

# GIS APPLICATIONS IN MUNICIPAL MANAGEMENT

STRATEGIES  
FOR SMALL TOWNS



**WORKFORCE  
SERVICES**  
HOUSING & COMMUNITY  
DEVELOPMENT

COMMUNITY  
DEVELOPMENT OFFICE

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## LIST OF TERMS

**ARCGIS STORYMAPS** offer a story authoring web-based application that can empower a municipality to share maps and geospatial data in the context of a narrative. StoryMaps can include maps, narrative text, lists, images, videos, embedded items, interactive elements, and other media. p. 15

**CULTURAL ATTRIBUTES** are related to the built environment and include elements such as buildings, roads, public utilities, historic structures, and local parks. p. 8

**DASHBOARDS** are essential information products, like maps and apps, providing a critical component to your geospatial infrastructure.<sup>15</sup> p. 24

**DATA LAYERS** refer to various data that can be overlaid visually in order to generate an image that incorporates all the information in a meaningful way.<sup>7</sup> p. 7

**GEOSPATIAL DATA** refers to data that is referenced to locations on the earth and can be mapped using GIS tools and software. p. 3

**GIS** is an acronym for Geographic Information Systems. p. 3

**GIS SOFTWARE** is a computer-based tool capable of storing, retrieving, managing, displaying, and analyzing geospatial data.<sup>8</sup> p. 7

**PHYSICAL ATTRIBUTES** are physical characteristics of the earth such as mountains, lakes, rivers, soil, and climate. p. 8

**USER COMMUNITIES** are a forum where GIS users can ask specific questions regarding their GIS work.<sup>20</sup> p. 28

## LINKS TO EXAMPLES

**GIS IMPLEMENTATION MODEL FOR SMALLER JURISDICTIONS** [www.oregon.gov/geo/Documents/Local%20Government%20GIS%20Road%20Map.pdf](http://www.oregon.gov/geo/Documents/Local%20Government%20GIS%20Road%20Map.pdf) p. 38


**HELPER LIGHTING INVENTORY DASHBOARD** [arcg.is/1yOeel](http://arcg.is/1yOeel) p. 24

**MAPPING FLOOD RISK IN EASTERN TOOELE COUNTY STORYMAP** [arcg.is/0jnKG](http://arcg.is/0jnKG) p. 15

**MAPS ON THE HILL ARCHIVE** [gis.utah.gov/about/maps-on-the-hill](http://gis.utah.gov/about/maps-on-the-hill) p. 19

**UTAH WILDFIRE RISK ASSESSMENT PORTAL** [wildfirerisk.utah.gov](http://wildfirerisk.utah.gov) p. 13





“GIS technology is moving very fast, and when it comes to GIS in planning, I’m afraid that the communities with little to no resources may get further behind.”

*Nate Wiberg, Five County AOG Planner*

## INTRODUCTION

A Geographic Information System (GIS) is a framework for gathering, managing, and analyzing geographic data. The keyword to this technology is geography, meaning that some portion of the data is referenced to locations on the earth.<sup>1</sup>

GIS is able to integrate different types of geospatial data and organize layers of information into visualizations such as maps and 3D scenes. GIS reveals deeper insights into data, such as patterns, relationships, and situations. It helps people gain actionable intelligence and make informed decisions.<sup>2</sup>

GIS allows a municipality to better manage their assets, communicate and collaborate, identify patterns, and combine a variety of geographic data in different ways. A solid GIS program consists of trained staff and a set of information technology tools that capture, store, manipulate, analyze, manage, and present geographically referenced data.<sup>3</sup>

### NEW TERMS

**GIS** is an acronym for Geographic Information Systems.

**Geospatial data** refers to data that is referenced to locations on the earth and can be mapped using GIS tools and software.

## A VERSATILE TECHNOLOGY

Geographic Information Systems are used by hundreds of thousands of organizations and individuals every day to make informed decisions while also saving time and money. In the planning and municipal management fields, GIS has become a valuable and versatile tool and resource. Municipalities use GIS to:<sup>4</sup>

- Manage community infrastructure and assets
- Estimate future growth demands
- Optimize public safety information and reporting
- Expand public engagement opportunities and platforms
- Share, collect, and analyze critical physical and cultural municipal data

While GIS-related tools have become an integral part of municipal management and planning, not all communities have been able to maximize the use of these important geospatial resources. Barriers such as lack of trained staff, restricted finances, limited capacity, and lack of awareness can make the integration of GIS into municipal management extremely difficult. Small rural communities often perceive GIS as a tool only available to large urban areas. As a result, many small towns may overlook the use of GIS tools and resources entirely.



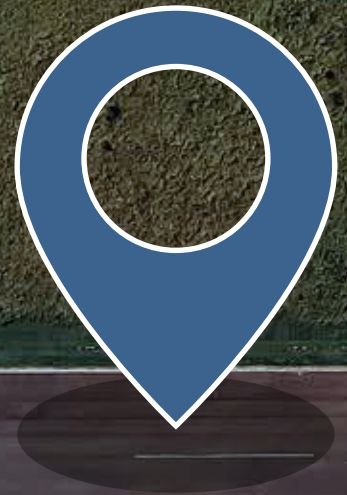
### **GIS CAPABILITY IS A CORE CONCERN FOR LOCAL LEADERS**

A 2017 statewide survey of communities under 10,000 people found that 57 percent of the 47 respondents felt they lacked adequate GIS skills relative to their community needs. In verbal responses to interviews, leaders from across Utah identified lack of GIS capability as a core concern in municipal management out of 47 responses representing 24 of 29 counties.<sup>5</sup>

The intent of this guide is to provide small town leaders, planners, and managers with a basic understanding of GIS and how GIS technology can support planning and municipal management activities. This guide gives an overview of what GIS is, how it can aid local governments, and outlines strategies for overcoming actual and perceived barriers to GIS implementation – especially those that inhibit small towns.



# THE VALUE OF GIS TECHNOLOGY



“ For local governments looking for ways to build safe, healthy, and resilient communities for their constituents, mapping and analytics using GIS offer new insights for delivering services more effectively and engaging residents more fully. GIS technology gives governments and their citizens access to the information they need to make more informed decisions.”<sup>6</sup>

*The Environmental Systems Research Institute (ESRI)*



An aerial photograph showing a two-lane asphalt road with white dashed lane markings. The road is flanked by lush green grass. In the upper right corner, a portion of a building with a red roof is visible. The overall scene is a rural or semi-rural landscape.

## MUNICIPALITIES RELY ON SPACIAL DATA

Local governments rely on data to make informed decisions on a daily basis. Geospatial data is essential when it comes to answering spatially-dependent questions that have an impact on municipal growth and development, quality of life, and public safety.

### **QUESTIONS A MUNICIPALITY CAN ANSWER WITH GIS TECHNOLOGY**

- Where is the best location for a new community park?
- How can we optimize community services like fire and police response, garbage pickup, or snow removal?
- In what way could a zoning adjustment attract new businesses and promote economic growth?
- What public infrastructure should be repaired or replaced first?
- How can we make it safer and easier for children to get to and from school?
- To what extent will a natural disaster event damage public and private property?





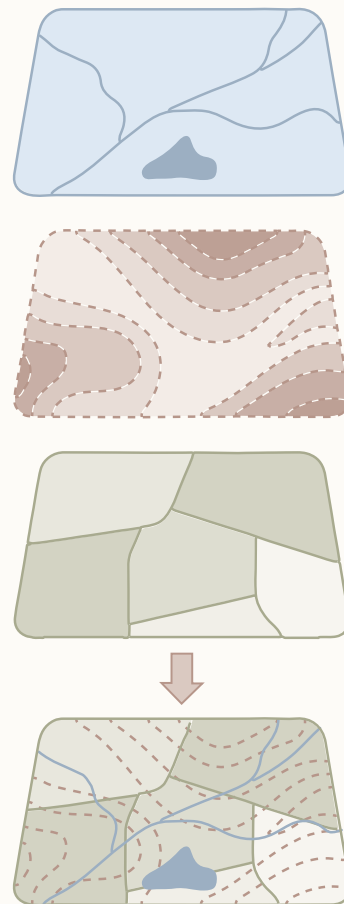
## GIS ANALYSIS & SOFTWARE

Geospatial analysis is how a person can answer questions and solve problems within a Geographic Information System. Before the use of computers, early geospatial analysis was performed by arranging transparent maps over one another to observe relationships between different physical and cultural attributes. Today, through the use of technology, those same attributes and data layers can be manipulated and analyzed using GIS software. GIS software facilitates how municipalities can utilize spatial data to their best advantage.

### NEW TERMS

**Data layers** refer to various data that can be overlaid visually in order to generate an image that incorporates all the information in a meaningful way.<sup>7</sup>

**GIS software** is a computer-based tool capable of storing, retrieving, managing, displaying, and analyzing geospatial data.<sup>8</sup>





# A WORD ON ATTRIBUTES

GIS empowers communities with spatial information that can be easily understood and acted upon. Spatial data is powerful because it can be visually mapped as well as linked to descriptive and numerical data that are easily accessible in spreadsheets or tables.

## NEW TERMS

**Physical attributes** are physical characteristics of the earth such as mountains, lakes, rivers, soil, and climate.

**Cultural attributes** are related to the built environment and include elements such as buildings, roads, public utilities, historic structures, and local parks.

Spatial data can represent both physical and cultural attributes of a specific locality or region. The world is a dynamic place and geospatial data can be updated, removed, or refined to reflect changing circumstances within a Information System. Physical and cultural attributes can include information associated with imagery, boundaries and places, demographics and lifestyles, basemaps, and transportation.<sup>9</sup>

 Canyon: Physical Attribute

 Library: Cultural Attribute

ATTRIBUTE TABLE SAMPLE: Statewide Library Locations

LIBRARY NAME	ADDRESS	CITY	COUNTY	PHONE
Cache County Library	15 N MAIN ST, PROVIDENCE UT 84332	PROVIDENCE	Cache	435-752-7881
Hyrum Library	50 W MAIN ST, HYRUM UT 84319	HYRUM	Cache	435-245-6411
Utah State University - Merrill-Cazier Library	3000 OLD MAIN HILL, LOGAN UT 84322	LOGAN	Cache	435-797-2633
Brigham City Library	26 E FOREST ST, BRIGHAM CITY UT 84302	BRIGHAM CITY	Box Elder	435-723-5850

# LOCAL GIS APPLICATIONS

## 📍 WASHINGTON CITY HOUSING LOCATION ANALYSIS

ANALYSIS & MAPS COURTESY OF NATHAN WIBERG, FIVE COUNTY AOG PLANNER

The Washington City Moderate-Income Housing Plan Implementation Team determined that a housing location analysis would foster discussion of appropriate locations for moderate income housing.

The goal for this analysis was to determine optimum locations for moderate income housing projects and to influence appropriate regulatory decisions as a result.

### MODERATE INCOME HOUSING LOCATION REQUIREMENTS

1. Locations that provided **access to a wide range of goods and services** such as medical care, education, and fresh food.
2. Locations that provided access to goods and services **via a variety of transportation methods** such as walking, biking, and public transit.

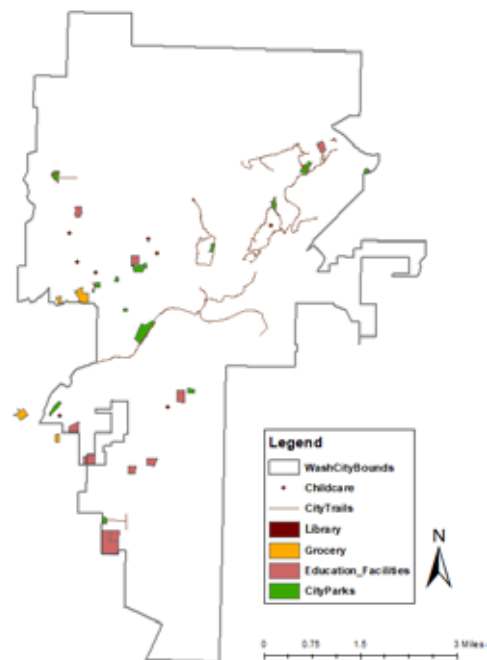
## 📍 THE PROCESS

### STEP 1 CRITICAL FACILITIES WERE DETERMINED

Critical facilities such as libraries, grocery stores, childcare facilities, education facilities, parks and open space, transit stops, job centers, and medical facilities, were located.

### STEP 2 WALKABLE ROADS WERE LOCATED

Sidewalks, crosswalks, pedestrian paths, and walkable roads were located.



Step 1: Washington City's critical facilities.

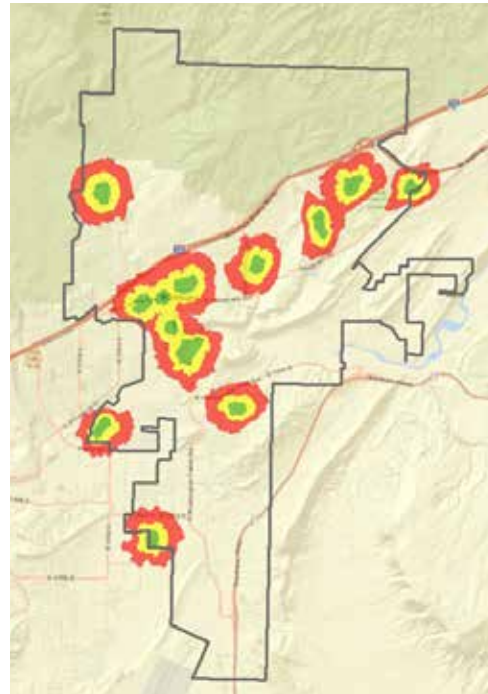


### STEP 3 DISTANCES FROM CRITICAL FACILITIES WERE DETERMINED

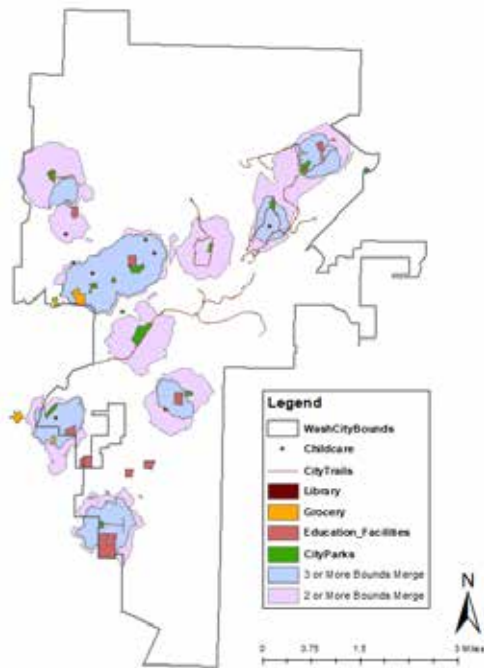
The Euclidean distance tool was used to determine distances from each critical facility along the network of walkable roads, paths, and sidewalks.

### STEP 4 THE EASIEST PATH WAS IDENTIFIED

The Cost Distance tool applied the classification results from the Euclidean distance analysis to determine the easiest path. In this case, the easiest path was along the roadways. A maximum half mile walking distance was used around the facilities.



Step 4: Determining the easiest path using the cost distance analysis tool.



Step 5: Areas that intersect three or more facility zones.

### STEP 5 AREAS THAT INTERSECT WERE LOCATED

Areas that intersected three or more of the determined facility zones were identified.

### STEP 6 BUILDABLE PARCELS WERE IDENTIFIED

Buildable parcels were identified by overlaying prime facility zones with existing parcel data. Unbuildable parcels were removed at a later time based on specific criteria such as steep slopes, poor soils, or floodplains. Parcels that need to be subdivided or rezoned to build units within the boundaries met the intent of the analysis.

## HOUSING LOCATION ANALYSIS CONCLUSION

There were several areas within Washington City that were within walking distance of three or more identified facilities. The area with the most vacant lots was also in proximity to the most critical facilities.

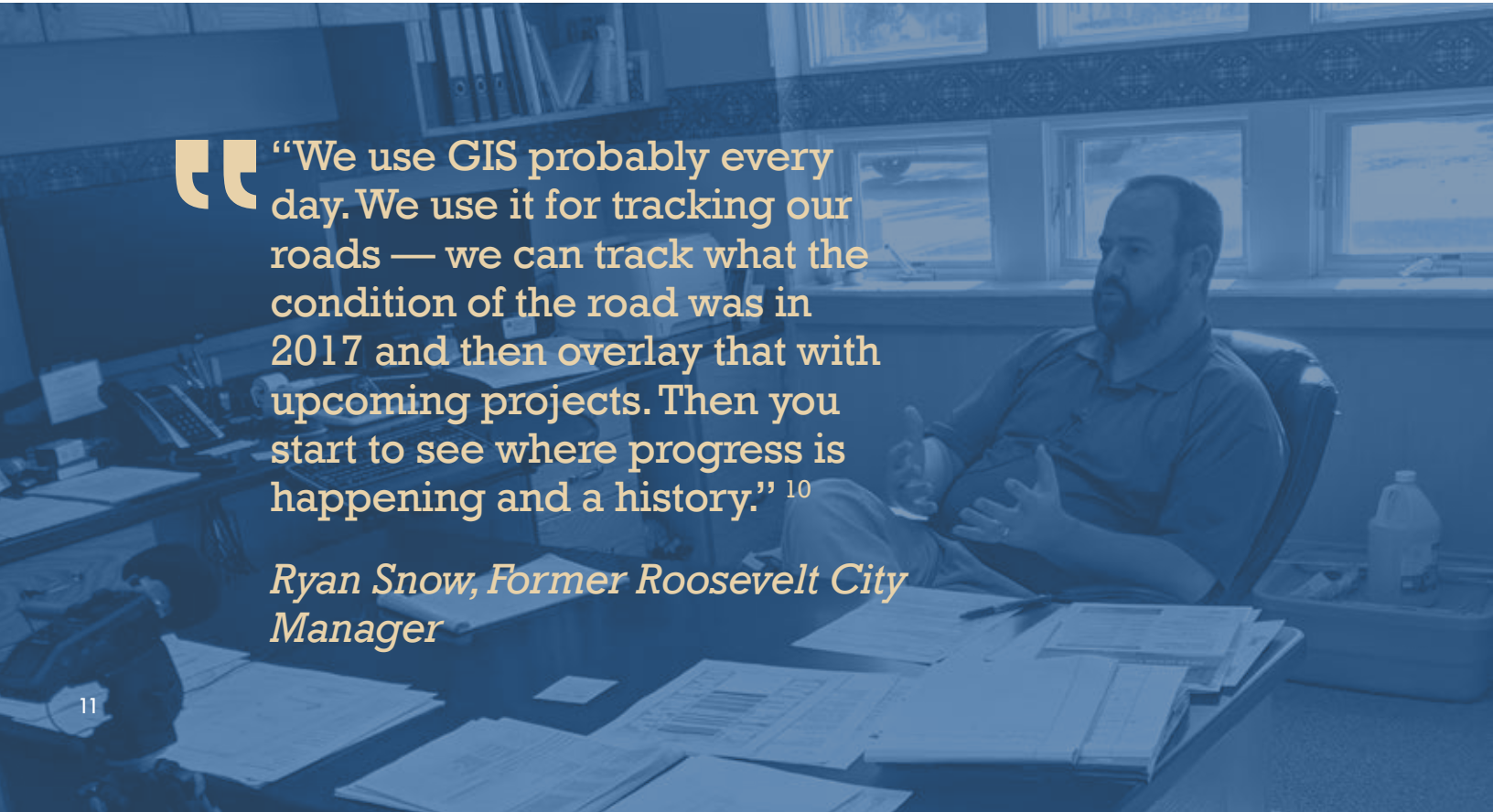
## MANAGING CAPITAL ASSETS IN ROOSEVELT CITY

Roosevelt is utilizing GIS to record institutional knowledge about the city's infrastructure such as sidewalks, trip hazards, size of water lines, and where fire hydrants are located.

The city is also using GIS to track the condition of infrastructure. "We use GIS probably every day. We use it for tracking our roads — we can track what the condition of the road was in 2017 and then overlay that with upcoming projects. Then you start to see where progress is happening and a history," says former City Manager Ryan Snow.

Roosevelt uses GIS to identify where important infrastructure, such as water lines, need to be fixed or replaced. The city's public works director is being trained and becoming acquainted with the city's database and other staff are beginning to automatically record and track information for their departments in GIS.

Budgeting for capital improvements is also essential. Considering both public interest and current conditions, the city recently developed a refined list of roads targeted for repair. By strategically combining two years worth of the available budget, Roosevelt was able to address more road repair work by merging remaining funds from the current fiscal year with funds allocated for the next.



“We use GIS probably every day. We use it for tracking our roads — we can track what the condition of the road was in 2017 and then overlay that with upcoming projects. Then you start to see where progress is happening and a history.”<sup>10</sup>

*Ryan Snow, Former Roosevelt City Manager*



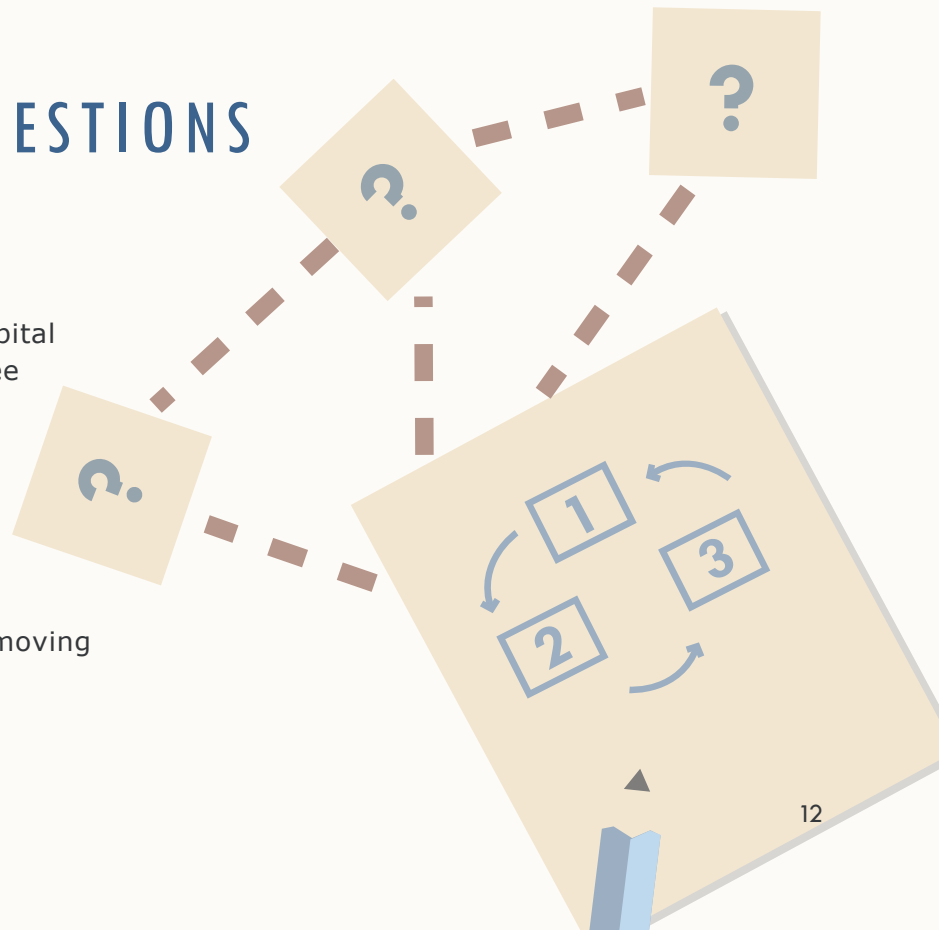
## OTHER WAYS A COMMUNITY CAN UTILIZE & BENEFIT FROM GIS TECHNOLOGY

- Manage community infrastructure and assets.
- Ease accessibility to public information with online zoning, utility and parcel maps, and other public data.
- Track and plan for infrastructure maintenance and updates related to water, sewer, electricity, and roadway infrastructure.
- Plan more effectively for the future.
- Visualize, explore, and assess the opportunities and challenges associated with future growth and development.
- Determine the most suitable locations for new homes, businesses, schools, and parks.
- Use printed base maps at public meetings to engage with citizens.
- Optimize public safety information and reporting.
- Support emergency response systems.
- Empower citizens to geographically pinpoint non-emergency issues, such as potholes and non-working light fixtures, and communicate those concerns to city management.
- Save time and money.
- Increase operational efficiency and effectiveness by consolidating a community's geospatial data and automating tasks.
- Analyze trends in order to allocate budgets and evaluate programs.
- Facilitate collaboration and data sharing between different sectors of local government.

## ASK THREE QUESTIONS

Roosevelt's approach to managing capital assets is to identify the infrastructure, record it, and make progress. As they develop their capital improvements plans, they ask three main questions:

1. What can we do with the funds we have?
2. How can we progress?
3. How do we manage so we are moving forward?



# EXPLORING WILDFIRE RISK WITH THE UWRAP PORTAL

Natural hazards are elements of the physical environment caused by forces outside of human control, such as wildfires, which can adversely impact human health, safety, and property because of their location, severity, and frequency.

The Utah Wildfire Risk Assessment Portal is the primary mechanism for Utah Division of Forestry, Fire, and State Lands to deploy wildfire risk information and create awareness about wildfire issues across the state.

It is comprised of a suite of applications tailored to support specific workflow and information requirements for the public, local community groups, private landowners, government officials, hazard-mitigation planners, and wildland fire managers.

Collectively these applications provide the baseline information needed to support mitigation and prevention efforts across the state.<sup>11</sup>

Visit [wildfirerisk.utah.gov](https://wildfirerisk.utah.gov) to learn more about the portal.



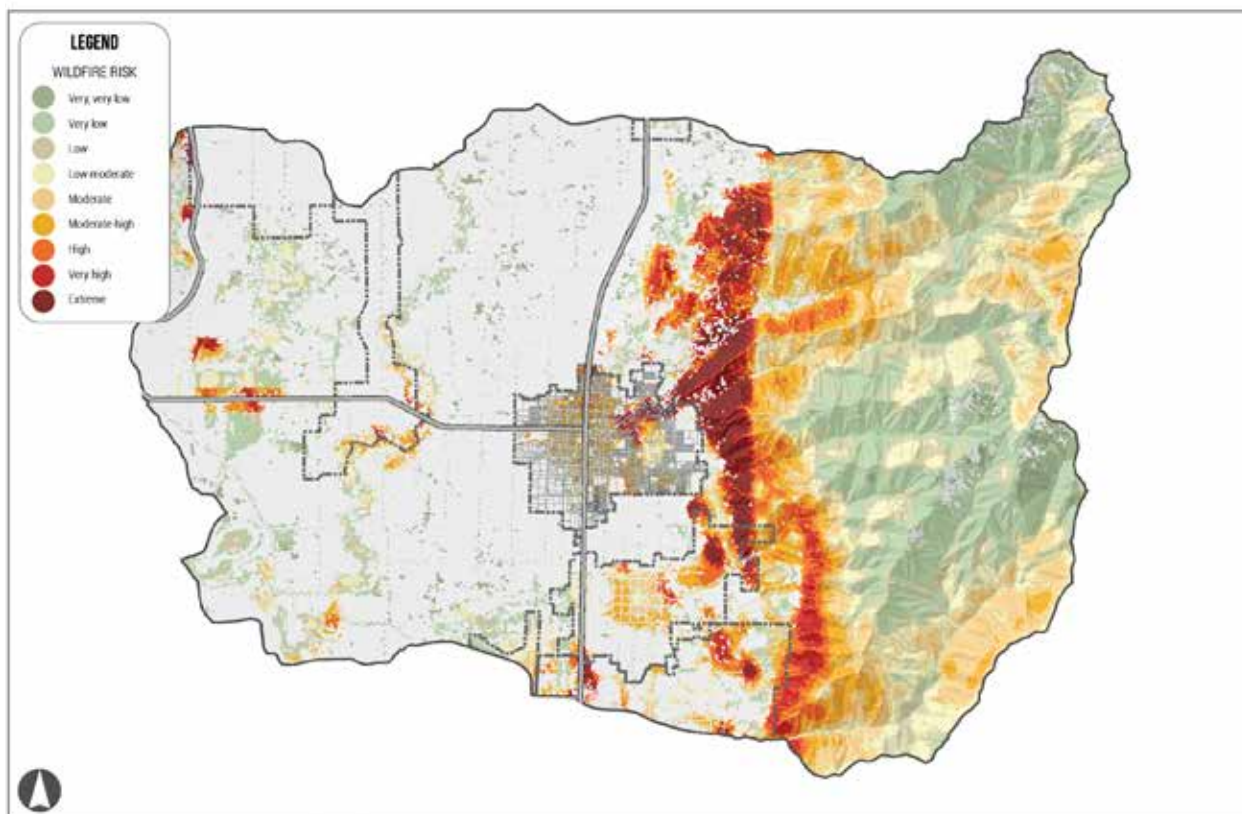


## UWRAP SUMMARY REPORTS

UWRAP map products and descriptions are designed to provide the information needed to support the following key wildfire risk management priorities:

- Identify areas that are most prone to wildfire.
- Plan and prioritize fuel treatment within programs.
- Allow agencies to work together to better define priorities and improve emergency response, particularly across jurisdictional boundaries.
- Increase communication with local residents and the public to address community priorities and needs.
- Identify areas where additional tactical planning may be desirable, specifically related to mitigation projects and Community Wildfire Protection Planning.
- Provide the information necessary to support resource, budget and funding requests.
- Plan for response and wildfire suppression resource needs.

*UWRAP mapping products were used to develop a wildfire risk map of the area surrounding Smithfield City.*



GIS DATA SOURCES: Utah AGRC, Oregon Dept. of Forestry, Smithfield City

**SMITHFIELD CITY**  
Natural Hazards  
Abiotic Classifications

**WILDFIRE RISK**

Disclaimer: This map was created by Utah's Rural Planning Group staff for the City of Smithfield and is for information purposes only. It is not intended to be used for legal, engineering, or surveying purposes. All information included is subject to change and users should consult with primary data sources for additional information or obtain more accurate data, if available.

# MAPPING FLOOD RISK IN EASTERN TOOELE COUNTY: A STORYMAP

COURTESY OF UTAH DIVISION OF EMERGENCY MANAGEMENT & HOLLY STRAND

The "Mapping Flood Risk in Eastern Tooele County" StoryMap was developed through a partnership between Tooele County Emergency Management, the Utah Division of Emergency Management, and FEMA. The StoryMap takes a complex and often data-centric topic, e.g. flood risk, and makes it approachable, engaging, and actionable for the residents of Tooele County.

## NEW TERM

**ArcGIS StoryMaps** offer a story authoring web-based application that can empower a municipality to share maps and geospatial data in the context of a narrative. StoryMaps can include maps, narrative text, lists, images, videos, embedded items, interactive elements, and other media.

Visit the StoryMap at: [arcg.is/0jnKG](http://arcg.is/0jnKG)

## APPROACHABLE

The Flood Risk StoryMap is organized into nine digestible sections and uses a simple tab-based navigation system to make it easy to find relevant information.

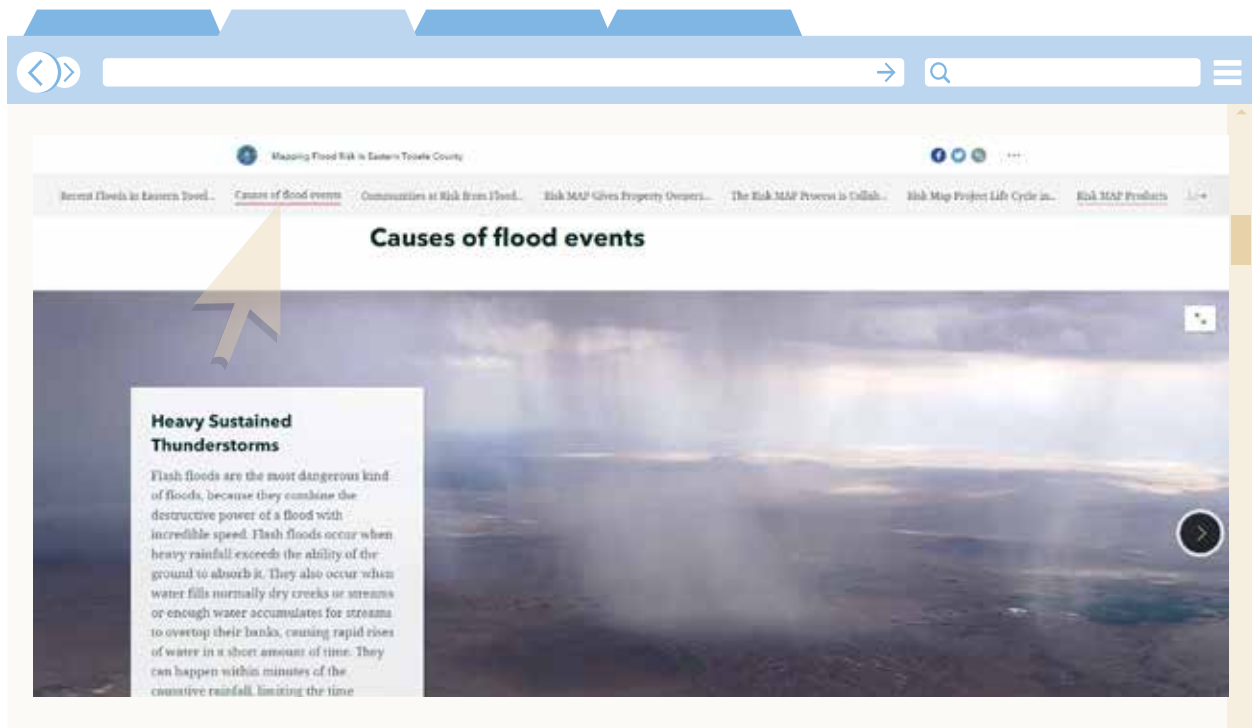


The StoryMap narrative begins with background information describing recent flood event in Eastern Tooele County.



## ENGAGING

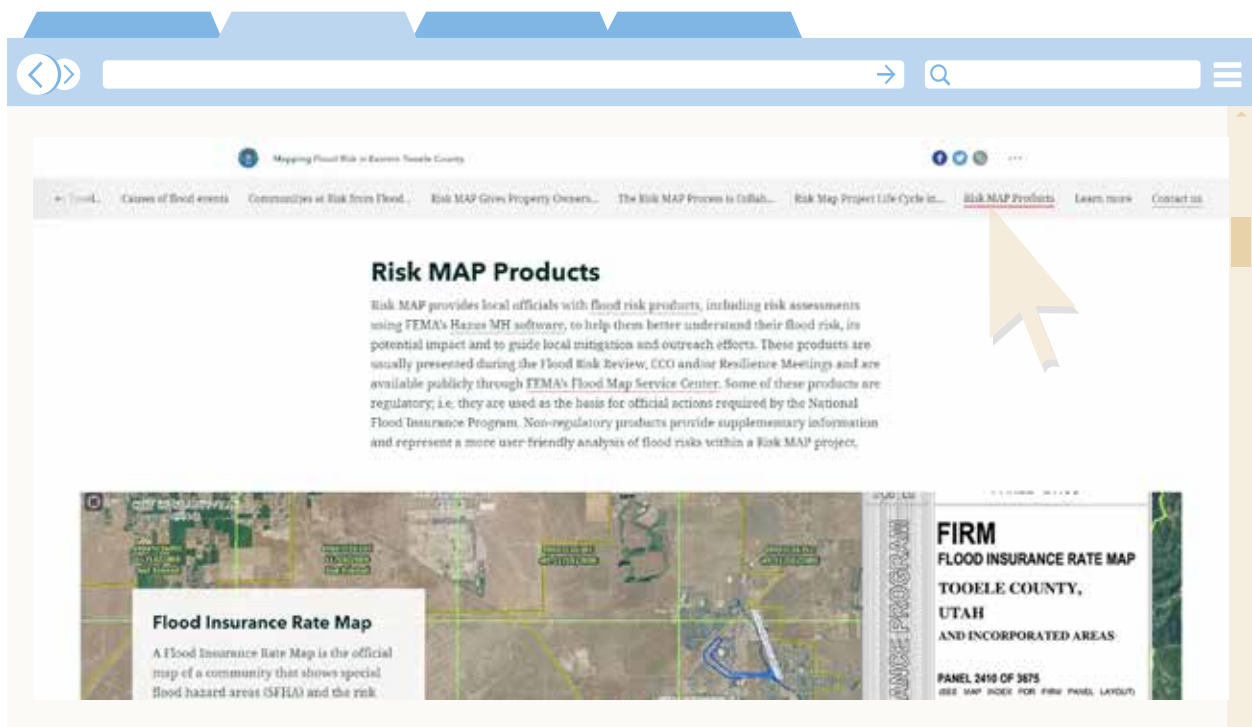
StoryMaps are visually attractive and offer a variety of ways to make content both engaging and educational.




Educating the public is a critical component of municipal management. In this section the audience can learn how flood events occur and which communities are most at risk of flooding.

## ACTIONABLE

The Flood Risk StoryMap make information actionable by providing links to Risk MAP products, resources to learn more, and the contact information of experts in the field.



The StoryMap provides links to important resources for improved floodplain management.



“ Most of my experience with communities and GIS is that they feel like it's over their head. I was at a hazard mitigation meeting a few weeks ago and someone said that GIS was out of their league. I cringed a little knowing that you don't have to be a GIS expert to interact with it.”

*Scott McComb, Former Bear River AOG Planner*

*Brian Carver interacts with a density exercise at the 2018 Cache Summit.*



# OVERCOMING BARRIERS

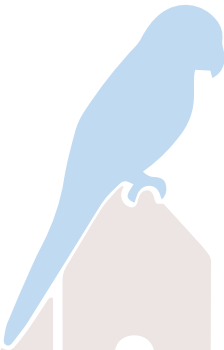
## GIS BENEFITS ARE UNIVERSAL

The perception that GIS is primarily an “urban tool” is an inaccurate one. Both urban and rural places can benefit from the use of GIS technology. A municipality’s needs and priorities will influence how and to what extent GIS is used as a municipal management tool. Just as physical and cultural attributes differ from place to place, a municipality’s GIS needs will also vary.

A larger city may be able to utilize the full array of GIS capabilities while a smaller town may benefit from just the basic applications. Because GIS is such a dynamic resource it can be used to support municipal management activities no matter the community size.

Common barriers to GIS implementation for small towns include lack of understanding and awareness, insufficient resources for training, lack of funding, and limited support for developing and maintaining GIS infrastructure.

The following sections describe strategies by which a small town with limited capacity can overcome common barriers to GIS implementation. The strategies are not listed in any particular order and are meant to provide a variety of options for consideration.



# BUILD YOUR GIS AWARENESS

It is not uncommon for local leadership to overlook the use of GIS technologies in their community simply because they seem inaccessible. In many instances a lack of understanding and awareness by community leadership are the foremost barriers to GIS implementation in small towns.

## MAPS ON THE HILL

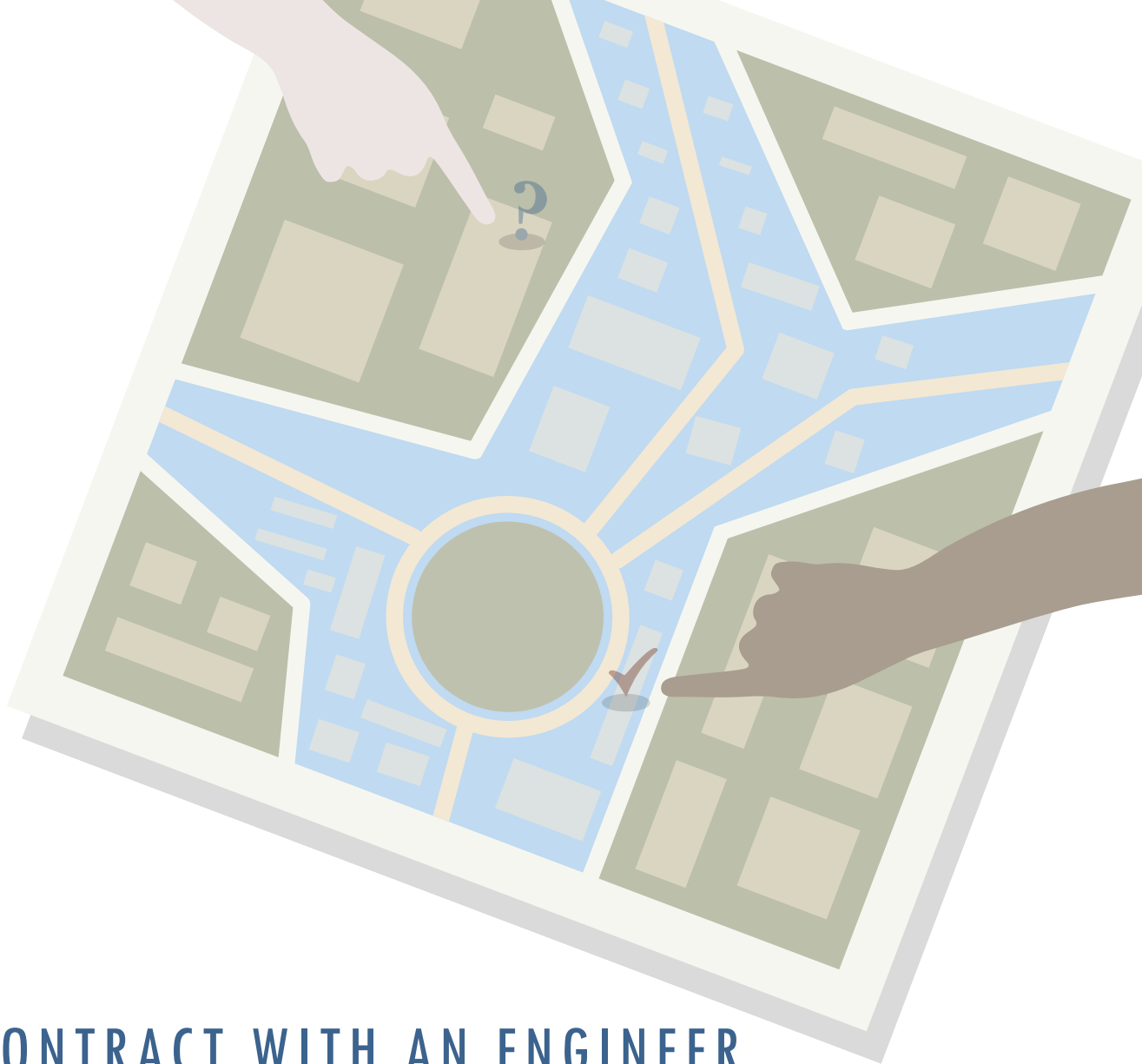
Over the past decade an annual event titled Maps on the Hill<sup>12</sup> has been held at the Utah State Capitol with the purpose of informing local officials at the state, county, and municipal levels about the diverse uses of GIS technology throughout the state of Utah.

During this event, GIS professionals as well as students present examples of their work and projects. While many of the presentations deal specifically with urban Utah, there are many examples of work and projects that are highly relevant to small towns.

Visit [gis.utah.gov/about/maps-on-the-hill](http://gis.utah.gov/about/maps-on-the-hill) to visit the Maps on the Hill archive.







## CONTRACT WITH AN ENGINEER OR CONSULTANT

Working with a consultant requires a robust scoping and procurement process. A city should have clear goals and objectives for deployment of GIS technology across their municipal services.

### **ACKNOWLEDGING LIMITATIONS**

One small Utah town is working to make public utility data available online while also acknowledging limitations to their own capacity to maintain and host a large database. Instead of giving up on the project, the town plans to contract with an engineering firm for the initial set up and ongoing maintenance of its GIS.

The engineering firm will maintain the data long-term, and the community will retain the ability to update and edit information and features as needed.




## ACCESS REGIONAL SUPPORT

For communities without the expertise or capacity to access GIS tools, regional GIS services may be a good option. Counties, special service districts, and other regional groups such as associations of governments, can pool efforts and resources to combine data, develop common applications, train users, provide services, and procure software and hardware when necessary.

Municipalities lacking independent financial or technical means can rely on the county or another regional entity to act as the GIS service provider. Regional planning and state development authorities may also act as GIS service providers. However structured, a regional GIS service agreement lowers barriers for using technology and extends regional capacity.<sup>13</sup>

*A list of county and regional contacts can be found on pages 33-35.*

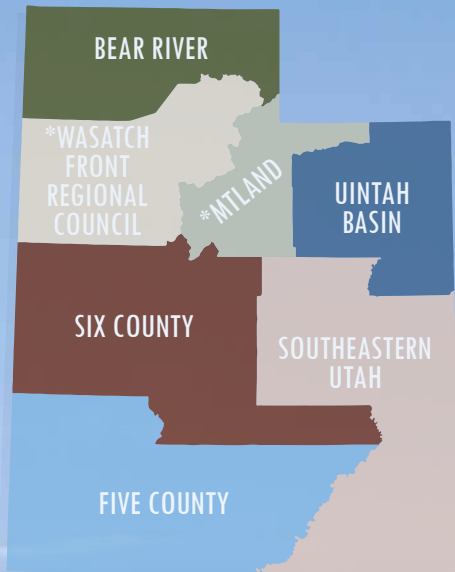


**Our agencies can help bridge the gap for the communities that have a difficult time affording GIS software or an engineer to do their GIS work. I believe that if we help small communities with general mapping as well as provide GIS analysis, we can help them save thousands of dollars per year"**

*Nate Wiberg, Five County AOG Planner*

*Wellsville Mountains, Arial view, Cache Valley UT. Photo by Steve Sellers*





## THE RURAL PLANNING PROGRAM

The Community Development Office works closely with regional planners in each Association of Governments (AOG) in order to provide direct assistance to communities. The program's mission is to help Utah's rural communities build knowledge, skills and abilities to achieve their goals.


The regional planners, also referred to as RPPs, can help bridge the gap for communities that cannot afford GIS software or an engineer's services. General mapping and analysis services provided by the RPPs can help communities save money while still accessing quality GIS services.

## A GLANCE AT REGIONAL GIS SUPPORT IN NORTHERN UTAH

EXAMPLES COURTESY OF ZAC COVINGTON, BEAR RIVER AOG PLANNER

In Bear River AOG, the regional planners have helped communities benefit from GIS in the following ways:

- Providing local land use mapping including zoning map updates.
- Parks, trails and open space mapping.
- Environmental overlay analysis for land use planning purposes.
- Specific GPS data collection such as existing tree inventories, trail delineations, and other detailed data collection.
- Hydrological analysis such as determining how many homes are in potential secondary water zones.
- Affordable housing planning including a geographic inventory of number of homes per moderate income level.
- Regional applications like pre-disaster mitigation planning and analysis, risk assessment and potential loss modeling.
- Data collection of existing critical facilities and infrastructure.



Helper in 2019 is going to be the field laboratory for the [University of Utah's] Dark Scholars Program. They'll be sending their kids down to help us with our light monitoring and help us achieve a reduction in light pollution."<sup>14</sup>

*Lenise Peterman, Helper City Mayor*

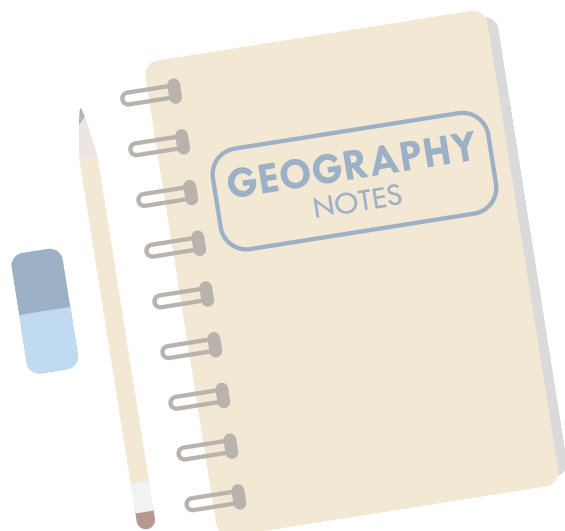
*Photo by University of Utah Drone Team*

## COLLABORATE WITH STUDENTS

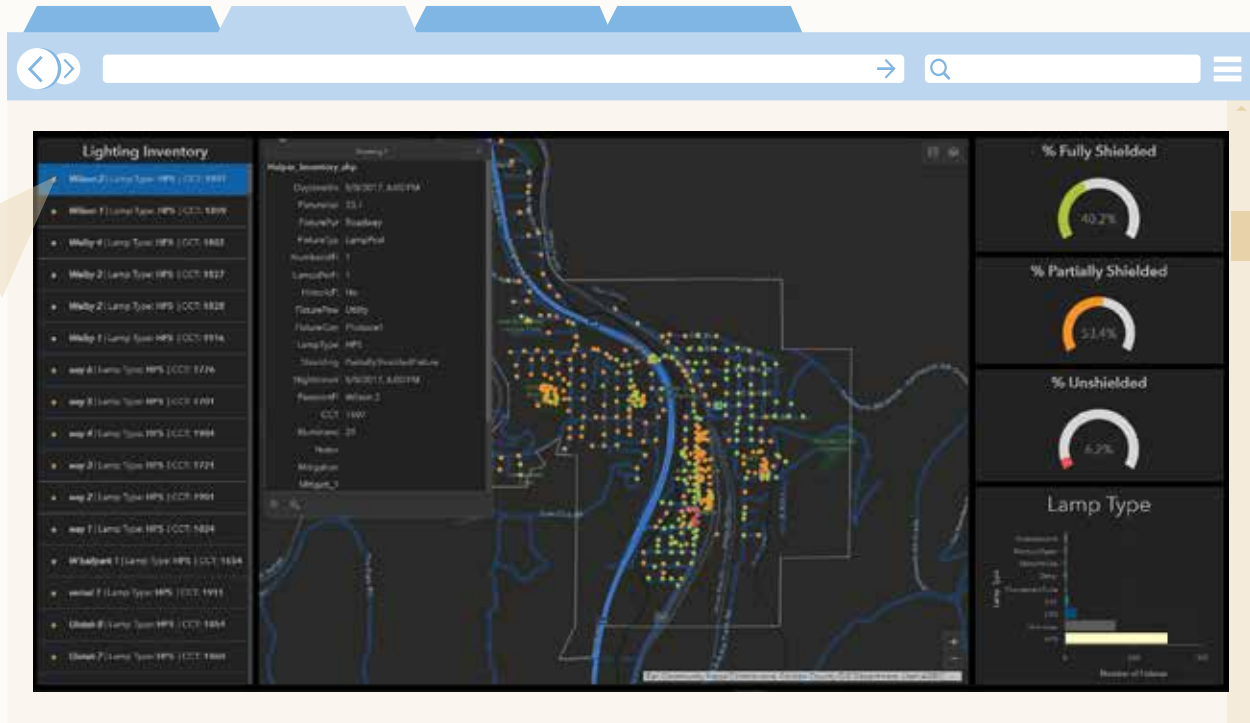
GIS services and project support can frequently be obtained through a college or university program. Schools with geography, landscape architecture, urban planning, engineering, or similar departments often have programs that connect students with real-world, community-based projects.

Student collaboration offers a more cost effective option than hiring a consultant and provides students with needed hands-on experience. Projects completed by students can also provide a foundation for future work done by a professional consultant.

Most universities cannot directly respond to a request for proposal due to the fact that they would almost always come in as the lowest bid. Municipalities seeking university assistance must approach them directly.







An online Dashboard provides a quick glance at Helper's lighting inventory data.

## COLLECTING DATA FOR HELPER

A partnership between the City of Helper and the University of Utah's Dark Sky Studies (DSS) minor has provided Helper with the data and technical support necessary to protect the community's rural dark skies.

The partnership began in 2017 when a group of University of Utah students performed a lighting inventory of all public light fixtures in town. From a facilities management perspective, this data empowers the community to better address residents' needs and complaints relative to public lighting. Long-term capital asset planning and budgeting is also improved due to the availability of accurate data.

### NEW TERM

**Dashboards** are essential information products, like maps and apps, providing a critical component to your geospatial infrastructure.<sup>15</sup>

An interactive ArcGIS Dashboard was later configured using the student-collected data. Data on light fixture locations, lamp types, and shielding states are all easily accessed online.

Students returned in 2019 with drones developed by the mechanical engineering program. With this new drone technology, DSS students were able to collect sky quality data and illuminance measurements for various locations throughout town.


Through this valuable partnership, Helper receives important resources, knowledge, and technology while students gain hands on experience, learn about public policy and ordinances, and engage closely with community members. In 2020 Helper was certified as Utah's second International Dark Sky Community thanks in part to the work of university students.<sup>16</sup>

Visit [arcg.is/1yOeeL](http://arcg.is/1yOeeL) to interact with the Helper Lighting Inventory Dashboard.

## FIND TRAINING OPPORTUNITIES & RESOURCES

Government officials of small towns can obtain GIS training from a variety of sources. Thanks to the Environmental Research Institute (ESRI) and other GIS providers, free beginner training sessions are widely available. Many of these are applicable to ArcGIS Online as well as the platform-based ArcMap and ArcGIS Pro.

In addition to free training, supplemental lessons are available for purchase from ESRI<sup>17</sup> and other GIS providers. Open source GIS platforms, such as QGIS, also have training resources that are tailored towards their specific platforms.



“Now that Six County has the option of providing GIS access to communities, we are looking forward to being able to offer base mapping services and tools for analysis of map data. Our goal is to make available this valuable resource to communities in our area when they are in the process of planning and looking towards the future.”

*Zach Leavitt, Six County AOG Planner*





## **TRAIN YOURSELF: A SIX COUNTY SUCCESS STORY**

COURTESY OF ZACH LEAVITT, SIX COUNTY AOG PLANNER

Six County Association of Governments (SCAOG) recently developed the capacity to offer GIS-related community support after their Regional Planner, Zach Leavitt, taught himself how to use the open source GIS platform Q-GIS.

In determining how to meet the region's GIS needs, Zach searched for cost and time-effective training opportunities. Most methods of learning were prohibitively expensive or not available in rural Utah so Zach taught himself by studying user manuals or consulting with mentors who could walk him through system basics. After exploring different software options, Zach determined that Q-GIS would be the best option based on his capacity and Six County's GIS needs. Free trainings created by the QGIS community were useful as Zach taught himself how to use the software.

Services now provided by Six County Association of Governments:

- City maps with road network data, proposed annexation areas, zoning areas, utilities, proposed bike trails, etc.
- Maps as public input tools to allow people to see what the challenges and opportunities of a particular plan could be.
- Maps for providing insight and answering questions such as determining areas that need more attention for fire mitigation efforts within city boundaries.

# EXPLORE AVAILABLE SOFTWARE OPTIONS

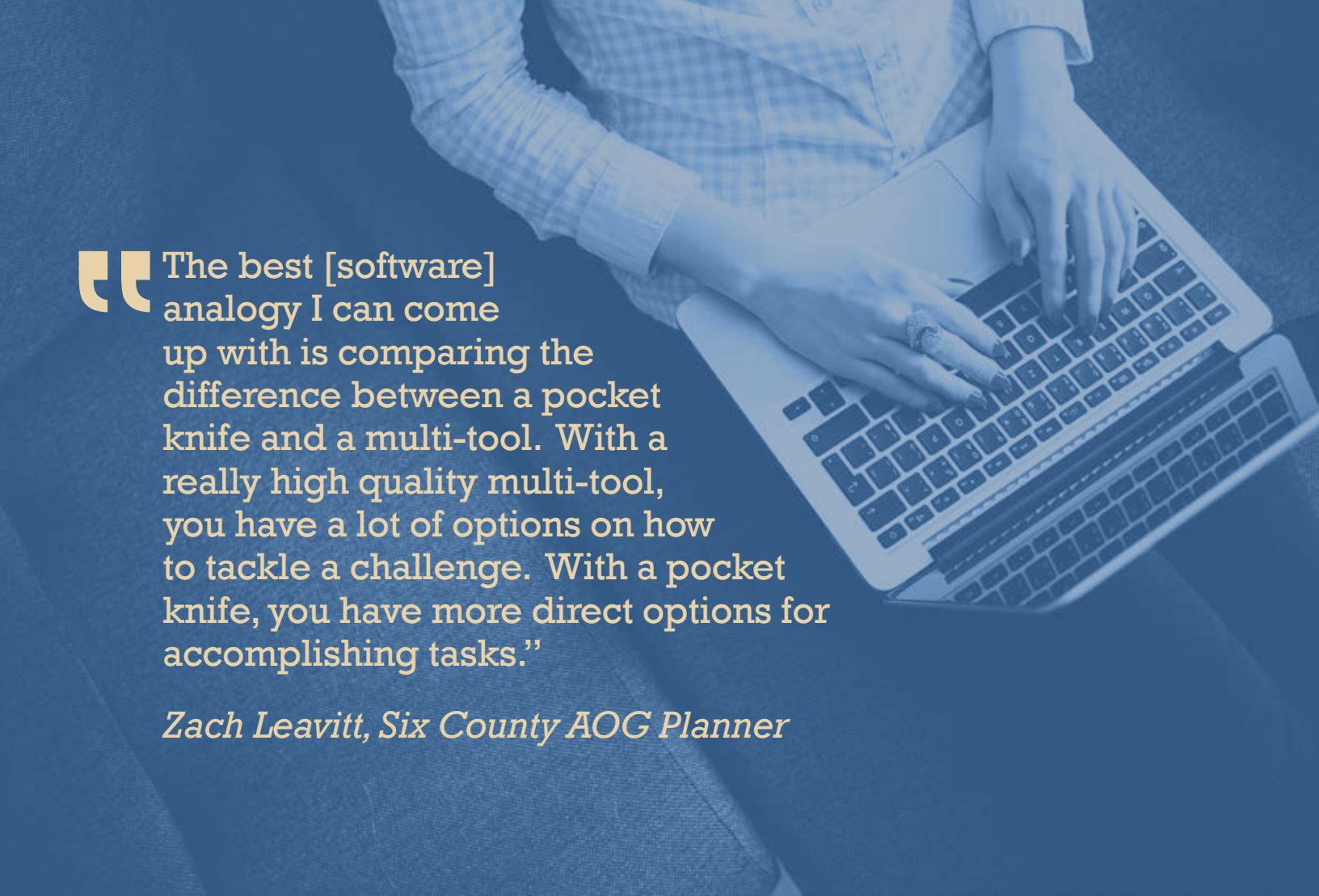
Purchasing GIS software is not a feasible option for everyone and before considering any technology options, a municipality, county or region must determine how a new technology will address specific goals and needs.

When it is the best option, a variety of excellent GIS software options exist – some of which are free. The chart below compares five software options based on cost, user community, and capabilities.<sup>18</sup> Budget and skill level of current staff will be important considerations in order to determine which option is best for your situation.<sup>19</sup> These five software options simply offer a starting point and additional possibilities should be explored.



SOFTWARE	COST	USER COMMUNITY	CAPABILITIES	WEAKNESSES
ArcGIS Desktop and ArcMap Pro (ESRI)	\$\$\$	★★★★★	Customizable, scalable, cloud-based/web mapping capabilities. ArcGIS is the industry standard.	Can be expensive, occasional crashes and stability issues
ArcGIS Online	\$\$	★★★★★	A little cheaper than ArcGIS Desktop, can be housed on the cloud, simplified functions that are useful for those new to GIS	Lacks some of the features of ArcGIS Desktop
QGIS (Quantum GIS)	Free	★★★★★	Open source, can extend abilities through plugins, large online user base	Plugins and tools lack organization
GRASS GIS	Free	★★★★☆	Great for geoprocessing, LiDAR, and network analysis	Steep learning curve, clunky user interface
MapInfo	\$\$	★★★★☆	Ease of use, faster processing, good table management	Poor formatting and support





“The best [software] analogy I can come up with is comparing the difference between a pocket knife and a multi-tool. With a really high quality multi-tool, you have a lot of options on how to tackle a challenge. With a pocket knife, you have more direct options for accomplishing tasks.”

*Zach Leavitt, Six County AOG Planner*

## **A LONG-TERM COMMITMENT**

Establishing a quality Geographic Information System is a long-term commitment and it is important to consider the price of yearly license renewal fees, software updates and maintenance, plugins, hardware requirements, and training expenses.

If there is space in the budget for a town or region to look into more expensive options, ESRI is willing to work with small towns on cost and has several different pricing options depending on user needs. Also consider how GIS software requirements may differ at local and regional levels.

A user community or forum is a space online where GIS users can ask questions regarding issues they encounter in their GIS work. Some of these forums are supported directly by the software company and others are independent. These user communities help software writers improve their products; this is one reason to choose a GIS platform that is used by many other people.

## **NEW TERM**

**User communities** are a forum where GIS users can ask specific questions regarding their GIS work.<sup>20</sup>



# CONCLUSION

## GIS SHOULD ALWAYS SERVE A COMMUNITY'S VISION

There are many ways in which a municipality with limited resources can benefit from GIS. In summary, local leadership can:

- Build your GIS awareness
- Contract with an engineer or consultant
- Access regional support
- Collaborate with students
- Find training opportunities & resources
- Explore available software options

Before pursuing any one strategy, it is critical that local leadership answer the question: **"How will GIS technology best serve our community and help us to achieve our goals?"** GIS integration should always serve a community's vision for the future.<sup>21</sup> See page 37 for a GIS implementation model case study.





## **ONE LAST STOP IN HELPER**

NARRATIVE COURTESY OF MAYOR LENISE PETERMAN

With a Public Works Director close to retirement, Helper City realized the need to have a clear roadmap for the long-term maintenance of the city's infrastructure systems. City leadership began to discuss the use of GIS technologies to better maintain city infrastructure in 2018 after Helper's water and sewer system data was incorporated into a GIS tracking system during an engineering project.

Discussions revolved around the need to incorporate all infrastructure data into a city-accessible system incorporating electrical, road and even signage data.

The city's plan and vision for GIS integration is to maintain, update, record, and share infrastructure data while incorporating a sustainable maintenance plan. GIS will be used to track and maintain city infrastructure systems and allow for a more robust understanding of where and when something has occurred – be it a repair or maintenance activity.





“ There is no logic that can be superimposed on the city; people make it, and it is to them, not buildings, that we must fit our plans.”<sup>22</sup>

*Jane Jacobs*





# RESOURCES

## COUNTY GIS CONTACTS

Most counties have a GIS Specialist or general contact in their public works or planning department. Find out if your county has a GIS contact or contacts below (*excludes Davis, Salt Lake, Summit, Utah, Wasatch, and Weber Counties*).

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### CACHE

**Cary Jenkins**

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### CARBON

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## **WAYNE**

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### **Rhett Jeffery**

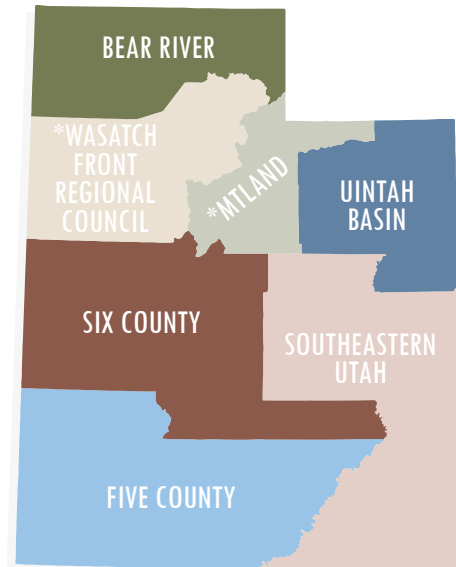
Wayne Co Road Dept Supervisor  
435-836-2682  
*rjefferywcrd@gmail.com*

# REGIONAL SUPPORT

## RURAL PLANNING PROGRAM

The Community Development Office (CDO) works closely with Regional Planners (RPPs) in each Association of Governments\* in order to provide direct technical assistance and resources to communities.

*\*Contact Christy Dahlberg [christy@wfrc.org](mailto:christy@wfrc.org) for Wasatch Front Regional Council or Robert Allen [rallen@mountainland.org](mailto:rallen@mountainland.org) for Mountainland.*



### BEAR RIVER AOG

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435-713-1420  
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**Community Dev. Office**  
[housing.utah.gov/community](http://housing.utah.gov/community)  
[community@utah.gov](mailto:community@utah.gov)



# STATE RESOURCES

## UTAH AGRC

**Website:** [gis.utah.gov](http://gis.utah.gov)

The Automated Geographic Reference Center (AGRC) is the State of Utah's map technology coordination office. AGRC staff (directory/contacts) have knowledge and experience in Geographic Information System (GIS) desktop software, hosted map- and web-services, mapping data resources, and GIS professionals and their activities around the state.

### CONTACT

**Matt Peters**

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**Jake Adams**

GIS Applications & Services  
385-499-0786  
[jadams@utah.gov](mailto:jadams@utah.gov)

## UTAH GEOGRAPHIC INFORMATION COUNCIL (UGIC)

**Website:** [ugic.org](http://ugic.org)

UGIC is a nonprofit organization whose mission is to lead the effective application of geographic information in Utah. It is their vision to provide a modern, accurate, documented, and accessible geospatial information infrastructure for all of Utah.

### CONTACT

[ugic.utah@gmail.com](mailto:ugic.utah@gmail.com)

## COMMUNITY DEVELOPMENT OFFICE

**Website:** [jobs.utah.gov/housing/  
community](http://jobs.utah.gov/housing/community)

### Mapping & Technical Assistance (M-TAP)

The Mapping and Technical Assistance Program (M-TAP) provides rural municipalities with resources to overcome actual and perceived barriers to using Geographic Information Systems. The program connects municipalities with appropriate state, regional, and local resources, and provides basic mapping and geospatial analysis assistance to small towns with limited capacity.

### CONTACT

**Aubrey Larsen**

M-TAP Program Coordinator  
435-213-7026  
[aubreychristensen@utah.gov](mailto:aubreychristensen@utah.gov)

### Capital Asset Self Inventory (CASI) ArcGIS Database

The Capital Asset Self-Inventory (CASI) Program offers a suite of resources and tools in support of community-performed capital asset inventories. In partnership with the AGRC, the Community Development Office has established an ArcGIS Online Organization which provides a platform for communities to gather, store, and analyze capital asset inventory data.

### CONTACT

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435-690-9992  
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# GIS IMPLEMENTATION MODEL FOR SMALLER JURISDICTIONS

## A CASE STUDY AT THE CITY OF HOOD RIVER, OREGON<sup>23</sup>

The city of Hood River, Oregon is a resort town with a population of 7,686 located approximately 60 miles east of Portland. The City's Public Works Department has historically been the primary source for maintaining spatial city infrastructure information including streets, parking meters, parks, sanitary and stormwater collection systems, and the city water system. GIS services have been supplied to the City by the Hood River County GIS department.

Hood River recently determined that having its own GIS technology would improve municipal efficiency, effectiveness and transparency and the decision to commit to a more robust system - including migration from Computer-aided design (CAD) to a GIS platform - was influenced in part by positive exposure to the capabilities of GIS technology.

For the City of Hood River, the key to successful GIS implementation has been a collaborative effort between the City's Public Works Department, City executives, regional, and county stakeholders. Below is a summary of the GIS planning and implementation process that Hood River followed.

### 5 MOST IMPACTFUL ACTIVITIES

1. Developing a roadmap to guide and communicate the strategic planning process.
2. Conducting in-depth interviews with staff and partners about the current GIS situation, immediate needs, and future potential uses.
3. Conducting a goal-setting and prioritization session with City stakeholders.
4. Developing a strategic plan addressing the identified goals and priorities.
5. Developing a draft GIS implementation plan to be expanded on, and adopted.



## TOP 10 ADVICE

1. Governance must be led by a decision-making body.
2. Increase GIS capacity and capabilities through collaborative partnerships.
3. Take advantage of grants to support initial needs assessment.
4. Allow sufficient time for stakeholders to participate in the strategic planning process.
5. Let shared business needs drive the strategic plan.
6. Establish metrics to measure progress.
7. Augment GIS capacity by sharing services and staff.
8. Use internships to quickly boost staffing.
9. Seek out existing information regardless of format.
10. Developing a business case can increase participation and buy-in.

Read the full case study at: [www.oregon.gov/geo/Documents/Local%20Government%20GIS%20Road%20Map.pdf](http://www.oregon.gov/geo/Documents/Local%20Government%20GIS%20Road%20Map.pdf)

“...the City of Hood River has made significant progress toward implementing and sustaining GIS capacity in order to facilitate its business and better serve its citizens and partners, while keeping costs relatively modest. The conduct of the planning process and the plans resulting from it have ensured well-rounded participation, orderly implementation, and a method to assess progress (p. 24).”

# GENERAL INFORMATION

## GIS DESCRIPTIONS

<https://researchguides.library.wisc.edu/GIS>

[https://www.caliper.com/maptitude/gis\\_software/default.htm](https://www.caliper.com/maptitude/gis_software/default.htm)

## GIS PRICING RESOURCES

<https://www.esri.com/en-us/arcgis/products/arcgis-online/pricing>

<https://www.esri.com/en-us/industries/enterprise-agreement/government>

## GIS TRAINING RESOURCES

<https://www.esri.com/training/catalog/search>

<https://gisgeography.com/free-esri-training>

## GIS KNOWLEDGE AND DATA RESOURCES

<https://gis.utah.gov/>

<https://utah.maps.arcgis.com/apps/Cascade/index.html?appid=5f15c60c02ef44459b3ce0f52f846aa1>

<https://gis.utah.gov/about/maps-on-the-hill/>

<https://www.esri.com/esri-news/arcwatch/archives>

<https://www.esri.com/esri-news/arcnews/winter18articles/accelerating-small-town-services>

<https://www.esri.com/esri-news/arcwatch/0115/small-town-big-dreams>

<https://www.esri.com/en-us/industries/government/departments/community-development>

<https://articles.extension.org/pages/69979/perseverance-pays-off:-how-a-small-community-in-iowa-put-gis-to-work>

## GIS SOFTWARE COMPARISONS RESOURCES

<https://gisgeography.com/mapping-out-gis-software-landscape/>

<https://gisgeography.com/qgis-arcgis-differences/>

<https://www.g2crowd.com/categories/gis>

[https://en.wikipedia.org/wiki/Comparison\\_of\\_geographic\\_information\\_systems\\_software](https://en.wikipedia.org/wiki/Comparison_of_geographic_information_systems_software)

<https://gis.financesonline.com/>

[https://www.capterra.com/gis-software/?utf8=%E2%9C%93&users=&sort\\_options=Highest+Rated](https://www.capterra.com/gis-software/?utf8=%E2%9C%93&users=&sort_options=Highest+Rated)



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- 6 International City/ County Management Association. (2018). A Guide for Smart Communities: Using GIS Technology for Local Government Management. Retrieved from: [https://icma.org/sites/default/files/18-137%20GIS%20e-Primer%20Report\\_final.pdf](https://icma.org/sites/default/files/18-137%20GIS%20e-Primer%20Report_final.pdf)
- 7 Geospatial Analysis. Environmental Science: In Context. Retrieved from: Encyclopedia.com: <https://www.encyclopedia.com/environment/energy-government-and-defense-magazines/geospatial-analysis>
- 8 Maptitude: GIS Software: What is GIS Mapping Software. Retrieved from: [https://www.caliper.com/maptitude/gis\\_software/default.htm](https://www.caliper.com/maptitude/gis_software/default.htm)
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- 11 Oregon Department of Forestry 2020. Utah DNR Wildfire risk Assessment Portal. © 2020 Utah State Forestry. Retrieved from: <https://wildfirerisk.utah.gov>
- 12 Utah Geographic Information Council (UGIC) & AGRC. Maps on the Hill. Retrieved from: <https://ugic.org/maps-on-the-hill>
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