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15 REASONS TO EMBRACE GIS AS A TEACHING TOOL

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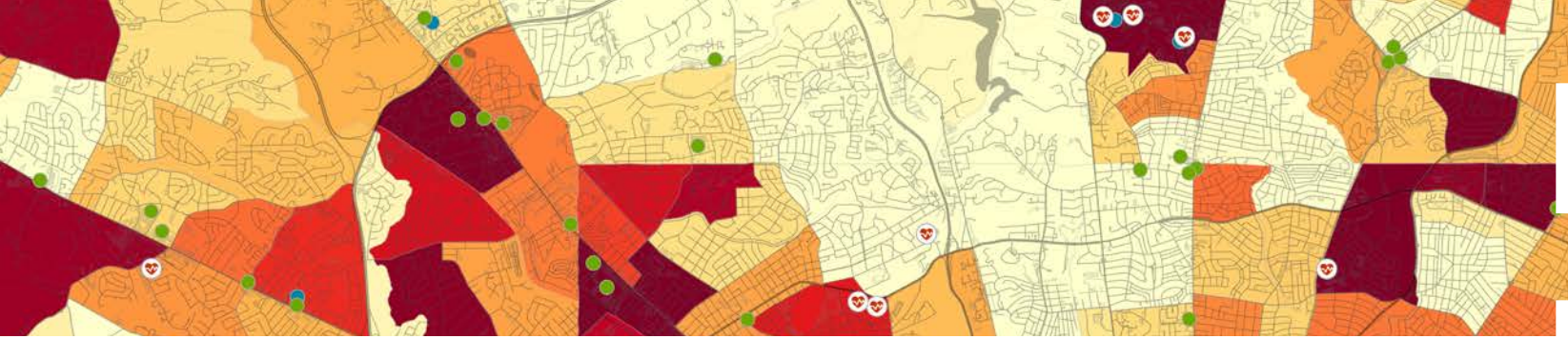
In an increasingly complex world, educators can embrace GIS as a tool for teaching and empowering students with the vital skill sets and technical prowess necessary for creative thinking and problem-solving.



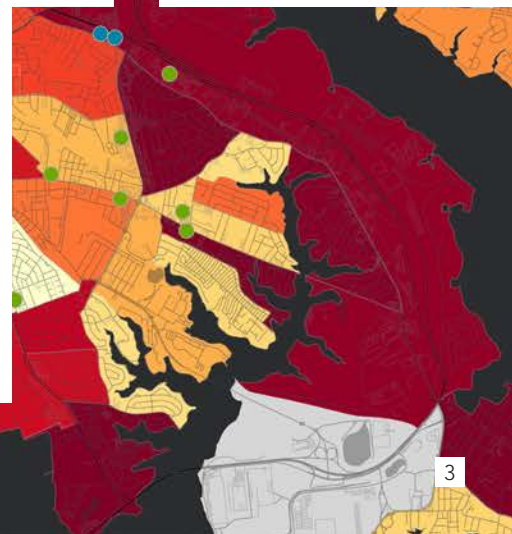
WHY TEACH WITH GIS?

As global challenges continue to rise, future generations will need a deeper understanding of the world around them to foster meaningful change and find innovative solutions. Higher education instructors will increasingly play a vital role in empowering future generations with the knowledge, skills, tools, and interdisciplinary collaboration necessary for creative solutions.

For decades, geographic information system (GIS) technology has been vital in exploration, innovation, and understanding of the world. By combining real-time data, powerful analytical tools, interactive maps, field collection tools, an API, and applications, GIS creates stunning visualizations and has proven to be an essential tool for problem-solving and informed decision-making.

As educators prepare the next generation for an increasingly complex world, many are turning to GIS as a tool for teaching. The educator's objective is not solely about teaching students how to use GIS but rather the value of the geographic approach to better understand the world. Those who leverage GIS technology as a teaching tool improve student engagement: students grow vital skill sets like spatial thinking, holistic awareness, adaptability, communication, and technical expertise.

Teaching with GIS prepares students to navigate future career paths and keep pace in a dynamic world. This ebook offers strategies to incorporate GIS in the classroom and highlights the benefits and skills students gain along the way.



Anchor GIS in program goals.

Educators are not simply teaching GIS for students to become proficient with specific tools in a specific software version. Because GIS fosters technological and soft skill sets, it enables students to gain new perspectives and so much more. In building lesson plans, educators should ask themselves how teaching about or with GIS helps achieve learning goals; how those goals can be articulated into course learning objectives; and how their goals can inform course readings, discussions, and real-world activities.

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Make GIS relevant but focused.

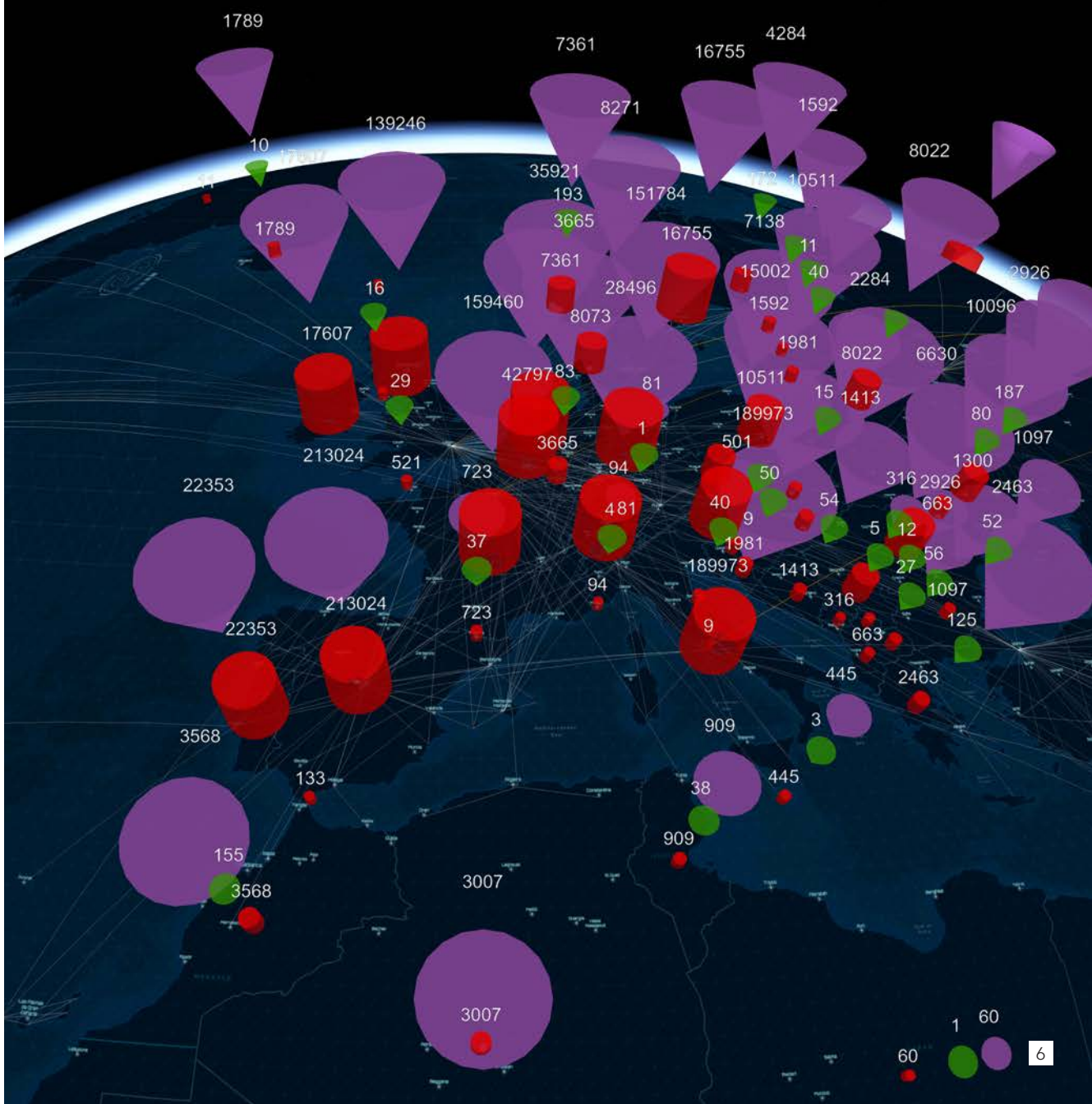
With ongoing challenges being both local and global, select a current event, business sector, or real-world problem to explore. Develop a mini lesson or focus sections of courses for a period (e.g., a single lesson, a week, two weeks, or a month). These can be presented as "geonews" that incorporates infographics, dashboards, and interactive maps. Tailor lesson plans to specific themes, scales, and problems during each period or section. While planning a curriculum, it's important to incorporate moments for students to shine. This can be achieved by asking students for feedback, such as what was most valuable or challenging to them, or one specific topic they would like to learn more about. Build activities where students share their maps and apps as assignments or with their peers. There is no shortage of GIS tools and spatial data to use for engaging, focused, and relevant coursework.

Make GIS instruction multilevel and multiscale.

Students come from different cultures, disciplines, and majors, which often means the depth of their experience with GIS can vary widely—from having no exposure to possessing an advanced skill set. Courses need to be designed to meet students at their level of GIS understanding to foster growth. To instill variety and interest, plan multiscale lessons that incorporate global topics or issues with solutions that have a local impact. The United Nations (UN) Sustainable Development Goals (SDGs) provide one set of relevant examples—such as water quality and quantity, human health, or environmental degradation—that also affect the local community. By investigating these areas of global focus, students can positively impact the communities that they care about.

Make GIS courses holistic and field based.

Since GIS influences so many facets of daily life, classroom instruction must enable students to see the bigger picture of the earth as a system of interconnected systems. By doing so, students foster respect for places—an earth ethic—and gain a deeper understanding of the importance of those places to the people that inhabit them. In tandem, this mindset can be built through service-learning activities where students collect, map, and analyze something in the field, whether it is in the physical or cultural environment.



Make GIS instructional content varied and visionary.

Regardless of the curriculum, it has always been important to vary how content is delivered. The same is true in GIS. Mix the instructional methods, media types, scales, problems, and the GIS tools used. Build vision and excitement into course content by including topics such as space-time cube mapping, artificial intelligence, and machine learning. Build skills using building information modeling (BIM), computer-aided design (CAD), and GIS tools; coding and Jupyter notebooks; virtual reality; and other cutting-edge GIS capabilities. Supplement these concepts using podcasts and video interviews with visionary people. Encourage students to consider what they can contribute to society by using GIS.

HOW GIS BENEFITS STUDENTS IN THE REAL WORLD

GIS is about more than just maps; the technology helps expose patterns, relationships, and trends. With GIS, people gain a holistic picture that leads to better decision-making, creative outcomes, and actions that make a difference. In teaching GIS, the end goal is not about creating a map. The goal is to foster perspective and comprehension. Richard Saul Wurman—author, architect, graphic designer, and TED conference founder—once said, "Understanding precedes action."

As the world grapples with complex challenges—from COVID-19 to climate change and population growth—higher education institutions must continue to find creative ways to empower students to be future leaders and problem solvers. Developing soft skills like communication, collaboration, critical thinking, social engagement, and empathy will be paramount for future generations to work together on important issues.

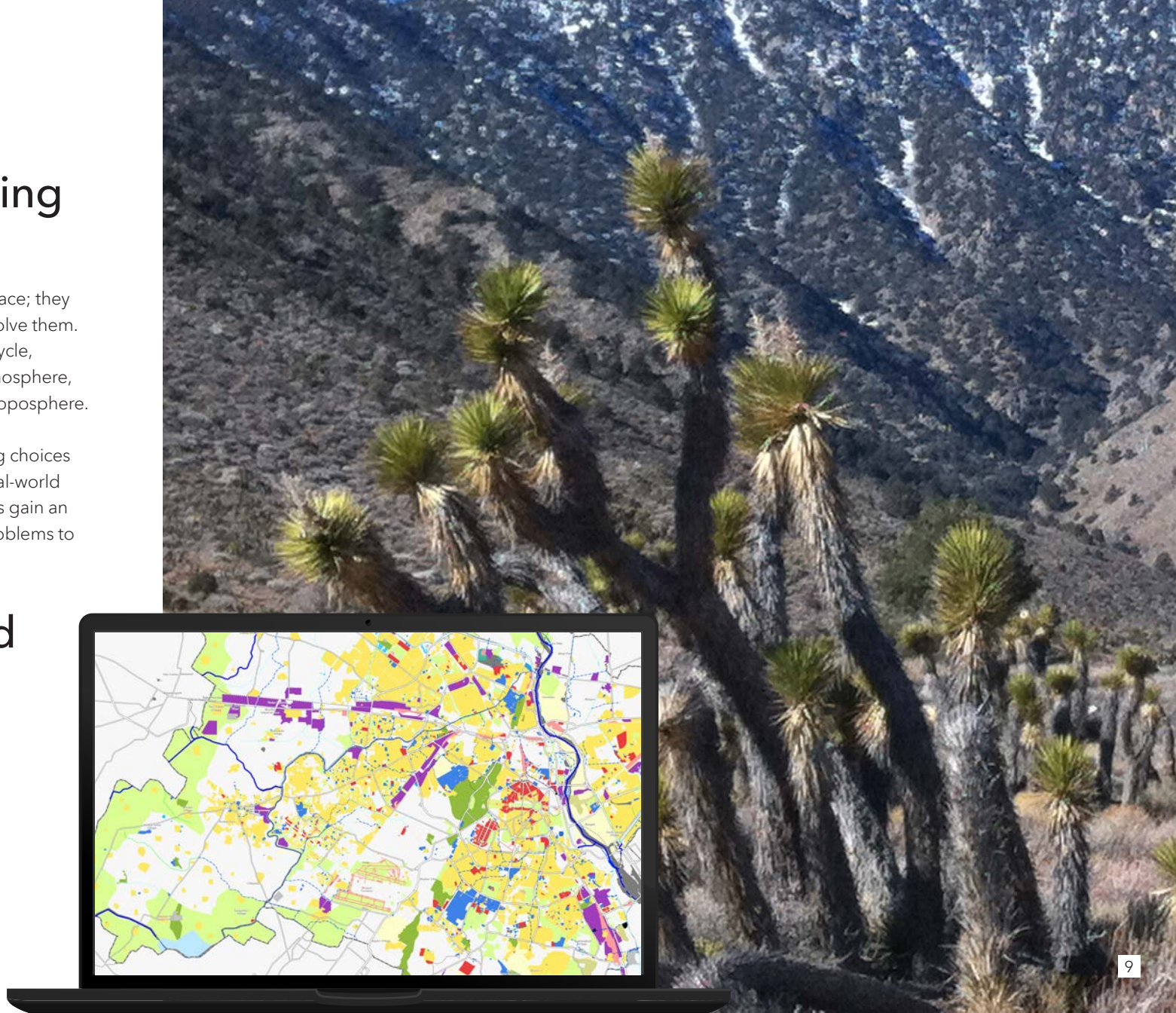
By its nature, GIS fosters many of these soft skills and benefits classroom lessons overall. Compiled here are the top five benefits of teaching with GIS. While they are not the only benefits by any means, this compilation focuses on those that best prepare future generations to be global stewards:

Encourage deeper thinking for problem-solving.

When students engage with GIS, they consider place and space; they think geographically and spatially about issues and how to solve them. This means considering the carbon cycle or the hydrologic cycle, among others. They think about interactions between the lithosphere, biosphere, cryosphere, hydrosphere, atmosphere, and anthroposphere. In doing so, students are critically thinking and thoughtfully questioning data sources, dates, authors, and scale, weighing choices of symbology and analytical tools. When GIS is applied to real-world scenarios, it enriches problem-based learning (PBL); students gain an understanding of framing, visualizing, and grappling with problems to assess possible outcomes and create solutions.

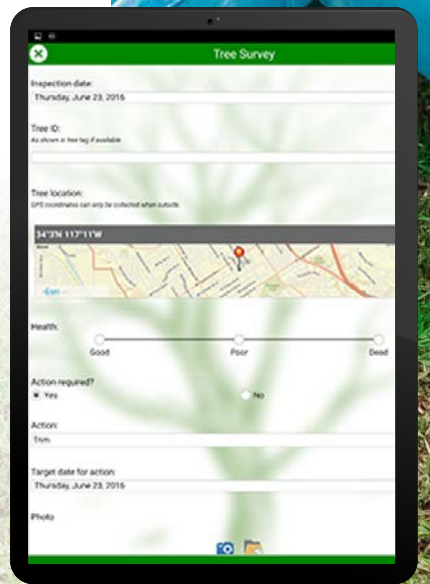
Develop geographic and scientific inquiry skills.

At its core, GIS has always been a thinker's tool. A good map encourages students to develop thoughtful questions across disciplinary, physical, and political boundaries and scales.



Increase data fluency and experience in the field.

Data is ever changing. The ability to foster lifelong learning with a wide range of data types, scales, and themes within the GIS environment allows students to develop fluency. Moreover, fluency can only grow by experience. Getting outdoors helps students understand the changing world and nurtures an earth ethic about places and people while empowering them to design and create field surveys, gather field data, and map results.



Further content knowledge and discovery of potential career paths.

GIS is rapidly expanding into the fields of business, data science, energy, engineering, health care, urban planning, natural resources, transportation, and social science, among others. As students investigate problems within these fields, they can identify gaps in their skills and knowledge. Simultaneously, students will be motivated toward potential career paths that interest them.

Empower students to be change agents and community leaders.

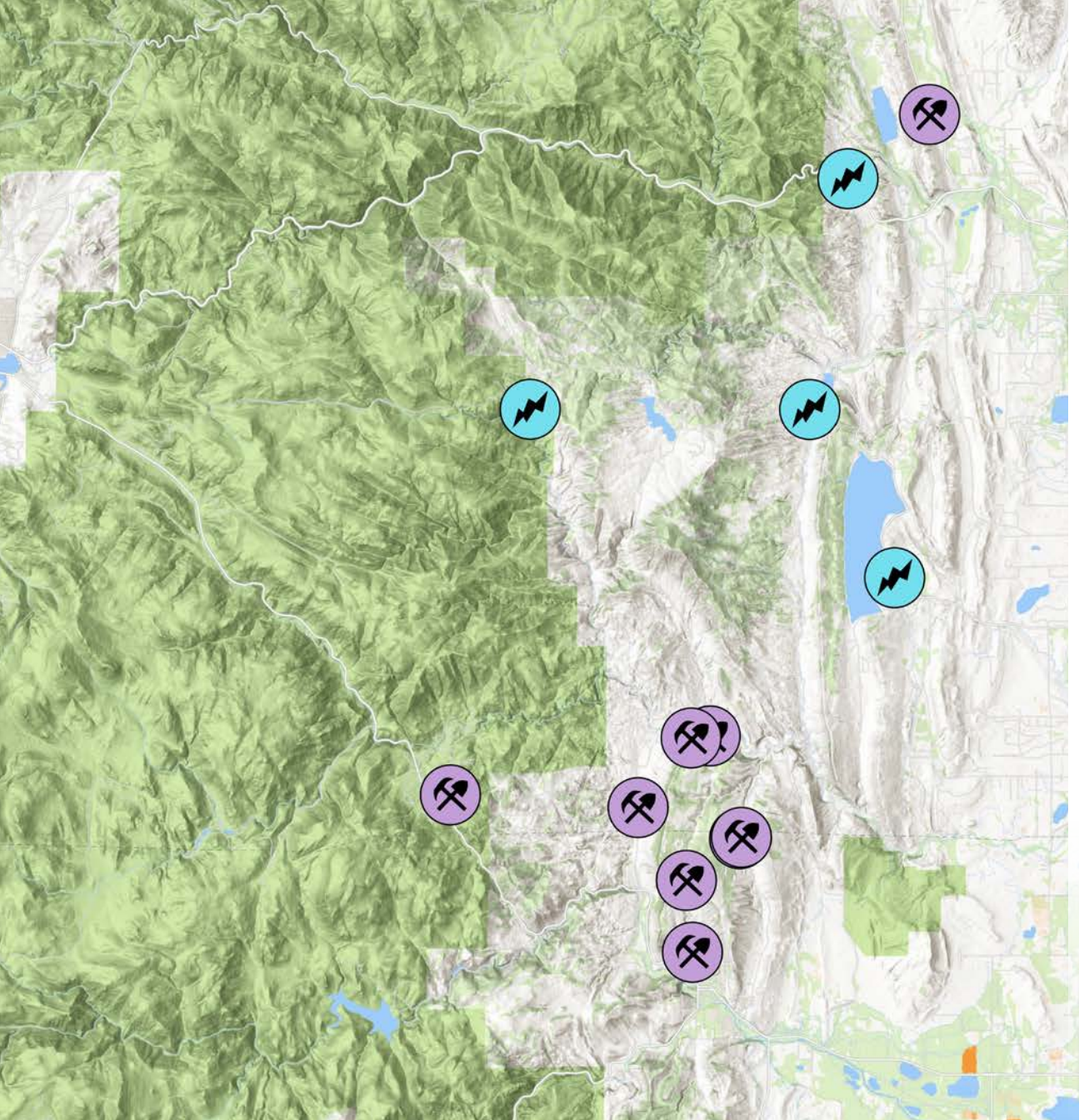
Teaching with GIS allows students to acquire a holistic understanding of community and social issues. As they explore the bigger picture, they gain confidence in their knowledge of the world, becoming forces of positive change on their campuses and in their workplaces and communities. They can use their skills in GIS to empower those around them to solve real issues and confront the challenges they face.

NURTURING GIS SKILL SETS FOR THE WORKPLACE AND MORE

GIS is becoming increasingly ubiquitous; location plays a vital role across industries and job types. GIS skill sets are needed for roles spanning municipalities, the environment, agriculture, IT, supply chains, and more. The career opportunities are endless—and GIS skills are in demand across the job market.

In today's complex and rapidly changing educational and technological environment, educators must ask themselves what skills should be nurtured for student success and what tools are the most valuable in the workplace.

While these are not the only technical skills students should obtain, GIS plays a pivotal role in solving real-world issues within their authentic contexts. The following are the top five GIS skills that teaching with GIS should nurture. These skills can be incorporated in classroom lessons and assessments via examining web maps or via oral or online student presentations. Moreover, these skills and examples can become key parts of student portfolios:



Understand, navigate, and work with map content.

Students need the basics for searching, opening, and saving basemaps, layers, and 3D scenes. Map navigation is essential. Students should know how to change scale and map projection; find locations and identify areas of interest; and measure, bookmark, and select features on maps and in attribute tables. Equally important is knowing when and how to apply symbology and classification methods. Students should have experience clustering, filtering data, and managing content on their device and in the cloud. They should understand how to render imagery across spectral bands. Lastly, students should be able to draw and sketch to configure points, lines, polygons, text, and other map objects. A student's ability to assess, stream, download, and create map content, and use and create metadata, is key to success.

Collect and map field data.

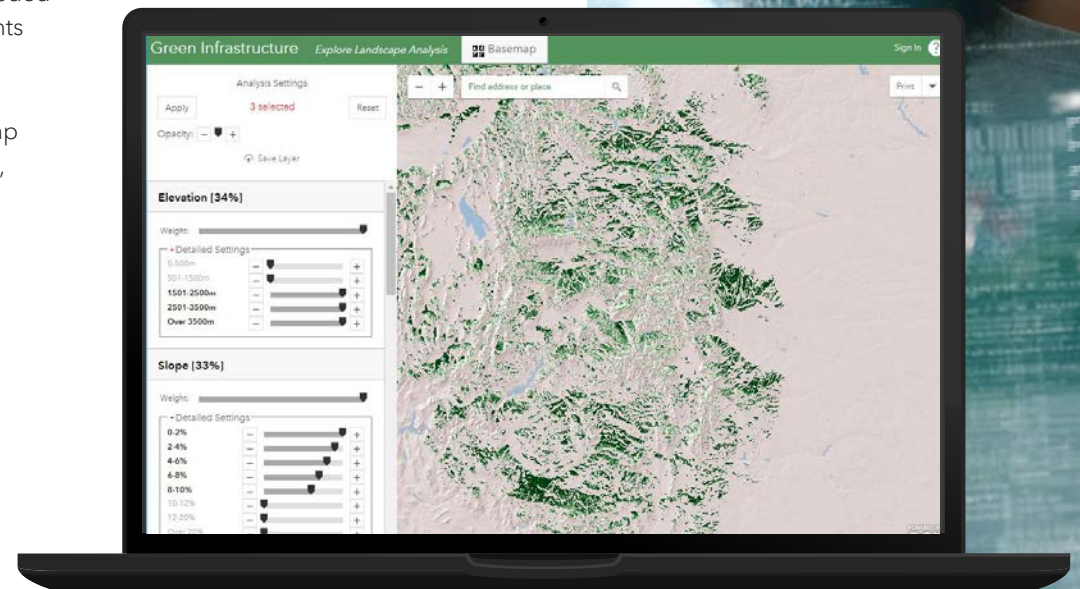
Understanding field methods and tools is essential. Equally important is the students' ability to collect and map data from the field data collection apps ArcGIS Survey123, ArcGIS Field Maps, ArcGIS Quick Capture, and iNaturalist, among others; GPS and fitness apps; geotagged photographs; and other tools and methods.

Create expressions, map content, and web mapping applications.

Students should learn to make and share map layers, maps, models, and web mapping applications that streamline data collection and promote collaboration. By creating and using expressions to filter, label, and symbolize their maps, students can practice communicating information to different audiences across industries or academic disciplines. They can also extend the value of their maps by creating interactive stories, infographics, dashboards, and other multimedia.

Perform analysis.

Ultimately, students need to use their maps for analysis, and it's vital that they understand what type of analysis is needed to answer a particular question. Students should have experience analyzing and summarizing data in contexts such as proximity and demographics using map overlays, map algebra, routing, joining, and spatial statistics.



Communicate, create, and share map content.

GIS is about researching real-world issues, events, and patterns, and communicating the findings of those investigations to others. Students should learn about and practice using different ways to communicate—such as using ArcGIS® Online, ArcGIS Instant Apps templates, dashboards, and storytelling apps—and be able to embed their maps, infographics, and other content that they create into videos, reports, and discussion boards. They should be able to communicate these results in oral and written form, online, and in and face-to-face settings.

THE POWER TO TRANSFORM EDUCATION WITH GIS

Regardless of discipline, method, or style, it is important for educators to maintain a mindset focused on honorable goals. The next generation must be prepared to solve challenges that previous generations have not faced yet and to effectively collaborate and communicate to create a better tomorrow.

Teaching with GIS is more than teaching mapmaking skills—it is a path to greater understanding. Students and educators alike play a vital role in the use of GIS to improve the world in which they live.

Learn more about benefits, skills, and strategies of teaching with GIS:
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