial resolution (H51H-1622)", Poster presented at the American Geophysical Union (AGU) 2016, 16 Dec 2016, San Francisco, CA.

Oregon

Grant Period 3:

Parrish, C., "UAS Activities at Oregon State University", Oral Presentation at the AmericaView Fall Technical Meeting, 23 Oct 2015, Sioux Falls, SD.

Grant Period 4:

Forfinski-Sarkozi, N., "Active-Passive Data Fusion for Global, Nearshore Bathymetry Retrieval", Oral Presentation at the Pecora 20 Symposium, 15 Nov 2017, Sioux Falls, SD.

Parrish, C., "Drones in Education: Research Perspective", Oral Presentation at the Drones in Education Workshop series, 21 Mar 2017, Corvallis, OR.

Parrish, C., "Unmanned Aerial Systems", Oral Presentation at the GIS in Action, 17 Apr 2017, Portland, OR.

Parrish, C., "Structure from Motion and GIS Analysis of UAS Data" Oral Presentation at the Drones in the Classroom Workshop for Oregon Educators, 27-29 Jun, Corvallis OR.

Pennsylvania

Grant Period 2:

Mueller, T., “Pipeline, Imagery and GIS Education”, Oral Presentation at the GeoBuiz Conference, 11 August 2015, Bethesda, MD. [PLACE] Bethesda, MD.

South Dakota

Grant Period 1:

Kjaersgaard, J., “Estimating Crop Water Use using Remote Sensing”, Oral Presentation at the Nutrient Use Efficiency Meeting, 6 Aug 2014 Sioux Falls, SD.

Kjaersgaard, J., “Estimating Water Use using Remote Sensing”, Oral Presentation for AmericaView Members Meeting, 8 Aug 2014, Webinar.

Grant Period 2:

O’Neill, M., “Online Sources of Geospatial Data”, Oral Presentation at the South Dakota Statewide Geospatial Conference, 15 Oct 2014, Mitchell, SD

Grant Period 3:

O'Neill, M., “South Dakota Lakes - A Look from Above”, Poster presented at the AmericaView Fall Technical Meeting, 23 Oct 2015, Sioux Falls, SD.

Grant Period 4:

O'Neill, Mary, “Remote Sensing Imagery: Types, Availability, Applications and Training”, Oral Presentation at the Black Hills Digital Mapping Association Conference, 5 Oct 2016, Rapid City, SD.

O'Neill, Mary, “Geospatial Education Resources Available from AmericaView”, Oral Presentation at the South Dakota Statewide Geospatial Conference, 25 Jul 2017, Mitchell, SD.

O'Neill, Mary, **“**South Dakota LiDAR Factsheet**”,** Poster presented at the Pecora 20 Symposium, 14-16 Nov 2017, Sioux Falls, SD.

Texas

Grant Period 2:

Dodge, R., “AmericaView: 10 Years of Service in the Domains of Remote Sensing Science, Technology and Education”, Oral Presentation at the AmericaView Winter Business meeting, 24 Feb 2014, Reston, VA.

Grant Period 4:

Dodge, R., “Training the Next Generation of Remote Sensing Scientists through Undergraduate Research Opportunities: The TexasView Experience”, Panel Oral Presentation at the Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Utah

Grant Period 1:

Holman, V., Kluever, B., McGinty, C. “The effects of cheatgrass (Bromus tectorum) on black-tailed jackrabbit (Lepus californicus) relative abundance at Dugway Proving Ground, UT”, Oral Presentation at the Maps on the Hill, 28 Jan 2015, Salt Lake City, UT

Thompson, T., McGinty, C., Ramsey, R.D., “Decadal analysis of aspen-conifer succession using remote sensing and GIS”, Oral Presentation at the Maps on the Hill, 28 Jan 2015, Salt Lake City, UT.

Grant Period 2:

McGinty, C., “Utah Geographic Information Council Educator Workshop”, Workshop Presentation at the Utah Geographic Information Council Annual Meeting, 14 May 2015, Snowbird, UT.

Grant Period 4:

Ramsey, R.D., McGinty, C., “Using Unmanned Aerial Systems to Evaluate Shrub Community Characteristics in a Semi-Arid Landscape”, Oral Presentation at the Pecora 20 Symposium, 16 Nov 2017, Sioux Falls, SD.

Vermont

Grant Period 1:

O'Neil-Dunne, J., “Tips on Working with Raster Data in ArcGIS”, Oral Presentation at the VCGI webinar series, 10 Mar 2014, https://www.youtube.com/watch?v=L_tgK5mHsJs

O'Neil-Dunne, J., “Data Fusion Approaches to High-Resolution Land Cover Mapping”, Oral Presentation at the AmericaView Fall Technical Meeting, 20 Oct 2014, Davis, CA.

Grant Period 2:

O'Neil-Dunne, J., “Unmanned Aerial Systems at the University of Vermont”, Oral Presentation at the Department of the Interior UAS Group, 13 May 2015, Webex Online.

O'Neil-Dunne, J., “LiDAR Data Analysis: A GIS Perspective”, Oral Presentation at the Vermont Geospatial Forum, 2 June 2015, Montpelier, VT

O'Neil-Dunne, J., “Unmanned Aerial Systems for GIS-Ready Mapping”, Oral Presentation at the Vermont Geospatial Forum, 2 June 2015, Montpelier, VT

O'Neil-Dunne, J., “Data Fusion Approaches in eCognition”, Oral Presentation at the AmericaView Webinar, 7 July 2015, Online.

Grant Period 3:

O'Neil-Dunne, J., “Contracting for UAS Services”, Oral Presentation for Vermont Center for Geographic Information Systems Webinar, 27 Jan 2016, Online.

O'Neil-Dunne, J., “UAS Applications”, Oral Presentation for Vermont Center for Geographic Information Systems Webinar, 24 Feb 2016, https://youtu.be/yfM7GxNERb8?list=PLMg5UHByMftctwv7zePjimDNwxOnuV8uM

O'Neil-Dunne, J., “UAS Mapping for Stream Risk Assessment”, Oral Presentation at the Vermont Geospatial Forum, 16 May 2016, White River Junction, VT.

O'Neil-Dunne, J., “High-Resolution Land Cover Mapping of Vermont”, Oral Presentation at the Vermont Geospatial Forum, 16 May 2016, White River Junction, VT.

Grant Period 4:

O'Neil-Dunne, J., “Object-Based Image Analysis Workshop”, Workshop Presentation at the Pecora 20 Symposium, 13 Nov 2017, Sioux Falls, SD.

O'Neil-Dunne, J., “Training Next Generation Remote Sensing Scientists”, Oral Panel Presentation at the Pecora 20 Symposium, 15 Nov 2017, Sioux Falls, SD.

Virginia

Grant Period 4:

Campbell, J., Parece, T.E., McGee, J., “Creating a Healthy Remote Sensing Education Pipeline-- A Selection of Virginia View’s Geospatial Outreach Activities”, Panel Oral Presentation at PECORA 20 Symposium, 16 Nov 2017, Sioux Falls, SD.

West Virginia

Grant Period 2:

Warner, T. “West Virginia View: An AmericaView statewide remote sensing consortium”, Oral Presentation at the Association of American Geographers Annual Meeting, 21 -25 Apr 2015, Chicago, IL

Grant Period 3:

Adaktilou, N.E., Landenberger, R., Warner, T.A., “How cool is your school?”, Oral Presentation at the WVSTA 2015 Annual Conference, 5 Nov 2015, Days Inn & Suites Conference Center, WV.

Adaktilou, N., Warner, T.A., Landenberger, R., “The urban heat island as an indicator of environmental quality in Morgantown, WV”, Oral Presentation at the ASPRS Eastern Great Lakes Meeting, 13 Nov 2015, California, PA.

Sivanpillai, R., Prichard, M., Warner, T.A., "Quantifying the influence of Landsat spectral index threshold values on mapping and estimating changes in glacier surface area", Oral Presentation at the Association of American Geographers Annual Meeting, 29 Mar – 2 Apr 2016, San Francisco, CA.

Grant Period 4:

Maxwell, A., "NAIP Orthophotography for Land Cover Mapping Tasks: A Review with Recommendations", Oral Presentation at the Pecora 20 Symposium, 16 Nov 2017, Sioux Falls, SD.

Wisconsin

Grant Period 2:

Batzli, S., Kissel, E., "EODN-IDMS: Earth Observation Depot Network", Oral Presentation at the GENI Engineering Conference 22 (GEC22) and US Ignite Application Summit, 23-26 Mar 2015, Crystal City, VA.

Batzli, S., Kissel, E., "EODN-IDMS A distributed storage service for open access to Landsat data for natural resources and educational applications using GENI's flexible cloud infrastructure", Oral Presentation at the GENI Engineering Conference 23 (GEC23), 17 June 2015, Champaign, IL.

Grant Period 3:

Batzli, S., "RealEarth: Visualization of Land and Meteorological Remote Sensing Imagery and Ancillary Data", Oral Presentation at the 2016 Geospatial Summit, 19 Apr 2016, Madison, WI.

Grant Period 4:

Batzli, S., "RealEarth: Access to Real-time and Archive Satellite Data and Derived Products", Oral Presentation at the American Meteorological Society Annual Meeting, 24 Jan 2017, Seattle, WA.

Batzli, S., "Will WisconsinView Get Trumped?", Oral Presentation at the Wisconsin Land Information Association Spring Regional Meeting, 2 Jun 2017, Fond du Lac, WI.

Batzli, S., "RealEarth Features and Updates", Oral Presentation at the University of Wisconsin-Madison Geospatial Summit, 26 Apr 2017, Madison, WI

Batzli, S., "RealEarth: Visualize Your Data", Poster presented at the Pecora 20 Symposium, 14 Nov 2017, Sioux Falls, SD.

Wyoming

Grant Period 1:

Sivanpillai, R., "Image Maps", Guest lecture presented for GEOG2150: Foundations of GI Science & Technology, 24 and 28 Mar 2014, Laramie, WY.

Grant Period 2:

Sivanpillai, R., “Mapping surface area changes of non-gaged reservoirs using multi-temporal Landsat data”, Oral Presentation at the Wyoming Water Association Annual Meeting, 29 Oct 2015, Casper, WY.

Sivanpillai, R., “Mapping reservoir surface area changes using multi-temporal Landsat data”, Oral Presentation at Outreach, 17 Sep 2015, Cheyenne, WY.

Sivanpillai, R., “Remotely Sensed Images for Flood Monitoring: Lessons Learned from the 2011 Midwestern US Floods”, Poster presented at the American Geophysical Union Annual Meeting, 15 December 2014, San Francisco, CA.

Grant Period 3:

Sivanpillai R., “Integrating Scientific Inquiry into an Undergraduate Applied Remote Sensing Course”, Oral Presentation at the 2015 AGU Annual Meeting, 18 Dec 2015, San Francisco, CA.

Sivanpillai, R., Prichard M., Warner, T. “Quantifying the influence of Landsat spectral index threshold values on mapping and estimating changes in glacier surface area”, Oral Presentation at the Association of American Geographers Annual Meeting, 29 Mar – 2 Apr 2016, San Francisco, CA.

Grant Period 4:

Sivanpillai, R., “Comparison of image enhancement algorithms for improving the visual quality of post-disaster satellite images”, Oral Presentation at ASPRS IGTF 2017, 13 Mar 2017, Baltimore, MD.

Dodge R., Biehl L., O’Neil-Dunne J., Sivanpillai R., Wang, Y., “Training the next generation of remote sensing scientists through undergraduate research opportunities”, Panel Oral Presentation at Pecora 20

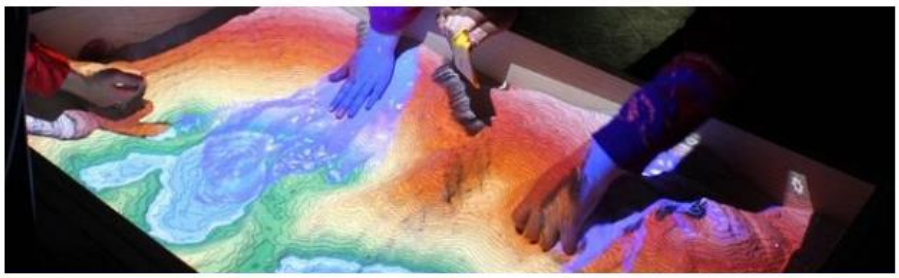
Appendix I – StateView Consortia Fact Sheets

AlaskaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Alaska

AlaskaView 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.

AlaskaView is encouraging the understanding and use of remote sensing and geospatial technology through education and outreach at the K-12, undergraduate, and graduate levels. Specifically, AlaskaView teaches a variety of earth science concepts through educational workshops and the deployment of the Augmented Reality Sandbox (shown below). This 3-dimensional environment allows all age groups to become engaged and excited about STEM concepts.



Landsat 8 image acquired on July 10, 2014 of the Prudhoe Bay Oil Field on Alaska's Arctic coast. This is a color infrared image, used to show vegetation health.

Consortium Membership

Association of Alaska Native Regional Corporation: http://ancsaregional.com/

Federal consortium members identified above do not receive funding from AmericaView.

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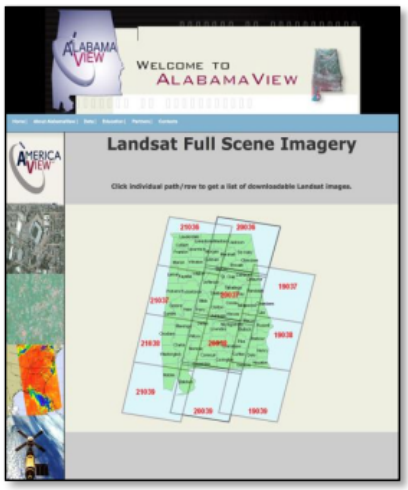
AlabamaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Alabama

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. AlabamaView benefits state economic development by using satellite, aircraft and ground-based remote sensing information, technologies, and applications for pressing issues within the state.



The long-term goals of AlabamaView are:

- Collaborate with Auburn University's developing Research Park to provide businesses with expertise in remote sensing and other geospatial technologies.
- Build a more useful and appealing website by using open source GIS technology, and increasing the amount of satellite and other remote sensing data by several orders of magnitude.
- Establish this website as a clearinghouse for Alabama spatial data, working with state agencies and other data providers to provide links to their holdings. To accomplish this, the AlabamaView website is advertised at topical conferences, and through media that have access to potential users.
- Develop new products from satellite and other remote sensing data that are important to the citizens of the state such as: digital elevation models (DEMs) from lidar data for analysis in the Gulf Coast area; crop yield estimates for farmers; water quality analyses; invasive species detection; products for tourism; and working with Park Services.
- Reach a large fraction of Alabama youth through partnering with schools and 4-H, giving K-12 students a taste for geospatial information technologies and their practical impact on our lives.
- Develop courses and curricula at partner universities and colleges that provide a large fraction of the student population with improved geospatial literacy.

Consortium Membership

Alabama A&M University
Auburn University
Tuskegee University
UAB The University of Alabama at Birmingham
Troy University
USGS science for a changing world
JSU Jacksonville State University

Federal consortium members identified above do not receive funding from AmericaView.

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ArkansasView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Arkansas

Graduate and undergraduate students at University of Arkansas participate in "Geospatial Unmanned Aircraft Systems (UAS)" and other advanced remote sensing curriculum developed with support from AmericaView. Federal funds significantly augment the remote sensing learning environment for K-12 through PhD studies, and for both on-campus and off-campus students.

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.

Established in 2002 by University of Arkansas' internationally recognized Center for Advanced Spatial Technologies (CAST), ArkansasView has been a strong supporter of remote sensing within the Center, the campus community, and throughout the state. Recent efforts have focused on a) the development of new degree and certificate programs including PhD Geosciences, MS Geography, and online certificates (e.g., https://goo.gl/hOICt1) aligned with remote sensing, b) statewide leadership in the development of new remote sensing courses including "Geospatial Unmanned Aircraft Systems (UAS)" (https://goo.gl/NcTu6H), c) multidisciplinary collaboration with faculty and graduate students in Arkansas seeking to apply remote sensing in their research, and d) advances in geospatial provenance (the ability to understand and replicate remote sensing workflows) as featured in the *Remote Sensing Handbook* (CRC Press; https://goo.gl/rPsvig) published in late 2015.

Through a 2014-2016 partnership with Communities Unlimited (https://communitiesu.org), a nonprofit organization serving communities in Arkansas and six neighboring states, ArkansasView has sponsored a geospatial internship for developing remote sensing-assisted workflows that address persistently poor rural communities' access to basic water infrastructure. Through partnerships of this nature and related University-led activities, ArkansasView is enhancing remote sensing education, research, and geospatial applications in Arkansas and America.

Consortium Membership

ArkansasView activities are led by Dr. Jason Tullis and Dr. Mohamed Aly from the Center for Advanced Spatial Technologies (CAST) at University of Arkansas. The Center is under the direction of Dr. Jack Cothren. Dr. Lu Liang from University of Arkansas at Monticello also contributes vital remote sensing leadership and expertise to ArkansasView. Since 2002, a number of organizations and individuals have contributed directly to realizing ArkansasView goals and initiatives. For example, the Arkansas GIS Office provides access to statewide remotely sensed data, the EAST Initiative trains high school students in remote sensing techniques, and Communities Unlimited trains remote sensing students in applications that benefit underbuilt communities in Arkansas and six other states.

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CaliforniaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in California

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

CalView has been associated with AmericaView since 2003 and became a full member of the consortium in 2006.

CalView's goal is to reach out to and inform the general public, educators and professionals within California about the accessibility and potential applications of geospatial data sets and remote sensing imagery.

With its growing numbers of consortium members, CalView is able to disseminate acquired geospatial information and imagery to a broader audience supporting better-informed decision making on pressing environmental issues such as the drought in California.

Landsat mosaic of California created from data sets acquired by Landsat 5 data during the period of July 1999 to September 2002 and the National Elevation Dataset.

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.

San Francisco State University
CAL FIRE Since 1885
ParcelQuest
USDA NRCS United States Department of Agriculture Natural Resources Conservation Service
California Department of Fish & Wildlife
El Dorado County California
California Space Grant
U.S. Department of the Interior Bureau of Reclamation
Department of Water Resources State of California
CGIA Facilitating coordination, collaboration, and advocacy for California's GIS community
FEMA
California Environmental Protection Agency Air Resources Board
Chevron Chevron Richmond
ARC
E&J Gallo Winery
DSA Technologies, Inc Business Vision. Technology Focus.
GIF

Any federal consortium members identified above do not receive funding from AmericaView.

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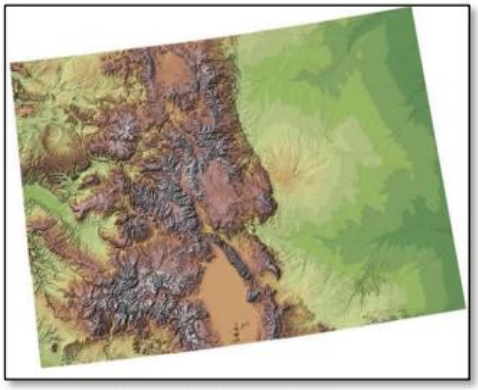
ColoradoView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Colorado

ColoradoView 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.

ColoradoView works to foster communication with partners and consortia members who are current or potential end users of Landsat and other remote sensing 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 Colorado Geospatial Centroid. Our USGS partners carry out research on grazing lands and invasive species in the western USA. Our USDA partners carry out research on grazing lands in Colorado and Wyoming. The ColoradoView consortium also includes the USGS North Central Climate Science Center and the National Institute of Invasive Species Science. We aim to expand the consortium to include other agencies concerned with natural resources in Colorado.



Colorado shaded relief map.

Consortium Membership

Federal consortium members identified above do not receive funding from AmericaView.

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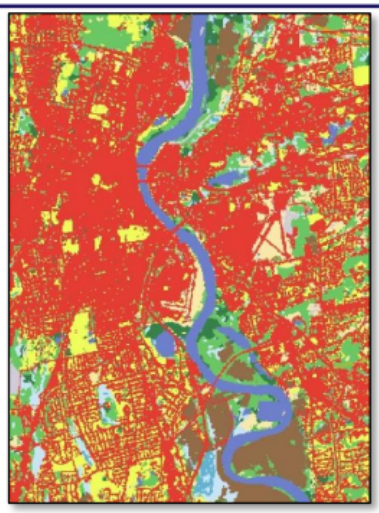
ConnecticutView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Connecticut

ConnecticutView 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 attaining AmericaView Full Member status in 2015, ConnecticutView has been working on developing various educational, research, and outreach activities to promote awareness and the use of remote sensing technology, from space-borne sensors to ground-based systems, within the state of Connecticut. Current activities of ConnecticutView include:

- maintaining a ConnecticutView website (http://ctview.uconn.edu),
- developing a server for delivery of near cloud-free image mosaics of Landsat satellite imagery of Connecticut,
- developing and delivering webinars on remote sensing-related subjects,
- providing basic remote sensing presentations to K-12 students with image content focused on specific geographical areas being studied,
- providing scholarships to undergraduate students based on completion of a student-conceived project that uses remote sensing technology and is focused on the Connecticut geographical area.
- creating a Connecticut statewide 2015 land cover map using Landsat OLI imagery as part of CLEAR's Connecticut's Changing Landscape project.



Land cover map of the Hartford, CT area derived from 2015 Landsat OLI satellite imagery as part of the Connecticut's Changing Landscape land cover project.

Consortium Membership

ConnecticutView is led by Dr. Daniel Civco and Mr. James Hurd from the Department of Natural Resources and the Environment in the College of Agriculture, Health and Natural Resources at the University of Connecticut. A ConnecticutView Consortium is currently being established. The vision for the Consortium is that it will be comprised of individual partners involved in using remote sensing technology in Connecticut. It will represent various organizations and agencies including Centers and Organizations within the University of Connecticut, other academic institutions for higher learning throughout Connecticut, federal and state agencies working within the state, non-profit organizations, and private companies. The purpose of the Consortium is twofold. First, the Consortium will provide guidance regarding future directions of ConnecticutView and development of High Impact Activities. Second, Consortium partners will be encouraged to become actively involved and participate in some aspect of the educational, research, and outreach activities of ConnecticutView. Current Consortium partners include:

UCONN Natural Resources and the Environment

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James Hurd
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CLEAR

Emily Wilson
Center for Land Use Education and Research
http://clear.uconn.edu

UCONN University Libraries Hartford

Michael Howser
Connecticut State Data Center
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Yale

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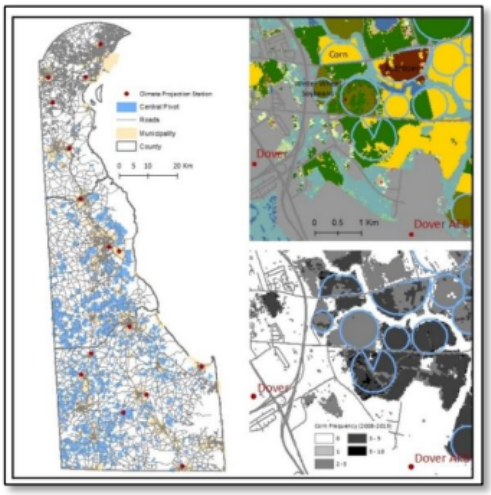
DelawareView Consortium Overview

Benefits to Delaware

The benefits of this project are to provide a method to estimate ET on a seasonal temporal scale and across the state of Delaware from readily available Landsat imagery. Since ET accounts for almost two-thirds of the annual average water budget, providing estimates of ET is valuable for water resource management and hydrologic studies.

As irrigation rapidly expands in Delaware and climate change continues to stress water resources, a method of computing ET across larger spatial and temporal scales will be extremely valuable to farmers, as well as to local and state water resources officials.



Central pivot irrigation systems across the state of Delaware (left) and a zoomed in view of an area east of Dover (right) showing irrigation areas enclosed in blue circles along with main crop information (upper right) and corn frequency information (lower right).

DelawareView Consortium Membership

The members of DelawareView include Tracy DeLiberty, John Callahan, Tina Callahan and Matthew Shatley. Tracy DeLiberty is an Associate Professor in the Department of Geography at the University of Delaware. Her research interests are in the areas of hydroclimatology, GIS, and remote sensing, focusing on land surface interactions with climate by investigating regional and global observations and remotely sensed datasets. John Callahan is an Associate Scientist with the Delaware Geological Survey (DGS). The DGS is a science-based, public-service-driven Delaware State Agency at the University of Delaware that conducts geologic and hydrologic research, service, and explorations for the benefit of the citizens of the First State. Tina Callahan works with the Delaware Environmental Monitoring and Analysis Center to promote and coordinate environmental monitoring efforts in Delaware and surrounding areas. Matthew Shatley provides programming support and is the coordinator of the university's satellite receiving station.

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GeorgiaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Georgia

Celebrating the 2016 Earth Observation Day with Coweta County Performance Learning Center Students

GeorgiaView, founded in 2003, 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 of GeorgiaView 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. The mission of GeorgiaView is to 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 membership to include more industries and K-12 institutions.

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Hawai`iView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Hawai`i

Hawai`iView 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.

For the past two years, Hawai`iView has been visiting K-12 classrooms across the state and community science events to educate Hawai`i's keiki (children) about the Landsat program, and the information that is available. Hands-on science lessons and visits include the use of "Landsat in a Box" that allows students to use classroom tools to collect data that can be compared to Landsat data and ties in to the basic concepts of light and heat. By connecting the basic concepts with hands-on activities, students are able to retain what they learn, and become familiar with the Landsat program at a young age.

Hawai`iView has been part of the AmericaView Consortium since 2006. The goals of Hawai`iView have been to increase public awareness of Landsat and Earth Observing in Hawai`i through free public science events and classroom visits. During the 2015-2016 school year, Hawai`iView conducted fifteen class visits and participated in two hands-on science outreach days that were free to the public. This reached a total of two-hundred and eighteen students, ten teachers, and twenty-two parents.

Hawaii Landsat State Mosaic taken from eros.usgs.gov

Consortium Membership

Hawai`iView is based out of the Hawaii Institute of Geophysics and Planetology (HIGP), which is part of the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaii at Manoa. Dr. Robert Wright (wright@higp.hawaii.edu) is the Principal Investigator for Hawai`iView and Ms. Amber Imai-Hong (amber@higp.hawaii.edu) is the Hawai`iView outreach specialist. Hawai`iView partners with NASA's Hawai`i Space Grant Consortium. The vision of Hawai`iView is to 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.

Federal consortium members identified above do not receive funding from AmericaView.

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IdahoView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Idaho

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.

Objectives of this consortium within the state of Idaho are to:

- Promote the development of novel tools and techniques that allow translating remotely sensed data into information that is meaningful to decision 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 publically available satellite imagery for Idaho.
- Encourage the use and scientific application of remotely sensed data from small Unmanned Aircraft Systems (sUAS).

A Master's of Science in Geographic Information Sciences student at Idaho State University launches Trimble's UX5 Unmanned Aircraft System to study the reintegration of meander bends in the Portneuf River Channel near Pocatello, Idaho.

Consortium Membership

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INDIANAVIEW CONSORTIUM OVERVIEW

ENHANCING THE UNDERSTANDING AND USE OF REMOTE SENSING IN INDIANA

IndianaView 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.

IndianaView is a state-wide consortium of 15 universities and institutions in Indiana. The vision for IndianaView is to facilitate and promote the sharing and use of public domain remotely sensed imagery (from both satellite and aerial platforms) by Indiana universities, four-year colleges, community colleges, K-12 institutions, libraries, museums, government agencies and the private sector. IndianaView was accepted into the national AmericaView consortium in 2004 with Purdue University as the lead institution. The AmericaView consortium is funded through the USGS Land Remote Sensing Program.

Accomplishments:

- Mini-grants have supported 25 projects conducted in seven institutions since 2004. These projects promote the use of remotely sensed imagery in K-16 education, facilitate the use of remote sensing data to monitor state-wide issues such as urban development, and provide easier access to remote sensing image data. Fact sheets for these projects are available at: www.indianaview.org/fact_sheets.html.
- Interactive class lessons for high school students to learn geospatial skills were developed as a result of a partnership with the Geography Educators' Network of Indiana (www.iupui.edu/~geni).
- Freeware applications and tutorials are available for analyzing remotely sensed imagery and determining long-term impacts of a change in land use.
  (MultiSpec: engineering.purdue.edu/ ~biehl/MultiSpec;
  L-THIA: engineering.purdue.edu/ mapserve/LTHIA7)
- A web portal based on the USGS GloVis software was created to provide access to Landsat TM, Landsat MSS, and Corona imagery and the USDA-NASS Indiana Cropland Data in easily readable file formats. A link is also provided to the Indiana University Spatial Data Portal that contains more than 30 terabytes of 6-inch to 1-meter orthographic image data for Indiana (www.indianaview.org/glovis/index.html).
- Real-time remotely sensed imagery and data products (MODIS and AVHRR) are available from the Purdue Terrestrial Observatory (www.itap.purdue.edu/pto).

CONSORTIUM MEMBERSHIP

Ball State University
Indiana State University
IUPUI Indiana University Purdue University Indianapolis
Indiana University
University of Notre Dame
Purdue University
Purdue University Calumet
Martin University
Vincennes University
GENI
Indiana Geographic Information Council
Indiana Geological Survey

Others:

- **Indiana University – South Bend**
- **Consortium of Universities for Spatial Information Science**
- **Indiana Space Grant Consortium**

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IowaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Iowa

IowaView 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 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 (http://ortho.gis.iastate.edu) which include summer NAIP imagery, spring imagery, and other datasets useful for research and education. Collecting these varied data and having them in one location improves accessibility, data discovery and efficiency of use.

IowaView moved to Iowa State University (ISU) in 2013 from its previous home at the University of Northern Iowa GeoTREE Center where it first received funding in 2007. ISU IowaView staff are housed at the GIS Facility, working with campus collaborators from several departments across campus. Education and outreach have been the primary focus of IowaView in the last two years and will continue in the coming years. Those goals have resulted in public mapathons to create data in underserved parts of the world, employing students to mosaic and georeference previously unused imagery, and creating an inventory of soil and water conservation practice data from aerial imagery.

Two additional projects just getting off the ground aim to provide remotely sensed data to end users. The first records hourly perspective views of a grassland landscape in southern Iowa that can be used to monitor seasonal and yearly changes; the second provides a computer node in the country-wide Earth Observation Depot Network, providing satellite imagery and products for download through a distributed network.

Black Hawk County, Iowa.
2015 USDA NAIP summer natural color aerial imagery showing changes in terraces and grassed waterways from 2010.

Consortium Membership

GISF ISU GIS Facility

www.gis.iastate.edu\GISF

Iowa State University

www.iastate.edu

dnr gis

http://www.iowadnr.gov/Conservation/Geology/Mapping-GIS

IOWA geographic information council

http://www.iowagic.org/

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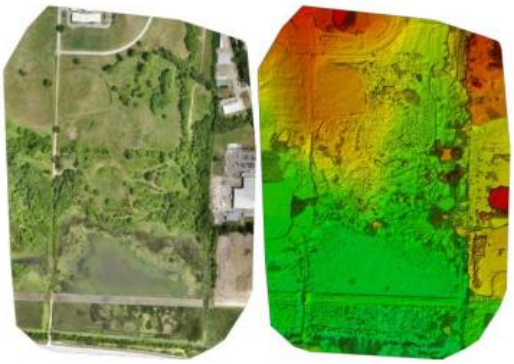
KansasView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Kansas

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. KansasView's consortium membership is strengthened by involvement in a number of collaborative efforts throughout the year that facilitate the sharing of information and resources of KansasView.

Among the most significant efforts has been KansasView's relationship with Haskell Indian Nations University has provided benefits to its students, to the Tribes of the State of Kansas, and to Tribes throughout the U.S., including:

- Remote sensing education of Haskell students as part of a highly successful program in Geographic Information Science that has placed graduates in Tribal positions, government agencies, and the private sector.
- Workshops for Tribal employees involved in GIS, environmental management and policy, and land management.
- An introduction to agencies and companies using remote sensing through technology demonstrations, guest lectures, and internships.



Orthomosaic created by digitally merging hundreds of individual air photos (left) and digital surface model showing heights of trees and other objects (right) of a portion of the campus of Haskell Indian Nations University obtained from a UAS mission flown by Tukuh Technologies, LLC in June 2016.

Consortium Membership

Regular interactions with the **Kansas GIS Policy Board**, whose members are appointed by the Governor to represent federal, state, and local stakeholders from across Kansas, offer an effective way to share expertise on the use of a range of remote sensing data for a variety of applications, including lidar, historical aerial photography, and satellite imagery. Through joint grant funding from the Policy Board and AmericaView, KansasView has provided several key datasets for the state, including land cover and inundation mapping.

The **State of Kansas Data Access and Support Center (DASC)**, the state's geospatial data clearinghouse, is also a key consortium member and data development and distribution partner on projects. By collaborating with DASC, the longevity of the distribution of archived data can be ensured.

KansasView also participates in activities of the **Kansas Hazard Mitigation Team (KHMT)**, which is coordinated through the Kansas Division of Emergency Management from the Adjutant General's Department. Activities of the KHMT include making periodic updates to the Kansas Hazard Mitigation Plan and providing input on the Federal Emergency Management Agency's Hazard Mitigation Grant Program funds.

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KentuckyView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Kentucky

KentuckyView 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.

KentuckyView is currently comprised of 12 member institutions and agencies. As KentuckyView continues to grow we expect that additional universities, colleges, non-profit organizations, and state and federal agencies will add their knowledge, experience and shared goals to ours as we seek to improve life for citizens throughout the Commonwealth. KentuckyView is directed by Dr. Haluk Cetin, a faculty member affiliated with the Mid-America Remote Sensing Center (MARC) and the Department of Geosciences.

The primary focus of KentuckyView is the use of images collected from satellites and aircraft, as well as other geospatial technologies, to support K-16 education, workforce development, applied research, data distribution, and technology transfer. Current projects include developing an archive of aircraft and satellite images that will be distributed to users free of charge, creating educational materials, and providing outreach workshops and workforce training throughout the state.

Landsat image mosaic of Kentucky. Landsat imagery is a vital data source for applied research, educational and outreach activities being carried out byKentuckyView partners. From cooperative research projects, to student and faculty minigrants, to classroom education and workforce training, to public outreach — so much depends on the availability of Landsat data..

Consortium Membership

- Morehead State University - Department of Earth and Space Sciences
- 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
- Murray State University – 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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LouisianaView Consortium Overview 2015 - 2016

Enhancing the Understanding and Use of Remote Sensing in 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 state.

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 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, aerial photography, etc. and a user-friendly dissemination mechanism,
3) provide educational opportunities at the Institutions of Higher Education, i.e. 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 and training

This is an example of imagery acquired through the International Charter and processed by members of the LouisianaView Consortium in response to 2016 floods.

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 Wetlands and Aquatic Research Center
Corp of Engineers - New Orleans District
Louisiana State University
Louisiana Coastal Community Resiliency Studio
USDA Natural Resources Conservation Service–La.
Louisiana Department of Transportation
Louisiana Dept of Agriculture
Louisiana State GIS Council

Federal consortium members identified above do not receive funding from AmericaView.

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MarylandView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Maryland

MarylandView 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 mission of the MarylandView Consortium is to ensure that government agencies, non-government organizations, colleges and universities, K-12 teachers, and businesses in Maryland make the fullest use of remotely sensed imagery and other digital geospatial data and technologies. MarylandView is actively seeking to grow and diversify our state's consortium, to engage K-12, college, and university students with remote sensing technologies and research, and to develop and distribute remote sensing data and educational activities.

Current MarylandView activities include:

- working with undergraduate and graduate students at Towson University to analyze land cover and land surface temperature with Landsat imagery;
- developing educational and outreach material for Baltimore County K–12 educators;
- continued development of the online mapping application MarylandViewer.

Landsat mosaic of Maryland. This image, along with other Landsat state mosaics, are produced and distributed by the USGS EROS Center. Images may be downloaded at: http://eros.usgs.gov/imagegallery/landsat-state-mosaics

Consortium Membership

MarylandView is a consortium of government agencies, non-government organizations, K-12 teachers, and businesses in Maryland. Consortium members include the Maryland Space Grant Consortium, the Maryland State Geographic Information Committee, Towson University Department of Geography and Environmental Planning, Towson University Center for Geographic Information Science, and the Maryland Geographic Alliance.

Maryland State Geographic Information Committee

150 years TOWSON UNIVERSITY

MARYLAND Geographic Alliance

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MichiganView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Michigan

MichiganView 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.

In 2007, MichiganView was formed to promote remote sensing within the state of Michigan for Michigan-based K-12 educators, state government practitioners, and users from academia and the general public. Initial activities focused on development of web-based technologies to improve remote sensing data access and exploitation. Since then, activities have expanded to include a strong K-12 outreach program.

MichiganView strives to promote and further the science of remote sensing in a variety of ways. K-12 remote sensing education programs expose students to remote sensing at an early age. In-class activities, which utilize exciting geospatial technologies, are designed to augment science, technology, engineering, and math curricula. MichiganView also conducts public outreach, and MichiganView members have given presentations on remote sensing at workshops and informal science café meetings.

MichiganView also serves as a remote sensing data provider. A variety of aerial and satellite imagery, such as Landsat, NAIP, and MODIS data, is available for download from MichiganView's website. New data provisioning methods are being tested and used at MichiganView to improve data access and use.

MODIS Image of Michigan's Upper and Lower Peninsulas, November 7, 2016

Consortium Membership

Michigan Technological University
www.mtu.edu

University of Michigan
www.umich.edu

Radiation Laboratory
www.eecs.umich.edu/radlab

Michigan Tech Research Institute
www.mtri.org

Michigan Tech
Geological and Mining Engineering and Sciences
www.mtu.edu/geo

SNRE School of Natural Resources & Environment
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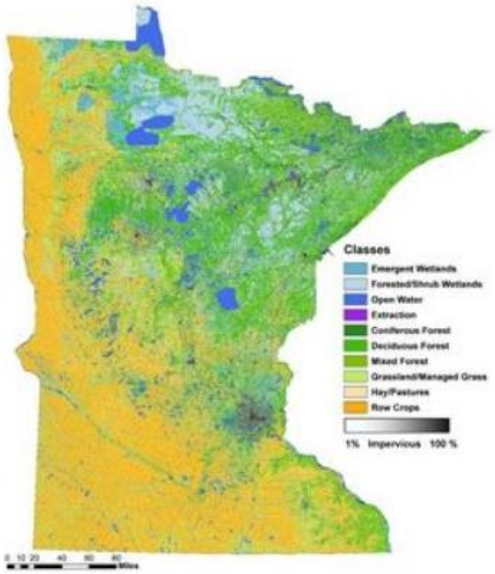
MinnesotaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Minnesota

MinnesotaView 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. MinnesotaView's goals are to:

1. Support the development, distribution and application of geospatial information derived from remote sensing data for mapping and monitoring land and water resources in Minnesota.
2. Enhance understanding of the characteristics and uses of remote sensing data and increase access to and application of remote sensing data and results by agencies, schools and colleges, and citizens.
3. Contribute to remote sensing education, particularly by hosting and updating the Remote Sensing Core Curriculum website.
4. Develop improved linkages between remote sensing and GIS to make the best use of geospatial data.



Statewide 2013 land cover classification of multitemporal Landsat and lidar data at 15-meter spatial resolution and overall accuracy of 96 percent.

Consortium Membership

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

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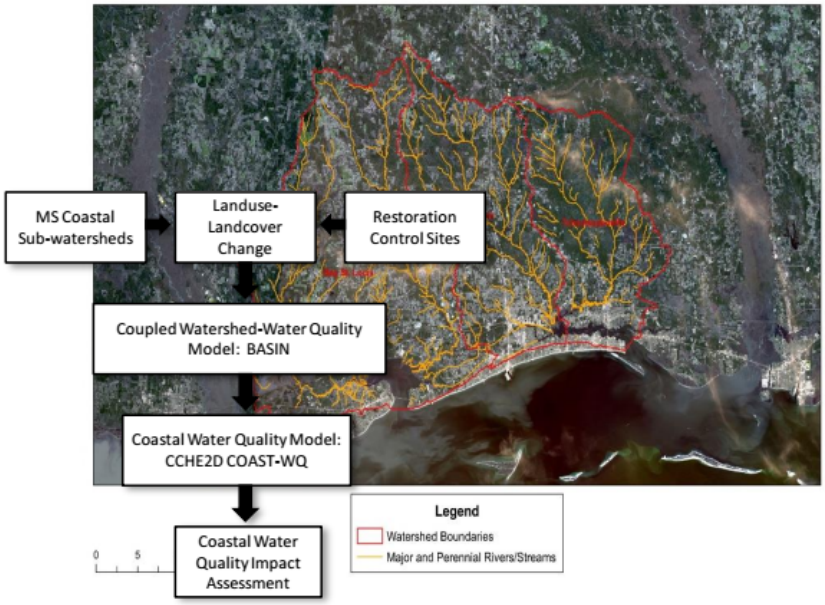
MississippiView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Mississippi

MississippiView 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 MississippiView initiatives demonstrate the valued application of remotely sensed data for practical analysis of issues impacting the state of Mississippi. Its 16th section lands project will be on-going and continue to improve the revenue for public education. With coastal restoration moving forward, understanding these watersheds is critical to improving water quality in Mississippi Sound. The significance of the soil moisture study to a heavily agricultural state like Mississippi cannot be overstated.

Bay St. Louis, Biloxi Bay, and Tchoutacabouffa Watersheds with 2015 Landsat Scene



Consortium Membership

The MississippiView consortium consists of representatives from the research institutions in Mississippi, as well as selected community colleges in Mississippi. The representatives are:

- Jones County Junior College - Chad Garick
- Alcorn State University - Lixin Yu
- Mississippi State University - Bill Cooke
- Jackson State University - John Young
- University of Mississippi Medical Center - Fazlay Faruque
- University of Southern Mississippi - George Raber
- Mississippi Valley State University - Raymond Williams
- University of Mississippi - Greg Easson

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MontanaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Montana

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. For example, MontanaView is currently leveraging its resources with support from the U.S. Department of Agriculture to address the impacts of bark beetles on Montana's forest resources.

Consortium Membership

Montana State University

Montana Association of Geographic Information Professionals

PARA Precision Agriculture Research Association

MontanaTech The University of Montana

NRCS Natural Resources Conservation Service

Montana Natural Resource Information System

The University of Montana

Salish Kootenai College — Grounded in Tradition. Charging into the Future.

USGS Northern Rocky Mountain Science Center

Federal consortium members identified above do not receive funding from AmericaView.

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NebraskaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Nebraska

The mission of **NebraskaView** is to ensure that Nebraskans make full use of satellite imagery, aerial photography and other geospatial data products through technologies such as geographic information systems (GIS) and remote sensing.

NebraskaView:

- conducts training & educational outreach,
- provides assistance in applications development,
- fosters technology transfer, and
- investigates and evaluates geospatial data sources for specific user applications.

NebraskaView engages in a variety of educational outreach activities. Some are formal, such as webinars developed specifically for state and local government geospatial data users (left). Others are more informal, such as the annual Teachers Night Out at the Durham Museum in Omaha, NE (right) where geospatial activities are targeted to K-12 teachers.

Consortium Membership

NebraskaView works closely with the Nebraska GIS Council (http://nitc.nebraska.gov/gisc/) and its member agencies (comprised of representatives of all levels of government, local through federal), as well as several Nebraska universities, to coordinate the development and application of geospatial information technologies in Nebraska.

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NewHampshireView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in New Hampshire

New HampshireView 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 HampshireView is based at the University of New Hampshire and 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 sharing of resources. 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. It provides networking and collaboration infrastructure, educational support, and outreach for all members. Specifically, the consortium provides:

- Education/Outreach through: guest lectures and webinars; presentations at technical meetings/conferences; workshops; and the GeoSpatial Services Center.
- Applied Research through: support for undergraduate and graduate student research internships; and software tools for evaluating the accuracy of thematic maps and fragmentation on the NHView website.
- Data Provision/Support through: sharing of software licenses and equipment (survey-grade GPS and others); and geospatial data and remotely sensed imagery archived by our partners.

USGS Landsat 8 mosaic of New Hampshire.

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 and houses the GeoSpatial Services Center.
- **Forest Watch, UNH**
  A New England environmental education activity using field, lab, 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**
- **NH Planning Commissions**
- **NH GIS Conservation Collaborative**
- **NH Fish and Game Department**

University of New Hampshire

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New MexicoView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in New Mexico

New MexicoView 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 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. New MexicoView funding has provided training to current and future land and natural resource managers in remote sensing basics and use of satellite imagery.

Remotely sensed data are widely used in New Mexico by state and federal agencies, universities, private entities, and non-profit organizations. Some of these uses are natural resource management activities (fire and range management), and conservation of species and biodiversity. A challenge for the New Mexico remote sensing community is to get mapping and monitoring applications developed by USGS, USDA, and New MexicoView partners into the hands of managers. The New MexicoView consortium is working on methods to bring the research and management communities together in New Mexico.

An example of community building is the collaboration of New MexicoView with The Wildlife Society (Southwest Section and New Mexico Chapter) to support a geospatial advisory committee to provide information to wildlife managers seeking to address ecological questions with remotely sensed data and geospatial technologies. This information includes webinars and articles about available methods and tools.

TOOLS AND TECHNOLOGY

A Toolbox of Apps

MOBILE TECHNOLOGY SUPPORTS WILDLIFE DATA COLLECTION

Article published in The Wildlife Professional about the use of Citizen Science Apps by organizations, agencies, and in education. Copyright 2016. Image used with permission of The Wildlife Society.

Consortium Membership

New MexicoView 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 an infrastructure, and supporting research and education in the state. Collaboration with the New Mexico Geographic Alliance, New Mexico Geographic Information Council, and NASA provide the foundation for education and outreach opportunities across the state.

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

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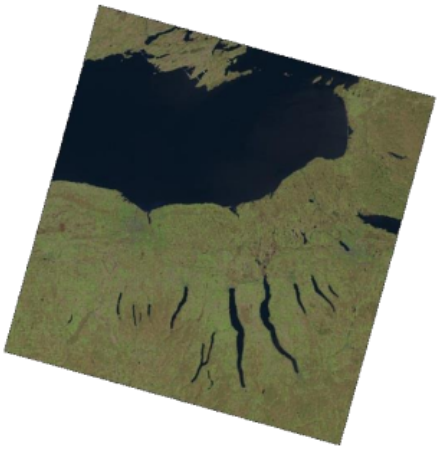
New YorkView Consortium Overview 2015 – 2016

Enhancing the Understanding and Use of Remote Sensing in New York

New YorkView (NYView) 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.

Remotely sensed imagery is used for a wide range of applications in New York State including analyzing land use and land cover change, characterizing vegetation dynamics, planning or monitoring urban growth, and supporting response to a wide range of emergency situations. The NYView consortium seeks to support the application of remote sensing data and products in order to solve challenges faced by New York State citizens.

When NYView became an Associate Member of AmericaView in 2009, the vision addressed two major activities: 1) facilitate access to diverse remote sensing data/ products, and 2) support collaborative research, teaching, and outreach among the members of the consortium. Since becoming a full member in 2014, this vision continues to frame the overarching priorities for NYView. NYView seeks to facilitate applications of remote sensing data within New York State, and mitigate the barriers to the potential success of such endeavors. Current efforts focus on engaging existing members, connecting with new members from various sectors throughout the state, and enhancing the broader understanding of remote sensing.



Landsat 8 image of Central New York, acquired April 20th, 2016

Consortium Membership

Current NYView consortium members include: the State University of New York (SUNY) College of Environmental Science and Forestry (ESF), the Institute for Resource Information Sciences (IRIS) at Cornell University, SUNY Fredonia, and SUNY Plattsburgh. NYView aims to continue to add consortium members to support collaboration and enhance remote sensing activities across the state. Interested researchers and users of remote sensing data should visit the NYView webpage (www.esf.edu/nyview) or contact the NYView Principal Investigator for more information.

ESF

Cornell University

IRIS

Institute for Resource Information Sciences

FREDONIA

STATE UNIVERSITY OF NEW YORK

Plattsburgh

STATE UNIVERSITY OF NEW YORK

New YorkView Principal Investigator:

Lindi Quackenbush

SUNY College of Environmental Science and Forestry

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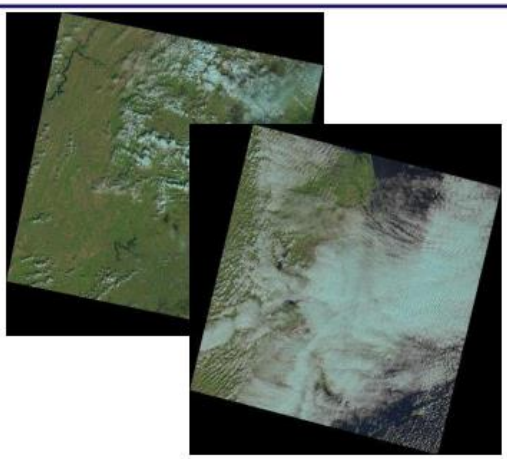
North CarolinaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in North Carolina

North CarolinaView 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.

North Carolina has regulations through the Coastal Area Management Act to mitigate human-induced impacts on SAV beds. The state is interested in identifying the annual location and extent of SAV beds within its estuaries. Due to the vast spatial extent of the Albemarle-Pamlico Sound Estuary and cost, the *in situ* survey is impossible. The State is only able to afford to survey the Estuary once every five years (http://portal.ncdenr.org/web/apnep/sav-monitoring). The feasibility and success of this NCView mapping activity using free Landsat multi-temporal images should allow the state, coastal managers, and researches, as well as concerned citizens to assess spatiotemporal distributions of SAV rapidly using repetitive coverage of satellite images.

North CarolinaView is also developing methods and algorithms to enable effective cloud removal, understand the performance of cloud removal algorithms, and contribute those algorithms to the global community.



North Carolina is covered by 11 Landsat image scenes. Between 1 January 2014 and 31 December 2016, the total number of Landsat-8 images collected for North Carolina exceeded 750. The number of images with 50% or less cloud-cover is about 440 image".

Consortium Membership

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

North CarolinaView Principal Investigator:
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<StateView> Website here.

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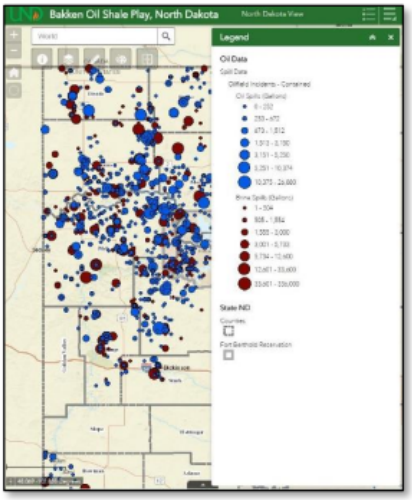
North Dakota View Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in North Dakota

North Dakota View (NDView) 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.

Led by the Department of Geography & Geographic Information Sciences at the University of North Dakota and established in 2004, NDView is dedicated to promoting remote sensing and geospatial technologies throughout North Dakota. NDView engages in the development of 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.

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 awards scholarships for professional development in remote sensing and geographic information systems. NDView also 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/conservation land-cover change.



Recent oil and brine spills in the area of the Fort Berthold Indian Reservation from NDView web GIS

Consortium Membership

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

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Laura Munski, Ph.D., Director, Dakota Science Center, laura.munski@gmail.com

Stacie Blue, Environmental Science Instructor, Turtle Mountain Community College, sblue@tm.edu

Angie Milakovic, Assistant Professor of GIS, Bismarck State College, angela.milakovic@bismarckstate.edu

Bob Nutsch, GIS Coordinator, State of North Dakota Information Technology Department, bnutsch@nd.gov

Gary Halvorson, Ph.D., Agriculture Division Director, Sitting Bull College, garyh@sbci.edu

Peter Oduor, Ph.D., Chair, Department of Geosciences, North Dakota State University, peter.oduor@ndsu.edu

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OhioView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Ohio

OhioView is a member of the AmericaView Consortium, 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. OhioView was formed in 1995 to improve distribution and access to data acquired from U.S. Government civilian satellites. Begun as a partnership between the Miami University Libraries and the Department of Geology, the consortium quickly grew to include Bowling Green State University, Ohio University, University of Cincinnati, Kent State University, and The Ohio State University.

Our consortium goals include:

- Sustaining a public access system in Ohio for geospatial data from the U.S. Government.
- Promoting the use of satellite and geospatial data in education.
- Facilitating the use of satellite data to monitor a wide variety of environmental issues, such as flood risk, crop health, urban sprawl, and loss of wetlands.
- Enhancing cooperation between education and state and local governments in remote sensing and digital mapping.

Consortium Membership

The OhioView consortium is comprised of 14 university partners that cover the far corners of the state. As of GY-2014 membership in the consortium included:

Bowling Green State University:	Dr. Anita Simic
Central State University:	Dr. Xiaofang Wei
Cleveland State University:	Dr. W.B. Clapham
Kent State University:	Dr. Mandy Munro-Stasiuk
Lakeland Community College:	Mr. Mark Guizlo
Miami University:	Dr. Mary Henry
Ohio State University:	Dr. Desheng Liu
Ohio University:	Dr. James Lein
University of Akron:	Dr. Linda Barrett
University of Cincinnati:	Dr. Hongxing Liu
University of Dayton:	Dr. Umesh Haritashya
University of Toledo:	Dr. Kevin Czajkowski
Wright State University:	Dr. Doyle Watts
Youngstown State University:	Dr. Bradley Shellito

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OklahomaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Oklahoma

OklahomaView 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.

OklahomaView is a statewide consortium established in 2014 to promote the utilization of remotely sensed data and to raise awareness among Oklahomans about applications of remote sensing technology to improve their quality of life.

Oklahoma has a diverse remote sensing user community including academic, federal, state, and private sectors. OklahomaView helps the remote sensing user community in our state address current and future environmental challenges by developing and coordinating research, education, and outreach activities.

2015 Geospatial Information Science Day Expo

2015 Oklahoma Workshop on Remote Sensing Technology and Applications

Consortium Membership

OklahomaView has implemented a Co-Director management structure in a cooperative effort between Dr. Xiangming Xiao of the University of Oklahoma (Xiangming.xiao@ou.edu) and Dr. Saleh Taghvaeian saleh.taghvaeian@okstate.edu of Oklahoma State University. Ms. Melissa Scott of the University of Oklahoma mscott@ou.edu serves as state coordinator.

OklahomaView Consortium Members

- USGS South-Central Climate Science Center
- USDA-ARS Grazinglands Research Laboratory
- Oklahoma Biological Survey
- Oklahoma Climatological Survey
- The Samuel Robert Noble Foundation
- OU Center for Spatial Analysis
- University of Tulsa

Federal consortium members identified above do not receive funding from AmericaView.

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OregonView Consortium Overview

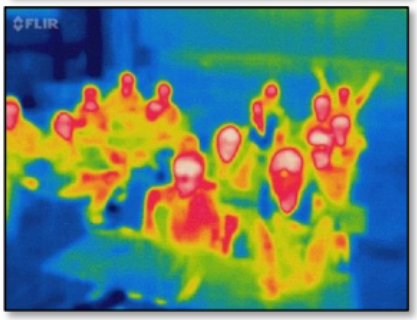
Enhancing the Understanding and Use of Remote Sensing in Oregon

OregonView 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. OregonView is a recent addition to AmericaView, having been awarded an affiliate development grant in 2015. Since its inception, OregonView has grown rapidly, building a robust membership of remote sensing and geospatial leaders in Oregon, extending across the university, government and private sectors. A scoping meeting held in December 2015 on the Oregon State University campus brought all current OregonView members together to discuss goals and collaboration opportunities.

The mission of OregonView is to enhance the beneficial use of remotely sensed data and derived geospatial products in Oregon through:

- Applications research
- Education and outreach
- Synergistic partnerships

A particular focus of OregonView over the past year has been on STEM education in remote sensing. Two middle school remote sensing workshops were taught by OregonView members in the 2016-2016 academic year, and more are planned for the current year.



Images: Top: Landsat mosaic of Oregon (courtesy of NASA and USGS). Bottom: middle school workshop: students using IR camera to explore imaging in different regions of electromagnetic spectrum.

Consortium Membership

The OregonView consortium membership comprises leaders in the remote sensing and geospatial information communities within Oregon and extends across the government, commercial and academic sectors. Member organizations include: Oregon Department of Parks & Recreation, USGS Forest & Rangeland Ecosystem Science Center, Oregon Framework Implementation Team (FIT), Oregon Geospatial Enterprise Office (GEO), GeoTerra, Portland State University (PSU), and Oregon State University (OSU) College of Engineering, College of Forestry, and College of Earth, Ocean, and Atmospheric Sciences.

Federal and state consortium members identified above do not receive funding from AmericaView.

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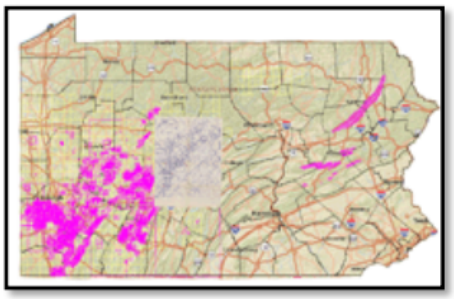
PennsylvaniaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Pennsylvania

PennsylvaniaView (PAView) (http://www.paview.psu.edu) 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. PAView was developed to further one of the primary goals of the AmericaView program – to educate the public about remotely sensed imagery and to provide an additional portal to data and information in a public forum.

The **goals** of PAView are:

- To build partnerships within the Commonwealth of Pennsylvania 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 remotely sensed 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 of Pennsylvania to enhance access to satellite data and to encourage the use of it in courses.



PA Mine Map Atlas - location of mines digitized.

The value of the PAView consortium to Pennsylvania rests with its ability to further one of the primary goals of the AmericaView Program – to educate the public about remotely sensed imagery and to enhance public access to data and information.

Consortium Membership

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

California University of Pennsylvania: Thomas Mueller, Ph.D., GISP (Co-PI)

Pennsylvania State University: Maurie Kelly, Ph.D. (Co-PI)

Clarion University of Pennsylvania

Bucknell University

Villanova University

PennsylvaniaView Co-Principal Investigator:
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RHODE ISLANDVIEW CONSORTIUM OVERVIEW

ENHANCING THE UNDERSTANDING AND USE OF REMOTE SENSING IN RHODE ISLAND

Rhode IslandView is a member of the AmericaView Consortium, a nationally coordinated network of academic, state government 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.

Rhode IslandView (RIView) is one of the newest consortiums to join AmericaView, having been competitively awarded full AmericaView membership effective July 2015. RIView is focused on developing outreach and educational resources that feature Rhode Island's broad array of remote sensing applications and resources. Rhode Island's unique coastal ecosystems lend themselves particularly well for innovative and important applications of remote sensing data and technology.

RIView's partners represent a diverse combination of interests that range from mapping traditional land-use and land-cover, to building Landsat-based decision support systems, producing new lidar-derived data products, monitoring sea surface temperature, modeling sea level rise scenarios, and designing sensors for undersea and interplanetary exploration. With AmericaView's support, RIView is the only RI-based organization that is working to bring these shared interests together.

Potential sea level rise scenarios for the Wickford area of North Kingstown, RI. Image features 2011 orthophotographs and lidar data coordinated by USGS.

CONSORTIUM MEMBERSHIP

University of Rhode Island

Department of Natural Resources Science
http://web.uri.edu/nrs

Graduate School of Oceanography
http://www.gso.uri.edu

Brown University

Department of Earth, Environmental, and Planetary Sciences
http://bit.ly/BrownEEP

Lead Institution, NASA Rhode Island Space Grant Consortium
http://bit.ly/RISpaceGrant

State of Rhode Island

Division of Planning
http://www.planning.ri.gov

Department of Environmental Management
http://www.dem.ri.gov

For more information about Rhode IslandView, please contact the consortium's coordinator, Greg Bonynge.
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South DakotaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in South Dakota

South Dakota View (SDView) Overall Vision: ***Building partnerships and capability within South Dakota to facilitate the utilization of remote sensing data and geospatial technologies for the benefit of its citizens and the economic development of the state***

SDView Long-Term Goals:

1. ***Develop the SDView consortium such that it meets the needs of South Dakota and participates synergistically within AmericaView, Inc.*** SDView provides a mechanism for coordination and sharing of geospatial activities and data in South Dakota and provides connections via AmericaView to expertise outside of the state.
2. ***Provide access to remote sensing data for South Dakota.*** SDView provides a gateway to U.S. Geological Survey (USGS) products such as Landsat imagery and to USGS search and download tools such as GloVis and EarthExplorer. Links to geospatial data and services from other federal, state and local sources are additionally provided.
3. ***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.*** SDView provides workshops and course materials for K-12 educators, university students, agricultural producers, extension educators, and the general public. SDView also continues to promote the expansion of the number of courses at South Dakota universities, tribal colleges, and technical institutes that include remote sensing as all or part of the content.
4. ***Support remote sensing research at research universities in South Dakota through access to data and, as funding becomes available, through grants and contracts***. SDView facilitates remote sensing research activities by providing access to remotely sensed data and by demonstrating practical applications of geospatial technologies.
5. ***Build partnerships with state and local government entities that explore and test the utility of remote sensing data products for practical applications that will benefit the citizens of SD.*** SDView will continue to serve as an effective mechanism for disseminating information about remote sensing data and applications to local, state and federal agency personnel in the state, as well as to private industry.

Consortium Membership

The SDView mission of **expanding the utilization of remotely sensed imagery and technology for the benefit of its citizens, scientists, researchers, and educators** is accomplished via a consortium of partners from throughout the state. The entities listed below in addition to many universities, technical institutes, and tribal colleges in the state have worked with SDView during 2015-2016 in a variety of activities that further the mission and goals of SDView.

- South Dakota State University Agricultural Heritage Museum
- SD Bureau of Information and Telecommunications
- City of Sioux Falls
- SDSU Extension - STEM
- Technology & Innovation in Education
- SD Dept. of Environment and Natural Resources
- SD Department of Education
- EROS Center SD/ND/WY/MT Liaison

Federal consortium members identified above do not receive funding from AmericaView.

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TexasView Consortium Overview

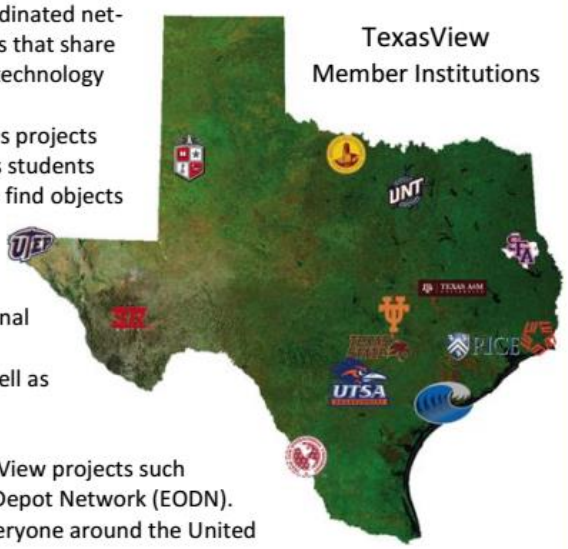
Enhancing the Understanding and Use of Remote Sensing in Texas

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.

TexasView provides educational outreach to K-16 students through various projects such as ***Watching Over Texas From Space (WOTFS) – "Find It"***, which guides students through using a geographic coordinate and orientation reference systems to find objects on satellite imagery, ***"Measure It"***, which introduces concepts of scale and Distance, and "***You Figure It Out***", which introduces association and texture into the image interpretation process. TexasView tailors K-12 educational projects to support the Texas Essential Knowledge and Skills (TEKS) Educational standards for science courses at multiple grade levels.

In addition, TexasView provides support for undergraduate research, as well as workforce training through the *TexasView Introduction to Remote Sensing Workshop*.

TexasView also 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 broaden and enhance access to remote sensing data for everyone around the United States and the world.



Consortium Membership

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 is founded on the concept of free and public exchange among its members of data, information and knowledge concerning the Earth and its processes, as observed by remote sensing and GIS technologies, for education, research, and local government applications.

Stephen F. Austin

The University of Texas at Austin

Midwestern State

Texas Tech

Texas A&M

The University of Texas at El Paso

Lamar

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

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UtahView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Utah

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 United States Geological Survey. That funding supports the AmericaView mission of advancement, availability, distribution, and use of remotely sensed data and technology through education, research, outreach, and technology transfer.

UtahView is hosted by the Remote Sensing/GIS Laboratory at Utah State University in Logan, Utah. The primary mission of UtahView is to promote the availability, distribution, and use of geospatial technology and data in the public and private arenas; to encourage the use of geospatial data in higher education and among K-12 schools; and to facilitate geospatial research and understanding at all levels.

The 2015-2016 year was eventful and successful. The previous UtahView State Coordinator, Mr. Christopher McGinty, accepted the position as AmericaView Program Manager, and Ms. Ellie Leydsman McGinty entered in as the new UtahView State Coordinator. During the past year, UtahView supported several educational and public outreach events for the purpose of fostering geospatial knowledge and skills. UtahView has continued to promote educational training and host educational workshops and develop partnerships with Utah educators, advocates of geospatial awareness, university and county extension agents, state and county employees, and the general public.

The Remote Sensing/GIS Laboratory at Utah State University in Logan, Utah.

Students at the Spring Break Mapmakers Camp educational event on March 30-31, 2016.

Consortium Membership

Dr. R. Douglas Ramsey, Professor in the Quinney College of Natural Resources and Director of the Remote Sensing/GIS Laboratory at Utah State University, Dr. Phoebe McNeally, Research Associate Professor and Director of the DIGIT Laboratory at the University of Utah, Dr. Sowmya Selvarajan, Assistant Professor of Geomatics and ASPRS Intermountain Region President, Ms. Ellie Leydsman McGinty, Researcher II in the Remote Sensing/GIS Laboratory and UtahView State Coordinator, and the Utah Geographic Information Council (UGIC) represent the UtahView consortium membership. Collectively, the consortium members bring a wealth of scientific, outreach, and technical experience to the urban, rural, and wildland regions of Utah.

S.J. & Jessie E. Quinney College of Natural Resources
Utah State University
Remote Sensing/GIS Laboratory

Utah Valley University

The University of Utah

UGIC
Utah Geographic Information Council

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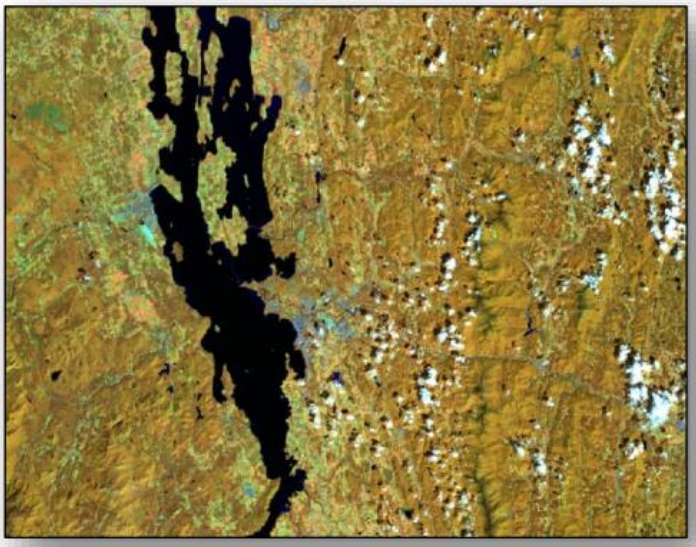
VermontView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Vermont

VermontView 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.

Remotely sensed data plays an important role in the Green Mountain State. High-resolution aerial photography helps communities update their property parcel maps. Civil satellites, such as the USGS Landsat program, provide an invaluable historical record that is used to quantify landscape change and monitor forest health. Detailed 3D topographic models generated from USGS funded airborne LiDAR are used to produce better flood risk models. Unmanned Aircraft Systems (UAS) are enabling emergency personnel to make better decisions, more quickly during natural disasters.

The VermontView consortium is dedicated to advancing remote sensing in the Vermont through education, outreach, training, networking, and data distribution.



Landsat-7 image of Vermont and Lake Champlain. The Landsat satellites have been acquiring imagery over Vermont, every 16 days, for decades.

Consortium Membership

The University of Vermont

Middlebury

VTrans Working to Get You There — Vermont Agency of Transportation

VCGI

Forest Service U.S. Department of Agriculture

Green Mountain College — Lux Fiat — Chartered 1834

Vermont Agency of Natural Resources

NRCS Natural Resources Conservation Service

USGS science for a changing world

University of Vermont — SAL TRC — Unmanned Aircraft Systems Team

Federal consortium members identified above do not receive funding from AmericaView.

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VirginiaView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in VirginiaView

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.

The federal government and private sector has made targeted investments 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 implementation of real-world remote sensing applications poses challenges for local governments, regional entities, federal agencies, the private sector, and educators.

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, and student and community engagement opportunities, and research. Many of our activities focus upon applications of Landsat imagery, distributed without charge by the USGS.

Landsat mosaic image of the Chesapeake Bay.
www.usgs.gov/media/images/chesapeake-bay-landsat

Consortium Membership

VirginiaView partners develop, leverage, and disseminate remote sensing resources and applications to stakeholders across the state. Partners also collaborate on funding proposals and research efforts. VirginiaView's programs, supported by other AmericaView members and the National Geospatial Technology Extension Network (NGTEN), have the capacity to efficiently extend resources and programming efforts nationally.

Federal consortium members identified above do not receive funding from AmericaView.

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West Virginia View Consortium Overview

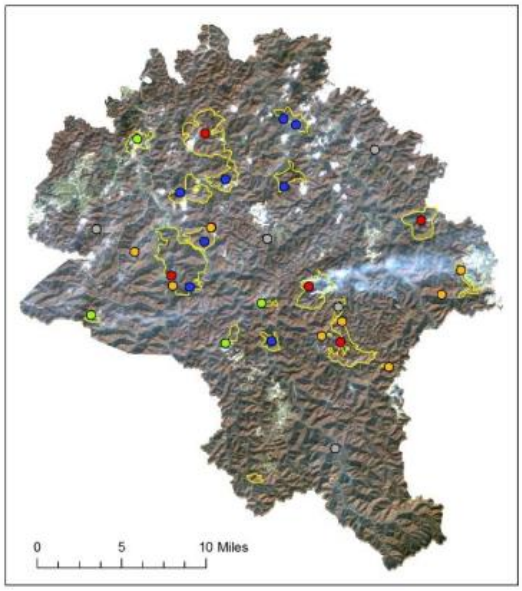
Enhancing the Understanding and Use of Remote Sensing in West Virginia

West Virginia 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.

West Virginia View promotes remote sensing through:

- 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.
- Grants to students to enhance educational experiences, with a particular focus on undergraduate and graduate research.
- The West Virginia View website as the largest source for free imagery and lidar data in the state of West Virginia.

Satellite-mapping of wildfire in 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

West Virginia University
NRAC
dep
USDA Forest Service
Alderson Broaddus Geospatial Laboratory
ABGSL
Alderson Broaddus University
WV GIS TC
Glenville State College
Davis & Elkins College
Marshall
SkyTruth
West Virginia Wesleyan College

Federal consortium members identified above do not receive funding from AmericaView.

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WisconsinView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Wisconsin

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.

WisconsinView bridges the gap between the research and user communities in Wisconsin. The federal government and private sector have investigated significantly in 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 are widely recognized; yet connecting state and local users with federal information requires local knowledge and a statewide network. WisconsinView addresses this need.

WisconsinView became an AmericaView member in 2004. Since that time 12 institutions have joined the University of Wisconsin-Madison to form the WisconsinView Consortium and over 18,500 individuals have registered to download remote sensing imagery from the WisconsinView website. WisconsinView partners share imagery and expertise. Together they develop imagery products and educational materials and seek to improve utilization of remote sensing resources throughout the state.

Landsat 7 image of the Fox River, Green Bay, and the Door County peninsula.

Consortium Membership

WisconsinView comprises the following 13 partner organizations:

Federal consortium members identified above do not receive funding from AmericaView.

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WyomingView Consortium Overview

Enhancing the Understanding and Use of Remote Sensing in Wyoming

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

Highlights:

- Promote remotely sensed data products
- Train current & future workforce in remote sensing technology
- Contribute to STEM education at k-16 levels
- Advance applied research and technology transfer

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 at the state and local level of the data collected by US government agencies.

Consortium Membership

University of Wyoming
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

Federal consortium members identified above do not receive funding from AmericaView.

WyomingView offers workshops in regional conferences such as GIS in the Rockies (above) to promote Landsat data and products to geospatial specialists.

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FIVE TIPS

For Universities Using

UAS in Disaster Response

UAS, when employed properly, can be a valuable tool for disaster response. They can collect data faster, more safely, and at a lower cost than traditional remote sensing techniques. Using your university UAS assets in disaster response is more than having access to drones and certified pilots. This guide provides five tips to guide your disaster response activities.

01

Practice Before Implementation

Don't let the disaster be the first time you employ UAS for disaster response.

Participate in federal and state disaster response exercises.

02

Get Certified

Federal disasters use the Incident Command System (ICS).

Get members of your team ICS trained. Training is free and available online.

03

Know the End User

Understand end user requirements and technological limitations.

Generate UAS products that can are immediately useful and easy to work with. Be prepared to provide tech support.

04

Look the Part

Your team should be easily identifiable and professional in appearance.

Wear uniforms with a distinguishable logo have safety clothing at the ready. Be ready with handouts with additonal information in case the public has questions.

05

Airspace Coordination

The airspace during a disaster response can get crowded with operations being carried out by everyone from the Civil Air Patrol to the media.

Coordinate with whomever is in charge of the air space. Ensure you have permission to fly. Carry a flight radio so you can communicate with aircraft directly.

AmericaView is a nationwide partnership of remote sensing scientists who support the use remotely sensed data through applied remote sensing research, K-12 and higher STEM education, workforce development, and technology transfer.

AmericaView

www.facebook.com/AmericaView @americaview www.amerciaview.org