

ALABAMAVIEW 2018 - 2019



ALABAMAVIEW HISTORY AND SUCCESSES

Alabama has been involved in AmericaView since it attended its first meeting in Fairbanks, Alaska 16 years ago. Over the years we have developed research methods that uses thermal imagery to assess drought conditions which has been a serious problem in Alabama. From training we received at the FTM, we developed methods using Object Based Image Analysis to map isolated wetlands for the entire state of Alabama. In terms of outreach, we developed a module for high school students using Google Earth to look at NDVI and the carbon cycle. This module was shared with the Alabama Science in Motion program that utilizes 11 mobile labs to deliver the materials to thousands of high school students every year.

One of our important activities involved the processing of statewide airborne LiDAR products for use in environmental applications. We have established a strategic partnership (USGS program objective #2) with the Southern Research Station of the US Forest Service to map urban tree canopy and produce a product that Forest Service employees can utilize and share to promote and maintain urban forests. This is important to the state of Alabama as urban trees and forests provide essential ecological, economic, and social benefits to a large part of the population. LiDAR data and Color Infrared NAIP imagery was used to map urban tree cover using GeOBIA methods in combination with Landsat 8 Leaf-off imagery to help us separate deciduous and coniferous tree cover.





LiDAR 1st return and last return data along with Color Infrared imagery help produce accurate urban tree cover maps.



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

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Another important activity involves investigating urban heat island (UHI) intensity using remote sensing and GIS techniques. Landsat 8 imagery (thermal bands) was used to measure UHI magnitude of urban areas in Alabama. Reasons behind specific location based UHI intensities are measured and analyzed. Thermal IR heat guns and temperature data sensors are then used to measure and monitor changes in temperature patterns. All of these data help to educate the state and local governments and other related organizations (USGS program objective # 2) to ameliorate the impacts of UHI. To further extend education and outreach activities AlabamaView has prepared modules on UHI intensity and impacts using Landsat images to train AMSTI (Alabama Math, Science, and Technology Initiative) teachers. The teachers will use the modules to teach students the benefits of remotely sensed images and its various uses (USGS program objective # 2).

ALABAMAVIEW 2018 - 2019 ACTIVITIES

AlabamaView held several education and outreach activities during 2018-2019 funding year. The 'Geography Awareness Week' event on Wednesday November 14th, 2018 was held at Cater Lawn on Auburn's campus. AlabamaView had a table where we promoted AmericaView and Remote Sensing through activities including online puzzles, a thermal remote sensing activity using infrared thermometers measuring the temperatures of different earth surfaces to explain urban heat issues, and we flew a small UAS to demonstrate the benefits of local high-resolution image data collection. We recorded approximately 70 Auburn University students in attendance.

AlabamaView Co-I Mitra and several graduate students held several outreach activities at Auburn High School on November 6th, 2018 and April 4th, 2019 where 4 presentations were given in total during several sections of the Environmental Science course. The presentations covered air pollution, urban heat, satellites and remotely sensed images, and sustainability measures. Discussions were related to real-world applications of the topics the high school students were studying. Job opportunities related to geography and geospatial sciences were discussed as well. This activity involved 98 high school students and 6 teachers.

The final activity held on April 22nd, 2019 was called the "Earth Day Extravaganza." It was a large event, attended by approximately 400 university students. AlabamaView had on display puzzles (both hard board and online), USGS Earth Shots, and the Earth Day poster. In addition, the 2nd Annual Earth Day Research Symposium was organized where posters were presented by students highlighting earth sciences and remote sensing applications. This event drew students from many disciplines, and many did not have familiarity with remote sensing and how satellites can help society understand and monitor the earth's environmental changes. There were interactions and discussions between various other groups on the value of sustainability and reversing some of the processes that have changed the face of earth. This event was successful in teaching younger college students the value of remote sensing and how AlabamaView is a flagship organization within the state to promote remote sensing education and benefits.



Dr. Chandana Mitra (at the center in above image) from the Department of Geosciences, Auburn University, explaining the importance of climate change and its influence on urban environments to Auburn High School Students as a part of a semesterly environmental awareness program tailored to youths. Graduate student Elijah Johnson (first image below) teaches high school students about geospatial science and climate change while Mitra (second image below) hosts the Earth Day Extravaganza.



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ALASKAVIEW 2018 - 2019



ALASKAVIEW HISTORY AND SUCCESSES

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

As a result of activities and support of AlaskaView the State of Alaska have benefited as follows:

- Geospatial training courses for K-12, university students, and for personnel of state, tribal, and federal organizations.
- STEM learning activities at the Fairbanks Children's Museum.
- Partnership across the state to promote USGS products for Alaska-specific research.
- Processed Landsat data for Alaska Fire Service in support of firefighting operations during 2005 fire season.
- Collaboration of AlaskaView, UAF-GINA, USGS and NOAA was a critical source for availability of Landsat data for fire-fighting operations and accurate mapping of wildfire perimeters during 2005-2011.





The Augmented Reality Sandbox at Fairbanks Children's Museum.

Alaska native high-school students in a geospatial data resource course in 2015.

The Augmented Reality Sandbox at a STEM event at UAF.

Consortium Development and Maintenance Efforts: AlaskaView maintained the consortium involvement through face-to-face meetings with local members that were involved in the geospatial courses and in the deployment of Augmented Reality Sandbox at the Fairbanks Children's Museum.

ALASKAVIEW CONSORTIUM MEMBERSHIP



Federal consortium members identified above do not receive funding from AmericaView.

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ALASKAVIEW 2018 - 2019 ACTIVITIES

AlaskaView offered two workshops on Remote Sensing Applications to middle- and high-school student participants of *Alaska Summer Research Academy* (ASRA) and *Upward Bound College Bound* (UBCB) program during summer 2019.

Goal: Introduction of remote sensing science and technology; access to open source geospatial tools and freely available remotely sensed data; hands-on training where the students worked on two case studies from Alaska:

- a) coastal erosion along Alaska's northern coast and
- b) forest fire in interior Alaska

Participants: Nine middle-school students (ASRA) and seventeen high-school students from remote villages (UCBC)

UCBC students also learned about Google Earth Engine and created custom maps using Google My Maps application.

ASRA students practiced collecting vegetation spectral using a PSR+ 3500 field spectrometer and learned about spectroradiometry and image interpretation in the field (at 2004 Boundary fire site). Students also explored boreal forest and exotic places through Google Virtual Reality.

Public Outreach: AKView participated in the 2019 Annual Science Potpourri event organized by University of Alaska Fairbanks' College of Natural Science and Mathematics. Exhibit included: Augmented Reality Sandbox, 3D printers, Landsat board games, NASA posters, USGS Landsat Science booklets.

Consortium Development: Collaborated with Alaska Satellite Facility, NSF Alaska EPSCoR program, Alaska Summer Research Academy, and Alaska Upward Bound College Bound program.



Middle-school student participants of 2019 Alaska Summer Research Academy working on a forest fire burn scar and burn severity mapping from pre- and post-fire Landsat images.



High-school student participants of 2019 Upward Bound College Bound program working on a lab on coastline erosion along Alaska's northern coastline.

Below pictures were taken during 2019 Science Potpourri event held at University of Alaska Fairbanks campus on 13th April 2019.



These activities meet the objectives 2 and 4 of NLRSEORA 2018 grant: "establishing strategic partnerships to develop and deploy remote sensing applications through collaborations involving university research teams and K-12 schools" and "developing materials for an educational and training workshop".

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http://www.sites.google.com/view/alaskaview

Facebook.com/ArcticRemoteSensing



ArkansasView 2018 - 2019



ARKANSASVIEW HISTORY AND SUCCESSES

Established in 2002 by University of Arkansas' Center for Advanced Spatial Technologies (CAST), ArkansasView has contributed to remote sensing successes within the Center, the campus community, and the state. Highlights are a) the development of new degree and certificate programs including PhD Geosciences, MS Geography, and online certificates in geographic information systems (GIS) aligned with remote sensing, b) support for graduate students and faculty in Arkansas seeking to apply remote sensing in their research, c) research on geospatial provenance to support replicability and reproducibility in remote sensing workflows, and d) research and educational progress in geospatial unmanned aircraft systems (UAS).



ASA Hazard Map, an ArkansasView-supported spatial decision support system (SDSS) completed in 2012, based on Landsat and airborne LIDAR, for forest land owners experiencing drought-induced red oak borer infestation (asa.cast.uark.edu).

In a partnership with Communities Unlimited that began in 2014, a nonprofit organization serving communities in seven states, ArkansasView sponsored a new geospatial internship for developing remote sensing-assisted workflows that address persistently poor rural communities' access to basic water infrastructure. Also, beginning in 2015, ArkansasView played a key role in the creation of the first two UAS-based courses at University of Arkansas. Students trained in these courses are supporting new agricultural, environmental, and industrial UAS applications in Arkansas.



ArkansasView funds have supported research on provenance that was published in Remote Sensing Handbook (left) and has produced short YouTube educational videos (right) on UAS techniques such as processing data from a thermal sensor.



ArkansasView enabled "Geospatial Unmanned Aircraft Systems", the first drone-based class at University of Arkansas, every Fall since 2016.



Online undergraduate "Certificate of Proficiency in Geospatial Technologies", the first undergraduate certificate at University of Arkansas launched with co-leadership from ArkansasView in Fall 2014. A graduate version was later launched in Fall 2016.

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ARKANSASVIEW 2018 - 2019 ACTIVITIES

Replicability and interchange of remote sensing workflows is rarely efficient, even within highly collaborative research and educational settings dedicated to internal transparency. In Year 1 (2018-2019) ArkansasView began development of a multiuser "remote sensing usability" database to bridge publicly available remote sensing data (e.g., federally-sponsored UAS collections, Landsat, National Agricultural Imagery Program, etc.) with specific local applications in Arkansas and collaborating states. During Year 1, ArkansasView produced a concept for a database as well as an online prototype called "Gigawatt" (GW; <u>https://gw.cast.uark.edu/</u>) using the popular MySQL database management system This progress set the stage for initial linkages (Year 2 and beyond) to be developed based on the wealth of remote sensing theory and experience available within AmericaView network and the practical needs referenced by consortium partners (e.g., Communities Unlimited which is headquartered in Fayetteville, AR).



Prior to Year 1, ArkansasView sponsored a project called "Gigawatt", intended for use in a local area network (GW-LAN), to accelerate multiuser development of remote sensing and UAS workflows. GW-LAN increases multiuser access and replicability for teams using commercial geospatial data processing tools such as ArcGIS Desktop/Pro, Agisoft Metashape, Pix4Dmapper, and other LAN-based tools. GW-LAN itself will become one of the "workflows" conveyed by ArkansasView in the "remote sensing usability" database started in Year 1.



This initial database schema for Gigawatt (GW) represents suggested tables needed to store streamlined but powerful information about remote sensing workflows created by participating online users. The concept of the schema can be stated as follows: "individuals with specific roles publish online versions of workflows, each accompanied by specific steps and citable resources". It should be emphasized that GW will be able to convey newer versions of a given remote sensing methodology that may involve a different team. The citable resources will point to actual input data sources (e.g., USGS), explanatory works (e.g., refereed publications), and specific versions of open source and commercial software.

Expansion of GW and its content will focus on conveying the practical local value of remote sensing to students, colleagues, rural communities, farmers, ranchers, etc. Year 1 progress has demonstrated that in effect, GW users will be able to search for applications, sensors, platforms, etc. and to contribute their own workflow information or "recipe" that is replicable using widely available resources. The software tools featured in GW can be any that are widely available (e.g., Google Earth Engine, Jupyter Notebook, etc.). However, as shown in the above schema, GW specifies the precise version of the software being incorporated. To ensure basic replicability, publication of the workflows in GW will first require that all steps can be successfully followed by someone with a "publisher" role. While the complexity of the database schema created in Year 1 is limited to ensure rapid and reliable online access, one possible future direction is to incorporate machine-readable provenance standards from such organizations as World Wide Web Consortium (W3C). Beginning in Year 2, a landing page and instructions for using GW will be made available via http://arkansasview.org/.



COMMUNITIES







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CALIFORNIAVIEW 2018 - 2019



CALIFORNIAVIEW HISTORY AND SUCCESSES

CaliforniaView was housed at Department of Land, Air and Water Resources and Center for Spatial Technologies and Remote Sensing (CSTARS), University of California, Davis. CaliforniaView's vision is to promote and advance remote sensing education within the state of California utilizing predominantly USGS Landsat data sets to solve societal problems. It has become the state's go-to remote sensing educational resource since 2012. CaliforniaView has supported California's economy and sustainable environment by

- Providing imagery and geospatial tools to the workforce for damage assessment and disaster preparedness.
- Relaying data-driven information to stakeholders to support betterinformed decision making on pressing environmental issues such as drought and wildfires.
- Educating and exciting the general public and educators about the benefits and applications of remote sensing imagery.
- Training educators and students on the accessibility of free Landsat data.
- Providing lesson plans guiding teachers on the implementation of remote sensing into their classroom curricula.



Landsat Mosaic of California created from a combination of Landsat 7 data during 1999

and 2002 and the National Elevation data.

CALIFORNIA (

To introduce remote sensing at the public venues, CaliforniaView has been hosting exhibitions at the annual University Open House (Picnic Day) at UC Davis with more than 70,000 visitors each spring. Interesting activities included a hands-on matching game with Landsat mosaic of California, a citizen science data collection-mapping project on campus, thermal infrared imaging test, and most recently a showcase of UAV systems including 3D Solo, DJI, and Precision The Drone showcase on 2019 Picnic Day, including (a) multiple sUAS system Hawk, and of UAV applications with posters.

■USGS

CaliforniaView has been actively participated in the national AV Earth Observation Day to engage K-12th Grade as well as college students. Activities included a lunch seminar for faculty and students, remote sensing game posters for discussions on local national environmental and topics.



UC Davis students playing matching games for the state capitals (left) and plant identifications (middle), and participating in seminar and discussions on remote sensing applications in natural and agriculture resource management (right).

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CALIFORNIAVIEW 2018 - 2019 ACTIVITIES

CaliforniaView is currently working on "**Promoting and** advancing remote sensing education across disciplines". The state of California is facing a critical need for remote sensing specialists working in government, state and private sectors, particularly due to the cascading impacts of recent droughts and heat waves on agriculture and forestry.

CaliforniaView has undertaken the following activities successfully to foster the interests, equip the students with the remote sensing skills for their research and future career:

(1) Providing training on Google Earth Engine (GEE) to lower the barrier of using remote sensing data for research. We hosted a joint workshop with Center for Spatial Science in February 2019. Demos covered a range of tools in GEE from exploring available data, fusion table, and GEE java scripts for analysis, including burn severity mapping and orchard planting year mapping.



Students from Hydrology, Ecology and Geography graduate groups at UC Davis visited NASA Ames Research Center, including the airborne facility tour and interactions with the "pixel-pushers" team.

(2) Engaging students from multidiscipline in project-based research. CaliforniaView supported two graduate students and two undergraduate interns in their research projects. Andy Wong, a PhD candidate from Hydrological Sciences, developed a pilot project on toxic algae bloom detection in Lake Tahoe using UAV technology. He has gained hands on experience on collecting aerial imagery, processing data, and developed automatic image segmentation. Yuhan Huang, a PhD candidate from Geography, developed Random Forest machine learning models to identify key drivers for fire severity California inter-coastal mountain ranges, based on Landsat data. A manuscript about this work has been submitted to Climatic Change. Two interns were trained together by the graduate students on a few drone related projects; they learned how to operate drones and process UAV images with Pix4D.



UAV flight planning and training.

(3) Organizing workshops and coordinating on brown bag meetings on emerging remote sensing technologies and realworld applications in agricultural and natural resource management. CaliforniaView sponsored the UCD mapping club for training on visualization of remote sensing and other geospatial data. For example, about 15 students around campus joined the Mapathon event this spring and were engaged with a lively discussion afterwards. We also coordinated and participated the campus wide drone show and talk events, which attracted undergraduate and graduate students from different major and graduate groups. We have reached out to potential presenters from academic, state and federal agencies, such as CAL Fire and Department of Water Resources, mostly based in Sacramento, and industries from bay area such as Planet and Climate Corp. Students will learn the real-world applications and also get a flavor of future career paths relevant to Remote Sensing and geospatial technologies.

(4) Expanding the consortium by bringing together K-12 educators, faculty, and researchers from a variety of State universities and colleges, professional organization, and industry. It also improved communication and encouraged close collaboration among consortium members. For example, we added a few partners from private industries including Climate Corp, Planet Lab, CERES Imaging, and LandIQ. We have established collaborative pilot projects with Climate Corp at the UCD Russell Ranch for remote sensing applications in precision agriculture; Planet Lab agreed to provide free commercial satellite data for our research.

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COLORADOVIEW 2018 - 2019



COLORADOVIEW HISTORY AND SUCCESSES

ColoradoView's broad objective is to facilitate innovative uses of Landsat and other USGS remote sensing data by students, educators and researchers in academia and government agencies who are working on issues that are important to the citizens of Colorado. ColoradoView (hereafter CV) addresses AmericaView's objectives of defining data requirements of the user community, establishing strategic partnerships to use GIS and remote sensing data and derivatives for education, research, and decision-making, and promoting research and remote sensing experience at the university level. During the previous grant cycle, CV has carried out the following research tasks.

Invasive species: The research focused on predicting the spatial distribution of invasive species for Colorado using a maximum-entropy model and the inputs from remote sensing and other data sources. The model successfully predicted the potential range for the two invasive species (wheat stem sawfly and cheatgrass) in Colorado, and the MODIS greenness and fire data improved model performance.

Distribution of UV-B radiation: The USDA UV-B Monitoring and Research Program (UVMRP) has a network of stations that measures UV radiation across the U.S. CV worked with the UVMRP program to use remote sensing data to produce improved maps of UV-B radiation. For Colorado, the improved maps can

be combined with crop cover maps to estimate UV-B impacts on agriculture.



NLCD 30-m Landsat-based land cover map of Colorado (2016)



Colorado Sustainable Grazing vegetation classification on the BX range



Grazing lands: The use of grazing lands is widespread in Colorado, both by domestic livestock and wildlife. Significant economic returns are realized by livestock producers, wildlife-based hunting, and tourism. CV worked with USDA and USGS to assess environmental impacts on grazing ecosystems, grazing impacts on vegetation and wildlife habitats, and appropriate management levels and carrying capacities. The developed utilities and procedures facilitated the use of Landsat, MODIS, and NAIP data in grazing land research.

UV skin damage index map for a day



Distribution of the Invasive Species (Yellow Toadflax)

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COLORADOVIEW 2018 - 2019 ACTIVITIES

Water availability is the main controlling factor of plant growth and production in Colorado. As Land Surface Temperature (LST) is a critical variable to monitor Earth's surface energy and water balance (i.e., linking to water availability), this year ColoradoView's HIA focuses on obtaining accurate, high-resolution, and gap-filled LST maps.

The first task retrieves 30-m LST from Landsat 8 band 10 observations in Colorado between 2014 and 2018 using the singlechannel algorithm developed by Jimenez-Munoz et al. (2009). The retrieval results are validated against the USGS Landsat 8 Analysis Ready Dataset at six CO counties (i.e., Denver, San Juan, Gilpin, Moffat, Elbert, and Phillips) representing the six dominant land use types (i.e., developed, barren, forest, shrub, grassland, crops) in Colorado. In general, the accuracy of the retrieved LST is high with the average RMSEs (outlier removed) at these counties between 0.58



Task 1. Daily average of LST retrieved from Landsat 8 B10 for Denver county between 2014 and 2018

and 1.15 K and the standard deviations between 0.21 and 0.90 K. The long-term LST trends over the 5-year period at these counties are small and not statistically significant.

The second task develops a partial-convolution based deep neural network with the U-Net like architecture to reconstruct the missing pixels in satellite images. The original partial convolution layer developed by Liu et al. (2018) is modified to consider both the convolution kernel weights and the number of valid pixels in the calculation of the mask correction ratio. In addition, the new partial merge layer is developed to merge feature maps according to their masks. Pixel reconstruction using this model was conducted using USGS Landsat 8 Analysis Ready Dataset (ARD) LST images in Colorado between 2014 and 2018. Complete LST patches (64 x 64 pixels) for two identical scenes acquired at different dates (up to 48 days apart) were randomly paired with ARD cloud masks to generate the model inputs. The model was trained for 10 epochs and the validation results show that the average RMSE values for a restored LST image in the unmasked, masked, and whole region are 0.29K, 1.00K, and 0.62K, respectively. In general, the model is capable of capturing the high-level semantics from the inputs and bridging the difference in acquisition dates for gap filling. The transition between the masked and unmasked regions (including the edge area of the image) in restored images is smooth and reflects realistic features (e.g., LST gradients). For large masked areas, the reference provides semantics at both low and high levels. This task has been summarized and published as the paper "Reconstruct missing pixels of Landsat land surface temperature product using a CNN with partial convolution" in the Proceedings of SPIE, Applications of Machine Learning, 2019.



Task 2. Four model validation examples. The subplots in each example from left to right refer to (1) the reference image (I_{ref}), (2) the to-berecovered corrupted image ($M \odot Igt$), (3) the complete target image (ground truth, I_{gt}), (4) the raw model prediction (i.e., the raw reconstructed image, I_{out}), and (5) I_{comp} , the mosaic of the unmasked part of I_{gt} and the masked part of I_{out} .

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CONNECTICUTVIEW 2018 - 2019



CONNECTICUTVIEW HISTORY AND SUCCESSES

ConnecticutView was accepted as an Affiliate Member of the AmericaView Consortium in 2010 and became a Full Member in 2014. AmericaView is a nationally coordinated network of academic, agency, nonprofit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. As such, the goals of ConnecticutView are to further the awareness and promote the use of remote sensing technology, from space borne sensors to ground based systems, within the state of Connecticut. To meet these goals, ConnecticutView engages in various activities targeted at the education of K - 12 students, undergraduate students, and the general public, in addition to using remote sensing technology to develop data and information that address specific issues within Connecticut.



Educational activities provided through ConnecticutView funding include the following:

One of a few Landsat remote sensing satellite cloud free image mosaics of Connecticut available for download from the CTView website (<u>https://ctview.uconn.edu</u>). Image captured April 2016 and displaying NIR, SWIR, and RED bands.

- Classroom presentations to middle school students covering basic remote sensing principles coupled with remote sensing content focused on special topics to help reinforce geographical concepts and terminology.
- Development of remote sensing based materials that address appropriate educational standards for Connecticut K-12 education that will become accessible online for use by Connecticut educators.
- Opportunities for undergraduate students to conduct a project of their choosing utilizing remote sensing technology for a study area within Connecticut; to provide hands-on learning experiences for students and support their individualized remote sensing based research learning.
- Development of webinar presentations related to remote sensing sensors, imagery, and data usage in cooperation with the University of Connecticut's Center for Landuse Education and Research (CLEAR) webinar series (<u>http://clear.uconn.edu</u>).



In class presentation to sixth grade social studies class, Hall Memorial School, Willington, CT.

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Undergraduate student project poster.



Title slide from webinar presented in May 2018.





CONNECTICUTVIEW 2018 - 2019 ACTIVITIES

To address the goal of providing awareness and promoting the use of remote sensing in Connecticut, ConnecticutView staff continue to identify and participate in projects that can take advantage of the technology. These relate to many of the objectives outlined in the USGS National Land Imaging (NLI) Program National Land Remote Sensing, Education, Outreach, and Research Activity (NLRSEORA) grant through the identification and communication of critical information and data requirements. These include support of remote sensing needs at the state level; fostering local and national strategic partnerships; advancing education and training, technology transfer and outreach to enhance the nation's current and future workforce; and supporting the U.S. Department of the Interior Secretarial Priorities.

A top priority activity of which ConnecticutView is undertaking is to characterize the extent and severity of forest defoliation due to gypsy moth caterpillars during the summers of 2016 and 2017. The gypsy moth caterpillar outbreaks resulted in significant defoliation of deciduous forest trees in eastern and southern Connecticut. Coupled with severe drought conditions during the same period has resulted in unprecedented ongoing forest mortality that is not fully understood by forest managers. Remote sensing technology is being utilized to provide a systematic analysis of the damage that has been inflicted on Connecticut forests. Through this project, ConnecticutView has the opportunity to influence directly management decisions in Connecticut and provide end users with a better understanding of the use of remote sensing science and technology. Results of the analysis are being provided to the general public in the form of an ESRI Story Map Journal accessible through the ConnecticutView website.

Another major endeavor of which ConnecticutView has developed is a mobile art exhibit that displays satellite based



"Our Earth Revealed" satellite imagery exhibit displayed during GIS Day, Nov. 2018 (left) and at the Connecticut Conference on Natural Resources, Mar. 2019 (right).



Analysis using Landsat 8 and Sentinel-2 remote sensing satellite imagery for the identification of gypsy moth caterpillar defoliated forest areas in Connecticut during 2016 and 2017.

remote sensing imagery. The exhibit, titled "Our Earth Revealed", contains images printed on canvas that highlight the patterns, shapes, colors, and textures of the natural and human-made landscape as well as views of forced migration, violence, and destruction triggered by autocracy, racial aggression, and ethnic tension. The intent is to prompt viewers to observe and recognize the beauty in the world and to contemplate the role humans play in its shaping. The exhibit was initially funded through a Metanoia on the Environment grant, and has been displayed at over five locations. Some samples from our collection can be viewed on the <u>ConnecticutView website</u>.

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Delaware View 2018 - 2019



DELAWARE VIEW HISTORY AND SUCCESSES

This is Delaware's first year as a full member to America View. Our work has focused on two main initiatives. The first initiative is research-based to estimate seasonal evapotranspiration (ET, sum of evaporation from the soil and transpiration water loss from plants) using a satellite-based energy balance model. In Delaware, ET may account for approximately two-thirds of the annual average water budget and these estimates are valuable to agricultural planners and water resource managers. The second initiative is centered on enhancing K-12 geography curriculum to meet the Delaware geographic education standards, introduce geospatial techniques, and providing relevant and exciting exercises to students.

Our research-based efforts began with a model called Surface Energy Balance Algorithm for Land (SEBAL) to compute ET, and we have transitioned to the Mapping Evapotranspiration at high Resolution with Internalized Calibration (METRIC) model because of its enhancements (Figure 1, 2), such as the internal calibration of the model using locally available weather data. The other advantage of METRIC are the tools and functions available in R. To date, two graduate students and three undergraduate students have been trained on using the satellite-based tools to estimate ET. Not only is this an area of active and worthwhile research with the extensive expansion of irrigation in Delaware, it has provided these students with geospatial skills training and expertise in remote sensing.



Figure 1. Input data for SEBAL model (Landsat 8 OLI dataset, DEOS weather observations).



Figure 3. Remote sensing workshop story map.

DelawareView 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 is funded by USGS grant agreement G18AP00077.

Delaware View's education and outreach efforts have brought together the University of Delaware and Geography K-12 Coordinator Education to introduce students to remote sensing data and GIS tools for geographic problem solving through teacher workshops (Figure 3) and enhancing the 9th grade Geography in the Modern World core curriculum with geospatial data and analysis tools accessible through ESRI ArcGIS Online web applications with accessible data and tools, along with story maps.



Figure 2. METRIC estimated instantaneous ET on 24 August 2016 2016.



DELAWARE VIEW 2018 - 2019 ACTIVITIES

Delaware View's efforts for this grant period focused on education and outreach. The first task extended its previous year's work to further enhance the geography high school core curriculum by creating ArcGIS Online web mapping applications to support geospatial data and/or analysis tools for four lessons that include:

- Firefly Music Festival lesson (Basics of Spatial Analysis Unit, Special Event Planning and Complementarity)
- *What makes a place unique lesson* (Unique Nature of Places Unit, Elements of Place)
- How has Delaware changed lesson (Unique Nature of Places Unit, Cities and Culture) (Figure 4)
- Saving the Everglades lesson (Environmental Interdependence Unit, Impacts of Ecological Cycle Modification - Florida Everglades)

All four lessons have an associated web mapping applications with necessary geospatial data to support the lesson. For example, *What makes a place unique* lesson contains population density, race, and landuse data layers in a simple, visually easy to understand legend and color scheme to identify the dynamics of the socioeconomic characteristics across Delaware.

Two workshops were offered to introduce remote sensing to the four lessons outlined above. Six teachers attended with four joining virtually. Given the low turnout for the two workshops, we have begun to focus on individual teacher training, and attend workshops and conferences K-12 teachers participate in to allow for one-on-one conservations of their needs.



Figure 5. Delaware View Education and Outreach activities



Figure 4. 2012 (top) and 2017 (bottom image) aerial photography of Middletown Delaware provides excellent example for change analysis with fast paced development in last 10 years.

Our second task for this grant period concentrated on creating a broader, more coordinated instructional program in geospatial technologies that would allow high school students to gain technical expertise in GIS and spatial analysis (Figure 5) beyond the high school curriculum. Delaware View, Geography K-12 Program Coordinator, and Delaware Technical Community College (DelTech) submitted an application to develop a GIS Career and Technical Education (CTE) Pathway with the support and guidance from Delaware Department of Education (DeDOE) in August 2018. DeDOE raised the application to state level and submitted it again in 2019. Delaware View and K-12 Coordinator were also successful in exploring opportunities with a local high school. We are set to offer a Geospatial Activity Block starting this fall to expose high school students to geospatial technologies. These efforts meet USGS Objective 3 and 4 providing education training.

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GEORGIAVIEW 2018 - 2019



GEORGIAVIEW HISTORY AND SUCCESSES



Celebrating the Earth Observation Day with Coweta County Performance Learning Center Students.

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



GeorgiaView member institutions.

GeorgiaView 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 is funded by USGS grant agreement G18AP00077.



Educating current workforce by offering drone image processing workshop for colleagues, companies, and graduate students.

AmericaView University

GeorgiaView has developed and maintained an online remote sensing course for the public that contains fourteen modules. Students and instructors from Ohio, California and Georgia have used the online course. URL: http://www.avuniv.org.



Keeping the invaluable legacy of our history. This image is an example of an orthorectified mosaic of 1955-1956 historical airphotos covering the Forsyth County, Georgia that has been performed by Dr. Sharma's team at UNG.



Supporting undergraduate student research with Landsat imagery and geospatial technology. Steven Whatley presents "Detecting Lava Flows with Thermal Imaging" at the UWG Scholar's Day in 2017.



GEORGIAVIEW 2018-2019 ACTIVITIES

GeorgiaView's 2018-2019 activities are highlighted into two projects. One is the publication of land cover maps for counties, U.S. congressional districts and regional commissions. Many people underestimate the extensive change of land cover in their living environment. Even if many online platforms provide land cover information, they are not reached to the public easily because of, mostly, technical limits. As a way of helping people's environmental awareness, intuitively and informatively, GeorgiaView has developed image atlas series using community boundaries in Georgia such as 159 counties, 14 congressional districts, and 12 regional commissions. As the first of its series, GeorgiaView has focused on urban and built-up areas. Landsat imagery, air photos, and the National Land Cover Database (NLCD) are critical datasets. Printed atlases were delivered to Regional Commissions, Georgia State Departments, congressional offices, and libraries. This activity supports the National Land Remote Sensing Education Outreach and Research Activity (NLRSEORA) Objectives 4 and 3.

Whe have alkeady used the atlas twice for zoining Becommendations. Thank you!

Testimonial by KC Krzic, Planning & Development Department, Rockdale County, GA.

The other project is the outreach activities to K-12 institutions with Landsat imagery, drone imaging, and remote sensing activities. Dr. J.B. Sharma and University of North Georgia students performed three outreach activities at West Hall High School and Hirsch Academy.



Professor J.B. Sharma at University of North Georgia has outreached to K-12 institutions to promote STEM education. Shown here is an in-situ thermal image taken at the West Hall High School.

In today lesson I've learned that changes in cities can be big like in Las Vegas the city grew as the years goes by and the population. People need water to survive so the lake of Las Vegas is getting dried which year and I learn what ROYABIV means. We used an EarthEngine to see the changes of earth and cities. (Testimonial by Isaias at West Hall High School)



An example of land cover map showing the U.S. Congressional District 6, Georgia. Situated at the north of metro Atlanta, the District's developed lands reached 69.1% in 2011, and its population growth has never stopped.





Outreach with Georgia Land Cover Image Atlas.

Jim Skinner, Senior Principal Planner at Atlanta Regional Commission.



Woodall and Daniel Moye, are

the UWG GIS Lab.

working on land cover mapping in

Habte Kassa, Senior Planner, Georgia Department of Transportation.



GeorgiaView Principal Investigator: **Dr. Jeong Seong** University of West Georgia 678-839-4069 (Office)

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HawaiiView 2018 - 2019



HAWAIIVIEW HISTORY AND SUCCESSES

HawaiiView became a full member of AmericaView in 2006, and for several years has been taking Landsat and Sustainable Land Imaging into the classrooms of Hawai'i. To encourage understanding of the impact of the data and the science and technology behind Sustainable Land Imaging, HawaiiView developed self-contained "Landsat 8 Science Kits". Landsat 8 carries the Operational land Imager (OLI) and Thermal Infrared Sensor (TIRS). Although these instruments are orbiting at an altitude of 705 kilometers above the Earth's surface, moving with a velocity of 7.5 kilometers per second, and cost tens of millions of dollars, students can replicate the sensors' measurements on the desktop using a low cost instrument set. Each HawaiiView Science Kit contains a handheld reflectance spectrometer and a hand held infrared radiometer, as well as a lesson plan and all stationary and materials needed to complete the activity. Students make measurements using these instruments and plot the data themselves.

This project has been ongoing since 2015, and in that time HawaiiView has impacted 1501 students, 57 teachers, and 87 parents. Most sessions were at public schools with a high number of minority and underrepresented students, as well as a high number of students in the free/reduced cost lunch program.



HawaiiView's "Landsat-in-a-box" science kits teach students about how light moves and is measured (top left), before allowing children to make their own reflectance measurements, plotting the results, and introducing them to concepts of measurements precision and accuracy (bottom). All materials needed to conduct the exercises are provided as part of the science kits (top right).

HawaiiView 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 is funded by USGS grant agreement G18AP00077.



HAWAIIVIEW 2018 - 2019 ACTIVITIES

HawaiiView continued to deploy its "Landsat in a box" lesson plans around the island of Oahu. Our previous work has allowed us to build up a substantial network of schools and educators. HawaiiView partners with the NASA Hawai'i Space Grant Consortium on this activity, and to supplement our classroom visits we also take part in daylong events organized by Hawai'i Space Grant Consortium and recently held workshops at the annual Astronaut Lacey Veach Day, and Ellison Onizuka Day of Exploration. This work supports objectives 2 and 4 of the NLRSEORA (National Land Remote Sensing Education Outreach and Research Activity) program. In grant year 2019 HawaiiView's activities reached 409 students, 30 teachers, and 31 parents, including 160 people who identified as having Native Hawaiian or Pacific Island heritage.



Pupils, their teachers and their parents using desktop reflectance spectrometers and infrared thermometers to make measurements like Landsat

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ІданоView 2018 - 2019



IDAHOVIEW HISTORY AND SUCCESSES

Idaho's economy strongly depends on its natural resources. Our IdahoView team uses remotely sensed information to study agroecosystems, forestry, geohazards, watersheds, and rangelands to aid in contributing to Idaho's land and resource management decision making. Further, to educate a qualified workforce in Science, Technology, Engineering, and Mathematics (STEM), IdahoView supports student participation in research and promotes outreach in the use of remote sensing and Unmanned Aircraft Systems (UAS) technology. Industries that require STEM are expected to increase in Idaho and across the nation with IdahoView prepared to support this activity through our partnerships in the state, region, and nationally.

IdahoView activities are aligned with the U.S. Geological Survey's mission to investigate the challenges between our natural world and growing human demands. Products developed by IdahoView are distributed for public use through statewide data repositories including: the Idaho LiDAR Consortium, Inside Idaho, and the Northwest Knowledge Network. Educational materials are shared via the IdahoView and AmericaView websites.



Hyperspectral imagery captured from UAS. Left image represents natural color, middle image false color and right image is final vegetation classification.



UAS LiDAR of forested hillslope for assessment of landslide geohazards.



Potato crop with plants infected by virus identified with purple crosshairs.

The IdahoView consortium consists of members from Idaho State University, Boise State University and the University of Idaho. Collectively our objectives 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, training, and scientific application of remotely sensed data from small Unmanned Aircraft Systems (sUAS)

IdahoView advances outreach in remote sensing and UAS education with K-12 students, programs, and teachers at Idaho schools. Through our activities over the years we have partnered with various state and federal agencies to solve societal issues relevant to Idaho's natural resources and environment.

Federal consortium members identified above do not receive funding from AmericaView.

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. AmericaView is funded by USGS grant agreement G18AP00077.



IDAHOVIEW 2018 - 2019 ACTIVITIES

PI Delparte leads the AmericaView UAS Working Group. To highlight the breadth and depth of research and education in UAS throughout the AV network, our team is in the process of showcasing stateviews' UAS domain expertise, sensor/platform capabilities, and related activities. Images and specific examples of education, outreach, and research will be coalesced, in collaboration with and permission from each stateview, and published to the AV website. Further, these highlights will be coalesced into AV themed UAS printed materials. These materials will be created in handout form for distribution by the UAS working group members . The goal of this outreach activity is to promote remote sensing with UAS and leverage the nationwide expertise of our AV network. By broadening our reach across academia, government agencies and the private sector, our AV network will further its opportunities for funding and raise awareness of the educational resources available through the AV website.



River survey with an unmanned aircraft for Chinook salmon.



Thermal survey along river channel for Chinook salmon.



Rangeland survey with an unmanned aircraft near Mt. Borah in Idaho.

In partnership with an IDView team member from Boise State University, we will develop a course module with a focus on spatial mapping and modeling of sagebrush steppe and thermal refugia for fish in Idaho rivers. Our learning module will incorporate UAS and space-borne sensors, providing hands-on experience in analyzing and acquiring geospatial data that is synergistic with recovering sagebrush populations. Our intent is to utilize UAS hyperspectral and thermal sensing (local scale) along with Landsat data (regional scale) to evaluate sites recovering from large authentic disturbances. By providing research experiences to students we will engage students from a variety of backgrounds to solve applied problems.

The second course module will focus on an applied exercise related to agriculture. Idaho is known for its potato production and we will leverage 5 years of data collection over potato fields to introduce students to image analysis for crop health measures related to water stress, disease detection, and nutrient deficiency. Delparte and a graduate student will develop the course module and include Landsat imagery comparisons for landscape level analysis.

UAS Workshops: our team will support Idaho drone workshops in collaboration with an AV member from the University of Idaho and co-lead one employee development workshop for Idaho and region.

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IdahoView Principal Investigator:



INDIANAVIEW 2018 - 2019



INDIANAVIEW HISTORY AND SUCCESSES

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, fouryear 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. Programs and activities sponsored by IndianaView include:

- Mini-grants have supported 29 projects conducted in seven institutions. These projects promote the use of remotely sensed imagery in K-16 education, facilitate the use of remote sensing data to address state-wide issues such as urban development, and provide easier access to remote sensing image data. (www.indianaview.org/fact_sheets.html)
- Student Scholarships provided undergraduate and graduate students with opportunities to participate in remote sensing projects that are relevant to the state and/or their community. (www.indianaview.org/fact sheets student scholarships.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 application and tutorials are available for analyzing remotely sensed imagery and determining long-term impacts of a change in land use. (engineering.purdue.edu/~biehl/MultiSpec)



Mini-grant project involving IGIC & GENI working with a Noble County High School educator and middle school students to generate GIS lesson materials and an ArcGIS Online Story Map Timeline for Noble County.

Student scholarship project to model carbon in Indiana state forests. (a) High-resolution forest carbon map in Yellowwood State Forest, Indiana; (b) LiDAR-based canopy height metric.



A graduate student is helping middle school students work through a flood activity using MultiSpec Online during a geospatial session for Purdue's TOTAL Camp in June 2017.

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. AmericaView is funded by USGS grant agreement G18AP00077.



INDIANAVIEW 2018 - 2019 ACTIVITIES

IndianaView student scholarship program

IndianaView provided scholarships for six undergraduate & graduate students from the member educational institutions to participate in geospatial projects. The scholarships represented three of the educational institutions in the IndianaView consortium.

Each of the students provided a fact sheet about their project and a testimonial on how the scholarship assisted them. Examples of activities that the students completed include: study compatibility of aerial and terrestrial lidar to upscale detailed measures of canopy structure to large spatial extents; examine the collective impacts of time since invasion by emerald ash borer, canopy structure and ash tree mortality on understory plant invasion in Indiana; study the distribution of high-rate multi-ecosystem service providing areas (hotspots) across the Chicago region in relation to local social context; evaluate a method for generating long-term and consistent remotely sensed nighttime light (NSTL) data; study important values cemeteries provide to an urban landscape such as their relationship to urban wildlife; and air-sea interactions play a crucial role on the onset of monsoon intra-seasonal oscillations.







Portable Canopy Lidar (PCL) system being used to measure 2-D forest canopy structure. The PCL system is mobile and efficient for measuring canopy structure.

<u>Scholarship Testimonial:</u> With the support of IndianaView, I participated in the Student Honors Paper Competition of Remote Sensing Specialty Group of AAG 2019 and won the first place. (NSTL project)

IndianaView mini-grant program

IndianaView provided a means for partner institutions to participate in IndianaView via geospatial projects relative to the state of Indiana. Two mini-grants were funded during 2019. One mini-grant was a project to promote education and training in UAV mapping/remote sensing and augmented reality (AR) visualization techniques. The resources and videos developed by this project will be made available online by the mid-2019-20 academic year to share with the wider Indiana and global community.

Another mini-grant developed a time series of land use and land cover maps for Marion County (Indianapolis) from 1998 to 2017 using Landsat data. The features used for the image classifications included solar reflectance values, land surface temperature, and several spectral indices.



Illustration of the change of Built-up area from 1998 to 2017 in Marion County, IN.

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IOWAVIEW 2018 - 2019



IOWAVIEW HISTORY AND SUCCESSES

Iowa Best Management Practices Inventory Dataset

In May 2019, the Iowa BMP Inventory Dataset was completed. The completion of this 4-year project provides the State of Iowa with a one-of-a-kind publicly available GIS dataset for locations of six commonly used NRCS conservation practices in every watershed in Iowa, with data from 2007-2010. This dataset was created to inventory and monitor conservation practices that could potentially meet nutrient reduction targets for Iowa watersheds. Student staff at Iowa State University digitized conservation practices in 1,711 watersheds; IowaView and Iowa DNR staff reviewed the data before making the GIS datasets public; visit https://bit.ly/2v4jfyX to read more about the project and download data. AmericaView funded portions of this work from 2015-2017.

After the baseline inventory dataset was created, there was interest to evaluate change over time. Using photography from the early 1980s, each practice in the baseline dataset was examined to determine if it existed in the earlier imagery. Spring and summer imagery from 2016-2018 were also reviewed to determine recent changes within a watershed. Funding allowed for an average of 25% of lowa watersheds to have change mapping performed.



Fayette County, Iowa. 2010 Iowa DNR 0.6-meter spring color infrared aerial imagery showing WASCOBS, terraces, contour buffer strip and grassed waterways.



Gregg Hadish presenting about the Orthoserver on Earth Observation Day at the Iowa State GIS Facility.



Cass County, Iowa. Spring 2018 color infrared aerial imagery.

lowaView 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 is funded by USGS grant agreement G18AP00077.

Outreach - Earth Observation Day

This is a high priority outreach event for the AmericaView organization. It provides the AV consortium with an opportunity to have a focused time of outreach across the nation to promote remote sensing and GIS. For Earth Observation Day 2018, IowaView invited Gregg Hadish, a staff member of ISU GIS Facility and Iowa NRCS, to be our featured speaker, presenting on the Iowa Geographic Map Server (<u>https://ortho.gis.iastate.edu/</u>.) Gregg has been involved with the development of the Iowa Geographic Map Server for nearly twenty years. He provided a hands-on demo of the web-based interface. The presentation highlighted recent innovations to the map server including updated interface options as well as many new features and image services.

Promote Iowa's Image Archive

The Orthoserver (<u>https://ortho.gis.iastate.edu</u>) has become a dependable resource for statewide imagery, elevation, and derived remotely sensed datasets such as land cover. Users from the ISU campus, public agencies, and private companies and individuals access the data with use growing each year. Data can be viewed in a browser or in GIS software. Keeping the data accessible and adding new datasets are important to enable continued research, analysis, discovery, and education for lowans.



IOWAVIEW 2018 - 2019 ACTIVITIES

Water quality issues are very important in the State of Iowa. For the last decade, research has been focused on meeting priorities set in the Iowa Nutrient Reduction Strategy. Cover crops have been identified as one potential solution for nutrient management. Cover crops are commonly planted in late summer or early fall around harvest time and terminated in the spring. The goal in planting cover crops is to protect exposed cropland from wind and water erosion during the months when cash crops are not growing.

There is a need by entities in Iowa, including current IowaView partners, to have recent and reliable cover crop data. The goal of this project is to create a repeatable and shareable process for detecting cover crops using publicly available imagery and data products. The first year of our research has focused on understanding the behavior of cover crops in Iowa, determining a methodology for distinguishing cover crops on the landscape, and developing a model for repetition.

Phenological cycles vary by region. Cover crop research in the Atlantic region of the United States documented much higher NDVI values for cover crops than is seen in Iowa; a previous study in Iowa gave a generalized NDVI range more in line with values calculated in our research. With this project we wanted to create a more detailed NDVI range based on phenological evidence of the state. To help with this calibration, specific data from rye cover crop research fields (cover crop planting, biomass sample dates, biomass weight, and date of cash crop planting) were used to better understand NDVI values.

Another piece of this year's research focused on using different techniques to visualize the landscape change over time. Initially, researchers reviewed images from September to June of a growing season, then late March through early June. For the test site in south central lowa, the most critical image dates were between mid-April and late May, the time between peak of the cover crop green up and cover crop termination before the seeding of the cash crop. It is best to have images with minimal cloud cover; however, spring in Iowa can be unpredictable which did pose a challenge to this method.

IowaView staff have looked at several different methods for visualizing the cover crop cycle over time. Two examples shown to the right: A) calculating difference in NDVI over two spring dates and B) using color band channels (RGB) to show different image dates over time. Additionally, to process images faster, a model was created that takes 4 bands of an image and then creates a file geodatabase from which it creates a Normalized Difference Vegetation Index (NDVI) image as well as using field boundaries (provided by the user) to create a statistics table including the average pixel value within the field boundary. Field boundaries were created using data available from the USDA and CropScape. Imagery inputs were from Landsat 8 and Sentinel 2, depending on which had an acceptable, cloud-free date of interest.

For the next year of the grant cycle we will refine the prediction process using three input dates to give a more accurate portrait of cover crop fields on the landscape. In addition, we will continue to produce cover crop existence data in additional watersheds across the state.



Locations of Project Watersheds



Method A: This image shows the calculated difference between two images NDVI images, 05/07/2018 and 4/29/2018. Areas in blue show the biggest negative change indicating a loss in NDVI (termination). Areas in red/orange show positive change (greening up). Areas in green were neutral or had minimal change over the time period.



Method B: This image is a composite of three images: image 1 (11/15/2017) in the red channel; image 2 (4/29/2018) in the green channel; and image 3 (05/07/2018) in the blue channel. Areas in bright blue/green show cover crops. Yellow is permanent vegetation. Pink/Red shows areas of spring emergence.

www.

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KansasView 2018 - 2019



KANSASVIEW HISTORY AND SUCCESSES

KansasView, a charter member of the AmericaView consortium, has promoted the mission and objectives of AmericaView over the past 15 years. During that time, KansasView has built its stateview consortium, promoted remote sensing education, contributed to data development and research programs, and conducted outreach with partner institutions and state agencies throughout Kansas.

Promoting remote sensing education: KansasView has provided research scholarships to its partner educational institutions, sponsored a statewide remote sensing conference, co-sponsored events with state agencies and non-profits, and presented at local and regional conferences. KansasView has developed new remote sensing courses and course activities at both the University of Kansas and Haskell Indian Nations University. Additionally, the KansasView Principle Investigator (PI) has mentored undergraduates in KU's PREP program, a program that facilitates the transition of minority students into graduate school (shown upper right).

Data and research development: KansasView has helped create, acquire, maintain and assess several key databases for Kansas consisting of remote sensing data that will facilitate and advance the utility of remote sensing data by our state agencies, educational institutions and the private sector. This year KansasView acquired and processed the National Science Foundation's National Earth Observation Network (NEON) data for the KU Biological Field Station to help promote educational and research use of the high resolution remote sensing data collected from an array of instruments on the Airborne Observation Platform (AOP) (shown lower right).

Building partnerships: KansasView partner institutions include the Kansas GIS Policy Board, the Data Access and Support Center at the Kansas Geological Survey, Emporia State University, Fort Hays State University, Haskell Indian Nations University, KU-Edwards, and Kansas State University, now including the Polytechnic Campus.

Participating in the GIS Policy Board, KansasView interacts and collaborates with numerous state agencies including the Water Office; the Division of Emergency Management of the Adjutant General's Office; the Department of Wildlife, Parks, and Tourism; and the Department of Health and Environment. Several agencies have jointly funded projects partially funded by AmericaView.

Cheyenne Sun Eagle, a graduate of Haskell Indian Nations University and a former PREP Program student who is in the last year of her M.A. program, recently won first prize in the student paper competition at the Great Plains Rocky Mountain Regional Meeting of the AAG. Pictured with advisor and KansasView PI, Dr. Stephen Egbert.



KansasView acquired and processed the NEON AOP data over the KU Biological Field Station. 2016 LiDAR digital elevation and digital surface data are shown above. For more information about the data, visit <u>www.ksview.org</u> or the NSF Neon website at <u>www.neonscience.org</u>.

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. AmericaView is funded by USGS grant agreement G18AP00077.



KANSASVIEW 2018 - 2019 ACTIVITIES

Introduction to Drone Mapping Course

KansasView's high impact activity for this year focused on the development and offering of a newly revamped course, Introduction to Drone Mapping, at the University of Kansas during the first half of Fall Semester, 2019. Instructors included Dr. Dana Peterson and Dr. Stephen Egbert of KansasView, and Dr. Xingong Li. The overall purpose for developing the course was to create course materials and procedures that could serve as a model for developing similar courses at our partner, Haskell Indian Nations University, and other AmericaView institutions. The primary goals of the course were to give students hands-on experience in flying drones, collecting imagery, and processing aerial data to produce digital surface models, aerial mosaics, and related products.

Specific teaching objectives included helping students understand (1) fundamental FAA rules for drone flights, (2) how to plan a drone aerial photography mission, (3) how to conduct safe flight operations, (4) how to use industry-standard drone mapping software, (5) useful drone apps, and (6) the range of potential drone applications. Class activities included in-class lectures, several sessions of drone flight and data gathering in the field, computer lab exercises, a guest lecture from a drone industry professional, and an independent research paper.

Course instructors had access to athletic practice fields at the University of Kansas for drone flight training and to the Baker Wetlands for drone mapping missions. Baker Wetlands is an extensive area of natural and restored wetlands lying in the Wakarusa River Valley just south of Lawrence, Kansas. The director of the Wetlands, Dr. Irene Unger, enthusiastically supported the use of the wetlands by the drone class, both for the value of the flight training and the resulting aerial photography that will be used for research and for promoting the value of the wetlands.

Redesigned website. With the assistance of Susan Patton of University of Kansas Information Technology, the KansasView website was completely redesigned, including a new look and interface. The new website highlights research, news and events, outreach, and data links.

New consortium member. KU –Edwards Campus and Salina Polytechnic Campus at Kansas State University joined the KansasView Consortium this year. K-State Polytechnic is widely known for its extensive Unmanned Aerial Systems training program.



Preparing for a drone mapping mission at the Baker Wetlands south of Lawrence. September 2019.



Oblique aerial view of the Baker Wetlands, looking northwest from the Wakarusa River. September 2019.



Homepage for new KansasView website.

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KENTUCKYVIEW 2018 - 2019



KENTUCKYVIEW HISTORY AND SUCCESSES

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 currently comprises 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 has developed a methodology to estimate soil moisture based on spectral measurements and imagery. The main objective of the project was to investigate the spatial and temporal variability in remote sensing soil moisture for the State of Kentucky.



Spatial Variability in Kentucky Soil Moisture

Remote sensing education and outreach activities, such as workshops, Earth Observation Day and Earth Day presentations, have helped inform and educate teachers, students and the public in Kentucky.



Train-The-Trainer teacher workshop



Earth Observation Day celebrations. Keynote speakers

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. AmericaView is funded by USGS grant agreement G18AP00077.



We are developing workshop modules to improve K-12 education in the state. Also, more assessment tools have been developed.

Earth Observation and Earth Day Events were also held in Kentucky. Keynote speakers gave presentations. Undergraduate and graduate students presented their project results in oral sessions. Poster sessions followed the student presentations.



An Earth Observation Day poster session



Earth Observation Day presentations at Murray State University



KENTUCKYVIEW 2018 - 2019 ACTIVITIES

KentuckyView has been involved with Kentucky water quality mapping projects to establish a methodology for mapping water quality parameters. Factors included total suspended solids (TSS) concentrations, turbidity and Chlorophyll-a (an indicator of phytoplankton biomass) using satellite imagery. For this project, Landsat-8, MODIS (Moderate Resolution Imaging Spectroradiometer) and Sentinel data were utilized to develop the needed methodology. This activity is the first key step in establishing state-wide and nation-wide water quality monitoring programs in support of environmental planning and modeling activities. KentuckyView specifically focused on harmful algal blooms (HABs) prediction and monitoring this year. HABs are defined as algae overgrowths in aquatic systems, some of which produce dangerous toxins in fresh and/or marine waters affecting human health and the environment. Nontoxic algal blooms (NAB) also hurt the environment and local economies (EPA, 2018). Two test sites in Ohio and Florida were selected.



Landsat 8-based mapping of Lake Apopka, Florida

Mean Temperature of Lake Erie by Y

nal Total Rainfall in Lake Erie by Yea



Lake Erie HABs monitoring

Empirically-based algorithms are playing an increasingly important role in HAB modeling, providing an important link between conceptual and dynamical modeling approaches. One of the main objectives of this monitoring was to establish an integrated empirical approach to predict and monitor HAB events using water quality parameters obtained from multispectral remote sensing (Landsat, MODIS & Sentinel), and GIS data, such as climate parameters (particularly temperature and rainfall), land-use/land-cover (LULC) characteristics including agricultural activities/practices, nutrient supply processes and urban sprawl, landscape metrics/spatial patterns and primary productivity to identify and validate such events more accurately.

A Train-The-Trainer (TTT) teacher workshop was held at Murray State University in April 2019. Several pre-service students and in-service teachers attended the TTT workshop. Several USGS and NASA products, such as Landsat and aerial imagery, etc. were utilized. The attendees worked on remote sensing modules, wrote a report for each module and answered questions related to the exercises in the modules.

A fellowship program for graduate and undergraduate students in Kentucky was established this year. The 2019 undergraduate award in the amount of \$400 was given to Ms. Mackenzie A. Nelson, Northern Kentucky University. The 2019 graduate award in the amount of \$600 was given to Mr. D. Tyler Mahoney, University of Kentucky. The students will be using their fellowship monies for their research.



TTT workshop



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KENTUCKY

http://www.kentuckyview.org.

http://www.kyview.org



LOUISIANAVIEW 2018 - 2019



Promoting the Benefits of Remote Sensing Science and Applications

Louisiana Disaster Response From the Carolinas to Florida to the Bahamas



LouisianaView (LaView) responded to Hurricanes Florence and Michael working as part of the International Charter during these historic events of 2018. LouisianaView team members coordinated the acquisition of the International Charter satellite imagery as the state responded to each of these disasters.

Imagery acquired through the International Charter and processed by members of the LaView/USGS team.



Working with each state, federal response programs, FEMA and the National Guard Bureau geospatial response groups, LaView teamed forces with remote sensing specialist from the USGS Water & Aquatics

Research Center to analyze and provide Radar/Optical flood data to geospatial first responders.

Again in 2019, LaView, working with the International Charter, coordinated satellite data acquisition for Hurricane Dorian impact areas across the Bahamas. This activation allowed LaView to assign AmericaView member programs across the AV Network to work as Value Added Providers for remotely sensed data products to aid emergency response programs working the event.

International Charter Dashboard for the project activation ID 620 over the Bahamas



BENEFITS TO LOUISIANA

Louisiana Hurricane Season GeoSpatial Data Mining Workshop



This annual workshop, held in early June each year, is now entering its twentieth (20) year. Through the cooperation of LouisianaView consortium members and co-sponsored with local USGS representatives, this workshop is offered free to those in Louisiana and surrounding states interested in up-to-date information on data availability for the geospatial emergency responder. Fifty-Five (55) Geospatial First Responders attended this workshop held June 6, 2019 at the Regional Application Center in Lafayette, Louisiana.

During the workshop of 2019, USGS representatives of the International Charter were on hand to assist in a GIS-Based Hurricane Tabletop exercise. This workshop has proved again and again what a cohesive network of geospatial data responders can mean to the inhabitants and economic base for the state of 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.



Bridging the gap between science and the public's perception of science

Intimate Science – the Intersection of

Science, Technology, Engineering, Art and Mathematics



In this traveling gallery exhibition, working with the USGS "Earth As Art" program, utilizing NASA Landsat and other Satellite Imagery we have comprised images to excite the imagination and entertain creative thinking. Over 50 Images from Satellite systems were displayed for multiple gala events and school visitations during 2018 and 2019, entertaining a host with images that depict the science of the Earth and invoke the art of the earth's natural landscape.



"The traveling Earth as Art gallery exhibit elevated our Earth Day event at New Orleans City Park artistically and scientifically."

-Liz Lowe, New Orleans City Park A Story Map *"Growing"* A Future Atchafalaya & Wax Lake Delta

O @ A

The natural color satellite Image shows the high amount of sediment deposition (white to light tan colors indicate suspended sediments in water) from both the Wax Lake and Atchafalaya River Deltas.

The visible bands are used in this combination, ground features appear in colors similar to their appearance to the human visual system, healthy vegetation is green. This band combination provide the most water penetration and superior sediment and bathymetric information. It is also used for urban studies.

This image was chosen to be displayed in the Earth As Art Gallery. (Photo from Seninel 2 Avril 16, 2018)

在人 匠 …



All anyone has to do is bring along their Imagination!



Poverty Point: A Louisiana Treasure

LOUISIANA

Jason Duplechin ENVS487 – Advanced GIS Analysis & Applications University of Louisiana at Lafayette

ity of Louisiana at Lafa 🔤 🛒 🤗

A look at Louisiana's World Heritage Site of Monumental Proportions

What if someone told you that there is a man-made construction in North America that is nearly as **old** and as massive as the Pyramids at Giza, Egypt?



The Gallery Exhibit is a program that provides opportunities for students to produce artwork from satellite and other remotely sensed images. The art describes features, events, or impacts on, or near, the surface of the earth. The artwork is critiqued and selected to serve as part of an educational and informative traveling exhibit, facilitating conversation and understanding of our world through a unique and memorable perspective. ESRI Story Maps are a tool utilized by students to create these unique educational outreach perspectives.

Louisiana Continues Earth As Art Education and Outreach

Earth As Art has been a theme for the LouisianaView program over the course of 2018-2019, visiting many areas across the United States, bringing science and art together for the viewing public. The Exhibit participated in Earth Observation Day in City Park, New Orleans, exhibited at science festivals, the state Remote Sensing Conference and multiple viewings in South Dakota, Baltimore, MD, Reston, VA and Lafayette, LA.

LouisianaView Principal Investigator: R. Brent Yantis University of Louisiana at Lafayette 337-344-8882 yantis@louisiana.edu



www.

http://www.louisianaview.org

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MICHIGANVIEW 2018 - 2019



MICHIGANVIEW HISTORY AND SUCCESSES

Since its formation in 2007, MichiganView has worked to promote and further the science of remote sensing within the State of Michigan. As a state member of the AmericaView Consortium, MichiganView's activities have focused on providing remote sensing imagery for the state, development of web-based technologies to improve remote sensing data access and exploitation, and outreach programs designed to make Michigan's citizens aware of the exciting ways remote sensing can be used to benefit people and the environment.

Recent work has focused on the creation of K-12 remote sensing education materials. By working with educators around the state, MichiganView has helped to implement exciting hands-on activities that incorporate remote sensing data and technology into science and math curricula. By introducing students to remote sensing during their K-12 education they have better opportunities to pursue degrees and careers in related fields. To date, MichiganView has worked with dozens of teachers and hundreds of students.

MichiganView has also been active in making access to data and derived products easier. MichiganView's website provides easy access to an archive of remote sensing data, and links to a variety of interactive maps containing useful geospatial information on a variety of topics. Additional work has included development of college-level Synthetic Aperture Radar course materials designed to train those interested in working in the geospatial field.



A cloud-free color composite image of Michigan's upper and lower peninsulas created with imagery from Landsat 8. Landsat data is used in many MichiganVlew activities.



Screenshot of an interactive module created to introduce Environmental Science students at Washtenaw Community College to remote sensing.



MichiganView PI Nancy French presents to a group of students and teachers at an event at the Michigan Science Center.



Composite Sentinel-1 SAR image of Michigan's Lake St. Clair used in SAR training materials created by MichiganView



The MichiganView consortium is based at the Michigan Tech Research Institute and is comprised of members from Michigan Technological University, the University of Michigan, and public and private school educators from around the state.

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. AmericaView is funded by USGS grant agreement G18AP00077.



MICHIGANVIEW 2018 - 2019 ACTIVITIES

One of MichiganView's primary efforts during the last year focused on introducing students to remote sensing science through development of hands-on activities that tie into Michigan's science curriculum standards. A main component of this activity is establishing partnerships that will allow students from a broad range of socioeconomic backgrounds to participate in activities involving remote sensing and geospatial technology.

MichiganView held several meetings with various groups in southeast Michigan during 2019 to discuss collaborations. Conversations with organizations such as the Wayne Regional Educational Service Agency have resulted in access to more teachers and students throughout Wayne County, which includes Detroit. For example, students from the Detroit Area Pre-College Engineering Program participated in an event that included a MichiganView remote sensing presentation followed by UAS demonstrations. Additional activities with other schools and organizations are under development.



Environmental Science students at Washtenaw Community College using an interactive ESRI Story Map to assess surface temperature variability across their campus.

Another of MichiganView's main activities is focused on advancing technology to facilitate easy access to remote sensing data. Efforts to support efficient data transfer technologies have been a significant component of this activity, and have included numerous proposals and pilot projects with other AmericaView consortium members. As part of this activity, MichiganView's website was also updated to include a map-based interface for data downloads. Several new interactive web-maps that display products derived from remote sensing data were added to the website as well. One example of this is the Mi-Environment tool, which identifies vulnerable Michigan communities based on social, climatic, and environmental factors.



MichiganView Co-Investigator Mike Battaglia speaks to students from the Detroit Area Pre-College Engineering Program during their visit to the Michigan Tech Research Institute.

Although MichiganView has traditionally worked with K-12 students and educators, an opportunity to work with Washtenaw Community College resulted in the inclusion of remote sensing content in the college's GIS and Environmental Science courses. The GIS students completed a lab activity focused on utilizing Landsat data and computing basic metrics such as the Normalized Difference Vegetation Index. The Environmental Science students participated in a field data collection effort on campus and analyzed their data with Landsat imagery using an ESRI Story Map created for the activity (http://arcg.is/1qHOLe). Additional activities and lesson plans are being developed with WCC with the goal of expanding the remote sensing knowledge of both students and instructors.





MichiganView Principal Investigator: Dr. Nancy French Michigan Tech Research Institute 734-913-6844 nhfrench@mtu.edu





MINNESOTAVIEW 2018 - 2019



MINNESOTAVIEW HISTORY AND SUCCESSES

MinnesotaView undertakes research, education, and outreach activities in remote sensing. The broad goals of these activities are to help stakeholders use remote sensing methods and products, to enhance public appreciation of the importance of remote sensing, and to publicize the results of remote sensing research done by MinnesotaView members. We particularly focus our efforts on outreach to users and potential users of remote sensing data and methods. The awareness of remote sensing has increased dramatically in Minnesota over the last several years, but there are numerous opportunities to further increase use, and to help ensure that such use is consistent with accepted best practices.

MinnesotaView also supports the development, distribution and application of geospatial information derived from remote sensing data for mapping, monitoring and analysis of land and water resources. Key activities in recent years have been mapping water clarity for over 10,000 Minnesota lakes and completing land cover/use maps for Minnesota (see figures on this page). Our remotely sensed data products can be viewed on our recently revised data portals:



Land Cover/Use of Minnesota mapped using Landsat imagery

Water Clarity Data Portal: <u>https://lakes.rs.umn.edu</u> Land Data Portal: <u>https://z.umn.edu/landcover</u>



Mixed land cover in Woodbury, MI



Lower Red Lake area with cropland, forest, wetland and lakes.

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. AmericaView is funded by USGS grant agreement G18AP00077.

Conversion of rural landscapes to urban and suburban land uses (e.g. Woodbury, MN in the figure to the left) results in increasing amounts of impervious surface area. Imperviousness affects the amount of runoff to streams and lakes and is related water quality of surrounding lakes and streams, to urban heat island effects, habitat degradation and fragmentation, and aesthetics of landscapes.

The University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory has completed classifications of land cover and impervious surface area of the state and for the Twin Cities metro area over several decades. Classification using Landsat Thematic Mapper data enables quantifying the spatial and temporal patterns of impervious surface area over large geographic areas at modest cost.

MinnesotaView was established in 2008 and is working with state agencies and universities in Minnesota to advance remote sensing research and application, education and outreach. The Consortium is led by the University of Minnesota's <u>Remote Sensing and Geospatial Analysis Laboratory</u>, and includes the <u>Minnesota Geospatial Information Office</u>, the <u>Minnesota Pollution Control Agency</u>, and <u>Minnesota Department of Natural Resources</u>.



MINNESOTAVIEW CURRENT ACTIVITIES

An ongoing focus of MinnesotaView is offering workshops on remote sensing to Minnesota stakeholders. We have developed a large amount of workshop content for lidar, object-based image analysis, and Unmanned Aircraft Systems (UAS). UAS operations and applications are increasingly of interest for a variety of stakeholders, including the Department of Natural Resources (DNR) Forestry group, DNR's Resource Assessment group, the MN Pollution Control Agency's wetlands and water scientists, county land management agencies, and many others. In the 2018-2019 grant year, we conducted five workshops for stakeholders around the state.

The images to the right depict data products derived from the Microdrones UAS shown in the middle-right. The top image shows the structure of a forest plantation, colored by height (red is taller). Such a dataset is useful for management planning, monitoring of tree health, and forest inventory studies. The bottom image is a high-resolution photo of a forest canopy in northern Minnesota, near Ely.

MinnesotaView performs substantial remote sensing research outreach. We believe it is vital that stakeholders and the public see the results of our work. These efforts include: 1) Exhibiting at remote sensing related events such the MN Drone Day and the annual GIS/LIS conference; 2) Showcasing remote sensing to thousands of attendees at the Minnesota State Fair; 3) Making research results and data product available on websites and web-based data serving tools; 4) Publishing research in peer-reviewed scientific journals; and 5) Involving local media outlets in publicizing our work.

As the only institution in Minnesota with a complete remote sensing and geospatial analysis curriculum, the University of Minnesota is a leader in the state and the Upper Midwest in remote sensing education. We continue to offer a wide range of courses on remote sensing and related topics (e.g. geodesy, spatial analysis, image processing, etc.) These courses are highly integrated across disciplines and incorporate the latest research results.



Photo-derived point cloud of a plantation forest in Minnesota



Microdrones MD-4000 research grade Unmanned Aircraft System



Drone image of a forest research stand in northern Minnesota

MinnesotaView Principal Investigator: Joseph Knight University of Minnesota 612-625-5354 jknight@umn.edu





MISSISSIPPIVIEW 2018 - 2019



MISSISSIPPIVIEW HISTORY AND SUCCESSES

UMGC is the organizational lead tasked with the operation and development of the State View Consortium (MississipiView) project at the University of Mississippi. UMGC is a program of the Mississippi Mineral Resources Institute (MMRI). UMGC is a leading multidisciplinary research center in the State of Mississippi for the advancement of geospatial information science and technology (GIS&T) and its innovative application to problems of local, state and national importance.

The mission of MississippiView is to promote and facilitate geospatial data usage, research, and collaboration among the geospatial community in Mississippi while fostering national and international cooperation. Our work connects us with local agencies and communities to assist in accomplishing their mission.



Mapping the effects of a landslide along the Skuna River in central Mississippi in March 2019.



Post-event analysis of a dam failure in northern Mississippi near Hatophia Creek in February 2019.



High-resolution (1-cm pixel) of University of Mississippi campus used for research and education.

Since 2005, MississipiView has provided outreach and created partnerships across the state. During spring 2019, torrential rainfall resulted in flooding, dam failures and landslides across the region. MississippiView provided support to researchers and regional officials to assist in their work. We have created new curriculum and provide access to educators

Our most recent collaborations build on past successes. These include:

- Benchmark for mapping coastal change
- Improving flood awareness using remote sensing
- Geospatial materials focused on 200th anniversary of the New Madrid Earthquake
- Remote sensing for lake water quality
- Analysis and update of land use in 16th section lands 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. AmericaView is funded by USGS grant agreement G18AP00077.



MISSISSIPPIVIEW 2018 - 2019 ACTIVITIES

MississippiView is working with local and state partners to provide geospatial and remote sensing support for a variety of research and outreach projects.

- MississippiView supported the work of a graduate student who evaluated the use of sUAS-derived imagery for monitoring flood protection infrastructure. Her work used structure-from-motion (SfM) photogrammetry to investigate methods of detecting movement in i-walls, which are common flood protection. Her thesis results were presented at a state-wide water resource conference.
- MississippiView took a large role in the Summer 2019 offering of the University of Mississippi High School Engineering Camp. The Camp is a weeklong STEM experience for 24 students from the 6th-8th grade from across the state of Mississippi. We developed an outreach program that included geology, environment resources, and monitoring using satellite and sUAS derived data.
- The M-Partners is a program that connects University of Mississippi capabilities with the goals and needs of local communities. MississippiView has participated by collaborating with the leaders of Charleston, Mississippi. We provide geospatial and remote sensing data related to their economic development and policy, marketing and tourism, and resiliency efforts.

<image>

Mississippi high school students learning about small unmanned aerial system (sUAS) during a filed demonstration.

Conferences and publications include:

- Yarbrough, L.D., 2019. Planning to Integrate Small Unmanned Aerial Systems (sUAS) into Your Current Data Acquisition Workflow? The State of the Technology: Highlights, Case Studies, Pitfalls, and Future Trends. Invited Talk presented at 2019 Mississippi Water Resources Conference, 02–03 April 2019, Hilton Conference Center in Jackson, MS.
- Dietz, Eleanor and Yarbrough, L.D., 2019. Evaluating the Use of sUAS-Derived Imagery for Monitoring Flood Protection Infrastructure. Presented at 2019 Mississippi Water Resources Conference, 02–03 April 2019, Hilton Conference Center in Jackson, MS.



Acquiring a GPS location of a ground control point for highresolution imagery along floodways of north Mississippi.

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MontanaView 2018 - 2019



MONTANAVIEW HISTORY AND SUCCESSES

The vision for the MontanaView Program is to identify and 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 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 modern geospatial tools. Another priority for MontanaView has been to train Montana's current workforce, especially agency personnel, in the most recent geospatial developments. Researcher members of MontanaView have used their expertise to address critical natural resource issues facing Montana.



Aerial photograph of a precision agriculture study site near Bozeman, Montana, acquired from a drone in late summer of 2019.



Bark beetle infestation in Montana



Lynx (photo courtesy of John Squires, United States Forest Service)

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. AmericaView is funded by USGS grant agreement G18AP00077. 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. Traditional mapping has focused on presence or absence of an infestation, which has limited utility for land managers. New developments by MontanaView researchers have added the ability to map infestation severity using many years of Landsat satellite data. This information can guide managers with respect to harvest activities and protective actions.

MontanaView is also working to guide forest management decisions with respect to the endangered Canada lynx. Researchers with MontanaView were able to use freely available Landsat satellite imagery from the U.S. Geological Survey to map both forest species composition and change in forest structure over a 44-year period. These maps were critical for understanding lynx historical forest usage.



MONTANAVIEW 2018 - 2019 ACTIVITIES

Extraction of biophysical and geophysical information from remotely sensed imagery remains one of the primary applications in remote sensing, whether extracted from single dates, multiple dates within a year to capture phenological changes, or from temporal datacubes. Many software packages exist for this purpose, but commercial software is limited in available statistical methods. Previous research supported by AmericaView has demonstrated the need for approaches that take advantage of the range of machine learning methods now available. MontanaView has developed and made available code in the statistical software R to enable this. Many geospatial software packages, including ArcGIS, QGIS, Imagine, and Google Earth Engine, however, interact better with the Python programming language. Therefore, MontanaView has developed and made available through a web-based download a manual and computer scripts for remote sensing image analysis with Python containing all of the same functionality as the previous R code. This code is open and freely available, and it can be adapted by geospatial scientists for use with Python compatible software or used directly as provided.

Python-Manual

- Manual for Remote Sensing Image Analysis in
- Python: Including Agnostic Image Analysis
- Scripts (to download, right click and save link as a .py file)
 ^{2,3,5etup}
 - 4.1.1 Import Classification Training Data
 - 4.1.2 Import Classification Training Data
 - 4.1.3 Import Classification Training Data
 - 4.1.4 Import Classification Training Data
 - 4.2.1 Import Classification Accuracy Assessment Data
 4.2.2 Import Classification Accuracy Assessment Data
 - 4.2.3 Import Classification Accuracy Assessment Data
 - 4.2.4 Import Classification Accuracy Assessment Data
 - 4.2.5 Random Extraction Of Validation Data From Training Data
 - 4.3.1 Importing Continuous Training And Validation Data
 - 4.3.2 Importing Continuous Training And Validation Data
 - 5.1.1 Compare Classification Models
 - <u>5.1.2 Compare Regression Models</u>
 <u>6 Output Final Image</u>
 - <u>6 Output Final Image</u>

A detailed manual and all necessary scripts have been made available by MontanaView for free download at: (<u>http://www.montanaview.org</u>)



The developed code can be used to analyze a remotely sensed image (in this case, one of Mount St. Helens on the left) and produce either a classified image (e.g., a land cover map shown in the upper right) or an image of a continuous biophysical variable (e.g., a map of biomass as shown in the lower right).

MontanaView Principal Investigator: Scott Powell

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http://www.montanaview.org



NEBRASKAVIEW 2018 - 2019



NEBRASKAVIEW HISTORY AND SUCCESSES

NebraskaView, established in 2002, is Nebraska's state node for AmericaView (AV), a national university-led, state-based consortium that unites a nationwide network of state and local users of satellite remote sensing data and technologies. NEView is administered by the Center for Advanced Land Management Information Technologies (CALMIT) at the University of Nebraska-Lincoln and includes other Nebraska institutions and agencies as partners.

The mission of NebraskaView is to ensure *that Nebraskans make full use of satellite and airborne imagery, aerial photography and other geospatial data products through technologies such as geographic information systems (GIS) and remote sensing.*

NebraskaView:

- promotes understanding of geospatial data and technologies through outreach and training, and
- fosters technology transfer.



Weatherfest public outreach event (left) 4H Big Red Camp (below)







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 is funded by USGS grant agreement G18AP00077.



NEBRASKAVIEW 2018 - 2019 ACTIVITIES

NebraskaView worked with the Eastern Nebraska Research and Extension Education Center (ENREC) to investigate the utility of and promote the use of different types of digital imagery at multiple spatial scales to university researchers, and agricultural and natural resource managers. A survey (in progress) was developed to compile data from ENREC researchers on currently collected and future spatial data needs.

A student intern from NEView consortium member University of Nebraska-Kearney collected publicly available spatial data (SSURGO soil data, NAIP orthoimagery, Landsat and MODIS satellite imagery, etc.) of the ENREC site.

Several different approaches were used to visualize and present the collected imagery to both ENREC researchers and a more general audience. These included an ESRI story map <u>https://go.unl.edu/enrec_soils</u>, a poster presentation at ENREC Open House and two NEView Fact Sheets.



ENREC Soils story map (above and below) showing soil characteristics associated with individual field research sites



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Eastern Nebraska Research and Extension Education Center (ENREC).



CALMIT/NEView poster for ENREC Open House, June 11, 2019) showing how false color images can be used to monitor crop growth.

NEView Fact Sheets (right) are used for outreach to researchers unfamiliar with spatial data and also the general public.

EBRASKA





Using NDVI TO STUDY FIELD-LEVEL PLANT HEALTH AND PRODUCTIVITY AT ENREC

NDVI patterns

The Normalized Difference Vegetation Index (NDVI) is a standardized index calculated from digital satellite remote sensing imagery. NDVI is used to map spatial patterns of vegetation greenness, which is a relative measure of plant biomass and chlorophyll content. It takes advantage of the contrasting characteristics between two common spectral bands in most multispectral remote sensing imagery—the chlorophyll pigment absorption in the red band and the high reflectivity of the internal leaf structure of plants in the near-infrared (NIR) band. This information can be paired with climate and soils data to explain plant responses over a growing season and identify areas of plant stress across the landscape.

NDVI values typically range from 0 to 1. Extremely low values near 0 represent areas with no vegetation, cloud cover, surface water or snow. Very low values (< 0.3) represent areas of little to no green vegetation, representing bare soil, senesced or dormant vegetation, or rock. Moderate NDVI values (0.3 to 06) can represent various types of information about vegetation. Factors such as the date/season of planting, different vegetation types (such as shrubs and grassland), different plant growth stages (such as crop emergence versus crop maturity) or stressed plant conditions can all influence this value. Highest values (often presented in bright green) represent forest areas and lush vegetation, while lower values are shown in shades of red.

Figure 1 right). NDVI from July 26, 2012. Imagery acquired by Landsat 7, which had developed a scanning anomaly that resulted in the evident striping pattern. 2012 was a drought year – red color represents potentially dormant or drought-stressed vegetation while the green shows areas of vigorously growing crops, especially those under pivot irrigation





Figure 2 (right) NDVI from July 22, 2019. Imagery acquired by Landsat 8. 2019 was a year of average to slightly above-average precipitation. In contrast to the 2012 NDVI, a greater proportion of the area is bright green, which shows NDVI values indicative of healthy, vigorously growing vegetation.

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www AmericaView org



www.NebraskaView.unl.edu

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ENREC FIELD SITES - SOIL TYPES

Online Soils Resource



www.AmericaView.org

Figure 1. Online interface of ENREC Soil Types https://go.unl.edu/enrec_soils

Soils are integral to the growth of natural and managed vegetation and key for agriculture crop production. Physical soil characteristics influence plant water relations and nutrient availability and are of prime interest for applications such as precision agriculture. A number of different soil types are represented at the field sites of the Eastern Nebraska Research and Education Center (ENREC) near Ithaca in Saunders County, Nebraska.

Under the direction of NebraskaView and the Center for Advanced Land Management Information Technologies (CALMIT), a student intern compiled USDA STATSGO soils data into an easily-accessible online interface (Figure 1). An interactive map depicts the soil types found within each field site at ENREC and allows ENREC field site users to examine, at a quick visual glance, the type and percentage of soil types within individual field sites (Figure 2). This provides a user-friendly visualization to a wide range of scientists who use ENREC as a key agricultural and natural resources research field facility.

Figure 2. To examine individual field information, click on a location and a pop up will appear showing the Field ID, soil series and description, the percent of the soil types occurring in that field, and the total size of the field.



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www.NebraskaView.unl.edu

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NewHampshireView 2018 - 2019



NEWHAMPSHIREVIEW HISTORY AND SUCCESSES

NewHampshireView has been an active member of the AmericaView Consortium since 2007. During this time, NHView has conducted numerous applied research projects, supported remote sensing outreach in NH and beyond, and provided educational training on geospatial analysis. A few of these highlights include:

- Evaluating forest mapping, forest change, and forest • fragmentation in NH from imagery including Landsat 8, WorldView-2 and others
- Using geospatial analysis for studying first-stage invasive • plant events in urban and forested environments
- Co-sponsoring a pilot study for a Geospatial Support Center
- **Reinvigorating GIS Day on Campus**
- Presenting remote sensing tutorials and putting them online
- Developing educational materials for K-16 students introducing remote sensing concepts specifically for New Hampshire
- Supporting graduate & undergraduate research

THE

All-day

Room 337

10am to 3pm Room 337

All Day

Self-guided Poster Walkthrough

Wednesday and Thursday



Dimond Library



Geospatial Support Center.

Mini-Trainings	Date	Live	Viewed	Viewed	Viewed
	Presented		as of	as of	as of
			12/15	12/16	9/19
Remote Sensing Basics	10/16/14	51	17,125	33,934	73,063
Selecting the Best Imagery	11/6/14	38	2,686	5,840	9,882
Accuracy Assessment of	12/4/14	48	1,624	3,591	6,234
Remotely Sensed Data	1.103 101				
The Power of NIR for	2/19/15	48	428	791	1,688
Mapping					
TOTALS		185	21,863	44,156	90,867

Table showing views of remote sensing tutorials.

NewHampshireView 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 is funded by USGS grant agreement G18AP00077.

GIS Day re-invigorated.



AmericaView Website: www.AmericaView.org Christopher McGinty, Executive Director: chris.mcginty@americaview.org Lisa Wirth, Program Manager: lisa.wirth@americaview.org Brent Yantis, Board Chair: rodnev.vantis@louisiana.edu



Viewing New Hampshire from Space

A Bird's-eye View of the Granite State!

New Hampshire from Space education/outreach materials shown in pamphlet form. Also available as posters for classroom use. Materials available on the NHVIEW website.

MPSHIRE

NewHampshireView 2018 - 2019 Activities

Evaluating Unmanned Aerial Systems (UAS) for Investigating Forest Characteristics

This multi-year high impact activity (HIA) will use various Unmanned Aerial Systems (UASs) including both fixed-wing and copter-based systems to evaluate three forest characteristics: (1) forest edge including species distribution and canopy structure, (2) cover type delineation for use as reference data, and (3) invasive species intruding into the forest. The methodology to conduct this research shares a common approach in that the analysis and results of the UAS imagery will be compared to samples collected on the ground to test if the UAS can provide accurate and more efficient information. This is the first of three years on this activity. This year the emphasis was on detecting invasive species using the UAS.



Picture of a senseFly eBee UAS used to collect imagery in this study. This is a light-weight, fixed wing platform capable of carrying a variety of sensors including both visible and multi-spectral cameras.

The results of the UAS analysis showed that these two invasive species, Berberis thunbergii (Japanese barberry) and Rosa multiflora (multiflora rose) can be successfully identified. The overall classification accuracy using an error matrix analysis was 82%. The object-based classification approach produced higher accuracies than the traditional pixel-based approach. Collecting the imagery in the spring was also more accurate than the fall. In conclusion, UAS offers great promise to more efficiently and effectively identify and target invasive plants.

Additional Activities:

- Support of the UNH Geospatial Support Center.
- Presentations on remote sensing through invited lectures to 4 undergraduate and 1 graduate course.
- Two undergraduate internships for Spring 19.
- One graduate internship for Summer 19.
- Presentation on UAS to NH House of Representatives Committee on Resources, Recreation, and Development. 5/1/19



The key concept for dealing with invasive species is Early Detection and Rapid Removal (EDRR). The use of UAS imagery was tested in this research to determine how it might aid in early detection.



Early detection of invasive species is made possible because invasives tend to leaf out earlier in the spring and remain later in the fall which provides a competitive advantage as shown in this figure, but also a window for detection.



Study area showing the areas of R. multiflora (multiflora rose) and B. thunbergii (Japanese barberry) along with the validation samples to compare the results of the UAS analysis with what was actually on the ground.

NewHampshireView Principal Investigator: Russell G. Congalton University of New Hampshire (603) 862-4644 russ.congalton@unh.edu



http://www.nhview.unh.edu



New MexicoView 2018 - 2019



NEW MEXICOVIEW HISTORY AND SUCCESSES

Established in 2008, 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. NMView is administered by the Center for Applied Spatial Ecology (CASE) in the Department of Fish, Wildlife, and Conservation Ecology at New Mexico State University. NMView includes many state and federal agencies, universities, private entities, and non-profit organizations

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. Federal consortium members identified above do not receive funding from AmericaView.

Remotely sensed data are widely used in New Mexico by public and private entities. Some of these uses include 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 other 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 (see right) about



Earth Observation Day posters for 2017 and 2018 translated into Spanish by New MexicoView.

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. AmericaView is funded by USGS grant agreement G18AP00077.







Article published in The Wildlife Professional regarding the use of Citizen Science Apps by organizations, agencies,



Graduate Students Nathan Lopez-Brody (top left), Reza Goljani (top right) and Aracely Tellez (bottom) were awarded New MexicoView Geospatial Scholarships for their use of remote sensing in their graduate research.

New MexicoView 2018 - 2019 Activities

NMView worked with the state chapters (AZ, NM, TX) of The Wildlife Society (TWS) and the Southwest Section of TWS in maintaining the Southwest Section Geospatial Advisory Committee. TWS is an international professional society focused on wildlife management and conservation. Participants on the committee represent state agencies, federal agencies, non-governmental organizations, universities and private companies. NMView collaborated with members of the committee to provide a presentation on mobile applications for the Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management (https://www.trilat.org/).

NMView is working with Globe Observer's Land Cover app ("Adopt a Pixel"). We are using current curricula developed by Globe Observer to train personnel on the Land Cover app. This includes a workshops given to AmericaView and USGS personnel, and training university students.



NMView completed the Spanish translation of AmericaView's EOD poster (right and below) and provided a downloadable pdf from the AmericaView and NASA websites.





Earth Observation Day poster for 2019 translated into Spanish by New MexicoView.



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NMView continues to build its consortium through support of the New Mexico Geographic Information Council.

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EARTH

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🖤 La Geociencia está en Todas Partes 🎫



New YorkView 2018 – 2019



NEW YORKVIEW HISTORY AND SUCCESSES

New YorkView (NYView) has been supporting the application of remote sensing data and products to solve challenges faced by New York State citizens as part of the AmericaView Consortium since 2009. Remotely sensed imagery provides a unique opportunity to observe the ground surface from above. This 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.

NYView initially focused on facilitating access to diverse remote sensing data and products, and supporting collaborative research, teaching, and outreach among consortium members. Since becoming a full member of AmericaView in 2014, NYView has supported training of high school teachers, undergraduate and graduate students, and used Landsat change pairs from sites across the state to demonstrate remote sensing applications for hundreds of visitors at the New York State Fair. NYView has also performed research that explored the integration of airborne lidar and Landsat data to quantify forest aboveground biomass as well as investigating the utility of remote sensing and spatial analysis to assess trends in vegetation extent and vigor along riparian corridors.



Rich Lake from Goodnow Mountain at the Adirondack Ecological Center in Newcomb, NY, September 2018.

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The reservoir of the Mount Morris Dam in the Genesee River in Letchworth State Park, July 2018.

by USGS grant agreement G18AP00077.

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 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.



New YorkView 2018 – 2019 Activities

Water quality is a priority issue in New York State and this was the primary focus for NYView during the 2018–2019 grant period. NYView continued developing strategic partnerships within the state, promoting growth of remote sensing skills for graduate and undergraduate students, and sought to improve communication between state and federal agencies. However, these efforts were framed within a broader context of better understanding the types of data and information needed by communities within New York. NYView activities this grant year focused on applying remotely sensed data to answer questions about land cover condition and change in critical zones that are known to impact water quality, in particular, focusing on channel migration zones.



Time series of channel migration and riparian vegetation change along a section of the Genesee River near Mount Morris, NY. Eight aerial photos acquired from 1938–2014 were utilized to delineate channel centerline and vegetation coverage within the selected study site.

NYView selected a study area covering approximately 7 kilometers of the Genesee River near Mount Morris, in western NY to study changes in channel migration. This area is located in an intensive agriculture region, and researchers have long observed bank erosion and channel meandering. For the selected site, a graduate student collected eight aerial images spanning 1938–2014 from US Geological Survey, US Department of Agriculture, ESF, Syracuse University, and New York State Department of Transportation archives. The student used the aerial images to manually delineate channel boundaries and document channel migration, and also to map riparian vegetation within 100 meters of the river. This analysis showed that channel migration exceeded 10 meters/year in some sections, with a total change in area ranging from 0.5-2 hectares/year. The figure on the left below shows that temporal variations of channel migration are generally decreasing, likely corresponding to a reduction of annual peak flow through control structures. The figure on the right below shows that as channel migration rate decreases, riparian vegetation extents within the buffer zone have increased. Visual assessment suggests that the majority of channel migration occurs where no riparian vegetation is in place. Further research will focus on quantifying the benefits of vegetation in reducing bank erosion.



Annual peakflow is a large driver of the variation of river channel migration at the Genesee River site. Channel locations were produced using aerial photo interpretation. Peakflow information was recorded at USGS gage 04227500 near Mount Morris, NY.



As channel migration rates along the Genesee River decrease, riparian vegetation regrowth occurs, particularly on newly formed river banks. Channel locations and riparian vegetation extent were produced using aerial photo interpretations.

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New YorkView Principal Investigator:
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NCVIEW 2018 - 2019



NCVIEW HISTORY AND SUCCESSES

NorthCarolinaView (NCView) consortium is a network of North Carolina remote sensing users made up of universities, community colleges, and local governments. The primary mission of the consortium is to foster and promote the uses of remotely sensed satellite, aircraft, and UAS (drone) datasets and technologies in educational institutes, state, county, and local governmental agencies, and the private sectors.

NCView Objectives

- Enhance remote educational opportunities in North Carolina
- Develop and enhance collaborative relationships of academic, federal, state, county, city, and public and private sector users
- Locate, access, and retrieve existing and future remotely sensed data and applications statewide
- Further the use of remote sensing in North Carolina to address critical issues facing the state
- Increase consortium membership

Current Eight NCView Members



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 is funded by USGS grant agreement G18AP00077. AMERICA

NCVIEW 2018 - 2019 ACTIVITIES

Analysis of flood events in eastern North Carolina after the 1999, 2016, and 2018 hurricanes

The eastern North Carolina (ENC) is no stranger to hurricanes. Three of the most notable hurricanes in the last 20 years have been Floyd of 1999, Matthew of 2016, and Florence of 2018. The ENC plain has suffered a lot of damage and lost usable land to flood waters that overfill the Tar, Neuse, and Cape Fear rivers, and their tributaries.

To understand what we learned from these flood events and how we do better to prepare for these devastating events in the future such that the flooding impact can be minimized, we focus on comparing three flood events caused by hurricanes affecting the ENC. The findings should help the city officials and concerned citizens prepare for and mitigate future flooding events.

FLOODING NEAR GREENVILLE AFTER HURRICANE FLOYD OF 1999



Modeled flood extend





Elevated houses

Findings: massive buyout, new LiDAR digital elevation model (DEM), new flood insurance rate map, and storm water management programs

New development after flood. Floodwater level is visible.

FLOODING NEAR GREENVILLE AFTER HURRICANE MATTHEW OF 2016



Local street flooding



Flooded airport



Undergraduate student, education and research

Findings: Decrease in flood-related damage due to the planning and mitigation activities since the 1999 flood event

FLOODING NEAR WILMINGTON AFTER HURRICANE FLORENCE OF 2018











Flooded highway

Flooded neighborhood

On-going ecover at UNCW and at local street Preparing for Dorian

Findings: Recovery/reconstruction activities were seen everywhere throughout the Wilmington area in September 2019

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North Dakota View 2018 - 2019



NORTH DAKOTA VIEW HISTORY AND SUCCESSES

North Dakota View has been engaged in outreach, teaching and research since 2004.

- Hands on training on remote sensing and geographic information system (GIS) at Turtle Mountain Community College. This project allowed students to investigate changes to the reservation using global positioning systems (GPS), Landsat, and aerial imagery.
- Development of a web-based community mapping project at Fort Berthold to document the Bakken oil boom, and its impact on the reservation and western North Dakota. The objective of this project was to provide a central location and simple way of viewing spatial data showing changes due to energy development. The information is being updated periodically.
- Developed and use an augmented reality sand box to illustrate land surface changes from a remote sensing perspective. North Dakota students and educators from grade school through university level have attended workshops around the state by NDView personnel. This popular tool mixes reality with computer technology to produce and project instant, colorized topographic maps onto land forms that students create to study the Earth's surface.



Middle school students work on watershed exercise with augmented reality sand box, 2019.



Working with UAS for data collection.



3D model example from workshop with ND Geographic Alliance.

North Dakota View is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. AmericaView is funded by USGS grant agreement G18AP00077.

NDView has also provided many scholarships to students engaged in research using geospatial tools such as remote sensing imagery (e.g. Landsat), GIS and GPS. Students at the University of North Dakota and North Dakota State University have been recipients of these scholarships and their research has included:

- Use of Landsat and Unmanned Aerial Systems (UAS) acquired imagery for the investigation of tile drainage on cropland hydrology in the Red River Valley, ND.
- Remote location of elk herds using GPS collars and habitat mapping from Landsat imagery. This study was a partnership with the North Dakota Game and Fish Department to identify potential conflict zones between elk and croplands. Locations included the Standing Rock Reservation, Turtle Mountain and the Pembina Hills.
- Comparison and correlation of satellite imagery with ground-based sensors for studying the phenology of grasslands at the University of North Dakota Oakville Field Station.



North Dakota View 2018 - 2019 Activities

The main focus for North Dakota View for the past year was education and training on environmental applications of unmanned aerial systems (UAS). A one day workshop was given at the ND Geographic Alliance Summer Institute for K-12 teachers. Participants were introduced to low cost software for creating 3D spatial models from digital imagery. The workshop was held at Minot State University. Teachers collected imagery from around campus and completed a series of exercises. Workshop materials were also provided in digital form for future use by the teachers with their students.

NDView purchased software (DroneDeploy, Pix4D, ERDAS Imagine) for UAS mission planning and analysis, and supported additional training. The software has been made available to the University of North Dakota campus through shared licenses and an open computer lab.



Science fair students learning about watersheds and remote sensing, March 2019.

Student research scholarships for \$750 each were awarded to two graduate students and one undergraduate student at the University of North Dakota. Students have used the awards to conduct research, and present findings at a national conference. In addition, two students were hired to maintain the NDView website, and process and update new information on North Dakota's natural resource development.

Activities by NDView and its collaborators have advanced the training of teachers and researchers in the state and region with new skills in geospatial technologies. Advanced software tools have been made available for the professional development of students and community members.



NDView supported student research presentation.

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https://arts-sciences.und.edu/ academics/geography/index.html

Facebook.com/groups/91074880028



OHIOVIEW 2018 - 2019



OHIOVIEW HISTORY AND SUCCESSES

OhioView is a consortium of universities and partners in Ohio dedicated to furthering education and research in Earth Observation Science. Initiated in 1997, Ohioview was selected by the United States Geological Survey to serve as the model for a national program dedicated to furthering remote sensing education, research and workforce training. In early 2001 the AmericaView program was formed and today enjoys a membership of 40 states.

OhioView members consist of 14 state universities as well as other schools. OhioView is overseen by a Board of Directors made up of PIs from several of the universities in the consortium. Most OhioView schools participate in the OhioView Software Pool, by which the member schools contribute to a central fund dedicated to purchasing specialized remote sensing software at a significant cost savings to each school. This software enables the classwork, education, and research conducted by OhioView universities.

Over the past 22 years, OhioView has been committed to research and education. The following are several examples of previous OhioView success stories:

- OhioView universities have collaborated in research with NASA concerning focused on developing algorithms to detect toxic algal species and Harmful Algal Blooms (HABs). During their flight campaigns, NASA and NOAA collected airborne hyperspectral data over Lake Erie, Ohio and along the Lake Erie shoreline to support these research efforts.
- Unmanned platforms (aka "drones" or "UAS") have gained widespread interest within the planning and resource management community. Previous OhioView work presented at the Ohio GIS Conference in Columbus, Ohio examined UAS applications in site characterization and environmental assessment. These are application areas where ultra-fine spatial resolution data is essential, but the large data volumes strain traditional image processing workflows.
- OhioView has partnered with the Wright Patterson Air Force Base Air Force Research Laboratory (AFRL) Discovery Lab to creatively address the educational needs of Ohio by educating and using geospatial technologies through the usage of a cutting-edge, virtual world platform.
- One of the longest running OhioView initiatives is the SATELLITES (Students and Teachers Exploring Local Landscapes to Interpret the Earth From Space) Program. This is offered yearly to K-12 teachers (particularly middle and high school level) in Ohio. SATELLITES provides K-12 teachers and students with hands-on, inquiry-based science, and STEM education using geospatial technologies. The student created projects are then presented and showcased at the annual SATELLITES Conference held each spring in Toledo, Ohio.

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Using remote sensing for monitoring and studying harmful algal blooms (HABs) in Lake Erie.



Three-dimensional model created through remotely sensed UAS imagery.



K-12 students presenting their remote sensing research at the annual SATELLITES conferences at the Penta Career Center.

OHIOVIEW CURRENT ACTIVITIES

OhioView Multi-University Remote Sensing Workshop

OhioView member universities Youngstown State University, University of Toledo, Bowling Green State University, and University of Dayton presented a day-long workshop for 65 participants on March 1, 2019, that covered a variety of remote sensing and geospatial topics.

Each university's PI presented their section of the workshop to not only the individuals at their site but across the internet to the other three sites simultaneously, and then participants at all four sites worked together on hands-on applications of remote sensing. These included imagery change detection (presented by Dr. Umesh Haritashya), vegetation monitoring (presented by Dr. Anita Simic Milas), designing and publishing web maps (presented by Dr. Bradley Shellito), and training in the NASA Globe Observer app and protocols (presented by Dr. Kevin Czajkowski).

ArcGIS Pro Training

OhioView member university Youngstown State University (YSU) held a workshop for regional geospatial professionals for switching from the former industry standard software, ArcMap, to the new standard, ArcGIS Pro.

35 participants attended the day-long workshop at YSU on February 8, 2019, which also included a demonstration of remote sensing imagery and content held on the new 4K visualization system of the YSU planetarium.

SPatial LITeracy - SPLIT Remote Sensing

The SPLIT Remote Sensing integrated the researcheducational cascade model to support surface water quality monitoring. It offered high school and university students the opportunity to gain hands-on field remote sensing learning and research knowledge in an actual research scenario. The program was also designed to educate K-12 teachers who could then contribute to creating a diverse and highly skilled future workforce in the field of remote sensing. The program also included an exhibition *SPLIT through ART* where students displayed over twenty visually appealing remote sensing images, each accompanied by its own story including information about image and related environmental issues.



Participants in the OhioView Multi-University Workshop publish Web maps at Youngstown State University, one of four locations involved in the hybrid workshop.



Participants in the OhioView Multi-University Workshop perform change detection of an urban environment at University of Dayton.



SPLIT Remote Sensing for Water Quality workshop at Bowling Green State University – NASA engineer Roger Tokars was one of the lecturers together with FAA and industry representatives, BSGU professors and students and high school teachers (May 2019).

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OhioView Principal Investigator: Anita Simic Milas Bowling Green State University



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OKLAHOMAVIEW 2018 - 2019



OKLAHOMAVIEW HISTORY AND SUCCESSES

History: OklahomaView became a full member of the AmericaView consortium in 2014.

High Impact Activity (HIA) Successes: *State-wide geospatial datasets of forests and surface water resources*: Oklahoma state is dominated by a transient climate from sub-humid to cold and dry, and characterized by diverse natural resources. OklahomaView HIA are centered in developing and improving remote sensing capacity to monitor, report and verify the spatial-temporal dynamics of natural resources in the state. It leverages various research activities and resources available in the OklahomaView consortium. The major outcomes include (1) improved knowledge and mapping tools for forests and surface water body in Oklahoma, and (2) geospatial datasets of forest and open surface water body during 1984-2015 (Zhou et al, 2017). The surface water mapping tool was further applied to generate annual maps of surface water body in the contiguous United States during 1984-2016 (Zhou et al., 2018).





Publications: Zhou et al., 2017, Continued decrease of open surface water body area in Oklahoma during 1984-2015, *Science of the Total Environment*. Zhou et al., 2018, Divergent trends of open surface water body area in the contiguous United States from 1984-2016, *The Proceedings of National Academy of Sciences of the United States*.



Participants photo in 2015 workshop



Student talk in 2015 GISday Expo

OklahomaView Consortium Development Activity: Oklahoma Workshop on Remote Sensing Technology and Applications: OKView organized the workshops in 2014 and 2015 at the University of Oklahoma. Each workshop brought together 50+ participants from universities (researchers, students, and faculty members), federal, state, and tribal government agencies as well as private industries.

OklahomaView Consortium Education Activity: *Geospatial Information Science Day (GISday)*: GISday is an international event to showcase spatial information science and technology (remote sensing, geographic information system, global positioning system) and their applications in the society. OkView is one of leading groups to organize annual GISday at the University of Oklahoma, which was held in November during 2013-2018. Each year, a few hundreds of students from the universities and high schools attended. It had tens of exhibit booths from the universities, federal, state and tribal government agencies, and private companies. It gave best student poster awards to graduate and undergraduate students who presented their work in posters.

Federal consortium members identified above do not receive funding from AmericaView.

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. AmericaView is funded by USGS grant agreement G18AP00077.



OKAHOMAVIEW 2018 - 2019 ACTIVITIES

OklahomaView HIA: Surface Water Resources: Surface water resources are critical to state economy and ecosystems. During GY14-17, we developed annual maps of surface water area in Oklahoma and the CONUS (see figure on the right) at 30-m spatial resolution. As many surface water bodies in Oklahoma are even smaller than 30-m and many small streams dried out in drought years, which posed threads to wildlife. In the GY18 HIA, we explored the potential of using time series Sentinel-2 images (10-m spatial resolution) to identify and map surface water body in Oklahoma. The figure below shows a comparison in Thunderbird Lake between Landsat-based (30-m) and Sentenel-2 (10-m). This work layouts the foundation for us to monitor, report and verify surface water body in Oklahoma at 10-m spatial resolution, and to estimate the year-long, seasonal, and ephemeral surface water area.



OklahomaView Consortium Education Activity: *Geospatial Information Science Day (GISday) in 2018*: OKView co-led the annual GISday Expo event at the University of Oklahoma in November 2018. The event had 300+ participants from universities, federal, state, tribal government agencies, and private companies. OKView also had a booth in the Oklahoma GISday at the Capital Hill in March 2019, which introduced AmericaView to the participants and may help recruit new members for OkView in the future.

OklahomaView Principal Investigator (GY14 - GY18):

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OREGONVIEW 2018 - 2019



OREGONVIEW HISTORY AND SUCCESSES

Established in 2015, OregonView is a member of the AmericaView Consortium, a nationwide partnership of remote sensing scientists who support applied remote sensing research, K-12 and higher STEM education, workforce development, and technology transfer. The mission of OregonView is to enhance the beneficial use of remotely sensed data and derived geospatial products in Oregon through:

- 1. Partnerships extending across the government, commercial and academic sectors
- 2. Remote sensing research
- 3. Education and outreach



OregonView shallow-water bathymetric mapping using remotely sensed data from a range of platforms.



OregonView-supported graduate student, Selina Lambert, teaches K-12 students about remote sensing as part of Discovery Days 2019.

OregonView's key accomplishments to date include:

- Leading several K-12 remote sensing workshops and demos
- Disseminating procedures and data products from research into inland water body surface temperature mapping from Landsat 8 thermal bands and *in situ* data
- Mapping shallow water bathymetry using Landsat 8 imagery and other remotely sensed data and distributing the data products via a webGIS
- Publishing peer reviewed journal papers on research led by OregonView-supported students
- Participating in state and regional geospatial events, including GIS in Action, the Northwest GIS Users Conference, and American Society for Photogrammetry and Remote Sensing (ASPRS) Columbia River Region (CRR) events

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. AmericaView is funded by USGS grant agreement G18AP00077.



OREGONVIEW 2018 - 2019 ACTIVITIES

Shallow, nearshore areas are notoriously difficult to map, which has created a global nearshore data void that hinders coastal planning, coral reef habitat mapping, and coastal resilience initiatives. OregonView researchers are working to fill this data void using Landsat 8 Operational Land Imager (OLI) data and NASA's Ice, Cloud and Land Elevation Satellite-2 (ICESat-2) Advanced Topographic Laser Altimeter System (ATLAS) to generate nearshore bathymetry (water depth maps) for coastal sites of interest to USGS, NOAA, and state and local organizations within Oregon.

The bathymetric digital elevation models and other products from this project are currently being distributed through a webGIS: http://shallowbathymetryeverywhere.com/



Shallow water data gaps, such as shown here for a southern California project site, exist in coastal areas around the world, due to the challenges and costs of mapping high-energy nearshore environments.



Dissemination of shallow-water bathymetry derived from Landsat 8 and ICESat-2 data. The data products and webGIS were developed by an OregonView-supported student.

Shallow water mapping with Landsat 8 and NASA's ICESat-2 ATLAS

OregonView's 2018-2019 activities also including the following:

- 1. Led a webinar on a joint effort between OregonView and the GLOBE Observer (GO) project, introducing the new GLOBE Observer Land Cover tool
- 2. Participated in national, state, and regional geospatial conferences and workshops
- 3. Organized an Earth Observation Day celebration at Oregon State University
- 4. Presented a remote sensing demo at Oregon State University's Family Science and Engineering Night, an ongoing pre-college education program directed at elementary and middle schools in Oregon's Willamette Valley

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PennsylvaniaView 2018 - 2019



PENNSYLVANIAVIEW HISTORY AND SUCCESSES

PAView is a collaborative effort of a consortium of members throughout the Commonwealth of Pennsylvania. PAView was established in September of 2005 and is a full member of the AmericaView program. The current members who have a wide range of research and outreach interests include: California University of Pennsylvania, Bucknell University, Clarion University, Villanova University, the Pennsylvania State University, and Pennsylvania Spatial Data Access--the public access GIS clearinghouse for the Commonwealth of Pennsylvania. PAView was developed to further one of the primary goals of the AmericaView program-- educating the public about remotely sensed imagery and to provide an additional portal to data and information in a public forum.



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

To insert your own image, right-click on the image above and choose "change picture".

Welcome to ChesapeakeView



ChesapeakeView Website



Students complete Humanitarian Mapping.

PennsylvaniaView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. AmericaView is funded by USGS grant agreement G18AP00077.

PA View has:

- Two of the PAView's previous work include assisting Washington, PA of a HAZUS flooding analysis and a creation of a Landfire exercise. Dr. Thomas Mueller and a student completed a HAZUS analysis of Washington, Pennsylvania.
- 2) Led an effort to create Chesapeake View a collaborative effort between the following State Views West Virginia, Virginia, Maryland, and Pennsylvania
- The PI has co-led the effort for increased visualization of Earth Observation Day (including initial discussions with AGI, led social media efforts, created lessons, co-led local mapathons, etc.)
- 4) Worked with teachers on using geospatial technology including imagery in their classrooms.
- 5) Worked on Humanitarian Mapping to assist Humanitarian agencies

Federal consortium members identified above do not receive funding from AmericaView.



PENNSYLVANIAVIEW 2018 - 2019 ACTIVITIES

PennsylvaniaView's High Impact Activity this year was to build a presentation and exercise for a freshman collegelevel geography courses using CropScape, a National Agriculture Statistics Service (NASS) web service. It "...provides a raster, geo-referenced, crop-specific land cover map for the continental United States." https://data.nal.usda.gov/dataset/cropscape-cropland-datalayer. The CropScape layers were developed using many sensors including Landsat imagery. After a rough draft was developed, the documents were evaluated by college students and scientists from the National Agriculture Statistics Service (NASS). In the exercise, students evaluate the Top 5 Crops in Pennsylvania and then examine the changes in Pennsylvania crop acreage over the past 10 years.



An example of data from CropScape. The different colors represent different crops. .

The PAView consortium members work on a wide variety of efforts related to remotely sensed data at their

universities. California University of Pennsylvania Co – PI: Thomas Mueller, Ph.D., GISP Pennsylvania State University Clarion University of Pennsylvania Bucknell University Villanova University

And Our New Member for 2019-2020 Montour High School







CLARION



PENNSTATE

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RHODE ISLANDVIEW 2018 - 2019



RHODE ISLANDVIEW HISTORY AND SUCCESSES

Rhode IslandView fosters local applications of drone-based technologies in Rhode Island. Drones have an unmatched capability to quickly and inexpensively capture detailed aerial photographs of small areas. Upon joining AmericaView in 2014, we have focused on facilitating online access to remote sensing data and promoting the use of small Unmanned Aerial Systems (sUAS). Our approach to this is largely through conducting demonstrations, providing undergraduate student training opportunities, and building data acquisition partnerships.

Remote sensing datasets of Rhode Island historically have been difficult to view by the general public. The computer file formats, complex software, and robust computer hardware used to efficiently access these types of data are not readily accessible by most. Rhode IslandView has created web-based map services in partnership with the Rhode Island Geographic Information System consortium (www.rigis.org). These services are used behind-the-scenes by Rhode IslandView and other online map application developers to directly connect our communities with remote sensing imagery and detailed lidarbased elevation models. These resources are actively used for K-16 education, municipal mapping websites, and statewide initiatives (including STORMTOOLS, the coastal inundation mapping tool developed by the RI Shoreline Change Special Area Management Plan). Rhode IslandView has built on these successes by offering presentations and workshops to local and national audiences.



Rhode IslandView 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 is funded by USGS grant agreement G18AP00077.





Launching a DJI Phantom 4 Pro at Napatree Point Conservation Area. Credit: P. August

Rhode IslandView's collaborators have diverse interests that from range traditional land-use and land-cover building Landsat-based mapping, to decision support systems, producing new lidar-derived data products, monitoring sea surface temperature, modeling sea level rise scenarios, and designing sensors for undersea interplanetary and even exploration. With AmericaView's support, Rhode IslandView is the only local organization that offers a platform to bring these shared remote sensing resources and skills together.

Flight operations center for a BirdsEyeView Aerobotics FireFLY6 Pro sUAS. Credit: G. Bonynge

RHODE ISLANDVIEW 2018 - 2019 ACTIVITIES

Rhode IslandView (RIView) is supporting undergraduate education opportunities, and developing new partnerships that introduce and support the use of drone-based aerial imaging.

In partnership with the University of Rhode Island (URI) Environmental Data Center, RIView funded an undergraduate research assistant during the Summer of 2019. This student was introduced to drone mission planning, operations, and equipment maintenance before shifting focus to perhaps the most challenging aspect of working with drones: data processing. The student was mentored on data management techniques the use of image processing software. Objectives for the summer included exploring how to streamline existing workflows by programming new image processing scripts, and venture into creating 3D renderings.



Normalized Difference Red Edge (NDRE) false color view of a commercial turf farm field. Credit: G. Bonynge

RIView further supported undergraduate education at URI by conducting real-time aerial reconnaissance for students participating in a Hazardous Waste Operations and Emergency Response (HAZWOPER) class final exercise.

Aerial orthophotographs were developed of Napatree Point Conservation Area in Westerly, RI, in partnership with the Watch Hill Conservancy. We initially attempted to fly the area with a fixed-wing drone but ultimately aborted due to weather and other environmental conditions. Follow-up flights were conducted with a quadcopter-style drone the collected extremely detailed true color imagery of the entire area. Extensive imagery was also collected of bluffs and a historical fort located at the extreme end of the peninsula for the purpose of building a 3D rendering. This imagery is extremely useful for the scientific team studying habitat and geomorphological change in this dynamic coastal area.

RIView partnered with researchers from the URI Department of Natural Resources Science and the Department of Ocean Engineering to test the functionality of a migratory bird tracking antenna array. This array monitors an area between Block Island and the neighboring wind farm, the first of its kind in the nation. RIView also assisted scientists from the URI Graduate School of Oceanography with evaluating the effectiveness of a new experimental migratory bird tracking system temporarily installed at the URI Narragansett Bay Campus. Also at URI, RIView gathered extensive imagery of a building at the URI Narragansett Bay Campus to learn how to build detailed 3D rendering, and evaluate the usefulness of the imagery for building inspection purposes by facilities management staff.



An aerial view of the Block Island Wind Farm, June 6, 2019. Credit: G. Bonynge

Rhode IslandView Principal Investigator: Dr. Y.Q. Wang University of Rhode Island 401.874.4345 yqwang@uri.edu







South DakotaView 2018 - 2019



SOUTH DAKOAVIEW HISTORY AND SUCCESSES

South DakotaView (SDView) is a charter member of the AmericaView organization. Since 2002 SDView efforts have focused on remote sensing education and outreach to students, educators, and current workforce personnel across South Dakota. SDView activities during the past few years include:

- South Dakota Statewide Geospatial Conference in Mitchell
 - o July 25-26, 2017
 - o 142 attendees
 - \circ $\ \ \,$ 36 speakers including four keynotes from EROS and Esri
 - Track for educators
- "Storytelling with Maps" workshop in Brookings for K-16 educators
 - o November 18, 2017
 - \circ $\,$ 16 K-12 teachers and one university pre-service educator $\,$
 - $\circ~$ Synergistic event that utilized resources and personnel from five AmericaView states: SD, TX, OH, LA and VA
- Interactive display at Big Sioux Water Festival in Brookings "South Dakota Lakes: A Look from Above"
 - o Annual event in early May on SDSU campus



Keynote speaker session at the July 2017 South Dakota Statewide Geospatial Conference in Mitchell



K-16 educators at the November 2018 "Storytelling with Maps" workshop in Brookings

South DakotaView 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 is funded by USGS grant agreement G18AP00077.

- Earth Observation Day events (2016-17)
 - $\circ\quad$ Watertown two events for 6 th graders
 - o Brookings seven events for kindergarten and second graders
 - Rural Madison one event at Hutterite Colony
- South Dakota Agricultural Heritage Museum display
 - "Weathering the Storm: Nature's Impact on South Dakota"
 - Featured remotely sensed imagery documenting extreme weather events such as hail, tornadoes, wildfires, blizzards and flooding
 - \circ $\,$ On display at the museum March-September 2018 $\,$
 - Presently traveling to K-12 schools in South Dakota
- Presentations and posters

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- o Black Hills Digital Mapping Association, October 5, 2016
 - "Remote Sensing Imagery: Types, Availability, Applications, and Training"
 - Pecora Symposium, November 16, 2017
 - "South Dakota LiDAR Factsheet"
- Technology and Innovation in Education conference, April 12, 2016
 - "Geospatial Technologies in the Classroom"
- o South Dakota Precision Ag Conference, February 2014
 - "Elevation Data: LiDAR, NED and More"



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within South Dakota to facilitate the utilitization of remote sensing data and geospatial technologies for the benefit of its citizens and the economic development of the state.

South DakotaView:

Building partnerships and capability

The SDView mission statement superimposed on remotely sensed imagery of South Dakota

SOUTH DAKOTAVIEW 2018 - 2019 ACTIVITIES

sUAS Curriculum Development and K-12 Outreach

This SDView High Impact Activity had two components. The first was to revise and develop curriculum for a university undergraduate-level introductory small Unmanned Aircraft Systems (sUAS) one-semester course, and the second was a one-hour K-12 activity. The sUAS course prepares students for the Federal Aviation Administration (FAA) Part 107 remote pilot exam. Other components of this course provide students with hands-on experience with sUAS systems, including: (1) Flight simulations and scenarios; (2) Experiences with on-board sensors; and (3) Processing and analysis of aerial imagery.

The one-hour K-12 activity demonstrates Landsat and other types of remote sensing image capabilities as well as an indoor sUAS flight demonstration. This has been incorporated into SDSU's College of Natural Sciences STEM outreach program.

South Dakota Statewide Geospatial Conference

SDView and its consortium partners hosted a statewide geospatial conference in Mitchell on July 24-25, 2019. The conference was attended by 107 geospatial personnel and ten vendors from across the state and beyond.

In addition to SDView, other AmericaView members played a significant role in the conference. LouisianaView's Earth as Art exhibit was on display throughout the conference. Brent Yantis from LAView made three presentations at the event. Chris McGinty, AmericaView's Executive Director, was a keynote luncheon speaker and also presented a workshop.

SDView consortium members involved in the conference were South Dakota State University, the SD Department of Transportation, City of Sioux Falls, the SD Department of Environment and Natural Resources, ASRC Federal Data Solutions (EROS Contractor), Technology and Innovation in Education, and the SD Bureau of Information and Telecommunications.

For five weeks before the conference, the Earth as Art exhibit was on display at the Brookings City Library. Brent Yantis made a public presentation about the exhibit at the library on June 18th.



Earth as Art display at the Brookings Public Library



South Dakota State University students receiving instruction on the operation of small Unmanned Aircraft Systems (sUAS) from SDView Principal Investigator Dr. Bruce Millett

Other 2018-2019 Activities:

• Participation in the Big Sioux Water Festival

This annual festival brought more than 1000 4th graders and their teachers from eastern South Dakota to the South Dakota State University campus on May 7th to learn about various water-related topics. SDView had an interactive ArcGIS Online display in the exhibit hall that looked at water from a remote sensing perspective.

• Mini-grants for University Students

Two \$1000 mini-grants were competitively awarded to graduate students for projects involving geospatial technologies. Students from all of South Dakota's universities and tribal colleges were eligible to apply. The first project: addressed the issues of sustainable land use, land change, and land management in Burkina Faso by looking at an agricultural practice called Farmer Managed Natural Regeneration (FMNR). The second project used a Sky Quality Meter (SQM), light meter, and GIS to measure light pollution.

 Earth Observation Day Activities
 Second graders from Medary Elementary School in Brookings learned about "South Dakota from Space" during an SDView visit on September 17.

SDView Website Renovation The SDView website received a complete renovation and a new website address (https://sdview.org).









TEXASVIEW 2018 - 2019



TEXASVIEW HISTORY AND SUCCESSES

TexasView (TXView) has been active across a broad spectrum of activities during the previous grant period. **Development of materials for and participation in training of educators** has been a continuing effort. Since 2013, PI Dodge has been developing **"Watching over Texas from Space"** activities. Texas-centric resources that engage students in a scaffolded set of image interpretation activities introduce concepts including scale, geographic coordinates, multispectral imaging, change monitoring, and applications including agriculture, forestry, coastal studies, and natural hazards such as wildfire, flooding, and hurricanes. These resources have been used in seven full-day teacher training workshops and four 1-hour overview workshops at seven different Educational Service Centers in Texas for over 200 teachers. They were also used in a 1-day teacher-training workshop following the Pecora Symposium in 2017, and in a 1hour intro workshop for AP Environmental Science teachers in 2019.



TexasView PI Dodge has also worked for the last four years on Earth Observation Day (EODay) resources, in a strategic partnership with NASA, USGS, and other StateViews. EODay is a national event and has become associated with *Earth Science Week* sponsored by the American Geosciences Institute. The AV-branded teaching resources are distributed to > 15,000 K-12 Earth Science teachers each year, and distributed in TXView teacher-training workshops as well.

San Angelo Secondary Science teachers study landforms and landform change using Landsat imagery over State Parks.



Normalized Burn Ratio just after the Bastrop Fire, 2011.



Introduction to Image Processing workshop 2016.

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Efforts to promote research and remote sensing experience at the university undergraduate and graduate level have focused on mini-grants to individual students and faculty mentors at consortium partner institutions. Minigrants have supported 17 faculty-mentored research projects during the past three years. These mini- grants are now a sustainable consortium-supporting activity for TexasView. During 2016 through 2018 the research opportunities were extended to seven consortium member institutions in multiple disciplines including geosciences, geography, and engineering.

Development of materials for and participation in training of professionals has been a sustained effort for TexasView. Co-PI Teresa Howard has offered the **"Introduction to Image Processing Workshop"** annually at the Texas GIS Forum as a four-hour, hands-on seminar to introduce GIS professionals to remote sensing software and methodologies. Attendees include Nation- and Statelevel professionals and professionals from industry and academia. A total update this year has transitioned to ArcGIS Pro and introduced QGIS and USGS Landlook into the workshop activities. The workshop is scheduled for two days at the GIS Forum in October of 2019, following a hiatus year in 2018.



TEXASVIEW 2018 - 2019 ACTIVITIES

TXView has identified the need to increase the number of undergraduate students who use remote sensing in an applied, project-oriented fashion. This first of two High-Impact Activities (HIAs) addresses grant objective 3: Promote research and remote sensing experience at the university undergraduate and graduate level to increase numbers and visibility of graduating students with employment skills in remote sensing. Three member institutions participated this year; six students utilized satellite and airborne imagery and field observations in diverse projects. The Bastrop Fire investigation (right) yielded field-verified maps of areas with fast, medium, and slow regrowth, useful for guiding remediation efforts. The student also developed "USGS Landlook Exercises" designed to introduce students to the Landlook Interface that allows rapid online viewing and access to USGS and Sentinal-2 images. This activity was also supported by a NASA STEM Enhancement in Earth Science (SEES) grant and SEES interns used the exercises in a summer workshop. This activity also will be used in Howard's "Introduction to Image Processing Workshop" in October 2019 at the Texas GIS Forum.



Boundaries of the Griffith League Scout Ranch, site of the Bastrop Fire field investigation. Student's testimonial states that **"two of the aspects of my TexasView grant project that I enjoyed the most were using GIS to visualize fire data and learning how field investigations work."** Currently a student in the Aerospace Engineering program at UT Austin, he also states that following this project he **"will be redirecting my graduate studies towards Data Science or Data Analytics, with the hope that I can one day assist with implementing machine learning in the remote sensing domain."**

Efforts to expand the dissemination of the *"Watching over Texas from Space"* activities have continued in cooperation with Texas Educational Resource Center network. This second HIA addresses grant objective 4: Develop materials for and conduct or participate in appropriate educational and training organizations, curricula, programs, workshops, meeting seminars, as well as technology transfer and outreach activities.

Two workshops served eleven and nine Middle- and High-School teachers in Midland and San Angelo, respectively. 100% plan to implement the activities, including new game formats, in their classrooms. The post-workshop assessment also indicated that 100% of the teachers agreed that the workshop met state content standards and promoted hands-on learning. Comments from teachers include

- "I greatly appreciate being introduced to such a variety of resources for studying landforms and earth change. I will use them in my class and suggest them for learners interested in deeper study."
- "I greatly enjoyed the activities. They are quick and easy for the classroom. The Power Points were very well detailed. It should be easy to use them in the classroom."
- "It was wonderful and the resources are so well organized. I really feel like I can go back on my own and navigate through them with ease."



New game formats for the **"Which is Which"** landform identification and **"How is Texas Changing"** before-and-after matching activities were shared with the public at an Earth Day Outreach event sponsored by Keep Midland Beautiful non-profit (left). These game activities were also used with students during the Pecora 21 Symposium Educational Outreach Activity in Baltimore, where 97 Middle School students and 8 teachers rotated through multiple hands-on activities.

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UTAHVIEW 2018 - 2019



UTAHVIEW HISTORY AND SUCCESSES

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 sectors; 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.

UtahView promotes and fosters geospatial knowledge and skills through outreach events, such as educational trainings, workshops, and presentations. UtahView partners with Utah educators, university and county extension agents, state and county employees, and the general public to coordinate events and activities. During these outreach events, UtahView presents information on geospatial technologies, remote sensing, global positioning systems, and unmanned aerial systems and engages participants and attendees through demonstrations and exercises.

In recent years, UtahView has interacted with land manager and agencies to demonstrate the use and value of geospatial technologies in sustainable land and natural resource management. For instance, demonstrations and workshops have been held during the Beaver River Watershed Tour and Training in Beaver County, Utah, and at Deseret Land and Livestock in Rich County, Utah.

UtahView has made a significant effort to have a strong presence in local high schools. UtahView coordinates with the Utah Geographic Information Council (UGIC) Education Committee to host GIS Day and Earth Observation Day workshops and activities during the annual spring conference. In the past, UtahView has worked with Escalante High School, Morgan High School, and Uinta High School. UtahView also works with undergraduate students, middle school students, young children, and senior citizen groups around the state.

In addition to hosting educational events and activities, UtahView attends the Maps on the Hill event, hosted by UGIC during the Utah legislative session, to effectively communicate the importance of using geospatial data and tools in addressing local issues to legislators and students.

UtahView also supports and engages in research activities. Through the AmericaView Mini-grant Program, UtahView developed a Landsat Analysis Ready Data (ARD) tutorial for college-level students that provides detailed instructions on how to process and analyze the data. UtahView also developed a methodology for evaluating historic landscape conditions in dryland river systems. By using a series of historic aerial photographs, historic land cover and river morphology were assessed to support restoration planning for the Price River in central Utah.

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Remote Sensing/GIS Laboratory at Utah State University in Logan, Utah



UAS demonstration at Deseret Land and Livestock



Presentation to Native American STEM Mentorship Program students



2017 Maps on the Hill Event



UTAHVIEW 2018 - 2019 ACTIVITIES

UtahView is continuing to develop and program a Landsat ARD analysis interface using Jupyter Notebook, Python, and R statistical analysis tools. The interface will allow users to extract spectral data from the Landsat ARD temporal series and present that information in the form of temporal trend lines. During the past year, UtahView has spent a significant amount of time developing the *Utah As Art* exhibit. The *Utah As Art* map series is a localized version of the USGS *Earth As Art* program. The goal of this exhibit is to display the diverse beauty of the state of Utah, to visualize the geography and natural resources in the state, and to demonstrate one of the many values of satellite imagery. The series presently consists of five maps, but the collection will at least double within the next few months. The collection has been presented at the 2019 UGIC Conference in Midway, Utah, and at various educational and outreach events. The exhibit is tentatively scheduled for a one-month long display at the Snow Horse Art Gallery at the Davis County Conference Center in January 2020. In addition to developing the map series, a companion tutorial has been developed for high school students who would like to make a map of their own (http://bit.ly/UtahAsArtTutorial).



In terms of education and outreach events, UtahView partnered with the UGIC Education Committee during the 2019 UGIC Conference to host a GIS/Earth Observation Day event on May 7, 2019 for students at Wasatch High School. Over 65 students participated in the event to learn about remote sensing, GPS, GIS, UAS, and ArcGIS Online. On June 26, 2019, UtahView presented to a group of over 40 senior citizens from the Logan Summer Citizen Program to demonstrate the use and value of remote sensing and UAS in natural resource management and science. On August 28, 2019, AmericaView, UtahView, and the RS/GIS Laboratory set up informational tables at the Quinney College of Natural Resources (Utah State University) Opening Social. Just prior to the event, several legislative staffers met with Christopher McGinty (AmericaView Executive Director), Dr. R. Douglas Ramsey (UtahView Principal Investigator), and Ellie Leydsman McGinty (UtahView State Coordinator) to learn about science-based programs and activities at Utah State University.



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VERMONTVIEW



VERMONTVIEW HISTORY AND SUCCESSES

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

The VermontView consortium is dedicated to advancing remote sensing in Vermont through education, outreach, training, networking, and data distribution.

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.



Vermont's high-resolution statewide land cover dataset was developed using methods funded by AmericaView.



UAS mapping of agricultural fields.



VermontView's UAS activities provide students access to cutting-edge remote sensing technologies.

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. AmericaView is funded by USGS grant agreement G18AP00077.



Expertise

With no remote sensing professionals employed within state government, VermontView is the resource agencies and elected officials turn to when they need unbiased advice.



Actionable Information

Vermont has a vast collection of publicly available remotely sensed data. VermontView helps to turn these data into information so that managers can make for informed decisions.

The Future Workforce

Developing the workforce of the future starts today. VermontView is active throughout the state in K-16 outreach and education, providing students with STEM learning opportunities.

VERMONTVIEW 2018-2019 ACTIVITIES



Public Safety

VermontView worked with state and local public safety agencies to help them integrate remote sensing technology into their operations.



STEM Outreach Through school outreach and summer programs, VermontView exposes students to the exciting career opportunities in the remote sensing field.



Integrating UAS and remote sensing technologies into the Civil Air Patrol's cadet search and rescue exercise.



Workforce Development Technology is constantly changing. The VermontView UAS workshop helps professionals obtain the skills they need to thrive in a competitive landscape.



STEM programs provide hands-on training to K-12 students.



The UAS workshop for professionals was attended by persons from public safety agencies, educators, and those from private industry.



The VermontView internship program provides a unique opportunity for an undergraduate student to carry out remote sensing research for a 6-month period.

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VIRGINIAVIEW 2018 - 2019



VIRGINIAVIEW HISTORY AND SUCCESSES

VirginiaView, as a longstanding member of AmericaView, has contributed to a broad range of activities that brings teachers, students, industry, and the public into contact with remote sensing imagery, learning resources, and new applications.

- VirginiaView conducts *workshops* for Virginia's teachers at various venues across Virginia.
- VirginiaView conducts workshops to *introduce remote sensing imagery* to staff of local/state agencies, and private industry.
- VirginiaView participates regularly in *Virginia's Science Festival,* introducing Landsat imagery and related Remote Sensing technologies.
- VirginiaView has prepared *eBooks* and online video tutorials to enable people of all backgrounds to acquire and use Landsat imagery to learn the practice of Remote Sensing.
- VirginiaView hosts and sponsors the annual GIS and Remote Sensing Symposium. This forum provides an opportunity for university faculty from multiple institutions and various disciplines to share their research interests. In addition, undergraduate and graduate students share their geospatial research interests with the broader community.

2019 VirginiaView Workshop Testimonials

This (workshop) was an excellent use of my time. I will be able to extend remote sensing techniques that I have learned at this workshop to probably 100 other individuals over the course of the next year.

Remote sensing is critical to understanding and managing human interactions with natural resources. This course gave me greater insight and confidence to work with remotelysensed data and incorporate GIS analysis into my teaching, research, and outreach.



Remote sensing workshops provide professionals with an introduction to Landsat imagery & Virginia imagery products



The GIS and Remote Sensing Symposium attracts over 80 participants including students and community stakeholders.



Remote Sensing symposium speakers represent both the public and private sectors.

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. AmericaView is funded by USGS grant agreement G18AP00077.



VIRGINIAVIEW 2018 - 2019 ACTIVITIES

VirginiaView is dedicated to supporting workforce development at various levels across the Commonwealth, and provides an array of professional development venues, resources, & opportunities, including:

<u>eBooks:</u> VirginiaView provides inexpensive and authoritative resources that provide researchers, industry, and the educational community with effective access to remote sensing imagery and instructions for image analysis. Our most recent resource (shown right) provides access to the recently released ebook *Remote Sensing with ArcGIS Pro.* This resource allows communities to immediately make the transition to the new ESRI product line. VirginiaView's Amazon Kindle eBooks are available at minimal cost (about \$3), and resources— imagery, and related support materials, are freely available on-line from USGS open-access imagery program. Within Virginia and some other states, ESRI software is available to students without cost. Use of our eBooks requires access to a computer, internet communications, and ESRI software. Over 35,000 eBook pages have been accessed. These resources have been adopted by several university institutions.



VirginiaView provides numerous professional workforce development, including eBooks, boundbooks, and online tutorials.

- <u>Online Tutorials</u>: VirginiaView and its partners have provided video tutorials to support the use and integration
 of remote sensing imagery and image processing techniques. These instructional videos have been accessed
 from across the United States and overseas, and have been viewed over 290,000 times.
- <u>Workshops</u>: VirginiaView conducts professional development workshops at various locations across the state. These workshops span an array of remote sensing topics, and are attended by local/state/federal government employees, the private sector, educators, and personnel from land trusts and other nonprofit organizations. Workshop topics in 2018-2019 included:
 - Mapping with Drones (5 workshops)
 - Using Remote Sensing with ArcGIS Pro (2 workshops)
- <u>K-12 Programs</u>: VirginiaView provides remote sensing programs to the precollege community. The Virginia Tech Science Festival connects participants of all ages and backgrounds with varied forms of imagery. A grade school student (shown at right) observes landscape changes at the VirginiaView exhibit as recorded over periods of several years, introducing her to the dynamic character of the communities that she previously regarded as fixed features. VirginiaView has participated the Science Festival for many years, recruiting university students as assistants, thereby nurturing their interests in Landsat Imagery and its applications.



Professional development workshops are held across Virginia



Remote sensing exposure starts in grade school

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WEST VIRGINIA VIEW

2018 - 2019



WEST VIRGINIA VIEW HISTORY AND SUCCESSES

West Virginia View is a consortium that promotes remote sensing and geospatial research, education, and outreach within West Virginia. Our primary objectives include:

- Establish the formal linking of, and cooperation between, the major remote sensing organizations in West Virginia, and promote community outreach by these organizations.
- Provide grants to students to enhance remote sensing-related educational experiences, including supporting graduate field research and conference travel.
- Provide access to remotely sensed data to support research and practical mapping projects.
- Foster the growth of remote sensing education. Outreach activities include licensing sharing, laboratory exercise production and exchanges, and even teaching classes at other institutions.

Past projects include:

- 1. Software licensing support for academic institutions in West Virginia
- 2. LiDAR data download web map: http://www.wvgis.wvu.edu/lidar/
- 3. Mapping urban quality of life using satellite imagery and citizen science
- 4. Mapping and delineating wetlands using imagery and terrain data
- 5. Mapping and delineating forest types using imagery and terrain data
- 6. High resolution land cover mapping across the entire state of West



Example of high resolution land cover generated for the entire state





Federal consortium members identified above do not receive funding from AmericaView.

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. AmericaView is funded by USGS grant agreement G18AP00077.



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WEST VIRGINIA VIEW CURRENT ACTIVITIES

Large Area Mapping of Vegetation at the Landsat Scale

There is a need for state agencies, such as natural resource divisions and environmental protection agencies, and NGOs to have accurate statewide information on land surface conditions. This project focuses on the production of foresttype maps for the state of West Virginia using Landsat data and other ancillary geospatial data layers, such as digital terrain data. We are producing hard classifications and probabilistic predictions using machine learning. We are also making use of field data provided by the WV Division of Natural Resources Natural Heritage Vegetation Database to train and assess the outputs. This project is ongoing.



Screen capture from Google Earth Engine, which is being used to create temporal composites of seasonal Landsat data across the state.

Development of Free Geospatial Educational Resources

During the 2018 funding year we produced two online courses that are currently hosted on our website (<u>http://www.wvview.org/</u>). These courses are called *Digital Earth* and *Introduction to GIScience*. Course content includes videos, lectures, lab exercises, assignments, and challenges.



Example YouTube video and course page produced as part of the online courses.

Recent Publications

Maxwell, A.E., M.P. Strager, T.A. Warner, C.A. Ramezan, A.N. Morgan, and C.E. Pauley, 2019. Large-area, high spatial resolution land cover mapping using random forests, GEOBIA, and NAIP orthophotography: findings and recommendations, *Remote Sensing*, 11(12) 1409 1-27. <u>https://doi.org/10.3390/rs11121409</u>.

Maxwell, A.E., and T.A. Warner, 2019. Is high spatial resolution DEM data necessary for mapping palustrine wetlands?, *International Journal of Remote Sensing*, 40(1): 118-137.

Maxwell, A.E., T.A. Warner, and F. Fang, 2018. Implementation of machine learning classification in remote sensing: an applied review, *International Journal of Remote Sensing*, 39(9): 2784-2817.

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WISCONSINVIEW 2018 - 2019



WISCONSINVIEW HISTORY AND SUCCESSES

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 The federal government and private sector have investigated Wisconsin. 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 20,500 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 satellite image of the Fox River, Green Bay, and the Door County peninsula.



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WISCONSINVIEWVIEW 2018-2019 ACTIVITIES

Flood Mapping with Satellite Imagery

WisconsinView is helping researchers who are collaborating in Wisconsin and Virginia to detect and map flooding with satellite imagery using the Joint Polar Satellite System (JPSS).

WisconsinView is facilitating access to higher resolution satellite imagery from Landsat to help provide more detailed mapping and is providing a visualization platform called RealEarth[™] (see below) to make the mapping results more accessible to emergency managers and other decision makers.



WisconsinView director Sam Batzli teaches how satellite imagery is used for disaster response during a Technology Camp for high school students and teachers at the University of Wisconsin-Madison.

Data Visualization and Mobile Apps

WisconsinView leverages a data discovery and visualization platform called RealEarth[™] developed at the Space Science and Engineering Center at the University of Wisconsin-Madison to support outreach and collaboration efforts of scientists. A browser interface and mobile apps provide access to hundreds of near real-time, satellite-derived imagery products and related data. Free for iOS (left) and Android (right):





WisconsinView Principal Investigator: Sam Batzli, PhD Space Science & Engineering Center University of Wisconsin-Madison 608-263-3126 sabatzli@wisc.edu



This flood map represents flooded areas in yellow, orange and red. Researchers created it with data from satellite imagery. It is displayed in the RealEarthTM iOS App (see below).

Outreach and Education

WisconsinView participates in public outreach events on the University of Wisconsin-Madison campus to demonstrate the value and importance of satellite imagery and information for a variety of applications. These applications include crop health monitoring in agriculture, hazard detection and mapping for emergency management, corridor and right-of-way studies for utility companies, and many other uses.



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WYOMINGVIEW 2018 - 2019



WYOMINGVIEW HISTORY AND SUCCESSES

WyomingView was established in 2002 to promote remote sensing science, technology and applications in Wyoming. Over these years, WyView has successfully conducted educational outreach, data distribution, and applied research activities:

- Applied research projects that include WyView partners (federal and state agencies) and agricultural producers for mapping natural resources, croplands, and wildfires.
- Train future workforce in image processing and information extraction by completing projects involving remotely sensed data.
- Targeted outreach activities in Laramie area schools (grades 2 – 8) to integrate remotely sensed data in the classrooms.
- Teach pre-conference workshops on Landsat Collections & Analysis Ready Data to GIS professionals
- Visit <u>www.uwyo.edu/wyview</u> for complete details.



Identifying WY waterbodies in the word puzzle (2nd grade students).

"Thank you so much for coming to ... present information on the water cycle, water pollution and conserving water. The topics were of high interest to our students ... hey really like the satellite pictures. These pictures are a great tool to show visuals..."

Stacy Hoffer, 2nd grade teacher

WyView has contributed to AmericaView program by serving on its board, and leading in few efforts to showcase AmericaView in national conferences. Wyview PI has organized three panels in ASPRS (2014), and Pecora (2017 and 2019) to highlight the importance of Landsat data for research and teaching.

WyView has contributed to disaster response activities through the Intl. Charter on Disasters by serving as Project Manager for two events.



Connor Elbert (above), WyView intern presenting the findings from his crop growth research using Landsat data. WyView PI, Sivanpillai (bottom), talked about tracking changes in waterbodies using satellite images to 2nd graders in a Laramie school.



A highlight article on integrating Landsat data in sixth grade science curricula was published in Photogrammetric Engineering & Remote Sensing 81(6): 425-431. 2015.

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WYOMINGVIEW 2018 - 2019 ACTIVITIES

I. Educational Outreach activities:

- Demonstrated environmental remote sensing applications to *325 students* in 2nd, 5th and 6th grades in 4 Laramie schools.
- Taught remote sensing concepts (reflection) to 225 eighth graders in Laramie Middle School (LMS). Students also completed a hands-on activity using ALTA Spectrometer.
- Taught two, ½ day workshops on Landsat Collections and Analysis Ready Data to 10 participants as part of the GIS in the Rockies Conference held in Denver, CO (Sept. 16, 2019).
- Published a peer-reviewed article in Science Activities (2019 56(1):19-26), describing the educational activities conducted in the 8th grade classrooms (LMS). Article DOI: 10.1080/00368121.2019.1638746.

"Thank you again for coming into our class and sharing ... satellite images with us! It was nice having access to those images and made a bigger impact understanding of events..." – Ms. Petty and Mr. Bauman, 6th grade teachers



WyView intern Jacob Disney, processed Landsat data for 6 years starting from 2010 to track vegetation changes in his parent's 40 acre ranch in NE WY. Vegetation pattern extracted from the images matched the management practices implemented in this field.

Applied Research: b) Rapid Flood mapping

• Trained 2 interns, Ela Piskorski and Kevin Jacobs on rapid flood mapping methods using pre- and post-flood satellite data.

III. Emergency Response

- WyView PI served as the Project Manager for the 2018 Woosley Fire in California (Activation ID: 591).
- As a part of the response, 11 UW student volunteers received training in processing pre- and post-fire satellite images, and generating burn severity maps. In addition to generating the fire maps, students mapped daily changes in the direction of the smoke plumes from MODIS and VIIRS images provided by WisconsinView.



UW students Magali Romanet & Morgan Elsom . analyze the smoke plumes from the Woosley Fire.

www.	http://www.uwyo.edu/wyview



Sixth graders @ Laramie Middle School saw how human actions can influence and shape their environment, and how changes occurring in one corner of the world can impact other areas (credit: Ms. Petty, 2019)

II. Applied Research: a) Rangeland vegetation monitoring

• Trained 2 interns to process Landsat data for rangeland vegetation monitoring in NE Wyoming. Tyler Jones, Rangeland Ecology major, assessed the effect of reseeding with cover crops in his parent's ranch using before- and after Landsat images. Jacob Disney, also Rangeland Ecology major, processed multi-year Landsat images to track changes resulting from improvements made to a 40-acre property owned by his parents. Both interns shared the findings with their parents for validation & obtained testimonies.

"The satellite image maps have shared some valuable information concerning our 40 acres. The colored images help to confirm what we have been hoping to achieve on this acreage... We would never have had the opportunity to access this imagery if the university hadn't been able to share it. Being a small producer makes it difficult to financially do a study such as this." - Ms. Karen Disney

Visit http://wyomingview.blogspot.com/p/interns.html for further details and testimonies from WY interns.

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