

GIS

IN THE ROCKIES

Premier Geospatial Conference
of the Rocky Mountain West **2018**

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WEDNESDAY

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GIS in Conservation

Aspen Room

Track Chair: Paul Millhouser and Nell Conti

Conservation encompasses the preservation, protection, and restoration of natural and cultural resources. GIS mapping and analysis has a long history in this field, helping to identify areas with high biodiversity and/or cultural significance, identifying threats, supporting conservation decisions, and making complex issues easier to understand. GIS is used by government, corporate, and non-profit organizations, here in Colorado, nationwide and around the world to protect our history and our planet for ourselves and generations to come.

An Introduction to NHDPlus High Resolution Value Added Attributes

Ariel Doumbouya and Hayley Thompson

Wednesday 10:30 – 11:00 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 1/3 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 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.

GIS for Surface Water – Using the National Hydrography Dataset

Jeffrey Simley

Wednesday 11:00 – 11:30 am

The talk will enable scientists, managers, and students to analyze the vital surface waters of the United States by combining the ready-to-use powers of a comprehensive database of the nation's waters and a GIS for geographic data analysis and mapping. This talk explains how the water that exists on the landscape has been translated into a computer database, and how data about the water, such as chemistry and fish habitat, can be linked to this database. Elevation data is also incorporated to produce watersheds at the micro and macro level. This, along with climatic data, leads to the creation of water flow and velocity estimates for every segment in the 7.5-million-mile drainage network in the U.S. With the development of this complete water information system, the attendee is poised to generate new knowledge of the behavior of surface water systems.

Making this all come to life is the application of GIS geographic and network analysis tools. The talk vividly demonstrates how the vast capabilities of GIS can be easily applied to the National Hydrography Dataset and companion Watershed Boundary Dataset to reveal the intricate properties of complex water networks using a variety of GIS operations made simple through the use of GIS.

The attendee will see how to input the National Hydrography Dataset into their GIS and trace the path of water within minutes. With just a little more effort, the reader will be able to create enlightening flow-volume maps showing how much water flows through any river system.

Markup Application for Hydrography Datasets

Tatyana Dimascio

Wednesday 11:30 – 12:00 pm

The U.S. Geological Survey has created a new web application, called Markup App, as a user-friendly communication tool for the public and partners to submit suggested corrections to the national datasets. The first phase of the Markup application is focused on the refinements for the hydrography datasets: National Hydrography Dataset (NHD), a National Hydrography Dataset Plus High Resolution (NHDPlus HR), and the Watershed Boundaries Dataset (WBD). This presentation will introduce the new application and discuss its role in the workflow for editing national hydrography features.

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

Updating the Watershed Boundary Dataset with the WBD Web Edit Application

Alexander Kaufman

Wednesday 1:00 – 1:30 pm

The Watershed Boundary Dataset (WBD) and National Hydrography Dataset (NHD) are complex geospatial representations of our nation's surface water. These two datasets are fundamental "ingredient" datasets of the NHDPlus High Resolution (NHDPlus HR) product, a seamless hydrographic framework for modeling the nation's surface water systems. In order to continually update and improve the NHDPlus HR dataset, the USGS coordinates with partners and stewards to update the WBD and NHD ingredient datasets. Traditionally, this is done with desktop GIS tools, including ArcGIS and custom-built USGS tools. We are currently building new web-based workflows which allow stewards and partners to propose updates in a web browser. This reduces the time needed to maintain desktop tools while maintaining the integrity of the WBD. The WBD Web Edit Application is a user-friendly way to update the WBD ingredient dataset quickly without downloading data or desktop tools. This presentation compares the desktop workflow to the new web-based method, with an emphasis on the improvements that web-based tools offer for the maintenance of the WBD.

A Fractured Landscape: A New Approach to Assessing Connectivity for Wildlife in Colorado

Paul Millhouser

Wednesday 1:30 – 2:00 pm

Landscape connectivity—the degree to which wildlife are able to move freely across the landscape—is an essential component of healthy ecosystems and wildlife populations, allowing animals to disperse into new territories, access seasonal resources and breeding habitat, and maintain the flow of individuals and genes across the landscape. As development, roads and other human use activities leave animals with smaller and more isolated pockets of intact habitat, active landscape planning and conservation efforts are needed to allow wildlife continued access to seasonal habitats and the ability to disperse into new habitat areas. Landscape connectivity has been described as one of the most critical elements of biodiversity conservation planning and is essential for allowing species to move and adapt to shifting habitats and an altered climate.

Rocky Mountain Wild, with the support of The Wilderness Society, set out to develop a replicable process that could be used to identify and prioritize areas critical to terrestrial wildlife movement in Colorado, and that would also be applicable to other states across the West. We developed a unique

approach that uses data about the degree of human development and other factors to allow the landscape itself to dictate the expanses that are the most important for connectivity.

The Effect of Channel Migration on Riparian Vegetation Along the South Platte River, Colorado

Joshua Rogerson and Jessica Salo

Wednesday 2:00 – 2:30 pm

Historically, the South Platte River in Colorado has experienced substantial inter-annual flow variability, but due to water management over the last century, there has been a parallel rise in ground and surface water level consistency. This is problematic for the dominant riparian vegetation of the region, the disturbance-dependent cottonwood, which relies on frequent flood events to clear vegetation to allow for the growth of new trees along the riverbank. Through this research, we attempt to understand the patterns and dynamics of the South Platte River's riparian vegetation to aid resource management. This research focuses on channel migration dynamics and how these impact adjacent riparian vegetation. To study this, we digitized riparian vegetation using orthophotos at roughly decade increments for a 30 km section of the South Platte in Weld and Morgan counties. We measured changes to riparian vegetation composition and channel locations. Preliminary results show that from 1999 to 2006, a period of overall low flow and drought conditions, this section of river experienced a narrowing of the active channel by 11%. This narrowing was accompanied by an expansion of forest, riparian shrub, and herbaceous vegetation. From 2006 to 2015, a period of time that included high flows and two major flood events, we observed channel expansion of 24%. This was accompanied by decreases in forests, riparian shrubs, and herbaceous cover.

Utah and Colorado Water Resources

Margaret Mulhern

Wednesday 2:30 – 3:00 pm

*Since the completion of the Flaming Gorge Dam in 1964, artificial flow releases along the Green River have promoted channel narrowing and encouraged non-native vegetation encroachment into the active stream channel. These changes in the Green River's flow regime have reduced the backwater habitat of four native endangered fish species: the Colorado pikeminnow (*Ptychocheilus lucius*), Razorback Sucker (*Xyrauchen texanus*), Humpback Chub (*Gila cypha*), and Bonytail (*Gila elegans*). To promote population recovery, this project developed the River Morphology Evaluation Toolbox (RMET), a Google Earth Engine (GEE) tool, to more efficiently and cost-effectively monitor changes in vegetation and hydrology across large spatial and temporal scales. Using imagery collected from Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS), Shuttle Radar Topography Mission (SRTM), and Sentinel-2 Multispectral Instrument (MSI) satellites, the team used the normalized difference vegetation index (NDVI), soil adjusted vegetation index (SAVI), modified normalized difference water index (MNDWI), and normalized difference water index (NDWI) to detect landcover changes. Trends in spectral index changes over user-selected focal years and the magnitudes of those changes were isolated and visualized through RMET. The project partners at the National Park Service and the Upper Colorado River Endangered Fish Recovery Program will use RMET to identify potential sites where changes in riparian vegetation and the active stream channel may have reduced fish habitat to make more informed recommendations for flow releases from the Flaming Gorge Dam.*

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GIS in Business

Evergreen/Conifer Room

Track Chair: Laura Atkinson

Trials and Tribulations of Switching to esri's Mobile Apps

Will Mast and Scott Ytzen

Wednesday 10:30 – 11:00 am

Are you considering changing to Collector or other ESRI mobile apps? Tetra Tech decided to make this change. What did we learn? How successful were we with the transition?

Over the last two years, Tetra Tech has successfully completed Phase I & II of the United States Coast Guard's (USCG) Utilities Inventory, Condition Assessment, and Mapping (ICAM) Project. We utilized ESRI's Collector for Phase 1 of the project. Also, we chose to modernize our legacy tablets to new Microsoft Surface Pro's. We implemented the use of an ArcGIS Online for our client and company personnel to see live updates as the project progressed.

The success of ESRI's mobile apps with this project has led us to use it with several other projects. We also added it to use of our GPS collection with Trimble Catalyst and VRS. ESRI's mobile apps are the way to move forward!

Development of a low cost and easy to configure geospatial ETL "data workflow" that can be deployed on AWS or via a Docker deployment

Matthew Krusemark

Wednesday 11:00 – 11:30 am

Does your organization consume external data via API calls, connect-up-to internal silo'd data sources and/or wrangle Shapefiles and spreadsheets in a somewhat messy way? Although an analyst with scripting chops can be a life-saver in a pinch, we all know that scripts have their limitations as far as standardization, cross-training and on-boarding new employees and maintaining operations. If you lose your scripting wizard to a new higher paying job, you might be trading water or worse. We will do a "Live" demo of an ETL data transformation that includes a US Census API call and a CSV loading to PostgreSQL and PostGIS. We will also talk a little DevOps and do this using a solution built on AWS and show a second similar solution with a Docker deployment for on-prem needs.

KID - The Knowledge Driven Approach to Extracting the Value from Geo-Data and More

Jim Barrett

Wednesday 11:30 – 12:00 pm

Land & Resource Management (L&RM) and other large organizations possess a great wealth in their Geospatial data, information and knowledge assets. The Knowledge, Information, Data (KID) model provides an approach to assist L&RM and other large organizations in leveraging what they already possess.

The KID approach flips the common 'data driven decisions' model on its head with a focus first on knowledge as the driver. Data first approaches rely on labor-intensive work of cleaning all data before determining its value. Through focusing first on identification, the unknown, the KID model derives greater value from existing data, improves quality without disrupting production, and enhances operational or adaptive management efforts. It provides a platform for efficient and iterative learning, data maturation toward higher quality decisions, and improved workforce effectiveness. KID is a creative solution to the problems so common in highly federated organizations seeking indicators of success only to produce analyses garbled with uncertainty, redundant or misfit solutions, and miscommunication, drowning in awkward data differentiation (Geo) systems integration, time consuming data calls and data cleansing efforts, and decentralized IT infrastructures impeding collaboration and exploitation --- KID helps find a way past the seemingly daunting future tasks related to extracting value from data.

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

Enabling Spatial Data Integration, Collaboration, and Governance Using a Common Geo-Registry

Nathan McEachen and Justin Lewis

Wednesday 1:00 – 1:30 pm

The business needs of governments drive collaboration with other governments in order to serve their constituents. This collaboration is often hindered by the lack of available resources to integrate spatial data.

Common Geo-Registries are currently being implemented in a number of countries to serve as the single source of truth for location data to facilitate collaboration across different organizations and across countries. By centrally managing location hierarchies such as geopolitical, health administrative, and services and how they relate to each other through governance workflows, data can more easily be accessed and shared, such as parcels. By using ontologies, these hierarchies can enable spatial data transformations to harmonize disparate datasets by location in a more automated way. By managing how hierarchies change over time, government entities can more easily visualize and compare indicators from different time periods.

We will discuss examples of how Common Geo-Registries are being implemented in different countries and how open source is winning over commercial software to implement them.

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GIS in Emergency Management

Evergreen/Conifer Room

Track Chair: Cate McNabb

Updating Maps for Emergency Management Routing

Devon Wallis

Wednesday 3:30 – 4:00 pm

This presentation will discuss map editing and how you can improve navigation in your local area highlighting the Santa Clara Fire Department to include and update mountainous driveway locations, thus improving emergency response times.

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GISCO: Your Geospatial Connection

Alpine Room 1

Society: GIS Colorado

Track Chairs: Pete Magee

This track will present proposed and/or completed GIS projects that have fostered a collaborative working relationship between government departments and between government agencies. This can include anything from communication and workflows to software or applications.

DRCOG's Regional Planimetric Project: A Case Study of Open Data Driving Innovation

Ashley Summers

Wednesday 10:30 – 11:00 am

The Denver Regional Council of Governments (DRCOG) has been facilitating an aerial photography project in our region since 2002. Funding comes from fifty partners, including local governments, public utilities, and public service providers. This collaborative partnership does two important things: it allows the group to buy expensive data that they could not afford on their own and it creates a common basemap for public entities to use for their planning and operations.

After the 2014 imagery project, the partners asked DRCOG to pursue a similar model for additional data. Specifically, they wanted planimetric features – delineations of the built environment – to be drawn from the high-resolution imagery product that we were already buying. With over twenty partners, we successfully completed a project to generate very detailed building roofprints, edge of pavement, sidewalks, parking lots and more. In addition, the products – which cover over 1100 square miles of the metro area - were made available for public download.

The partners and DRCOG had use cases in mind when purchasing the datasets including asset management and bike/pedestrian planning. After making this data open, we realized that others – including public, private, and academic entities – saw potential with the data as well. Since publishing it, we've seen a proliferation of uses in everything from technology startups to 3D modeling to energy research.

This project is an example of how open data can drive entrepreneurship, innovation, collaboration, and partnership.

Growth Planning: Improving Local Housing Datasets to Enhance Regional Modeling

Dorothy Friday

Wednesday 11:00 – 11:30 am

In planning applications at the Denver Regional Council of Governments (DRCOG), geospatial housing data is predominantly used to model current and future development and travel patterns. Good quality data improves these models and helps our region to establish a much more in-depth understanding of regional growth and behavior. A quantitative inventory of housing unit locations helps economists and planners predict housing availability, measure open space, and improve transportation infrastructure.

This presentation will provide background on DRCOG's use of housing data, along with an open discussion on how to better integrate local housing data with regional planning efforts. We will describe various housing data geometries, present an index of building types (single unit versus multi-unit typologies), and discuss complexities related to parcel data. We will also provide workflow tips and other information on how to create robust local housing datasets.

ZDV-3D, A Modern 3D Visualization and Analysis Tool for Denver Air Route Traffic Control Center

Berrett Doman

Wednesday 11:30 – 12:00 pm

Air traffic control (ATC) manages complex three-dimensional airspace. In particular, Denver Air Route Traffic Control Center (Denver Center) is responsible for a 60,000-ft. tall volume of airspace covering over 265,000 square miles! Denver Center needs a modern 3D GIS platform capable of depicting its numerous aeronautical features including ATC areas, sectors, minimum safe altitudes, airways, military airspace, airports, navigation equipment, communication information, and surveillance infrastructure. The main objective of this study is to incorporate these entities into a 3D digital twin of Denver Center, titled ZDV-3D. ZDV-3D intends to produce intuitive mediums for visualizing and analyzing ATC system interrelationships. esri technology applications will be incorporated including ArcGIS Pro, ArcGIS Online, and ArcGIS Earth. I will review capabilities and limitations of Denver Center's current geospatial tools and highlight benefits of implementing the latest ArcGIS 3D rendering capabilities into this project. I will also address production challenges, plans for further ZDV-3D development, and ways

to share outcomes with other ATC facilities. ZDV-3D will enable Denver Center to provide optimized efficiency and safety for all who fly in our increasingly crowded skies.

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

Opioid Use in Larimer County: Surveillance for Sharing with Community

Nina Wickens-Bhowmik

Wednesday 1:00 – 1:30 pm

Abstract

GIS Colorado Panel Discussion

Moderated by Pete Magee

Wednesday 1:30 – 3:00 pm

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

Permenent Water Quality Control Measure Survey 123 Inspection Report Mobile App

George Suresh

Wednesday 3:30 – 4:00 pm

Abstract

Envisioning Redevelopment in Dillon, Colorado

Meghan Boydston

Wednesday 4:00 – 4:30 pm

This project was completed as a Capstone Project was submitted in partial satisfaction of the requirements for the degree of Master of Urban and Regional Planning, College of Architecture and Planning, University of Colorado Denver. The objective of this Capstone Project is to provide the Town of Dillon a visual framework to guide its community engagement and redevelopment. The Town of Dillon is in the process of redeveloping 1.59 acres of the Core Area, and wants to be careful to make sure redevelopment enhances views from public areas.

A viewshed analysis was completed with ArcPro from valued observation points in public spaces and a model was created for four scenarios: no development, existing conditions, zoning buildout, and development with no constraints. A height analysis provided the existing conditions model, using Lidar data calculated elevation points at the ground level and at the top of buildings to find their elevation and placed on top of a basemap displaying ground elevation. The zoning height models were created using the same building footprints as currently exist, but extruded to the height allowed in the Town of Dillon zoning code. The constraints removed was created by adding large building footprints or multiple building footprints on every developable parcel. Each new building footprint was extruded to a height above the height allowed in the Town of Dillon zoning code.

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Track Chair: Muthu Sampath

USGS 3D Elevation Program

Carol Lydic

Wednesday 10:30 – 11:00 am

The U.S. Geological Survey (USGS) National Geospatial Program is developing 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 primary goal of 3DEP is to systematically collect 3D elevation data in the form of high-quality light detection and ranging (lidar) data over the conterminous United States, Hawaii, and the U.S. territories, with data acquired over an 8-year period. 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. The 3DEP initiative is based on the results of the National Enhanced Elevation Assessment 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.

The Role of GIS in Developing a Comprehensive Stormwater Infrastructure Master Plan to Inform an Intergovernmental Agreement

Denise Magditch and Chris Martin

Wednesday 11:00 – 11:30 am

The City of Colorado Springs (City) is immersed in ongoing stormwater litigation due, in part, to forest fires and flooding events in the recent past, which have overstressed the drainage infrastructure. An Intergovernmental Agreement (IGA) was enacted between the City, Colorado Springs Utilities, and Pueblo County to address needed infrastructure improvements. Matrix Design Group is developing the Stormwater Infrastructure Master Plan (SIMP), which collects, standardizes, integrates, and analyzes 50 plus years of information on proposed stormwater capital and operations & maintenance projects needed to address current and future stormwater and drainage limitations in the City. GIS is a critical component of the project, and is involved heavily in identification, compilation, and prioritization of stormwater projects and drainage infrastructure. Utilizing the Esri ArcGIS suite of tools, including Collector for ArcGIS, the team assembled projects, photos, and condition information for some 270 miles of open channel into databases, as well as performed data maintenance to condense the studies, master plans, projects, and activities into a comprehensive uniform plan to be executed by the City. The compiled data will be displayed in an interactive online mapping tool powered by Geocortex, which will assist in tracking the progress of short-term and long-term projects, as well as associated budgets, and provide metrics for requested summary reporting. The SIMP project is key to planning the City's stormwater infrastructure improvements and imparting direction to the IGA.

Publishing Bureau of Land Management Data on the Web

Jason Frels and Stacey Crowe

Wednesday 11:30 – 12:00 pm

The Bureau of Land Management (BLM) is an agency within the US Department of the Interior that manages public land in a multiple use and sustained yield manner. The BLM publishes a growing number of datasets related to its mission and programs to the public using Voyager and ESRI Geoportal software products.

This presentation will cover the various types and scales of BLM data (e.g., state level data, landscape level data, national level data), where these data are published and discoverable, and how the Voyager and ESRI Geoportal publication nodes are tied together for a seamless user experience. We will also cover how these technologies are integrated with other interagency platforms and metadata catalogs. Lastly, we will discuss the road ahead for maintaining a data presence on the web with increasingly changing technology and the opportunities that these changes in technology provide.

-----Lunch 12:00 – 1:00 pm -----

What a Relief: Designing Multi-Scale Terrain Representation for The National Map

Elaine Guidero

Wednesday 1:00 – 1:30 pm

The National Map, created and hosted by the U.S. Geological Survey, is the source for authoritative digital topographic data and derivative basemaps of the United States. One of these basemaps is multi-scale shaded relief. The basemap spans zoom levels 1-16 (approximately 1:295,000,000 to 1:9,000) and was last refreshed in April 2017. With GDAL and ArcGIS, new shaded relief layers were derived from lidar-updated one-arc-second elevation, for zoom levels 9–12 (1:1,000,000–1:144,000), and from GMTED2010 global elevation, for zoom levels 1-8 (1:2,000,000 and smaller scales). Complete continental coverage was added with the one-arc-second elevation as well. The relief layers themselves are multi-directional hillshades, at zoom levels 6–16 (1:9,000,000–1:9,000), and single-direction hillshades at zoom levels 1–5 (1:18,000,000 and smaller scales). Hillshades were adjusted for contrast and gamma in ArcGIS before being cached into the basemap.

Prioritization Modeling Lancaster County PA TIP Prioritization

Aron Langley

Wednesday 1:30 – 2:00 pm

To assist the Lancaster County PA Planning Commission with its Transportation Improvement Program (developed cooperatively between the Metropolitan Planning Organization (MPO), PennDOT, and South Central Transit Authority), a GIS prioritization model was developed to score, rank and prioritize various regionally-significant and federally-funded transportation projects throughout the county. The prioritization modeling and scoring, based on 25 weight-based selection criteria, evaluates over one hundred potential TIP project locations throughout the county using a series of environmental, social, economic, geographic, and safety factors throughout the region resulting in a prioritized ranking of TIP projects. Testing the limits of ESRI's Model Builder, the toolset and its graphical interface can be used by multiple staff to investigate planning alternatives and meet changing needs on an ongoing basis.

Historical Topographic Map Collection

Brian Collinge

Wednesday 2:00 – 2:30 pm

The United States Geological Survey (USGS) created nearly 200,000 1:250,000-scale and larger printed topographic maps between the inception of the topographic mapping program in 1884 and 2006 when they began producing digital format maps. In 2011 the USGS began production of the Historical Topographic Map Collection (HTMC) by scanning these maps and creating a GeoPDF and GeoTIFF product for each unique paper map. In addition to producing high-resolution, geo-referenced digital copies of the legacy lithographic maps, the USGS is also accurately cataloging and creating metadata for each product. This presentation will talk about what the HTMC is, how and why it is being created, where you can access the available GeoPDFs and GeoTIFF's, and the current program status.

A New Approach to Boundary Labels in U.S. Topo Products Utilizing Auto-Labels

Bethany Walker

Wednesday 2:30 – 3:00 pm

Boundaries were first included on the U.S. Geological Survey (USGS) 1:24,000 scale 7.5-minute digital topographic quadrangle map series, US Topo, in 2010 starting with state, county and U.S. Forest

Service (USFS), National Park Service (NPS), military, Fish and Wildlife, and National Cemetery boundaries were added from 2013 to 2014. Boundary labels are placed using ESRI Maplex Label Engine, and then converted to annotation. The boundary annotation is then manually edited, as needed, to correct poorly placed, missing, or duplicate annotation. In late 2018, US Topo will be incorporating additional boundary areas such as wilderness, and wild and scenic rivers. The addition of these new boundary areas prompted a complete redesign of current boundary symbology, with the goal of incorporating a more holistic cartographic approach for symbology and labeling. Additionally, US Topo will be moving away from annotation and rely on set label placement from the Maplex Label Engine, a process being tagged as 'auto-labeling'. The introduction of auto-labels will eliminate manual manipulation of boundary annotation. For some features, such as the international boundary, auto-labeling will present challenges in producing well placed and consistent labels. This presentation will address the current boundaries displayed in US Topo, challenges of incorporating new boundaries and auto-labels, and future goals for boundary symbolization.

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

TBD

Wednesday 3:30 – 4:00 pm

Building an esri Workflow Manager to Maximize High Quality, Consistent Data Products in Large Volume

Sara Boyer

Wednesday 4:00 – 4:30 pm

The production system of the U.S. Geological Surveys' US Topo 1:24,000 scale topographic maps have utilized the ESRI Workflow Manager (WMX) extension since 2011. WMX has enabled production editors to generate and edit cartographic content as well as provide a platform to quality control final products. With a yearly goal of more than 18,000 maps, WMX provides the mechanism for a highly efficient production line as well as producing a more consistent high-quality product. To build a workflow for any program can be challenging which can lead to a misconception that it is too difficult or expensive to implement. This discussion will use the US Topo experience to showcase the variety of options available to support a production line of any size. Steps to break down a project to determine the ideal workflow course will be covered. Finally, ideas on how to approach an established workflow and make adjustments for better efficiency will be examined.

Pits and False Hills and Spikes, Oh My! Fixing Blunders in the USGS Seamless 1/3 Arc-Second DEM

Barry Miller

Wednesday 4:30 – 5:00 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 blunders resulting from errors in data capture, processing, or in the original source map sheet. The purpose of this presentation will be to discuss the types of blunders that are

present in a small fraction of our legacy data, how those blunders came to be, and what steps USGS is taking to fix these issues to better support our customers.

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GIS in Education

Alpine Room 3

Track Chair: Sara Boyer

The Meaning Behind a Career as a GIS Professional

Esther Worker

Wednesday 10:30 – 11:00 am

Getting a GIS Job is not easy. Once you do have a job, will your career as a GIS Professional last 2, 5, 10, or 40+ years? What have you done to prepare for your future success?

We'll explore the many paths and journeys a GIS Professional may want to consider for building, maintaining, and growing a meaningful career that feeds your personal passions while integrating your GIS expertise and talents for a life time of personal satisfaction and learning. Do you live by the 5 Ps, 6 Ps, 7 Ps, 10 Ps or 12 Ps of Planning and Performance? Make choices that will make you happy for a long time, rather than just focusing on the present.

Denver Street Trees and Road Safety: A Geographic Information Systems Analysis

Nicholas Coppola

Wednesday 11:00 – 11:30 am

At the time this research was conducted, according to the National Highway Traffic Safety Administration (NHTSA) the United States had seen a 7.2% increase in traffic fatalities from 2014 to 2015 which was the largest increase seen in 5-decades. More recent reports from the NHTSA show that in 2016 there was an increase of 5.6% from 2015.

According to the National Association of City Transportation Officials (NACTO) Urban Street Design Guide, vehicle speed is a critical element in "cause and severity of crashes" and street trees are considered a speed reduction mechanism. The implication behind this statement is that street trees can be used as a mitigation element in roadway design to assist in increasing traffic safety.

With the use of geographic information systems (GIS) software, tree canopy spatial data was evaluated with 10 sets of previously grouped streets that include segment types: light, moderate, heavy, and arterial. This presentation will show what correlation(s) were discovered between tree canopy coverage and traffic safety at select street intersections and corridors based on research conducted in 2016. More specifically, tree canopy coverage will be analyzed with crash rates, vehicle speeds, total number of crashes and crash severity.

Topics will include spatial data details, methodology for data collection, creation, and analysis, and overall results.

Trail Difficulty Per Segment: A GIS Based Analysis of Hiking Trails

Lisa Dubas

Wednesday 11:30 – 12:00 pm

The standard "easy," "moderate," "difficult" trail rating system is a very subjective way to rate trails and does not give potential hikers enough information to decide if the trail fits their abilities. This Capstone

project sought to make trail ratings less subjective, while giving potential hikers a way to see where the more difficult segments of the hike may be, and to provide information on what makes those segments more difficult.

A multi-criteria approach to hiking trail ratings per segment was developed, which used surface and obstacle information collected on the trail using Collector for ArcGIS, with subsequent analysis in ArcMap using publicly available elevation data. Factors, which contributed to rating the trail as a series of segments, included total trail distance, altitude, trail surface, obstacles encountered, trail gradient, and elevation gain.

The process was applied to ten trails throughout Maricopa County in Arizona, which will enable potential hikers to pre-screen the trails for sections that may give them difficulty. Hikers could use this information to choose a hike more suited to their abilities, or use them as a preview of what they will encounter during the hike.

-----Lunch Break 12:00 – 1:00 pm

Car Racing with Collector

Elizabeth Tulanowski

Wednesday 1:00 – 1:30 pm

GIS educators often don't get the opportunity to work on "real" research projects or gain day-to-day experience with geospatial technology. In order to stay on top of an ever-changing industry, sometimes they have to get creative. In this instructional, and hopefully entertaining demonstration, presenter Elizabeth Tulanowski will show how Collector for ArcGIS was used to capture her path around a racetrack, and how the data was processed to calculate lap time and speed. Data setup including schema design, and accuracy considerations will also be discussed.

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

Trail Difficulty Per Segment: A GIS Based Analysis of Hiking Trails

Lisa Dubas

Wednesday 1:00 – 1:30 pm

The standard "easy," "moderate," "difficult" trail rating system is a very subjective way to rate trails and does not give potential hikers enough information to decide if the trail fits their abilities. This Capstone project sought to make trail ratings less subjective, while giving potential hikers a way to see where the more difficult segments of the hike may be, and to provide information on what makes those segments more difficult.

A multi-criteria approach to hiking trail ratings per segment was developed, which used surface and obstacle information collected on the trail using Collector for ArcGIS, with subsequent analysis in ArcMap using publicly available elevation data. Factors, which contributed to rating the trail as a series of segments, included total trail distance, altitude, trail surface, obstacles encountered, trail gradient, and elevation gain.

The process was applied to ten trails throughout Maricopa County in Arizona, which will enable potential hikers to pre-screen the trails for sections that may give them difficulty. Hikers could use this information to choose a hike more suited to their abilities or use them as a preview of what they will encounter during the hike.

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Professional Panel

Alpine Room 3

Wednesday 3:30 – 5:00 pm

Moderator: Steve Hick

Panel: Elthron Anderson, Esther Worker, Darcee Killpack, PJ Thorstenson

Looking for some great advice about career growth or maybe reinvigorate your geospatial career? Local GIS professionals from the public and private sector share their GIS career trajectory and offer guidance on how to achieve professional goals.

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Vendor Showcase

Alpine Room 4

Track Chair: David Siddle and Brian Collison

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 general user feedback.

Frontier Precision

David Siddle

Wednesday 10:30 – 11:00 am

Abstract pending

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

David Thomas

Wednesday 11:00 – 11:30 am

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.

LiDAR and Point Clouds and Laser Scans, Oh My!

Tammy Peterson

Wednesday 11:30 – 12:00 pm

As the costs of today's sensors/scanners decrease and new types become available, the use and application of 3D datasets is becoming far more prevalent. However, it seems that the end user community are at very different places within the spectrum of adoption and integration of these datasets within their daily workflows. At what phase is your organization at – not even contemplating, giving it consideration, just beginning to use, or can't live without it? If within the first two categories, why is that? Yes, the datasets are large, need to be massaged into a manageable format and then most

importantly, somehow easily shared across the organization with experts and non-experts alike, to truly derive the value of their insight and decision-making information. But that's simply done...isn't it? Join this interactive, facilitated discussion, that will help prompt ideas of how when used in conjunction with other geospatial datasets, 3D data can provide your organization or project team with powerful visualization and enhanced collaboration.

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

GIS Ascends to New Heights with Cityworks

Christine Christensen and Reece Hanzon

Wednesday 1:00 – 1:30 pm

Cityworks is the original and leading GIS-centric software solution for permitting and public asset management. Combined with Esri's ArcGIS technology, Cityworks provides users with a platform to manage, track, and analyze their public infrastructure assets. By harnessing the visual data representation and powerful analytical capabilities of GIS, Cityworks efficiently manages daily operations, such as service requests, work orders, inspections, permits, and code enforcement cases to keep your organization running smoothly. Cityworks is used by local government agencies, utilities and special districts, facilities, airports, marinas, urban forests, and more. Join us for a look at how Cityworks can help you leverage the power of your GIS to build a safer, more sustainable, and resilient community.

Frontier Precision

Mel Philbrook

Wednesday 1:30 – 2:00 pm

Pending abstract.

Sharing Spatial Data Freely

Ian Isaacs

Wednesday 2:30 – 3:00 pm

One of the most important roles that can be filled by mature GIS agencies is that of a data librarian. Wikipedia notes that ... "The role of a librarian is continually evolving to meet social and technological needs. A modern librarian may deal with provision and maintenance of information in many formats, including: books; electronic resources; magazines; newspapers; audio and video recordings; maps; manuscripts; photographs and ..." Following along with this notion Boundless believes that sharing of maps should be as free as possible to permit GIS agencies to encourage widespread use of vital data and the information that will flow from this data. This presentation will show how Boundless is using its Exchange content management system with state and local governments to accommodate the need for GIS agencies to freely share spatial data both internally and externally to any user.

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

LaserGIS for Everyone: Eliminate Mobile Asset-management Workflows Deficiencies

Derrick Reish

Wednesday 3:30 – 4:00 pm

Learn about the new laser offset mapping workflow within Esri Collector for ArcGIS. Understanding how the rapid advances in GIS technology have created an opportunity for you to do more with less. By

integrating lasers with smart devices, mobile mapping apps and GPS/GNSS devices that you might already own, you can maximize productivity with an immediate ROI. The variety of measurement functions laser rangefinders can provide will allow you to complete field tasks quicker and safer.

Using Voice to Interact with Geospatial Information

Michael Giddens and John Thompson

Wednesday 4:00 – 4:30 pm

Geospatial data is an increasingly critical aspect of the decision-making process - whether for business or personal needs. Queries, web sites and BI tools have been the traditional way to access and work with geospatial information, but with the latest technologies voice has become a popular and valuable form of search. Voice is now a faster and easier way to communicate than mobile apps and can provide specific answers to questions. At Xentity, we have built a service that allows organizations the ability to easily connect verbal questions with data platforms, both spatial and non-spatial, to quickly provide dynamic answers easily.

InfoGroup

Allan Benek & Kam Draper

Wednesday 4:30 – 5:00 pm

Many government agencies utilize and process vast volumes of data. Assuring that all the data they have is good quality and tells the right story can be a big challenge. Inaccurate and outdated data results not only in unreliable models, analysis and mapping projects but also serious financial loss.

What we do as a data company is offer quality business and residential data sets that agencies can use to check accuracy, find additional details and the ability to make a more informed decision. We'll walk you through the three key areas of real-time data success: Compile, Search, Submit.

Compile: Hear about the advancements our dedicated teleresearch and data compilation teams are making, and how these changes are boosting data quality utilizing new methodologies and strategies for signals, feedback, verification and fulfillment.

Search: Learn how you can query our database in real-time.

Submit: See how businesses can provide us feedback on our data in real-time via our Express Update product.

THURSDAY

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Giant Map of Colorado

Aspen Room

Thursday 8:30 – 10:00 am

It's a plastic tarp! It's a Twister mat! No, it's the National Geographic's Giant Map of Colorado. This 14' x 21' map typically used for K-12 lessons and activities is on display from 8:30 – 12 pm for your viewing pleasure.

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**ASPRS: Big Data
Evergreen/Conifer Room**

Society: ASPRS – Rocky Mountain Region
Track Chair: Sheila Pelczarski

Organizations from across industries are undertaking more projects supported by big data. As technology evolves, “big data” is becoming an ever-present challenge. These projects represent some of the most exciting things happening in GIScience today. This track will highlight emerging workflows that allow GIS professionals to analyze large datasets that support decision making and project goals.

Applying the Best of Remote Sensing and Deep Learning to Refugee Tent Detection

Chloe Hampton and Martha Morrissey

Thursday 10:30-11:00 am

The aim of this presentation is to present a fusion of methods for better object detection in satellite imagery and apply it to a quantitative analysis of human rights crises. Refugee camps in and around Syria will serve as a case study for this presentation. This research illustrates how traditional remote sensing methods such as, Spectral Angle Analysis (SAM), and machine learning methods, specifically Convolutional Neural Networks, can be used for refugee tent detection. SAM, as a method of tent detection, was used over a time series of images, and achieved an accuracy of 88 percent in the Rubkan refugee camp on the border between Syria and Jordan. To scale this analysis over larger areas of satellite imagery, we will discuss using SAM to generate labeled training data for CNNs and the result of applying them over a large area.

Front Range Oblique Photography Available Today

George Halley

Thursday 11:00 - 11:30 am

For years, the insurance industry has used oblique photography to create detailed property reports on the fly for assessment purposes. In the last year, that stock library has been made available to the larger GIS and mapping community. This presentation will discuss what is available, show the quality of the photography, and offer real solutions to access it within your applications. In addition, a short description will be made of how the insurance industry uses the data and the machine learning used to support this work.

Utilizing Landsat to Detect Ephemeral Water Sources in Support of a USGS Feasibility Assessment and Management Strategy of Equids

Kristen Dennis

Thursday 11:30 – 12:00 pm

Since 1971, federal agencies have been tasked with managing burros in federally-designated herd management areas (HMAs). Because these areas are often large and remote, obtaining sufficient data on horse and burro populations and habitat preference can be difficult and expensive. In recent years, the United States Geological Survey (USGS) has partnered with the Bureau of Land Management (BLM) to study the population dynamics and habitat preferences of wild horse and burro populations on the Sinbad HMA in central Utah. Researchers at the USGS and BLM hypothesize that surface water is potentially an important factor in wild horse and burro habitat selection, thus these agencies are interested in determining how water availability affects species' movement in both time and space. NASA DEVELOP leveraged NASA Earth observations and pre-existing water availability data to determine the spatial and temporal distribution of water on the landscape. Maps were developed to

help researchers create habitat selection models for wild horses and burros on the Sinbad HMA and elsewhere.

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

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

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

Exploration of Indigenous, Native and Tribal Place Name Preservation in the United States

Jeffery M Young

Thursday 2:30 – 3:00 pm

Examples of indigenous, native and tribal place name preservation practices in the United States will be compared and contrasted. At least five regions of the United States will be examined including northeastern Pennsylvania, southern Indiana, south central US, northern New Mexico and Hawaii. In the case of northeastern Pennsylvania and southern Indiana, tribal communities were displaced as the American settlers expanded west. South central US became a reservation-based settlement region by Federal Government policy and treaties with multiple Native American tribes. The northern New Mexico Pueblos are quite different in that the tribal communities have been in place for hundreds of years; the most notable being the Taos Pueblo where Tiwa has been spoken on a daily basis for 1000 years and Tiwa continues to have a persistent influence on place name usage despite the presence of the colonial Spanish and the English speaking American settlers who followed. Hawaii may have historically benefited by its isolation early on in Native Hawaiian history, but rapid development over the last several decades has strained preservation initiatives. In response the Office of Hawaiian Affairs has developed an authoritative Kipuka database which contains approximately 10,000 historic sites. In all cases for the five regions listed above, a discussion of methods and practices employed for sacred site protection will be presented. Preliminary findings suggest there has been loss or degradation of sacred sites and place name changes over time and land transfers have contributed to site disruption and damage. The author will present findings on these special concerns related to ongoing efforts to preserve and protect indigenous, native and tribal sacred sites across the US.

What Do You Do With a Bunch of Lidar?

Nickolas Viau

Thursday 3:00 – 3:30 pm

Interested in exploring the use and potential of 3D Lidar data? If you're interested lidar data and you'd like to get ideas on how to take advantage of it, this is for you! This presentation introduces several examples of lidar in real world projects, the potential value of lidar to various types of work, and key resources for locating quality data (free!).

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Society: Rocky Mountain URISA

Track Chair: TBD

A forum to share your success in using GIS for local and regional development in communicating concepts, and plans.

Colorado Water Plan: The First Three Years

Phyllis Thomas

Thursday 8:30-9:00 am

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.

Historical GIS: A Discussion and A Demonstration of Using Story Maps in History

Drew Heiderscheidt

Thursday 9:00 – 9:30 pm

This Story Map Journal aims to add a spatial component to the causes of American Independence, using references in the Declaration of Independence as a starting point, and specifically outlining (and explaining) the grievances within the Declaration. Each clause is summarized and mapped, with an explanation of the event the grievance is referencing. As such, this Story Map Journal borrows the structure of Pauline Maier's book American Scripture, specifically the chapter titled "Mr. Jefferson and His Editors," and splits it into three parts. Part One explores the first 12 clauses of the Declaration of Independence (or the "By" clauses); Part Two explores clauses 13 through 22, which specifically outline wrongs done by the King to the Colonists; and Part Three investigates clauses 23 through 27, in which more recent (relative to the publication of the Declaration of Independence) wrongs were outlined.

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Career Development Academy

Alpine Room 1

Thursday 2:30 – 3:30 pm

This year's CDA will offer presentations by Richard Serby of Geosearch, Inc. followed by mock interviews with GIS Professionals (timeslots are limited). The interactive session 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 specialists are all invited to participate. Attendance is complimentary and conference registration is not required to participate in CDA. Sign up for mock interview slots will begin Wednesday morning at the conference. CDA will begin at 2pm in the Aspen room.

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GIS in Development

Alpine Room 1

Track Chair: Lucas Kaim and Bill Emison

This track will offer the opportunity to see several projects and developments highlighting the advantages and challenges using open source and developing technologies in diverse contexts and applications.

FOSS4G in the Government (Proof of Concept)

Samuel Song

Thursday 8:30-9:00 am

A proof of concept migrating existing Veterans Affairs National Cemetery's GIS data from MS SQL Server/ArcGIS software configuration to an open source GIS platform using PostGIS/PostgreSQL, QGIS, and JavaScript in order to reduce software licensing costs and annual subscription fees. There are many misconceptions about open source software such as not being equivalent to Commercial off-the-shelf (COTS) software or it's less secure and may include malicious code. Some GIS professionals fear a transition to open source platform dues to its complexity and many different moving parts, but it is possible to fully adopt open source platform from existing ArcGIS configuration.

Semantic Web

Lucas Kaim

Thursday 9:00 – 9:30 am

Abstract pending.

GRASS GIS: Striking Terrain Visualizations in the Rockies

Robert Dzur

Thursday 9:30-10:00 am

For 33 years GRASS GIS has offered open source tools for geospatial analysis, visualization, and processing. With its roots in raster analysis, GRASS GIS has always provided a wide array of robust classic terrain analysis tools such as slope, aspect and shaded relief imagery. Recently contributed GRASS Add-on programs such as r.skyview extend GRASS's already highly capable terrain visualization capabilities. This module calculates the sky view factor (SKF; Zaksek et al., 2011) of the surrounding terrain at a given location with terrain shading based on the amount of sky visible at that location. The module is capable of multi-directional analysis resulting in striking terrain visualizations that enhance the definition of subtle terrain features and highlight from light to dark the degree to which the terrain is open to the surrounding landscape. Although this module is computationally expensive, its results offer the potential to improve error detection in LiDAR DEM production as well as serve as inputs to slope based sustainable land and zoning code development. This presentation will demonstrate the functionality of r.skyview through a tour of LiDAR-derived terrain visualization in areas from Ft. Collins, Colorado to the Southern Rockies Organ Mountains of Las Cruces, New Mexico.

-----Morning Break 10:00-10:30-----

Developing a National Map of Subsurface Infrastructure

Geoff Zeiss

Thursday 10:30-11:00 am

In its 2017 Infrastructure Report Card, the American Society of Civil Engineers assigned an overall grade of D+ to U.S. infrastructure. Addressing the problem of bringing national infrastructure up to a standard where it becomes an enabler of economic expansion rather than a drag on the economy is hindered by a lack of systematic information readily available to decision makers of the inventory of

infrastructure assets, their location, and condition. Geospatial data and technology are key to providing an accessible platform making it possible for decision makers to have a uniform view of national infrastructure. The economic argument for the benefits of accurate 3D maps of underground infrastructure is well-founded. The value of mapping underground infrastructure is gaining increasing attention at the national level. France has embarked on a program to map all critical underground infrastructure. The Netherlands has mandated a national database for sharing information about underground infrastructure. This presentation will focus on why the time is right for a discussion with the objective of including subsurface infrastructure in the development of a national infrastructure map

New Developments in Global Web Mapping Platforms

Steve Milroy

Thursday 11:00-11:30 am

Web mapping platforms provide mapping technology from the cloud and are constantly evolving & improving. These web mapping platforms provide the APIs & building blocks to enable powerful web mapping solutions & applications, including the use of aerial imagery, maps, geo-coding, routing features & more. In the past year, there have been an incredible number of updates from the major web mapping players. This presentation provides a high-level view of the exciting new developments in web mapping.

Highlights include:

- Google – New pricing model*
- Bing – Powerful, new fleet management APIs*
- Azure maps - New Azure maps platform released in May 2018*
- HERE Maps – New mobile Software Development Kits (SDKs) allow developers to build mapping-based mobile maps*
- Open Street Map – Evolving open source (freeware) options*

Presentation Learning Points:

- Understand the new introductions, features & functions from the major web mapping platforms*
- High-level comparison of new web mapping platforms*
- How the new, web-based mapping technology provides a sleek, streamlined approach to the development of mapping applications*
- Examples of how this web-based approach has resulted in development of powerful, affordable new applications: RouteSavvy (routing planning software) & MapSavvy (WMS imagery service) used as examples.*

USGS & Citizen Science: Success and Enhancements for TNMCorps

Samantha Doering and Erin Korris

Thursday 11:30 – 12:00

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. Using an online mapping application, volunteers 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. A new and internally-developed web application was launched in 2016. TNMCorps has also broadened the variety of approaches used to engage with volunteers. As a testimony to its success, TNMCorps recently passed a major milestone, with volunteers having collected more than 300,000 points. This presentation will provide an overview of the TNMCorps project as a whole while briefing audience members on milestones and enhancements.

-----Lunch 12:00 – 1:00 pm-----

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

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

What's New in Q... Version 3, that is

Dave Murray

Thursday 2:30 – 3:00 pm

QGIS is one of the world's most popular GIS program. There is good reason for this. It is a full featured desktop GIS with outstanding cartography, data manipulation and analysis tools. With the release of version 3.0 this amazing program now is set for wide-spread adoption. The back end has been completely upgraded along with the migration to the latest version of Python. With the growing pains come opportunity. This presentation will review the new functions of QGIS and make a compelling case for your consideration as another program in your toolbox.

Look Ma, No Server and Big Data - Using serverless functions to mine Open Geodata on AWS

Matthew Krusemark and Trent Pingnot

Thursday 3:00-3:30 am

Amazon Web Services (AWS) has an Open Data initiative that has proven remarkable in making data such as Landsat, OpenStreetMap and Census ACS publicly accessible. Serverless AWS technology has changed the game by freeing us from deploying and maintaining servers. Come learn how to combine AWS serverless technology to mine the enormous OpenStreetMap open dataset on AWS.

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PLSC

Alpine Room 2

Society: PLSC

Track Chair: Steve Parker

PLSC is dedicated to the improvement of land surveying education and practice. This half day track focuses on the basics of coordinate systems (knowledge essential to GIS) as well as the application of surveying in GIS and latest developments from the National Geodetic Survey. We encourage anyone doing geospatial work to attend.

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GIS in Recreation

Alpine Room 3

Track Chair: Greg Matthews

Adding Value to "Colorado the Beautiful" Initiative -Aerial Mapping and Data Collection

Michael Carr

Thursday 8:30 – 9:00 am

The main point of this abstract is increasing the value of the current Colorado the Beautiful Initiative through additional data points gathered by mapping the trail systems with the use of unmanned aerial systems and 3rd party software to build the additional data points to be included in the current mapped environment.

I have used Unmanned Aerial Systems and 3rd Party Mapping Software Companies (DroneDeploy, Precision Hawk, Pix4D, and DroneMapper) to build sample data to support my work

I have been able to create sample maps, photos, video of certain trail sections to show how additional data sets can be included to increase the value of the initiative for both the public and government sectors

With the data I have collected, I can discuss several points of interest with the conference. I can show how the data can be utilized to benefit the public sector: Safety, knowledge, and planning and the government sector: trail maintenance, anticipating future problems- heavy traffic areas or lost hikers, plant health - fire danger and erosion, and intersection of multiple agency and private land area issues.

The Latest Trail Technology - Crowdsourcing, Maps, and Apps

Brian Riordan

Thursday 9:00 – 9:30 am

Americans are increasingly recognizing the health, quality of life, environmental, and economic benefits that trails and active transportation offer. As a result, now more than ever it's important to connect people to our trails, improve the planning of new trails, and better understand how visitors use trails.

For this session, we'll explore what role technology plays in how people engage with trails. How can land managers utilize technology to publish better information to their visitors and also understand who's engaging with their recreational infrastructure? Learn how to reach and understand new audiences, using everything from apps that get people outdoors to crowdsourced data.

The Making of a Trail. Desktop and Field GIS Deployed to Plan for New Trails in Silverthorne.

Nick Viau

Thursday 9:30 – 10:00 am

As a part of a joint effort between the Town of Silverthorne and the Summit Sky Ranch development, Allpoints GIS and Contour Logic were contracted to provide trail planning services on private and National Forest lands. Several variables presented challenges that required detailed planning work. Lidar data analysis, 3D web scenes, survey data, high resolution web maps, and ArcGIS Collector in the field were all employed in a joint desktop and field GIS effort to create trail plans. I will detail our GIS methods and products from this project from start to finish.

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

Virtually Touring the National Trails

Ryan Abrahamsen

Thursday 10:30 – 11:00 am

Terrain360 has been commissioned to create a 360° "streetview" map of the Captain John Smith National Scenic Trail, Huron River Water Trail, Lake Huron, Lake St. Clair, Detroit River and other important waterways in 2018. We will be discussing the technical and mechanical challenges of capturing/managing massive amounts of GIS data and imagery from these projects. We will also discuss dissemination of the data on a forward-facing exploration tool.

Partnerships Lead to Additional Recreational Content on US Topo Maps

Elizabeth McCartney

Thursday 11:00 – 11:30 am

In 2010, the USGS National Geospatial Program (NGP) began producing the new US Topo map series. The first maps were relatively simple, but quality and content have continually improved. Recreational features, especially trails, are among the most often requested features, but have been difficult to add due to lack of national datasets. Some trails in National Forests were added in 2014. In 2015 the USGS partnered with the International Mountain Biking Association (REI-Adventure Projects) to include trails outside of Federal lands. A pilot project with the National Park Service in 2016 added trails, visitor centers, trailheads, and campgrounds to US Topo maps covering the Great Smoky Mountains National Park. 2018 US Topo maps include trails, trailheads, campgrounds, picnic areas, visitor centers, and other recreation information on selected Federal lands, using data provided by the relevant agencies. Continuing into the future, the USGS is working on partnerships with states and other organizations including The National Map Corps to expand recreational features to non-Federal lands. All such data will be in the public domain and published in The National Map geospatial databases.

BikeDenver Downtown BID Bike Parking Analysis

Gianfranco Palumbo

Thursday 11:30 – 12:00 pm

Bike parking in downtown Denver is crucial to the providing more multi modal options in order for the City of Denver to meet its Mobility Action Plans goal of doubling the number of bike commuters. The ebb and flow of traffic into the city is made more convenient by access to various mobility choices. Visible bike parking encourages fledgling riders and visiting commuters that biking is a safe and secure transportation option. Not only is it fun to bike to our favorite places, it's free. When there is available bike parking on every street, there is an understanding that people have options when choosing their preferred method of transportation. And peer pressure wants that option to be a bicycle. BikeDenver has conducted a full bike rack analysis of the existing bike parking available within the Downtown Denver Business Improvement District (BID). Utilizing AGOL and Survey123, BikeDenver collected data in the field of all the bike parking locations through the map provided to us by the BID. During the course of the survey, BikeDenver counted logical groupings of racks as clusters if they were within a few feet of each other. In this way what some may interpret as individual racks, they entered as clusters due to proximity. The survey focused on short-term bike parking. A more thorough survey is needed to assess long-term and private property bicycle storage in the BID.

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

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

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

A Creek Runs Through IT

Shannon McElvaney

Thursday 2:30 – 3:00 pm

The City of Manitou Springs is planning a creek walk along Fountain Creek, an aspirational goal for over two decades. The question is: how to unite a diverse set of stakeholders with competing interests to agree on a preferred route, that incorporates their values and priorities? The answer was to use geodesign.

Geodesign is a powerful participatory planning method that uses stakeholder input and geospatial analytics to show the possible impact of design scenarios. It gets its strength in two ways: 1) from the diversity of participants—proving the adage that two heads are indeed better than one—and 2) from the power of spatial analytics, which allow the visualization of the world both as it is, and as it could be.

The presentation will focus on how geodesign methods were used to define stakeholder groups, clarify values, and prioritize criteria to help decision makers evaluate planning scenarios. Esri ArcGIS Pro was utilized to develop models—such as bikeability, walkability, ADA compliance, and more—that were used to both visualize and evaluate the impacts of each route segment. The spatial analysis resulted in an innovative solution that addressed both the concerns of both government and public stakeholders.

Attendees of this session will learn how to use geodesign as a systems approach for informed decision-making. More importantly, they will learn how to use spatial technology to guide conversations among diverse stakeholders to come up with plans that people understand and are happy with.

Mapping National Wildlife Refuge System Visitor Services Features

Richard Easterbrook

Thursday 3:00 – 3:30 pm

The U.S. Department of the Interior is focused on enhancing and expanding hunting, fishing and other recreational opportunities on land and water managed by the Department. The National Wildlife Refuge System created a feature service, hosted in ESRI's ArcGIS Online (AGOL), that allows users to capture refuge features and assets that provide access, assistance, recreation and enjoyment information to the public into an enterprise geodatabase. Using Collector for ArcGIS and a custom AGOL editing application, Refuge System staff and CSU Geospatial Centroid interns are mapping visitor service features throughout the country. This dataset will feed the locations of Refuge features to web maps, mobile apps and traditional cartographic products, using standardized symbology and nomenclature, which enhances visitor experience.

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Vendor Showcase

Alpine Room 4

Track Chair: David Siddle and Brian Collison

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 general user feedback.

Open Space Challenges and Meter Reading in Augmented Reality

Brian Collison

Thursday 9:00 – 9:30 am

The Argis Lens brings GIS data into the three-dimensional world meter readers work in. Learn how the City of Thornton, CO is improving asset documentation in the field by integrating Augmented Reality with their ArcGIS implementation.

ERDAS Imagine, What's New and Tips and Tricks

Jeff Van de Vaarst and Matt Falter

Thursday 9:30 – 10:00 am

This presentation will cover the latest release highlights as well as tips and tricks for processing LiDAR data, ERDAS Imagine modeling capabilities and a roadmap for cloud-based processing. The session will highlight exploiting the full spectrum of LiDAR from viewing and measurements to surface and terrain modeling as well as extraction of point clouds from imagery. In addition, we will discuss the migration of our image exploitation capabilities from the desktop to the cloud.

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

Introduction to Building Web Mapping Apps

Matt Bullock

Thursday 10:30 – 11:00 am

In this fun and fast paced session, you'll be introduced to the basic concepts of building 2D and 3D mapping applications that run in a browser.

Solving Critical Real World Issues with Hexagon Smart M.Apps: The Map of the Future

Michael Ann Lane

Thursday 11:00 – 11:30 am

With the proliferation of location-aware mobile devices and the emergence of everyday analytics, geospatial technology now spans every market, crosses national boundaries, and affects every trending issue. There is no doubt that cloud-based solutions are increasing in demand, requiring next generation, customizable technology to harness multisource data and transform it into focused solutions to be consumed by users of every level. The M.App Portfolio platform is designed to create smart, lightweight, customized market applications that address unique business and industry problems by combining geospatial analytics with cloud technology, as well as enterprise-level deployment environments. These applications, known as Hexagon Smart M.Apps, link sophisticated analytics and spatial models to geospatially relevant information, conveying data about solutions through intuitive, customizable, interactive and innovative displays. In this presentation, you will see several Smart M.Apps in action to better understand how this platform is changing the way we visualize, interpret, and interact with spatial information. Learn how Hexagon Geospatial has teamed with the World Antiquities Coalition to use Smart M.App technology to track missing and stolen cultural artifacts. See how the Green Space Analyzer provides a new way for decision makers to influence policy. Understand how a Smart M.App helps count endangered species in Africa. See how Smart M.Apps address the problems of refugee camps and can be used in country-wide census. Hexagon Geospatial technology provides the ability to address the challenge of linking business information with multisource multi-sensor data, in near real-time to answer questions and make decisions about our dynamically changing Earth.

Building High-Performance Government: 5 Tips to Mapping Your Journey

Heather Henderson

Thursday 11:30 – 12:00 pm

"With thousands of citizens relying on your city's GIS and related technology, a lot is resting on your shoulders. Your team works day and night to map and maintain millions of dollars in infrastructure assets, plan for the future, and keep your residents safe and informed. But, how do you keep up when budget cuts, disasters, and staff changes are thrown into the mix?"

During this session, you'll learn how to build effective, innovative GIS teams and implement efficient processes. In addition, you'll uncover the 5 reasons why local government agencies are working to become high performing, plus expert tips to help you get started on your journey today."

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

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

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

The Data-driven Government

Joe Francica

Thursday 2:30 – 3:00 pm

Today, GIS is not just software. It's data. It's people. It's getting to the answer. Quicker. Data is expanding. More users demand access to information but don't consume the information in the same way as a GIS professional would. But as curators and managers of geospatial information, GIS professionals are looking to support the entire organizational needs not just those in GIS Departments. The chief information officer is acutely aware of how much geospatial data is being collected; now, how do city and state governments leverage these data for smarter, more effective government services. Here are five pillars of the data-driven government to consider:

- 1. Extensibility: Whatever the choice, the platform must be customizable for users beyond the GIS department. Knowledge workers need access to geospatial technology too.*
- 2. Usability: GIS is a complex tool. However, today's desktop platform must be adaptable to many types of workflows.*
- 3. Flexibility: The next generation of geospatial solutions must be ready to support the desktop, cloud, SaaS as well as mobile platforms. GIS must adapt to the user's preferred IT environment...not the other way around.*
- 4. Compatibility: GIS must work in mixed environments of open source and commercial software and ingest data from myriad sources.*
- 5. Expandability: Can your GIS environment work in the world of big data? Smart cities depend on ingesting sensor data produced at high rates that require geoprocessing on a scale not thought possible until recently.*

Spatial Analysis Using ArcGIS Pro

Shelby Hines

Thursday 3:00 – 3:30 pm

Learn essential concepts for using ArcGIS Pro to explore, analyze, and produce reliable information from your data. Topics include planning and preparing for spatial analysis, automating workflows, and exploring a variety of tools for proximity, overlay, space time, and 3D analysis.

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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.

2016 Quarterly Volume Weighted Average API Gravity by County, State of Wyoming

Joel Murray and Jason Boroos

The American Petroleum Institute (API) gravity is one of the key characteristics essential to defining the quality of crude oil. This poster explores quarterly volume weighted average fluctuations in API gravity for counties in the state of Wyoming.

Trends of Suburban Poverty Based on Walkability: A GIS Analysis of Minneapolis Suburbs

Rachel Pierstropp

Single-use zoning and car dependency are critical components of the disapproval of American suburbs because these aspects contribute to poor urban conditions for walking to key destinations. As suburbs become increasingly impoverished—both as poor households move to the suburbs and existing residents drop below the poverty line—the ability for low-income residents to access important destinations via non-car transportation becomes increasingly important. Two tools for modeling walkability in ESRI's ArcMap software were developed using the clientele of a nonprofit human services organization in suburban Minneapolis. The results are expected to show the limited ability of suburban residents to walk to essential daily destinations, such as schools, grocery stores, and transit stops. With this new information, the organization will better understand the geographic characteristics of their clients, and be better equipped to plan services based on local infrastructure and client locations.

Veterans Statistics in the Rockies

Samuel Song

Map showing veteran population by county in Colorado along with other veteran statistics.

Utilizing Geospatial Modeling Techniques for Trend and Prediction Patterns on Eolian and Erosion Sediment Deposits

Jim Sanovia

This project integrates research objectives, sample collection, and evaluation of erosional and aeolian transport trends using laboratory and geospatial analysis. Site location is at Slim Buttes in Harding County, South Dakota and consists of several of the approximately 34 abandoned open-pit uranium mines in the county. Most of the mines are on U.S. Forest Service land and have received no capping or other remediation efforts for the past 50 years. More recently, US-EPA CERCLA funds and a \$179 million settlement have provided funding for the investigation and clean-up of these mine sites. Past studies have indicated the presence of heavy metals and other elements such as arsenic, uranium, radium, and thorium at various locations. Geospatial analysis of trends and predictions from all sites will provide a better understanding of these transport patterns. Field sample sites were analyzed for the presence of heavy metals and mean grain size. Samples were then sieved to separate fine to very-fine soil fraction to determine the percentage of material that could be subjected to aeolian transport in the study area. Directionality components of ambient and bulk sampling were analyzed geospatially using ESRI ArcGIS 10.5. This paper answers two important questions. First, do radionuclide concentrations tend to decrease moving away from the mine sites. The second, do the mean grain size have a directional pattern of the northwest to southeast lining up with regional wind trends.

Modeling Hydrologic Parameters in High Plains Aquifer Units using GIS and a Convolutional Neural Network

Lilly Jones

The Ogallala and Arikaree units of the High Plains Aquifer consist of a heterogeneous sequence of silts, sands, clays, and gravels and comprise the northernmost extent of the High Plains Aquifer. The hydrogeologic complexity and variability of these units make it difficult to estimate hydrologic parameters for these units. For locations without monitoring wells, these values have been derived in the past through regression equations or by building process-based models.

Artificial intelligence and deep learning are emerging areas of inquiry in the hydrological sciences. Artificial neural networks (ANNs) consist of interconnected nodes of computational units that can be used to model complex, non-linear relationships between inputs and outputs. ANNs can be used to predict missing values in sparse datasets. Once trained, ANNs can be used for predictive analytics.

A geodatabase was built to integrate data from the several entities that manage these aquifer units. Site-specific contaminant and water quality data are being integrated into the geodatabase so that analysis can be performed. A convolutional neural network (CNN) will be constructed using published data as a baseline for training. Model calibration can be completed by withholding 20% of the data during the training phase, and then comparing CNN predicted hydrologic values against field-measured hydrologic values. The CNN can then be used to model hydrologic parameters and assess aquifer vulnerability for these High Plains Aquifer units.

Geodesign Applied to an Urban Campus and Its River Reach: Colorado College and Monument Creek

David Sachs and Will Rundquist

Situated in the historic downtown area of Colorado Springs, the Colorado College campus lies along Monument Creek, within the Fountain Creek watershed. Until 1935, Monument Creek was a healthy riparian system bordered by homes, park land, and campus and the historic downtown of Colorado Springs. Colorado College's campus landscape included the creek and its floodplain, but that connection was lost as flood control measures were put in place, water quality diminished, and urban infrastructure (stormwater conduits, streets, rail line, and utilities) encroached.

Using Colorado College and immediate surroundings as a study region, we use ArcGIS and Geodesign principles to 1) map historical and present-day infrastructure, 2) assemble hydrological, environmental, and land use data, and 3) identify prospective area for interventions that may enhance water quality and restore riparian ecology, and 4) design campus landscape elements that promote a healthy hydrological system for Monument Creek. Esri CityEngine software is used for creation/visualization of 3D models to be used for community input and dialog and to acquaint campus and city planners/decisionmakers with well-researched designs that, if implemented, promise to enhance the urban environment. Our undergraduate team and study project is a component of "Changing our Global Infrastructure," an international academic collaboration. Collaborating schools provide Geodesign training through investigation of local/regional problems, develop and share science-based, data-rich landscape and urban designs that function with rather than negatively impact earth surface processes and habitats, developing a capability for rapid response to the current and future impacts of rapid global change.

Identifying Additional Land Suitable For Food Production On The Pine Ridge Indian Reservation.

Amanda Ruiz

Food Sovereignty is based upon the ability to have food security and be self-sufficient. Whether it is a Nation, an Indigenous tribe, or a community. Creating foods, made readily available to the Oglala Lakota people on the Pine Ridge Indian Reservation will embrace cultural awareness of foods as

medicine, restore a healthy balance to individual lifestyle, strengthen food security, and create sustainability on the Pine Ridge Indian Reservation by identifying land suitable for food production. The objective of this project is to Identify additional land suitable for potential food production on the Pine Ridge Indian Reservation. This project looked at Landsat 7/8 National Land Cover Data (NLCD) datasets to identify how it had its land datasets classified. Further reclassifying and geoprocessing steps were taken to identify additional agriculture lands and for potential sites. The result of this project shows where potential additional lands could be used for agricultural use.

Monitoring Crop Growth Variations in a Wyoming Field using Growing Season Satellite Data

Anna Savage and Ramesh Sivanpillai

Farmers aim to minimize variation in crop growth and maximize output. Field with uniform crop allows for more effective harvesting and achieve consistent output quality. Identifying variations in growth is often conducted through scouting, which requires lot of time and resources. Also farmers might not be able to scout their fields multiple times within the same growing season. Remotely sensed images acquired from satellites could be a viable option for obtaining variations in crop growth. These satellites collect imagery in the visible and invisible regions of the electromagnetic spectrum at preset intervals which can be used for monitoring crop growth conditions throughout the growing season. In this study, we obtained 4 satellite images in the 2017 growing season for a field in Southeast Wyoming and derived estimated crop growth with a commonly used vegetation index. Our results indicate that satellite images were able to identify significant ($p < 0.01$) variations in crop growth throughout the growing season. These findings will be useful for the farmer to identify the sources of variations due to underlying factors such as soil, topography and moisture.

Gray Wolf Habitat Suitability Analysis in the State of Wyoming

Joshua Zeeb

Wolves have been thriving in Yellowstone & Greater Teton National Park ever since they were reintroduced to the Rocky Mountain region in 1995. There are potentially more areas that Gray Wolves could migrate to in Wyoming. Geographic Information Systems (GIS) can be used to help find areas where wolf packs may colonize while traveling across the state. When weighing prey density, public land, and potential rendezvous points we can measure the likelihood of a wolf pack colonizing around the entire state. However, conflicts arise where colonization probability will be limited due to human population, road, and livestock density. Wyoming has a loose wolf hunting management practice compared to surrounding states largely due to livestock conflicts for ranchers within the state. A map of potential conflict areas for wolf colonization could help with producing a more sound hunting management practice in Wyoming.

NHDPlus High Resolution

Ariel Doumbouya

NHDPlus High Resolution (NHDPlusHR) is an integrated geospatial data product which incorporates the National Hydrography Dataset (NHD), 3D Elevation Program (3DEP) data and the Watershed Boundary Dataset (WBD). NHDPlusHR is currently being produced and distributed by the US Geological Survey (USGS) National Geospatial Technical Operations Center (NGTOC). NHDPlus High Resolution data provides all of the NHDPlus Version 2 attributes such as natural flow estimates, flow adjustments for diversions, stream order and much more while providing the additional detail of the current High Resolution NHD and 1/3 arc-second seamless digital elevation models.

Jefferson County's GIS Supports Mission Statements and Mandates

Stephen Mitchell

Decision makers may not fully comprehend how technology fulfills the business requirements of the enterprise, so this poster was created for a County technology fair to both educate and promote our use of GIS.

The poster describes how Jefferson County departments, divisions and elected offices employ GIS in support of individual mission statements and mandates. It also diagrams the 'hub-and-spoke' organizational model employed in the County's GIS efforts.

Same Data, Different Stories

Stephen Mitchell

It is often fascinating how the same data may tell different stories depending on how it is rendered!

Using ArcPy to Automate Contour Snapping

Seth Webinger and Lindsay Decker

The Map Production Services unit of the Operations branch at the U.S. Geological Survey's (USGS) National Geospatial Technical Operations Center (NGTOC) generates 1:24,000-scale contours for each 7.5-minute US Topo extent. To achieve seamless contour lines across 7.5-minute extents, manual edits are required to snap mismatched segments together. To increase efficiency of this manual process, an ArcPy tool was created to automate snapping of contour line endpoints along 7.5-minute cell boundary edges. The tool evaluates three focal criteria: contour endpoints must have the same elevation value, contour endpoints must not reside in the same cell, and both contour endpoints must be within reasonable ground distance from one another. If contour lines meet the aforementioned criteria, a center ("snap-to") point is generated and the two contour lines are snapped at the cell boundary. Early results return nearly a 90% success rate with the remaining "un-snapped" contour lines typically due to differing contour intervals, differing elevation data collection methods, and differing elevation data collection dates. These differences result in contour line termination at cell boundaries, large gaps between contour lines, and an overall change in topography between adjacent 7.5-minute cells. This poster will focus on the purpose of this tool and how it can be used to improve efficiency during the contour editing process.

How Does Proximity to Predator Activity Centers Affect Nest Site and Success in Flammulated Owls (*Psiloscops flammeolus*)?

Jordan Ellison

*The increased structural protection of cavities may provide concealment from predators, resulting in lower rates of predation compared to other nesting types. Little is known how other factors impact predation on the cavity-nesting flammulated owl (*Psiloscops flammeolus*) by the North American red squirrel (*Tamiasciurus hudsonicus*). To address if proximity to middens affects nest success, I mapped all owl nests ($n=60$) and nearby squirrel middens ($n=223$) from 2005-2017 on a study site in the Manitou Experimental Forest. Mean distances were calculated between owl nests and nearest squirrel midden. Nests were categorized as successful or unsuccessful if failed due to predation. No significant difference was found between distances from middens to successful owl nests (53 ± 8 m) and unsuccessful owl nests (60 ± 20 m; $t=0.564$, $p=0.58$). This exhibits the need for further research on the influence of other habitat characteristics on predation rates of flammulated owls by red squirrels.*

Investigating Variations in Coral Reef Morphology using Photosmosaics and Analysis of Percent Coverage

Justin Culman

Coral reefs serve as an important component of tropical marine ecosystems' functionality and composition. However, coral cover in the Caribbean reefs continues to decline due to climate changes.

Corals are adapted to thrive in a limited range of environmental conditions, where small changes in the oceans structure, such as temperature, light intensity, and physical disturbances, can lead to wide-scale loss of organisms. In the present study, I investigated five categories of coral reef morphology--massive, brain, flowering, plating, and branching--to assess how variations in depth change coral coverage and abundance. A section of the coral reef was surveyed off the coast of Bonaire, Netherland Antilles, in the Southern Caribbean. The study collected large-scale imagery, called photomosaics, used to create a robust, archived dataset with detailed representation of the benthos. The study site contained two 50m² subplots, one shallow and one deep, to represent two separate conditions based on environmental variables such as light intensity and nutrient availability. Each subplot was traced in Photoshop based on each morphological type. The GPS coordinates of each subplot boundary allowed for the images to be georeferenced into a geographic information system to calculate precise percent coverage data from each type of morphology. Plating and flowering morphologies had a higher percent area cover in deeper depths. Massive, brain, and branching morphologies had a higher percent area cover in shallower depths. With variations in morphology and shifting environmental conditions, certain species of coral may dwindle in numbers, biodiversity, and coverage.

Neighborhood Facilitation and Inhibition Drives Spatial Distribution of Seedlings and Saplings at an Abrupt Treeline

Alexa Hoffman and Francis Russell

Mechanisms responsible for creating the spatial structure of treelines and how they will respond to climate change are poorly understood. Here we present a field study on the relationship between growth and distribution of seedlings and saplings in relation to distance from neighbors within different zones of the ecotone at an abrupt treeline located on Pikes Peak, CO. We divided the ecotone into four zones: forest, lower-sheltered, upper-sheltered, and tundra. After marking all seedlings, we produced a drone-derived orthomosaic to: map the distribution of the marked seedlings, and digitize canopies of saplings and adult trees through the ecotone. We measured the growth, damage, and height of all seedlings and saplings in a 30m wide AOI. Results showed that: within the lower-sheltered zone, seedlings and saplings were growing significantly slower compared to other zones. Additionally, seedlings were significantly underrepresented in 1m buffers (chi-squared = 257.3, df = 1, p<.0001) and 2m buffers (chi-squared = 319.2, df = 1, p<.0001) around adult trees and saplings. This indicates the prevalence of competitive neighbor-neighbor interactions. Within the upper-sheltered zone seedlings were overrepresented in 1m buffers (chi-squared = 31.9, df = 1, p<.0001) around saplings, but underrepresented in 2m buffers (chi-squared = 40.7, df = 1, p<.0001). Overall they were growing better compared to other zones. This indicates short-range facilitation and long-range inhibition in this zone. In the tundra, seedlings were growing worse in comparison to the upper-sheltered zone, and were overrepresented in the 1m buffers (chi-squared = 94.6, df = 1, p<.0001) around saplings.

Colorado Population Change Over Time in 3D

Joe Gunning

3 dimensional representation of relative population change (+/-) over a specified time period.

Legal Documents and GIS for Utilities- What is legally owned and potential issues.

Joel Burley

This poster will show the need for utilities and to capture land and easement assets from legal documents to accurately show what they legally have interests in and possible conflicts that can arise. The poster will mostly focus on electrical utilities but can be applied to gas, water, wastewater, storm-water, and other types of utilities.

Fire District Map in Support of Rural Mountain Area Fire Districts

Kathy Arbogast

Fire District that are mostly manned by volunteers do not readily have GIS staff on hand to provided mapping needs. Providing map products in support of volunteer fire fighter efforts using County Open source data.

Wasatch Canyons: Recreation Concentration

Kristy Bruce

Wasatch Canyons are the water source for the Salt Lake Valley and are the Valley's primary mountain recreation area. To maintain clean water, manage trail maintenance, and continue to promote recreation, Salt Lake County is trying to consolidate use to specific areas. These concentration areas, identified by canyon on the poster, provide a variety of recreational opportunities, trail difficulty types, and facilities. As parking throughout the canyons is limited, the concentration areas will have seasonal bus access with different stops featured in summer and winter. Salt Lake County is using the map in public processes to gather feedback on the location of the concentration areas. Many recreational areas throughout the West are experiencing growth that has the potential to impact habitat, water quality, and experiential elements such as noise and crowding. Salt Lake County's effort to provide concentration areas and expanded bus services will become a model approach for other communities experiencing similar growth pressures.

Technical:

- The map illustrates the use of the bumpmap tool to create pine trees using USGS landcover data to identify the correct locations for pine tree vegetation types.*
- Representation features classes were used to give the study area and trails a drop shadow.*
- GIS Pro was used to create the 3D viewshed of the canyons from Salt Lake using a USGS aspect raster.*
- QGIS was used to extract trail profiles.*
- Adobe Illustrator and InDesign were used to generate the legend and trail profiles.*

Using 3D Drone-based Digital Models to Investigate

Kathryn Kummel and Michelle Kummel

In the arid West, conversion of intermittent streams to arroyos makes the already limited water even less available to the ecosystem. This study used two drones (one we designed and built in 2016, and a DJI Phantom we piloted in 2018) to study a rapidly down-cutting stream with average movement of the nickpoint in 1999-2017 of 5.6m/year (Google Earth data). The stream had three active nickpoints and was divided into 4 sections: Surface Stream, Incised Section (downstream of first nickpoint), Active Section (defined based on movement seen in Google Earth), and Arroyo. Two hypotheses were tested: (1) Basic hydrologic characteristics of the stream should differ between the sections and reflect the increasingly incised stream. (2) The sections should differ in erosion and deposition rate. Statistical analysis was performed for digital surface models from 2017 and 2018 and multispectral orthomosaic from 2017. Statistical analyses showed the intermittent stream transitioned from an upstream section of deep pools and shallow, grassy riffles to a deeply incised state (low entrenchment ratio) with no or few shallow pools to hold water. As the stream incised it lost connection with the flood plain (except where the floodplain re-formed in the Arroyo). The Active section had the steepest slope and the highest erosion and deposition rate. However, the presence of multiple sharp "nickpoints" and bank collapses suggested that erosion was generally occurring "catastrophically" (i.e., quickly, in large quantities) in a few places rather than gradual erosion in all areas.

The Effect of Climate on Fire in California's Central Valley

Anthony Bates

Wildfires are an ever present danger in California. Many studies have been conducted examining the effects of climate on the size of fires in the forests of Northern and Eastern California. There has been comparatively little written about the interaction between climate and fire in the grasslands of the

Central Valley (CV) California. It was suspected that the conclusions reached for the forests surrounding the CV may not hold true for the CV itself because of differing types of vegetation, nearby population centers, and fire regimes. The goal of this study is to examine how climate, measured by the Palmer Drought Severity Index (PDSI), affects the overall number of fires and fire size in two drainage basins (Sacramento and San Joaquin) that make up the CV. The question is whether there is a lag between high or low PDSI and fires. Fire data was obtained from the CAL Fire Fire Resource and Assessment Program (FRAP), PDSI data was collected from NOAA's Climate Data Online database, and vegetation information comes from the USDA Forest Service. Fire and PDSI data run from 1900 to 2016. Data was filtered in ArcGIS using the USGS National Hydrography Dataset. Cross Correlation Function and Superposed Epoch Analysis were used to analyze years with the most area burned. Analysis appears to show that in the Sacramento region the strongest relationship between PDSI and area occurs in the year of the fire, while in for San Joaquin there appears to be a lag of two years..

From Drifts to Dams: Following Wyoming's Water Resources through Story Maps

Rosemary Hatch and Chris Nicholson

Wyoming, a relatively arid headwaters state whose waters are sourced primarily from mountain snowmelt, has long prioritized the development of reservoirs and related infrastructure to manage this important resource. Water is a crucial component to the state's agriculture, industry, recreation, and much more; therefore for effective use stakeholders, water managers, and the public need to be able to easily access information on the availability and current state of Wyoming's water development programs. As the use and deployment of interactive, more visually oriented, data platforms have increased, the Water Resources Data System and the Wyoming Water Development Office have developed a series of ESRI Story Maps as a way to provide information on water availability, new storage and infrastructure projects across the state. ESRI Story Maps combine spatial information, such as locations of reservoirs, new projects, and weather stations, with narrative and images to tell a story about changes to the state's water supply and infrastructure. Three Story Maps have been built to help communicate water resources information to decision-makers: Wyoming's Dams and Reservoirs, Wyoming Small Water Projects, and Wyoming Snowpack Melt-Out. These Story Maps are informative, eye-catching, and user-friendly tools that together provide a public platform that tells the story of Wyoming's most valuable resource.

Connecting Data to the National Hydrography Dataset

Kevin McNinch and Michael Tinker

The United States Geological Survey (USGS) creates and maintains the National Hydrography Dataset (NHD), which portrays the surface water of the nation. The NHD surface water network provides a framework for linking data sources such as, hydrologic observations, natural resource surveys and other water-related datasets.

USGS is currently creating new methods by which hydrologic observations can be referenced to the NHD and shared as map services. For example, the USGS is creating a flexible data schema, called the Hydrography Referenced Data (HRD), that can be used for any kind of hydrologic observation. USGS is also designing a Hydrography Referencing Tool (HRT) which will be a browser-based tool that allows linear referencing and flexible indexing of any kind of hydrologic observation to the NHD.

The HRT and HRD are both aligned with the vision of the National Hydrography Infrastructure and the Internet of Water. Supporters of these initiatives are collaborating on web tools and Application Programming Interfaces (APIs) for discovery and search of community-generated HRD through a future-designed web portal.

This poster shows how the new HRD and HRT projects at the USGS fit within a collaborative community of data holders of data related to the NHD.

Informing Progress: Improvements in Reporting for Environmental Consulting

Greta Robison

Survey and data collection are integral components of the environmental consulting sector. Progress in data collection technology has enabled faster updating for staff and clients, however, incoming field data can often be overwhelming for those interested in overall progress, as opposed to specific updates. In the past, progress has been reported to clients and managers in the form of large spreadsheets and busy map books, methods that can provide useful details but are hard to understand at a glance. In an effort to save time and improve communication, the SWCA Environmental Consultants GIS team has been using ESRI's Dashboard and Story Map applications to provide daily progress updates and project summaries for our clients and staff. Both have proven to be versatile tools for simplifying complex data with minimal scripting and widget configuration. In this poster, we share our experiences improving communication of spatial information to all using these applications. We discuss our lessons learned, as well as the impacts our changes have made for reporting, workflow, winning projects, and interdisciplinary work.

Examining NHD's VisibilityFilter Attribute: What is it, Where is it Available, and What is the Accuracy?

Hayley Thompson

The National Hydrography Dataset (NHD) includes a VisibilityFilter attribute that enables users to represent NHD vector features in the NHDPlus High Resolution (HR) at eight different map scales; ranging from 1:24,000 up to 1:5,000,000. Using a feature thinning model and workflow that approximates natural drainage density patterns for the conterminous United States, each feature is assigned a VisibilityFilter value, indicating an appropriate map scale, and all larger scales, for representing the features. This attribute is available for the NHDFlowline, NHDWaterbody, NHDArea, and NHDLine feature classes within NHDPlus HR.

Though the VisibilityFilter attribute is not yet nationally available, progress on populating the VisibilityFilter attribute is being tracked via a web mapping application hosted by ArcGIS Online (<https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=8cdeb11b2d224d81b74072a37d1de984>). As the VisibilityFilter attribute is populated, data is available via download from nhd.usgs.gov and the web map is updated.

As datasets with the VisibilityFilter attribute become available, ongoing research is being conducted to identify differences between datasets at the 1:100,000 map scale, as defined by the VisibilityFilter in the NHDPlus HR data, and the 1:100,000-scale NHD Medium Resolution data. The intent of this research is to identify patterns and areas of potential improvement within the methods used to calculate the VisibilityFilter attribute, and to subsequently improve the accuracy in later versions of the VisibilityFilter.

How Hot is the Hot Spot: Analyzing Hot Spot Techniques in Crime Mapping Applications

Nathaniel Penrod

Hot spot analysis is one of the most widespread mapping techniques used today. The easy readability and visual appeal of hot spot maps have made them ubiquitous tools for engaging the public and seasoned GIS professionals alike. To study crime trends, crime analysts employ hot spot analysis techniques to identify areas which experience above average criminal activity. While many hot spot methodologies are used to identify general crime trends, it can be difficult to elucidate precise areas for targeted law enforcement intervention due to the challenge of determining what makes a hot spot "hot." To enhance the understanding of the statistical meaning and validity of hot spot maps, this study compared the use of standard deviational ellipses, nearest neighbor hierarchical clustering, kernel density interpolation, and the Getis-Ord G_i^ statistic to map the spatial distribution of homicides in Chicago, Illinois, in 2017. This project found that while all four techniques identified similar general areas with high homicide rates, the more statistically rigorous methods, such as nearest neighbor hierarchical clustering, may be more meaningful for crime analysts. Additionally, this study reinforces*

that background knowledge of the area and phenomenon being mapped are critical since small adjustments in analysis parameters dramatically alter results. Overall, this project's findings highlight the usefulness of hot spot analysis in crime mapping and underscore the responsibility of the analyst to understand the data and procedures utilized to produce hot spot maps in order to accurately convey significant information..

Shifting Representation: Rocky Mountain Fur Company Trade Network (1823-33)

Richard Yates

The fur trading period is of great historical and economic importance to the development of the United States of America, and is integral in understanding the American processes of resource extraction, westward expansion and state- building. I have constructed, to the extent of my knowledge, the first animated or digital map of the Rocky Mountain Fur Company and its exploits in the American West. This StoryMap details the evolution of the Rocky Mountain Fur Company's trade network during the decade of 1823-33, by displaying the routes of the individual RMFC sponsored expeditions from the period. The StoryMap is the foundation of a fur trading pedagogical tool that can operate at three different levels of education. Firstly, this tool can be used in a Primary education setting by utilizing historical interpretation to deliver great stories from American history, sowing interest in an underrepresented historical period in addition to demonstrating historical diversity. Secondly, this tool can be used in a Secondary education setting to foster critical thinking surrounding American history. Realistic discussion surrounding all aspects of westward expansion and its impacts can ensue. Thirdly, this tool can be used in a Post-Secondary education setting as an introduction to the field of Digital Liberal Arts.

The process for building the map consisted of finding mapped historical trade routes from the period and geo-locating them in GIS software. I was introduced to GIS and StoryMaps through this project, which has greatly expanded my horizons in terms of historical interpretation and data representation.

Jefferson County Open Space, Park and Trails Atlas

Robert Thayer and Christopher White

The Jefferson County Open Space (Jeffco Open Space), Park and Trails Atlas 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 atlas 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 volumes as new acquisitions occur, regions develop and cartographic standards progress.

White Ranch Park Map Suite (Kiosk, Brochure, Website Map)

Robert Thayer and Christopher White

High quality cartographic design has quickly become the standard for Jefferson County Open Space. Standardization of our symbology makes it easier for the GIS Team to replicate our visual branding and streamline our production efforts. We publish the White Ranch Park map through 3 major visitor education venues; at trailhead kiosk, brochures and on our website. In effort to ensure quality and present a consistence message we synchronize these 3 products. Trail information, amenities, and geographic boundaries give a complete picture of what one will experience at the park.

Jefferson County Open Space Organizational Data | Now and Then: A Relational Model Tale

Christopher White and Robert Thayer

This poster looks at the transition of an existing organizational database into a relational database model. From left to right, the poster shows the existing structure of the database prior to the project, the

workflow used to normalize the database, and the relational organizational database after the completion of the project.

Black Bear Trail Map

Robert Thayer and Christopher White

This is a regional park mapping product developed by Jefferson County Open Space. The intent of this product is to provide park visitors a sense of the larger regional connections between South Valley Park, Deer Creek Canyon Park, and Hildebrand Ranch Park. Additionally this product highlights the newly built Black Bear Trail Connection between Deer Creek Canyon Park and Hildebrand Park.