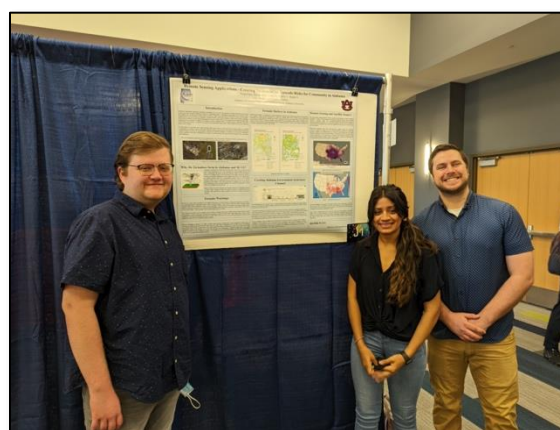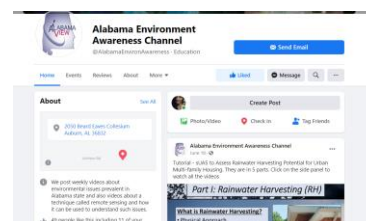# ALABAMAVIEW
2021 - 2022

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ALABAMAVIEW 2021 - 2022 ACTIVITIES

- The major activity for 2021-2022 was the continued development of Alabama Environmental Awareness YouTube channel (https://www.youtube.com/channel/UC43YJ2HG3flUmHGvp5Ldu1Q). This program promotes the awareness and application of Remote Sensing in the state of Alabama. This reporting period our students produced the following videos:
  - Alabama Wetland Protection
  - Water Quality PSA
  - Tornado Mapping in Alabama
  - Urban Expansion - Parts 1 and 2
- The YouTube channel, Facebook group and Instagram was shared with groups such as:
  - the Greater Birmingham Alliance to Stop Pollution (GASP) - https://gaspgroup.org/
  - Little USA Solar Farm - https://www.littleusa.solar/
  - RePicture - https://www.repicture.com/students
  - Alabama Interfaith Power and Light: https://www.alabamaipl.org/
  - Southeast Climate and Energy Network: https://www.scen-us.org/
- One of the most important parts of this project has involves the training of graduate and undergraduate students in utilizing RS methods for environmental applications. The Directors of AlabamaView meet with students on a weekly basis to discuss ideas and work progress. Students we have trained this year include:
  - Nazifa Tasneem
  - Pooja Patel
  - Austin Barnhard
  - Blake Phillips
  - Byrd Alexandra

A facebook page was maintained to promote the work, activities, and videos created for Alabamaview. All the videos are promoted through this page: https://www.facebook.com/AlabamaEnvironAwareness/?view_public_for=100846665005207 to reach out to many. The page is also shared with Alabama citizens so they know about Alabama environment and how remote sensing can be used to assess and evaluate various aspects of Alabama's environment.

Pooja Patel presenting at undergraduate symposium

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BENEFITS TO ALABAMA

The videos are created to raise awareness among Alabama citizens about the environment and how RS can be used to access, evaluate, and communicate such information. Research using Auburn library resources, google scholar and google search were conducted to find topics and relevant information. Scripts were created and needed RS analysis were conducted. Required logos and graphs were created using Adobe illustrator and PowerPoint. After the audio was recorded for the script, the video was stitched together using Premiere Pro. A few examples of videos include:

The **Alabama Wetland Protection** video provides an overview of how wetlands provide ecosystem services to the state of Alabama and how using Remote Sensing and USGS NAIP imagery can be used as an effective method of mapping wetlands. Being able to monitor available wetlands and water resources helps with resource management practices for a sustainable future.

Another video highlights the use of Remote sensing to **Estimate Potential Solar Power**. Alabama has a huge potential for solar power generation, but Alabama's available policies and programs are not favorable to utilize this potentiality of solar power. This video created – Solar power potential in Alabama - can help the Alabama resource managers to understand and then use it to promote solar power generation to the citizens and the policy maker.
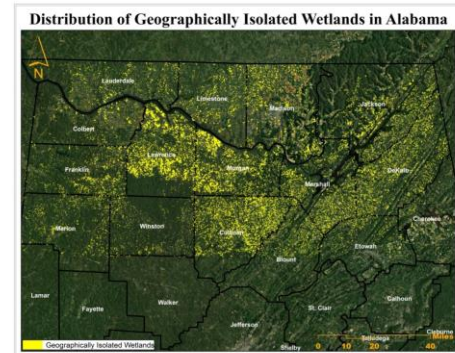
Geographically Isolated Wetlands mapped with Remote Sensing and USGS NAIP Imagery
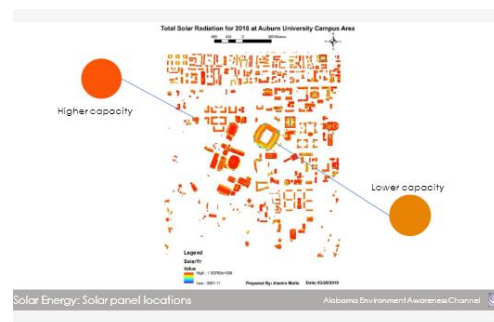
Solar Power Potential

ALABAMAVIEW CONSORTIUM MEMBERSHIP

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ALASKAVIEW 2021 - 2022 ACTIVITIES

AlaskaView updated two open access online introductory courses: 1) GIS Foundations and 2) Remote Sensing of Wildfires (RSW) geared toward students and professional beginners in geospatial field. This updated courses are running on **edX.org** (a global nonprofit online education and learning platform) since August 9, 2022. The courses are self-paced (consisting of video lectures, illustrations, interactive exercises, and quizzes).
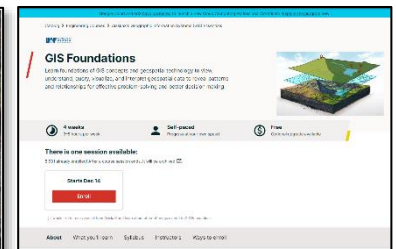
Goal: Introduce GIS and remote sensing science and applications through natural resources and wildfire applications—a problem that is worsening with climate warming and best addressed using geospatial science.

Map showing GIS Foundations learner locations.

Course instructors surveying wildfire burn severity and shooting footage for the course.

GIS Foundations course about page

This activity meets the objective 4 of the USGS/NLI "*developing online educational materials that are immediately actionable by teachers or students with a minimal implementation curve*".

Outreach: In 2022, we launched '**Alaska As Art**' initiative:

• to increase awareness of satellite earth observation in education, research and societal well-being
• to increase awareness of the climatic and geologic processes that continue to shape the Alaska's dynamic landforms and the climate change effects

Consortium Development: Collaborated with UAF eCamups, UAF Institute of Agriculture, Natural Resources and Extension, edX.org, NSF Alaska EPSCoR program, and U.S. Fish and Wildlife Service.

ALASKAVIEW CONSORTIUM MEMBERSHIP

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

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

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BENEFITS TO ALASKAVIEW

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

Enrollment in edX courses: Currently, we are offering 4 open access courses on edX platform. These courses have been benefitting Alaskans and global learners alike. The learners include Alaskan university students and faculty, state and tribal agencies workforce.

Total enrollment 18,339 (as of Dec. 2022) from 179 countries. Among the top 10 enrollment countries 5 are developing countries (India, Nigeria, Pakistan, Egypt, and Turkey).

GIS Foundations Learner Statistics: Female: 38%; Male: 61%.

Learners education level: 14% high school diploma or less; 51% college degree; 33% advanced degree.

Student Support and Research: Anushree Badola, Ph.D. student, received salary support for the edX course development as a co-instructor and for graduate research. She published a paper in the Int. J. of App. Ear. Obs. and Geoinformation; and presented at 2021 AGU Fall Meeting and at the 16th Int. Circumpolar Remote Sensing Symposium.

We offered $1,000 fellowship to Lora May, a MS student, conducting research on snow evolution in Caribou-Poker Creeks Research Watershed, interior Alaska (with support from a NASA SnowEX project).

Public Outreach: In 2022 AKView participated in 2 events organized by University of Alaska Fairbanks:
- 2022 Arctic Fest held at Pioneer Park, Fairbanks, Alaska
- 2022 Arctic Research Open House; exhibit included: a poster on forest health research, Landsat board games, NASA posters, and USGS Landsat Science booklets.


*Image as art displays at the 2022 Arctic Fest held at Pioneer Park, Fairbanks, Alaska. **Arctic Fest** is an annual festival that features the arts, sciences, and Indigenous cultural and knowledge systems, all focused on changing environment.*

The K-12 students and the general public participants of 2022 Arctic Research Open House.

Below pictures were taken during 2019 Science Potpourri event, EOD celebration, and ASRA student visit to EPSCoR VisSpace at University of Alaska Fairbanks campus.
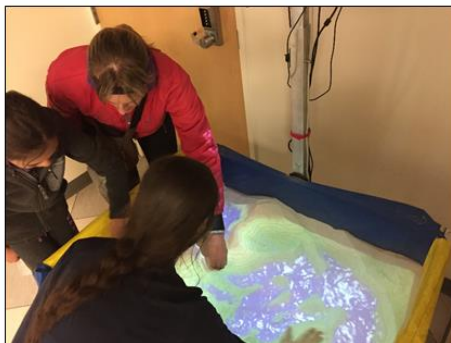
These activities meet the objectives 2 and 4 of NLRSEORA 2018 grant: "establishing strategic partnerships to develop and deploy remote sensing applications through collaborations involving university research teams and K-12 schools" and "developing materials for an educational and training workshop".

AlaskaView Principal Investigator:

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ARKANSASVIEW 2021 - 2022 ACTIVITIES

- In 2021 – 2022, ArkansasView focused on applied remote sensing to study geohazards in Arkansas. The StateView conducted a cost-effective Synthetic Aperture Radar Interferometry (InSAR) study for monitoring and modeling the spatial and the temporal patterns of crustal deformation to characterize its underlying causes in Central Arkansas. The atmospheric phase-delay was eliminated by applying a sequence of temporal and spatial filtering, and the digital elevation data acquired by the Shuttle Radar Topography Mission (SRTM) of 1-arc sec spatial resolution were used to model and remove the topographic contribution from the interferometric phase. The study area has moderate topography in some locations; thus, the altitude-dependent atmospheric phase delay was modeled and subtracted from the interferometric phase, as well, to produce high precise crustal deformation maps.

- This multi-sensor InSAR study included data acquired with different radar geometries at the C- and L-bands. C-band data have a short wavelength, which enabled detection of slow Earth's surface motions in major cities due to natural and anthropogenic processes. L-band polarimetric data have a longer wavelength, which make them less sensitive to the atmospheric variations compared to C-band data. Due to their relatively long wavelength, L-band data captured details of deformation in densely vegetated areas. The use of L-band data to monitor crustal deformation in Arkansas demonstrates the potential for NASA's NISAR planned L-/S-band mission to monitor Earth's surface motions in densely vegetated areas.

- The StateView created two StoryMaps: one focused on "Sensors" (https://tinyurl.com/mswp2mw6) and the other one highlighted the "Remote Sensing Research" (https://tinyurl.com/bdhujpk4) within ArkansasView, which allows sharing experience with all other StateViews participating in the AmericaView consortium.

- The ArkansasView director, Dr. Mohamed Aly, co-chaired the Geological Society of America (GSA) 2021 NC/SC Joint Section Meeting and served as an at-large faculty advisor to the Geosciences GeoHog Conference, held at the University of Arkansas in 2022.
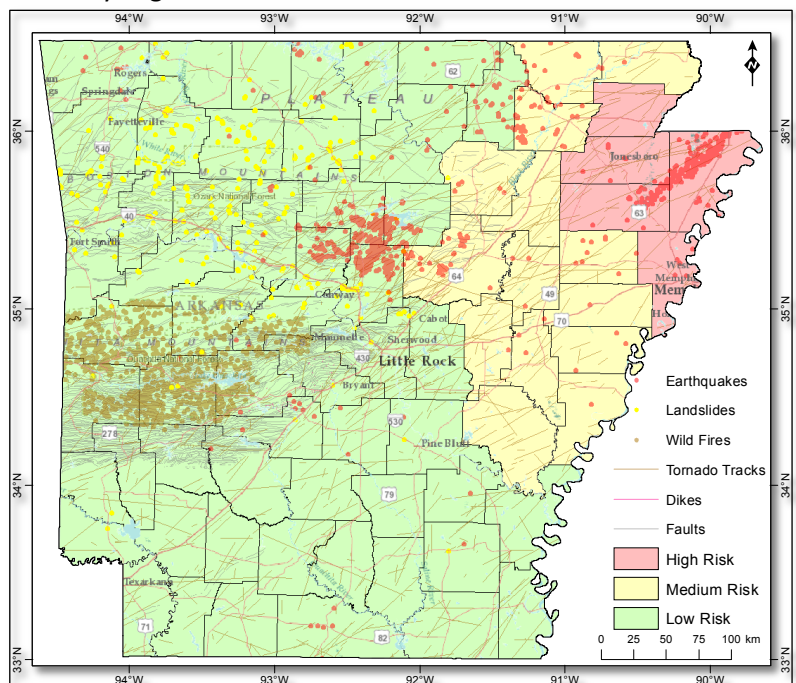

Location map of major features and geohazards in Arkansas. It shows rates of seismic risk across the state, estimated by USGS based on only earthquake activity in the New Madrid Fault Zone. Small red dots represent recent earthquakes. The major fault systems, dikes, tracks of recent tornados, and locations of documented active landslides and common wildfire events are also represented as indicated in the legend.

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BENEFITS TO ARKANSASVIEW

- This pioneer interferometric study addressed the contemporary strain accumulation due to recent seismic activities and investigated ground stability in Little Rock and its surroundings; therefore, the study outcomes are anticipated to help the decision-makers in determining if remedial actions should be taken to prevent broad structural damage in the study area. Furthermore, the study outcomes will support the sustainable development in Arkansas, which demonstrates the value of geodetic research for societal benefits.

- Three ArkansasView graduate students at the University of Arkansas were trained as summer interns: two of them (Rasool Vahid, a PhD student in Environmental Dynamics, and Mahmud Afroz, an MS student in Geography) were partially funded by ArkansasView and had the opportunity to promote their research and remote sensing skills. The third graduate student (Travis Tipton, an MS student in Geology) had an internship fully sponsored by the Arkansas Geological Survey (AGS) to study active landslides in Arkansas. His summer internship was supervised by Martha Kopper, the Geohazard Section Supervisor at AGS. This extended the collaboration ties with AGS and provided Travis with the opportunity to continue studying active landslides in his MS degree using advanced machine learning techniques under the supervision of Dr. Mohamed Aly.

- The StateView PI, Dr. Aly, taught a couple of online Global Campus classes focused on geospatial technologies, which allowed him to communicate his remote sensing experience to a boarder range of off-campus students from the industry and other academic institutions across the entire State of Arkansas. Such courses help prepare the next generation of researchers, scientists, and educators.

Ground motions (color fringes) in central Arkansas and its surroundings draped over the amplitude image (grey scale). Each color cycle indicates 12 cm of displacement in the satellite line-of-sight (LOS) over the three-year period of this study.
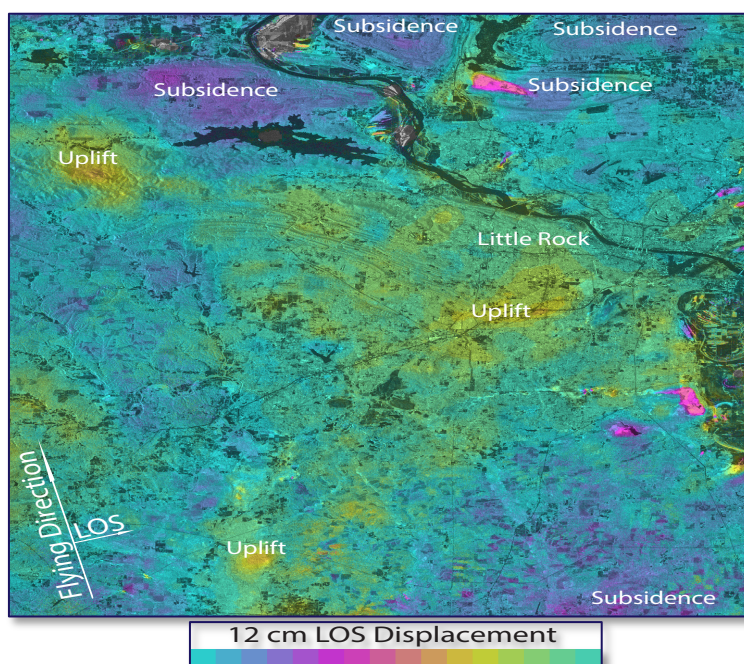
ARKANSASVIEW CONSORTIUM MEMBERSHIP

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

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## CALIFORNIAVIEW 2021-2022 ACTIVITIES

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. In GY 2021, CaliforniaView focused on developing and promoting the synergistic use of the remote sensing imagery from different sensors to inform and enable adaptive management at finer scales. Other activities have also advanced remote sensing education across multiple disciplines.
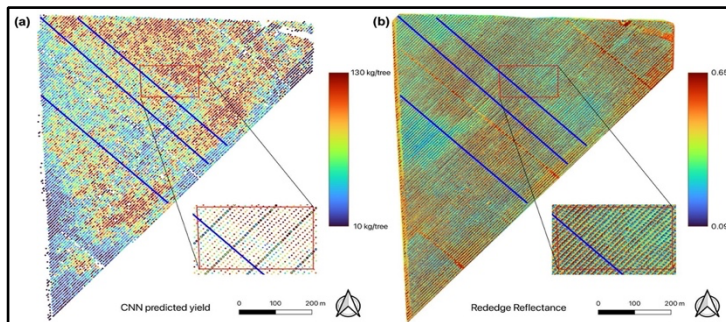
(a) CNN model predicted within-field yield distributions and (b) red edge reflectance from CERES multispectral imagery.

Advancing near real-time tree crop monitoring with multi-scale data fusion and deep learning. CaliforniaView trained a master student to develop feature level fusion to integrate NAIP and UAV super high spatial resolution imagery with Planet satellite imagery for almond tree monitoring and yield estimation. A Convolutional Neural Network model was developed to take the multi-spectral imagery directly as input for almond fresh weight estimation. This study demonstrates the power of deep learning to optimize data-driven resource management.

Improved fuel characterization within the Wildland-Urban Interface (WUI) areas. CaliforniaView supported a pilot study in Sonoma county to assess the existing maps of fuel types and structures. Aerial lidar data was used to generate percentage tree cover and tree height products across the whole County at ~1m resolution. The Lidar based fuels maps captured well the fine scale composition and structure of fuels in the heterogeneous WUI landscapes.
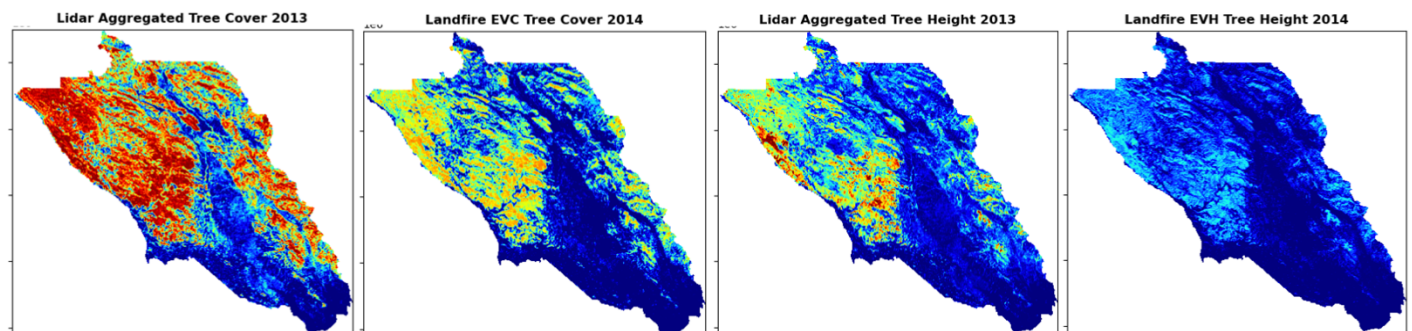
Public engagement with remote sensing technology. CaliforniaView hosted exhibitions at the annual University Open House (Picnic Day) with more than 30,000 visitors. One booth was set up to display and introduce drone platforms and cameras. Example UAV applications were showcased by poster presentations. Another photo booth attracted many visitors to take thermal photos with plants and foil hats, demonstrating the concept of thermal signals.

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BENEFITS TO CALIFORNIA

California's landscape is ecologically and climatological diverse, vulnerable to warming, drought, and wildfires. As a most productive agricultural state, it also faces the challenge of minimizing water and N use while maximizing the yield. CaliforniaView has been contributing to cost-effective monitoring across scales with remote sensing technology and facilitate data-driven adaptive management for sustainable natural resource and agriculture. Our research, education and outreach activities have benefited a broad range of stakeholders by

- Demonstrating and providing support to state agencies and the specialty crop industry on satellite and UAV remote sensing technology and AI.

- Training students from multiple disciplines via targeted curriculum development, mini project mentoring, and workshops to equip next generation workforce with remote sensing foundation and tools.

- Educating broader audience about the benefits and recent advancements of remote sensing and AI applications.

- Showcasing and sharing multi-scale remote sensing framework and workflow for upscaling drone-based sensing with high resolution satellite imagery, to support better-informed decision making across scales under a changing climate.

AI enabled advancement in agricultural monitoring and prediction with remote sensing observations

Yufang Jin
Remote Sensing and Ecosystem Change Lab
Dept. of Land, Air and Water Resources, UC Davis

Remote Sensing with LP DAAC:
Data Assets and Cloud Processing

Part 1. Introduction to NASA's remote sensing datasets and tools for data discovery   (May 17: 12pm - 2pm PDT)

Part 2. Introduction to cloud-based remote sensing data access and processing with Python   (May 20: 10am - 12pm PDT)

CALIFORNIAVIEW CONSORTIUM MEMBERSHIP

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

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COLORADOVIEW 2021 - 2022 ACTIVITIES

Evapotranspiration (ET) is a measurement of total water moved from the land surface to the atmosphere. As such, ET may serve as an indicator of the ecosystem's health, hydrologic cycle, agricultural processes, and water dynamics in the area of interest. In Colorado, the ET measurements can be used for vegetation health and drought indices as well as irrigation schedules and agriculture planning.

In GY21, ColoradoView continued the HIA on the ET retrieval and its pattern analysis with this year's focus on the spatial pattern of ET in Colorado. ColoradoView scientists and a student intern contribute to the work. The USGS Landsat Analysis Ready Data (ARD) ET dataset between 2000 and 2018 was utilized in the work. The results showed that the agriculture land has the highest ET values in the easily identifiable crop circles throughout the eastern region of Colorado. In the urbanized areas the lowest ET values are seen due to manmade landcover like asphalt streets, concrete and building roofs. The eastern grasslands return ET values greater than the western mountainous regions in the spring and summer months. The mountains are mostly masked during fall, winter, and early spring due to snow cover. There is clear difference in ET values from the southwestern counties to the northwestern counties due to multiple factors like weather patterns, land cover types and climate change.


Screenshot of a Google Colab notebook for extracting the Evapotranspiration (ET) and quality assurance layers from USGS Landsat Analysis Ready Data.
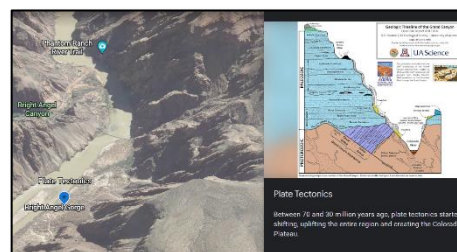

The 2022 AmericaView Annual Meeting hosted by ColoradoView at Colorado State University. The meeting strengthened collaborative work on AmericaView initiatives and promoted the exchange of remote sensing expertise on research, education, and outreach. An Outstanding Service Award was given to Rita Deike in recognition and acknowledgement of her support to AmericaView and furthering earth observation education.

Another student intern project explored the wildfire impacts on solar UV radiation at the ground level. The student prepared the narrowband UV direct and diffuse irradiances at 7 UVA/UVB channels provided by the USDA UV-B Monitoring and Research Program, covering the complex fires occurred in 2020 and mild wildfires in 2016. As expected, a more significant reduction in direct irradiance was found in the 2020 wildfires especially in the lower UV wavelengths. The contribution of diffuse (scattered) irradiance to the total was higher during the day with wildfires compared with the smoke-free days.
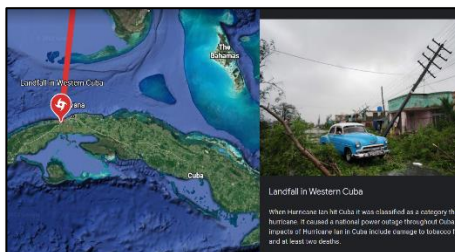
Screenshot of student's (Layna Webb) Google Earth Project on the Hurricane Ian.

Screenshot of student's (Margaret Thompson) Google Earth Project on the Grand Canyon tour.

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BENEFITS TO COLORADO

- Provided the student interns the opportunity to engage in real research projects, through which they learned
  - processing of Remote Sensing imagery using Google Earth Engine scripts;
  - programming in a team environment;
  - statistical techniques; and
  - how to write summary reports / present findings for scientific investigations.
- Analyzed temporal and spatial patterns of ET in Colorado, providing researchers, policy makers, and stakeholders with the water stress condition in Colorado for the past two decades.
- The observed relative increase of the diffuse solar irradiance across the UVA/UVB spectrum during the wildfires may contribute to the increased formation of ozone and decreased air quality in Colorado.
- Promoted Remote Sensing (RS) education through lectures (Physical Geography) at Colorado State University. The lecture includes several projects. The project on Google Earth teaches students a powerful way to present stories on any topic that involves geophysical elements including RS images. The project on assembling a weather station allows student to review and understand what they learned about weather, climate, solar energy, etc. and to see their measurements' real-world impact – improving weather forecast accuracy specific to their local areas.

Student intern Joey Paulson presented the wildfire/smoke UV effects at a SPIE conference.

ColoradoView scientist Maosi Chen gave a lecture on Google Earth at Colorado State University.

COLORADOVIEW CONSORTIUM MEMBERSHIP

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ColoradoView Principal Investigator: Dr. Wei Gao

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CONNECTICUTVIEW 2021 - 2022 ACTIVITIES

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 academic and outreach activities targeted at the education of K - 12 students, undergraduate students, graduate students, and the public. In addition, remote sensing technology is used to develop data and information that address specific issues within Connecticut.

Invasive Plant Monitoring: During the project year of 2021-2022, ConnecticutView launched a new research initiative focused on invasive plant distribution mapping in Connecticut forests' understory. Among other anthropogenic and natural disturbances, Connecticut forests are being dramatically exposed to the expansion of invasive plant species. Increased temperatures due to climate change and forest disturbances, such as Gypsy moth caterpillar damage provide conditions more conducive to spread and survivability for other invasive plants. The 2020 Forest Action Plan from the Connecticut Department of Energy and Environmental Protection has identified taking measures to control and manage invasive plants in Connecticut forests as a key priority. Among the list of invasive plant species, two invasive plant species significantly contribute to the degradation of habitat: Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*). In the absence of predation and disease in their introduced environments, these two invasive species present serious threats to forest ecosystem health and biodiversity. Japanese barberry and multiflora rose can damage the structure of native plant communities, prevent native seedling regeneration, and diminish the overall productive capacity of the forest, depreciates native songbird habitat, *and* pose risk on human health. We are in the process of analyzing Sentinel-2 timeseries imagery to identify probable phenological windows to discern invasive understory from native plants and forest overstory.

The information on project scope and preliminary results of the multi-temporal analysis is being shared via an ESRI Story Map accessible through the ConnecticutView website.
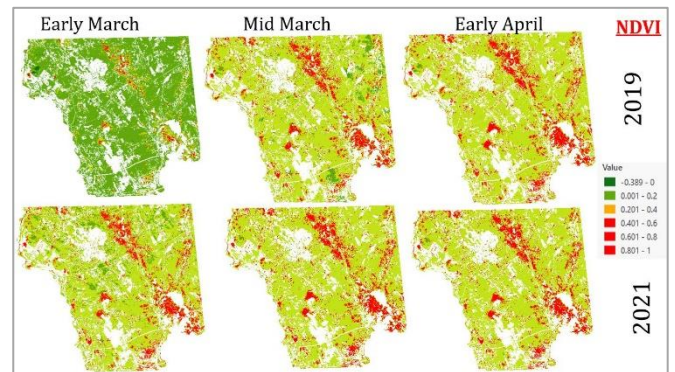
Examples for forest understory infested with (A) Japanese Barberry (B) multi-flora rose. We are utilizing Town of Mansfield and UConn Forest (C) as one of the candidate study sites to investigate Sentinel-2 imagery derived NDVI timeseries This area is heavily infested with both Japanese barbery and multiflora rose. Preliminary findings suggest that mid-March to early-April NDVI could be a probable window to identify invasive understory.
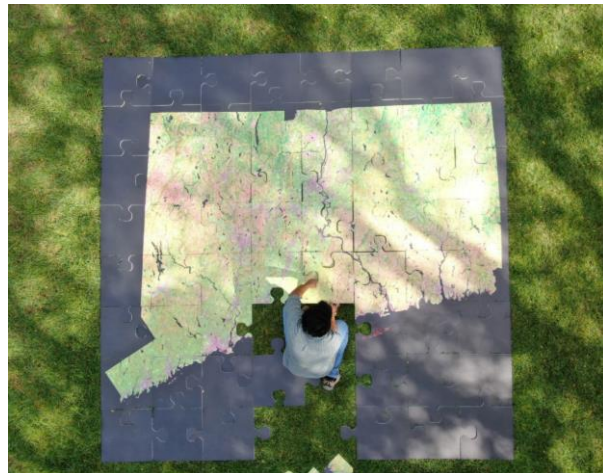
Connecticut Invasive Plant StoryMap. Study results are being incorporated to the StoryMap as the research progresses.

BENEFITS TO CONNECTICUT

While small in area, Connecticut is a diverse state. Connecticut has an abundance of forest, numerous water bodies, and the state borders the Long Island Sound, an ecologically important estuary into which a majority of Connecticut watersheds drain. Connecticut also has a high population density with its associated urban and suburban development, road networks, and golf courses. As such, remote sensing technology can serve as a valuable tool to assist in the monitoring and management of the diverse Connecticut landscape and help educate the citizens on the impacts of human activities on the earth, both locally and globally. Imagery can also serve to highlight the beauty of the planet on which we live.

Setting up the floor puzzle in front of the UConn College of Agriculture, Health and Natural Resources.

- Provide remote sensing based informational and data products that address issues specific to Connecticut to improve monitoring and management of the landscape.
- Expose K-12 students to remote sensing technology and provide educational outreach programs and materials.
- Provide quality imagery through "Our Earth Revealed" satellite image exhibit to expose the public to local and global landscapes.

We have printed more art pieces capturing different landscapes to showcase in local public libraries as part of Earth as Art galleries

CONNECTICUTVIEW CONSORTIUM MEMBERSHIP

ConnecticutView collaborates with various partners on a per-project basis. Current partners include:

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DELAWAREVIEW 2021 - 2022 ACTIVITIES

DelawareView Principal Investigator Dr. Tracy DeLiberty and the Delaware Center of Education Director Dr. Mary Schorse taught the state's first dual enrollment course in Geospatial Science and Technology at Newark High School (NHS). NHS is one of the most diverse public high schools in the state; the five students enrolled in this initial geospatial course offering represented the school's socio-economic and ethnic diversity. Three of the students earned University of Delaware credits for their work. The course introduced students to the geospatial technologies of GIS, GPS, and remote sensing using mini-lectures to illustrate core principles, and hands-on activities to solidify concepts. Students completed self-paced lessons on collecting and mapping geographic data, accessing online data layers, creating maps, and conducting spatial analysis to solve problems spatially. Students became proficient in both ArcGIS Online and ArcGIS Pro. NHS provided each student with a dedicated laptop and the DE GeoEducation Committee provided textbooks. Students were exposed to practical applications of these technologies and geospatial career paths through selected online videos, Geography in the News analyses, and interactions with guest lectures.

Students learning to collect GPS data.

Students setting up a survey instrument.

Students taking a "selfie" while learning to fly a drone.

Taking a break from class and playing EOD 2021 Landsat poster game.

Delaware Middle/High School Storymap Competition Award Ceremony.

With coaching and mentoring from Drs. DeLiberty and Schorse, the dual enrollment students submitted a storymap to the ESRI 2022 ArcGIS School Competition. Their storymaps included topics of:

Delaware's Poultry Industry
The Unspoken Economic Powerhouse
Alejandro Lobo
April 25, 2022

Delaware State Bug
A look into Delaware's ladybug
Mariam Samake
April 27, 2022

The History of Peach Trees in Delaware
How did peaches affect Delaware?
Wendy Santana M
April 25, 2022

Delaware Secretary of Education Mark Holodick held an award ceremony for the students and families at the State of Delaware Cabinet office.

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BENEFITS TO DELAWAREVIEW

DelawareView dedicates a significant amount of time to Earth observation education and advancing the use of digital maps in K-12 classrooms. Strategic partnerships with Delaware's education and GeoEducation communities have been instrumental in getting these initiatives off the ground.

- **Forming a Partnership with DE Department of Education (DDOE)**: DDOE and the Delaware GeoEducation Committee continued their partnership to host the annual MS/HS Storymap competition which has grown each year in awareness and participation.
- **Connecting with K-12 Administrators and School Councilors:** The NHS dual enrollment course provided an opening for course instructors to educate building leadership and school guidance counselors about the breadth of geospatial career options and the growing workplace demand for spatial analysis skillsets.
- **Educating K-12 Teachers:** In partnership with the Social Studies Coalition of DE, and the DE Teachers of Science, K-12 teachers are being trained on the use of digital mapping and satellite imagery in the classroom. Training is provided to select teacher cohorts through virtual professional learning workshops.
- **Educating K-12 Students:** Direct outreach to students, through formal courses as well as through extra-curricular clubs and special events, classroom visits, and summer camps raised students' awareness of the role played by geospatial technologies in monitoring our planet.

Showcasing imagery use in environmentally-oriented careers at the Delaware YES! Summit.

Geography Awareness Week classroom visits
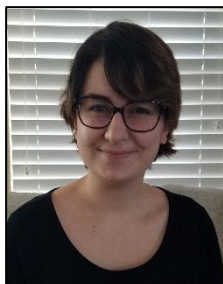
DELAWAREVIEW CONSORTIUM MEMBERSHIP

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Delaware View PI

Mary Schorse
Delaware Center for
Geographic Education Director

Environmental Science Undergraduate Students

Faith Brown

Alexis Cervantes

GEORGIAVIEW 2021 - 2022 ACTIVITIES

GeorgiaView's activities are highlighted by two major geospatial projects. One is the publication of Georgia Landcover Image Atlas Volume IV: Rivers and Imperviousness to outreach regional authorities with the atlas. It focuses on the change of imperviousness levels caused by human impacts. A total of 191 maps were designed using the boundaries of 159 counties, 14 U.S. congressional districts, and 12 regional commissions. The atlas used the imperviousness datasets from the U.S. Geological Survey, the Landsat satellite imagery, and the Cropland Data Layer dataset from the U.S. Department of Agriculture. The atlas was delivered to 116 local and regional offices in Georgia including the Georgia governor's office, U.S. congressional offices, regional commissions, Georgia Department of Natural Resources, water authorities, and county public works. The atlas is also freely available in the PDF eBook format at the GeorgiaView website, https://gaview.org.

Earth Observation Day Event. Local high school students and teachers joined the event and various experiments and activities were explored.
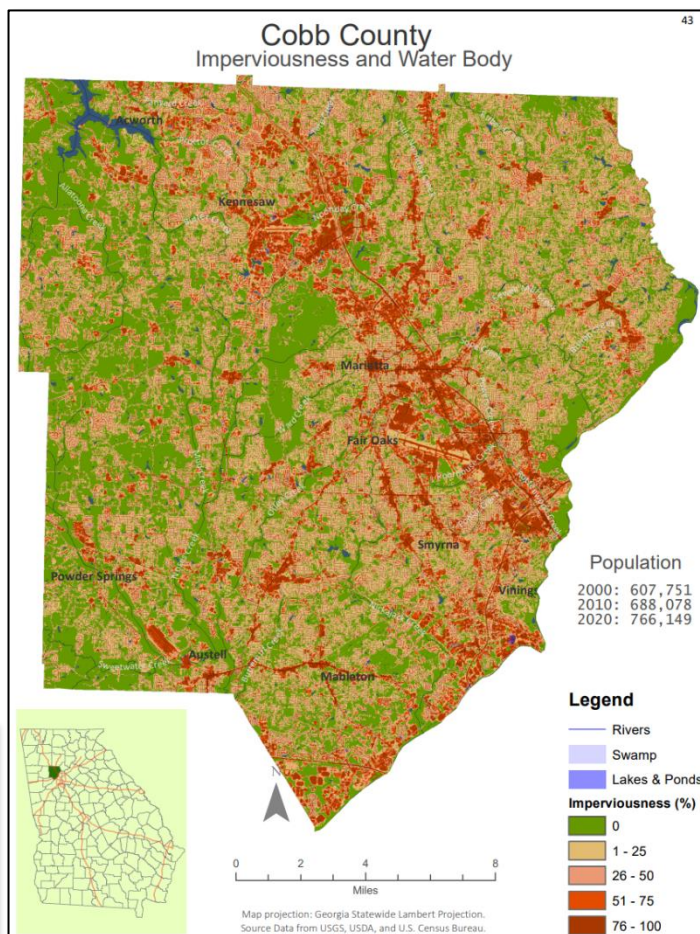
Rivers and Imperviousness (Cobb County example). Increasing imperviousness and climatic anomalies may cause devastating floodings. An example is the 2009 flooding of the Sweetwater Creek that overflew I-20, engulfed the Six Flags theme park, and claimed ten lives.

The second project is the Earth Observation Day (EOD) event on August 29, 2022. Carrollton High School juniors and seniors (31 in total) and 4 teachers joined the event. Students explored environmental science labs and geospatial technologies, offered by ten University of West Georgia students and faculty members. The EOD event was also featured at Times Georgian, a local newspaper (https://tinyurl.com/bde63fe5).

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GeorgiaView has brought broad impacts to the State of Georgia by promoting geospatial technologies, educating science, and helping decision making about natural resources. The following are testimonials about the Georgia image atlas and the Earth Observation Day event.

"Thanks so much for thinking of us. This atlas provides a great resource and actually will assist us as we attempt to map our waterway locations and entrance points to assist us when we may be called for rescues on our waterways, not to mention the development applications that this resource provides." Glen Polk, Fire Chief & Homeland Security Director, Spalding County.

"I wanted to take a moment to Thank You for sending the Georgia Land Cover Image Atlas to me. I have never heard of this atlas before but it will be a great resource for my office. Very informative contents." Becky Martin, Lamar County Emergency Management Agency.

"I didn't realize so many students go to UWG." "I am surprised that we are allowed to use expensive tools." "I like the small number of students to teacher." "Wow, no bells, I can come and go when I want?" "I can eat as much as I want?" "Teacher there trust students with equipment." " I don't feel like we are in Carrollton." Carrollton High School juniors and seniors.

"As a student myself in the geography degree program, I was ecstatic to assist in demonstrating to the next generation of college students advanced topics and emerging technologies during our Earth Observation Day." Sam Anderson, UWG undergraduate student assistant.

"I just wanted to let you know that I received the Landsat atlas – what an excellent document! I hope that our GIS department will be able to incorporate this into our system." Barry Lucas, Director, Forsyth County Water and Sewer.

Drone flight and imaging practice. A female high school junior flies a drone for the first time. August 29, 2022.

Water flow modeling during the EOD event at UWG. Students experimented various water flow scenarios. August 29, 2022.

GEORGIAVIEW CONSORTIUM MEMBERSHIP

University of North Georgia (Dahlonega)
Kennesaw State University
University of North Georgia (Gainesville)
Rotorworks
University of Georgia
Atlanta Regional Commission
Georgia State University
University of West Georgia
Georgia College
Georgia Southern University
Skidaway Institute of Oceanography

UNIVERSITY of WEST GEORGIA.
UNIVERSITY of NORTH GEORGIA
KENNESAW STATE UNIVERSITY
UNIVERSITY OF GEORGIA
ARC ATLANTA REGIONAL COMMISSION
Georgia State University
RotorWorks, LLC
GEORGIA COLLEGE
GEORGIA SOUTHERN UNIVERSITY
Skidaway Institute of Oceanography UNIVERSITY OF GEORGIA

Delivering Georgia Land Cover Image Atlas Volume 4 to 116 local offices and authorities. Dr. Rose and a student (Sam Anderson) help packaging.

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Georgia VIEW

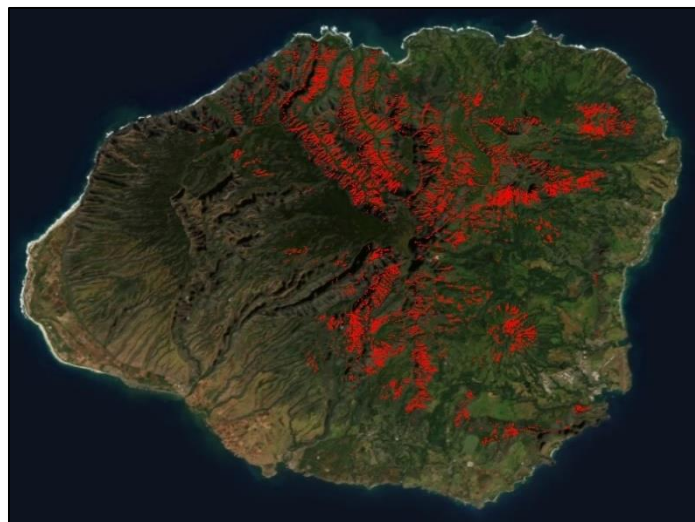https://gaview.org

HawaiiView 2021 - 2022 Activities

Our main HIA is to map Uluhe for the island of Lanai by collaborating with scientists from USGS Pacific Island Ecosystems Research Center and Pulama Lanai to develop reference datasets and using Landsat-8 cloud-free mosaics generated from GY19. We compared our Landsat-8 based classification with the one from WorldView-2. We further produced the first-ever statewide map of Uluhe by applying the Landsat-8 based model developed from Lanai to other islands.
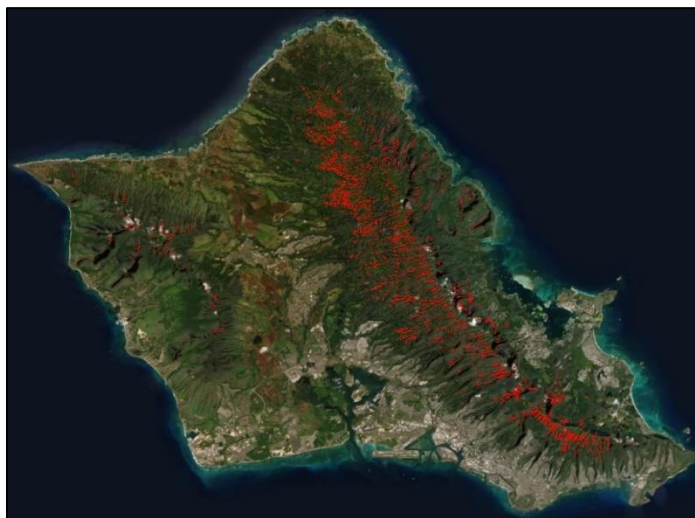
Uluhe in Honolulu County (Oahu island)

Uluhe in Hawaii County (Big Island)

Uluhe in Kauai County (Kauai island)

Uluhe in Maui County (Maui, Molokai, Lanai, etc. islands.)

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- Uluhe (*Dicranopteris linearis*) is a fern species that plays key roles in conserving Hawaii's ecosystems by 1) preventing invasive weeds from rapid establishment and promoting the growth of native trees such as ʻōhiʻa lehua (*Metrosideros polymorpha*), 2) stabilizing the soils in areas of steep slope and high rainfall, and 3) providing critical habitat for endemic animals such as the Hawaiian petrel, a federally listed endangered bird species. In recent decades, Uluhe has experienced dieback or retreat from stressors such as introduced insect feeding and plant invasion. It is critical to develop effective methods to map its spatial distribution and monitor the changes.

- With the Landsat-8 cloud-free mosaics generated from GY19, we produced the first-ever statewide map (https://hawaiiview.org/data/uluhel8/) of Uluhe.

- One master graduate student was trained and supported for mapping Uluhe using remotely sensed imagery.
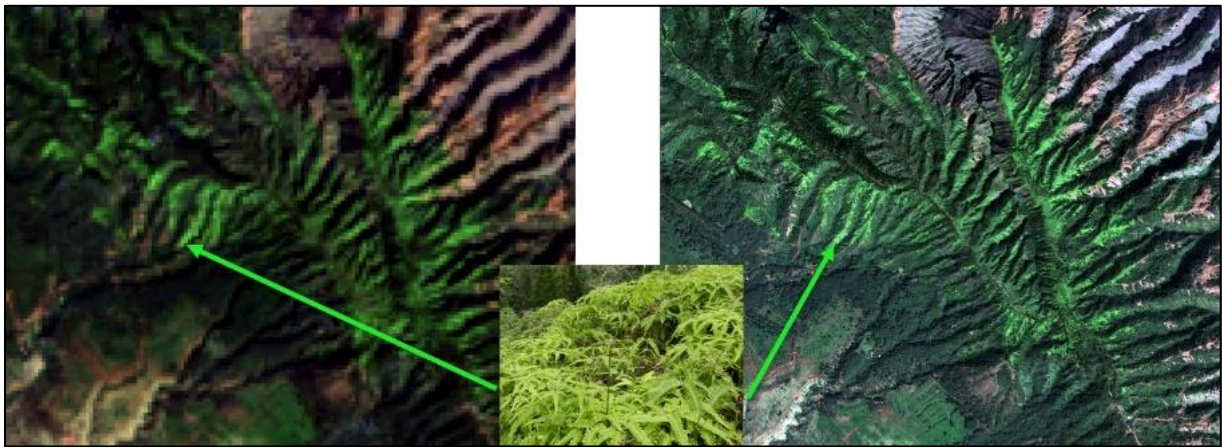
Uluhe's monotypic cover and vibrant green color stands out in Landsat-8 (Left) and WorldView (Right)

HAWAIIVIEW CONSORTIUM MEMBERSHIP

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

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https://bit.ly/3lOmoex

IDAHOVIEW 2021 - 2022 ACTIVITIES

Our IdahoView PI attended the Pecora 2022 conference and contributed to AmericaView's efforts in outreach and communication of remote sensing research and education. At Pecora, IdahoView also provided an oral presentation on our 2021-2022 HIA using LiDAR analysis to develop an algorithm to detect geohazards along transportation corridors. Railroad corridors in northern Idaho are subject to landslides, debris flows, and rock fall. This project is a collaborative effort with partners from Idaho Geological

AmericaView at Pecora 2022. Doug Ramsey from UtahView (left) and Donna Delparte from IdahoView (right).

Survey, Geoscientists at Idaho State University and an industry partner at Burlington Northern Santa Fe railway company. Movement along these railroad corridors have affected rail operations and emphasized the need for a detailed understanding of geologic hazards and slope dynamics in this region to prevent river corridor contamination from materials transported in rail cars. These geologic hazards have the potential to severely impact railroad assets, profitability, and public safety, particularly when hazardous materials are transported such as oil tanker railcars. Knowing where the conditions and slope characteristics are ideal for initiating these mass movements and where deposition is likely is important for installing mitigation measures. Object-based image analysis (OBIA) is a method of feature extraction at an object level involving multiresolution segmentation and the classification at an object level instead of a pixel level.

Oil tanker rail cars along the Kootenai River in northern Idaho, August 2021

In this study we used topographic parameters such as canopy height, slope, aspect, plan curvature, profile curvature, and flow accumulation derived from UAS LiDAR to develop expert system rulesets to classify rockfall, landslides and deposition areas across three study sites using OBIA. We created three classification rulesets for each site: landslide initiation areas, rockfall initiation areas, and deposition areas. With these expert-derived rulesets railroad companies can map these susceptible slopes when planning mitigation and adaptation strategies.

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The accuracy of our rulesets was determined by examining areas of high slide or fall initiation susceptibility and how they corresponded with areas of measured change from previous LiDAR data collected in 2017. Overall, our models identified areas of rockfall initiation, landslide initiation, and deposition susceptibility that corresponded with an average of 69% of significant change between our study sites. Over time we expect to improve our rulesets through monitoring movements longterm. All rulesets were reviewed by a geohazards expert. Expert based susceptibility modeling relies on the knowledge of the geohazard expert to review criteria influencing rockfall, landslide and deposition potential especially in areas with limited records on mass movement frequency.

Rockfall and landslide susceptibility map

Engaging Students in STEM Activities

It is vital to Idaho's economy to educate a qualified workforce in Science, Technology, Engineering, and Mathematics (STEM) professions. Industries that require STEM are expected to increase in Idaho and across the nation. IdahoView actively engages graduate and undergraduate students in field data collection and the hands-on use of advanced sensors to address issues that impact Idaho's natural resources to aid decision making. Both undergraduate and graduate students are encouraged to participate in the research and communication of results to stakeholders through one-on-one interactions, posters and oral presentations.

MS GIS student Dana Drinkall presenting her LiDAR research at a 3 Minute thesis event at ISU (Fall 2021)

IDAHOVIEW CONSORTIUM MEMBERSHIP

IdahoView partners:

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

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INDIANAVIEW 2021 - 2022 ACTIVITIES

**IndianaView Student Scholarship Program**

IndianaView provided scholarships for six students (five graduate and one undergraduate) from the member educational institutions to participate in remote sensing and geospatial projects. Each of the student provided a fact sheet about their project and a testimonial on how the scholarship assisted them.

Completed students' projects include: Deep learning-based tree detection and species identification; Using UAVs to Complete Large Area Tree Mapping; Extracting tree trunks from backpack Lidar point cloud data by combining geometric features and deep learning; Multi-temporal UAS imagery collection for monitoring natural disturbance based management practices; Potential streamflow response to policy-induced wetland change in the White River Watershed, Indiana; and Integrating aerial photography and photogrammetry for interactive map-making.

Students' testimonials show that the scholarship opportunity motivated them to apply remote sensing data in their disciplinary studies, opened opportunities for their data collection and analysis, and improved their confidence in using cutting edge technology in field data collection.
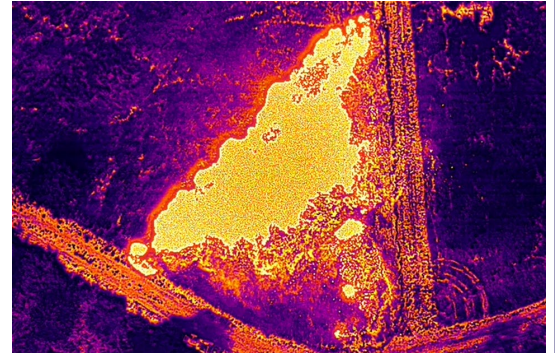
High resolution thermal imagery that was captured during a prescribed burn event in a natural grassland.
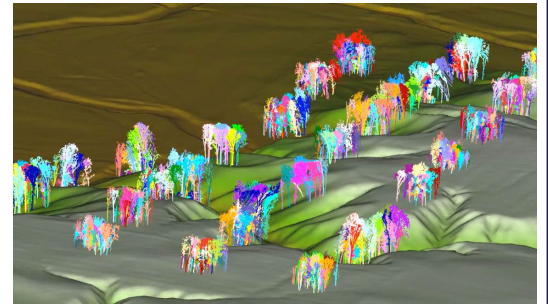
A Digital Terrain Model of a portion of Martell Forest populated by the individual trees extracted from terrestrial laser scans.
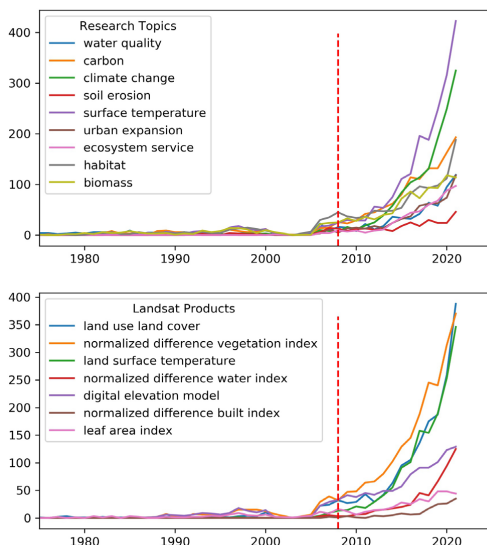
The annual trend of Landsat research publications by research topics and Landsat products from 1975 to 2021

IndianaView mini-grant Program

IndianaView provided a means for partner institution to participate in IndianaView via geospatial projects relative to the state of Indiana. Two mini-grants were funded during 2022. One mini-grant project conducted a mega literature review on Landsat products based scientific publications in the past fifty years. Major research topics, study areas, research techniques/methodology, and products were identified for the more than thirty thousand articles using Natural Language Processing and computational text analysis. The second mini-grant was to support the research about the impact of low-head dam removal in Logansport, Indiana. The project supported UAS data collection (RGB and Lidar) before and after the low head dam removal, as well as setting up the web services to visualize the UAS data. The 3D point cloud [before the removal](#) and [after the removal](#) are available online.

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BENEFITS TO INDIANA

- The student scholarship program has greatly encouraged students across Indiana educational institutions to apply geospatial information in their specific research areas. Supported by the scholarship, students have presented at several national and regional conferences. Several manuscripts are also ready to be submitted.

- The scholarship program expanded the digital forestry initiative at Purdue University. Four of the students scholars research are in the forestry and natural resources area for Indiana, which helped Indiana to secure two larger scale grants from the USDA NIFA Sustainable Agricultural Systems, and the USDA Climate-Smart Commodities project.

- The dataset collected by the IndianaView support were shared publicly from the digital forestry data portal (https://hub.digitalforestry.org/) for collaboration.

- The mini-grant project has collected year-long monitoring image in both RBG and Lidar to learn about the consequence of low-head dam removal in Eel River, Logansport, Indiana.

- One student scholar project studied the streamflow change in response to the recent state legislation (SB 389, passed in 2021) which minimizes the protection plan for the remaining state protected wetlands.

- Led by IndianaView PI, the post-bachelor certificate program in geospatial information science has graduated six students in its first year launch. Twenty-six students were admitted into the program including majors in agriculture, civil engineering, earth science, and business.

Collected dataset from a natural forest environment pre-controlled burn
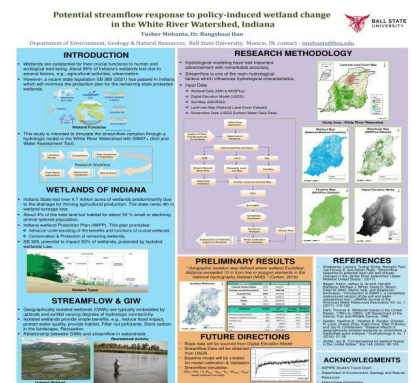
Student's poster at the American Water Resources Association Conference.

INDIANAVIEW CONSORTIUM MEMBERSHIP

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

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INDIANA VIEW

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IowaView 2021 - 2022 Activities

Mapping Our Future: Expanding GIS and Remote Sensing (GIS/RS) Knowledge in Iowa

A strong geospatial foundation is a necessity to lay the framework for higher-level geospatial and remote sensing education. During grant year (GY) 2020, IowaView's HIA focused on understanding the current conditions of GIS/RS education in K-12 Iowa classrooms with the use of a survey. From those results, it was concluded that there is an information gap about GIS and how it can be used in the classroom. Those previous year results informed IowaView's GY 2021 activities and project staff focused on finding opportunities to promote GIS/RS knowledge through outreach. IowaView staff coordinated in-person teacher professional development events and developed educational resources and activities.

During GY21, we were able to begin transitioning back to in-person activities while also participating in various online activities. Below are some highlights from GY21:

Participants flying a UAV during July 2022 Teacher Workshop

- **Provide GIS/RS Learning Opportunities for K-12 Teachers**

  April 2022: IowaView staff co-presented with a consortium member to provide a 45-min workshop about using GIS in the classroom at the statewide Iowa Technology Education Connection Conference held in Des Moines, Iowa. AmericaView resources were shared throughout the presentation and 7 attendees were given AmericaView posters, books, and USGS trading cards.

  July 2022: IowaView staff and a consortium member hosted a two-day geospatial technology workshop at William Penn University in Oskaloosa, Iowa to provide three K-12 teachers a more in-depth opportunity to explore using GIS and Story Maps in the classroom and gain continuing education credits.

Large Image: IowaView state coordinator Amy Logan and ISU GIS Facility staff Josh Obrecht at the 2021 GIS Day outreach event at ISU. Small Image: GIS Day Cake

- **GIS Day 2021**

  IowaView staff hosted a GIS Day open house in the atrium of ISU's College of Design. There were over 50 participants. This was an opportunity for students to learn more about the academic opportunities available for learning GIS including an undergraduate minor and graduate certificate in GIS. It was also a time to distribute AV posters and educational materials.

- **IowaView Website**

  IowaView had an active website presence (40 posts during GY21) with regularly updated content as well as Landsat 50th promotional information. This included producing Landsat IowaShots images and time-lapse videos; 11 were released during GY21. During this reporting period, 4,632 users visited the site with 7,669 pageviews.

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BENEFITS TO IOWA

- During GY21, IowaView staff analyzed the results from the GY20 K-12 GIS education survey to better understand the current use of GIS in K-12 classrooms as well as understanding barriers to using GIS. This information is beneficial to IowaView, the Iowa Geographic Information Council, the State of Iowa, and other entities to help understand current conditions and better target educational resources. The results were shared to GIS/RS audiences at two conferences in March and June 2022. A StoryMap summarizing the major findings of the study is available: https://arcg.is/0HTPOS

- IowaView staff were asked by teachers at the July 2021 GIS workshop to create a list of Iowa data resources for teachers and students to use when creating StoryMaps. The resulting StoryMap, published in July 2022, includes data and imagery sources, lessons plans and other resources: https://arcg.is/1e9WWT

- Some metrics from the GY21 reporting year:
  - 35 college students and 15 faculty/staff interactions during GIS Day 2021
  - 120 K-12 teachers received emails regarding Iowa GIS resources and training notifications
  - 10 K-12 teachers received training during spring and summer in-person events
  - 40 GIS community members attended presentations about K-12 GIS use in Iowa
  - 15 youth attended 4-H Youth GIS Workshop
  - 3 students groups participated in the Iowa Map Contest
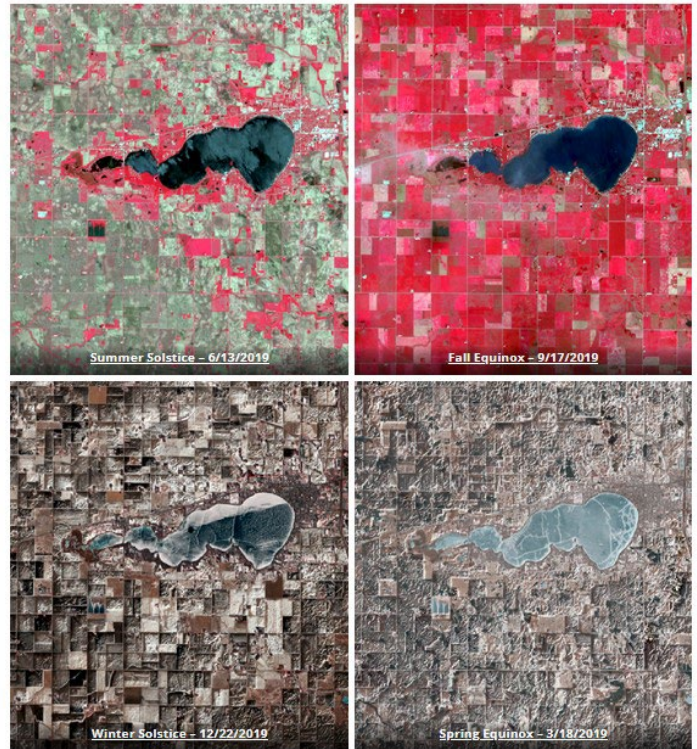
An example of Landsat IowaShots: four seasonal Landsat 8 images of Clear Lake, Iowa. The images are in color infrared.
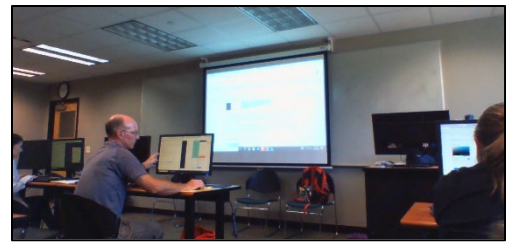
July 2022 K-12 Teacher Workshop at William Penn University in Oskaloosa, Iowa

IOWAVIEW CONSORTIUM MEMBERSHIP

The mission of the IowaView consortium is to increase the knowledge and use of remote sensing and other geospatial technologies for the benefit of the citizens of Iowa, through education, research and service. IowaView supports the collection and management of publicly accessible remote sensing data archives (ortho.gis.iastate.edu) which includes current and historic imagery, LiDAR elevation and other datasets useful for research and education. Collaborators come from several departments at ISU as well as from public agencies and organizations.

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KANSASVIEW 2021 - 2022 ACTIVITIES

This year KansasView produced an online interactive educational tool, "Mapping Kansas Ecosystems", to showcase the new Kansas Ecosystems land cover map. This resource was created for public consumptions including K-12 and higher education.

The Mapping Kansas Ecosystems educational tool contains:

- Introductory remote sensing concepts including information on how the Kansas Ecosystems land cover map was made.
- An interactive web mapping application to explore both the land cover map and the 2,600+ field sites visited across Kansas for the mapping project (Fig 1.).
- An overview of historical and current ecosystem influencers including human land use and management, like prescribed burning (Fig 2).
- A series of map tours to introduce grassland, woodland, and wetland ecosystems mapped in Kansas. The tour engages users with creative descriptions of each ecosystem type mapped and a series of associated images. Images for an ecosystem include:
  - A landscape photograph of the ecosystem
  - An aerial/satellite image containing the ecosystem
  - A plant found in the ecosystem
  - An animal found in the ecosystem
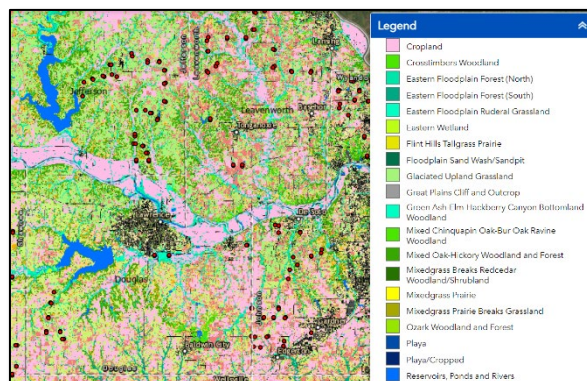
Fig 1. A subset of the web application containing the Kansas Ecosystems land cover map and field sites.

Fig 2. This Landsat image was included to illustrate prescribed burning in the tallgrass prairie ecosystem. Burn scars are shown in black along with white smoke plumes.
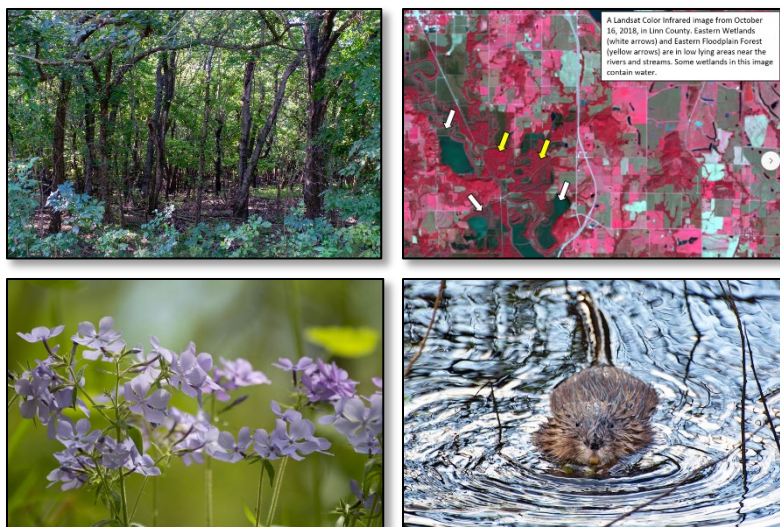
Fig 3. Images used in the map tour for the Eastern Floodplain Forest Ecosystem.

Excerpt for Eastern Floodplain Forest: In the northeastern corner of Kansas, where 600,000 years ago glaciers covered the earth, forests of cottonwood, maple, and sycamore grow along the river's edge, while wildflowers such as sweet *William's phlox* blanket the understory. The Eastern Floodplain Forest, found near the water's edge provides home for animals such as the *muskrat*. Experience the Eastern Floodplain Forest at the Kansas Perry Wildlife Area.

http://bit.ly/3WjXpBC

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BENEFITS TO KANSASVIEW

We selected images to integrate how Kansas ecosystems appear *on the ground* and *from above* (Earth observations). A variety of aerial and Landsat and Sentinel satellite imagery were selected from different seasons and using different band combinations (e.g., true color, near-infrared color composite) (Fig 4).

Another goal was to make a self-contained, easily accessible educational tool. KansasView used ESRI StoryMaps, a platform that supports mixed media content and customization. We also created a web application using ERSI Web Application Builder. Once the content is shared with the public, users only need internet access and a web browser.

KansasView participates in the Kansas Ecosystems Summer Institute at the University of Kansas to provide remote sensing and geographic information systems educational resources to middle and high school science teachers (Fig 5). The creation of the Mapping Kansas Ecosystems stemmed directly from interactions with Kansas science teachers. Our hope is that teachers can easily integrate this tool into classroom curriculum. We also plan to share this tool with state agencies and other entities who use land cover data and want to learn more about the new Kansas Ecosystems land cover map.

This May 12, 2022, Landsat image in Doniphan County uses an agriculture index where healthy vegetation appears bright green (the forest and vegetated crop) and sparse vegetation appear pink-purple (bare crop and grassland). Mixed Oak-Hickory (white arrows) looks like green fringe hanging along the southern border of the winding Missouri River.
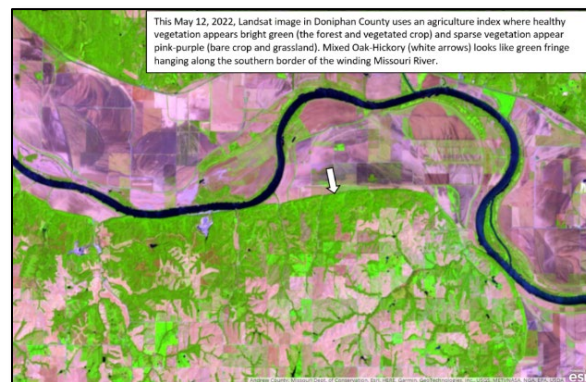
Fig 4. This Landsat image was used to highlight the Mixed Oak-Hickory Ecosystem (shown in green) south of the Missouri river in northeast Kansas.

Fig 5. Kansas science teachers at the Kansas Ecosystems Summer Institute.

KANSASVIEW CONSORTIUM MEMBERSHIP

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FORT HAYS STATE UNIVERSITY
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HASKELL INDIAN NATIONS UNIVERSITY

K·STATE
Kansas State University.

KARS
Kansas Applied Remote Sensing Program

KU THE UNIVERSITY OF KANSAS

KU EDWARDS CAMPUS
The University of Kansas

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KENTUCKYVIEW 2021 - 2022 ACTIVITIES

KentuckyView has been working on inland water quality and quantity mapping using Landsat imagery for the State of Kentucky for several years. During the current year, Ohio River Integrated Geospatial Interinstitutional Network (ORIGIN) research collaboration program including KentuckyView, OhioView and West VirginiaView, continued to monitor the Ohio River for mapping water quality and harmful algal blooms (HAB) events using multispectral and hyperspectral remote sensing, and other geospatial techniques. Drs. Anita Simic Milas from OhioView, Haluk Cetin from KentuckyView, and Aaron Maxwell from West VirginiaView coordinated the ORIGIN program. Kentuckyview also established collaborations with researchers at the Goddard Space Flight Center of NASA, and several USGS offices including the USGS Ohio Kentucky Indiana Water Science Center, Louisville, KY, and Murray Field Office, Murray, KY. During the current year KentuckyView specifically focused on HABs prediction and monitoring. Landsat-8 and Sentinel-2 datasets, and Google Earth Engine were used for such efforts. The results showed that Turbidity mapping performed better (R^2=0.81) compared to the TSS (R^2=0.76) and Chlorophyll (R^2=0.65) mapping, which showed lower R^2 values.

Workshops: A workshop was held on Murray State's main campus to educate pre-service teachers and students. Visible and infrared cameras were used for the training. We hired one undergraduate student to work on the project. He was trained in water quality mapping and produced his initial water quality maps of western Kentucky, particularly for the Ohio River. Another student was also trained in water quality mapping.

Earth Observation Day and Earth Day activities: A virtual Earth Observation Day (EOD) event was held at MSU on Tuesday, October 12, 2021. Three Keynote speakers, Dr. Oluwabunmi Dada of MSU, Mr. Eric Morris of Geospatial Project Manager, GISinc and Dr. Junfeng Zhu, Kentucky Geological Survey, University of Kentucky, and the KentuckyView PI Dr. Cetin gave presentations. There were 27 participants at the event.

K-12 outreach activities: The MSU student chapter of ASPRS met two times to establish plans to work with K-12 students on a common geospatial project. Kentuckyview participated the Archaeology Day event held in Wickliffe Mounds State Historic Site, Wickliffe, Kentucky. We used several tools, such as a UAS, thermal camera, imagery, poster, and an EOD game poster, to educate the participants. We served 181 people. Of those, 126 were adults and 55 children.

State-wide undergraduate and graduate student fellowships: The winners of the 2022 undergraduate award in the amount of $500 were Mr. Logan McGowan, MSU and Mr. Blake Kennedy, MSU. The winner of the 2022 graduate award in the amount of $1,000 was Ms. Kabita Paudel, Kentucky State University. The students would use their fellowship monies for their research.
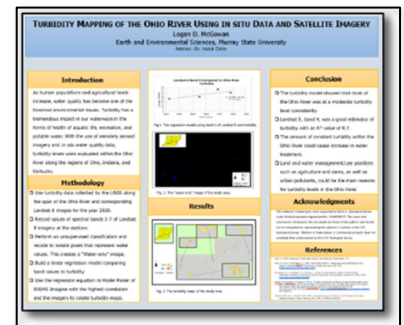
Turbidity analysis of the Ohio River
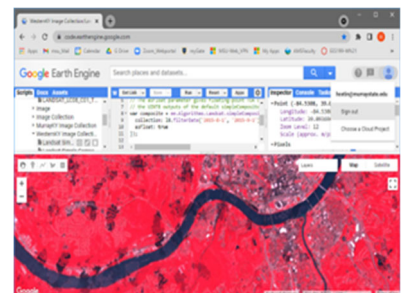
Google Earth Engine modeling

Archaeology Day event, Wickliffe, Kentucky

The 2021 EOD event at MSU

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BENEFITS TO KENTUCKY

KentuckyView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state. KentuckyView 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. The primary focus of KentuckyView is on the use of images collected from remote sensors, as well as other geospatial technologies, to support K-16 education, applied research, and public outreach. The Kentucky Spectral library has been utilized to help process satellite data, such as Landsat 8 and 9.

KentuckyView has conducted research on soil moisture, water quality and quantity, and harmful algal blooms. For the state of Kentucky, these projects inform the water research community and improve understanding the environmental conditions, which allow Kentucky to manage the water resources more efficiently.

We are developing workshop modules to improve K-16 education in the state. Also, more assessment tools have been developed. Remote sensing education and outreach activities, such as workshops, story maps, Earth Observation Day, Earth Day, and GIS Day presentations, have helped inform and educate teachers, students, and the public in Kentucky.

KENTUCKYVIEW CONSORTIUM MEMBERSHIP

- *Murray State University - MARC and the* Department of Earth and Environmental Sciences (official member of record)
- *Morehead State University*
- *Kentucky Division of Geographic Information*
- *Kentucky Geological Survey*
- *Eastern Kentucky University – Department of Geography*
- *Jefferson Community and Technical College*
- *Kentucky State University*
- University of Kentucky – College of Agriculture
- Western Kentucky University – Department of Geography and Geology
- University of Louisville – Center for Geographic Information Sciences
- Northern Kentucky University – History and Geography Department

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

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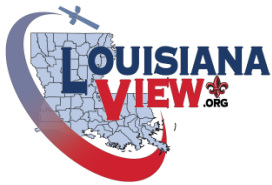
http://www.kyview.org

PROMOTING THE BENEFITS of Remote Sensing Science and Applications

Creating a Bridge.….

NSF grant to further UL Lafayette's satellite imagery research, outreach

PUBLISHED | January 26, 2022
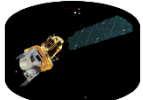
….…. The National Science Foundation was impressed with the University of Louisiana at Lafayette's use of satellite imagery from space for research, outreach and, yes, even art exhibits.

It's why the NSF awarded a $364,874 grant to UL Lafayette's Regional Application Center. Brent Yantis, the center's director, is principal investigator and director of the LouisianaView program.

The bridge program is intended to spur interest in science, technology, engineering and mathematics, or STEM, careers. "Working alongside the sciences and geography disciplines – we refer to it as not only STEM education, but STEAM – because we're adding art into the mix," according to Yantis.

This NSF grant works alongside the RAC's ongoing participation in the "Earth as Art" program. This USGS program was launched in 2002 to educate the public about satellite imagery that informs scientific research. UL Lafayette students who take part enhance images of the Earth's surface captured by NASA and USGS. The Regional Application Center displays the pieces at schools, museums, civic buildings and other events.

https://louisiana.edu/news-events/news/20220126/nsf-grant-further-ul-lafayette%25E2%2580%2599s-satellite-imagery-research-outreach

BENEFITS TO LOUISIANA

23rd annual
Hurricane Season Geospatial Data Mining Workshop
NASA/UL Lafayette Regional Application Center
University of Louisiana at Lafayette
2022
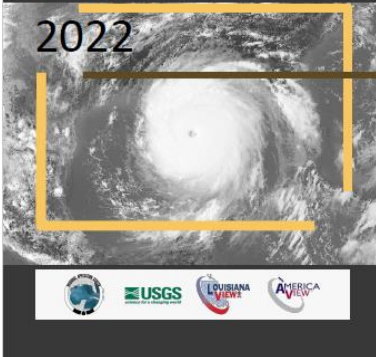
3rd Year Virtual with a twist….. **Hurricane Season Workshop for Emergency GeoSpatial First Responders**

This annual workshop, held in early June each year, played out its twenty-third (23rd) year as our third virtual workshop held in-person. Through the cooperation of the LouisianaView consortium members and co-sponsored with the local USGS liaison, this workshop was offered free to everyone interested in up-to-date information on data availability for the geospatial emergency responder. One Hundred and sixty-six (166) Geospatial First Responders from more than 15 different countries attended this workshop held June 2, 2022 via Zoom/In-person from the UL Lafayette Regional Application Center. This day workshop hosted 16 speakers from multiple Federal, State and Private Response Teams, each presenting their data, websites, links, and contacts while also fielding questions live from those in attendance, proving again and again what a cohesive and informed network of geospatial responders can mean to the inhabitants and economic base within Louisiana, the Gulf of Mexico region and the Caribbean.

Break out your *Pirogue!*

RISING WATER

Rising Water is shaping the future of Louisiana and the Gulf Coast. Explore with us the shifting physical landscapes and how human activities must respond to them.

GeoPaths – GEOSERVICE ....

GEOScience **S**tudents **E**xcelling **I**n **R**eal, **V**ital **I**nvestigations with **C**ommunity **E**ngagement

The GEOSERVICE project is an effort to address the future STEM and geosciences workforce needs. The goal of the GEO SERVICE program is to increase and retain the number of undergraduates pursuing a geoscience major. The GEO SERVICE program partners high school and undergraduate students with faculty, graduate students, and community mentors in a program that includes learning geosciences content relevant to addressing environmental challenges, while engaged in broadly mentored, research-based, community-focused Service-Learning Projects (SLPs).

SCAN HERE FOR MORE INFORMATION

LouisianaView Consortium Membership

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http://www.louisianaview.org
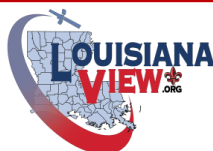
Facebook.com/LouisianaView

MICHIGANVIEW 2021 - 2022 ACTIVITIES

As part of the AmericaView network, MichiganView's primary goal is to promote the inclusion of remote sensing and geospatial technologies in Michigan classrooms. This is achieved through the creation of tools and activities that augment science and social studies curricula at a variety of educational levels. At the K-12 level, MichiganView works with educators to co-develop materials that assist in meeting content expectations as defined by the Michigan Department of Education (MDE). By using MDE standards as a framework for lesson development and curriculum augmentation, MichiganView is able to create products that can be utilized by schools throughout the state of Michigan. At the college level, MichiganView develops activities and tutorials that provide an introduction to remote sensing for students whose major area of study does not include it in standard coursework.

Example of a land cover map of Cheboygan, MI created with Google Earth Engine by a student at a MichiganView workshop.

In the 2021-2022 grant year, MichiganView created new tools that were included in social studies content for 3rd and 4th grade students. 3rd graders used a web-app to assess how geographic tools, such as remote sensing, can be used to study the earth. 4th graders used an interactive online tool to learn how human activities can impact the environment. The tool integrated a variety of satellite images to assess positive and negative impacts of these activities. MichiganView also developed materials and conducted trainings for undergraduate environmental science students taking part in an intensive summer course focused on Great Lakes science and conducted a seminar on thermal imaging for community college students.

A 4th grade student assessing land cover change using Landsat imagery on an interactive Smart Board.

Forestry
Michigan was once covered almost entirely by forest. Many of these forests were cleared for farms and cities, but...

Mining
Michigan's Upper Peninsula has been an important mining center for almost 200 years. In the 1800s, copper mining...

Agriculture
Agriculture, the practice of cultivating plants for harvest, is an important aspect of Michigan's economy. Michigan...

Dams
In Michigan, dams are used for a variety of reasons, such as controlling floods. The Hardy Dam in the western part of...

Urbanization
As populations increase, people need more places to live. The suburbs outside of Detroit have been growing for...
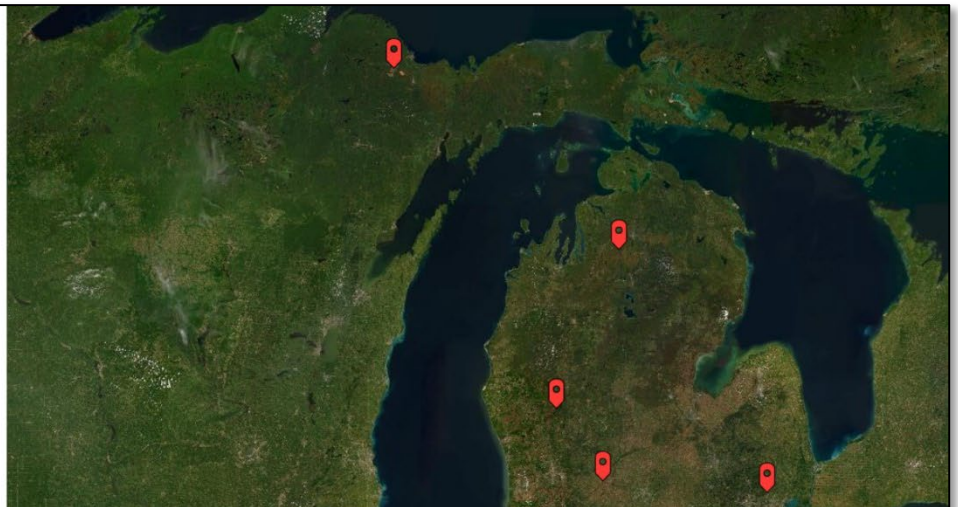
Screenshot from an ESRI StoryMap developed by MichiganView and used in 4th grade classrooms. Students used the tool to explore human-environment interactions throughout the state and around the country. The interactive module is available online at: https://arcg.is/1jSrnS0.

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BENEFITS TO MICHIGAN

- MichiganView uses freely accessible, web-based tools for most of its outreach work in order to reach broader audiences than would be possible with desktop software. ESRI Story Maps are typically used for K-12 activities, while advanced tools, such as Google Earth Engine, are used for students with more technical skills.

- MichiganView utilizes publicly available imagery, such as Landsat, when creating lab exercises and tutorials to ensure interested students can access additional data without issues.

- Whenever possible, hands-on, field-based components are incorporated into MichiganView activities to provide students with knowledge of how remote sensing can be applied to real world problems.

- MichiganView provides remote sensing expertise to organizations such as the Michigan Science Olympiad, which hosts dozens of science-based competitions to inspire middle and high school students to pursue STEM careers.

Community college students posing for a picture with a thermal camera during a remote sensing lecture.

Undergraduate students using a handheld radiometer to measure vegetation spectra.

MICHIGANVIEW CONSORTIUM MEMBERSHIP

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MINNESOTAVIEW 2021 - 2022 ACTIVITIES

MinnesotaView undertakes education and outreach activities in remote sensing through the offering of workshops. The broad goals of these activities are to help stakeholders use remote sensing and to enhance public appreciation of the importance of remote sensing. 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:

Water Clarity Data Portal: https://lakes.rs.umn.edu
Land Data Portal: https://z.umn.edu/landcover
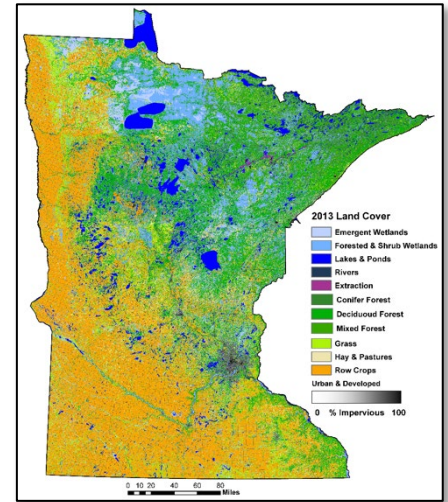
Land Cover/Use of Minnesota mapped using Landsat imagery
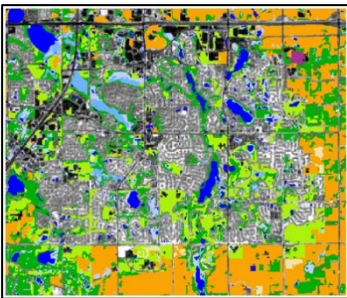
Mixed land cover in Woodbury, MN
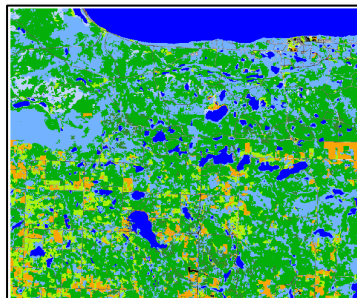
Lower Red Lake area with cropland, forest, wetland and lakes.

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 Remote Sensing and Geospatial Analysis Laboratory, and includes the Minnesota Geospatial Information Office, the Minnesota Pollution Control Agency, and Minnesota Department of Natural Resources.

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BENEFITS TO MINNESOTA

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 2021-2022 grant year, we conducted two workshops for stakeholders around the state.

The images to the right depict data products derived from our research. 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.
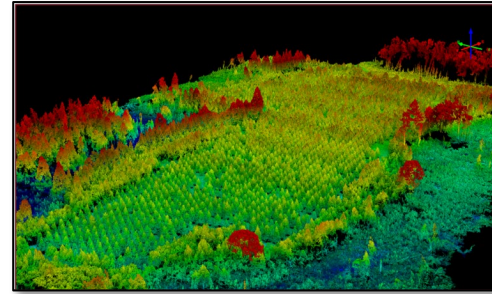
Photo-derived point cloud of a plantation forest in Minnesota

Drone image of a forest research stand in northern Minnesota

MINNESOTAVIEW CONSORTIUM MEMBERSHIP

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MISSISSIPPIVIEW 2021 - 2022 ACTIVITIES

MississippiView was established in 2003 and is led by the Mississippi Mineral Resources Institute (MMRI) at the University of Mississippi. We promote and facilitate geospatial data usage, research, and collaboration among the geospatial community in Mississippi while fostering national and international cooperation.
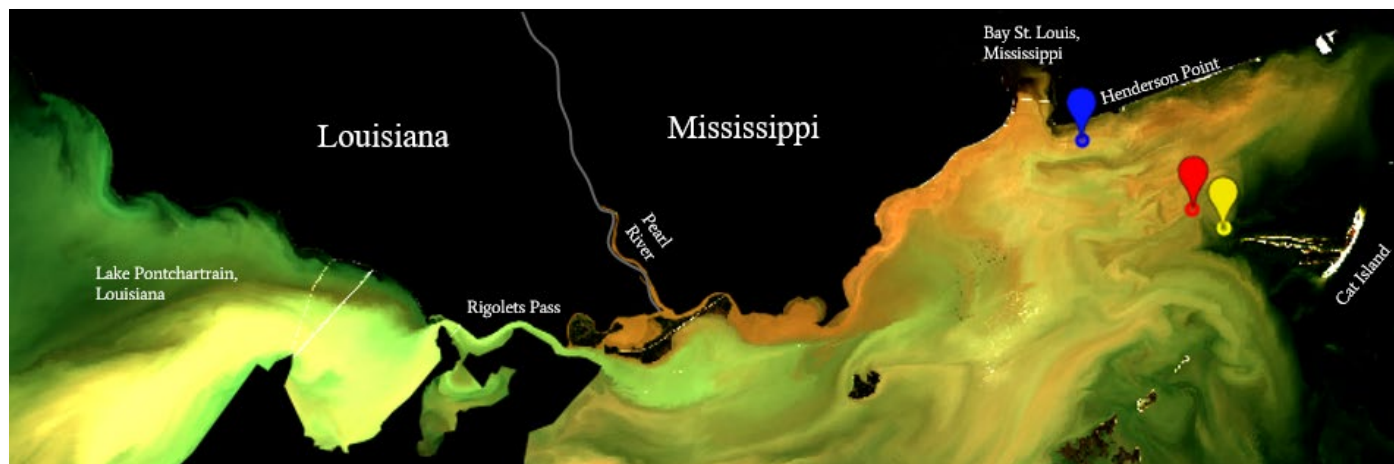
Our high impact activity (HIA) involved studying the impact of sediment and freshwater influx on the ecosystem of the Mississippi Sound estuary. If salinity plunged below 1 gram per 1,000 grams of seawater, mega-fauna (dolphins and turtles) dies and the oyster reefs are decimated. Freshwater flushing into the Mississippi Sound can cause this die off. In 2005, Mississippi harvested nearly 500,000 bags of oysters and only 10,000 bags in 2018.

Due to record flooding in much of the Mississippi River valley, the Bonnet Carré spillway was opened in both 2018 and twice in 2019 to relieve flooding pressure on levees in New Orleans. This unprecedented event resulted in a large influx of freshwater into the Mississippi Sound through Lake Pontchartrain. This was a unique opportunity to study the recovery of an estuarine ecosystem from a major event. The fresh, sediment-laden water from the Mississippi River flowed into Lake Pontchartrain, mixed with the brackish water of the lake and then flowed through Rigolets Pass into the western Mississippi Sound.

Gulf Coast oysters are an important economic agricultural product of Mississippi. Source: Gulf Coast Mariner

Using Landsat and Sentinel-2 satellite imagery, and in situ water quality monitoring, researchers were able to observe movement of sediment in coastal waters. The Sentinel-2 image BELOW acquired in 2021 shows the different colors of sediment coming from Lake Pontchartrain and Pearl River basin. Dark to black is land or deeper water. The blue, red, and yellow markers are locations of monitored oyster beds.

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BENEFITS TO MISSISSIPPI

MississippiView brings benefits to the state of Mississippi:

- Supports research to investigate impact of flooding and sediment from inland erosion on gulf coast aquiculture, specifically oysters.
- Flooding and groundwater withdrawal are of utmost importance to the state of Mississippi. Projects can help monitor these processes and lead to more effective responses to a natural disaster and better management of a valuable resources.
- Use of geophysics and UAS-based thermal for mapping potential underseepage pathways of levees. Piping and the formation of sand boils, poses a significant threat to the integrity of floodplain levees.
- Applications using a variety of the spaceborne, aerial, and terrestrial-based sensors are taught to students of Mississippi and support applied research in the state.
- MississippiView supports teaching curriculum and expanding our consortium to promote training future users and advancing the workforce in a changing world.
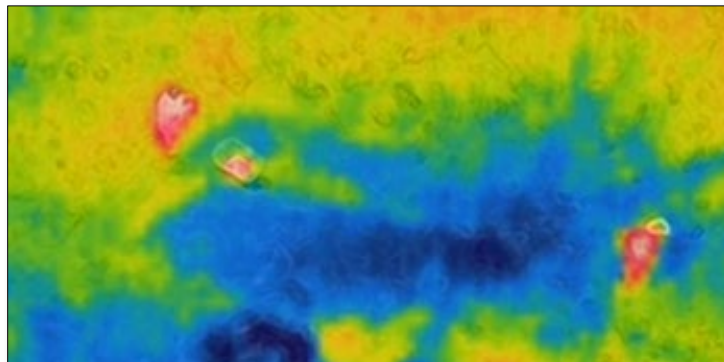
UAS-based imagery provides high-resolution thermal data at a seepage location during a flooding event along a Mississippi River mainline levee. TOP: Visible light image; BOTTOM: cooler water in the thermal imagery is shown in blue and is from seepage from under the levee. Individuals are towing a ground penetrating radar (GPR) antenna across the seepage area.

LEFT: MississippiView assists in workshops with regional high schools. Students worked with local experts and University of Mississippi faculty to explore opportunities in applied sciences. Using Landsat, Sentinel-2 and drone imagery to provide vegetative maps and real-time vegetative stress and thermal imagery.

MISSISSIPPIVIEW CONSORTIUM MEMBERSHIP

MississippiView is engaged in developing partnerships within the state. We have teamed with outreach efforts from the University of Mississippi's School of Engineering, School of Education, and School of Applied Sciences to provide spatial data and aerial/satellite imagery to support student learning and research.

We have continued to work with students from Rust College in Holly Springs, Mississippi

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MISSOURIVIEW 2021 - 2022 ACTIVITIES

The increasing availability of geospatial data converged with recent advancements in artificial intelligence, machine learning, and cloud infrastructure offers the potential for breakthroughs in science, policy, and national security. To broaden the use of Earth Observation data and demystify machine learning and AI for remote sensing application, the development of easy-to-use libraries and teaching materials are necessary.

During 2021 – 2022 reporting period, we have published two peer reviewed papers, organized two workshops (GEOINT and GIS Day @SLU), and developed two python-based geospatial raster processing libraries (Raster4ML, and Ag-Lapse). These efforts are made to promote the use of geospatial data and contribute to the mission of AmericaView by advancing K-12 and college education.

Additionally, MissouriView consortium students and faculty presented 40 posters at Geo-Resolution national conference co-hosted by Saint Louis University and National Geospatial-Intelligence Agency.
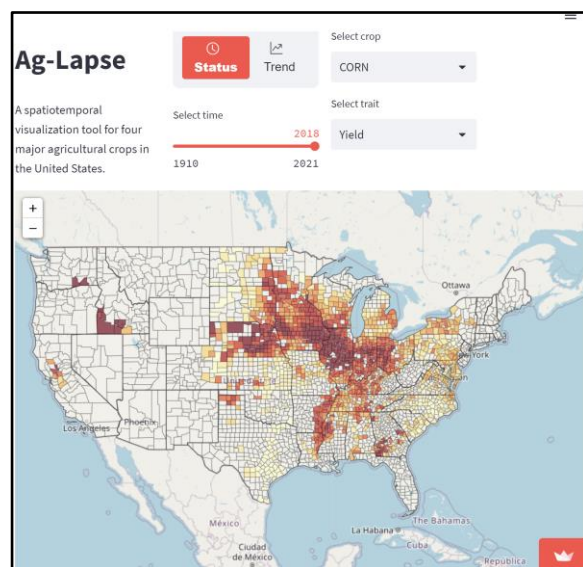
Ag-Lapse -Corn yield across the USA
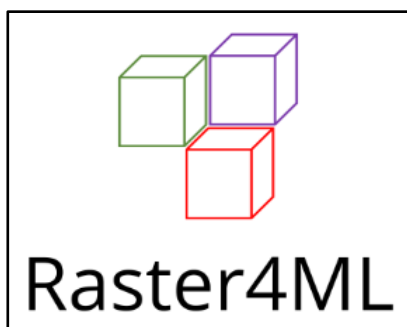
Raster4ML Raster Processing Library

Presentation at GEOINT summer immersion at Saint Louis University

- Raster4ML
  - o Raster4ML is a geospatial raster processing library for machine learning. When machine learning models are to be used, it is often necessary to convert the complex raster data and vector data into a tabular form, which can be understood by the machine learning algorithms. Raster4ML is a python package that has easy-to-use functionalities to perform that task. It can also calculate more than 350 vegetation indices from satellite or UAV images automatically. LINK

- Ag-Lapse
  - o Ag-Lapse shows an interactive webmap that highlights different spatiotemporal pattern of crop yields across the United States. The map supports county-level information from as early as 1900 to as close as 2021. Four major crops of the United States are covered. The map shows yield, harvest area and planting area for all the crops. LINK

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BENEFITS TO MISSOURI

- 11 HSSU students were trained through the GEOINT Summer Immersion workshop organized by Harris-Stowe State University and Saint Louis University in collaboration with USGIF. The goal of the workshop was to bring underrepresented students to campus and talk about mentoring opportunities, and opportunities for graduate school, and to provide two sessions that introduced students to themes in geospatial research. The first theme was devoted to remote sensing and the second theme was devoted to spatial statistics. Students were able to get hands-on experience. They were able to see the power of remote sensing and spatial statistics research.

- Raster4ML will help scientists and students from the geospatial science, GIS or remote sensing background to automate their research pipelines. Crop breeders and precision agriculturists from Missouri can find it very helpful to accelerate their tasks.

- The 2022 Geo-resolution conference provide a venue for collaboration among geospatial experts and students in government, academia, and industry. People came from coast to coast, in-person and online to contribute to this year's theme of "Geospatial Perspectives on Climate Change: Predicting and Mitigating Effects". Over 150 students participated in-person in the conference, the poster session, the mentoring lunch and the career fair. LINK
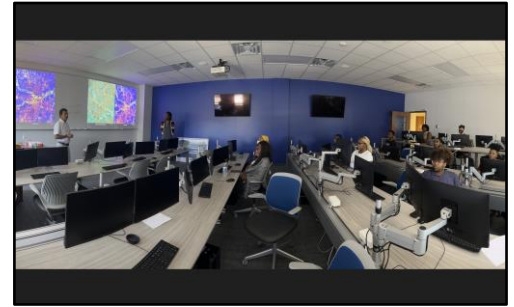
Students from the Harris Stowe State University (HSSU) participated the Summer Immersion in GEOINT hosted by the Saint Louis University.

Geo-resolution 2022, Geospatial Perspectives on Climate Change: Predicting and Mitigating Effects

MISSOURIVIEW CONSORTIUM MEMBERSHIP

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MONTANAVIEW 2021 - 2022 ACTIVITIES

MontanaView successfully completed the High Impact Activity "Fellowships for undergraduate and graduate students conducting applied remote sensing projects." The goals of this activity were to 1) support students and provide encouragement and resources for them to pursue a career in geospatial sciences and remote sensing; and 2) benefit the state of Montana by providing information, data, and analysis that will improve the management of natural resources. MontanaView awarded 11 fellowships ($1,000 - $1,500 each) to students at six institutions across Montana.

The following is a list of the students and their institutions, project titles, and mentors (in parentheses):

- Michael McInenly, University of Montana, Using INSAR to measure seasonal changes in halite salt crust elevation in the Salar de Pajonales, Chile (Dr. Anna Klene)
- Spencer Vieira, University of Montana, Impacts of wildfires and climate change on western larch regeneration, western U.S. (Dr. Anna Klene)
- Nate Heili, Montana State University, Irrigation ditches as novel ecosystems that may provide ecological connections across aquatic-terrestrial boundaries (Dr. Wyatt Cross)
- Hayden Yates, Montana State University, Challenges and limitations of UAV-based thermal infrared (TIR) remote sensing with a FLIR Duo Pro R camera (Dr. Andrew Laskowski)
- Erin Mcgowan, Montana Tech University, Modeling the spatial distribution of stream power and lateral channel migration rates: A fluvial geomorphic tool for restoration practices (Dr. Glenn Shaw)
- Yihuan Gao, Montana Tech University, Measuring the glacier change in Glacier National Park using Landsat imagery (Dr. Xiaobing Zhou)
- Madisan Chavez, Montana State University Billings, Assessing change in acreage of irrigated agriculture in the Stillwater watershed of south-central Montana (Dr. Joe Hoover)
- Kalai'i Sim, University of Montana Western, Lateral channel migration and sediment transport of beaver dominated streams, Red Rock Creek, Montana (Dr. Arica Crootof)
- Megan Francois, University of Montana Western, Lateral channel migration of beaver dominated streams, Odell Creek, Montana (Dr. Arica Crootof)
- Randall Finley, Salish Kootenai College, Mapping historic forest management with aerial photographs for the Confederated Salish and Kootenai Tribes (Dr. Robert Kenning)
- Bryce Norling, Salish Kootenai College, Mapping historic forest management with aerial photographs for the Confederated Salish and Kootenai Tribes (Dr. Robert Kenning)
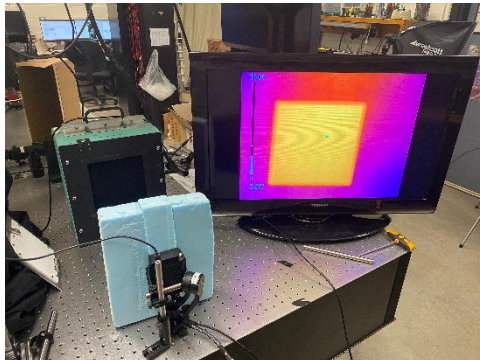
Experimental setup for test of FLIR Duo Pro R radiometric thermal camera exposure to environmental conditions by Hayden Yates for her MontanaView remote sensing fellowship project.

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MontanaView 2021 - 2022 Activities

MontanaView continued to provide mentoring to graduate student Zach Fighter of Montana State University, on his research titled "Multi-scale analysis of *Ventenata* control treatments on the Crow Reservation." *Ventenata dubia* is an invasive winter annual grass that impacts plant community diversity and forage production. Zach completed an ambitious field campaign during the 2022 growing season in which he acquired near-weekly drone measurements of his experimental *Ventenata* control treatment plots on the Crow Reservation, Montana.

Experimental control plots and ground control points for invasive winter annual grass Ventenata dubia on the Crow Reservation in Montana.

Zach Fighter, graduate student at Montana State University, flying a drone at a field site on the Crow Reservation, Montana.

MontanaView Consortium Membership

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NEBRASKAVIEW 2021 - 2022 ACTIVITIES

The NebraskaView program in partnership with the Nebraska Environmental Trust (NET) and three communities in Nebraska used publicly- available, USDA National Agricultural Imagery Program (NAIP) multispectral imagery to develop urban tree canopy maps for each community. NebraskaView also applied advanced image classification methods to airborne hyperspectral over the University of Nebraska-Lincoln's East Campus in a pilot study to demonstrate the capability of remote sensing to classify and map specific tree species in urban areas.

The goal of these NebraskaView activities is to develop practical remote sensing methods to map urban tree canopies, which currently does not exist for most communities in Nebraska and advance the use of remote sensing for urban forest management within the State.

Results:

- Urban forest canopy maps were completed over the cities of Lincoln, South Sioux City and Waverly.

- A pilot study for classifying and mapping specific tree species was completed using hyperspectral imagery for UNL's East Campus.

- Provided remote sensing training and research experience for an undergraduate honors student and hosted 72 freshmen in UNL's honors program to discuss ways remote sensing can be used in their various fields of study.
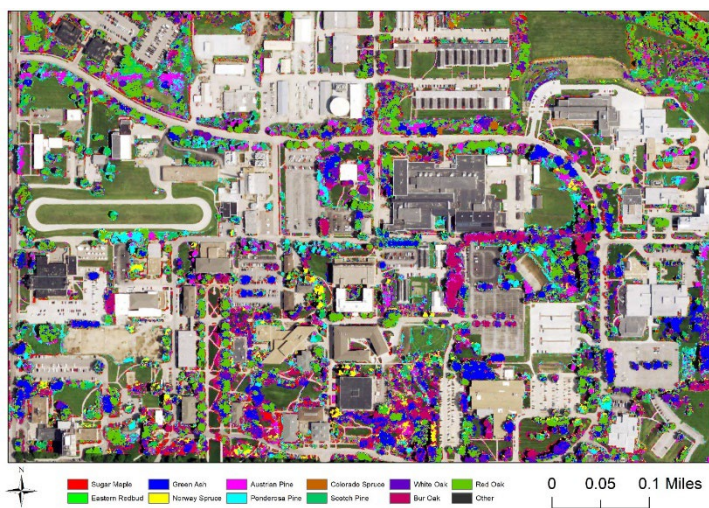
Tree species map for UNL's East Campus classified from multi-date, hyperspectral airborne imagery.

Urban tree canopy map for Waverly, NE classified from USDA NAIP multispectral imagery.

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John McGee, Board Chair:
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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.*

Specific benefits of Nebraska View to the State include:

- Support decision makers in evaluating and selecting the most appropriate remote sensing imagery and other spatial data for a specific application.
- Demonstrate the value of remotely sensed data and assist in developing applications.
- Provide remote sensing education and training to students, professionals and the general public.
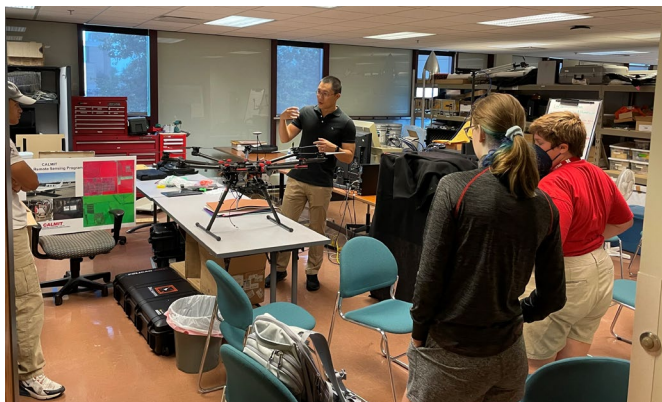
Demonstration of UAV and ground-based remote sensing systems used in agricultural and natural resource applications for UNL Honors program students.

Educational presentation on the types of satellite-based imagery and their applications for UNL Honors program students.

NEBRASKAVIEW CONSORTIUM MEMBERSHIP

City of Lincoln, Nebraska Parks and Recreation

Nebraska Forest Service

The Nebraska Environmental Trust

University of Nebraska-Lincoln Community and Regional Forestry Program

City of Waverly, Nebraska

City of South Sioux City, Nebraska

Federal consortium members identified above do not receive funding from AmericaView

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http://www.nebraskaview.edu

NEWHAMPSHIREVIEW 2021 - 2022 ACTIVITIES

NewHampshireView began two high impact activities in 2021 that will continue through the 2022-2023 grant year. The first of these activities is to use high-spatial resolution remotely sensed imagery to measure levels of cyanobacteria in New Hampshire waterbodies. High levels of cyanobacteria can cause sickness to those who swim or recreate in the impacted lakes (Figure 1). In the first year of the project, lakes with and without high levels of cyanobacteria were sampled from both high-resolution imagery and simultaneously, water samples were collected (Figure 2). The water samples were analyzed in a lab to measure the levels of cyanobacteria (Figure 3). The remotely sensed imagery will be processed, and an analysis performed in the second year of the project to determine the relationship between the water samples and the imagery to determine if the imagery is an accurate predictor of cyanobacteria in the water.
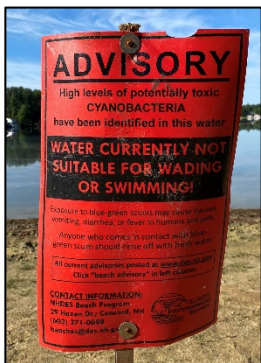
Figure 1. Lake advisory for cyanobacteria.

Figure 2. Sampling lakes using a canoe and collecting water samples for analysis in the lab.

Figure 3. Analyzing the water samples in the lab.
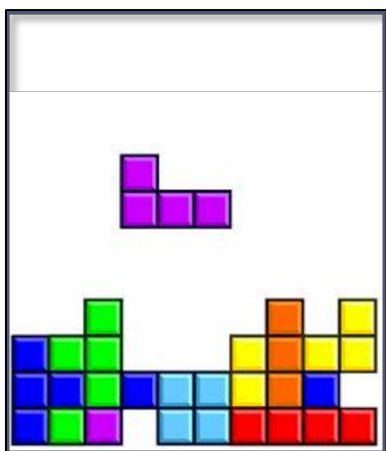
Figure 4. An example of spatial thinking.

The second high impact activity is also a two-year project and involves the development of a series of education videos and exercises to introduce and demonstrate the concept of Spatial Thinking. Everyone has the ability to think spatially, and this ability can be enhanced with awareness and practice. For example, playing the game, Tetris, is a very good way to improve spatial thinking as it encourages the player to fit the random shapes into the right position to complete the row (Figure 4). Often this process speeds up as the game continues forcing the player to make quicker decisions. In the first year of this project, a review of the spatial thinking literature was conducted and used to produce an introductory video (in 2 20-minute sessions) along with an introductory exercise/learning activity. Also, a plan was developed for the videos and exercises to be created in the second year. These videos and exercises will build on the introductory material and demonstrate the power of spatial thinking using a variety of real-world examples.

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BENEFITS TO NHVIEW

- NHView participated in the development of StoryMaps as part of the Earth Sensors and Research (ESRC) committee of AmericaView. Two StoryMaps were produced; one on NHView member's expertise in earth remote sensors and the other in research expertise.
- NHView Director, Russ Congalton, presented two seminars by zoom during this year. One was on Loons in New Hampshire and the other was on Forest Characterization.
- NHView celebrated 10 years of contributing to the University GeoSpatial Support Center (GSC). This facility provides consulting and workshops on remote sensing and geospatial analysis to students, staff, and faculty. Most, but not all, of the consulting and workshops were conducted virtually, but successfully.
- NHView funded an undergraduate intern, Isabelle Lopez, to work in the Basic and Applied Spatial Analysis lab (BASAL) to aid our research. As a result, Izzy was awarded a Summer Undergraduate Research Fellowship to continue her research with us.

Cyanobacteria collection.

Izzy Lopez, undergraduate intern.
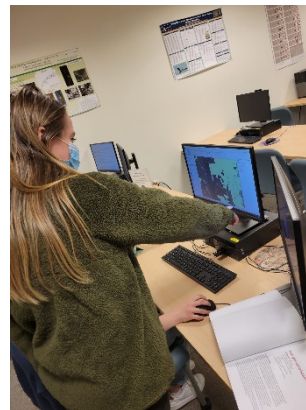
Consulting in the GeoSpatial Support Center

NHVIEW CONSORTIUM MEMBERSHIP

- **Department of Natural Resources & the Environment, UNH**
  The Basic and Applied Spatial Analysis Lab (BASAL) conducts basic research on spatial data uncertainty/map accuracy and applied research applying the tools of remote sensing, GIS, and spatial data analysis to solve natural resource problems.
- **NH GLOBE Partnership, UNH**
  Carries out GLOBE teacher training in atmosphere, land cover, hydrology, soil and earth system science with a focus on land cover mapping and geospatial technologies.
- **EOS-EarthData, UNH**
  A digital library of Earth science data that serves scientists, educators and the public.
- **NH GRANIT GIS Repository, UNH**
  A cooperative project to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers.
- **Diamond Library, UNH**
  The library maintains an extensive map and aerial photo collection for NH and houses the GeoSpatial Support Center.
- **Forest Watch, UNH**
  A New England environmental education activity using field, lab, and satellite data analysis methods for assessing the state-of-health of local forest stands.
- **Cooperative Extension, UNH**
  Offers short courses in geospatial technologies including GIS, GPS, and field mapping.
- **Dartmouth College**
- **NH Planning Commissions**

NEW MEXICOVIEW 2021 - 2022 ACTIVITIES

New MexicoView made great advances toward meeting the Primary HIA goal of establishing strategic partnerships to advance K-16 experiential learning and remote sensing research in New Mexico. I established collaboration with NM Space Grant Coordinator Paulo Oemig and Holli Kohl, NASA GLOBE Observer coordinator, (Photographs at right) to engage students with opportunities to work for a space agency, government lab, or research center. Holli has coached us to create of a GLOBE Observer land cover team to increase observations of New Mexico's unique landscapes to GLOBE.gov. This also led to participation on NASA's Citizen Science working group.

TRIO-Upward Bound quickly adopted my ideas by scheduling a "Week as a Geography major". This brought one group of 36 high school students to campus June 13-17 2021. These students participated in citizen science observations, pacing and tree measurements, geo-inquiries and various STEAM related modules. Emphasis was on the sun as the source of energy for life and EMR linked photosynthesis and carbon capture and release.

ABOVE: Paulo Oemig of New Mexico Space Grant Consortium presented to Geography Colloquium Oct. 14, 2021

ABOVE: Holli Kohl brought GLOBE Observer to life in the Geography Colloquium, March 18, 2022. Back left: D. Dugas, A. Ratliff, H. Bergmann, P. Viramontes, O. Akrasi, M. Djan. Front right: S. Valencia, A. Ransom,T. Chakraborty, C. Campbell, H. Kohl, Squatting, P. Oemig and B. Hanson.

ABOVE: Pablo Viramontes demonstrates using the land cover app in GLOBE Observer.

ABOVE: TRIO-UP students add tree data to GLOBE Observer during a Week as a Geography major.

ABOVE: TRIO-UB from Alamogordo brought 17 students over for one day, June11, 2022. They met graduate student, Torit Chakraborty, analyzing satellite imagery in the lab.

Above: Samantha Valencia, Pablo Viramontes, and Dr. Campbell at TRIO AWARDS 7/14/2022

LEFT: Amber Ransom demonstrates the hand-held spectro-radiometer to TRIO-Upward Bound students June 16, 2022. The different surfaces reflect specific wavelengths.

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BENEFITS TO NEW MEXICO

- EOD poster Viewing Water from Space includes a game exploring water quality related to urbanization, industry, farming and habitat. Bi-lingual students choose to play the English or Spanish version while discussing environmental conditions in New Mexico.

- Inform students and educators of the historical connection and future opportunities New Mexico citizens have regarding space exploration, research development and industry, and Earth Observation of New Mexico's landscapes. Identify and acknowledge the special relationship local communities have to the land of the Chihuahuan Desert.

- Identify careers in New Mexico related to land management, resource use, and environmental studies.

ABOVE: TRIO-UB students play the Viewing Water from Space, NASA EOD poster/game.

COLLBORATORS

NASA GLOBE Observer	Holli Kohl, Peder Nelson, Paulo Oemig	>300 observations
TRIO-Upward Bound, Las Cruces	Rosa De La Torre-Burmeister	36 students
TRIO-Upward Bound Alamogordo/Hatch	Lourdes Ambriz	17 students
NMSU College of Ed.	L. Cifuentes, M. Sterling, S. Morales	STEM modules
NMSU Languages & Linguistics	Antonio Garcia, Jeff Longwell	3 +translations
City of Las Cruces	BLM Las Cruces Field Office	NPS

NEW MEXICOVIEW CONSORTIUM MEMBERSHIP

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

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NEW YORKVIEW 2021 – 2022 ACTIVITIES

New YorkView (NYView) continues to perform research focused on water-related themes including spatial and temporal characterization of wetlands in New York State (NYS). Wetlands provide a wide range of ecosystem services including recharging groundwater aquifers, supporting biodiversity, and protecting shorelines. During GY21 a graduate student classified types of wetlands in NYS using a range of input data types, including both spectral and spatial data from Landsat and Sentinel sensors and features derived from those data such as multi-spectral indices and texture. The research also explored the value of including forest height metrics derived by a team of researchers from the

National Aeronautical and Space Administration Goddard Space Flight Center (NASA GSFC) and the University of Maryland from Global Ecosystem Dynamics Investigation (GEDI) and Landsat data. GEDI is a laser ranging mission operating from the International Space Station. The student found that adding GEDI-derived height within an object-based classification improved separation of the vegetated wetland classes. The image to the left shows an example of the classification results for a study site in Central NY.

Study site in Central New York shown with National Agricultural Image Program (NAIP) imagery (right) and corresponding wetland classification

NYView is supporting the NYS Department of Environmental Conservation (DEC) in an ongoing project aimed at using satellite imagery to monitor harmful algal blooms in NYS lakes. NYS uses a Citizens Statewide Lake Assessment Program (CSLAP) to complement agency evaluation of water quality in lakes across the state. Trained CSLAP volunteers collected data at more than 200 lakes across the state, but this still thousands of lakes aren't regularly assessed. The DEC wants to develop an operational lake-water assessment tool for monitoring. A graduate student funded by

NYView and DEC is using the relationship between in-situ CSLAP data and

Algal bloom on Owasco Lake, Cayuga County NY.

Sentinel-2 imagery to establish a model that could use remote sensing data to target lakes for ground observations.

Faculty and graduate students from ESF talking with community members at the New York State Fair.

Faculty, staff, and graduate students from the SUNY College of Environmental Science and Forestry (ESF) supported NYView's remote sensing education efforts at the New York State Fair in September 2022. ESF personnel used a STELLA (Science and Technology Education for Land/Life Assessment) device to demonstrate the spectral response of different samples. The STELLA was built by staff at ESF using directions developed by researchers at NASA GSFC.

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BENEFITS TO NEW YORK STATE

As part of the AmericaView Consortium, NYView has supported the application of remote sensing data and products to solve challenges in New York State (NYS) since 2009. Remotely sensed imagery provides a unique viewpoint to observe the ground. This imagery supports a wide range of applications in NYS including analyzing land use and land cover change, quantifying water quality, characterizing vegetation dynamics, planning or monitoring urban growth, and supporting emergency response.

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 demonstrated applications of remote sensing data for visitors at the New York State Fair using Landsat change pairs from sites across the state and using a handheld spectrometer to perform observations. NYView has also developed video modules and lab exercises to support use of the cloud-based Google Earth Engine platform.

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

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

In addition to the important education focus described above, NYView has explored integration of airborne lidar and Landsat data for quantifying forest aboveground biomass and investigated remote sensing and spatial analysis for assessing vegetation trends along riparian corridors. Ongoing research projects focus on using remote sensing data to support assessment of water quality in lakes and characterizing change in wetlands over time.

NEW YORKVIEW CONSORTIUM MEMBERSHIP

Current NYView consortium members include the State University of New York (SUNY) College of Environmental Science and Forestry (ESF), the Institute for Resource Information Sciences (IRIS) at Cornell University, and SUNY Fredonia. NYView also has collaborators at other institutions of higher education and agencies within NYS as we seek to encourage 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.

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NORTH DAKOTAVIEW 2021 - 2022 ACTIVITIES

Remote Sensing and Forestry institute for K-12 Teachers. NDView co-hosted this two-day institute in June 2022 with the ND Geographic Alliance and the ND Forest Service. This institute was part of the GeoFIT summer teacher education program. NDView provided funding to cover the one credit tuition for participants via the University of North Dakota, North Dakota State University, or Minot State University.

• Advance education and training, technology transfer, and outreach were provided to teachers in remote sensing and forestry. Teachers were given hands-on learning experience in the classroom using internet-based tools for the analysis of Landsat and Sentinel satellite imagery. Analysis of local and global forested areas was conducted. Participants initiated lesson plans to transfer these skills to K-12 students.

• Classroom exercises were followed up with field-based exercises in spatial resolution of satellite imagery, tree measurements and plant identification. Training took place on the campus of Minot State University, Denbigh Experimental Forest (US Forest Service) and the Towner State Nursery (ND Forest Service and North Dakota State University).

August 22nd Modis Satellite Imagery for North Dakota
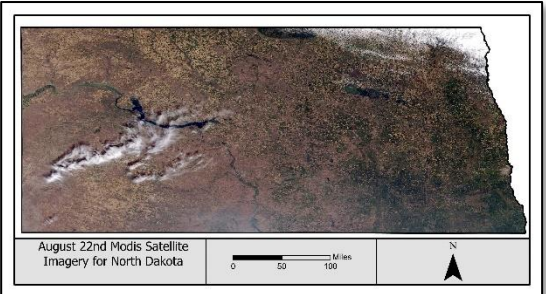
North Dakota landscape from MODIS imagery, August 22, 2020. development.

Teachers working in the classroom at Minot State University, (June 2, 2022).

Tree coring and measurements at Minot State University (June 2, 2022).

Assessing tree health, Denbigh Experimental Forest, Denbigh, ND (June 3, 2022).

Institute participants at Denbigh Experimental Forest, Denbigh, ND (June 3, 2022).

Towner State Nursery, Towner, ND (June 3, 2022).

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BENEFITS TO NORTH DAKOTA

- NDView provided scholarships for undergraduate and graduate students at the University of North Dakota for research and training in remote sensing related areas. Students conducted research in wildlife-vehicle collisions, water quality and harmful algal blooms.

- NDView hired two student interns for summer 2022 to work on data analysis on brine spills and to put together a story map on the spills associated with oil production in the state.

- NDView conducted training for ND K-12 teachers in remote sensing and other geospatial technologies and covered their tuition costs.

- NDView provided access to specialty software for training and analysis on remote sensing data from satellites, aircraft, UAS and ground-based sensors, for students and faculty at University of North Dakota.

- NDView funded student transportation to the ND Geospatial Summit, and purchased new computer equipment for student research and outreach.

Amalie Joergensen, NDView scholarship winner, is researching wildlife-vehicle collisions.

JamesGuy Gierisch (left) and Jacob Moll, NDView scholarship winners are researching water quality.

NORTH DAKOTAVIEW CONSORTIUM MEMBERSHIP

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## OHIOVIEW 2021-2022 ACTIVITIES

OhioView Presents: Workshop Series

OhioView member universities Youngstown State University, University of Toledo, Bowling Green State University, Kent State University, Miami University, and University of Dayton presented two workshops for a combined attendance of more than 140 participants on February 4 and 25, 2022. PIs from each university presented a section of the workshop that covered a variety of remote sensing and geospatial topics that used freely available software and data. This workshop is the latest in an ongoing series and was held online to be open to participants from across the country throughout the AmericaView network.

OhioView Teacher Training

Ohio teachers participated in professional development to learn how to incorporate satellite imagery and GIS analysis through ArcGIS Online into student projects. An OhioView teacher collaborated, during the summer, with high school students who were part of the University of Texas STEM Enhancement in Earth Science (SEES) Program and traveled to Austin, TX in support of the program. The teachers will use the techniques they learned in their classrooms this school year.

Water Quality Monitoring and Education

Bowling Green State University (Dr. Anita Simic Milas) was part of the ORIGIN (Ohio River Integrated Geospatial Interinstitutional Network) program in collaboration with KentuckyView and West VirginiaView. Undergraduate and graduate students were involved in mapping water properties such as turbidity and chlorophyll-a, an indicator of phytoplankton biomass as well as in mapping soil moisture and evapotranspiration.
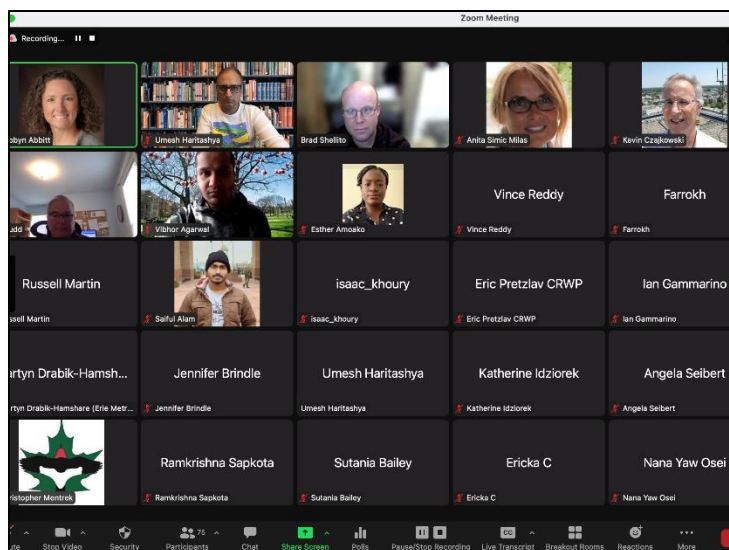
Participants in the 2022 OhioView Presents remote sensing workshops participated online via Zoom to receive instruction on multiple types of remote sensing applications using freely available software and data.

ORIGIN / SPLIT (SPatial LITeracy) students – Peer learning: Students learned from each other how to map algal blooms by using various remote sensing software and visualization techniques. Landsat 8/9 and Sentinel-2 data were used for mapping water properties.

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BENEFITS TO OHIO

- Initiated in 1997, OhioView is a consortium of universities in Ohio dedicated to furthering education, research, and workforce training in Earth Observation Science. OhioView is overseen by a Board of Directors made up of PIs from several of the universities in the consortium. Many 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, educational efforts, and research conducted by OhioView universities.

- The OhioView "Online GIS and open-source remote sensing" workshops served approximately 140+ faculty, students, and workforce members over two days. Instruction included using building a ArcGIS StoryMaps Map Tour (Dr. Bradley Shellito), comparison of multispectral and hyperspectral classification (Dr. Joseph Ortiz and Mr. Mac Woodman), using NASA SeaDAS with ocean color and water quality (Dr. Anita Simic Milas and Mr. Kamrul Islam), classification using Google Earth Engine (Dr. Umesh Haritashya and Dr. Vibhor Agarwal), using the NASA Globe Observer app to validate tree height measurements (Dr. Kevin Czajkowski with Mr. Brian Campbell), and mobile data collection with online forms and Survey123 (Ms. Robbyn Abbitt).

- 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. and provides 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 that will be May 10, 2023 this year.

- The ORIGIN program established a network of institutions, researchers and students who applied existing and newly developed algorithms for monitoring water quality issues such as algal blooms.

- The SPLIT (Spatial LITeracy) Geoscience program deepened students' understanding of geoscience using geospatial information through field and hands-on training series. This program was also funded by the NSF.

- Regional partners include NASA Glenn Research Center and the Old Woman Creek State Nature Preserve.

K-12 SATELLITES students at North Star Montessori Academy present their investigation on the Influence of Luge Track Color on Ice Quality at the GLOBE Midwest Collaborative Conference

Participants at the 2022 online OhioView Presents remote sensing workshops receive instruction on using the GLOBE observer app for citizen science in relation to NASA projects.

Participants in the OhioView teacher professional development studying land cover at Earth Heart Farms in Oak Harbor, OH.

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OHIOVIEW

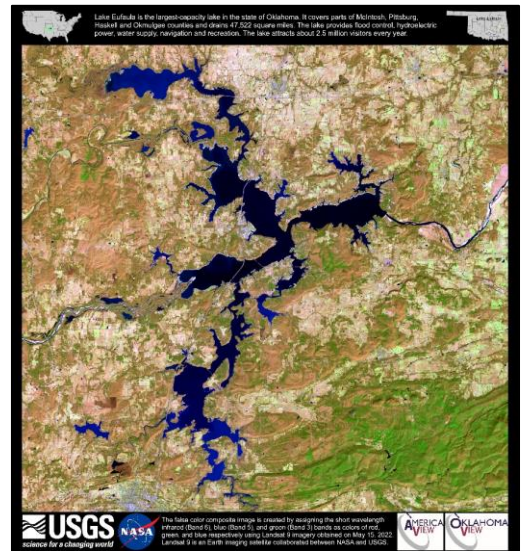http://www.ohioview.org

@OHViewGeo

OKLAHOMAVIEW 2021 - 2022 ACTIVITIES

The proposed HIA for GY20 was to reveal the beauty of Oklahoma with remote sensing images to promote the awareness of remote sensing science and technology.

Five unique landscapes were chosen to develop aesthetically beautiful posters with satellite remote sensing images, high spatial resolution imagery from small Unmanned Aerial Systems (sUAS), and ground photography.

Different band combinations have been evaluated to highlight these unique landscapes in Oklahoma. Then color composite images were used to make high quality posters to show Oklahoma as Art. Drone and ground photos were included to spark the viewers' interest in earth observation by connecting the familiar scenery with the satellite image that depicts the landscape from space.

Site	Description
Black Mesa	Oklahoma's highest point, where the Rocky Mountains meet the shortgrass prairie
Gloss Mountains	A series of mesas and buttes with sparkling selenite crystals
Great Salt Plains	Salt lake with white shore area
Lake Eufaula	Oklahoma's largest lake
Little Sahara	Vast sand dunes in the middle, named for its resemblance to the Sahara Desert
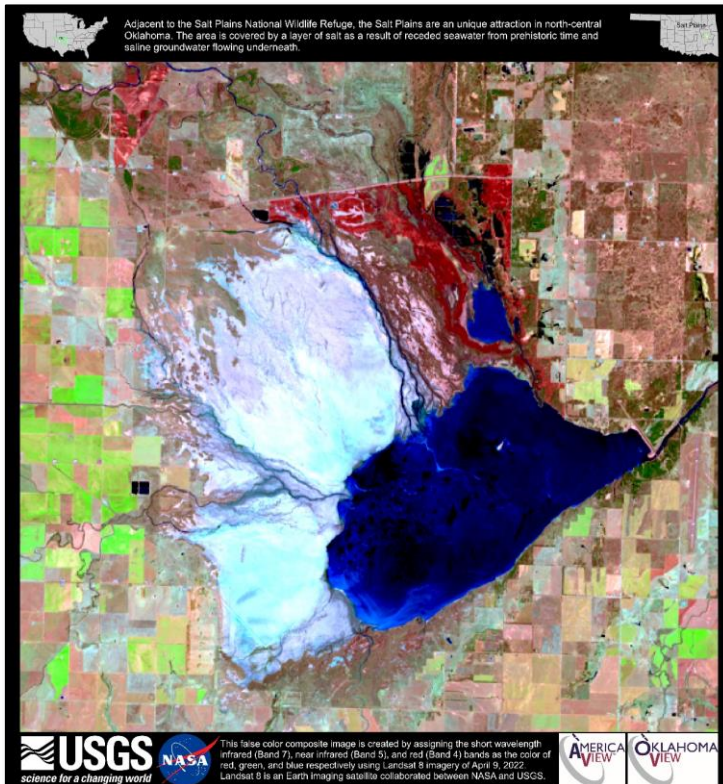
False color composite image (band 7, 5, 4) from Landsat 8 showing the Great Salt Plains in Oklahoma

Top: a drone image showing the white shore area
Bottom: a ground photo showing crystal-digging site

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BENEFITS TO OKLAHOMA

- Two undergraduate students learned how to download Landsat images and create color composite images in ArcGIS Pro. One undergraduate student learned how to plan field trip and fly sUAS under various conditions.

- Posters made from Landsat images are being reviewed by the consortium members of OklahomaView to further enhance collaboration.

- These posters will be distributed to various groups, such as the consortium members of OklahomaView, local art museums, libraries, and schools.

- We are in the process of making an ArcGIS StoryMaps, using the satellite images, sUAS and ground photos to further improve people's awareness of remote sensing in Oklahoma.

False color composite image (band 7, 5, 4) from Landsat 8 showing Lake Eufaula in Oklahoma

A drone image showing the landscape of Little Sahara

A bird wandering on the shoreline of Lake Eufaula

OKLAHOMAVIEW CONSORTIUM MEMBERSHIP

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OREGONVIEW 2021 - 2022 ACTIVITIES

The 50th Anniversary of Landsat is an extraordinary milestone in Earth observation and science, both globally, and in our home state of Oregon. Leveraging the Earth Observation Day (EOD) Gameboard, "Rivers: Our National Water Resource," co-designed by Oregon State University PhD student, Selina Lambert, OregonView led a number of activities around the theme: *thinking in time series*.

The EOD Game was introduced at an EOD Celebration, co-hosted by OregonView and OSU's Student Chapter of the American Society for Photogrammetry and Remote Sensing (ASPRS), and enhancements were developed throughout the year with participant feedback. Through multiple outreach and education events, including an EOD Game presentation at the ASPRS Virtual Conference, OregonView has helped inform students and stakeholders about space-based observations of a changing Earth.

OSU PhD student, Selina Lambert, gives coastal remote sensing presentation at a SCUBAnauts 2022 event.

Land Cover Challenge 2022

OregonView's Peder Nelson and Prof. Robert Kennedy discuss space-based observations of a changing Earth in Globe program videos.

OregonView State Coordinator, Peder Nelson, organized and led multiple sessions related to the "thinking in time series" High Impact Activity (HIA) at GeoFest2022, an event sponsored by OregonView member, Nancee Hunter, at the Center for Geography Education in Oregon. This event was attended by 48 teachers. Presentations and workshops included: "Teaching Cause and Effects with the Landscape Change Monitoring System" by Peder Nelson and Austin Michelbrink; "Oregon as Art: Celebrating 50 years of Views of Oregon from Space (Or: You Can Teach Any Topic with Satellite Images!)" by Peder Nelson; and "Introducing and Demonstrating EOD Game" by ASPRS Student Chapter member, McKenzie Kramer. The "Oregon as Art" presentation stemmed from work that OregonView conducted collaboratively with University of Hawaiʻi in an "Earth as Art" eight-week class.

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BENEFITS TO OREGON

STEM outreach and citizen science are central to OregonView's mission. A 2022 STEM For All Multiplex showcase, "Engaging the Public in S.T.E.A.M. with Landsat," featured Oreg onView's Peder Nelson. This video highlights how science has been transformed through 50 years of Landsat, and how participants can become actively engaged in citizen science, using the NASA-supported GLOBE Observer mobile app and AmericaView and USGS data and resources. OregonView members were also featured in two Globe Program videos: Land Cover Challenge Wrap Up and Carbon Cycle and Ecosystem Change.

OregonView's 2022 outreach activities also included:

- Gave two presentations at the AGU 2021 Fall Meeting on OregonView's previous activities in satellite derived bathymetry
- Led a Working Group on the 50th Landsat Anniversary celebrations
- Gave presentations at the JALBTCX 2022 Coastal Mapping and Charting Workshop
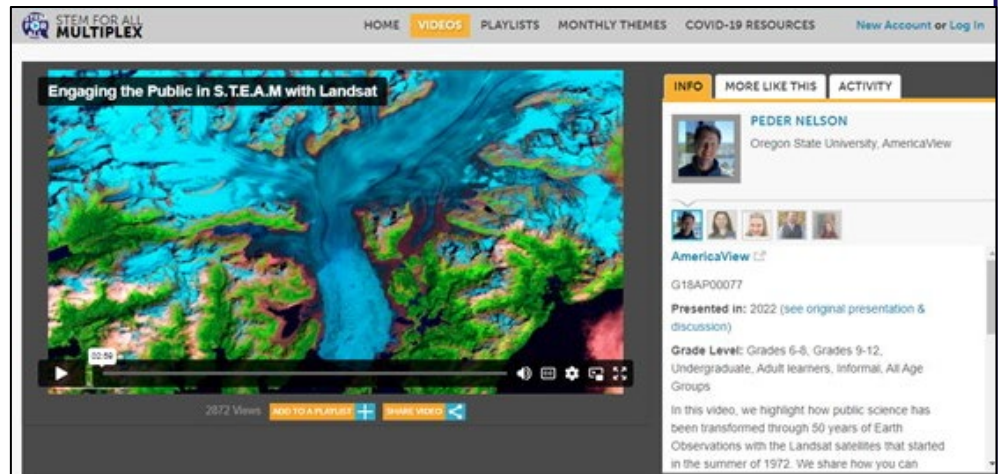
A 2022 STEM For All showcase, "Engaging the Public in S.T.E.A.M.," highlights how science has been transformed through 50 years of Landsat

OREGONVIEW CONSORTIUM MEMBERSHIP

The OregonView consortium membership comprises leaders in the remote sensing and geospatial information communities within Oregon and extends across the government, commercial and academic sectors. Member organizations include: Oregon Department of Parks & Recreation (OPRD), USGS Forest & Rangeland Ecosystem Science Center, Oregon Framework Implementation Team (FIT), Oregon Geospatial Enterprise Office (GEO), Portland State University (PSU), Oregon State University (OSU) College of Engineering, College of Forestry, and College of Earth, Ocean, and Atmospheric Sciences.

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

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PENNSYLVANIAVIEW 2021 - 2022 ACTIVITIES

In service to the AmericaView initiatives of PennWest University – California (formerly California University of Pennsylvania), multiple projects were completed or developed during the academic year Fall 2021 to Spring 2022 and through the following summer and fall of '22. Most of those projects fall within the scope of the Pike Run Watershed but serve the broader communities within Washington, Fayette, and Allegheny Counties of southwestern PA and extended reach to eastern Ohio, northern West Virginia, and northwestern PA. Projects include course-related education involving PennWest – California (PWUC) students in Hydrology, Geomorphology, Introduction to Soils, Watershed Evaluation and Management, and Advanced Environmental Geology. Over three entire semesters, over 100 students participated in field experiences involving stream flow and water quality measurements using equipment and materials secured through AmericaView funding. One example of impactful student opportunities included using GIS and database management, in addition to spatial data for the region of eastern Washington County. Students evaluated historical maps and aerial imagery against modern imagery and satellite data to identify land use changes and determine potential sources of sediments and nutrients to regional streams.
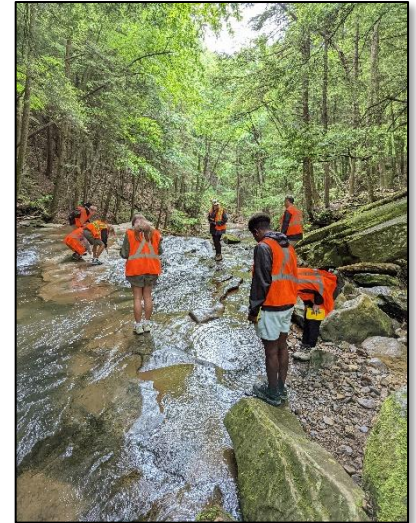
Students working on stream flow and water quality.

Table work of drilling.

Drill Work.

In Spring 2022, a special symposium in concert with the Pittsburgh Geological Society (PGS) and multiple environmental consulting firms invited students, professionals, and community members to the "SAI Farm" of PWUC's Student Association, Inc. This "drilling workshop" leveraged academic and environmental professionals' experience to share common challenges of resource extraction and legacy industries in western PA. Participants used historical and modern maps and air photos to determine potential environmental hazards, predict the behavior of contaminants, and establish potential remedial strategies. During the workshop, three faculty members (PWUC – 2, Slippery Rock University – 1), five professionals, including drillers, 25 students, and 12 community members participated. After "table" work simulating Phase I site investigations using spatial and tabular data, and participants spent the following day in the field on a drill rig site with professional demonstrations of geotechnical and environmental techniques.

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BENEFITS TO PENNSYLVANIA

PennsylvnaniaView's projects are not just focused on southwestern Pennsylvania. We are a consortium of members throughout the Commonwealth of Pennsylvania. Our primary goal is to educate the public about remotely sensed imagery and provide any information in a public forum. Here is one example:

Villanova University Project

Imagery was acquired from multiple sources (Planet Lab and SPOT-6 1.5m pan-sharpened, orthorectified imagery) to piece together data of the City of Philadelphia before and after Hurricane Ida hit. One neighborhood in particular was used as a case study in this research which had reported significant impacts from flooding during Hurricane Ida as well as a previous tropical storm that occurred in 2020, Tropical Storm Isaias. Each image included RGB and Near-Infrared bands that allowed researchers to utilize the Normalized Difference Water Index (NDWI), a calculation which enhances open water features while reducing the reflectance of soil and vegetation features.

The results indicate that Hurricane Ida caused widespread moisture increases, and likely areas of storm water inundation, especially within the neighborhood of Manayunk.

Post Hurricane Ida in Manayunk
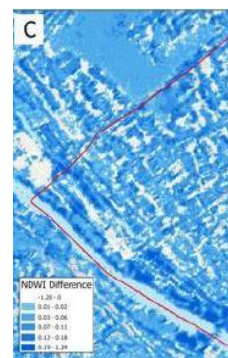
Results of the NDWI calculation.

PENNSYLVANIAVIEW CONSORTIUM MEMBERSHIP

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PENNSTATE 1855

PennWest CLARION

Bucknell UNIVERSITY

VILLANOVA UNIVERSITY

PennsylvaniaView Principal Investigator:

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PENNSYLVANIA VIEW

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RHODE ISLANDVIEW 2021 - 2022 ACTIVITIES

Rhode IslandView study predicts tree mortality from spongy moth outbreaks in Rhode Island.

Spongy (a.k.a. gypsy) moth is an invasive insect that had outbreaks in southern New England between 2015 and 2017 and in northern New England over the past two years. During outbreaks, the insects cause widespread defoliation of deciduous trees and extensive tree mortality in the southern New England region. Satellites, such as Landsat, allow the extent of severe canopy defoliation to be monitored. However, GIS modeling was needed to estimate the amount of tree mortality that resulted from the defoliation.

With AmericaView support, the University of Rhode Island recruited and mentored graduate and undergraduate students to create a GIS model that predicted the severity of tree mortality resulting from the spongy moth outbreaks in Rhode Island. The model predictions were based on defoliation, mapped with Landsat imagery, and other GIS data representing soil conditions, forest type, drought severity, terrain, and other environmental factors.
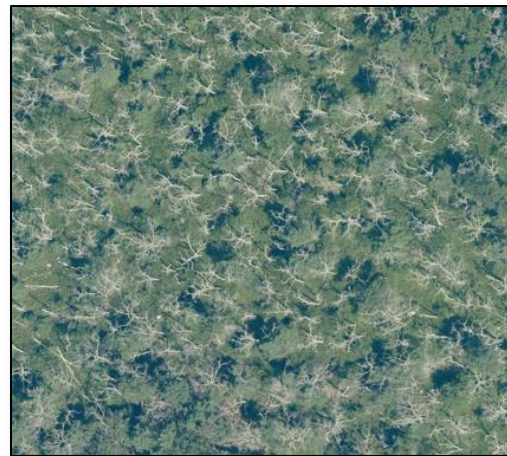
High tree mortality in Rhode Island resulting from the 2015-2017 spongy moth outbreak.
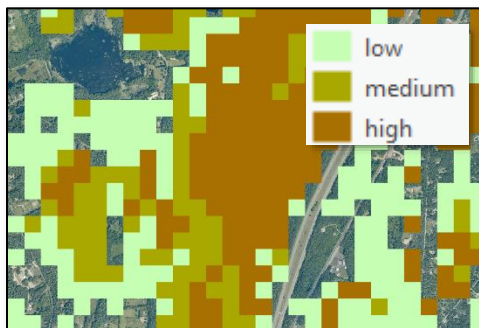
Tree mortality predictions (bottom) compared to summer aerial imagery.

The model predicted 3 classes of tree mortality (low, medium, high) with 62% accuracy or 2 classes of mortality (low, high) with 78% accuracy. We found that defoliation was by far the most important factor in predicting tree mortality. Important secondary factors included:

- Distance from coast,
- Forest canopy density,
- Drought condition,
- Distance to developed areas,
- Forest type (deciduous vs. coniferous).

According to our model:

- 21% of Rhode Island forests experienced moderate tree mortality (3-10 canopy trees/ha)

- 23% of Rhode Island forests experienced severe tree mortality (> 10 canopy trees/ha)

- At least 500,000 canopy trees were killed by the outbreak.

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BENEFITS TO RHODE ISLAND

The tree mortality model will help land managers protect public safety and create habitat for wildlife conservation.

The model output will show citizens and land managers where to focus efforts on dead tree removal to reduce threats to motorists, powerlines, and recreational users of the forest. Wildlife managers can manage forests in some of the high tree mortality areas to create early successional habitat which is uncommon in the state but needed for the survival of many wildlife species. The study demonstrated the capabilities of Landsat and geospatial modeling to predict tree mortality resulting from pest outbreaks.

The Rhode IslandView activities supported one graduate and one undergraduate research assistant during the spring and summer of 2022. They gained valuable experience in learning how to find and work with satellite and aerial imagery and use machine learning tools through the Environmental Systems Research Institute (ESRI)'s ArcGIS Pro software. The students developed skills in communicating technical remote sensing material to non-technical audiences through oral and poster presentations. They will bring the skills and knowledge gained to their professional communities upon entering the workforce.
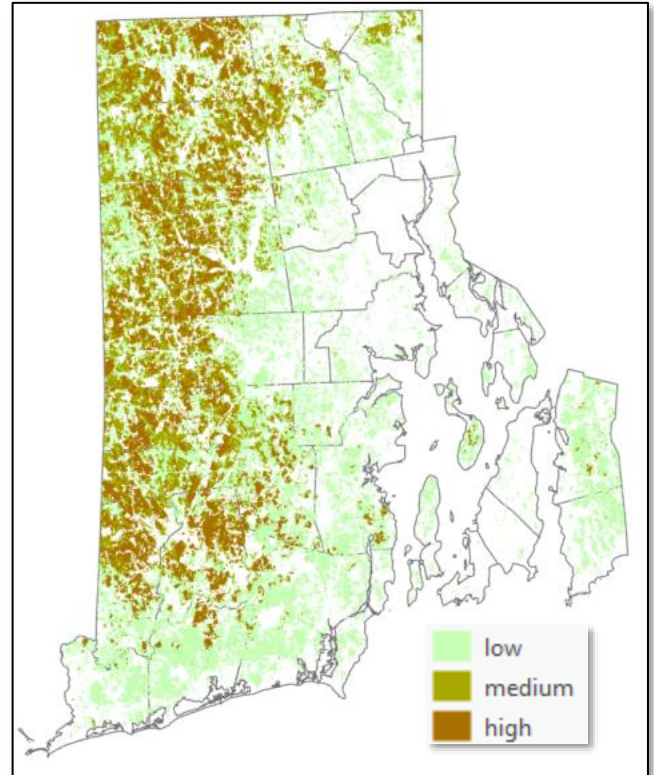
Statewide tree mortality predictions.

RHODE ISLANDVIEW CONSORTIUM MEMBERSHIP

Rhode IslandView Principal Investigator:

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SOUTH DAKOTAVIEW 2021 - 2022 ACTIVITIES

South DakotaView (SDView) is focused on remote sensing education and outreach to students, educators, and current workforce personnel across South Dakota. SDView activities during this past year include:

- **South Dakota as Art Workshop for American Indians**
  The workshop was held at the American Indian Science & Engineering Society 2022 AISES Region 5 Conference. The objective was to develop material for and conduct a South Dakota as Art Workshop for American Indians. *SDView* downloaded Landsat imagery from the USGS Global Visualization Viewer (GloVis). Image modifications and enhancements were performed using an open-source software called GNU Image Manipulation Program (GIMP). Attendees were provided with laptops and preloaded software.

  Selected topics covered by the *South Dakota as Art* workshop included:
  - Background of Earth as Art and USGS website.
  - Instructions on the application and techniques for using the GNU Image Manipulation Program (GIMP) to modify Landsat imagery.
  - Discussion on Landsat imagery band combinations.
  - Describing resolution and spatial features.
  - Discussion of landform/landscape features in South Dakota.
  - STEAM discussion on merging sciences and arts.

American Indian Science & Engineering Society 2022 AISES Region 5 Conference.

Reid Dettbarn (SDSU student) Identifies Landsat land features.

L9T2 event.(from L to R) Millett, Applegate, Trujill, and O'Neill.

- **53rd Annual South Dakota State Geography Convention**
  - Thursday, March 31st and Friday, April 1st, 2022.
  - Students presented remote sensing research posters.
  - Physiographic identification from Landsat imagery.
  - South Dakota as Art display.
  - Open to the public (>200 visitors).
- **Landsat 9 Transition Time (L9T2) Event**
  - August 10-11, 2022, at the Earth Resources Observation and Science (EROS) Center in Sioux Falls, SD.
  - SDView PI served on the planning committee for the Landsat 9 transition from NASA to USGS.
  - Dr. Hankui Zhang, Khuong Tran, and Mary O'Neill presented papers.
  - Keynote Speaker - Assistant Secretary, Tanya Trujillo (ASWS)
  - Speaker - Dave Applegate, Ph.D., Director, U.S. Geological Survey.
  - 135 attendees between online and in-person.
- **Two $1000 mini-grants**
 - Competitively awarded to graduate students for projects involving geospatial technologies.

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BENEFITS TO SOUTH DAKOTA

- **Remote Sensing as Art Workshop -** The *South Dakota as Art Workshop for American Indians* strived to bring awareness and foster an interest in geospatial technologies with American Indian students in South Dakota. In addition, it encouraged American Indian students to express their interpretation Earth's varied landscapes as art.

- **Conferences / Conventions -** SDView participated in in the Annual South Dakota State Geography Convention. It is the oldest continuous student-run conference in the nation. The conference provides a venue for students and invited speakers in the geospatial community to present, learn, and connect with experts in the field and for students to present their research and projects.

- **Minigrants –** Provided support for technology in the classroom and students to present their research:
    - Implementation of GPS technology in Public Schools.
    - Estimation and Evaluation of Particulate Emissions for Indonesian Peatland and Non-peatland Fires.

Attendees creating art from Landsat imagery.
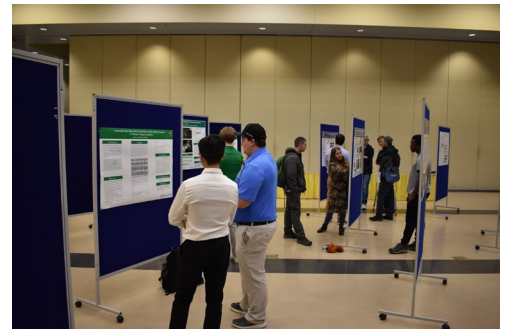
Student poster presentations at the 53rd South Dakota State Convention.

SOUTH DAKOTAVIEW CONSORTIUM MEMBERSHIP

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

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TEXASVIEW 2021 - 2022 ACTIVITIES

TexasView recognizes the impact on outreach and education through the ***Earth as Art*** exhibitions hosted by StateViews in recent years. TexasView has developed exhibition materials for ***Texas as Art***, with the intent of displaying the exhibition in cooperation with TexasView partner institutions over the next several years. The exhibit is focused on 10 ecoregions of Texas defined by Texas' Department of Parks and Wildlife (TPWD), whose online resources support the exhibit.

The exhibit highlights the applications of satellite imagery across a broad range of challenges that affect Texas' ecoregions. Focusing on Texas State parks "brings the challenges home" and makes the exhibit relevant for diverse venues. New artwork is developed for each new host institution, in partnership with local stakeholders. Local artists have been invited to co-exhibited to provide ground-based perspectives.

Texas as Art has been disseminated through public and conference presentations (seven); exhibits at two partner institutions (Sul Ross State and Texas Tech Universities); four public exhibits; two conference exhibits; two workshops. Exhibit proposals have been accepted and scheduled for two partner institutions in GY23 (Midwestern State University and University of Texas at El Paso.
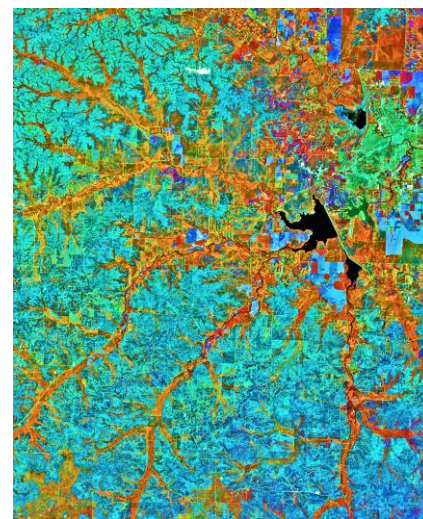
Texas as Art image of San Angelo city and State Park area. Drainages converge towards the Concho River; reservoirs support local agriculture and domestic needs in the Rolling Plains Ecoregion.
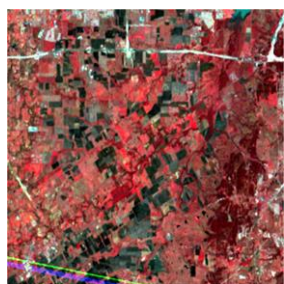
Change from agricultural land use (1974) to urban and suburban (2022) followed development of Joe Pool Reservoir near Dallas, TX.

Development of materials for and participation in training of educators continues. **"Watching over Texas from Space"** was offered at the Sibley Nature Center in June of 2022, to an audience of 11 teachers ranging from pre-K to High School. The workshop focused on "what can we see on satellite imagery" and "what can we do with satellite imagery". Table-top activities reinforced identification of landforms and land use. Handout activities introduced concepts of geographic grids and scale as participants identified surface features and measured distances.

Change detection was introduced during the second half of the workshop. Participants were introduced to online change resources including the U.S. Geological Survey's ***Earthshots*** website and the NASA Earth Observatory resource ***World of Change***. Change pair matching games were introduced in tabletop, lecture, and virtual versions. Next, the Texas as Art virtual exhibit resource was introduced, including the scavenger hunt activities that are keyed to the artworks.
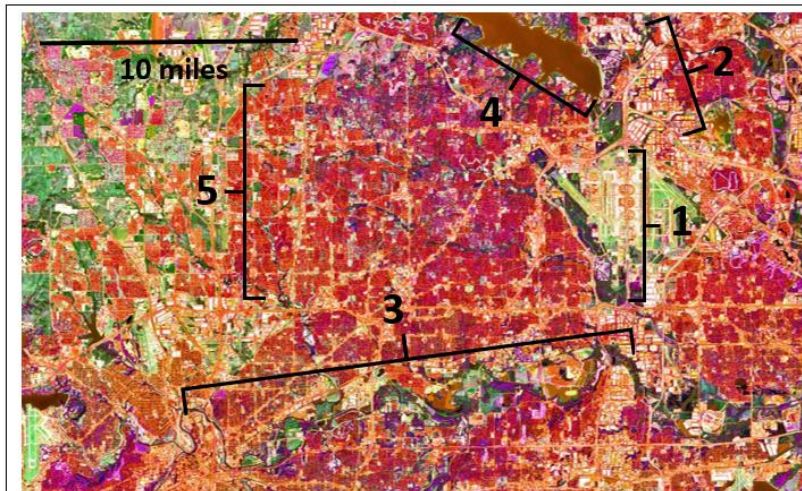
Finally, the teachers were given a drive with multiple resources, including three digital remote sensing books, all the materials from the workshop and from the earlier (GY20-21) "Our Changing Earth" online workshop, and the mini-grant funded new publication "Watching over Texas from Space", a new teacher's guide. This publication emphasizes correlations with Texas Essential Knowledge and Skills (TEKS) standards and the Next Generation Science Standards (NGSS) for Earth Science.

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WHAT CAN WE SEE ON SATELLITE IMAGERY?

In this view of the city of Fort Worth, Texas, you can see:

1. A large airport with multiple runways
2. Industrial warehouses
3. A meandering river running through populated area
4. A drinking water reservoir with muddy water
5. Residential neighborhoods

Materials in the newly published book **Watching over Texas from Space** has been growing over the past six years, as TexasView has expanded its outreach effort through teacher-training workshops. Lessons that provide imagery for teachers to use at multiple grade levels have been integrated with activities, games, and lectures, to enable teachers to easily find and use imagery in the classroom and in laboratory activities to address knowledge and skills defined within the Texas Essential Knowledge and Skills (TEKS) standards. The imagery used in the lessons is predominantly over the State of Texas, but the topics that are covered also fit very well with core ideas and skills defined in the Next Generation Science Standards (NGSS). This publication introduces a new approach to enable teachers to insert imagery into a lecture, an assignment, or an activity, by identifying targeted knowledge and skills where imagery can meet teachers' needs and then providing examples that are ready to use and easily accessible and replicable.

TexasView Consortium Membership

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

TexasView is founded on the concept of free and public exchange among its members of data, information and knowledge concerning the Earth and its processes, as observed by remote sensing and GIS technologies, for education, research, and local government applications.

| Midwestern State | The University of Texas at Austin | The University of North Texas | Sul Ross State University | Texas A&M | Texas Tech | University of Texas of the Permian Basin |

| Stephen F. Austin University | Texas A&M at Corpus Christi | The University of Texas at El Paso | Texas State University | The University of Texas at San Antonio | University of Houston |

TexasView Principal Investigator:

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Midwestern State University

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UTAHVIEW 2021 - 2022 ACTIVITIES

UtahView is hosted by the Remote Sensing/GIS Laboratory in the Quinney College of Natural Resources at Utah State University in Logan, Utah. Dr. R. Douglas Ramsey is the UtahView Principal Investigator and Ellie Leydsman McGinty is the UtahView State Coordinator. During GY21, UtahView (1) presented on the history of the Landsat Program at an ASPRS GeoByte Webinar, (2) developed a series of history posters that highlighted some important individuals and events associated with the Landsat Program, (3) conducted a literature review and created an annotated bibliography on U-Net architecture and convolutional neural networks, and (4) continued to present the Utah As Art exhibit at various AmericaView-related events.

The ASPRS GeoByte Webinars are online seminars sponsored by the ASPRS GIS Division. On April 8, 2022, UtahView presented *A History of the Landsat Program*. This presentation was based on the **Google Earth Web tour** that was developed by UtahView for a GY19 AmericaView Strategic Project Mini-Grant.

To accompany the Google Earth Web tour and the ASPRS GeoByte Webinar, UtahView developed three posters that were presented at the Pecora 22 Conference in Denver, Colorado. The three posters included the following:
1) **The Pioneers of the Landsat Program**
2) **Project EROS: An Earth Resources Observation Satellite Program**
3) **Remembering Charles J. Robinove**

UtahView worked with a GIS Technician, Aidan Buie, in the Remote Sensing/GIS Laboratory at Utah State University to conduct a literature review and to develop an annotated bibliography on U-Net architecture and convolutional neural networks (CNNs). The objective of this effort was to identify a list of methods that could support object-based image analysis. Two documents were developed, including:
1) **A Brief Explanation of U-Net Architecture**
2) **CNN, UNet, and Other Remote Sensing Models**

ASPRS GeoByte Webinar presentation title slide.

Excerpt from the Project EROS poster.

Annotated Bibliography by Aidan Buie.

BENEFITS TO UTAH

   During GY21, UtahView continued to develop educational and outreach materials that promoted and furthered the understanding of geospatial science and applications. The ASPRS GeoByte Webinar highlighted the value and legacy of the Landsat Program. The poster series provided some remarkable information about key scientists and individuals involved in the Landsat Program. One of these scientists, Charles (Chuck) Robinove, passed away in early 2022 and very little was known about him in terms of his scientific contributions. The information that was gleaned about Chuck after some in-depth investigations revealed that he played a pivotal role in the Landsat Program. The literature review and annotated bibliography have the potential to support remote sensing studies that integrate machine learning algorithms. These documents can serve as a basic reference for academics and students who are interested in delving into more sophisticated object-based image classification approaches. Lastly, the Utah As Art map collection and puzzles generated for AmericaView events continue to foster geographic literacy and awareness and to serve as a platform for engaged and interactive learning.

Utah As Art at 2022 Geo Week in Denver, Colorado.

Santa Barbara County floor puzzle at the Lompoc Public Library in celebration of the Landsat 9 launch.

Elizabeth Robinove, Chuck's widow, at the Pecora 22 Conference in Denver, Colorado.
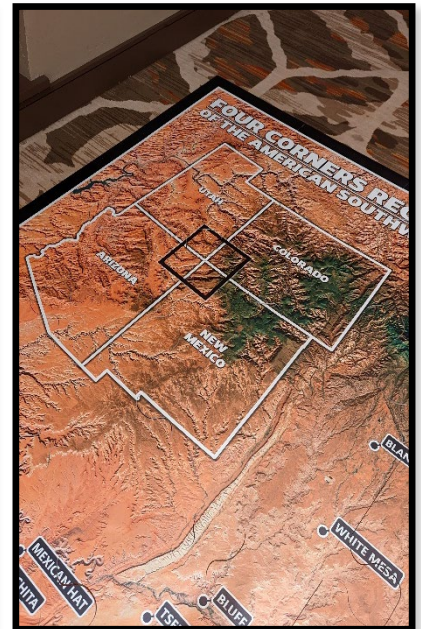
Four Corners floor puzzle at the Pecora 22 Conference in Denver, Colorado.

UTAHVIEW CONSORTIUM MEMBERSHIP

   The UtahView consortium membership consists of Dr. R. Douglas Ramsey, Professor in the Quinney College of Natural Resources and Director of the Remote Sensing/GIS Laboratory at Utah State University; Dr. Phoebe McNeally, Research Associate Professor and Director of the DIGIT Laboratory at the University of Utah; Dr. Sowmya Selvarajan, Assistant Professor of Geomatics at Utah Valley University; Ellie Leydsman McGinty, Researcher III in the Remote Sensing/GIS Laboratory and UtahView State Coordinator; and the Utah Geographic Information Council (UGIC). Collectively, these consortium members bring a wealth of scientific, outreach, and technical experience to the urban, rural, and wildland regions of Utah.

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 @UtahView

 @UTview

 @utahview

VERMONTVIEW 2021 - 2022 ACTIVITIES

The Need for Local-Scale Land Cover Information
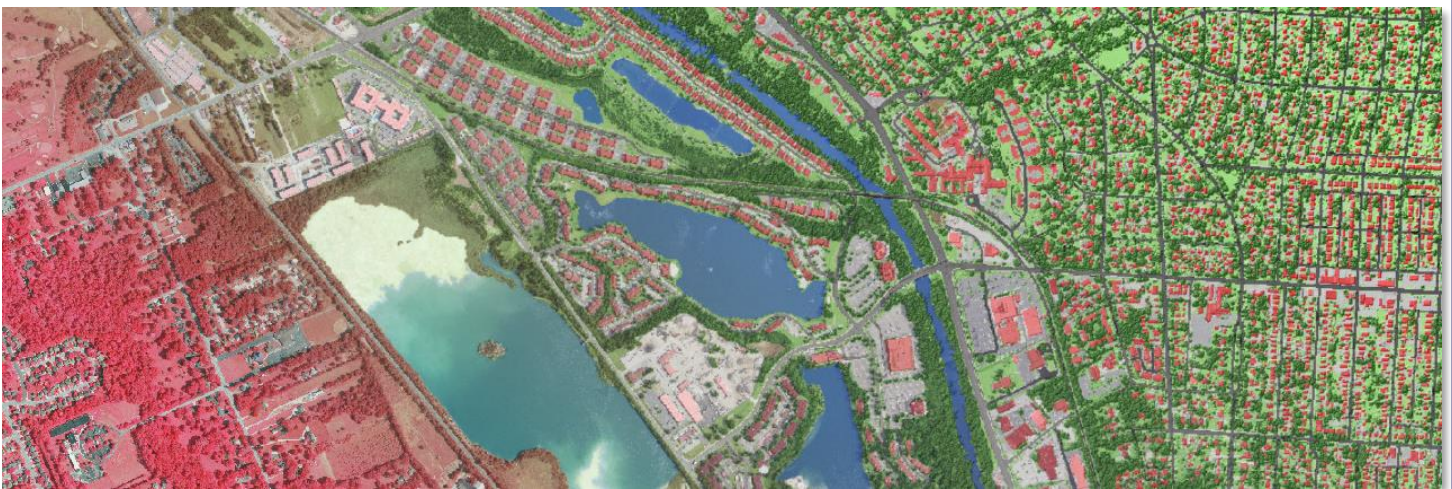
Cities across our nation are turning to green solutions, such as tree planting, to combat climate change and address long-standing issues of inequality. To make informed choices, decision-makers need access to accurate, high-resolution land cover data that enables them to quantify the features in their community and relate this to other information such as socio-demographic data and heat island measures.

Awash in Data, Lacking Information

Cities across our nation are turning to green solutions, such as tree planting, to combat climate change and address long-standing issues of inequality. To make informed choices, decision-makers need access to accurate, high-resolution land cover data that enables them to quantify the features in their community and relate this to other information such as socio-demographic data and heat island measures.

A Free, Easy-to-Use Artificial Intelligence Solution

VermontView, in partnership with Microsoft and Development Seed, created a free solution that allows anyone to generate high-resolution land cover data for areas in the United States. The PEARL Planetary Computer Land Cover Mapping tool uses Microsoft AI, freely available data from federal government sources, and VermontView-produced land cover data as the backbone for its solution.

The PEARL Planetary Computer Land Cover Mapping tool makes it easy for any user to derive land cover from publicly available imagery.

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Lisa Wirth, Program Director:
lisa.wirth@americaview.org
John McGee, Board Chair:
jmcg@vt.edu

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.

Analytical Capacity
VermontView leverages the massive computing infrastructure at the University of Vermont to apply big data analytics to extract actionable information from vast remote sensing datasets.
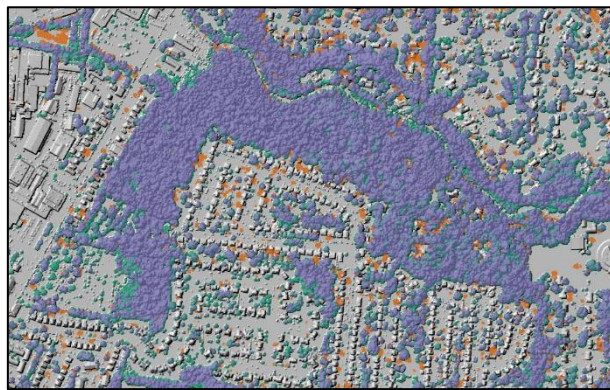
The Future Workforce
Developing the workforce of the future starts today. VermontView is active throughout the state in K-16 outreach and education, providing students with STEM learning opportunities.

Collaboration
With resources strained we know collaboration is more important now more than ever. VermontView brings people together to solve

VermontView's high-resolution land cover mapping helps local-decision-makers understand their communities to help plan a greener future.
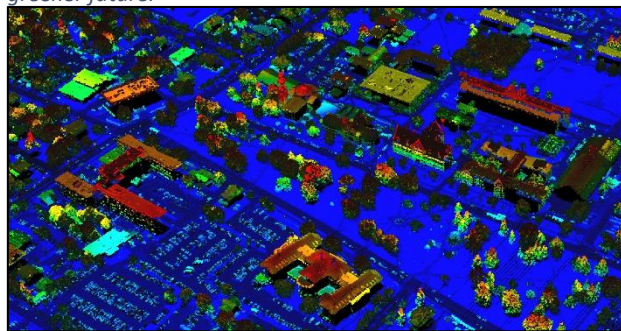
LiDAR has proved an invaluable tool for Vermont. VermontView provides technical expertise ranging from quality control to technical assistance.

VERMONTVIEW CONSORTIUM MEMBERSHIP

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VIRGINIAVIEW 2021 - 2022 ACTIVITIES

VirginiaView, a longstanding member of the AmericaView Consortium, has contributed to a broad range of activities that bring teachers, students, and the public into contact with remote sensing imagery through educational programming and resources. Through workforce development opportunities, VirginiaView provides remote sensing education for an array of stakeholders, including students, middle school / high school educators, 2-year college and university faculty and staff, government employees, and private industry. VirginiaView provides targeted programs to advance STEM education that is vital to Virginia's New Economy.

During 2021-2022, VirginiaView continued to respond to workforce needs across the commonwealth by redesigning our popular *Mapping with Drones* workshop. Six workshops were then conducted, with ~95 professionals completing the 3-day intensive workshop.
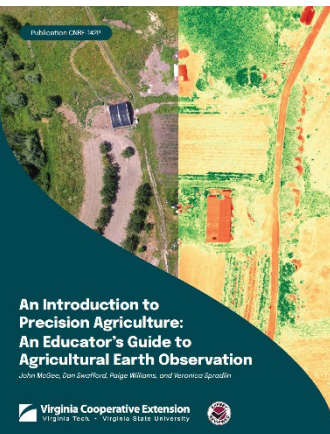
VirginiaView also refined and redesigned two STEM-based curriculum guides to support the needs of pre-college educators. These curriculum guides include *An Introduction to Precision Agriculture* (upper left) and the *sUAS Manual Flight Exercises* manual (lower left). These resources were piloted with teachers in 2022, and will be further disseminated to educators across the state in 2023.
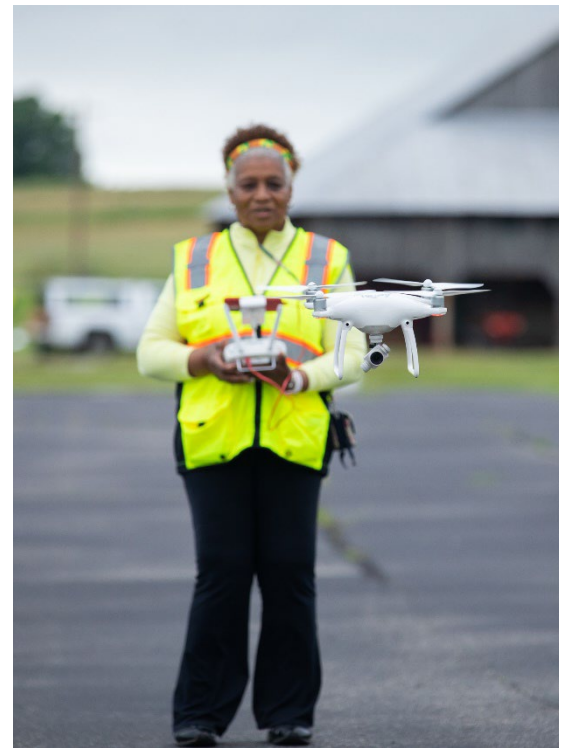
The Mapping with Drones workshop prepares professionals to conduct safe flight operations that support data capture.

Mapping with Drones Workshop *as* Testimonials:

…I attended this workshop a representative of my agency, VDACS Office of Plant Industry Services. I and several other inspectors had received training through another online program and our Part 107 license in 2019. My firm advice to my agency will be that any inspectors in the future who wish to train for and receive their Part 107 should do it through this workshop. Many of the areas of learning were covered better and yet more succinctly in this workshop; it is very helpful that I also learned ways to put our drone to use in the field.

…Without a doubt the professionalism and quality of the drone lectures were beyond expectation and delivery. This is a great set of lectures within the workshop that can really boost even the toughest learner into finding delight and satisfaction with drone piloting and mapping skill sets.

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John McGee, Board Chair:
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BENEFITS TO VIRGINIA

VirginiaView supports the needs of Virginia's communities through professional development at all levels and provides many text-based and video resources for self-paced learners. These educational opportunities are designed to target the evolving needs of Virginia's workforce. They can be transformative.

- Instructional video tutorials have been viewed over 478,000 times, with over 33,500 views during GY 2021 alone.

- Video tutorials have been viewed for over 14,500 hours, with 1,300 hours watched during GY 2021 alone.

- Approximately 95 individuals received remote sensing professional development training during GY 2021. The majority of the workshop participants received their FAA Remote Pilot Certificate (RPC) and later attended other hands-on professional development drone and remote sensing workshops at Virginia Tech.
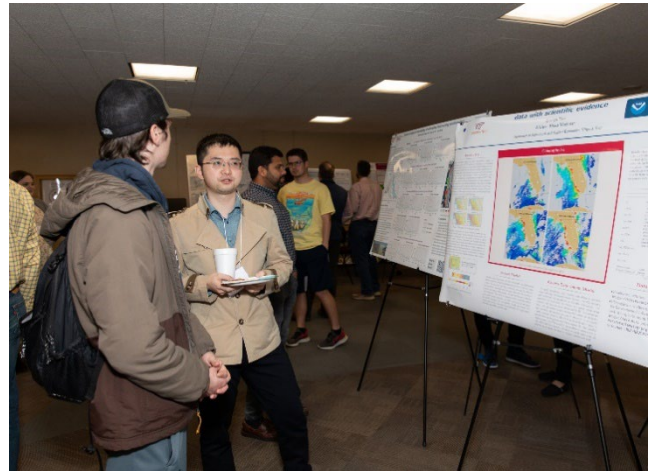
VirginiaView provides workforce development training for multiple stakeholders, and provides both research and service-learning experiences for both undergraduate and graduate students.

Book Description	Pub. Type	Year Pub.	# Copies down-loaded	# Kindle pages read
RS in ArcGIS ArcMap	eBook	2015	516	11,890
Lidar ArcGIS Desktop	eBook	2016	335	19,026
Lidar ArcGIS Desktop	print	2016	70	--
RS in ArcMap, 2nd ed	eBook	2017	228	8,765
RS in ArcMap, 2nd ed	print	2017	119	--
RS with ArcGIS Pro	eBook	2019	720	44,150
RS with ArcGIS Pro	print	2019	447	--
Lidar ArcGIS Pro	eBook	2020	208	13,700
Lidar ArcGIS Pro	print	2020	88	--
Total	**--**	**--**	**2,731**	**97,441**

- VirginiaView continues to disseminate remote sensing book (and eBook) tutorials on Amazon. These publications have been extremely popular with over 97,400 Kindle pages read, and 2,730 copies downloaded. These books are utilized by educators across the U.S. and globally. Requests have been granted to translate these materials into different languages. These remote sensing educational resources utilize Landsat imagery, since this data collection responds to real-world application needs.

VIRGINIAVIEW CONSORTIUM MEMBERSHIP

VT COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT VIRGINIA TECH™

Virginia Cooperative Extension — Virginia Tech · Virginia State University

B Blacksburg High School

VIRGINIA PENINSULA COMMUNITY COLLEGE

VIRGINIA SPACE GRANT CONSORTIUM

VT | CONSERVATION MANAGEMENT INSTITUTE

GERMANNA COMMUNITY COLLEGE

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https://flickr.com/photos/vageospatial/albums

WEST VIRGINIAVIEW 2021 - 2022 ACTIVITIES

Our **first HIA** this year focused on continuing to develop **free, online course materials** relating to remote sensing, GIS, and geospatial data science. Key activities this year include:

- Updating our website and hosted courses including *Methods in Open Science*, *GIScience*, *Open-Source GIScience*, *Digital Cartography*, *Client-Side Web GIS*, *Remote Sensing*, *Open-Source Spatial Analytics (R)*, and *Geospatial Deep Learning*
- Adding new modules to our *Open-Source Spatial Analytics (R)* course relating to tidymodels, shiny apps, and raster analysis with terra.
- Adding a new course relating to open data science using Python.
- Adding new lab exercises to our *GIScience* course.

Our **second HIA** focused on working with KentuckyView and OhioView as part of the **ORIGIN project**, which is associated with water quality predictive modeling.

New course webpage.

R packages that are covered in our course content.


```
class Course:
    def __init__(self, subject, number, name):
        self.subject = subject
        self.number = number
        self.name = name
    def printCourse(self):
        print("Course is " + self.subject + " " + str(self.number) + ": " + self.name)

x = Course("Geography", 550, "GIScience")
x.printCourse()
type(x)


x.number = 350
x.printCourse()
```

Python code example.

```
names(pre) <- c("Blue", "Green", "Red", "NIR", "SWIR1", "SWIR2")
names(post) <- c("Blue", "Green", "Red", "NIR", "SWIR1", "SWIR2")


pre_nbr <- (pre$NIR - pre$SWIR2)/((pre$NIR + pre$SWIR2)+.0001)


post_nbr <- (post$NIR - post$SWIR2)/((post$NIR + post$SWIR2)+.0001)


dnbr <- pre_nbr - post_nbr


tm_shape(dnbr)+
tm_raster(style= "equal", n=7, palette=get_brewer_pal("YlOrRd", n = 7, plot=FALSE))+
tm_layout(legend.outside = TRUE)
```

R code using terra package to calculate difference normalized burn ratio.

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BENEFITS TO WEST VIRGINIA

- Provide educational materials for students and geospatial professionals
- Foster remote sensing education, outreach, and research in the state
- Provide access to LiDAR data via a web app
- Fund software purchases
- Provide summer funding for graduate students

Published student research paper supported by West VirgniaView.

West VirginiaView webpage.

WEST VIRGINIAVIEW CONSORTIUM MEMBERSHIP

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

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WISCONSINVIEW 2021 - 2022 ACTIVITIES

WisconsinView's "High Impact Activity" leverages its *RealEarth* mapping platform and visualization tool to empower Earth observation education and outreach. The goal is to assist StateView members of AmericaView in sharing educational materials and research results by utilizing *RealEarth* as an Earth science communication tool. The platform is flexible and works in both web browsers and mobile devices. Mobile devices with locational services give educators an opportunity to put their students "into the data" as an immersive experience. This year WisconsinView developed video tutorials and conducted an in-person workshop at the AmericaView annual meeting in Fort Collins, Colorado.
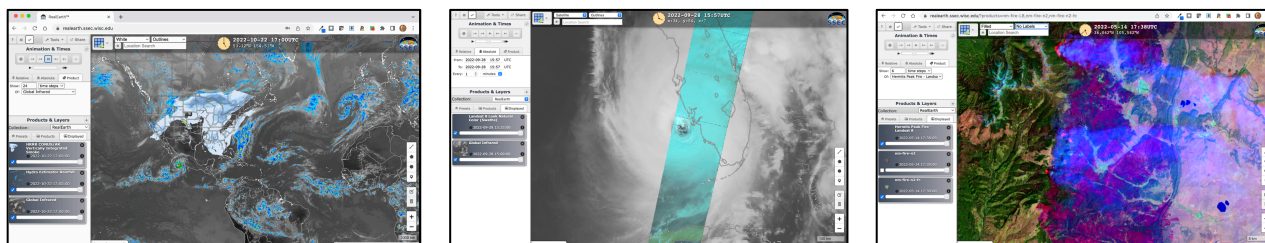
Examples of satellite-derived rain rate with wildland fire smoke (left), Landsat-8 over the eye of Hurricane Ian (center), a New Mexico wildland fire.

RealEarth is a flexible tool that allows visualization of nearly any spatial data. At the PECORA22 conference in Denver, Colorado, WisconsinView's Sam Batzli showed how the *RealEarth* platform facilitates data visualization across the atmospheric science and Earth science domains. He showed examples of how Landsat imagery can be overlaid with GOES (Geostationary Operational Environmental Satellites) weather imagery to give higher spatial resolution to meteorological features of interest. *RealEarth* is structured around time and location, making it possible to synchronize visualization and animation of data of different types. Because much of the imagery in *RealEarth* is acquired and displayed in near real-time, it is useful for event-based monitoring of severe weather events and natural hazards like wildland fires and flooding. This HIA advances education, training, technology transfer, and outreach.
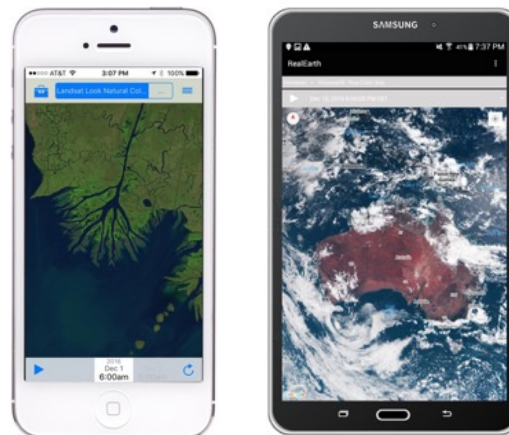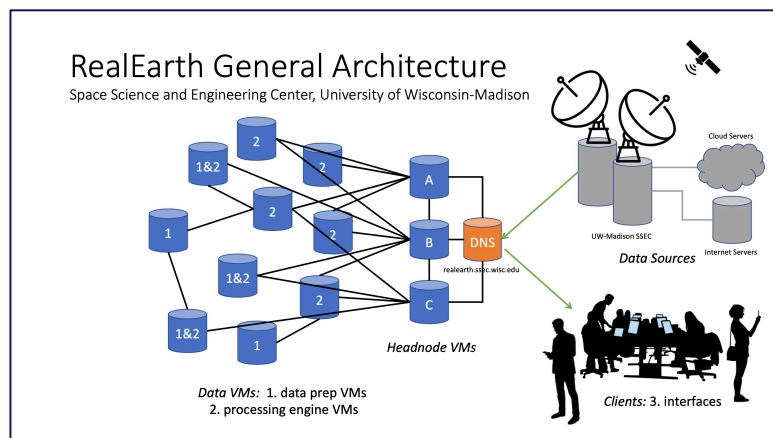
The architecture of the RealEarth *visualization platform (left) with examples of the iOS mobile app showing a Landsat 8 image of a river delta (center) and the Android mobile app showing geostationary imagery of Australia (right).*

AmericaView
Empowering Earth Observation Education
americaview.org

Since its establishment in 2004, WisconsinView has supported Earth observation education and outreach across Wisconsin in the following ways:

- **Presenting** Earth observation data and information at public science events across the State and in local classrooms.

- **Enriching** access to high-value data sets such as LiDAR and aerial photography through a 100TB ftp server.

- **Demonstrating** how to utilize emerging web mapping technologies such as OGC WMTS in workflows by professionals as well as in the classroom.

- **Partnering** with organizations and agencies to leverage expertise and synergies.

WisconsinView collaborates with other StateViews with similar goals and regional concerns, sharing research and education ideas and leveraging the power of the AmericaView network.

Students enjoy a 3D experience of a terrain model at a museum outreach event in Milwaukee, WI.
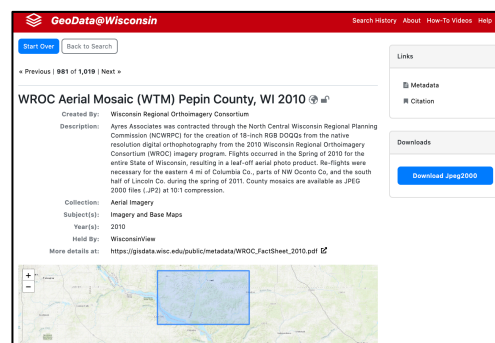
WisconsinView partners with the State Cartographer's Office and UW-Madison Department of Geography to catalog data sets for improved discovery.

CURRENT WISCONSINVIEW CONSORTIUM PARTNERS

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

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WYOMINGVIEW 2021 - 2022 ACTIVITIES

11 UW Students Successfully Completed Internships

In GY 2021-22, one graduate and ten undergraduate students completed their internship (1 student completed 2 different projects). These students (future workforce) were trained on remote sensing projects for crop damage assessment (1 student), crop water stress (1), rangeland reclamation (1), wildfire mapping (1), invasive mapping (1), water mapping (2), and rapid flood mapping (5). These students used Landsat and Sentinel-2 A/B images for mapping and monitoring projects. Training students in problem-based remote sensing projects was the primary high-impact activity proposed by WyomingView for GY.

Four undergraduate interns presented their findings in the Wyoming Undergraduate Research Day (URD) in Laramie, WY (Apr 23). WyView PI trained these interns on image processing and presentation skills. Interns trained in water/flood mapping will be presenting their findings in an upcoming national conference.

WyomingView interns (from left to right) Shelby Stith, Traylin Bruegger, Jordan Jochems with WyomingView PI. Not pictured: Cody Green. These interns presented their findings in 2022 Wyoming Undergraduate Research Day, in Laramie, WY. Since 2004, WyomingView has trained 94 interns. Read testimonials from interns at:
https://wyomingview.blogspot.com/p/interns.html

Three EOD and 2 Outreach Activities

WyomingView reached out to 265+ school students (grade levels 8-12) in GY 2021-22.

- EOD activities were customized to match the content covered in the science classes
  - Fourth graders saw the association between rivers and human settlements, and growth over time (*15 students*)
  - Sheridan High School students were introduced to the images acquired in the visible and invisible regions of the spectrum and their utility for monitoring Earth surface features (*16 students*)
  - Laramie Middle School students (8th graders) used ALTA II Spectrometer for measuring spectral reflection of 2 sets of leaves, and later connected those measurements to satellite observations (*223 students*)
- Outreach activities to promote remote sensing science & applications to high school students in a) Science Fair Enrichment activities, and b) Women in STEM events.

*More than 75 Wyoming high school students were introduced to tracking changes with satellite images and later assembled the large floor puzzle "Wyoming from Space". This activity was conducted as part of **Women in STEM** event in Laramie.*

EOD and outreach activities are effective to promote remote sensing applications and to recruit next generation of students.

AMERICAVIEW
Empowering Earth Observation Education
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BENEFITS TO WYOMING

- Past WyomingView interns are currently working in federal, state, and local government agencies & in private companies. Past interns have confirmed the value of the training they received as part of the internship
- New testimonials from past interns will be uploaded to: https://wyomingview.blogspot.com/p/then-now.html.
- WyomingView will continue to recruit and train more interns for future workforce development.

  - WyomingView PI was invited by the Wyoming Farm Bureau Federation to its meetings to highlight the benefits of Landsat data for monitoring Wyoming crop and range lands.

  - The first event was held in Cheyenne in March to coincide with their legislative outreach activities. The second event was held in Casper in November. More than 75 farmers and ranchers (in both events) were introduced to Landsat data and products, and how they can be used for mapping crop growth, crop stress, invasive species, and water availability in the state.

  - Three farmers expressed interest in working with student interns for monitoring their fields and ranches.

WyomingView PI highlighted the benefits of 50 years of Landsat data in Wyoming Farm Bureau Federation's annual meeting Casper, Wyo.

WYOMINGVIEW CONSORTIUM MEMBERSHIP

In the 2022 WyoGeo annual meeting, WyomingView PI talked about "Accessing Landsat Data and Products in the Collection Format Era". County and city planners from Wyoming were in attendance and learned the changes in data characteristics and distribution over the 50 years of the Landsat program (Sep 15, 2022 – Laramie).

WyomingView works with farmers and ranchers to promote remote sensing applications:

- In GY 2021-22, WyomingView worked with 4 farmers and ranchers for monitoring crop damage (MT), crop water stress (WY), invasive species mapping (WY), and rangeland reclamation (WY).
- Four WyomingView interns worked with these farmers and ranchers for processing Landsat and Sentinel-2 images.
- Three farmers provided testimony describing the benefits of Landsat imagery for monitoring ground conditions.

Testimonials provided by these farmers and ranchers are highly valued by AmericaView and USGS. WyomingView will continue to work with farmers and ranchers through the internship program.

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WYOMING VIEW

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