



Sessions at a Glance

Tuesday

People and Culture

RM-URISA: A Medium for Local and Regional Development

Roundtable

Climate and Great Outdoors

Public Service and Safety

PLSC

GISCO: Communicate, Educate, Engage and Inspire

Technology Spotlight

Wednesday

ASPRS

UAS

Career Development Academy

Educators and Students

Public Service and Safety

GISCO: Communicate, Educate, Engage and Inspire

Asset Management

NHDPlus High Resolution - Creation and Applications

Technology Spotlight

Poster Session

Tuesday

People and Culture Aspen Room

Positive GIS

Paddington Hadza

Tuesday 10:30 – 11:15 am

This talk is about a GIS which intentionally looks at people and their communities through a positive lens. This GIS is intended to bring hope, build happiness, instill confidence and promote self-reliant development especially in communities that are perceived or made to feel disadvantaged. The conceptual framework, underlying rationale and implementation methodology of this appreciative, empowering and sustainable GIS are effectively presented and discussed through multimedia.

Modern Solutions to Historic Problems: Using GIS Tools in Cultural Resource Management

Poppie Gullett, Jake Fritz, Thomas Wilson, Sean Fallon

Tuesday 11:15 – 12:00 pm

Historians working within the field of cultural resource management survey, analyze, and make recommendations on the treatment of the historic built environment. Although the resources we work with are old, the technologies we use to inform our research and assessments are cutting edge. Historians use GIS and geospatial thinking every day to locate potentially historic resources, prepare surveys, and inform our research. But beyond the bread-and-butter of survey and research, we use GIS tools to tackle a variety of problems presented in our field that call for more creative solutions. Using traditional historic information-gathering methods in tandem with tools like ArcGIS and Google Earth, our team has tackled questions such as “How will a new bridge impact an existing historic district?”, “Which method of clearing rockfall is least invasive to historic viewsheds?” and “How can we survey over fifty historic properties along a ten-mile corridor in just a few days?” In this presentation, learn how to develop a more robust understanding of the past through the application of geospatial thinking.

-----Lunch Break 12:00 – 1:00 pm -----

RM-URISA: A Medium for Local and Regional Development Aspen Room

Municipal Solidarity: How Denver Water Works Towards the Future Together

Brian Douglass, John Nolte, Joey Stone

Tuesday 1:00 – 1:30 pm

With the rising consequences of historical misgivings coming to the surface via the Colorado One Call Legislation, the municipal challenge of managing demand versus supply, an exhausted system of bureaucracy struggling for answers, and an expanding community across our country in desperate need of transformative solutions, our civil professionals are faced with a world of opportunity to promote a critical cultural evolution. Three professionals at Denver Water are uniquely committed to this opportunity and the solidarity needed for success. In this session, we'll share the early iterations of this experience, the challenges we have faced thus far, and the fears and hopes we have for the future.

State of Colorado Water Plan: How Are We Doing?

Phyllis Thomas

Tuesday 1:30 – 2:00 pm

In October 2015, the State of Colorado Department of Natural Resources introduced the Colorado Water Plan. The Plan described itself as a "roadmap that leads to a productive economy, vibrant and sustainable cities, productive agriculture, a strong environment, and a robust recreation industry. It sets forth the measurable objectives, goals, and actions by which Colorado will address its projected future water needs and measure its progress—all built on our shared values. Just as it was created, this plan will be implemented by working collaboratively with the basin roundtables, local governments, water providers, other stakeholders, and the general public. It includes a set of policies and actions that all Coloradans and their elected officials can support and help implement." This presentation briefly assesses how the state's organization, people, and policies meet the expectations of the plan.

5 Forces, 5 Trends, 5 Skills for GIS in the 2020s

Joseph Kerski

Tuesday 2:00 – 3:00 pm

Geo-awareness, geo-enablement, geotechnologies, citizen science, and storytelling are combining to bring us in the GIS community to a pivotal moment. How can these forces, along with 5 trends in GIS, transform how our world moves into the next decade? What 5 skills are needed for you in the GIS community to chart your own course forward? Join Geographer Joseph Kerski for a fun and lively discussion as we reflect on the progress the community has made and the challenges that remain through 5 forces, 5 trends, and 5 skills.

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

**Round Table
Aspen Room**

Preparing Students to Become GIS Practitioners in a Fast-Paced Field

Ashley Summers, Becky Powell

Tuesday 3:30 – 5:00 pm

-----Laser Technology, Inc, Reception, 5:00 – 7:00pm on the Patio!-----

**Climate and Great Outdoors
Conifer/Evergreen Room**

US Geological Survey National Digital Trails Network

Greg Matthews

Tuesday 10:30 – 11:00 am

A major component of the Department of Interior's vision is to "Increase access to outdoor recreation opportunities for all Americans so that our people can be healthier, more fully enjoy the wonderful features of their federal lands, and take advantage of hunting, fishing, and other outdoor recreation pursuits that are the roots of the conservation movement." The US Geological Survey is advancing that

vision with the launch of the National Digital Trails Network (NDT) project. The two-year project consists of three major goals:

1. Develop a web-based geospatial analysis tool to assist Federal land managers in identifying and prioritizing candidate trails for the connection of existing trails and trail networks.
2. Aid in the creation of a robust national geospatial trail dataset including, at a minimum, trails from key Federal agencies including the U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, and the Bureau of Land Management.
3. Develop a mobile responsive application that will assist trail stewards, land management agencies, and members of the public, in the maintenance of trails information.

Join us for a discussion of the project and a demonstration of the Trail Routing, Analysis, and Information Linkage System (TRAILS) tool.

Water Fields of Colorado

Jeffrey Young

Tuesday 11:00 – 11:30 am

Since the invention of center pivot irrigation (CIP)...circa 1940, CIP has had a profound impact on agricultural practices in the Western US and globally. Water fields have expanded substantially in arid Colorado particularly on the Great Plains. Clearly there has been a visual transformation of rural landscapes. Some questions have been raised regarding the long-term effect of these CIP-based land and water management practices. Can source aquifers be sustained? What are the economics of CIP on food and feed output? How do such methods of irrigation affect global food supplies? This paper will focus on changes to landscape over time in selected areas of Colorado using historic and most current publicly available aerial and satellite source imagery supplemented by field observations.

AdventureSafely® - A New Technology for Saving the Lives of Outdoor Recreationalists

David Thomas

Tuesday 11:30 – 12:00 pm

At AdventureSafely, LLC, we are developing mobile app technology intended to save the lives of hikers, mountain bikers, and others who venture off into remote areas where there is little or no cell coverage. How can your cell phone help you if you are in an area where there is no cell coverage? There are two different ways that our technology can help a person if there is no cell coverage. Attend this talk to learn about our unique strategies for speeding search and rescue efforts in such remote areas.

-----Lunch Break 12:00 – 1:00 pm -----

Creating a Vision for Climate Resilient Wildlands in Central Colorado

Alison Gallensky

Tuesday 1:00 – 1:30 pm

Colorado's natural landscape is facing multiple interrelated and compounding threats including a growing population, expanding energy development, and a changing climate. We are beginning to see the impacts of these threats in our wildlife populations, as elk herds, bighorn sheep, and other species are showing declines.

Fortunately, there are places in Colorado's diverse high-elevation landscape that can continue to have a rich variety of plants and animals if those places and the corridors that connect them are protected.

Rocky Mountain Wild is leading a collaborative effort to create a science-based Conservation Vision using a combination of expert opinion and geospatial modeling within a science-based Climate Adaptation Framework. Identifying resilient wildlands and corridors is the first step to ensuring a biologically health future for our region.

The Conservation Vision Project is starting by focusing on the Upper Arkansas and South Platte River region in Central Colorado. Rocky Mountain Wild is collaborating with Wild Connections, the conservation organization that works to protect wildlands, native species, and biological diversity in this region.

GIS modeling is an important component of this project. This presentation will focus on the Climate Adaptation Framework, sources of data, and preliminary results. I will also discuss next steps including the role of expert opinion and citizen science to refine the Conservation Vision and plans to expand the Vision to include all of Colorado.

Implementing NASA Earth Observations to Validate Spectral Detection Models of Northern Wild Rice

Kristen Dennis

Tuesday 1:30 – 2:00 pm

*Crop wild relatives (CWRs) are genetically related to cultivated crops and function as repositories for genetic diversity. These plants have the potential to improve the yield, nutritional value, and resilience of crops, thereby buffering against widespread crop failure and supporting rural economic productivity. Our partners at the USDA Agricultural Research Service's National Plant Germplasm System (NPGS) are tasked with preserving CWRs, such as northern wild rice (*Zizania palustris* L.) in Minnesota. Additional partners at the Minnesota Department of Natural Resources (MN DNR) monitor wild rice and other aquatic vegetation by conducting annual field surveys. Currently, the NPGS relies primarily on habitat distribution modeling to predict suitable habitats for CWRs, while the MN DNR relies on its field surveys. This project focused on validating a digital ocular sampling (DOS) method for wild rice detection with the intention of improving habitat distribution modeling and facilitating wild crop monitoring. Previous research incorporated Sentinel-1 C-band Synthetic Aperture Radar and Landsat 8 Operational Land Imager data into a DOS approach, which was subsequently validated in this project with in situ data collected by the MN DNR. Results confirmed that models trained with MN DNR field data, as well as a combination of spectral and radar variables, outperformed other model iterations and are highly accurate in their classification of rice. We also found that DOS is not suitable for training models to distinguish between different aquatic vegetation types. These insights will provide end users with an improved framework for integrating remote sensing into their wild rice monitoring processes.*

Employing NASA and ESA Earth Observations to Monitor Alpine Lake Algal Productivity

Sarah Wingard

Tuesday 2:00 – 2:30 pm

Alpine lakes in Rocky Mountain National Park (RMNP) serve as an important habitat and water source for wildlife and contribute to the overall aesthetic value of the park. However, since the 1960s, alpine lakes within RMNP have experienced intensified algal productivity as a result of rising temperatures and increased nitrogen and phosphorus deposition. This increased algal productivity may have negative impacts on water quality, ecological function, and park aesthetic. Due to the remote location of many of these lakes, continuous monitoring of algal productivity is difficult. In order to assist in the surveillance of these lakes, the Rocky Mountain Water Resources II team partnered with the United States Geological Survey's Fort Collins Science Center and the National Park Service at RMNP to develop a methodology integrating satellite imagery for monitoring chlorophyll-a concentration as a

proxy for algal productivity. In 2016, DEVELOP's Rocky Mountain Climate team utilized Landsat 8 Operational Land Imager (OLI) to predict chlorophyll-a levels but were limited by the spatial and temporal resolution of the data. This feasibility analysis compared the efficacy of integrating higher resolution Sentinel-2 Multispectral Instrument (MSI) data with Landsat 8 OLI indices in detecting chlorophyll-a at two RMNP focal lakes, Sky Pond and The Loch. An increased understanding of the algal productivity of these lakes will allow our partners to promote best management practices in maintaining the resilience and preserve the beauty of these fragile ecosystems.

Forecasting Red Spruce Restoration in the USFS Monongahela National Forest

John Dialesandro

Tuesday 2:30 – 3:00 pm

*Within the Monongahela National Forest (MNF), situated in the Allegheny Highlands of West Virginia, extensive logging and mining practices have significantly altered the structure and composition of flora and fauna over the past two centuries. Of particular concern to MNF land managers are red spruce (*Picea rubens*) stands, which provide shelter and food to several endangered and threatened species. To aid red spruce restoration, this study mapped current and historical stands and identified non-native stands with suitable habitats for red spruce in the Sharp Knob Red Spruce Restoration Area. Data from Landsat 5 Thematic Mapper (TM), Landsat 8 Operational Land Imager (OLI), and Shuttle Radar Topography Mission (SRTM) were input into classification tree and fuzzy logic algorithms. Furthermore, 2018 classification maps were utilized in the TerrSet Land Change Modeler to forecast red spruce extent up to 2040. As a product of these analyses, we produced three sets of maps: four time series maps of red spruce stands from 1989 to 2018, a map that identifies suitable stands for future restoration efforts, and a red spruce land cover change map up to 2040. Our results indicate that 562 hectares are suitable for future restoration in Sharp's Knob, with an 8% gain in red spruce stands from 1989 to 2018. However, forecasting results indicate that management intervention will be necessary for this trend to continue.*

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

Round Table and Workshop

Conifer/Evergreen Room

Asset Management

Phyllis Thomas, Royal Koepsell

Tuesday 3:30 – 5:00 pm

Now more than ever, utilities need to know the inventory of their assets, their condition, priority, operational and maintenance cost, funding options, and risk. This session will allow attendees to assess their current asset management plan and consider steps for the future.

The presenters will describe current projects and case studies of local utilities and the benefits and advantages of a systematic approach to asset management.

-----Laser Technology, Inc, Reception, 5:00 – 7:00pm on the Patio!-----

Public Service and Safety
Alpine Room 1

Data.census.gov

Jim Castagneri, Lacey Loftin

Tuesday 10:30 – 11:15 am

Explore data.census.gov, the new site to access Census Bureau data. With no data releases in American FactFinder after June 2019, this platform will be the primary way to access data from the 2018 American Community Survey, 2017 Economic Census, 2020 Census, and more! Join us to see a live demonstration and learn how to access data from the new site.

2020 Census Geographic Programs Debrief

Jim Castagneri

Tuesday 11:15 – 12:00 pm

The Census Bureau has conducted a variety of geographic programs in partnership with local governments and planning agencies in preparation for the 2020 census. These programs include the Local Update of Census Addresses (LUCA), the Participant Statistical Areas Program (PSAP), the Boundary Annexation Survey (BAS), and the New Construction Program (NCP). In this session, we will summarize these programs, their results and the impact on an accurate count for the 2020 Census.

-----Lunch Break 12:00 – 1:00 pm -----

Building a PostGIS Geocoder on Open Data

Matthew Baker, Jeffrey Bradley

Tuesday 1:00 – 1:30 pm

With the wide availability of authoritative open address data, geocoding doesn't have to 'guess' a location, but simply match address information against a database of addresses. PostgreSQL with the PostGIS extension combined with open address point information from various open data catalogs across the state allow for fast in-house rooftop-level geocoding from inside a database.

Driving Web Maps from Google Sheets through PostgreSQL

Matthew Baker, Jeffrey Bradley

Tuesday 1:30 – 2:00 pm

Google sheets are becoming a more common collaboration and data sharing tool throughout many organizations. While not a true 'database', they can be accessed through PostgreSQL foreign data wrappers, and integrated into an existing relational database. With the combination of PostGIS, Node.js and Leaflet, Google Sheets can serve as the back-end of a web mapping application, and give an easy way to update data and quickly see the results on an interactive map.

Escape Route Index: A New Geospatial Measure of Wildland Firefighter Evacuation Potential

Michael Campbell

Tuesday 2:00 – 2:30 pm

Escape routes are some of the most important safety measures available to wildland firefighters, providing pre-defined pathways to safety from the fire line. The presence, abundance, and quality of potential escape routes in a wildland environment are limited by terrain and vegetation conditions. Provided that these conditions can be mapped ahead of time, we can direct fire crews towards safer

locations with higher potential for efficient evacuation. In this study, we introduce the Escape Route Index (ERI), which is a geospatial measure of the relative efficiency with which fire crews can evacuate from any given location in a wildland setting. ERI is a measure of the distance one can travel within a given time frame subject to existing landscape impediments relative to the distance one could travel in that same time frame in the absence of any impediments. ERI values range from 0 (very poor evacuation potential) to 1 (ideal evacuation potential). In its initial implementation, landscape impediments are limited to the slope of the terrain and the dominant vegetation/fuel type, derived from DEM and LANDFIRE data, respectively. The use of these freely-available datasets allows for nationwide implementation of the ERI algorithm. To demonstrate the implementation of ERI on a useful scale, we mapped ERI on the pixel-level at a 30-m resolution throughout Angeles National Forest in southern California. Results suggest that vegetation/fuel type possessed a dominant effect over slope on ERI, suggesting the need for a more nuanced, perhaps lidar-based measure of vegetation density in future implementations of ERI.

USGS 3D Elevation Program

Carol Lydic

Tuesday 2:30 – 3:00 pm

The U.S. Geological Survey (USGS) National Geospatial Program manages the 3D Elevation Program (3DEP) to respond to growing needs for high-quality topographic data and for a wide range of other three-dimensional (3D) representations of the Nation's natural and constructed features. The goal of 3DEP is to complete acquisition of nationwide light detection and ranging (lidar) data in 8 years to provide the first-ever national baseline of consistent high-resolution elevation data, both bare earth and 3D point clouds, collected in a timeframe of less than a decade. Interferometric synthetic aperture radar (IfSAR) data will be acquired for Alaska, where cloud cover and remote locations preclude the use of lidar in much of the State. 3DEP is based on the results of the National Enhanced Elevation Assessment (NEEA) that documented more than 600 business uses across 34 Federal agencies, all 50 States, selected local government and Tribal offices, and private and nonprofit organizations. The presentation will include the latest updates on 3DEP and online services.

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

Fixing Errors in the USGS Seamless 1/3 Arc-Second Digital Elevation Model

Barry Miller

Tuesday 3:30 – 4:00 pm

The U.S. Geological Survey (USGS) National Geospatial Technical Operations Center (NGTOC) maintains the USGS Seamless 1/3 Arc-Second (approximately 10-meter resolution) Digital Elevation Model (DEM). This national dataset provides foundational elevation information for earth science studies and mapping applications over the conterminous United States, Hawaii, Puerto Rico, other territorial islands, and parts of Alaska. Through the 3D Elevation Program, the Seamless DEM is continually updated with new lidar and interferometric synthetic aperture radar (ifSAR) collections (IfSAR in Alaska only). Although eventually all of the 1/3 Arc-Second Seamless DEM will be derived from lidar or IfSAR, currently portions of the dataset, especially in the western United States, are still sourced from legacy data created from digitized 1:24,000 scale topographic map contour lines. This legacy data contains some errors resulting from discrepancies in data capture, processing, or in the original source map sheet. The purpose of this presentation will be to discuss the types of errors that are present in a small fraction of our legacy data, how those errors came to be, and what steps USGS is taking to fix these issues to better support our customers

The Future in a Dynamic National Spatial Reference System

Brian Shaw

Tuesday 4:00 – 4:30 pm

The National Oceanic and Atmospheric Administration's (NOAA) National Geodetic Survey (NGS) has been providing the positioning infrastructure for the nation since 1807 when Thomas Jefferson created the Survey of the Coast. Society continues to learn more about how dynamic our world is, through improvements in technology with satellite-based positioning, and other new systems of measurement that did not exist when today's National Spatial Reference System (NSRS) was developed. The world is in constant change and there is a need to track changes in our environment with faster and more accurate observations. This can be accomplished with a modernized NSRS that will provide a precise, consistent and accurate positioning infrastructure that is readily and easily accessible primarily through Global Navigation Satellite System (GNSS) observations. The NSRS will provide the spatial infrastructure for the future of self-driving cars, building information models, and improving flood plain mapping for the safety of life and property. The NSRS will be easier and more cost effective to maintain providing the ability to account for dynamic changes in positioning such as plate tectonics; subsurface ground fluid withdrawal induced subsidence -- in some places inches per year of vertical change; and other geophysical phenomena. This presentation will provide an update of how the future NSRS will improve and what can be done to prepare for this paradigm shift in positioning.

ArcGIS Tools and Solutions for Emergency Management

Dave Vaillancourt

Tuesday 4:30 – 5:00 pm

This session will explore a variety of the emergency management solutions available for free to users of ArcGIS. We will discuss and see various examples of applications that assist in Situational Awareness, Damage Assessment, and Public Engagement. We will also explore what you can do to be ready for the next event.

-----Laser Technology, Inc, Reception, 5:00 – 7:00pm on the Patio!-----

PLSC

Alpine Room 2

Society: PLSC

Project success begins at a foundational level and collaboration from beginning to end, by all those involved. What project control coordinates were used and why? What coordinate system was used? What mapping projection and scale factor were applied? How was the data collected and why was that method chosen? How is the data communicated internally and externally to the other disciplines, companies, client, stakeholders, agencies the information that each need to know? If you have ever asked yourself or someone else these questions, then you may be interested in the Land Survey track. Come hear about how these questions were answered and what kind of solutions were formulated on real world projects!

The New Colorado State Plane Coordinate System - NATRF2022

John Hunter

Tuesday 10:30 – 11:15 am

Colorado State Plane Coordinate Systems are getting redefined in 2022. Having a working knowledge of the new State Plane system will be critical for all geospatial professions that utilize and/or produce geospatial data. This presentation will explore the details of the new State Plane Coordinate System including the options that Colorado has elected to utilize, the differences between NAD83 and NATRF2022, as well as other ancillary changes that are coming in 2022 such as the new look longitudes, and the adoption of the International Foot.

Grid vs. Ground for the Geospatial Professional

Joey Stone

Tuesday 11:15 – 12:00 pm

Geospatial Professionals employ datasets from a multitude of sources and with varying spatial accuracy levels. Many high spatial accuracy datasets from surveyors and engineers utilize modified coordinate systems to represent true ground distances. The amount of distortion in a projection, commonly referred to as Grid V. Ground, is an important consideration that plays a vital role in the accuracy of the GIS and especially spatially derived analytics. I will cover the concept of Grid vs. Ground and the tools available in ArcGIS Pro to mitigate linear distortion.

-----Lunch Break 12:00 – 1:00 pm -----

Utilizing GIS Data in Land Surveying Deliverables

Kayce Keane

Tuesday 1:00 – 2:00 pm

This presentation will circle on when one can utilize GIS data in land surveying deliverables. Land Surveying is governed by DORA rules and regulations as well as state statute in a number of its deliverables. There are ways, however, that we can utilize GIS grade mapping information in our deliverables, but it comes with a number of caveats. Together we'll explore this topic.

Colorado811: One Call for a Culture of Asbuilts

Bryan Douglass

Tuesday 2:00 – 2:30 pm

The Colorado One Call Law has motivated a myriad of emotions throughout our professional, municipal, and development communities. While concern is valid, trepidation is encouraged, and the struggle to comprehend our future is real, the call for action should be embraced as the critical opportunity for solidarity our Surveyors, Engineers, Geospatial professionals, and Legislators need.

How Denver Water Survey Section Utilizes ArcGIS Online to Support Business Functions

John Hunter, Neil Wagner

Tuesday 2:30 – 3:00 pm

The Denver Water Survey Section utilizes ArcGIS Online to aid in project management and decision making. ArcGIS Online serves as the vehicle to provide team members and managers a real-time interactive experience while accessing crucial project information. By leveraging tools such as Collector for ArcGIS, Operations Dashboards and Web AppBuilder, the Survey Section has been able to accomplish goals that were once not possible. The Survey Section now has a growing database of

projects and the ability to track project information and produce metrics, all in real-time. By taking advantage of the mobile platforms, the Survey Section has been able to ensure relevant project information is available to all team members regardless of their location while continuously updating project information. This presentation will focus on the Survey Sections use of Collector for ArcGIS, Operations Dashboards, and Web AppBuilders to manage projects and produce metrics as well as how the Survey Section is designing similar workflows for other survey functions.

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

Migrating CADD to GIS for Engineering Projects in 2-3 Easy Steps

Teresa Smithson

Tuesday 3:30 – 4:00 pm

Engineering projects deal with data sets in different formats (i.e. CADD, GIS, KML) and different projections, many customized. Because of this, there is a need for flexible tools that extract, transform, manipulate and organize the data logically within flexible workflows. The presentation will focus on describing 1) the challenges to automate the process; 2) the use of enterprise tools for migration; and 3) the benefits of using GIS products generated in ArcMap for your engineering projects.

Lessons Learned: The GIS Professional, the Colorado County Surveyor, and a Call for Solidarity

Bryan Douglass

Tuesday 4:00 – 4:30 pm

Rising demands from a data-driven society have introduced a world of opportunity and potential via geospatial technologies. Unfortunately, the foundational contributions of the Land Survey community are universally withering while the GIS community progressively evolves. The traverse to ultimate salvation will bring us together, and that traverse commences in the office of the Colorado County Surveyor. We need each other. Here's why.

Photogrammetry for Drones

Harold Schuch

Tuesday 4:30 – 5:00 pm

Most drone operators use them for pretty pictures or to collect visual information without performing any precise measurements. This slide presentation is dedicated to those who would like to learn what the principal procedures are that allow technically sound results. One project (the measurement of a bridge) will be taken through all the necessary steps. At the end of the presentation, there will be a live demonstration of photogrammetric software.

-----Laser Technology, Inc, Reception, 5:00 – 7:00pm on the Patio!-----

GISCO: Communicate, Educate, Engage, and Inspire
Alpine Room 3

Principles of Cartography for Web GIS

Tom Neer

Tuesday 10:30 – 11:00 am

GIS and cartography have been in a constant state of evolution over the last 50 years. The latest evolution being the transition from static to interactive maps. How do we continue to effectively communicate to our audience in this new interactive medium? We will review the traditional Principles of Cartography and how they apply in today's Web GIS applications.

If You Aren't Managing Who Is?

Brandi Rank

Tuesday 11:00 – 12:00 pm

Do you lead through change? Do you know how to? Do you track and report metrics? Do you know how to? Do you communicate to the executives in your organization? Do you know how to? Do you brag about your team? Do you know how to? This presentation will focus on some practical ways to track and report metrics. Ideas to consider when considering messaging to your audience; understanding that the C-suite has a different set of priorities than your peers. I will talk about leading through cultural change and provide some ideas that I have found successful. I will discuss strategies related to using social media to brag about you work. This presentation is primarily written for GIS Managers, but all are welcome to attend and start leading by example immediately!

-----Lunch Break 12:00 – 1:00 pm -----

The Good, The Bad & The Ugly of Addressing

Stephen Mitchell

Tuesday 1:00 – 1:30 pm

Stephen Mitchell, Administrator of Jefferson County's Address Street Political (ASP) Database and Tools, has worked with addressing in a local government setting for nearly 30 years. While Mitchell has seen much good addressing, he has also seen far too many examples of bad and even some ugly addressing! Steve will illustrate examples of each while discussing aspects of good addressing.

Jefferson County's Address Street Political (ASP) Database & Tools

Stephen Mitchell

Tuesday 1:30 – 2:00 pm

Jefferson County, Colorado has maintained its address, road-centerline and political polygonal data in integrated environments that have evolved through time to become the current Address Street Political (ASP) Database and Tools. The system's administrator will provide a high-level overview of why and how these data entities are integrated, discuss the ASP schema in terms of key data relationships and associated business rules, and illustrate some of the tools employed in the course of data maintenance.

Developing an Airspace Calculator Using Web AppBuilder for ArcGIS: Best Practices and Lessons Learned

Chris Martin and Rachel Pierstorff

Tuesday 2:00 – 2:30 pm

Matrix Design Group recently developed a custom tool for the communities surrounding Keesler Air Force Base in Biloxi, Mississippi. The tool identifies the elevation at which a vertical structure would penetrate the airspace, calculates the allowable height of a structure, and indicates if the height of the structure is compatible with the airspace restrictions at the given location. This information is invaluable during the development review process and takes the estimation out of a complicated calculation. ArcGIS Enterprise and the Developers Edition of Web AppBuilder for ArcGIS were used to create this

tool. Join us as we not only detail how the tool was made, but also delve into some hurdles that had to be overcome and discuss lessons learned during configuration, development, and deployment.

Introducing ArcGIS Notebooks

Hayley Miller

Tuesday 2:30 – 3:00 pm

This session will introduce you to ArcGIS Notebooks, designed to bring together the worlds of GIS and Data Science. Learn how you can use ArcGIS Notebooks to augment your traditional analytical workflows and get a crash course in the basics of data science. This session is designed for people who are curious about ArcGIS Notebooks or just getting started with data science.

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

Web Analysis in ArcGIS

Dave Vaillancourt

Tuesday 3:30 – 4:00 pm

Join us for an exploration into essential spatial analysis workflows and tools in ArcGIS Online. We'll review and demonstrate various types of spatial analysis from basic to more advanced. We'll also introduce you to the rich set of analysis tools capabilities using Insights for ArcGIS.

The Present and Future of Stately Things

Jolene Geiss, Donnie Luchetti, Harraz Mohd Reza

Tuesday 4:00 – 5:00 pm

Did you know the State of Colorado has three viewers publicly accessible for lidar, broadband, and vector datasets? We will walk through how to access the viewers, export the data you need and who to contact for data you can't find.

-----Laser Technology, Inc, Reception, 5:00 – 7:00pm on the Patio!-----

Technology Spotlight

Alpine Room 4

Businesses showcase new and existing products related to geospatial technologies and information science. Attend to learn about current or emerging technologies and techniques that could help make your job easier. This is your chance to ask questions, provide suggestions and give general user feedback.

Evolving Applications of Mobile Mapping

Bob Parry

Tuesday 10:30 – 11:00 am

Mobile mapping and data collection apps are making it easier for organizations with employees who work in the field - even those with limited expertise - to collect, share and maintain GIS data. Through case study examples, learn how mobile apps are used by field teams as an efficient way to streamline operations in infrastructure projects, emergency response, logging, and renewable energy.

Nearmap: We Change the Way People View the World, So They Can Profoundly Change the Way They Work

Charles Staton

Tuesday 11:00 – 11:30 am

Nearmap specializes in high resolution aerial imagery delivered via the cloud. We currently cover 72% of the US Population and just started capturing in Canada.

We operate in several vertical spaces including Architecture, Engineering, and Construction as well as the Government and landscaping space to note a few. We store petabytes of historical data and have 72,000 + customers that access our imagery daily.

With Nearmap, you are able to explore your environment with ease, clarity and minimal impact to unlock opportunities and make more informed decisions, directly from your workstation.

We offer a complete product stack in order to achieve your goals, whether it be through our vertical, oblique, or 3D offerings.

Nearmap makes a seamless integration experience into third party applications by way of the Esri Marketplace, or a suite of scalable APIs.

Our imagery can be used as training models for Machine Learning and Artificial Intelligence capabilities as well, which greatly reduced time and cost for our customers.

ArcGIS Enterprise: Deployment Tips and Tricks

Gary Parker, Lindsay Svadbik

Tuesday 11:30 – 12:00 pm

At 10.5.1 ESRI introduced ArcGIS Enterprise, combining Portal for ArcGIS, Server for ArcGIS, SDE, ArcGIS Datastore and ArcGIS WebAdaptor. This presentation explores the different components of ArcGIS Enterprise and how they work together, including ArcGIS Online. ESRI Best practices will be highlighted throughout the presentation which aims to outline tips and tricks for your journey into Enterprise from design to implementation.

-----Lunch Break 12:00 – 1:00 pm -----

Mapping the Urban Forest: Geospatial Methods for Analyzing Tree Canopy in Cities

Maegan Blansett, Carrie Asselmeier

Tuesday 1:00 – 1:30 pm

Communities across the globe are looking to the “urban forest” as a form of green infrastructure. Tree canopy in the built environment promotes human health and well-being, conserves energy, improves air quality, sustains wildlife, mitigates stormwater issues, boosts the local economy, and could even be the solution to our planet’s mounting climate crisis. But how can these communities quantify the value of their urban forest resource and strategically protect, promote, and expand their tree canopy amidst issues like development, drought, pests or disease, and limited resources? This presentation will provide an introduction to the various methods for assessing urban tree canopy using geospatial tools and technology such as object-based image analysis (remote sensing) of imagery and elevation data, point-based statistical sampling, and on-the-ground surveying, as well as the data products resulting from each and their possible uses. Techniques for incorporating the derived data into broader planning and management efforts will also be discussed, including case studies local to the Rocky Mountain region and elsewhere. Come learn how states, counties, and cities of all sizes are applying GIS to improve their communities, with trees!

TreePlotter: Tree Inventory Software to Manage Urban Forests

Ian Hanou, Maegan Blansett

Tuesday 1:30 – 2:00 pm

PlanIT Geo, based in Arvada, CO, offers a full spectrum of urban forestry consulting services ranging from on-the-ground inventory and risk assessment to high-level remotely sensed tree canopy analysis and plantable space prioritization. We are also the creators of TreePlotter, a suite of four subscription software products that allow its users to map, manage, and plan for their urban forests and parks at both the site-specific and landscape scale. TreePlotter is built on a web-based GIS platform, optimized for use on any desktop or mobile device online or offline, and designed to provide real time access to tree data for unlimited users. This presentation will feature a live demo of our highly customizable, cloud based software products used by governments, private businesses, and non-profit organizations worldwide. Come see how we're "mapping a greener future" with the power of GIS.

The Power of Points

Andrew Carey, Mitch Tweedy

Tuesday 2:00 – 2:30 pm

sUAS(Drone) LiDAR collection can provide an incredible density of geospatial point data. Join CompassDrone to learn from our experience flying LiDAR over unique landscapes such as tidal bays, jungles, and remote deserts. You learn firsthand the challenges of field deployment and how our clients are successfully integrating these advanced technology data sets and derived products. Topics specifically address to cover Mission Flight Planning (maintaining consistent altitude AGL) Vegetation penetration, LiDAR Calibration, and Accuracy Data Validation.

Full Motion Video from DJI to ESRI ArcPro

Andrew Carey

Tuesday 2:30 – 3:00 pm

DJI-captured video and telemetry can be accessible via the Esri Full Motion Video Multiplexer Add-in for ArcPro. FMV mapping is used extensively in utility maintenance, public safety & security, crop monitoring, wildfire management, tree inventorying, and numerous public works projects. CIRRUAS has the ability to extract mapping-grade data from full-motion drone video. In developing CIRRUAS, CompassDrone mapping experts wrote a script that extracts 12 key telemetry elements collected by the drone during flight, such as locations, headings and attitudes of the camera and platform. The script then correlates this flight information with the captured FMV to match telemetry with every second of video. Once in ArcPro, the video can be viewed and queried like any other GIS-ready image. Users can watch the video in one screen while viewing the drone's location and movement on a map display. Precise altitude and location coordinates can be queried at any point in the video. More importantly, the user can access ArcGIS tools to delineate and extract ground features in the video, and the resulting polygons show up instantly in the GIS map. Extraction can also be performed from the GIS map to the video.

-----Afternoon Break 3:00 – 3:30pm -----

-----Poster Session – Meet the Poster Presenters During the Break!-----

Real-Time Correction and Post Processing for Cloud-Based Data Collection Applications

David Siddle

Tuesday 3:30 – 4:00 pm

Intended for users of cloud-based apps: Collector, Survey 123, TerraFlex, PenMap, etc., on current and “road map” options for real-time correction and Post Processing solutions.

Exploring the GIS Module in Trimble Business Center

Karissa Barnes

Tuesday 4:00 – 4:30 pm

The GIS Module is an extension for Trimble Business Center. It creates a seamless way to integrate survey data from Trimble Business Center directly to a file geodatabase or sde database in ArcGIS. The GIS schema can be extracted to use with Trimble Access for new feature collection. We will demonstrate how to improve your geospatial workflows.

OPEN for Business

Kara Tinkum, Leah Twombly

Tuesday 4:30 – 5:00 pm

The implementation of an organizational wide Real Estate and Operations enterprise solution for multiple short line railroads.

-----Laser Technology, Inc, Reception 5:00 – 7:00pm on the Patio! -----

Wednesday

ASPRS

Aspen Room

Society: ASPRS – Rocky Mountain Region

Forest Health Assessment for the Cook Inlet Ecoregion, Alaska

Michael Tuffly

Wednesday 8:30 – 9:00 am

Synthetic Aperture Radar (SAR) has been around for decades. However, the data may have been underutilized by remote sensing scientists due to complex image processing procedures. Of late, a new suite of SAR satellites coupled with advancements in computer processing, and artificial intelligence (AI) software have catapulted the technology. The European Space Agency's Sentinel-1 C-band SAR satellite data can be used to assess forest health conditions in most areas of the world under myriad weather and environmental conditions.

*This study assesses forest susceptibility to the endemic spruce beetle (*Dendroctonus rufipennis* Kirby) in the Cook Inlet ecoregion of Alaska for a two-year time period (2017 and 2018). Data used in this analysis are Sentinel-1 C-band SAR, optical remotely sensed data from LandSat-8 OLI and MODIS; in addition to a digital elevation model. These data are then evaluated for importance and assigned categorical break points via an AI method using the Classification and Regression Tree (CART) analysis. The results from this modeling effort produced accuracies of 74% and 77% for 2017 and 2018, respectively.*

Mapping the Camp Fire Burn Severity Using Synthetic Aperture Radar (SAR)

Michael Tuffly

Wednesday 9:00 – 9:30 am

On November 8th, 2018, the Camp Fire began burning on the west side of the Sierra Nevada mountains in Butte County, Northern California. This catastrophic fire took the lives of over 85 people and destroyed over 14,000 structures. [https://en.wikipedia.org/wiki/Camp_Fire_\(2018\)](https://en.wikipedia.org/wiki/Camp_Fire_(2018)). The Fire was extinguished on November 25th.

Synthetic Aperture Radar (SAR) data is rapidly playing a role in mapping burn severity. SAR satellites use microwaves to collect data. Microwaves are not influenced by low sun angles and shadows, extensive cloud cover obscuring the burned area, or snow. However, SAR data does require more effort in data processing to produce useful products for mapping burn severity.

Two Sentinel-1B Single Look Complex (SLC) scenes were collected from the University of Alaska in Fairbanks <https://vertex.daac.asf.alaska.edu/>. One of the scenes was collected before the Camp Fire started (10/24/2018) (pre-fire). The second scene was collected after the fire was extinguished (12/11/2018) (post-fire).

The two ESA Sentinel-1B SLC scenes were decomposed (i.e. dual-pol H- α decomposition). The decomposition was performed using the ESA Sentinel 1 Toolbox (SNAP) <http://step.esa.int/main/>. SNAP is an easy to use open source software package designed to process Sentinel data.

After the SAR decomposition was implemented the Alpha band (α) for the pre-fire and post-fire were isolated. Research by Engelbrecht, et al., 2017 states that wildfire burn severity can be mapped using the Normalized Difference α -Angle Index (ND α I).

References

Engelbrecht, J., A. Theron, L. Vhengani and J. Kemp (2017). "A Simple Normalized Difference Approach to Burnt Area Mapping Using Multi-Polarization C-Band SAR." Remote Sensing 9(8)

GIS to NCS: Roadway Planimetric and 3D Breakline Mapping in the National CAD Standard

Robert Dzur

Wednesday 9:30 – 10:00 am

High-resolution mapping techniques from sources such as Mobile LIDAR Scanning (MLS) offer the capability to describe map features at highly detailed scales of analysis previously often limited to isolated road corridor projects. The City of Hobbs, New Mexico, collected an extensive City-wide MLS dataset comprising approximately 300 linear miles of driven roadways. This MLS point cloud dataset served as the baseline repository from which transportation-related GIS features were extracted. The feature data differentiated more than 55 different transportation features encompassing more than 120,000 mapped objects spanning the public way from approximately back of sidewalk across the roadway to opposite back of sidewalk. GIS attribution and layer naming conventions provided for intelligent feature construction and translation into the National CAD Standard (NCS) with FME into an NCS template-driven AutoCAD Civil 3D drawing file. Unique data processing aspects such as point-based pavement marking features, processed in QGIS open source GIS software, added rotation attribution for proper display of CAD block elements. The same planimetric roadway feature data set was also processed as 3D breaklines and draped in GRASS GIS software to produce 3D vectors for surface modeling. This presentation will highlight some of the more technically challenging aspects of moving GIS data into the National CAD Standard. The City of Hobbs project demonstrates how multiple GIS tools operating on MLS derived planimetric and breakline features are providing a practical and powerful means to map transportation assets at a City-wide scale.

-----Morning Break 10:00 – 10:30am-----

UAS

Aspen Room

Large Scale Mapping with UAVs

Trent Casi

Wednesday 10:30 – 11:00 am

Coming from 5 years of UAV experience and information systems, I aim to educate on how to tackle more complicated large scale mapping missions. My research question for this abstract is: How can I earn the best ROI without sacrificing quality on large scale mapping projects? Many factors go into this decision from operations, equipment selection, organization, and georeferencing methodologies. I would also like to go into the applications typically involved with large mapping projects, and where the UAV fits economically compared to other geospatial technologies. I am a customer success engineer for a UAV manufacturer, so it is my job to educate and guide the market to implementing UAV mapping technology successfully.

UAS Data Processing and Fleet Management for Operational Efficiency

Nathan McEachen, Jeff Akers

Wednesday 11:00 – 12:00 pm

Organizations in many critical infrastructure industries of all sizes face the common problem of managing large amounts of aerial imagery collected from remote locations. There is a need to have all UAS data delivered to a standard data warehouse for ease of ingestion, archiving, and collaboration. The demand for these data management solutions is exploding with many utilities, oil and gas, land management, telecom, and civil engineering companies creating more and more imagery and other 3d and 4d data for analysis and decision support.

The Department of Interior has recognized this need early on and has focused resources and energy on creating the solution that will not only handle a single set of use cases but scale along with the explosion of data. The DOI has funded an open source application, called UAS-DM, that is designed to centrally manage UAS imagery, facilitate uploading to the cloud in low internet conditions, and automate imaging processing workflows such as orthorectification. The DOI is making this available to the public as a common good to help foster a collaborative community to make UAV operations as seamless as possible. This platform as a service is extremely useful for all enterprises that are in need of capturing, managing and using UAS data to help maintain their assets and create better decision making.

We will demonstrate the UAS-DM application, outline the feature roadmap, and show its extensible framework for building collaborative workflows around image collection, processing, sharing, and metadata capture to enable location intelligence.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

-----Afternoon Break 2:00 – 2:30pm -----

Career Development Academy

Aspen Room

Wednesday 2:30 - 5:00 pm

CDA is designed for any individual seeking to, or anticipating, transition from one stage of their career to another. Students, early career professionals, and seasoned GIS experts are all invited to participate. Attendance is complimentary and conference registration is not required to participate in CDA. This year's CDA will offer presentations by Geosearch, Inc. and Dave Murray, GISP from the City of Westminster. Presentations will be followed by an interactive workshop with a professional coach. Get clear. Get confident.

State of Geospatial

Jessica Touchard, Richard Touchard

2:30 - 3:15 pm

This presentation includes data and statistics about employment, skills in high demand, which areas of the country are hot job markets, and related information about the geospatial employment market.

Land That Good Government Job, and Beat the 'ALGOS' at Their Own Game

Dave Murray

3:15 - 3:45 pm

You'll come away from this presentation with specific techniques and methods to be able to get over hurdles that the hiring process places in your way. You'll also get a clearer idea of where to focus your energies to build a satisfying career in the Geospatial Industry.

Soft Skills for a Hard Industry Workshop

Gail Montgomery, Cristina Amigoni

3:45 - 5:00 pm

Gain confidence in speaking about your strengths and career goals. This workshop is designed to help you identify what it is that you REALLY want and build the confidence to pursue that vision. Discover your target and how to aim for it!

Pre-Conference Resume Review

Get tips and feedback from a GeoSpatial employment specialist. Complimentary resume review is available (<http://www.geosearch.com/submit-your-resume.html>) for anyone in the midst of a job search, those who are gearing up for a big transition, and people who prefer to maintain an up to date resume. Common suggestions are related to formatting, skillset language that will be flagged appropriately by auto-filters, and guidance to present experience in a way that is most appealing to employers. Submit your resume to GeoSearch, Inc. for constructive feedback aimed at helping individuals advance their careers.

Educators and Students

Conifer/Evergreen Room

Beyond the Textbook: Connecting Students to the Geospatial World

Elizabeth Tulanowski

Wednesday 8:30 - 9:00 am

The resources we provide our students need to evolve along with technology in order to engage modern students. Countless educational opportunities exist beyond the textbook and beyond the classroom: online training, social media (Twitter as a learning tool? Yes!), podcasts, professional events, and more, that can enhance the learning experience and better connect students to the geospatial world. Traditional teaching styles, textbook readings, and assignments just don't cut it anymore.

In this presentation, I'll answer such questions as:

What are the benefits of incorporating resources like these as supplemental material or assignments in a GIS course, and how have I implemented it in my classes?

How can educators get students excited about geospatial tech to show them just how versatile it is?

What geospatial resources exist (for students and GIS professionals alike) to explore and connect to an ever-changing geospatial world?

This session will share a lot of useful resources, and may be of interest to not only educators and students, but also GIS professionals.

Leveraging Indoor Mapping in School Planning

Tammira Taylor, Elizabeth Halpin

Wednesday 9:00 - 9:30 am

Understanding geographic relationships is essential to school infrastructure planning, especially when juggling scarce resources, overlapping jurisdictions, and mission sensitive deliverables. This presentation will describe how Albuquerque Public Schools uses CAD drawings to create indoor GIS datasets to enable planning for future enrollment and special needs services, while ensuring diversity and equitable distribution of resources.

Reducing Operational Overhead by Optimally Siting Facilities Within a Service Territory

Jacqueline Sinclair

Wednesday 9:30 - 10:00 am

Background: San Miguel Power Association (SMPA) is a small rural electric distribution cooperative located in southwest Colorado serving approximately 13,500 members within a 3,690 sq. mile service territory. Approximately 88% of the roads within the SMPA service territory are unpaved. The varied topography and precipitation events impede travel and increase the operational overhead cost for accessing some service locations while also posing safety concerns for linemen. This project analyzes member account history and the accessibility characteristics of service locations in the service territory to identify optimal sites for installing automated service disconnect (SD) meters and reduce operational overhead.

Methods: SMPA customer information system (CIS) data was evaluated using multiple criteria to identify a set of service locations that satisfied SD meter candidacy parameters set forth by management. The geographic analysis processes involved the development of two seasonal friction surface models using interpolation of spatiotemporal data by Kriging and weighted overlay. The winter and summer models served as input to final cost distance analyses from office locations to service locations identifying locations most encumbered by access constraints.

Conclusion: The final project results indicate 662 meters, approximately 5% of all service locations, as optimally suited for SD meter exchange thereby reducing future operational costs for accessing these sites. Mapped outputs can be used for subsequent decision making, further analysis, and map application development for prioritizing and tracking SD meter installation.

-----Morning Break 10:00 – 10:30am -----

Charting Your Spatial Career

Esther Worker

Tuesday 10:30 - 11:00 am

Developing and implementing your career plan takes time, attention and effort. Nor is there is a “right” or “wrong” way to approach it. Things to consider are Advancement, Self Awareness, Self Motivation, Professional Networking, Risk management, and what are the benefits of being a “lifer” or a “job hopper”?

Should you make a career map for the next 40 or 60 years? Or stay flexible and open to changing opportunities? Examine options for your future professional development!

Land Use/Cover Change and Soil Erosion in Nzhelele Valley Limpopo Province, South Africa

Blessing Mavhuru

Wednesday 11:00 - 11:30 am

The main objective of this study was to classify land use/cover and how it has changed in Nzhelele Valley Limpopo Province, South Africa. The study aimed to identify and analyse the types of land use/cover in the years 2005, 2010 and 2015 with a view to assess the impact on soil erosion over time. Using GIS, the changes within land use/cover were assessed through the classification of satellite images. The study area was classified into four major land cover/use classes which are vegetation, gravel road, built up land and agricultural fields. Over the period 2005-2015 the resultant land use/cover demonstrated (i) a significant increase (12%) for vegetation cover, (ii) a significant decrease in agriculture (16%) land use/cover, (iii) increase in built-up land (1%), as well as (iv) an increase in gravel roads (3%). This study envisages assisting policy makers in decision making on land use management for Nzhelele Valley.

A Better Way to Measure Distance and Area on Uneven Digital Terrain

Georgios Charisoulis

Wednesday 11:30 - 12:00 pm

This research reports on methods to improve current GIS methods of measuring distance and area on Digital Elevation Models. Distance and area metrics are a foundation for many GIS modeling applications such as freight transport costs, point source pollutant flows, storm surge flooding, avalanche or debris flow risks, or habitat fragmentation. GIScientists are charged with delineating shortest path routing and to highlight either affected populations in high danger or areas most likely to be impacted. Current practice measures distance on DEMs by tallying distance between pixel centroids, and computes area by assuming that all pixels are the same size and shape. When pixels are quite small (10 meters or less) and terrain is flat and smooth, existing methods produce reasonable estimates. As pixel sizes increase (for example to regional or continental scales), the assumption that all measurements should begin and end at pixel centroids introduces errors in modeling outputs. And when terrain is mountainous, especially in localized landscapes (such as Boulder County) where terrain characteristics vary, modeling errors can become dramatic. We are working to quantify the rate at which errors propagate at coarser spatial resolutions (meters to kilometers), examining a suite of modelling factors that can reduce accurate distance and area measurements. This presentation specifically examines error propagation in uniform and non-uniform terrain, using a Boulder County freight routing example for distance (shortest cost path) metrics, and a flood risk example for area metrics, demonstrating how uneven terrain can introduce errors into shortest cost estimates and flood risk models.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

-----Afternoon Break 2:00 – 2:30pm -----

Small Changes in Street Connectivity Can Result in Big Gains for Student Walking

Jeremy Auerbach

Wednesday 2:30 - 3:00 pm

Student active commuting to school is an important component to student achievement and student health. Increasing street and trail connectivity between and within residential developments and schools is a key to overcoming several barriers to student active commuting. Advanced network optimization techniques were applied to several urban and suburban schools from a representative U.S. school system to locate the optimal new connections that maximize student walking to a school and minimize the length of the connection. Benefits, which include potential cost-savings to a school system if they had fewer students to bus to school and the increased time of physical activity from student walking, are compared to the financial costs of the new connections. Results from this case study showed that short and inexpensive connections could lead to a large number of potential student active commuters and a significant increase of physical activity for those potential walkers. This work can foster the integration of student walking and student health in residential planning decisions around schools.

When El Niño Rages: How Satellite Data Can Help Water-Stressed Islands

Nick Luchetti

Tuesday 3:00 - 3:30 pm

There are more than 2,000 islands across Hawaii and the U.S.-Affiliated Pacific Islands (USAPI), where freshwater resources are heavily dependent upon rainfall. Many of the islands experience dramatic

variations in precipitation during the different phases of the El Niño–Southern Oscillation (ENSO). Traditionally, forecasters in the region relied on ENSO climatologies based on spatially limited in situ data to inform their seasonal precipitation outlooks. To address this gap, a unique NOAA/NASA collaborative project updated the ENSO-based rainfall climatology for the Exclusive Economic Zones (EEZs) encompassing Hawaii and the USAPI using NOAA’s PERSIANN Climate Data Record (CDR). The PERSIANN-CDR provides a 30-yr record of global daily precipitation at 0.25° resolution (~750 km² near the equator). This project resulted in a 478-page climatic reference atlas. This atlas is based on a 30-yr period from 1 January 1985 through 31 December 2014 and complements station data by offering an enhanced spatial representation of rainfall averages. Regional and EEZ-specific maps throughout the atlas illustrate the percent departure from average for each season based on the Oceanic Niño Index (ONI) for different ENSO phases. To facilitate intercomparisons across locations, this percentage-based climatology was provided to regional climatologists, forecasters, and outreach experts within the region. Anomalous wet and dry maps for each ENSO phase are used by the regional constituents to better understand precipitation patterns across their regions and to produce more accurate forecasts to inform adaptation, conservation, and mitigation options for drought and flooding events.

Public Service and Safety

Alpine Room 1

Upcoming Regional Data Projects – Imagery, Lidar, Planimetric Features

Ashley Summers

Wednesday 8:30 - 9:00 am

The Denver Regional Council of Governments facilitates regional acquisition projects for foundational data such as imagery, lidar, and planimetric features. With our projects, we aim to create value for the whole community by acquiring products that support a wide variety of users and use cases and by freely distributing data. During this presentation, we will discuss plans for projects that will occur in 2020 and 2021.

Esri’s Business Analyst Extension at South Metro Fire Rescue

Heather Hoelting

Wednesday 9:00 - 9:30 am

South Metro Fire Rescue has unified three fire departments over the past 3 years, serving an area that grew from 181 to 292 square miles in the Greater South Denver Metro Area. With Cunningham Fire, Littleton Fire, and South Metro Fire combining into one fire department, the demographics and population growth has expanded and changed over the past 3 years. South Metro Fire Rescue GIS and Analytics Department is utilizing Esri’s Business Analyst extension to create reports and identify areas within the district such as population at risk, English as a second language, or areas of large population growth such as Sterling Ranch. These reports are then utilized by the Risk Reduction and Accreditation Team to better understand and serve our growing community. It is with tools like these that South Metro Fire Rescue provides more effective and targeted risk reduction and education programs tailored toward specific communities around the district. This presentation will discuss the previous workflow of processing and using census data and how the Business Analyst extension has streamlined the process to produce reports and capture more accurate demographic data.

How the Sausage Is Made: A Peek into Specialized Cartography

Elaine Guidero

Wednesday 9:30 - 10:00 am

Over the past few years of creating multi-scale and specialized maps at USGS for a variety of audiences and needs, I've learned many techniques and lessons. From managing multi-scale data to tweaking hypsometric tints, I will share memorable successes, mistakes, and demonstrations in ArcGIS and Adobe Creative Suite.

-----Morning Break 10:00 – 10:30am -----

Empowering CDOT Maintenance Crews with a GIS Tool for the Field

Gary Aucott

Wednesday 10:30 - 11:00 am

The Colorado Department of Transportation has deployed a GIS-based system to collect more accurate data on their maintenance activities. Some of the goals of this effort were to reduce errors in work orders and to improve the tracking of work done on specific assets. The solution provides a tighter integration between the work order system and the geodatabase of assets, plus a mobile application that combines SAP Work Manager for logging work and Critigen Lemur for a map interface. To tie it all together requires ArcGIS Enterprise feature services and Python scripting. We will discuss how these various components integrate to provide a spatially enabled mobile tool for maintenance work crews.

From the Unknown to the National Map: The Sesquicentennial Colorado River Exploring Expedition (SCREE)

Genevieve Barron

Wednesday 11:00 - 11:30 am

In the spring of 1869, John Wesley Powell began the first of two expeditions down the Colorado River into the 'Great Unknown'. Information gained from Powell's early efforts of land surveying initiated development of a national topographic mapping program and established consistent mapping standards that are still in use today at the US Geological Survey (USGS). This presentation will feature highlights from the 2019 Sesquicentennial Colorado River Exploring Expedition's (SCREE) 'Lake Powell to Glen Canyon Dam' segment. In addition, the presentation will also reflect on the progression of Powell's systematic mapping inquiry to the topographic products of the 21st century, the National Map and the US Topo series.

Multi-Scale Mapping with Large Production Output – Lessons Learned and Moving Forward

Sara Boyer

Wednesday 11:30 - 12:00 pm

Researchers at the U.S. Geological Survey's, National Geospatial Technical Operation Center (NGTOC), are looking at methods to build maps on a multi-scale platform capable of high production throughput. The NGTOC is a center devoted to creating new innovative ways of mapping, especially for high quality and accuracy on a large production scale. In 2009, the NGTOC reestablished the US Topo 1:24,000 scale mapping program which now distributes updated maps for the entire United States every three years. The Center intends to build on lessons learned from the US Topo success to create a multi-scale, high throughput process. Though the idea of large production multi-scale mapping seems straightforward, publishing varied scaled maps utilizing a repetitive production line has presented many challenges. We will discuss this year's approach to the project, what was accomplished and what will potentially be undertaken next year. Included will be examples of ArcMap templates, data and annotation, and a look at the first version of Workflow Manager used by the production line.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

-----Afternoon Break 2:00 – 2:30pm -----

A Geospatial Catalog of Stormwater Infrastructure Across Colorado: The Benefits and Challenges of Consolidating Stormwater Data Among Various MS4s

Jeremiah Unger, Tyler Dell

Wednesday 2:30 - 3:30 pm

Geospatial mapping is a valuable tool that can be used to quickly identify and display the location and features of various stormwater infrastructure ranging from inlets, pipes, detention basins and water quality control measures. Geospatial data has several uses, but there has yet to be an effort in Colorado to display all the stormwater infrastructure data available across the state. As political boundaries rarely correspond to watershed boundaries, it is often the case that runoff which falls within one municipality will have a direct impact on another, especially in the dense urban areas surrounding Denver. For this reason, having a consolidated database allows municipalities to be more aware of the connectedness of their stormwater system. Additionally, a consolidated database allows municipalities to see how others track their infrastructure, and opens up the possibilities for conducted risk analysis, developing maintenance plans, and creating replacement/improvement plans all while considering the entire watershed. Across Colorado, municipal storm sewer systems (MS4s) are responsible for maintaining a database of the location of their stormwater infrastructure however there has not been a consistent method of creating and displaying this database. This project worked through the challenges of accommodating various platforms used to track infrastructure as well as combining different terminology and data types. Geospatial data was displayed using an online geospatial platform developed at CSU. The challenges of consolidating this data, the method of displaying the data, and the future uses of this tool are discussed.

GISCO: Communicate, Educate, Engage, and Inspire
Alpine Room 2

What's New in USGS Mapping Products, Services, and Tools?

Darcee Killpack

Wednesday 8:30 - 9:00 am

Do you want to know what new products, services, and tools are being created by USGS? Come find out. This presentation will showcase some of the improvements, updates, and new products, services, and tools related to US Topo, 3D Elevation Program, and National Hydrography Data.

One Small Business Owner's Innovation in Response to SUE Legislation

Brian Collison

Wednesday 9:00 - 9:30 am

Not all Colorado 811 tier one members are large organizations. The SUE law affects companies of all sizes, including family-owned, private businesses such as Crawford Properties in El Jebel, CO. Crawford Properties consists of approximately 289 mobile home lots, 15 apartments and rental homes, 29 commercial units, and an assortment of tenants renting open space for storage. Its maintenance crew of half a dozen work continually on improvements and repairs to the property. The company averages around ten CO 811 transactions a month, which they are required by law to give a positive

response to excavators before digging begins. Their forward-thinking manager, Prentice Hubbell, was already investigating augmented reality as a tool to address “spatial confusion” in his work crew before the law came into effect. Using the Argis Lens as a visualization instrument has helped improve his crew’s situational awareness by providing a faster and easier orientation to the location of underground infrastructure. Learn more about how AR and accurate GIS mapping is improving job efficiency in this private business

What Do USASpending.gov, National Parks Service, The Province of Ontario Canada, The Attorney General of Pennsylvania, and Boston School District All Have in Common?

Ian Isaacs

Wednesday 9:30 - 10:00 am

Each of these agencies use the Mapbox platform to engage with their constituents, the general public and their internal staff. Learn via an examination of each of the applications developed by these clients why they individually choose one of the world’s largest live location dissemination platforms.

USASpending.gov requires that anyone in the USA can see and interact with the large amount of data needed to convey Federal Government spending down to the county level across many years. The National Park Service requires that anyone in the USA can plan a trip to their parks and if they wish, also use a mobile application with offline data to help them explore their park of choice. The Province of Ontario required a way in which to brand their maps to attract any business from anywhere in the world to locate and grow in Ontario Canada. The Attorney General of Pennsylvania creates and stores a great deal of open data in tabular form. They need a way to bring this data to life and make it more valuable to the citizens of the state. The Boston School District needs to be able to show each parent in their school district where the school bus is that will either pick up their child/children or where the bus is that will drop off their child/children.

-----Morning Break 10:00 – 10:30am -----

A Unique Window into GIS: Augment Reality Improves Situational Awareness

Brady Hustad, Myles McReynolds

Wednesday 10:30 - 11:00 am

The City of Englewood, CO, has found a unique window into their GIS data. By equipping the city’s distribution crew and collection crew with the Argis Lens, a mobile augmented reality (AR) visualizer, the city has seen an improvement in job efficiency. These crews now spend less time orienting to a two-dimensional map when they arrive on site. Instead they get instant situational awareness and location in AR. The adoption of AR into their day-to-day routine also allows the crews to determine when there are discrepancies in the GIS record and allows them to be corrected by collecting new data with Collector for ArcGIS. Ultimately this leads to less time on the job site, and more jobs getting done. Learn more about the City of Englewood’s effective new workflow that has gained them this level of improvement in their GIS data and safety on the job site.

Meaningful Mapping on the Island of Kalamos: Historic Imagery, Participatory Mapping, and Drones

Sophia Linn, Riley Ross

Wednesday 11:00 - 11:30 am

Off the western coast of mainland Greece lies the Inner Ionian Marine Protected Area. Designated because of its historic diversity of marine life and its naturally secluded and protected physical

environment, it has the capacity to harbor a rich and diverse ecosystem both in the water and on land. However, despite its formal protection status, enforcement is limited and competing interests have led

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to a degraded environment. During a two-week stay on the island of Kalamos, a team from the Geospatial Centroid at Colorado State University provided GIS and mapping support to Terra Sylvestris, a small non-profit organization that seeks to 'rewild' the region through scientific research and community action. Through georeferencing historic aerial imagery (from the 1940s), recording the 'spatial' memories of long-time residents, and capturing drone imagery, we contributed useful data to the ongoing conservation efforts on the island.

Can a Map Create a Movement? Lessons Learned from a Community Effort to Create a Better Bike Map

Avi Stopper, Gianfranco Palumbo

Wednesday 11:30 - 12:00 pm

Why don't more people ride bikes in Denver? It's not because they don't want to ride. It's because they're scared of riding on big city streets. That fear isn't unreasonable; riding in the bike lane on MLK is anything but a pleasant, low-stress affair. That's why we created the Bike Streets Project — bikestreets.com — an all-volunteer, community effort to create a comprehensive map of low-stress bike routes across Denver and get tens of thousands of people riding bikes on a regular basis. We believe that anyone, irrespective of age, background, or ability, should be able to ride to any destination. Now. Not in 2030 or 2040 when (or if) bicycle infrastructure gets to an acceptable level. The centerpiece of the Bike Streets Project is a new bike map that uses 350+ miles of neighborhood streets (and forgoes conventional bike lanes on big, scary arterial streets.) The Bike Streets Map was designed through a combination of GIS techniques coupled with old-school community organizing — folks within neighborhoods across Denver sharing "folk knowledge" about the places they like to ride bikes. What started as an online only map has expanded via a community-funded Kickstarter to a printed map, 17,000 copies of which have been given away for free at destinations across Denver. In this talk, we'll share the lessons learned so far about fusing contemporary mapping techniques with biking and community organizing.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

-----Afternoon Break 2:00 – 2:30pm -----

Asset Management **Alpine Room 2**

Field Survey Using ArcGIS Online, Collector and Survey123: An Integrated Approach

Jeff Eisman

Wednesday 2:30 - 3:00 pm

Mobile field survey using has become incredibly powerful and easy to implement using ArcGIS Online, Collector and Survey 123. This presentation will look at comprehensive solution to survey indoor electrical assets. The approach looks at 3 components, this first is ArcGIS Online. In this approach ArcGIS Online is used to host the electric asset feature layer; the basemap reference layers that were created from CAD files and the web maps, apps and dashboards.

The second component is ArcGIS Collector. That is the mobile map solution the field technicians will use to collect the location of the Electric assets. They will also have offline access enabled to allow for non-connected areas to be used.

The Third component is Survey 123. This provides powerful survey tools to help the field technician collect very detailed information on the assets.

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While this solution was used to collect electric assets, it is not industry specific, the great thing is that this workflow can be used across industries to collect a variety of data using complex surveys.

Using Risk & Condition to Develop Asset Management Strategy

Brett Ruoti

Wednesday 3:00 - 3:30 pm

Providing safe, sustainable water, wastewater and stormwater solutions is a critical priority for community leaders, utility managers and a reasonable expectation of citizens. Many utilities rely solely on age based deterioration to forecast asset condition and replacement strategies. This session will discuss best business practices for incorporating risk and physical condition into your asset maintenance strategy. Risk is defined as Probability of Failure and Criticality of Failure. Maintenance workers can score their assets based on these risk factors to better understand potential impact to services provided. Furthermore, adding condition assessment based on physical deterioration of assets helps prioritize where the maintenance dollars should be spent.

NHDPlus High Resolution - Creation and Applications

Alpine Room 3

Wednesday

What is the NHDPlus High Resolution? Creation and Applications

Michael Tinker

Wednesday 8:30 - 9:00 am

The National Hydrography Dataset (NHD) is the U.S. Geological Survey's geospatial dataset used to portray surface water in The National Map. The NHD represents the drainage network with features such as rivers, streams, canals, lakes, ponds, coastline, dams, and streamgages. The NHD also includes a linear referencing system based on reach codes that functions like a street address, and network connectivity information that enable analysis and discovery of information upstream or downstream of a point of interest.

The National Hydrography Dataset Plus (NHDPlus) enhances the NHD by incorporating two other USGS datasets, seamless elevation data from the 3D Elevation Program (3DEP), and delineations of drainage divides from the Watershed Boundary Dataset (WBD). The NHDPlus comprises an integrated suite of hydrologic geospatial data sets, including a hydrographic stream network, polygonal catchment areas representing incremental drainage areas for each stream network element, and Digital Elevation Model (DEM) derivatives including flow direction and flow accumulation grids. The USGS and U.S. Environmental Protection Agency (USEPA) collaborated to produce two versions of the National Hydrography Dataset Plus (NHDPlus V1 and NHDPlus V2), using the Medium-Resolution NHD at 1:100,000 scale, 30-meter elevation data from 3DEP, and WBD. Now the USGS has begun work on NHDPlus High Resolution (NHDPlus HR), which uses techniques and software from NHDPlus V2 with the NHD High Resolution (1:24,000-scale or better), 10-meter elevation data from 3DEP, and WBD. Many applications have been built upon the previous versions of NHDPlus, and we anticipate that even more will make use of the NHDPlus HR.

This presentation serves as the overview presentation for the 2019 GIS in the Rockies NHDPlus HR Track: "What is the NHDPlus High Resolution? Creation and Applications".

Collection of International Elevation Data for NHDPlus High Resolution Dataset

Brian Collinge

Wednesday 9:00 - 9:30 am

NHDPlus High Resolution (NHDPlus HR) is a powerful dataset combining data from the 3D Elevation Program (3DEP), the Watershed Boundary Dataset (WBD), and the High Resolution National Hydrography Dataset (HR NHD) into a scalable geospatial hydrography framework. Many United States watersheds have contributing areas and tributaries outside the boundaries of the United States, which requires elevation data that is not in the 3DEP. This presentation will focus on the high resolution elevation component of the NHDPlus HR, how and where elevation data was collected for areas outside the boundaries of the United States, and challenges with formatting diverse data to conform to the standards used for NHDPlus HR.

WBD Improvements for NHDPlus HR

Alexander Kaufman, Lily Niknami

Wednesday 9:30 - 10:00 am

The Watershed Boundary Dataset (WBD) is a seamless baseline hydrologic unit (HU) dataset for the United States. The WBD is delineated in a nested, multi-level, hierarchical drainage system. It is used for mapping and analysis of the Nation's surface water systems at many scales. WBD is one of the component datasets used to create the National Hydrography Dataset Plus High Resolution (NHDPlus HR). Elevation-derived catchments in NHDPlus HR are created using the WBD, NHD, and 3D Elevation Program (3DEP) 10-meter Digital Elevation Models (DEMs). The derived NHDPlus HR catchments generally conform to the WBD HU12. However, exceptions occur, highlighting areas that require review and modification. This presentation examines the various ways a user can update the WBD data to improve vertical integration between WBD and NHDPlus HR.

-----Morning Break 10:00 – 10:30am -----

VisFilter Uses and Creation for NHDPlus HR

Travis Landauer

Wednesday 10:30 - 11:00 am

The NHD Visibility Filter attribute is used for multiscale cartographic representation of the National Hydrography dataset and will be included in the NHDPlus HR. With variation in surface water density across the United States, either natural or created by increasing local data resolution and densification, the generalization process allows for consistent cartographic display of water resources. The attribute can be used to query and display NHD data at 8 scales. This presentation will discuss the underlying process for the creation of the Visibility Filter attribute and its functionality.

NHDPlus High Resolution Value Added Attributes

Hayley Thompson, Cynthia Ritmiller

Wednesday 11:00 - 11:30 am

The NHDPlus High Resolution (NHDPlus HR) is a scalable geospatial hydrography framework built from the high resolution National Hydrography Dataset, the Watershed Boundary Dataset, and elevation data, primarily 1/8 arc-second 3D Elevation Program data. The NHDPlus HR allows for modeling and assessment at a local, neighborhood level, while nesting seamlessly into the national context.

Similar to the medium resolution NHDPlus version 2 (NHD Plus V2), the NHDPlus HR is comprised of a network of stream reaches, elevation-based catchment areas, flow surfaces, and value-added

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attributes (VAAs) that enhance stream network navigation, analysis, and data display. NHDPlus HR VAAs provide attributes such as stream flow, velocity, temperature and precipitation distributions, and cumulative drainage areas. NHDPlus HR VAAs also allow the selection of more generalized stream networks, as well as upstream or downstream navigation.

Complementing and enhancing the various spatial datasets, the NHDPlus HR VAAs provides greater detail than the NHDPlus V2, thereby supporting national, regional, or local analysis and modeling, while retaining the spatial accuracy of the highest-resolution, nationally available datasets.

How Stream Gauge Data Is Used to Create Flow Volume for NHDPlus HR Streams

Tatyana DiMascio, Michael Tinker

Wednesday 11:30 - 12:00 pm

In December 2015, the State of Colorado implemented its Water Plan to outline the management of water to 2050. This presentation summarizes the goals and objectives of the Plan and recounts its current progress during a period of drought, wildfires, flooding, climate change, and unprecedented growth. In this election year, the discussion will compare major candidate positions and ballot initiatives with the intent and purpose of the Water Plan.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

-----Afternoon Break 2:00 – 2:30pm -----

Uses of NHDPlusHR

Michele Basile

Wednesday 2:30 - 3:00 pm

The National Hydrography Dataset Plus High Resolution (NHDPlus HR) is a national, geospatial model of the flow of water across the landscape and through the stream network. It provides a common hydrologic framework for addressing hydrologic observations. The built-in stream flow network, along with the stream flow volume and velocity Value Added Attributes, enables complex data analysis and modeling, such as time of travel studies. The USGS actively maintains stream gauges, dams, and stream diversions that are linked to the NHDPlus HR. This presentation covers technical details for addressing data to NHDPlus HR and how stream gauge data is used to create mean annual flow for all streams in the NHDPlus HR.

USGS NHDPlus HR Panel Discussion

Wednesday 3:00 - 3:30 pm

Technology Spotlight

Alpine Room 4

Wednesday

The Future of Geospatial Is Education – How Hexagon's Geospatial Division Is Preparing for Tomorrow's Geospatial Challenges

Michael Lane

Wednesday 8:30 - 9:00 am

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At Hexagon, we believe in pushing boundaries with innovative technology. As we migrate from traditional, static GIS desktop platforms to dynamic, GPU accelerated 3D visualization applications, it is critical that we set up students for success in the careers they choose to pursue. Our goal is to ensure that current curriculum lines up with advancements in geospatial technology and the expansion of the geospatial industry into multiple disciplines. To meet this goal, Hexagon's Geospatial division has launched three new programs to grant universities access to powerful solutions for educational purposes: M.App X for Education, M.App Enterprise for Education, and Luciad for Education.

- *M.App X for Education offers access to the only enterprise-level, cloud-based Intelligence platform on the market with advanced remote sensing capabilities and geoprocessing designed for the defense community.*

- *M.App Enterprise for Education offers an on premise-cloud deployed foundation to build customized geospatial applications. M.App Enterprise has hit the market by storm and is the Smart Nation, Smart City, Smart Site platform that government, utilities, transportation industries are adopting to solve their real-world problems.*

- *Luciad for Education offers a set of APIs to connect dynamic sensors in a GPU-accelerated environment for visualization and analytics of big data. It is second to none when it comes to creating critical and complex solutions.*

These are the geospatial platforms of the future. Discover how both industry and academia are using these platforms today to prepare for the next generation of geospatial.

Simple, Familiar, Fast: An Open-Source Approach to Integrating Data

Rich Henry

Wednesday 9:00 - 9:30 am

During the design, engineering and construction of large assets (pipelines, electric transmission towers, etc.), an enormous amount of geospatial data is generated - and has been for decades. However, accessing and using that data in an efficient way is a problem that has continued to persist – costing significant time and money. In this presentation, we'll demonstrate a new approach to integrating and viewing data with open source spatial technology and by leveraging Amazon Web Services. With our client, we'll share how cloud and open source infrastructure is simplifying data integration, reducing geoprocessing times for large datasets, and increasing in adoption internally. In an industry inundated with on-premise servers, expensive IT overhead, and limited options to scale for large data sets (without adding substantial licensing cost), our client has found success in a simple, fast and familiar platform.

What's New with Tableau Maps?

Steve Fenn, Matthew Krusemark

Wednesday 9:30 - 10:00 am

Come and check out the latest that Tableau has to offer with GIS data & maps! We'll share a variety of examples of how to get started with Tableau maps, how to leverage data/maps from Mapbox in Tableau and more. We'll also share how to build a workflow in the Cloud with your own data leveraging our commercial data pipeline solution integrating with Tableau as the data storytelling and data viz.

-----Morning Break 10:00 – 10:30am -----

Deriving Accurate Hi-Res Data on a Budget

Benjamin Wittman, Noah Polizzotto

Wednesday 10:30 - 11:00 am

Cities and urban areas have significant impacts on the local environment and surrounding areas. As awareness of the impact of urban development on surrounding ecosystems and green infrastructure rises, cities are looking for easier ways to track and measure changes in their land cover. Remote sensing is an increasingly common tool for classifying land cover although the data collection, creation and analysis costs are often limiting and preventative. A detailed land cover classification provides a city with estimates of green/gray infrastructure, areas of bare earth/soil, vegetation, tree canopy and water acreage, all of which have value for stormwater runoff estimates, population health assessments, environmental equity, and green infrastructure health. This presentation will compare the implementation of freely available National Agriculture Imagery Program (NAIP) imagery, commercial satellite imagery, LiDAR, and other sources. We will go over the challenges involved with using data collected in different time periods, methods and benefits of using more than one data source during classification, and creating an accurate final product using the best available data.

LaserGIS Asset Data Collection to Increase Field Mapping Efficiency

Kassie Carley, Joe Cronn

Wednesday 11:00 - 11:30 am

Laser Technology's reflectorless measurement technology is the ideal solution for collecting GIS field data. Mapping technology is always evolving and field workers are adapting to the new technology and trends to increase their workflow efficiency. The "Bring Your Own Device" (BYOD) craze has been exploding because companies are designing mapping apps that are accommodating to different operating systems, GNSS devices, peripherals and workflows.

The TruPulse laser rangefinders integrate with field apps and GNSS devices for a more efficient asset collection workflow. With the laser mapping system integrated with the GNSS solution, you can safely position yourself to capture high accuracy coordinates around trees, buildings, or dangerous terrain.

You also have the flexibility to easily integrate LTI lasers with systems and devices you already own!

Learn more about:

- Laser mapping offsets methods*
- Integration with third party apps: Esri Collector, Trimble,*
- How to collect additional attribute data: Heights, spans, clearances*

Big Forces Come Together

Stan Hennigh

Wednesday 11:30 - 12:00 pm

In this session we will discuss the potential that the Esri/Autodesk Partnership bring to the CAD/BIM to GIS industry. Participants will see and learn about the new directions and opportunities this partnership offers to them in a practical sense. There will be brief previews of some of the new technologies being employed by key projects in this space, as-well-as discussion on the doors that the partnership affords many aspects of the Survey, Civil, Building Design and Construction industries.

-----Lunch Break 12:00 – 1:00 pm -----

-----Keynote Speaker 1:00 - 2:00 pm -----

What's New with ArcGIS Field Apps

Shelby Hines

Wednesday 2:30 - 3:00 pm

The ArcGIS suite of field apps can improve coordination and operational efficiency for any type of organization. Learn what's new with field apps and check out Tracker for ArcGIS, a location tracking solution, and ArcGIS QuickCapture, an app for rapid data collection. Easy-to-use apps support field activities in connected or disconnected environments and can be deployed as SAAS or behind your firewall.

Extending Your Geospatial Wizardry with Machine Learning

Daniel Aragon

Wednesday 3:00 - 3:30 pm

Are you a geospatial wizard? Do you expertly join, clip, intersect, and extract a mess of data into a harmonious alchemy of sought-after insights? Are you a sorcerer of raster calculations, deftly applying your conditionals and proximity queries, adding and weighting overlays with precision to create maps of byzantine beauty? Well, time to add another book of incantations to your geospatial book of spells. In this talk we'll explore three types of machine learning that you can use today to answer questions about your data – classification, segmentation, and computer vision. When combined with your domain knowledge and geospatial tools, these methods open new lines of inquiry and possibly new value in your existing data. We'll discuss general approaches and specifics about when and how to use these tools. This talk isn't solely for geospatial wizards, but anyone involved in combining data, questions, and a bit of magic.

Poster Session

Track Chair: Doug Haller and Jake Fritz

The Poster Session is a great way to visually present current or past projects and/or cartographic productions without having to sign up for a full presentation in a designated room. Poster topics range all across the board on subject matter and are a great visual tool to present projects and maps.

Colorado Wildfire Risk Assessment and Online Portal

Amanda West Fordham

The Colorado State Forest Service (CSFS) developed the Colorado Wildfire Risk Assessment (CO-WRA) in 2012 to help decision-makers, landowners and communities assess wildfire risk. CO-WRA tailored the west-wide quantitative risk assessment framework developed by the U.S. Forest Service to Colorado. The Colorado Wildfire Risk Assessment Portal (found at <http://coloradoforestatlas.org/>) is a web-mapping tool that provides access to statewide data associated with CO-WRA. CO-WRAP is open-source and includes public and registered professional user applications. In 2018, the CSFS updated CO-WRA and CO-WRAP; notable enhancements include a statewide seamless vegetative fuels dataset, improved weather data, an updated wildland-urban interface (WUI) layer using the best available population data, and a new statewide burn probability layer. These data and information can be used to: (1) create public awareness about wildfire risk; (2) provide state and local planners with information to support mitigation and prevention efforts; (3) identify areas that may require additional planning related to wildfire mitigation projects; (4) assist in the development of Community Wildfire Protection Plans (CWPPs) and other hazard mitigation plans; (5) complement forest stewardship and forest management plans; and (6) inform decision-making and research at local and state levels.

Visualizing ABM for Disaster Mitigation

Diana Guillen-Piazza

Establishing a way to respond to threats can dramatically change the outcome of a situation, from situations of weapons of mass-destruction, environmental disasters, to political violence. Simulations can be a powerful tool to visualize and analyze for a better response in the face of chaos. Functional efficient responses from fire, police, and other emergency agencies can be the difference for hundreds of lives making it out of a bad situation. Handling new threats is part of public safety and to better predict situations you need to see the threat with the flexibility to change key variables in a moment's notice. The following simulation visualization is of "Characterizing Response to a WMD Event in a Mega-city" based on agent-based-modeling using MASON, AutoCAD and GIS.

Jefferson Transit Authority

Stephen Mitchell

Even though Jefferson County, Colorado has no transit authority per se, it is possible to conceptualize the county in a "subway-style" map.

In this map, transit lines are theme based and derive purely from the mind and perspectives of the cartographer.

Detecting Leaf Damage with Mobile Phone Photos

Ela Piskorski, Ramesh Sivanpillai

Early detection of leaf damages in crops can lead to their effective treatment and thus minimize loss. While infrared data are useful for such applications they may not be affordable or accessible to farmers everywhere. Therefore, farmers scout their field on foot, collect leaf samples from suspected diseased or damaged plants, and obtain estimates from experts, i.e. plant pathologists, prior to any treatment. With the availability of cameras in mobile phones, farmers can collect true color images of crops without needing experts to travel to their farms. In this study, we evaluated true colors for assessing crop damage. Digital images of leaves of five different crops grown in Coimbatore (India) were digitally classified using ISODATA and K-means algorithms. Proportion of the leaves damaged were estimated from these classified images. These estimates will be compared to the corresponding values of damage visually estimated by experts. If comparable estimates can be obtained from these images, farmers can collect more data in the same amount of time and obtain estimates of crop damage. Preliminary results obtained from this study showed that digital classification of images collected in the visible region can provide a consistent estimate and distinguish types of damage.

Development Plan for the System for Collecting and Directing the Waters of the Golshahr-Hashtgerd Electric Train Using GIS, AHP and MCE in Hashtgerd New City

Saeid Ghareh Hassanloo, Hamid Ghareh Hassanloo

Determining the optimal route in which technical and engineering considerations, economic, and environmental considerations have been applied requires techniques that consider the parameters that are effective in determining the route together. In this research, effective parameters were determined in determining the topographic status (slope, altitude), vegetation cover, land use, population density, pipeline length, river and road, important areas and locations, settlements, sensitive ecosystems, and application of base maps and geometric location extraction of points from google earth, and land survey. Subsequently, the layers of the relevant parameters were loaded in the GIS environment and after applying certain weights, the operation of the cost mapping was determined based on the hierarchical process of valuation, composition and, finally, the optimal route using the least cost algorithm. Considering the sensitivity of the mentioned design in the development and necessity of using the hashtgerd new city, and considering the conditions of the hashtgerd station at this location, three scenarios for the collection and transfer of surface water in this section of the studies are proposed and the characteristics of each one of the possible scenarios is presented. Finally, considering the characteristics and disadvantages of each of the scenarios presented, the third scenario is selected as the method of collecting and directing the surface water to the hashtgerd station and is proposed, and this scenario is followed by the employer Honored Project In the second phase studies, the operational plans required for the scenario will be presented.

USGS NGTOC Denver Outreach: Exciting the Next Generation of GIS Users

Lindsay Decker, Bethany Walker

The Map Production Services unit of the U.S. Geological Survey's (USGS) National Geospatial Technical Operations Center (NGTOC) utilizes in-house geospatial data to produce 7.5-minute, 1:24,000 scale digital US Topo products made available to the public. Outreach is an important part of spreading knowledge of the USGS NGTOC mission and its usable products. In 2017, an outreach program was initiated with Aurora School District (Denver, CO) targeting 3rd grade students studying Geography. The goal of the program was to incorporate grade-appropriate curriculum provided by the teachers along with a fresh perspective based on real-life applications from USGS Geographers. Map Production Services staff developed a two-part program that includes a USGS-led presentation describing maps, followed by hands-on activities utilizing US Topo products. The students learned about elements that make maps meaningful and saw how USGS data is assembled to create maps

used in the real world. This poster will walk through the 3rd grade program, focusing on key map elements and the US Topo products used. The goal of this outreach is to excite a younger generation about geography and to create future 'map detectives' of the world.

Geologic Map of the Poncha Pass Area, Chaffee, Fremont, and Saguache Counties, Colorado

Theodore Brandt

This report presents a 1:24,000-scale geologic map, cross sections, and descriptive and interpretive text for the Poncha Pass area in central Colorado. The map area is irregular in shape, covering all of one 7.5' quadrangle (Poncha Pass) and parts of five others (Mount Ouray, Maysville, Salida West, Salida East, and Wellsville). The map boundaries were drawn to cover all of the "Poncha mountain block," our designation for the approximately 15-kilometer-long northwestern end of the Sangre de Cristo Mountains. The map conveys the areal distribution of: (1) Proterozoic basement rocks forming the core of the Poncha mountain block, (2) overlying Tertiary volcanic rocks, (3) Miocene and younger basin-fill deposits, (4) Quaternary surficial glacial and alluvial deposits, and (5) faults and folds affecting all of the above units. The Poncha mountain block, which lies within the Rio Grande rift, is topographically and geologically distinctive. Generally, the Rio Grande rift is internally characterized by subsided structural basins or grabens and subdued, low-relief topography rather than elevated mountain blocks. The intrarift, topographically high Poncha mountain block spans the axial part of the rift and separates the low-lying basins of the west-tilted Upper Arkansas River half graben and east-northeast-tilted San Luis half graben.

Laying the Foundation for Integrated Data—Elevation-Derived Hydrography Specifications and Capture Conditions

Christy-Ann Archuleta, Silvia Terziotti

With the increasing availability of 3DEP very high resolution elevation data across the United States and the pressing need for better integrated elevation and hydrography data, the U.S. Geological Survey has been investigating methods to improve the horizontal and vertical alignment of these datasets. In preparation for pilot projects in Alaska and the Continental United States, the USGS has developed specifications and capture conditions detailing the requirements for elevation-derived hydrography from lidar and ifsar datasets. This poster describes the specifications and capture conditions which lay the foundation for elevation-derived hydrography data acquisition that will meet the needs of The National Map and geospatial data users nationwide.

Supervised Classification of Russian Olive in the Animas Valley: A Pilot Study Using Object-Based Image Analysis and NAIP Imagery

Anna Riling

*Object based image analysis (OBIA) incorporates not only spectral but textural and spatial elements of a class and avoids the "salt and pepper" effect of pixel-based classification with high resolution imagery. Russian olive (*Elaeagnus angustifolia*) is an invasive species prevalent in the Animas Valley in southwest Colorado and is easily distinguished in aerial imagery due to its silvery-green canopy. This study used 1-meter, 4-band National Agricultural Image Program (NAIP) imagery to classify Russian olive in a study area on the Animas River, achieving a user's accuracy of 91.3 percent with a K Nearest Neighbor classifier. Methodology and parameters from this pilot study are intended to be used in future efforts with feature extraction classifications for mapping Russian olive on a regional scale.*

Modelling Wildlife Corridors Using a Raster Based Selection Model

Anthony Dunnam

*As human development encroaches on natural habitat, many wildlife species must adapt to living within the limits of urban areas. When towns and cities expand, wildlife conflict and vehicle collisions increase in frequency and management measures must be taken to prevent these conflicts. Understanding habitat selection of mule deer (*Odocoileus hemionus*) in urban areas allows for more informed decision making for human and wildlife safety. In this project, spatial data for existing infrastructure were used to analyze potential mule deer habitat within and around the City of Fort Collins. The goal of this analysis was to inform the process of management and placement of wildlife corridors or other preventative measures such as signs or underpasses. This was accomplished using ArcGIS Pro to classify and weight desirable habitat and create a cost analysis dataset to reflect likely use of urban and sub-urban area by mule deer based on various factors. This analysis resulted in a city-wide network of potential wildlife corridors and a set of problems sites clustered around the city's edges and busy roads. These theoretical sites would provide a sound foundation for wildlife surveys to test the model and precisely install animal conflict mitigations.*

Several Years of Custom Mapping at the U.S. Geological Survey (USGS)

Brendan Berve

For the past several years, the USGS National Geospatial Technical Operations Center has had an ongoing relationship with the Department of the Interior and Congress to provide specialized maps. These maps range from grayscale document figures to highly detailed wall posters and are created for a variety of purposes and recipients. Requests usually have short deadlines, necessitating highly organized data and flexible templates that minimize production time. Other requests become long-term projects, with maps taking months and sometimes years to revise and complete. This poster summarizes recent projects and illustrates the workflows required to fulfill requests.

Decadal Proliferation of Oil and Gas Wells in Major U.S. Basins

Joel Murray

The Rocky Mountain region is one of the most active areas for horizontal oil and gas drilling in the United States. Horizontal rigs are being used in shale formations where long, lateral wells are needed to tap the oil and gas from the relatively compact and hard rock strata. Utilization of this technology has led to the proliferation of oil and gas wells throughout this area in recent times.

New Cloud-Based Products and Services from the National Map

Liz Huselid

The National Map serves geospatial data for the nation in a variety of formats, including traditional topographic maps, downloadable data of all kinds, and cloud-based geospatial web services. Featured new offerings this year include:

- *A dynamic elevation service referencing best available data, with several new options for visualization including slope, aspect, multi-directional hillshade, and more;*
- *New cloud-hosted lidar data access options, including an AWS Public Lidar Dataset and Requester Pays S3 Bucket;*
- *Soon-to-be-released lidar search and download tool (Lidar Explorer) which leverages the power of the Entwine Point Tile file format for on-the-fly 3D visualization, and Point Data Abstraction Library (PDAL) for cloud-based geospatial analysis and processing with an AWS Serverless workflow;*
- *New cartographically enhanced cached basemaps, hosted in the AWS cloud*

Linear Distortion in the NGS Colorado Statewide Projection

Joey Stone

The poster will be map of Colorado illustrating the linear distortion when using the NGS statewide Colorado State Plane projection.

Westbound on the Zephyr: A Viewing Guide for the Rockies Stretch

Juan Sabogal

The California Zephyr is touted as one of the most scenic routes in the Continental U.S. While the sightseer lounge offers spectacular views of the Colorado River, passengers have no way of deciding which side of the railcar to sit on for the best views. This poster aims to provide a seating guide for the Denver - Glenwood Springs portion of the route.

USGS & Citizen Science: The National Map Corps

Samantha Doering

The National Map Corps (TNMCorps) is a U.S. Geological Survey (USGS) citizen science project that uses crowdsourcing techniques to update structures data for The National Map and U.S. Topo maps. Volunteers use an online mapping application to confirm or update structures such as hospitals, cemeteries, post offices, schools, law enforcement, and fire stations. Since its initiation in 2010 and nation-wide expansion in 2013, TNMCorps has evolved to become a stable and productive citizen science project. TNMCorps uses a wide variety of approaches to engage volunteers. TNMCorps also uses a broad range of QA/QC procedures, some of which are incorporated into its user engagement efforts while others occur internally. Several past studies have shown that data contributed by volunteers is of a very high quality. As a testimony to its success, TNMCorps recently passed a major milestone with volunteers having collected more than 400,000 points. TNMCorps is also expanding the types of structures they are collecting. This poster will present an overview of the TNMCorps project as a whole while highlighting milestones and expansions.

Beaver Brook Trail

Robert Thayer, Alexander Guthrie

Beaver Brook Trail is a challenging hiker-only trail connecting Clear Creek Canyon Park, Denver Mountain Parks' Genesee Mountain Park, and Windy Saddle Park. This 3D perspective map was created to give visitors a more realistic depiction of this trail and experience.

State of the Dakota Ridge

Christopher White, Robert Thayer, Eric Delynko, Christy Bouchard

This poster takes an objective look at the Dakota Ridge geologic formation within Jefferson County, Colorado. This feature highlights one of the more unique landscapes in the county and is a good example of a diversely changing system due to the influx of population on the Front Range of Colorado. Through examining a list of features from Geology, Hydrology, Animal Corridors, Vegetation Cover, Paleontology, Recreation, and Land Use, we will look at how Jefferson County Open Space (Jeffco Open Space) is taking a proactive approach to preserving this landscape for both the growing population of the Front Range and the environment.

Jeffco Open Space Dashboard

Christopher White

With the current industry trend moving GIS into cloud database management and web mapping, Jefferson County Open Space has developed an internal self-service tool using ArcGIS Online and Ops Dashboard to help provide information from the data we manage. Using the out of the box functionality of Ops Dashboards provided by ESRI through ArcGIS Online, we can summarize statistical information on our Land Boundaries and Park Features we manage. This statistical summary information can then be easily accessed by decision makers at our organization to better facilitate the data drive decision making process here at Jeffco Open Space.

System Reliability Improvement: Inspection and Maintenance

Heather Luzade r- Petersen, William Morley

Approximately 75% of our system is comprised of overhead electrical distribution conductor. The power poles that support this conductor undergo periodic inspection for maintenance or replacement. We use GIS to manage the spatial aspects of this inspection process. We will display our process graphically, much the same way we do electronically and in hard copy.

Jefferson County Open Space

Robert Thayer, JCOS Team

The Jefferson County Open Space (Jeffco Open Space), Conference Room Map is dedicated to showcasing visitor recreation opportunities and natural resources through cartographic design generated by the GIS and Map Update Team at Jeffco Open Space. This resource also aims to educate internal and external parties on Jeffco Open Space's current park infrastructure and management policies. Jeffco Open Space will aim to periodically publish new versions as new acquisitions occur, regions develop and cartographic standards progress.

Geospatial Analysis of Two Independent, Remotely-Sensed Data Sets of Evapotranspiration Applied in a Riparian Corridor Encroached by Invasive Species

Matthew Lurtz

Evapotranspiration (ET) in habitats with riparian vegetation can be difficult to estimate due to relatively abundant water supply, spatial vegetation heterogeneity, and interactions with anthropogenic influences such as increased salinity and shallower groundwater tables from irrigation. In semi-arid southeastern Colorado, ET estimates are scarce for the riparian corridor that borders the Arkansas River. My proposed research is related to applying probability and statistics to explore the similarities and differences of two independent estimates of ET derived from remotely-sensed products and other spatially-gridded data sets. Estimates of ET are calculated using Landsat 5 and 7 scenes as input into the operational version of the Simplified Surface Energy Balance Model (SSEBop) and a vegetation-index based model which utilizes the enhanced-vegetation index (EVI) or the normalized difference vegetation index (NDVI). Initial results show peak rates of ET occur in May, June and July spanning an 11 year duration (1999-2009). Testing two ET models that are arithmetically different in a riparian corridor could yield insight into the forces that promote vegetation in an anthropogenic-influenced and environmentally-harsh area. Data assimilation, calculation of ET and the statistical analysis of the two ET models will appeal to ecological engineers, quantitative geoscientists with emphasis in remote sensing and applied statisticians. Conclusions inferred from the two-model comparison addresses USDA's perennial goal of developing efficient water management practices.

Jefferson County Snow Removal Atlas

Robert Thayer, JCOS Team

The Jefferson County Open Space Snow Removal Atlas is generated to support Field crews in snow removal operations This atlas also aims to educate internal and external parties on Jeffco Open Space's current trailhead infrastructure and management policies related to snow removal. Jeffco Open Space will aim to periodically publish new volumes as new infrastructure updates occur, regions develop and cartographic standards progress.

Leveraging the Landsat Archive for Temporally Robust Indicators of Ecological Resilience and Resistance in the Great Basin

Eric Jensen

This project leverages the Landsat archive to evaluate drivers of resilience and resistance (R&R) of shrubland plant communities in the Great Basin region from 1984–2019. Previous research in the region has characterized R&R with static soils-based approaches, ultimately leading to the development of spatial data files classifying R&R as low, medium, or high. Here, we develop novel approaches for linking spectral diversity indices calculated throughout the Landsat archive to field-based plant species diversity measures and ultimately to dynamic temporal indicators of R&R. The objectives for the project are to 1) calculate spectral diversity indices across Landsat time-series to model field-sampled plant species diversity for Great Basin shrublands, 2) apply the plant species diversity model throughout the Landsat time-series to create annual maps of predicted plant species diversity from 1984-2019 across the Great Basin, and 3) develop a hierarchical spatiotemporal model of R&R based on plant species diversity model and known co-variables to predict ecosystem response to fire, using a post-fire recovery interval measure as an indicator of R&R for evaluating models. The indices and models have potential applications as spatial decision-support layers in land and resource management, particularly based on the advantages of the Landsat archive in terms of spatial and temporal resolution.

Volunteers of The National Map Corps

Erin Korris

The mapping crowdsourcing program, known as The National Map Corps (TNMCorps), encourages volunteers to collect man-made structures data for the U.S. Geological Survey (USGS) National Geospatial Program's web-based The National Map. All 50 states, as well as Puerto Rico and the US Virgin Islands, are available for volunteers to collect and update structure feature types including schools, fire stations, courthouses, cemeteries, and others. Volunteers can add, modify, delete, and verify structures data through a customized online map editor. As of June 2019 over 1,700 volunteers have made more than 535,000 edits to over 422,000 unique points. This poster profiles the contributions of volunteers who have earned our top recognition badge, Squadron of Biplane Spectators (6,000+ points), as compared to all other volunteer contributions.

Mapping the Camp Fire Burn Severity Using Synthetic Aperture Radar (SAR)

Michael Tuffly

Optical remote sensed data, such as NASA's LandSat satellites or the European Space Agency (ESA) Copernicus Sentinel-2 satellites, are common tools for mapping, assessing, and quantifying wildfire burn severity over the landscape. Of late, synthetic aperture radar (SAR) from the ESA Sentinel-1 satellites have proved very useful in mapping burn severity due to the natural ability of microwaves to penetrate atmospheric disturbances such as clouds and smoke. Moreover, SAR data is not influenced by low sun angles.

Forest Health Assessment Using Synthetic Aperture Radar for the Cook Inlet Ecoregion, Alaska

Michael Tuffly

Synthetic Aperture Radar (SAR) has been around for decades. However, the data may have been underutilized by remote sensing scientists due to complex image processing procedures. Of late, a new suite of SAR satellites coupled with advancements in computer processing, and artificial intelligence (AI) software have catapulted the technology. The European Space Agency's Sentinel-1 C-band SAR satellite data can be used to assess forest health conditions in most areas of the world under myriad weather and environmental conditions.

*This study assesses forest susceptibility to the endemic spruce beetle (*Dendroctonus rufipennis* Kirby) in the Cook Inlet ecoregion of Alaska for a two-year time period (2017 and 2018). Data used in this analysis are Sentinel-1 C-band SAR, optical remotely sensed data from LandSat-8 OLI and MODIS; in addition to a digital elevation model. These data are then evaluated for importance and assigned categorical break points via an AI method using the Classification and Regression Tree (CART) analysis. The results from this modeling effort produced accuracies of 74% and 77% for 2017 and 2018, respectively.*