

Strategic Accelerated Review Proposal: Wyoming Geographic information Science Center (WyGIS)

a unit within the Division of Academic Affairs
reporting directly to the UW Provost

December 15, 2020

Introduction

The Wyoming Geographic Information Science Center (WyGIS) is an interdisciplinary academic unit within the Division of Academic Affairs focused on research and development of geospatial information science and technology and its application in education, science, government, and business.

The President's Proposed FY2021-2022 Budget Reduction Plan (2 November 2020) identifies WyGIS as one of ~15 departments, centers, and degree programs to be considered for “accelerated strategic review”. The stated purpose of these accelerated strategic reviews is “to decide if certain units require more investment, slight reorganization to strengthen them, reinvestment, or realignment” (p. 89).

In response, this document identifies an initial set of potential opportunities and enabling mechanisms to be considered for additional investment in WyGIS’s work. These recommendations are based on an assessment of the Center’s existing strengths, weaknesses, opportunities and challenges, and are accompanied by an articulation of benefits and broader positive impacts to be realized by the University and State if these investments were to be enacted.

Background

WyGIS is a success story of UW’s EPSCoR Program, growing out of a 1996 National Science Foundation EPSCoR capacity-building grant (~\$3M) and operating for five years as the Spatial Data and Visualization Cluster (SDVC) under the Office of Research in Economic Development. In 2001, the SDVC was re-organized as the Wyoming Geographic Information Science Center and structurally re-aligned as a standalone academic unit within the Division of Academic Affairs with a direct report to the UW Provost. At the time, the primary rationale for this administrative structure was to foster the Center’s involvement in the University’s education mission, enable WyGIS to collaborate more easily across college (and later school) boundaries, and operate more nimbly in its interactions with state government.

In 2001, WyGIS’s personnel included four research scientists and one staff support person with an annual overall budget (FTEs + operating budget) of less than \$300,000. Today, the WyGIS team

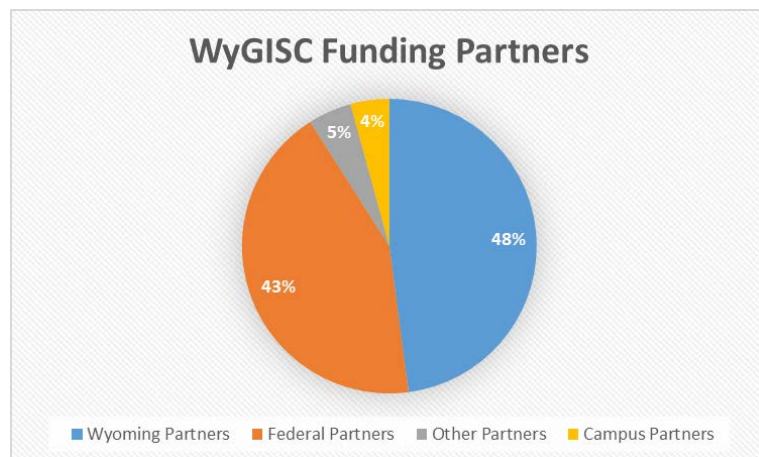
numbers more than 25 individuals, including nine faculty, eight geospatial professionals, two administrative support staff, one post-doctoral research associate and six student research assistants. The Center’s FY21 budget includes ~\$1.25M in unrestricted operating funds and more than \$1M in ongoing contracts and grants. For FY21, the Center also anticipates receiving between \$125,000 and \$150,000 from tuition revenue generated during the first two semesters of our new GIST education program.

The multi-disciplinary research expertise of the WyGISC team includes geography and geographic information science, computer science, decision science, ecology, forestry, water resources, and wildlife and fisheries management. Technical expertise includes geospatial data science, geographic information systems, satellite remote sensing and image processing, unmanned aerial systems, geographic visualization, spatial analysis and modeling, software application development, and web map design. Currently nine members of the WyGISC team hold the designation of certified GIS Professional (GISP) by the GIS Certification Institute, while four hold the Federal Aviation Administration Small Unmanned Aircraft Systems Pilot Certification.

Contributions to UW’s Land-Grant Mission and Strategic Priorities

WyGISC advances UW’s current strategic plan, *Breaking Through, 2017-2022*, within and across the three primary foci of our work - research, statewide engagement, and undergraduate / graduate education, as well as in our significant international engagement, and our mission critical, operations oriented work helping manage UW’s campus facilities infrastructure.

Research. WyGISC’s research is largely applied and focused on geospatial data science methods and software application design and development. Traditionally, application areas have been concentrated in agriculture, ecology, energy, water, and wildlife. WyGISC serves in a research support role for many partners across campus and has participated in each of the funded NSF EPSCOR Track 1 grants that have been awarded since the SDVC.



Over the last five years, WyGISC has been awarded more than \$9.5M in contracts and grants. During that same period, WyGISC researchers produced 90 publications, including articles in both *Science* and *Nature*. Additionally, WyGISC faculty made more than 125 professional presentations, and conducted two dozen technology transfer workshops. WyGISC faculty are recognized nationally for their work, most recently with Dr. Ramesh

Sivanpillai’s appointment as a 2021 Fellow of the American Society for Photogrammetry and Remote Sensing in recognition of his research and service contributions to the remote sensing community (the second highest honor bestowed in this prestigious national organization).

Statewide Engagement. Engagement has been a core component of the WyGISC mission since its beginning. In particular, providing easy access to geospatial data and building capacity in adoption and use of geospatial technology by stakeholders across the State of Wyoming has been a significant area of activity.

Major partners in state government include the Governor’s Policy Office, Wyoming Business Council, Wyoming Energy Authority, and Wyoming Game & Fish Department. Local government partners include the Wyoming County Commissioners Association and the Wyoming Association of Conservation Districts. Federal partners include the USDA Natural Resource Conservation Service.

Since 1997, WyGISC has maintained a statewide geospatial data clearinghouse for Wyoming, currently known as the Wyoming Geospatial Hub. Another major contribution includes a wide range of Web map-based planning tools. Examples include:

- Wyoming Natural Resource and Energy Explorer
- Wyoming Sage-Grouse One Steppe application
- NRCS Integrated Resource Management Analyst
- Wyoming Integrated Spatial Database & Online Management System
- SuiteWater watershed planning tool
- State Wildlife Action Plan
- Wyoming Public Lands Initiative Interactive Information Hub
- Wyoming Opioid Epidemic Information Portal
- Wyoming State Broadband Map

Beyond the state, WyGISC has worked closely with the Western Governors Association, the US Fish and Wildlife Service, and the Federal Geographic Data Committee on a number of research and technology transfer activities.

WyGISC has been recognized for its efforts with awards including an ESRI Special Achievement in GIS Award (2006), U.S. Department of the Interior Wyoming Land Conservation Initiative Certificate of Appreciation (2012) and a National States Geographic Information Council Catalyst Geospatial Excellence Award (2018).

Education. WyGISC’s mission expanded significantly this year with the launch of the interdisciplinary Geospatial Information Science & Technology Program, but even before this, WyGISC faculty contributed to teaching geospatial courses offered by other units, including Botany, Ecosystem Science and Management, Geography, and the Haub School. Beyond the classroom, WyGISC faculty have mentored 35 students participating in UW Undergraduate Research Day over the last five years, and have served as instructors and mentors in UW’s High School Summer institute and Summer Research Apprentice Program. WyGISC faculty have been recognized for their teaching as UW Science Initiative Learning Actively Mentoring Program (LAMP) Fellows, UW Mortar Board ‘Top Prof’ honorees, and as faculty fellows in the UW Daniels Fund Ethics Initiative in the UW College of Business.

The *Wyoming Student Atlas* (2014), whose co-authors included two WyGIS faculty, earned an international award for Best Atlas publication (ESRI International Users Conference, 2015) and was featured in the U.S. entry at the 27th International Cartographic Conference and the 16th General Assembly of the International Cartography Association (Rio de Janeiro, August 2015). More than 15,000 copies of the atlas have been distributed to Wyoming classrooms and libraries.

Interdisciplinary Geospatial Information Science & Technology Program. After three years of planning, the interdisciplinary program in Geospatial Information Science & Technology (GIST) was approved in June 2020 by the UW Board of Trustees with strong support from Faculty Senate, ASUW, and the UW Provost's Office. WyGIS began offering a professional M.S. degree, three graduate certificates, and two undergraduate certificates in Fall 2020. The online graduate certificates are in GIS, Remote Sensing, and Unmanned Aerial System (UAS, a.k.a. drones), and the undergraduate certificates are in GIS and Remote Sensing. The Trustees also approved a B.S. degree in GIS&T to be launched in fall 2022 contingent on student demand. The program offers 17 undergraduate courses and 17 graduate courses taken by students from across campus. Geospatial Science is interdisciplinary and enhances student training in fields ranging from STEM disciplines to business and the humanities.

In its first semester – fall 2020, the GIST Program offered eight undergraduate courses and nine graduate courses, generating 325 and 184 student credit hours respectively. Despite the COVID-19 pandemic and no formal recruiting, the MS GIST program has already admitted five graduate students. Flexible course scheduling (e.g., online asynchronous; half-semester courses; one- and two-credit standalone modules) have been well received by students. The nascent program has also responded nimbly to pandemic impacts, for example, pivoting a drone piloting field course to online delivery using gaming consoles when the instructor contracted the SARS-CoV-2 virus.

Already looking to expand GIST offerings, WyGIS has submitted a proposal for the addition of a thesis option for the MS GIST degree. In 2021, the Center will pursue a Professional Science Master's designation for its online MS GIST degree from the National Professional Science Master's Association.

Other. WyGIS maintains a strong international research and service presence. Examples include its participation in the *International Charter, Space and Major Disasters*, a worldwide collaboration through which satellite data are made available for the benefit of disaster management (Note: WyGIS coordinated satellite imagery support for both the 2011 Mississippi River floods and 2018 California wildfires.), and participation in the *Carnegie African Diaspora Fellowship Program*, as well as field research in Australia, India, and Central Asia. WyGIS is currently pursuing membership in the *United Nations initiative on Global Geospatial Information Management (UN-GGIM) Academic Network*.

Since 2004, WyGIS has led UW in maintaining a campus-wide Enterprise GIS in support of campus property and facilities management, including utilities maintenance and space allocation. This work is funded by the UW Real Estate Operations unit in the Division of Administration. It also supports

UW’s research enterprise, as evidenced by WyGISC’s asset management work for the College of Agriculture & Natural Resources’ Agricultural Experiment Station field locations across the state.

SWOC Assessment

In considering opportunities for increased investment in re-organization of the Center, the following Strengths-Weakness-Opportunities-Challenges assessment is provided as one source of context for subsequent decision making.

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Highly trained geospatial faculty and staff representing a significant investment in human resources • Wide applicability of geospatial methods and technologies supports interdisciplinarity • Well-established centralized geospatial resources for university and state • Strong relationships and good reputation with Governor’s Office, other state agencies • Strong engagement with undergraduate research • Positive, diverse and stable work environment 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Limited student involvement • Communicating accomplishments • Limited discretionary funds for R&D, programmatic support, IT system administration • Low to moderate scholarship productivity rate • Relatively narrow technology skillsets • Not strong leaders in initiating new research
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Newly launched GIST Program • UAS research and technology transfer • Untapped partnerships beyond traditional natural resource focus (data science, digital humanities, BIM, block chain) • Internal re-organization in progress (addition of tenure-stream faculty, external advisory board) • Expansion of faculty research programs • Private fund-raising opportunities with new level of support from UW Foundation • Mission aligns well with UW President’s “Four Pillars” • Expertise well-positioned to help address state economic recovery and diversification 	<p style="text-align: center;">Challenges</p> <ul style="list-style-type: none"> • Now functioning more like a school but not integrated with college and school decision making and lack that type of stature within the university • Recent growth creating change in the culture of the Center • Funding needs inhibit greater selectivity in research priorities • Nature of contract work inhibits ability to dedicate resources toward producing peer-reviewed publications.

WyGISC is in the midst of a transition in which its mission has expanded significantly with the creation of an undergraduate and graduate curricular program and the addition of tenure-stream faculty with 100% academic appointments in the Center. WyGISC’s greatest strength has and will continue to be its interdisciplinary partnerships across campus, with significant potential for more - and more diverse - collaborations in the future. The launch of the GIST program presents great opportunity for student impact and is already helping address identified weaknesses of limited

student involvement, even during the pandemic, and the need for improved communication with constituencies. The challenges listed above are representative of the “growing pains” the Center is experiencing with its ongoing expansion.

Opportunities for Investment

Undertaking this strategic planning assessment is timely, as WyGISC has just completed an internal personnel re-organization involving the addition of tenure-stream faculty, creation of a new Geospatial Job Family for contract- and grant-funded administrative professional staff, and establishment of a new Leadership and Administrative Support Team. The Center has also recently initiated a new 12-month strategic planning process modeling after the *Good to Great in the Social Sectors* planning framework (Collins 2005). To support that work, a new external advisory board is being established, along with a cross-campus curriculum advisory committee. Finally, for the first time, the UW Foundation has assigned specific development officer resources to assist the Center in creating a comprehensive fund-raising strategy.

In considering opportunities for investment, it’s important to note that WyGISC’s mission closely aligns with President Seidel’s four pillars of success for UW becoming a best-in-class 21st Century land-grant university:

- **More digital:** Everything about WyGISC resonates with digital strategies and their benefits within society, including research, teaching and learning – and centered around, in WyGISC’s case, data-driven problem-solving, information visualization-based communication, and concepts of location, space and place;
- **More entrepreneurial:** From its beginnings, the Center has successfully pursued entrepreneurial funding avenues to support its work; this will continue and grow in the future as the university must necessarily become less reliant on state government funding;
- **More interdisciplinary:** As noted in the preceding SWOC assessment, one of WyGISC’s greatest strengths is the long-standing importance it has placed on being interdisciplinary; much opportunity exists to expand on these past experiences through more deliberate coordinated interdisciplinary research and teaching;
- **More inclusive:** WyGISC’s new interdisciplinary GIST Program has been designed to enable greater inclusion of a diverse range of learners, accomplishing this through innovative online delivery, module-based courses, and creative scheduling.

WyGISC’s research capacity also meshes well with three of the five UW Grand Challenges (Biodiversity and Earth System Change; Energy Transition and Economic Diversification; Rural Health Issues), and can enable collaboration within UW’s Crossing Divides Initiative through geospatial cyberinfrastructure deployment.

Recommendations. The following table outlines a set of eight (8) opportunities for investment in WyGIS and the geospatial capacity of the university.

Significant Investment Cost	Description	Cost	Other Comments
Development of infrastructure to position UW as a leader in UAS (drone) research and development	Indoor and/or enclosed facilities for drone vehicle testing and training; fixed-wing UAV capable of “Beyond Visual Line of Sight” flying (with sensors).	Facility: \$3 Million (one-time) Fixed-Wing Drone: \$100,000 (one-time)	Facility will be made available to statewide resource managers and first responders.
Cluster Hire in (geospatial) data science	Opportunity to build interdisciplinary expertise in geographical sciences, location analytics, public health, system dynamics modeling.	Cost dependent on number of hires.	Partnership with multiple colleges and schools.
Moderate Investment Cost	Description	Cost	Other Comments
State engagement research scientist position	Position leverages all other statewide geospatial service work; supports WyGIS’s role in geospatial governance and coordination.	\$60,000 to \$120,000 (0.5 FTE or 1.0 FTE salary/benefits, ongoing); may be funded in part with external funds.	Already a mission-critical position within Center but current funding model is not sustainable. Possible partnership with Cooperative Extension Service.
System administration support	Growing need for dedicated geospatial system administration support within the Center.	\$60,000 to \$120,000 (0.5 FTE or 1.0 FTE, ongoing); may be funded in part with GIST tuition revenue.	Could be shared with one or more other units.
Low Investment Cost	Description	Cost	Other Comments
Tenure-stream conversion for existing faculty	Applies to 5 existing research scientist and lecturer positions.	No additional annual cost.	Long-term benefit of fostering excellence among faculty.
GA line re-allocation	Support for GIST MS program; teaching assistants for high-enrollment lab courses.	No additional annual cost (if made available as result of other program consolidations and closures.	Benefit in leveraging GIST tuition revenue.
Space consolidation	Addresses need for faculty lab space and graduate student office space.	Minimal remodeling costs.	Opportunity to keep space consolidated; address ADA needs.
Evaluate and possibly restructure WyGIS organizational leadership positions	Reflects changes in administrative needs over the last ~5 years including addition of a GIS&T Program Director position	May be salary implications depending on structural re-organization decisions (e.g., if WyGIS were to become a school, or conversely be absorbed within a larger unit).	Ideally completed before start of next Director appointment or as part of structural re-alignment.

Parallel to these investment ideas, a need – and opportunity – exists to address the question of how WyGIS truly moves from ‘good to great’ – that is, to determine what the Center does and can

do best and what drives our resource engine, with the ultimate goal of defining and achieving *superior performance, distinctive impact, and lasting endurance* in teaching, research, and engagement.

Part of advancing from good to great requires strengthening of existing partnerships and pursuing new ones. For example: the potential role of geospatial specialists within UW's Cooperative Extension Service; "geo-blockchain" collaborative research with the new Center for Blockchain and Digital Innovation in the College of Business; and GIS-BIM teaching opportunities with the Department of Civil and Architectural Engineering.

Another part of advancing from good to great is considering potential organizational re-alignment scenarios that may foster WyGISC's ongoing and future success. This should be done as part of the Center's ongoing strategic planning process over the spring and summer of 2021. Possible organizational scenarios to be evaluated include:

- Remaining a standalone center within Academic Affairs
- Remain a standalone Center and restructured for growth - e.g., become an umbrella Institute (or school) that contains other centers and/or programs
- Re-alignment under an existing college or merge with an existing school
- Become part of a new school – e.g., School of Computation

Scenarios should be evaluated in the context of the broader ongoing university-wide program review, including opportunities for cost-saving and increased efficiencies. Working in coordination with the Provost's Office, WyGISC is well situated to study these options at this time, identifying and considering synergies with other units on campus with the help of its new external advisory board.

Conclusion

In summary, WyGISC has played a central role in geospatial science for nearly 25 years at UW, in Wyoming, nationally, and internationally. It is an established research partner across campus, and it supports state and federal agencies with both service and research activities. Recent approval of the new GIST program is allowing WyGISC to become an important contributor to interdisciplinary education of undergraduate and graduate students, and recruitment of new tenure-track faculty will help us fulfill our goal of adding basic geospatial research to our already strong applied research program. WyGISC's mission aligns strongly with President Seidel's four pillars and other UW goals and activities, including EPSCoR, Research Grand Challenges, and the Crossing Divides Initiative. We are grateful to be considered for strategic investment; our established human and technical resources position us to be an important player in helping strengthen UW and diversify Wyoming's economy.