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

AmericaView: A National Remote Sensing Consortium
Grant Award Number: G18AP00077

AmericaView Technical Report for Grant Year 2018

Period of Performance
18 September 2018 to 17 September 2019
(With NCE from 18 Sept 2019 to 31 March 2020)

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

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Glossary of Terms

AGI	American Geosciences Institute
ARSET	Applied Remote Sensing Training
ASPRS	American Society for Photogrammetry & Remote Sensing
AV	AmericaView
AWS	Amazon Web Service
CO-I	Co-Investigator
DOI	Department of Interior
DRR	Disaster Risk Reduction
ED	Executive Director
EO	Earth Observations or Earth Observatory
EOD	Earth Observation Day
EOS	Earth Observing System
EROS	Earth Resources Observation and Science
ESA	Ecological Society of America
ESRI	Environmental Systems Research Institute
ESW	Earth Science Week
FBI	Federal Bureau of Investigation
FTM	Fall Technical Meeting
FY	Fiscal Year
GEE	Google Earth Engine
GY	Grant Year
HIA	High Impact Activity
ISRSE	International Symposium on Remote Sensing of Environment
LST	Landsat Science Team
LWG	Landsat Working Group
NASA	National Aeronautics and Space Administration
NCE	No Cost Extension
NLI	National Land Imaging
NLRSEORA	National Land Remote Sensing, Education, Outreach and Research Activity
OBIA	Object Based Image Analysis
OLI	Operational Land Imager
OSM	Open Street Map
PI	Principal Investigator
PM	Program Manager
SBSWG	Satellite Based Sensor Working Group
SC	State Coordinator
STEAM	Science, Technology, Engineering, Art, and Mathematics
STEM	Science, Technology, Engineering, and Mathematics
sUAS	Small Unmanned Aerial System
SV	StateView
SWOT	Strengths, Weakness, Opportunity, Threat
UAS	Unmanned Aerial System
UASWG	Unmanned Aerial System Working Group
UAV	Unmanned Aerial Vehicle
USGS	United States Geological Survey
VAP	Value Added Provider
VPWG	Veterans Priority Working Group
WBM	Winter Business Meeting
WQQU	Water Quality, Quantity, and Utility
WWG	Water Working Group

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1 Introduction and Overview

1.1 Report Purpose and Structure

This report summarizes the activities for the United States Geological Survey (USGS) National Land Imaging (NLI) program Grant Award G18AP00077 for the National Land Remote Sensing Education, Research and Outreach Activity (NLRSEROA) to AmericaView (AV) from 18 September 2018 to 17 September 2019, with a no-cost extension (NCE) from 18 September 2019 to 31 March 2020. This report satisfies the grant year reporting requirements for Period 1 of the award. The report contains a detailed description of completed activities for grant year 2018 (GY18). Metrics for this report were captured, interpreted, and presented by AV Staff.

The report is organized in four sections with associated supporting material available for download at links noted within the report. Section one provides an AV and StateView (SV) consortium overview. Section two presents selected achievements that have been accomplished by AV SV members, or at the national level, to meet the USGS NLI grant objectives. Section three is a brief grant year review. Section four is a fiscal summary and report of grant fund expenditures.

Note: In order to maintain a reasonably sized technical report document, all supporting materials are available for individual download:

- *Capability of Existing Remote Sensing Data Products to Meet the Needs of AmericaView's User Constituencies*
- *AmericaView Bibliography of NLRSEORA Grant Supported Publications*
- *AmericaView GY18 Fact Sheets (bulk download)*
- *AmericaView GY18 2019 Winter Business Meeting Agenda*
- *AmericaView GY18 StateView Membership Highlights*
- *AmericaView GY18 Earth as Art Fact Sheet*

1.2 AmericaView – A National Consortium

AmericaView, a 501(c) (3) non-profit education and research organization, is a nationally organized consortium of state-based consortia with more than 15 years of experience advancing the availability, timely distribution, education, and widespread use of remote sensing data and technology. AV SV members are led by 39 local universities that facilitate state-based consortia consisting of more than 300 local, state, and regional members with a directive of advancing the widespread use of remote sensing data and technology through education and outreach, workforce development, applied research, and technology transfer. Each SV delivers remote sensing related educational, research, and operational products and services that meet the needs of the state, local, and regional communities that it serves. The success of AV is a direct result of the power of collegiality and of the *power of the AmericaView network*.

The concept of a national consortium to advance the adoption and use of remote sensing technologies and products at the state level was conceived in 1998 with the establishment of OhioView. Expansion to the national level was authorized by the United States Congress and achieved by AV. AV was

incorporated as a non-profit in 2003, and began with ten members. Today AV is a locally facilitated and nationally coordinated consortium that has grown to 39 SV members (Figure 1). AV SV Principal Investigators (PIs), Co-Investigators (Co-Is), and State Coordinators (SCs) include some of the foremost remote sensing scientists and educators in the nation, and include editors of major journals, authors of key remote sensing textbooks, and directors of major research laboratories. These remote sensing professionals impact the Earth science community in a wide variety of areas including, but not limited to, environmental monitoring; water quality, quantity, and utility studies; plant-phenology camera studies; natural resource management; traditional and precision agriculture; and, disaster response and risk reduction. Collectively, the PIs of AV are responsible for millions of dollars of competitive grants, lead quality research programs nationally and internationally, and successfully disseminate their research outcomes through publications, presentations, and the web.

Figure 1. The AmericaView national consortium during the GY18 Winter Business Meeting at USGS headquarters in Reston, Virginia.

AV facilitates sharing educational and research material. AV's national websites, including AmericaView.org and the AmericaView University, share pertinent and updated remote sensing resources. AV's social media presence, including Facebook, Twitter, and YouTube, reach thousands of educators, students, decision makers and scientists across the nation and around the world. Metrics collected over the past decade indicate broad interest based and hundreds of thousands of visits and revisits, from the merely curious to the significantly interested. The volume of imagery and other geospatial data, training lessons, and articles that are downloaded through the website interfaces underscores the value of this information and continuing support of these resources.

AV's national organization includes committees and working groups chaired by AV SV members and composed of SV consortium members. These committees and working groups align closely with key objectives of the NLI NLRSEORA program. AV is able to establish working groups that have the ability to respond to prevailing topics of interest or organizational needs. The structure of individual working groups is flexible in order to allow formation or dissolution as needed. Committees and working groups are sustained by consortium members with greater than 1,000 hours of service per year, beyond the funded sub-grant activities.

1.3 Administration and Coordination

AV is a nationally organized consortium of states guided by a board of directors. The duties of the AV board of directors are to provide general oversight to the national organization and ensure the charter

of the organization is observed and the bylaws are followed or modified as necessary. The board is elected from active SVs or other individuals having explicit interest in the mission of AV. Board terms are three years in length and are staggered to ensure that the retention of critical organizational knowledge is maintained and transmitted to new board members. Board member elections occur yearly at the annual AV business meeting. The board is guided by officers including chairperson, vice-chairperson, secretary, and treasurer. (Table 1)

Although AV has no formal employees, it operates under a consultant staff including an executive director, program manager, financial manager and information analyst, and bookkeeper. The duties of the AV staff are to guide the national AV organization; ensure the mission, goals, and objectives of projects are accomplished; to ensure fiscal security; to develop and sustain beneficial relationships; and to maintain fiscal responsibility over the organization. The AV staff work in a virtual format from various locations. (Table 1).

AV is primarily funded by the USGS. Although an independent organization, AV maintains close ties to the USGS to ensure that needs and objectives of USGS, specifically the NLI program are successfully completed. This close working relationship is facilitated by regular communication between the AV Staff and the assigned USGS liaison and contract financial officer. USGS transmits needs, questions, and programmatic requests through the liaison to AV staff. AV staff can then respond to those requests or identify AV members that can assist in the response.

Board of Directors	**October 2018 - June 30, 2019**
Dr. Rebecca Dodge	Chair and Treasurer
Dr. JB Sharma	Vice Chair
Ms. Roberta Lenczowski	Secretary
Dr. Russell Congalton	Director
Dr. Richard Lawrence	Director
Mr. Jarlath O'Neil-Dunne	Director
Ms. Mary O'Neill	Director
Mr. Brent Yantis	Director
Staff	
Mr. Christopher McGinty	Executive Director
Ms. Lisa Wirth	Program Manager
Ms. Jeanie Congalton	Financial Manager and Info Analyst
Ms. Eufemnia Gough	Bookkeeper

Board of Directors	**July 1, 2019 to June 30, 2020**
Mr. Brent Yantis	Chair
Dr. Russell Congalton	Vice Chair
Ms. Roberta Lenczowski	Secretary
Dr. Rebecca Dodge	Treasurer
Mr. Jarlath O'Neil-Dunne	Director
Dr. Thomas Mueller	Director
Ms. Mary O'Neill	Director
Ms. Robin McNeely	Director
Staff	
Mr. Christopher McGinty	Executive Director
Ms. Lisa Wirth	Program Manager
Ms. Jeanie Congalton	Financial Manager and Info Analyst
Ms. Eufemnia Gough	Bookkeeper

Table 1. List of AV Board of Directors and Staff during GY18 with modifications after June 30, 2019 due to annual elections.

1.4 National and StateView Changes

During any given grant period, there are changes at both the national and membership levels. During GY18, AmericaView was pleased to retain the services of Ms. Lisa Wirth, the former principal investigator for AlaskaView, as the new AV national program manager. Ms. Wirth brings many years of

leadership and programmatic experience to the AV staff. Additionally, AV retained the services of Ms. Eufemnia Gough as bookkeeper. Ms. Gough brings years of accounting and bookkeeping experience to AV and directly supports the financial manager in fiscal responsibilities.

At the SV level, as PIs retire or step aside for various reasons, the AV staff, Board, and membership have the opportunity to vet and approve new SV PIs. This process involves a thorough review of the prospective PI credentials and interests by the AV staff, Board, and membership. Both the Board and membership vote to accept the prospective PI as laid out in the AV bylaws. In GY18, AV welcomed five new PIs. AV also welcomed DelawareView as the newest "Full Member" to the consortium. Dr. Tracy DeLiberty serves as the DelawareView PI at the University of Delaware. During GY18, MarylandView was not active due to PI heath issues. HawaiiView only completed half of their effort due to a change in PI duties and availability.

AlaskaView	Dr. Santosh Panda
CaliforniaView	Dr. Yufang Jin
MontanaView	Dr. Scott Powell
West VirginiaView	Dr. Aaron Maxwell
South DakotaView	Dr. Bruce Millett

2 AMERICAVIEW GRANT YEAR 2018 OBJECTIVES AND KEY SUCCESSES

2.1 NLRSEORA OBJECTIVES

2.1.1 Objective 1 - Gather Nationwide Remote Sensing Data and Information Requirements

As a nationwide consortium, led by 39 universities, AV will continue its past work gathering, defining, consolidating, and communicating data and information requirements of local user communities to agency personnel and those that support the development of Earth observing platforms. As a national consortium, AV will work closely with agency scientists and researchers to relay the availability of data and tools, and provide training, to local user communities. AV will improve the nation's capabilities and resources in land remote sensing by creating clear communication channels between all levels. These objectives will be accomplished through AV's national and state consortia, by enhancing the coordination of information regarding the capability of existing remote sensing data products to meet the needs of its user constituencies (including academic, scientific, and local end user communities). AV will assemble this information at the national level and provide feedback to decision makers and agency personnel to help improve the nation's land remote sensing capabilities.

<u>AV National Work Plan</u>

Periods 1-5: AV's national and state consortia will collect information on the ability or identified weaknesses of existing remote sensing data and derivative products to meet the needs of the user constituencies.

Numerous SVs are conducting research projects that are benefiting from the Earth Observation Enterprise. The result of interagency coordination and cooperation has allowed the opportunity for projects to bring different sensors and platforms together for projects that benefit multiple user constituencies. A few examples are noted below. AV will continue to identify and encourage projects

throughout the duration of the grant that help take the pulse of the user community to identify new approaches to combine new and existing data sets.

- OregonView is using ICESat-2 and Landsat-8 to conduct shallow bathymetric mapping, making data freely available to the public.
- KentuckyView used Landsat-8, MODIS, and Sentinel to study harmful algal blooms (HABs) to begin developing inland waterbody (reservoirs and lakes) quality monitoring methodology.
- CaliforniaView supported a PhD student that conducted a pilot project on HAB detection in Lake Tahoe, California using UAV technologies.

AV Satellite-Based Sensor Working Group (SBSWG) Work Plan
Period 1: AV will use its unique position as a consortium of 39 SV's to help define, consolidate, and communicate the data and information requirement of its constituents. The SBSWG will further this objective by identifying and communicating data, information needs, and requirements of AV's constituents and stakeholders to agencies charged with the development and operation of the Landsat and related programs. Prior to its initial Fall Technical Meeting (FTM) under this grant, AV will request information from USGS about specific sensors or platforms about which USGS may be interested in seeking additional or specific information. Each SV member will identify current remote sensing data and information requirements from its own consortium members and other state and local-based stakeholders. General guidance regarding the reporting process will be provided by the SBSWG. A workshop will be held as part of the FTM, during which members will present, discuss, and consolidate the current remote sensing data and information requirements of the AV stakeholders. The results of this workshop will be summarized and delivered to USGS and the Landsat Science Team (LST) within two months of the meeting and presented as part of the AV annual report for this grant period. AV will contribute stakeholder and constituent medium resolution land-imaging needs and requirements to the LST and will participate in relevant public LST discussions vital to AV constituents and stakeholders.

A workshop was held on 25 March 2019 during the AV Winter Business Meeting in Reston, Virginia. AV members were sent an email on 11 February 2019 in anticipation of the workshop requesting members to prepare for the workshop by reaching out within their institutions and among their stakeholders. Three broad topics for the workshop were identified: (1) sensors (e.g., what's good and what can be improved with Landsat and follow-on missions); (2) data products (e.g., L1T, ARD, surface reflectance, land cover maps); and (3) data delivery (e.g., EarthExplorer, GloVis, Google Earth Engine, Amazon Web Services).

The workshop was conducted as a modified SWOT (strengths, weaknesses, opportunities, and threats) exercise. Each of the three topics was discussed in an open, facilitated forum. At the end of each discussion, the 45 participants representing 39 states were asked to fill out an index card listing up to three strengths and opportunities and up to three weaknesses and threats with respect to each topic. Responses were compiled by the chair of the AV Satellite-Based Sensors Working Group and summarized in this report, which was circulated among the Working Group for comment. This effort will be continued throughout Periods 2-5 of the grant. AV had hoped to present this information to the LST following this data gathering activity; however, following the inception of the new LST, AV was not invited back to participate in regular meetings as had previously been the case. While nearly all LST meetings are open to public participation, AV did not have funds budgeted for travel and participation – which were formally covered by the LST and USGS. Therefore, AV was unable to update the LST regarding this effort. As of 13 December 2019, personnel at USGS are looking into the possibility of an

invitation for AV to the February 2020 LST meeting in Phoenix, Arizona. If invited, the AV representative will present the findings of this activity at that time.

Encouraging New Affiliates Work Plan

Periods 1-5: As AV continues to pursue the USGS NLI objectives, the AV national consortium will seek new affiliate state members who are interested in furthering the NLRSEORA objectives. Ultimately, AV will strive to include all fifty states, the District of Columbia, and U.S. territories as appropriate levels of funding are realized.

Efforts to encourage affiliate development were undertaken during GY18 in Missouri and Nevada. Contacts were made with Dr. Ming-Chih Hung from Northwest Missouri State University, Dr. Vasit Sagan from St. Louis University, and Dr. Robert Washington-Allen from the University of Nevada, Reno. Discussions were fruitful; all parties were invested in the NLRSEORA objectives and priorities through their existing projects and were excited at the possibility of joining the AmericaView program. During GY18, no affiliate members were able to be added due to budget limitations. Discussions will continue and it is planned to invite each of them to the AmericaView annual meeting scheduled for March 2020 in Fort Collins, Colorado. Additional grant funding will be required to accept any new full members to the national AV consortium.

AmericaView StateView Activities Work Plan

Period 1-5: All AV members will continue to develop and build local SV consortiums through relevant and timely High Impact Activities (HIAs) and by interfacing with local users. SVs will summarize these relationships and issues, educational opportunities, and outreach opportunities initiated through these consortia developments.

AmericaView has been steadily developing its national consortium since 2002. The maintenance of the consortium enables AV to better understand and serve the remote sensing needs of the residents in the states that it serves. Encouraged growth of the national consortium and state consortia strengthened AV's networking, remote sensing expertise, and knowledge sharing collaboration. AV continues to work to sustain and strengthen its consortium through each SV that consists of varying numbers of members, ranging from 1 to 26 members. Figure 2 describes the wealth of activities conducted by all of the SVs in GY18 to benefit their local consortiums, which in turn, strengthens AmericaView's national impact.

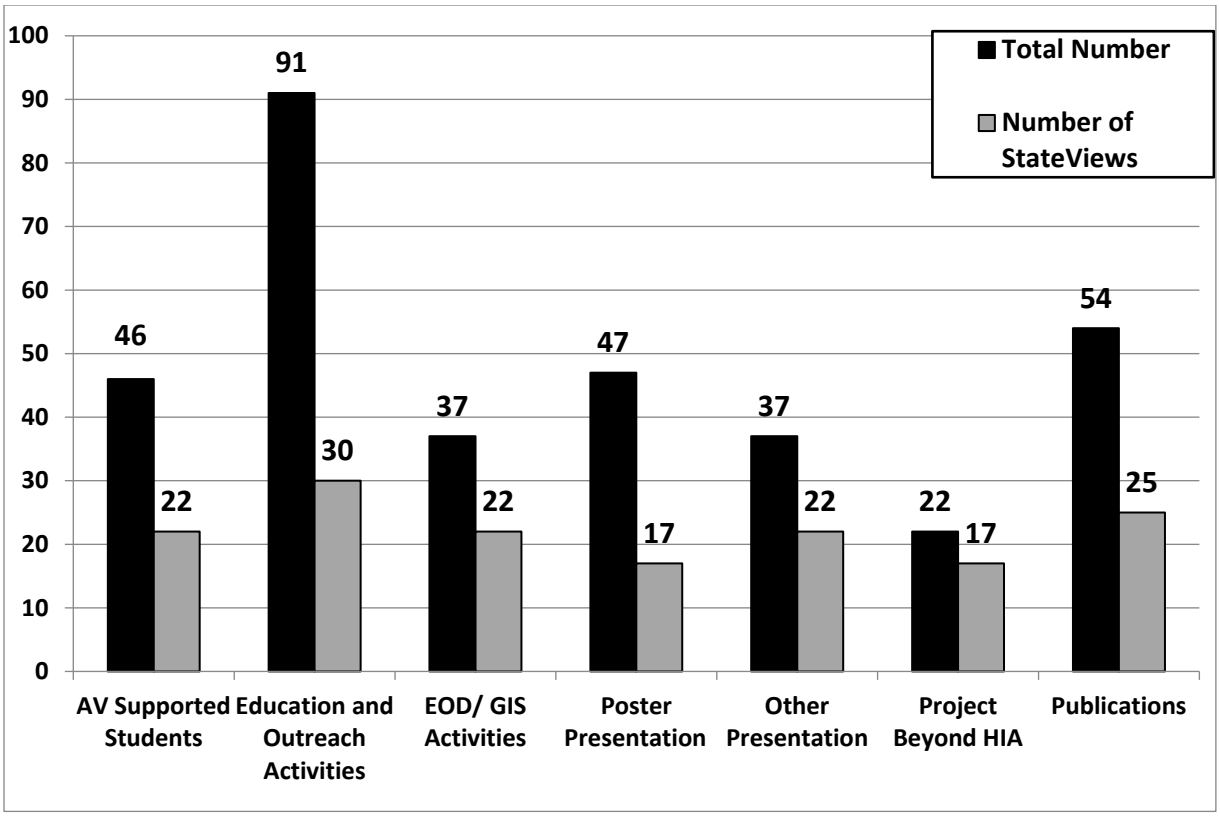

Figure 2. Graph illustrating the different categories in which each state supported their SV consortium in GY 18 through their SV activities (*EOD – Earth Observation Day*).

During GY18, every SV invested time in maintaining and expanding their local state consortia to the benefit of USGS NLRSEORA priorities and objectives. Notably, VermontView supported its existing consortia members by reaching out to additional organizations to help support their training and outreach activities. VermontView has helped to advance the adoption of remote sensing within state agencies through dedicated outreach, engagement, and training activities, with a specific focus on public safety and agriculture. These two state agencies have limited geospatial expertise within their organizations. In mid-October 2018, VermontView conducted a UAS workshop for the Lake Champlain Area Maritime Security Group, an interagency collaboration between the Coast Guard, Vermont State Police, Customs and Border Protection, Lake Champlain Ferries, the FBI, and local law enforcement. Numerous SVs leveraged funding through their consortiums, to the benefit of their consortium and USGS in GY18, details shown in Table 2. It is efforts such as this that dramatically increases the return on investment for the Department of the Interior by investing in the AV program. The success of AmericaView is through the power of the network, made possible through each member state consortium.

State	Name of Project	Other Funding Agency	Brief Description and Overall Outcome
AR	Data Preparation, Processing and Exploitation of Overhead Imagery	US Department of Energy Oak Ridge National Laboratory	In this multi-year project, Tullis served as experimental UAS operations lead, leveraging lessons learned through participation in AmericaView UAS working group; during GY18, time spent upgrading University of Arkansas' UAS capacity.
CO	N/A	Google Cloud Platform Education Grants	An $10,000 computing credits were granted for the completion of the task 2 of ColoradoView 2018 HIA.
IN	MultiSpec	NSF	Continued development of desktop and online versions of the freeware MultiSpec remote sensing application. Releases on 3/1/19, 4/10/19, & 8/19/19. KNN classifier was added as a new feature. Work being done for Support Vector Machine classifier.
IA	Iowa Phenocam	ISU Dept. of Natural Resource Ecology and Management	Iowa phenocam hardware was transferred from the Grand River Grasslands to the ISU campus under the new direction of Adam Janke, professor in NREM. The phenocam system was damaged and needs repair before installation in Ames; funding is being explored for the future.
MN	Lake Clarity Monitoring	MN Environment Natural Resources Trust Fund	Project is developing a near-real-time lake clarity monitoring program based on Sentinel data. Currently in development.
NH	UNH Geospatial Support Center	UNH Library	The library houses a Geospatial Support Center for geospatial consulting to students, staff, and faculty at UNH. One of my graduate students is one of the consultants and I also provide support through providing my expertise, when needed.
OH	Converting Maumee River waste products to create usable soil	St. Ursula Academy High School	In addition to the educational component and knowledge transfer between BGSU and St. Ursula Academy high school teachers and students, this project includes an initial research step where the impact of various soil types on crops is explored.
OK	Mapping surface water resources in Oklahoma	NSF USDA	Develop annual datasets of open surface water body in Oklahoma.
UT	Annual UGIC EOD/GIS Day	Utah Geographic Information Council	UtahView continues to work with the UGIC Education Committee to coordinate with local high schools to teach K-12 students about GIS, GPS, remote sensing, UAS, and ArcGIS Online.
VT	Vermont high-resolution land cover funding	State of Vermont	This project, building on AV-funded pilot projects, developed the first statewide high-resolution land cover dataset for Vermont.
VA	Responding to Significant Weather Events	VT CNRE GeoTEd-UAS	Working in partnship with GEOG Department and the Conservation Management Institute to support the sUAS imagery needs of the Blacksburg Regional Office National Weather service following major weather events (tornados, etc.)
WV	Slope failure risk mapping in WV	FEMA	Use machine learning to map landslide risk across state of West Virignia. Have completed valley and ridge portion of state and am producing manuscript.
WI	Burn Scar Mapping with VIIRS	NOAA	This project involves designing, building, and testing a prototype web-based dashboard for rapidly producing satellite-derived post-fire Burn Intensity Delta Greenness Estimation (BRIDGE) maps to support mudslide and debris flow warnings issues by the National Weather Service.

Table 2. List of StateViews that leveraged funding in conjunction with their AV activities.

Metrics Assessment of Progress

Periods 1-5: Within the Technical Report for each grant period, and at annual meetings, AV SVs will summarize their experiences with the consortia's remote sensing data and information requirements gathering efforts. Metrics, to be determined by the SBSWG, may include the following: issues faced at local levels; data and sensors used to address issues; successes of data and sensors to solve local issues;

and needs or shortcomings of data and sensors to solve local problems. AV will report these summarized metrics to USGS/NLI in annual reports.

During GY18, the chair for the SBSWG retired and relinquished the position before the end of the budget period. Efforts were made by the ED and PM to encourage a new volunteer for this position. Unfortunately, this position was not filled prior to the end of GY18 and the metrics for this work plan were not fully accounted for. This issue will be resolved in mid GY19 per newly initiated incentives approved by the AV Board. These incentives will work to enhance overall committee and working group participation. Additional metrics will be collected in upcoming program periods.

Consortium development will continue to be closely tracked by AV. SVs will report annually on the status of their consortium development efforts. Metrics, to be determined by the ED, may include the following: name(s) and roles of consortium members; additions to local consortiums; benefits those members provide to the consortia, and how new and current members help the SV meet their HIAs and project objectives.

As period one of a five-year grant, AV has initiated a program that tracks the number of consortium members for each SV as a part of our annual metrics gathering effort (Figure 3). In years 2-5, AV will begin collecting metrics on how each SV consortium is changing. There were a number of principal investigator changes in GY18 and the early part of GY19, and as such, some state consortiums are in flux as new PIs are building their individual programs. Although only the first year of the program cycle, there were notable successes throughout the AV network. Specifically, ArkansasView developed a project that stemmed from two-way communication between local communities and the ArkansasView PI. The project has the potential to benefit USGS and the nationwide consortium as a whole. As part of their multi-year approved HIA, ArkansasView has developed a multiuser "remote sensing usability" database to bridge publicly available remote sensing data with specific local applications in Arkansas and collaborating states. In period 1 (GY18) of the project, ArkansasView produced a concept for a database as well as an online prototype called "Gigawatt". Their GY18 progress has set the stage for initial linkages to be developed with the expertise and connections throughout the AV network.

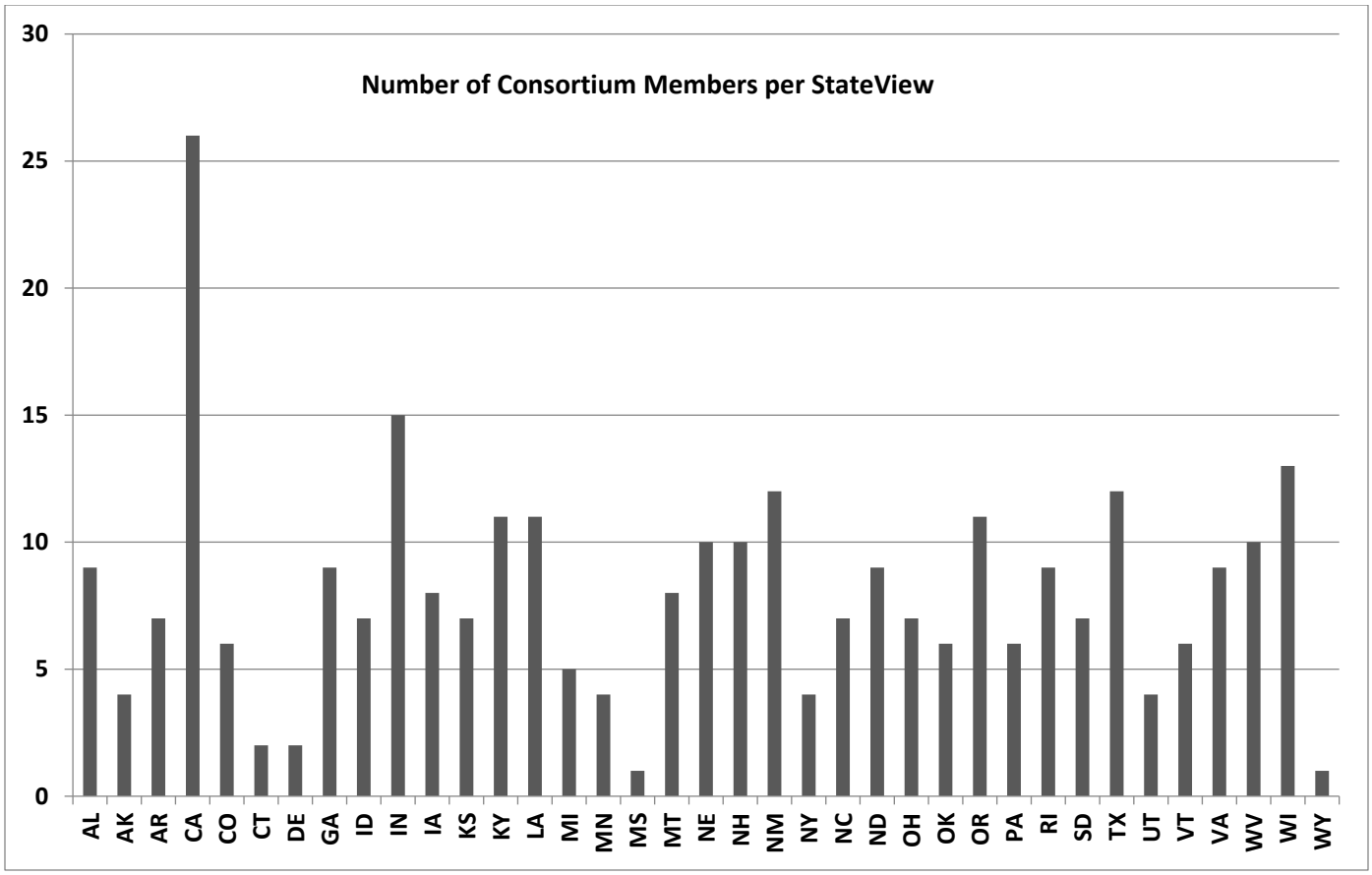

Figure 3. Graph showing the number of consortium members per StateView for GY18.

2.1.2 Objective 2 - Establish Strategic Partnerships

AV enjoys many vibrant strategic partnerships at the national and local levels, which it will further strengthen through this proposal. As remotely sensed and other geospatial applications proliferate into many areas of our society and economy, AV will actively seek and develop new partnerships that reinforce the study, development, and deployment of these applications, educational materials, and tools. With these partnerships, emergent tools, systems, and applications in remote sensing and related geospatial technologies (such as Google Earth Engine (GEE), Unmanned Aerial Systems (UAS), object-based image analysis (OBIA), Amazon Web Services (AWS), novel sensors, proliferating satellite image providers, big data, and deep/machine learning - will be introduced into the repertoire of the current and future remote sensing workforce. AV will establish well-defined partnerships with industry leaders, who have common interests in STEAM workforce development. These relationships will help develop a workforce proficient in remote sensing that is strategically postured to benefit society and the economy. AV will collaborate with institutions that share its strategic goals of advancing remote sensing literacy, applications, STEM/STEAM, and workforce development. AV aspires that its nationwide SV network will continue its 15-year expansion and anticipates, with this grant, an even greater direct connection to regional communities, school systems, local, tribal state governments, and NGOs.

<u>AmericaView National Activities Work Plan</u>

Periods 1-5: AV's Executive Director will look for opportunities to grow the strategic partnerships. The ED will attend national meetings and symposia as an advocate for the NLI NLRSEORA program objectives

and will actively participate to help establish the positive awareness that stimulates the formation of effective and mutually beneficial alliances.

The AV ED is responsible for the long-term viability of the AV program and opportunities to advocate for the NLI NLRSEORA program. Throughout GY18 the ED has attended meetings, conducted outreach, and worked to develop relationships to further this objective. Specifically, the ED attended the South Dakota Statewide Geospatial Conference to promote the USGS NLI and AV Earth as Art initiative; visited the USGS EROS Center in Sioux Falls to discuss future support of USGS EROS initiatives. Additionally, the ED and AV Board Chairperson (at that time, Dr. Rebecca Dodge, TexasView) met with USGS NLI Program Coordinator, Mr. Timothy Newman, about the objectives and needs of the NLI program within the greater USGS purview.

The ED will alert the AmericaView Board and SVs to announcements about possible private and public grants that, if won, would encourage leveraging AV and partners' expertise and advancing appreciation of the great value of remote sensing. These opportunities will enable AV and its members to leverage projects and funding to further the overall beneficial impact of the NLRSEORA grant objectives and mission of USGS NLI.

The AV ED and PM gained significant ground in identifying strategic opportunities outside of the NLRSEORA grant. During GY18, four proposals were submitted to industry and other government agencies, shown below. While many of them were not immediately fruitful, these efforts allowed us to gain further insight into the different sectors for future submissions.

- ExxonMobil Foundation
- Shell Energy
- Navy STEM
- NSF Smart and Connected Communities

Industry representatives will periodically be invited to provide technical presentations at AV monthly members meetings and the FTM and WBM gatherings. Engagement with these experts encourages more strategic interactions, keeping both AV and the invited guest(s) aware of joint opportunities for collaboration.

The ED and PM worked diligently during GY18 to enrich the program with opportunities to hear technical presentations at the AV monthly membership meetings. Table 3 lists each presentation that was held during this first grant year. Through the efforts of the ED, AV began developing working relationships with Earth Observing Systems, NASA GLOBE, and numerous USGS departments. This year, AV had a combined FTM and WBM in Reston, Virginia. This provided the opportunity to hear from the USGS Director and other government and industry professionals. During GY19, it is planned that the FTM and WBM will be a single, combined meeting again and AV will continue to provide enriching opportunities with esteemed invited guests at these meetings.

Month	Speaker	Organization	Title
December	Nikita Chernega	EOS	EOS Platform: Cloud Solution Designed for Imagery Distributors, Data Providers, and End Users
January	Holli Kohl & Peder Nelson	GLOBE	Citizen Science for Earth Observation Science with GLOBE Observer
February	Chris McGinty	AmericaView	AmericaView Introduction, USGS NLRSEORA Grant Overview, and New PI Orientation
March	Danielle Golon	USGS	March 2019 Updates from the LP DAAC
March: WBM	Jim Reilly	USGS	USGS Director Address to the AmericaView Membership
May	Tim Newman	USGS	USGS Update: Briefing to the AmericaView Members Meeting
June	Board Candidate Presentations	AmericaView	
July	Kristi Kline	USGS	Landsat Update for AmericaView
August	Julia Jester	USGS	The Role of the Congressional Affairs Team at USGS
September	Sam Batzli	AmericaView	RealEarth Overview

Table 3. List of presentations held at AmericaView monthly membership meetings during GY18.

2.1.3 Objective 3 - Promote Undergraduate and Graduate Research and Employment Skills

Leveraging its strength as a national consortium of more than 180 colleges and universities in 39 states as well as its strategic partnerships, AV will continue to promote meaningful research and remote sensing experiences for university undergraduate and graduate students. These opportunities will allow students to obtain hands-on experience in both emerging and evolving areas of remote sensing science and applications. AV PIs and consortium members are, and will continue to be, actively engaged in the use of spaceborne sensors such as Landsat and Sentinel; employing emerging technology such as machine learning, OBIA, and UAS; and, developing methods, tools, and algorithms that integrate multiple data types to address a host of societal issues. AV SVs will support educational opportunities and internships for undergraduate and graduate students, including veterans. Students will gain critical employment skills by learning to conduct research that address local concerns and evaluates national and global problems, and endeavors to solve some of society's most pressing issues. AV members' proven success at generating research grant dollars will enable this objective to be highly leveraged. Student-involved research activities will increase the ability of the nation's future workforce, both quantitatively and qualitatively, to incorporate remote sensing technologies as a basic aspect of our nation's infrastructure.

<u>AmericaView National Work Plan</u>

Periods 1-5: Undergraduate and graduate students will participate in the development and distribution of Earth Observation Day (EOD) materials within participating SVs.

Earth Observation Day was a resounding success in GY18. Twenty-two SVs held 37 events across the nation. Several notable activities are listed below, where undergraduate and graduate students were engaged in the development and distribution of materials.

- OregonView celebrated EOD with a seminar presentation from Oregon State University graduate student, Ben Babbel, on bathymetric mapping with Landsat 8 Operational Land Imager (OLI) and ICESat-2 ATLAS data, based on results from ORView's GY18 high impact activity.
- OhioView engaged undergraduate and graduate students in the development of displaying Landsat and Sentinel-2 images on canvas, paper and metal for EOD. Story maps accompanied each image explaining the remote sensing topics.

- Murray State University Student Chapter of ASPRS and KentuckyView organized Earth Day and Earth Observation Day activities including thermal camera, UAS, Remote Sensing Memory Game, and EarthShots cards on April 24, 2019.
- NorthDakotaView held an undergraduate student poster presentation of GIS and Remote Sensing related research projects for one of their EOD events.
- PennsylvaniaView worked with undergraduate students in a Humanitarian Aid Map-A-Thon using Open Street Map (OSM).

Periods 1-5: AV will encourage multi-SV research projects that will involve graduate and undergraduate students to develop traits of collaboration and collegiality for future careers.

Collaboration between AV SVs is encouraged. These collaborations have demonstrated successful results and have produced educational resources and training materials. AV continues to encourage the participation of students for specific projects in the coming years. During GY18, funding was not directly available for mini-grant program. This funding is often opportunistically available due to changes in funding areas and national program demands.

Periods 1-5: AV and SVs will promote research publications and presentations by students through diverse media, including in-person presentations, webinars, email blasts, and social media (including Facebook, Twitter, and YouTube).

- OregonView employed graduate and undergraduate students that resulted in two publications regarding their GY18 HIA on Active-Passive Spaceborne Data Fusion for Mapping Nearshore Bathymetry. A result from the undergraduate student work can be viewed at: shallowbathymetryeverywhere.com. Further information, including methodologies may be found here.
- VirginiaView served on the planning committee and organizes the statewide undergraduate and graduate student Poster and WebMap App Showcase at the Virginia GeoCon (annual statewide conference).
- ArkansasView supported students who created online UAS videos; used in AV-supported training on UAS curriculum, Google Earth Engine, and remote sensing research with Landsat time series.

Metrics Assessment of Progress

Periods 1-5: At the national level, the responsible committees will collect and summarize reports from every SV with an EOD effort, following past practice. SVs will report the outcomes of student engagement efforts at the SV level. Other metrics, to be requested by the ED, may include the following: tracking number of students involved in SV-funded research or other employment opportunities; tracking the number of publications and presentations by AV-funded students. AV will report these summarized metrics to USGS/NLI in annual reports.

Throughout GY18, 22 SVs financially supported a total of 46 undergraduate and graduate students with AmericaView funds. The students worked on a variety of remote sensing related topics. Some SVs focused on education and outreach training and materials development, others simply allowed the opportunity to learn about GIS and remote sensing in a professional environment, and others were support for a Master's thesis and PhD dissertation. Selected projects are listed below and the total

amount of publications created in GY18 is shown in Figure 4. A bibliographic list of all publications resulting from AV GY18 funding is available here.

- ArkansasView Ph.D. supported student from 2016-2019: Training in Google Earth Engine and remote sensing workflows involving time series; contributed to outstanding dissertation research and position as Assistant Professor and endowed chair at Arkansas State University.
- DelawareView graduate student supported in 2019: Graduate student helped pull data together for two lessons to enhance core Geography High School Curriculum with remotely sensed data and geospatial analysis. The topics included understanding geolocation and landscape change.
- KansasView Ph.D. student supported in 2019: Dana Peterson, as the KansasView coordinator. KansasView funds helped support Dana Peterson's PhD research using Landsat and MODIS data for regional-scale grassland mapping. She has graduated and has recently become the PI for KansasView.
- Rhode IslandView undergraduate student supported in 2019: Undergraduate research assistants were trained and mentored in the fundamentals of sUAS flight planning, equipment maintenance, and data processing. Students were able to apply newly acquired skills to support students participating in the Hazardous Waste Operations and Emergency Response (HAZWOPER) class.

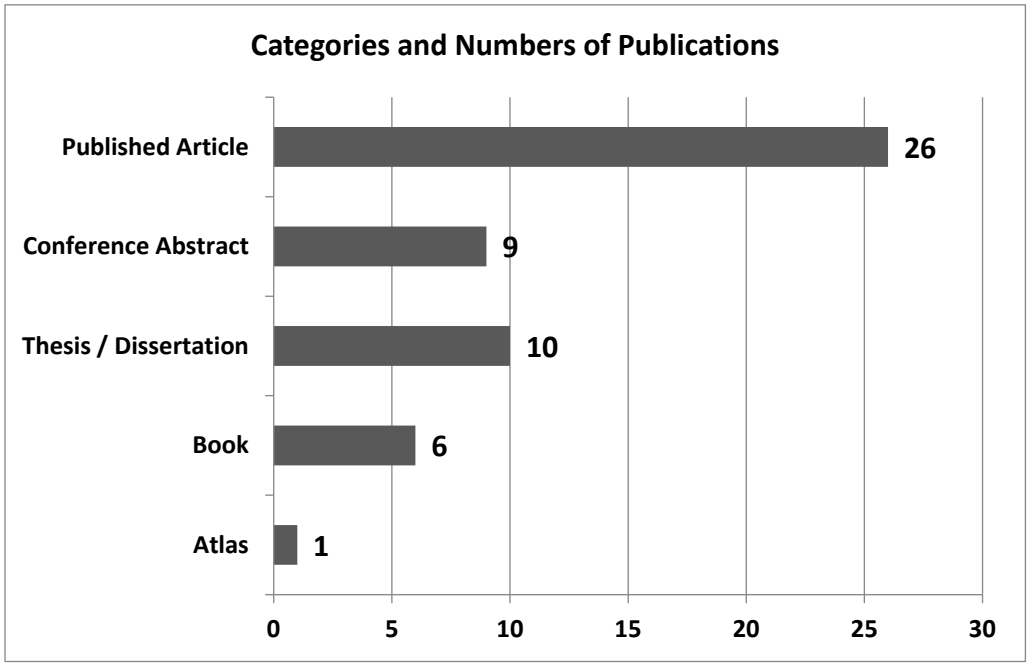

Figure 4. Categories of GY18 publications from all SVs.

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

Originally conceived and established to facilitate free and rapid access to Landsat data, AV has long been successful at facilitating the sharing of remote sensing data and technology to meet needs at state, local, and regional levels. Through time, and advancements in technology and open data policies, the mission of AV has shifted from access and availability, to one of education, training, technology transfer, and outreach. AV will increase the remote sensing competency of the nation's current and future workforce. Quantifiable objectives include supporting remote sensing science instruction in K-12 grades to improve

STEAM education and to strengthen national science education standards; utilizing AV's academic university network to improve the quality of instruction at the university and college level; and increasing the employability and effectiveness of workers by introducing remote sensing skills into the existing workforce. AV, through SV consortia, and as part of the NLRSEORA program, will continue to reliably and successfully conduct education and training, technology transfer, and outreach activities at the community, state, regional, and national levels. These activities will continue to include the development of education and training materials; establishment and refinement of curricula; hosting of local, state, national workshops; and, conducting outreach locally and nationally.

AmericaView National Work Plan

Periods 1-5: The AV Education Committee will continue to organize and celebrate Earth Observation Day. AV will continue its national participation in American Geosciences Institute (AGI) Earth Science Week (ESW) (which is held annually in October). AV's website published ArcGIS and Google Earth-based lessons, as well as additional Earth imagery games and puzzles, will be updated and expanded to provide complementary materials for educators and students.

AV (in collaboration with NASA, USGS, and AGI) developed a poster for Earth Observation Day and for inclusion in the Earth Science Week packet, https://americaview.org/program-areas/education/earth-observation-day/. IndianaView completed the creation of online puzzles of the 2019 EOD poster images, https://www.indianaview.org/image_puzzle.html. During GY18, the AmericaView Earth Observation Day website yielded almost 1,700 unique visits with more than 75 percent of those visits viewing and downloading EOD posters. Additionally, more than 10,000 posters were distributed by mail in AGI ESW packets to educators throughout North America.

Periods 1-5: AV will continue to facilitate interaction and association of SVs with the International Charter in support of disaster risk reduction, mitigation, and support. AV will establish the Disaster Risk Reduction (DRR) working group of interested SVs and partners to focus on use, training, and deployment of remote sensing data and technology. AV members will share their expertise in disaster analysis with others via online and in person AV meetings, via email blasts, and at regional/national conferences. The shared information will include identifying or sponsoring training opportunities offered by the USGS, suggestions for how to manage data flow and data provision to first responders, research results, and approaches to post-disaster land and water cover analysis.

An overall reorganization of committees and working groups is being undertaken at the AV national level. During GY18, a DRR working group was not established, but work involved with this effort was undertaken within the SPWG. As GY19 progresses, the reorganization of the working groups should be complete.

An example of the power of the AV network occurred during an International Charter Activation for Hurricane Dorian. The Dorian activation started on 4 September 2019 and lasted well into October 2019. AV serves a key hub for the Charter to access Program Managers to support major disaster activations (or calls to action/support). In 2019, LouisianaView, working with the International Charter, coordinated satellite data acquisition for Hurricane Dorian impact areas across the Bahamas. This activation allowed LouisianaView to solicit the support from the national AmericaView consortium to provide support as a Value-Added Providers (VAP) for remotely sensed data products. As an example of a VAP, ArkansasView (Dr. Jason Tullis) volunteered to serve as a VAP providing opportunities for ArkansasView students to support the activation effort by processing remotely sensed radar data. Figure 5 is one product developed by students that were used in the response.

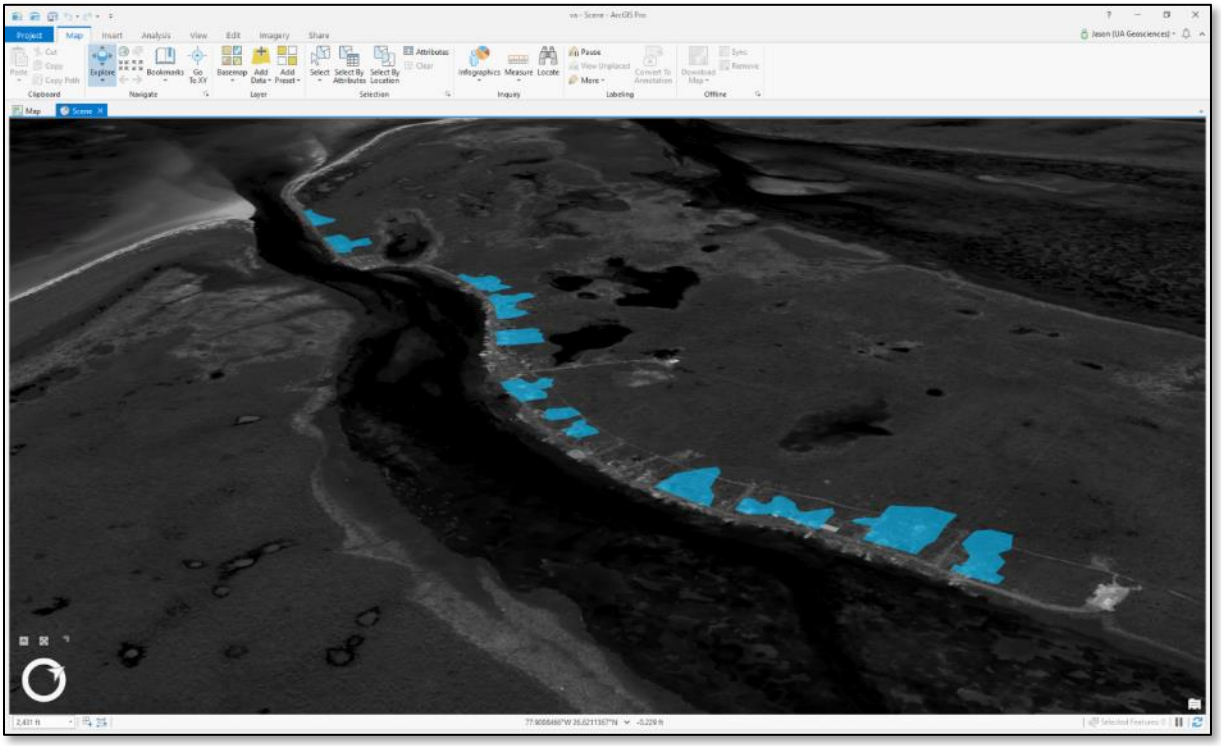

Figure 5. Polygons of debris fields in East Grand Bahama created by ArkansasView students using WorldView 1 data collected 10 Sep 2019 and a PostgresSQL/PostGIS enterprise geodatabase.

The below testimonials were provided by those students.

Tia Francis, MS Geography student, University of Arkansas; Tia previously lived in Nassau, Commonwealth of the Bahamas "Working with the AmericaView network for Hurricane Dorian emergency response was both **helpful as a student in geospatial technologies and as a young professional looking to pursue careers in natural hazards and risk mitigation**. On one hand, I gained experience working with Enterprise GIS and aerial imagery interpretation. On the other hand, I also learned how geospatial technologies can be broadly integrated into disaster responses and a glimpse into the time, manpower and needs of such emergency efforts."

Cassandra Howe, PhD Geosciences student and Distinguished Doctoral Fellow, University of Arkansas "The work we did to download and organize imagery for the International Charter activation helped us establish an effective group-oriented workflow for future needs. We quickly learned that one person needed to be assigned to a particular job such as downloading imagery, or removing cloud-obscured imagery and then we needed to be able to communicate our work with others in a timely manner. **I got a better sense of our different strengths as individuals and I think we figured out how to use collaborative software, like Microsoft Teams, to keep each other apprised of our work and make sure nothing was being needlessly duplicated.** The digitizing of impacted areas in and of itself is relatively simple, but **learning to coordinate those efforts among a team was really valuable experience for me.**"

Periods 1-5: *AV will enhance its digital presence by actively enhancing its website (www.americaview.org) and sustaining a social media presence (Facebook, Twitter, and YouTube) to share and promote remote sensing resources, educational material, tools, and data, and to facilitate the*

development of nationwide and global partners. A reassessment of the AV University educational portal will be conducted and suggestions for updates to support AV and NLI objectives will be developed.

Websites are essential to sharing important information. During GY18, the AV website had 26,655-page views and 9,978 new users. Though, these say nothing about repeat visits or the length of visit and that order of information would help complete the story of visitor persistent interest in and reliability on the information. The AV University educational portal was initially reassessed during GY18. It was decided that AV will work toward a more modern platform that will allow greater discoverability of data and ease of access. Work has begun on the replacement concept through the water working group. A CKAN database was set-up to act as an online data search and discovery tool, similar to data.gov. CKAN was selected due to the opensource and simple, but powerful, ability to serve and manage all types of data, including spatial data types. The initial proof-of-concept is being developed within the water working group with their specified datasets. Once that effort is complete, it will be evaluated for a larger-scale effort to encapsulate much of the online resources that are currently hosted on the AV website and the AV University educational portal. This could potentially lead to greater use of the information by users and the ability to track metrics in more detail.

Social media is an important way of sharing resources, tools, and successes. During GY18, AV utilized Twitter, Facebook, and YouTube to transmit these materials.

During GY18, AV's social media presence garnered:

- 44,000 Twitter impressions, including 510 link engagements
- More than 6,100 YouTube views
- Over 349 hours of educational video viewing
- More than 1,000 Facebook page and post views

These interactions are themselves only the beginning of the story. Many of these views led to the access and download of remote sensing educational materials, access to online (digital) resources, and the viewing of educational videos ranging from unmanned aerial systems disaster applications to the use of Landsat Analysis Ready Data.

Periods 1-5: AV will continue to educate local and national decision makers. AV SVs will be encouraged to schedule visits with decision makers in Washington, D.C., and their own states, where they will provide educational updates and have educational discussions regarding the successes of their SV efforts and the benefits of the NLRSEORA program overall. These visits provide the opportunity for PIs and accompanying students to explain how remote sensing programs, such as those supported by NLI, have been beneficial to natural resource management issues within their state.

Education of national leaders and decision makers is a critical component of NLRSEORA. Historically, AV has worked to share the success stories of each SV member. These stories have historically been shared through annual national outreach and educational activities. During period 1 of the NLRSEORA, members focused on sharing SV successes to local and state decision makers, project partners, and the public. In some cases, SVs welcomed groups of decision makers to their home campuses where they presented work conducted within the state. An example of this effort is exemplified by UtahView, hosted by Utah State University, which welcomed congressional members and staffers as part of a campus-wide outreach event showcasing state-based educational efforts.

Metrics Assessment of Progress

Periods 1-5: Through annual SV reporting, AV SVs will track and report on the success and impacts of education, training, technology transfer and, outreach at the national and SV level. For example, the number of projects, descriptions of educational and training materials, offered (and links if they are offered online), technology transfer successes, and numbers of outreach opportunities offered and numbers of participants/workforce personnel reached. During the RCA process, each SV will describe the proposed HIA and answer specific questions regarding the applicability of the effort to specific objectives of the grant proposal. At the end of the funded period, each SV will assess the status of the original intent and report outcomes. Those will be summarized in AV's Technical Report submitted to USGS/NLI at the end of each period. Each SV will submit a fact sheet on each HIA at the end of a grant period, describing impact with numerical and textual summaries as appropriate. These fact sheets will be peer-reviewed and approved by the ED and PM before cumulative information is provided in the Technical Reports.

Each SV submitted a fact sheet summarizing their work during GY18. Additional metrics chosen to describe the overarching impact on populations served for objective 4 during GY18 included:

- Number of students supported by AV funds.
- Number of education and outreach events.
- Number of Earth Observation Day or GIS day events
- Number of posters developed
- Number of other presentations outside of the previous categories
- Other projects leveraged with SV funds beyond their HIA
- Number of publications.

Previous results showed the education and outreach activity category with the greatest numbers conducted by a majority of SVs, with publications and AV supported students as the second and third most popular activities (Figure 2). To look at the impact at the local level in more detail, the education and outreach activities and the EOD/GIS activities were split into different student and non-student categories. Figure 6 shows the total numbers for each category of supported students. K-12 students are the highest served population through SV activities.

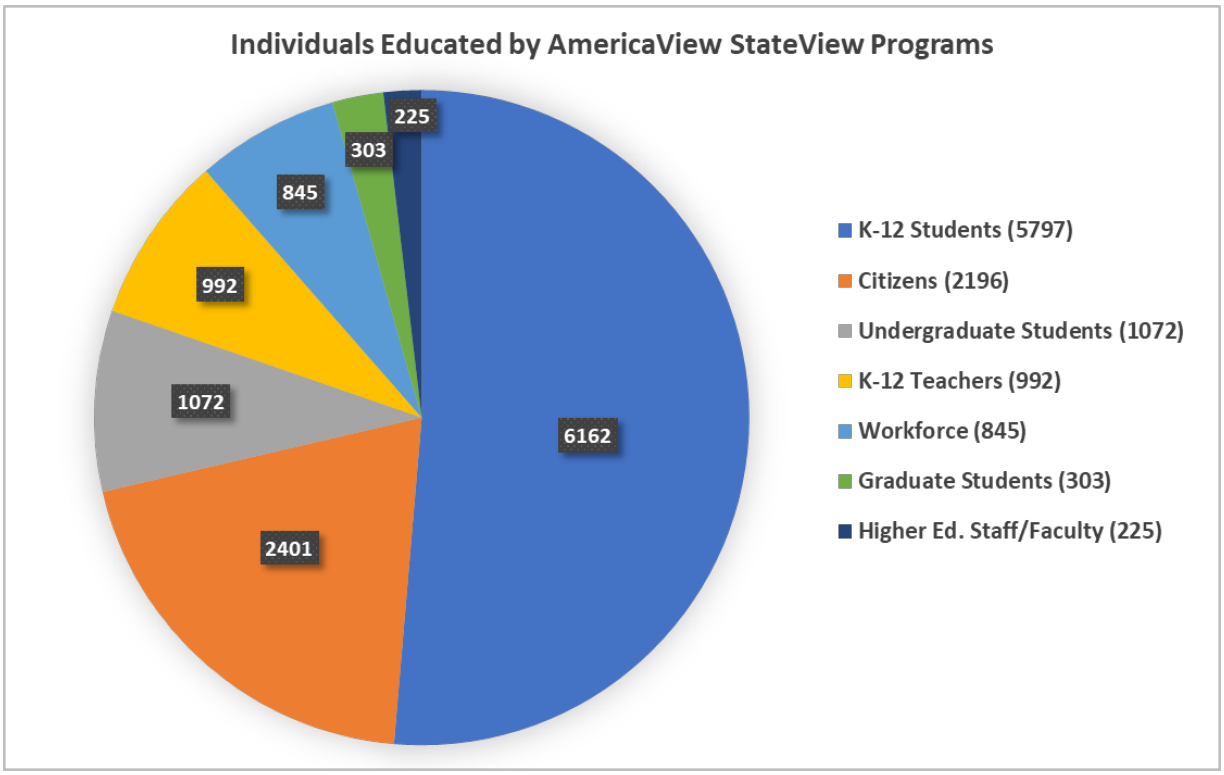

Figure 6. Pie chart depicting the numbers of the different categories of student and non-student participants in SV activities during GY18, fulfilling NLRSEORA Objective 4.

2.1.5 Objective 5 - Support the U.S. Department of the Interior Secretarial Priorities

As a nationwide, university-based, and state-implemented consortium, AV advances the widespread use of remote sensing data and technology through education and outreach, workforce development, applied research, and technology transfer to the public and private sectors at community levels. These key AV objectives directly align with the U.S. Department of Interior Secretarial Priorities, as they relate to the NLI program. AV's SV PIs will continue to focus on remote sensing needs at local levels, building trust between AV consortia, communities, local governments, the U.S. DOI, and other government and commercial entities. Through the NLRSEORA program, and the goals of NLI, AV will continue to focus on building strong, beneficial relationships that advance the use and understanding of remote sensing through education, research, outreach, education, and technology transfer. These key objectives, the very heart of AV, act as a vector for better understanding and use of remote sensing science and technology. The use of this dynamic and rapidly evolving technology will support current and future generations in the establishment of best practices to better manage our land and water resources and adapt to environmental and societal changes.

The program proposed by AV will enable, in documented ways, the DOI goals and will reinforce cooperation throughout the team of Bureaus, Services, and Offices that comprise the department. AV is organizationally structured, as a consortium, to communicate with and understand local communities and to build confidence within those communities' leaders with whom AV commits itself to working on demanding environmental, social, and economic challenges. This proposed work plan describes the communications approaches that have been used in the past and that will be improved and expanded during this next grant agreement. The AV committees and working groups will continue to coalesce the SV efforts and to encourage discussion and sharing of best practices at both community and national

levels to aid in the dispersion of learned experiences for managing land and water resources, while adapting to observed environmental changes.

<u>AmericaView National Activities Work Plan</u>

Periods 1-5: The overall work plan, and ultimate objective for this proposal, is to build trust and to work within our local communities to encourage the use of remotely sensed data, technology, and to provide educational opportunities to support the core ideals of active conservation and management of our lands and waters. Through these efforts, AV will help to restore and maintain trust within the local communities, improving communication between the local and federal levels with many technology transfer efforts and frequent outreach involvement. These efforts will support both the current workforce and the next generation of community and business leaders, scientists, and educators.

The fundamental mission of the AmericaView program is suited to achieve many of the DOI Secretarial Priorities. During GY 18, AV helped restore and maintain trust within local communities through undergraduate education efforts by working with local ranchers in Wyoming; using remote sensing imagery and analysis to improve land management practices for cattle grazing and crop yields. This example is further reinforced across the United States as SV consortium members develop and maintain trusted relationships. Further, AV improved communication between the local and federal levels through the completion of 338 activities by state consortium members (Figure 7). A total of 11,900 individuals were trained and educated on the societal benefits of remote sensing technologies and applications during these events.

2.2 AMERICAVIEW SUMMARY OF GRANT YEAR ACCOMPLISHMENTS

During GY18, 38 SVs worked to bring 338 different remote sensing education and outreach lessons, events, and training opportunities to 11,900 individuals across the country. AV has also worked diligently in affiliate development by beginning conversations with two additional states, Nevada and Missouri. It is planned that these two states will be represented during the 2020 annual meeting. Each of these activities has allowed AV to effectively invest federal dollars into local communities, which culminates in advancing DOI and USGS priorities and objectives.

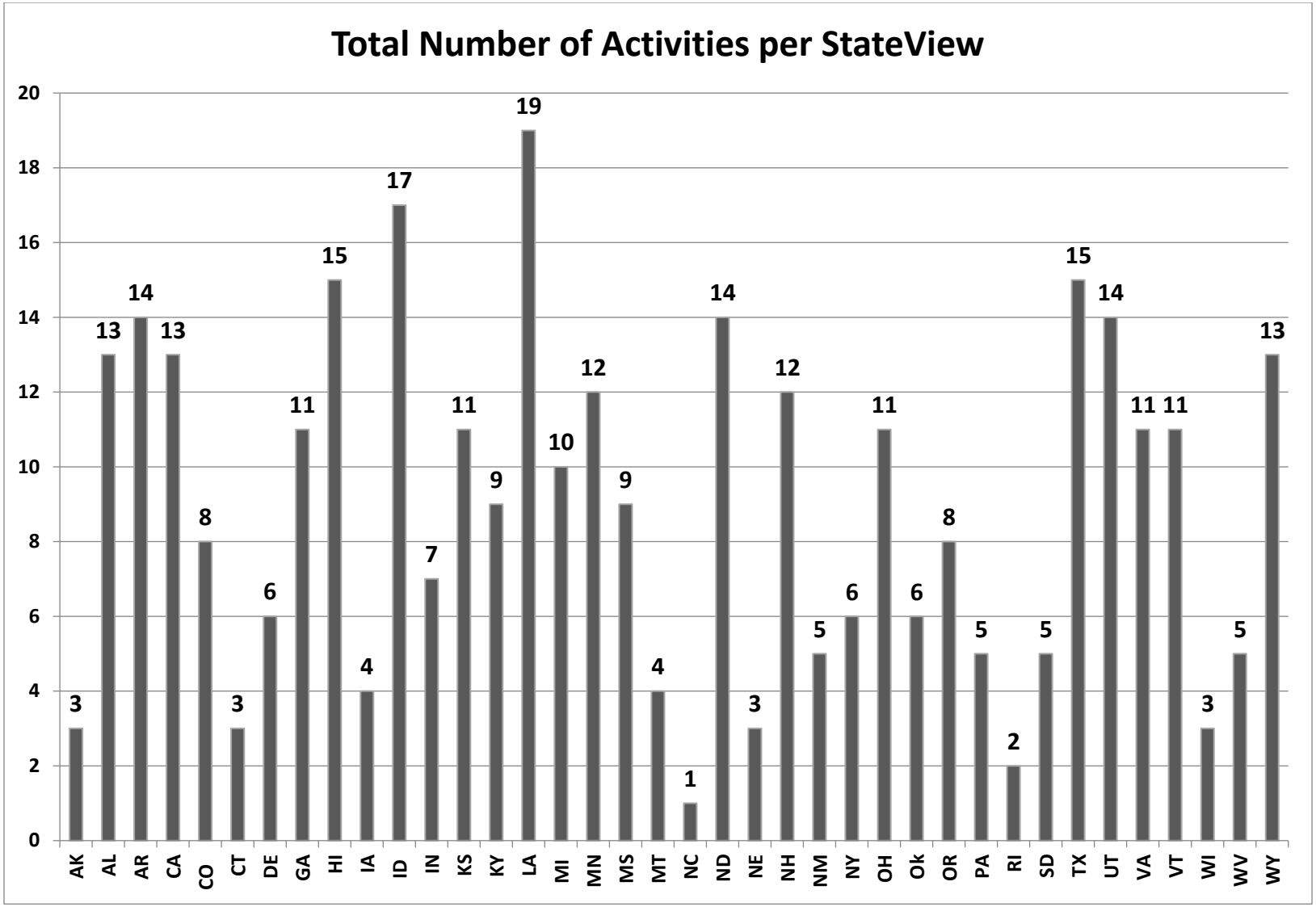

Figure 7. Chart showing the distribution of all SV HIA and non-HAI activities during GY18. The AmericaView consortium completed 338 activities in GY18.

2.3 STATEVIEW KEY SUCCESS STORIES

During grant year 2018, AmericaView SV's worked with industry, local and state governments and communities, K-12, undergraduate, graduate students, and teachers. Collectively, they have met all of five NLRSEORA objectives and have successfully carried the DOI message from the national to the local level. The following are notable student stories from selected SV activities.
GeorgiaView worked with local high school students by conducting hands-on remote sensing lessons. Several students provided testimonials, which are listed below. The key take-away from these students is that AmericaView has given them the opportunity to expand their understanding of remote sensing and Earth science; to think and look at the world differently by simply showing them that you can look at any place on the Earth using remote sensing technologies.

NLRSEORA Objectives Fulfilled:
Objective 4 - Advance Education and Training, Technology Transfer, and Outreach
Objective 5 - Support the U.S. Department of the Interior Secretarial Priorities

Alejandra – "I really enjoyed your lesson. **I found it really interesting as I have never really learned in detail about using satellite to look on a map**. I enjoyed you letting us try and explore it on a computer after explaining to us. Learning about this really made me created an interest in me."

Kinsey – "I enjoyed listening to how satellites are advancing and helping us study the whole world from a single spot. I enjoyed how we got to go and look at different areas to see how much the cities have developed. **The exposure to other science fields really opens my mind to new things**. Professor Sharma made the discussion fun and interactive."

Zach – "I felt that the talk was beneficial in exposing us to new sciences. It also **showed us new possibilities in different pathways we could take with our careers later in life**. Professor Sharma also made it seem fun, rather than boring science work. I always see a bunch of tired old men working in lab coats when I think of science but he made this field seems more interesting. It showed us how we affect the environment as well, so now we can think more about what we are doing if we expand our territory."

Juli – What I learned was that **you can look at any place in the world**.

AmericaView Benefits Local Decision Makers
NLRSEORA Objectives Fulfilled:
Objective 2 - Establish Strategic Partnerships
Objective 4 - Advance Education and Training, Technology Transfer, and Outreach
Objective 5 - Support the U.S. Department of the Interior Secretarial Priorities

During GY18, GeorgiaView's HIA was focused on making land cover maps for counties, congressional districts, and regional commissions coalesced into atlases. These image atlases were used by local governments twice in the past year for zoning recommendations.

Undergraduate Student / Graduate Student / Workforce Development
NLRSEORA Objectives Fulfilled:
Objective 3 - Promote Undergraduate and Graduate Research and Employment Skills
Objective 4 - Advance Education and Training, Technology Transfer, and Outreach

Objective 5 - Support the U.S. Department of the Interior Secretarial Priorities

IndianaView's HIA for GY18 was to provide stipends to undergraduate and graduate students to conduct geospatial projects. Six students were awarded stipends this grant year, through a rigorous competitive selection process. Testimonials from two of the recipients below show how AmericaView funding was leveraged to continue a project that was previously supported by the National Science Foundation and was used to help support an underrepresented, first generation college student.

Jessica Elliott, Graduate Student, Forestry & Natural Resources, Purdue University
"Receiving the IndianaView student scholarship for remote sensing education, research and applications was not only a great honor in its own right, but a valuable asset in the continuation of my undergraduate research and education. **My research project began as a part of the National Science Foundation Research Experience for Undergraduates program and has continued through the generosity of organizations such as your own.** The funds received from the IndianaView Student Scholarship allowed me to travel with the Forestry and Spatial Ecology Lab, under the instruction of Dr. Songlin Fei, to the US-IALE (International Association for Landscape Ecology) academic conference in Fort Collins, CO in April 2019**. This experience was one of the most significant of my academic career, allowing me to greater understand my place in science and the opportunities that are available to me all over the world.** It would not have been possible to have attended without the funds provided by the scholarship, which helped to pay for conference registration and airline tickets."

Mayra I. Rodriguez Gonzalez, PhD Candidate, Forestry & Natural Resources, Purdue University
"This month (August 12-15) I participated in the 2019 ESA (Ecological Society of America) annual meeting held in Louisville, Kentucky. For this meeting, I was awarded $750 through the IndianaView sponsored grant. I used this money to cover the expenses during my trip, allowing me the opportunity of sharing my research in a rich and cultivating scientific environment. Overall, my experience was very positive. When I presented, I got to talk to various scientists who were interested in my work. Through these interactions, I was able to think further on how to improve my methods. Additionally, we held luncheons and other activities that allowed me to connect further with them, building a network for the future. I would not have been able to benefit from this opportunity without the grant. Thus, it actively benefitted my experience. **It brought me (a Latina and first-generation student) to be part of a platform where scientists gather to connect and share research and it helped me get exposure to the field of Urban Ecology**, which was the main topic in the session I presented. **Thanks to this experience, I now feel one step closer to my goals**."

One of TexasView's HIA's was providing mini-grants to consortium member institutions for undergraduate applied remote sensing research projects. The products of the mini-grants have led one student to change their career path from civil engineering by pursuing a Master's degree in GIS and remote sensing. This change came from the student grasping the power of geospatial data, specifically remotely sensed imagery such as Landsat. Another graduate student is redirecting his studies from aerospace engineering to Data Science after gaining an understanding of the use and usability of data that would be created by sensors he could possibly be building if he remained in his initial career path. Use and application of geospatial data to support Earth applications was exceptionally compelling to him. Two of the recipients were first generation college students.

Julio Ramirez, University of Texas El Paso, Department of Civil Engineering
"During these past months working on Lower Valley Water District (LVWD) project has increased my knowledge and developed new skills. Besides that, it has been very beneficial for my future educations'

determinations. In other words, I got interested in Geographic Information Systems and remote sensing when I used them for the Water Infrastructures projects. Therefore, **I am now deciding to obtain a Master of Science in GIS/remote sensing and Geomatics Engineering at the University of Colorado.** This experience has been a great opportunity to meet other people who enjoy and work, not only that, I was able to go this past summer to Esri Conference. The conference helps me to obtain new ideas, learn new concepts, and practice GIS to integrate them in (LVWD) project."

Ishan P. Paranjape, University of Texas at Austin, Aerospace Engineering student
"As a student of aerospace engineering, I am fascinated by how satellites maneuver over the Earth to collect data about our planet. I applied for a TexasView Land and Education Grant because I was curious about the link between aerospace engineering and remote sensing. **While the only key link between aerospace engineering and remote sensing I discovered was that the Landsat satellites flew over and took aerial images of the Bastrop, TX only at certain times due to the satellites' orbital mechanics.** I became more fascinated by the aerial images and the data they provided. Although I began to work on this project expecting myself to apply what I've learned in my aerospace engineering classes so far, I was instead reminded of why I really like the space sciences. It was not the orbital mechanics of Landsat 5 and 8 that fascinated me as much as the data obtained from these satellites. **Because I so enjoyed working with satellite data this summer, I will be redirecting my graduate studies towards Data Science or Data Analytics**, with the hope that I can one day assist with implementing machine learning in the space sciences and remote sensing domains."

Former AmericaView-Supported Student Success Stories
IndianaView supported undergraduate student Karen Arnold in 2017 through an AV student scholarship. Details on her project can be found in IndianaView's 2017 factsheet. She successfully completed her degree from Indiana University – Purdue University, Indianapolis, and is now working in the geospatial sciences at an engineering and surveying firm in Indiana.

WyomingView supported undergraduate student Orin Hutchinson who conducted a project on post-wildfire monitoring. He successfully completed his degree and is now working with the Bureau of Land Management as an Engine Captain. He uses the remote sensing and GIS tools he learned while a student to fulfil many aspects in his position (Figure 8).

In GY18 AV produced a series of SV Membership Highlight sheets for social media and partner distribution. These sheets highlighted special, meaningful, and impactful SV activities in GY18. These included awards to UtahView SV coordinator, Ellie Leydsman-McGinty displaying the award for the "*Utah as Art"* program maps; TexasView PI, Rebecca Dodge conducing outreach activities on Earth Day 2918; WyomingView's *Women in STEM* conference, held in Laramie, Wyoming; Larry Biehl, IndianaView PI, conducting Earth Observation Day activities; and, the Georgia Land Cover Image Atlas developed by GeorgiaView PI, Jeong (JC) Seong.

2.4 Board and Membership Meetings

AV board and membership meetings were conducted each month of the grant year, with the exception of September 2018 when the new grant cycle began. AV maintains excellent attendance at all its meetings by SV PIs, Co-Is, State Coordinators, consortium members, and government partners. Nearly 80% of SV members regularly attend the optional monthly membership telecons. These meetings were conducted through a GoToMeeting subscription. The meetings contained informational presentations

from industry, government, and AmericaView SVs (Table 3). The GY18 Fall Technical Meeting and the Winter Business Meeting (download meeting agendas here) were combined into one single meeting held at USGS headquarters in Reston, Virginia, which included excellent representation from each SV. Board members devoted over 980 hours to provide program governance, administrative guidance, and financial due diligence. SV PIs volunteered, at national, regional, state, and local levels, to give presentations, lead panels, and provide advice; these were all well-received efforts that enhanced the effectiveness of the consortium.

2012 – Spring	2019 - Spring
What I received from this opportunity to work with remote sensing and data analysis was a broader perspective of what this kind of technology can do and what activities may in the future be done by remote sensing. My project was centered on wildfire monitoring and I was able to see that in some cases, time and resources may be better allocated by using images rather than taking a field trip out to the site. This experience has taught me to keep an open mind about what technology can and cannot do and it has given me another tool that I will be able to use in my future career. As a WyView intern, Orin presented his findings of his post-wildfire monitoring work in the Wyoming Undergraduate Research Day on April 21, 2012.	I have had the opportunity to use the skills and processes that I learned with WyView often in my job. I am an Engine Captain for the BLM at present and am in charge of supervising fire crews in the summer. In the fall, winter and spring I do a lot of work with our fuels reduction program through planning, implementation and post treatment monitoring. We use remotely sensed data, primarily satellite imagery to evaluate areas for post treatment effectiveness and recovery depending on the specific parameters of the project. [T]he majority of our projects are mechanical treatments to manipulate the vegetation to remove encroachment issues in to riparian areas. We also do some prescribed fire to reduce fuel loading and to manipulate vegetative communities for multiple resources. We have also used the imagery to identify project areas based on an analysis of the percent of cover of a specific type of vegetation such as conifer trees or sagebrush within a large block of the landscape that can be looked at during the field season to ground truth and fine tune treatment polygons for future treatments. Lastly I get to use remotely sensed data to look at burn area severity and post fire recovery for our larger fires on our district which was my interest while I was in college. We use the data that we gather to plan and implement burn area rehabilitation in areas that are deemed necessary of intervention to stabilize the area.

Figure 8. Former WyomingView supported undergraduate student, Orin Hutchinson, testimonial on how working with AV has helped him in his current career.

2.5 Committees and Working Groups

During GY18, AmericaView members contributed more than 1,040 hours to committees and working groups to strengthen national collaborative endeavors and to share remote sensing information and knowledge. Committees and working groups work to support both the AV national organization objectives as well as supporting individual SV requests.

2.5.1 Education and Outreach Committee

The AV Education and Outreach Committees have historically acted as independent groups with overlap in tasks and participating members. The Education Committee has supported AV national and SV activities with a focus on the development of lesson plans, specialized educational resources (including

educational posters), and other remote sensing education tools. The Outreach Committee has worked to increase remote sensing awareness by developing and maintaining strategic relationships and materials and facilitating outreach activities at the national and SV levels. In 2018, the committee chairs, Larry Biehl (Education Chairperson, IndianaView PI) and Mary O'Neill (Outreach Chairperson, South DakotaView) identified common threads between the committee efforts that could be augmented by operating the committees in tandem. Following that model in GY18, the Education and Outreach committees were co-chaired by Biehl and O'Neill and worked with all members to accomplish overlapping tasks and objectives.

2.5.1.1 Earth as Art

Period 1: The AV Outreach and Education committees will identify SVs interested in hosting a traveling Earth as Art Gallery Exhibit, including preparation of necessary educational materials, and will begin strategies for touring the exhibit.

The travelling Earth as Art Gallery Exhibit has become an incredibly popular education and outreach tool during GY18. It was hosted at four different events (listed below) across the country and has been requested by many others for display in GY19. The exhibit is large and expensive to move long distances, thus restricting the number of events where it can be displayed. AV national is currently exploring a sustainable approach to making this incredible resource accessible to more communities.

- AmericaView Winter Business Meeting, Reston, Virginia, March 2019
- South Dakota Statewide Geospatial Conference, Mitchell, South Dakota, July 2019
- Brookings Public Library Exhibit, Brookings, South Dakota, July 2019
- Southern Energy Conference, Lafayette, Louisiana, September 2019

2.5.1.2 Outreach and Education

Period 1: Members of the AV Outreach and Education committees will establish the AV Veterans Priority Working Group (VPWG) to foster the development of opportunities for remote sensing and geospatial education and career success among veterans returning to school or entering the workforce. The VPWG will develop a work plan to implement the effort described in the following paragraph. The VPWG will meet monthly and report to the AV ED and Membership monthly. Efforts will be summarized in the AV annual technical report.

The AV Outreach and Education committees have worked to develop resources that will support veterans that are seeking further educational opportunities as they return to the civilian workforce or prepare for other military service roles. The Veterans Priority Working Group (VPWG) was established as part of the GY18 proposal. During the GY18 PoP, AV submitted a proposal to the Office of Naval Research STEM office soliciting additional funding for expanded veterans' educational opportunities. While the AV proposal was rejected, AV was invited to review the comments and resubmit for future funding opportunities. In light of this limited success, it has been determined that the VPWG should be merged into a more active group with in AV to facilitate further work. Additionally, Dr. Curtis Edson, formally of MichiganView, recently took a position at the United States Air Force Academy. As a veteran, Dr. Edson has expressed interest in furthering the future efforts of the AV veterans' programs.

Periods 1-5: The AV Education Committee will continue to organize and celebrate Earth Observation Day. AV will continue its national participation in AGI Earth Science Week (which is held annually in October). This affiliation allowed AV to provide material to thousands of K-12 teachers across the country. AV will continue to collaborate with NASA and USGS in the development of materials for the ESW packets. These

materials, which include posters with earth science images and games involving imagery, have appeared in classrooms across the nation. AV's website published ArcGIS and Google Earth-based lessons, as well as additional Earth imagery games and puzzles, will be updated and expanded to provide complementary materials for educators and students.

Through a dynamic partnership with USGS and NASA, AV has developed educational Earth Observation Day (EOD) posters and activities. Additionally, online, digital *Earth Image Puzzles* have been developed for home and classroom use.

Pecora 21 – ISRSE 38

USGS invited AV to organize a STEAM event for the Pecora 21/ISRSE 38 conference that was held in Baltimore, Maryland in October 2019. This event was open to middle school aged students from the Baltimore area schools and students from informal science groups. Over 100 area students participated in more than 15 hands-on and highly interactive activities. This was an incredibly successful event due to partnerships with USGS, NASA, and local organizations.

Additionally, during period 1, AV recorded more than 2,100 website visitors accessing the AV online remote sensing educational tutorials; 1,300 website visitors accessed the AV online imagery puzzles; and, more than 1,200 website visitors accessed and downloaded the AV Earth Observation Day page materials (including posters and lesson plans).

Baltimore area students assembling a Landsat Earth as Art puzzle provided by LouisianaView.

2.5.2 Satellite-based Sensors Working Group

The Satellite-based Sensors Committee (SBSWG), formally the Landsat Working Group (LWG), was reorganized to reflect a broader view of space-born Earth remote sensing platforms and programs while maintaining a major focus on the use and use cases of the Landsat platform.

Period 1: AV will use its unique position as a consortium of 39 SVs consisting of universities, multiple organizations, and other remote sensing stakeholders throughout the nation to help define, consolidate, and communicate the data and information requirement of its constituents. This objective will be accomplished using a two-way collaborative process between the AV constituents and stakeholders, who are primarily data end users operating at the state and local levels, including (but not limited to) governmental agencies (local, state, tribal, and federal), private resource managers (such as agricultural producers), university researchers and students, and K-12 educators and students).

This effort was explained in section 2.1 of this report.

2.5.3 Water Working Group

The Water Quality Quantity and Utility (WQQU) was renamed the AV Water Working Group (WWG) to add inclusion of all water-related remote sensing activities. The group has a specific charge to meet with national NGOs, universities, and industry to discuss critical water issues that may be supported by remote sensing, and begin the development of a knowledge-sharing gateway that focuses on these important issues.

The specific charge for the WWG in GY18 has been to initiate collaboration between states to develop the AV WWG knowledge-sharing gateway. This effort has led to a larger push to develop materials that support water-related remote sensing activities, including sharing the "stories" of active SV activities in addition to the development of an online knowledge portal. The portal is presently in development and testing by the WWG and will be employed to support the objectives in periods 2-5.

2.5.4 Strategic Partners Working Group

Under the guidance of the AV Outreach Committee, a Strategic Partnerships Working Group (SPWG) will be created and will include the AV ED, at least one AV Board member, and any interested SV members. During Period 1, the SPWG will sustain or initiate active relationships with Group on Earth Observations (GEO) (in process), AmeriGEOSS (in process), SPH Engineering (in process), University of Nevada Reno (interest expressed), and Arizona State University (interest expressed). The SPWG will distribute a survey to the AV members that will recommend additional strategic partners, contacts, and describe how those organizations could support the objectives and missions of the NLI NLRESORA program, AV, and SV local user. The group will report its findings to the AV Board no later than six months through Period 1. The ED will work with the AV Board and SV members to select the most viable potential partners. A 'Strategic Partnership Plan' (SPP) will be prepared for Periods 2-5.

A SPWG was successfully formed during GY18 and was led by Dr. JB Sharma, a Board member and a member of the GeorgiaView consortium. Meetings were held virtually, once per month with members. Dr. Sharma conducted a survey to the AV membership searching for recommendations for strategic partners that align with the mission and objectives of the AV consortium. These results were used to begin the process of contacting different strategic partners. In addition to the grant proposals that were submitted and discussed under Objective 2, strategic efforts were placed in building relationships with the National Science Foundation. An in-person meeting was organized during the winter business meeting in Reston, Virginia with the purpose of learning more about NSF's goals and objectives and explaining how AV could help them meet those goals and objectives. Additional contacts were made with GeoCollaborate, who has built a collaborative platform that could benefit USGS and AV disaster response activities. Discussions have continued with this group into GY19. AV engaged in the energy

industry by attending the Southern Energy Conference in Lafayette, Louisiana. Many potential benefits for both organizations were discovered during this meeting and efforts to build relationships with different energy companies will continue during the life of this grant. Additional conversations were initiated with the National Council for Science and the Environment, Earth Observation Systems, the American Society for Photogrammetry and Remote Sensing (ASPRS), Earth Observing Systems (EOS), Global Air Media and the United States Naval Office for STEM programs. AV continued to maintain long-term partnerships with NASA GLOBE, NASA Goddard, ARSET, AGI, and the International Charter. Initial components of the SPP have been implemented through the development of ESRI story maps to tell the AV story effectively. This will continue to be developed in GY19 and beyond.

Period 1: The SPWG and Education Committee will develop a working partnership with the National Science Teachers Association (NSTA), capitalizing on the Association's nationwide network of state-based chapters that strive to promote excellence and innovation in science teaching and learning.

Dr. Rebecca Dodge (TexasView) has established a strong working relationship with NSTA members in Texas and the Gulf Coast states. Work on this effort is expected to begin during GY19.

Metrics Assessment of Progress

Periods 1-5: To be a member of AV, a SV must have a state consortium that may include a "strategic partner." SV period reporting will include listing of their partners. Metrics may include the following: frequency of interactions between the partner and the nature of their work; the outcomes or opportunities of the partnership to the SV, AV, NLI, USGS, and DOI; and (if applicable) how many learners including traditional and non-traditional students, veterans, or working professionals were supported. AV will summarize this information to USGS/NLI in each period's Technical Report.

As this was the first year in a new 5-year grant cycle, efforts were focused on the initial organization of the SPWG and the development of the SPP. These metrics were not collected during GY18 but will be documented in subsequent budget years.

2.5.5 UAS Working Group

Periods 1-5: As the keen interest of UAS grows, AV's UAS working group will continue to facilitate the development of new and original UAS applications, approaches, and methods. The UAS working group will interface with USGS to identify key needs at federal and state levels.

The UAS working group is led by IdahoView PI, Donna Delparte and conducts monthly meetings with group members. Due to the popularity of UAS in research and as an educational tool, participation in this working group is high. The UASWG interfaces with USGS staff member Jeff Sloan during these meetings where different technologies, tools, methods, and best practices are discussed. Multiple presentations from SVs research are also presented and provide a platform to discuss new ideas and approaches to the integration of UAS into research and the classroom. Multiple UASWG members hosted train the trainer events through their SV activity. These are workshops where K-12 teachers are given the tools necessary to integrate UAS into their classrooms (Figure 9).

Period 1-5: The UAS working group will identify best practices in applications among AV members, will prepare and broadly distribute this work, and will update attendees at AV national meetings.

The collaborative nature of the AV national consortium was exemplified in the November 2019 publishing of the book, *Applications of Small Unmanned Aircraft Systems: Best Practices and Case Studies*. Contributions to this book were made by numerous AV PIs and edited by Dr. JB Sharma.

Figure 9. Train the trainer workshop hosted by KentuckyView featuring UAS integration in the classroom to help teachers engage students in remote sensing applications and technologies.

2.5.6 Veterans Priority Working Group

Period 1: Members of the AV Outreach and Education committees, as well as any other interested SV members, will establish the AV Veterans Priority Working Group (VPWG) to foster the development of opportunities for remote sensing and geospatial education and career success among veterans returning to school or entering the workforce. The VPWG will develop a work plan to implement the effort described in the following paragraph. The VPWG will meet monthly and report to the AV ED and Membership monthly. Efforts will be summarized in the AV annual technical report.

Periods 1-5: Utilizing the experience of AV members who are veterans and professionals in the fields of remote sensing and geospatial sciences, AV SVs will work to develop learning opportunities that directly support veterans. (Period 1): Interface with government (and other) agencies, including GeoTech Center, and strategic partners to determine key knowledge and skill sets that are required in order to be hired within agencies in the next 2-5 years.

The VPWG has worked to establish additional training, tools, and opportunities that support veterans. The VPWG will continue to seek opportunities that enable AmericaView to support veterans in furthering existing skill and seeking new tools as they return to the workforce. These efforts will accelerate and continue in GY19.

3 NLRSEORA GRANT YEAR 2018 – IN REVIEW

3.1 MISSION AND OBJECTIVES

AmericaView's mission as a nationwide, university-based, and state-implemented consortium is to advance the widespread use of remote sensing data and technology through education and outreach, workforce development, applied research, and technology transfer to the public and private sectors.

Period 1 of AV's NLRSEORA grant was exceptionally successful. The AV consortium was fully represented by a national audience who fully supported the United States Department of the Interior, United States Geological Survey, and the National Land Imaging program initiates. AV continues to strive to meet the objectives of all of these partner organizations as the foundation to its own mission promoting the use of remotely sensed imagery and geospatial technology throughout the United States and beyond. The mission of AV is not simply providing resources, but to understand local data and operational needs and transmit that information back to the USGS, and its partners, in order to serve the nation as a whole.

Throughout GY18, AV met and addressed the following USGS objectives:

- Gathering nationwide remote sensing data and information requirements and conveying those needs to U.S. DOI and USGS
- Establishing strategic partnerships that further both the goals and mission of U.S. DOI, USGS, and AmericaView
- Promoting undergraduate and graduate research and employment skills across the nation including those skills required by students, veterans, and others in the workforce, returning to the workforce or other students seeking to build or retool their skill sets
- Advancing education and training, technology transfer and outreach in the areas of remote sensing, geospatial data, and spatial analysis
- Supporting the U.S. DOI Secretarial Priorities, focusing on education and development of relationships within the Bureaus, Services, and Offices that comprise the DOI and, externally, at state and local levels. AV also promoted education, outreach, and a broader understanding of the use of remote sensing science and expertise across the nation, thereby facilitating the use of DOI USGS products, services, and knowhow

These objectives were successfully addressed through the power of the AV network as a nationwide, collaborative and collegiate, process spearheaded by a national Board of Directors, Staff, and 39 incredible SV members.

3.2 LESSONS LEARNED

AV strives to improve its operational capabilities on a national and local level by evaluating lessons learned and applying new techniques to assure future successes. AV has learned a number of important lessons in GY18:

- Programmatic/activity requests must be carefully vetted due to limited resources. Specifically, with respect to the ever-increasing number of requests for lectures and exhibits, these types of support must be accomplished with care and forethought.

- Outreach requests, at national and local levels, must be carefully evaluated. Blind approval or the desire to say “yes” can cause extensive impacts to the availability of program time and overall program quality. These requests must also be carefully vetted to ensure those, especially in rural or underserved communities, are afforded equal opportunities.
- Excessive numbers of committees and/or working groups, while ideal for focusing on many issues, can cause some time requirement and information overload to group members. This leads to fatigue and, ultimately, the lack of any/all participation.
- Exceptionally close relationships must continue to be maintained with SV PIs. This ensures all objective are addressed and the SV work plan is completed, thereby meeting the DOI, USGS, and NLI objectives.