

Executive Summary of Initiative

The Spatial Analysis & Research Center (SpARC) at UC Merced fosters interdisciplinary research in the spatial sciences and supports education through training and curriculum development. SpARC is the campus-wide hub for spatial science research, analysis, education, visualization, spatial data archiving, and access to spatial science software and equipment for UC Merced and its partners. SpARC leads faculty and community partner grants for research and other activities with a spatial aspect and collaborates on ongoing projects. SpARC also participates in the development of expanded undergraduate and graduate curriculum in geography and spatial sciences. In addition to research, UC Merced uses GIS to analyze land-use, landscape, circulation and utilities for the growing UC Merced campus. On campus, SpARC collaborates with SNRI, HSRI, CITRIS, the Great Valley Center, ReCESS/Blum Center, and other centers. SpARC's unique niche derives from UC Merced's proximity to the Sierra Nevada Region and San Joaquin Valley.

Definition of Thematic Area

SpARC most closely fits into the theme of #7 – **Information, Computational, and Data Sciences and Engineering** as the core focus of spatial analysis is in the high demand for advanced computational hardware, robust data management and complex analyses and visualizations of spatial information.

Due to the interdisciplinary nature of spatial analyses, SpARC also supports themes 1-6

1. Disparities: Equity, Diversity and Social Equality
2. Cross-cultural Studies and Cultural Production
3. Human Health
4. Innovation and Entrepreneurship
5. Environmental Sustainability
6. Energy and Energy Systems

Other SAF Initiatives that may contribute to our theme are:

- Strategic Initiative in Management of Innovation, Sustainability, and Technology
- Cognition, Computation, and Human Data Science
- Statistical and Quantitative Research
- Proposal for a Thematic Campus Center: Environmental and Sustainable Systems

Spatial Analysis and Research Center (SpARC) and Spatial Science Initiatives

- California Institute of Drone Engineering Research (CIDER)
- Health Research At UC Merced
- Sustainability, Energy, Climate and Communications
- UC Merced Library's Open Proposal
- Strategic Plan for the Life and Environmental science Bylaw 55 Unit for 2013-2020
- Promoting Healthy Development in Underserved Populations
- Hard Rock Reserves Institute
- Public Health At UC Merced
- Arts, Humanities and Anthropology (AHA) in the World at UC Merced
- Sociology
- Center for the Study of Comparative Inequalities
- 2020 vision for Electrical Engineering and Computer Science at UC Merced

Intellectual components of the Initiative

The challenges facing the San Joaquin Valley make it a microcosm of the world and thus uniquely position UC Merced to address global problems through a focus on the local. These challenges include health, poverty, education, and environmental and cultural sustainability. SpARC's mission complements the 2009 vision since 1) spatial analysis and thinking are fundamental to solving these problems; 2) as pointed out in the 2009 vision, the solutions will have to be interdisciplinary which is ingrained in SpARC; and 3) SpARC's niche derives from its proximity to the Sierra Nevada Region and San Joaquin Valley, as well as its relationships with local community and land management partners including local government, state and local agencies, and federal agencies such as the National Parks Service, US Geological Survey, and the US Forest Service. Indeed, SpARC's focus on interdisciplinary research and education in the spatial sciences connects it to all five of the research themes of the 2009 vision:

1. Environmental Sustainability: The spatial sciences are key to developing the processes and resource management practices required to achieve this goal.
2. Human Health: Public health, which deals with prevention rather than treatment of disease, is a solution to a major problem for the San Joaquin Valley in the form of epidemics of asthma and diabetes as well as major health disparities because of poverty and illiteracy. Spatial data and analysis are fundamental to creating and implementing public health policies.
3. Cognitive Science and Intelligent Systems—Interdisciplinary Inquiry in Minds, Machines and Management: Intelligent systems are needed to address the Big Data problem. Most of this data has a spatial component, either through association with a place on the Earth, or in some other spatial reference frame such as the locations of the atoms in a molecule.

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4. Community, Culture and Identity: These topics include issues related to the distribution and well-being of individuals and communities of the Central Valley and beyond, and relates to the study and management of the monuments of civilization of the past and present.
5. Dynamics of Social and Economic Progress: Societies and economies are increasingly globally interconnected and thus cannot be studied in isolation. Some of the strongest connections between these entities are geospatial.

Current key areas SpARC will continue to pursue include delivery of spatially integrated analyses and visualization for UC Merced researchers, staff and students. Spatial analysis platforms are moving from an isolated desktop with a highly-skilled and trained geospatial professional into integral mapping and analytical systems delivered through simple web interfaces. We need to continue training highly skilled individuals; however, there is a growing need to educate the public in the use and benefits of spatial analysis. The geosciences career track is rapidly growing and geospatial experience as a skill set is becoming a requirement for private and public employers for other careers.

Moving forward, SpARC is collaborating on opportunities to provide LIDAR and three-dimensional mapping and data conversion services and support to UC Merced researchers. SpARC is also participating in new technologies to support Unmanned Aerial Vehicle mapping and identifying best practices in data conversion, analysis and delivery methods of information captured using UAV mapping techniques.

UCM's Role

SpARC fulfills an important need at UC Merced. Centers of the type described here exist at almost every university in the country and ours meets the unique location and vision of UC Merced. Diverse researchers across all campuses utilize spatial analysis and visualization, and it is ubiquitous in campus planning, communications, development, education and government relations as well as scholarship. UC Merced partners are utilizing the training, services and opportunities for collaboration that SpARC offers.

Three dimensional mapping, LIDAR mapping, remote sensing and UAV aerial mapping and conversion are all areas SpARC can support with data conversion, archiving, analyses and visualization of these data capture methods. Services in high demand which can expand research also include custom development of web applications and automation tools for conversion, analysis and mapping of spatial information.

Faculty Participation, ByLaw Units & Graduate Groups

SpARC is a campus-wide endeavor of broad intellectual scope. Nearly every research center, undergraduate major, and graduate program currently has a spatial component, or has the potential for one. One sign of the breadth of SpARC's reach on campus is the membership of our steering committee, whose members and their affiliations are as follows:

- Erik Rolland (EECS/MGT/MIST)
- Steve Roussos (HSRI/Blum)
- Josh Viers (ES/CITRIS/SNRI)
- Gene Barrera (Physical and Environmental Planning)
- Emily Lin (Library – Digital Assets)
- Steve Shackelton (SNRI)
- Roger Bales (ES/SNRI)
- Paul Brown (SSM/HSRI)
- Michael Dawson (SNS)
- Holley Moyes (SSM)

Programmatic Needs

In 2020, SpARC will expand its capacities to serve as a Centralized Research Unit appropriate to a research university that provides

- Staffing a full-time lab offering drop-in access to computers running specialized spatial science software, portable equipment rental (e.g. GPS receivers), large-format printing, map and atlas scanning, and spatial data serving.
- Providing short term spatial analysis and visualization consultation and assistance for graduate students and faculty on a no-recharge basis
- Supporting ongoing data creation, project and map design, data analysis and data serving services on a recharge basis.
- Offering beginning and advanced spatial science short courses for faculty, staff, students and community partners on a tuition basis.
- Maintaining site licenses and managing installations of spatial science software packages.
- Running a spatial science seminar and brown bag series.

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- Partnering with campus and community applicants to seek gifts, grants and contracts with a spatial analysis and visualization component.

In addition, although SpARC will not be a degree granting department nor support its own faculty FTEs, SpARC will play a lead role in developing a cross-school undergraduate minor in Spatial Science, a self-paying MA in Spatial Science, and workshops and continuing education courses in spatial science. These initiatives could include a hybrid-distance learning component for Central Valley and Sierra Nevada professionals. The same MA courses will also support an optional spatial science specialization for PhD students in all of UC Merced's graduate programs. We estimate 100 students enrolled in undergraduate minor, 50 students enrolled in the MA program, and 200 continuing education students enrolled in workshops and short courses, with the potential for developing customized curricula in co-sponsorship with the National Parks Institute and other UC Merced initiatives. The curricula will include principles of GIS and other emerging GIScience technologies including LIDAR, remote sensing, geographic visualization, and geospatial data mining. SpARC affiliates will also participate in and provide leadership in state and national organizations such as UCGIS and CGIA. In order to support these goals, we anticipate the need for the following resources.

- A four person SpARC staff including an academic coordinator, web development/GIS technical specialist, administrative support person/outreach coordinator, and a permanently funded executive director
- Approximately 20 new faculty hires across campus whose expertise includes spatial science and whose undergraduate and graduate teaching portfolios will contribute to spatial science curricula. **Asforementioned, SpARC will not be a degree granting program but will serve as a focal point for current and new faculty whose research involves a spatial component.**
- Equipment including a terrestrial LIDAR scanner, Total Station, ASD hyperspectral instrument, 3D monitor, upgraded high-capacity data servers, high-accuracy GPS, laser range finders, and large format printers/scanners; and adequate laboratory and storage facilities for these devices. Our funding model through recharge will enable SpARC to expand our services to UC Merced and community partners.
- A GIS teaching lab with a capacity of 30-40 students.
- A laboratory suite of approximately 4000 square feet to accommodate four full time employees, a conference room, a computer laboratory with 20 workstations, high-speed broadband connectivity, large format printing, work area for laptops and mobile computing, and large layout tables. It would be ideal to relocate the SpARC suite to a research-hub facility of similar digitally-oriented shared core facilities, or the library. This would facilitate centralized campus-wide access and management.

