



ARCS® Foundation, Inc.
UNIVERSITY RELATIONS APPROVAL FORM B

For approval of Departments/Programs

Within an Institution not previously approved for ARCS Funding

In order to receive funding from ARCS Foundation, every Department /Program or Multidisciplinary Program is required to be approved by ARCS National through the National Board University Relations review and approval process.

- If the Department/Program or Institution housing it is ranked within the top 50 in the nation (see SUGGESTED RESOURCES FOR RANKING DEPARTMENTAL SUBMISSIONS, in the Appendix of this form), please complete **Section I**
- If the Department/Program or Institution housing it is **not** ranked within the top 50 in the nation (see SUGGESTED RESOURCES FOR RANKING DEPARTMENTAL SUBMISSIONS, in the Appendix of this form), please complete **Sections I and II**
- If this is a Multidisciplinary Program, please complete the additional questions as indicated below. Please refer to the SUGGESTED RESOURCES FOR RANKING DEPARTMENTAL SUBMISSIONS, in the Appendix of this form, and as appropriate, please complete **Sections I and II**

This completed form, along with any attachments, must be submitted to the National Chair, University Relations at least six (6) weeks prior to a National Board meeting. Incomplete forms cannot be considered.

CHAPTER:

Chapter VP University Relations or President:

Elizabeth Callander, President // Leslie Van Houten and Chris Simpson Brent, Co-VP's UR

Email: e_callander@att.net // philles@comcast.net and chris.simpson.brent@gmail.com

Tel: 415-516-7774 // 415-464-7272 and 415-328-8580

Date Approved for Submission by Chapter Membership: September 26, 2021

Date of Submission to National Chair, UR: September 29, 2021

NATIONAL:

Date and Resolution by National:

SECTION I
Basic Information

Name of Institution:
(Parent organization)

University of California, Merced

Name of Division:
(School, college, division, institute, if applicable)

School of Engineering

Name of Department/Program or Multidisciplinary Program:
(Indicate if multidisciplinary and explain)

Environmental Systems

Institution Contact:

Marjorie S. Zatz

Title:

Interim Vice Chancellor for Research and Economic Development

Email:

mzatz@ucmerced.edu

Tel:

209-228-0085

Institution Information

1. Provide a brief history of the institution

Just 16 years ago, a vibrant new university broke ground in the heart of California. The University of California, Merced (UC Merced) joined ranks with the most renowned university system in the world – the University of California (UC) system – and the nation’s first research university of the 21st century was born. UC Merced was conceived both to serve the needs of the rapidly growing Central Valley, one of the world’s most productive agricultural regions, and to increase access to a UC caliber education for California’s top achievers. Since opening its doors in 2005, UC Merced has rapidly become nationally recognized for its programs, research centers, and award-winning faculty, particularly in the Science, Technology, Engineering and Math (STEM) fields. The first master’s degrees were awarded in the 2005-06 academic year and the

first doctoral degrees in 2008-09. As of Spring 2021, the number of enrolled graduate students at UC Merced has grown to more than 740, with more than 90 graduate degrees conferred for the academic year.

UC Merced is a research university on the move and is already recognized as one of the top universities for both academic quality and the ability to transform the lives of its graduates. It is increasingly being recognized for outstanding academic programs and a commitment to environmental sustainability. In UC Merced's short history, it has earned accreditation from the Western Association of Schools and Colleges and the Accreditation Board for Engineering and Technology; received the Hispanic Serving Institution and Minority Serving Institution designations for its diverse student body; became the first American university to reach carbon neutrality as a campus; completed the Merced 2020 Project – the largest public-private infrastructure project in the state, doubling the size of campus to support 10,000 students; and in fiscal year 2018-2019 the net impact of the university's operations spending added \$206.7 million in income to the regional economy and \$514.6 million to the San Joaquin Valley economy.

In its 2021 rankings, U.S. News and World Report ranked UC Merced fifth among all universities in supporting social mobility and 97th among all national universities. The Carnegie Classification of Institutions of Higher Education ranked UC Merced as R2 – Doctoral Universities: high Research Activity in 2016, faster than any other university has achieved this status, and is working towards achieving the premier ranking of R1 – Doctoral Universities: Very High Research Activity (see <https://carnegieclassifications.iu.edu/>). Money Magazine ranked UC Merced 76th of 739 schools in their 2020 Best Colleges Rankings and 12th for Most Transformative Colleges based on students surpassing expectations based on their academic and economic backgrounds (highest in the UC system).

The University is financially sound. The UC Office of the President has demonstrated its belief in the importance of UC Merced's growing contribution to the Valley and the state, by committing multi-year funding to sustain the university's growth rate, with the concomitant number of faculty, staff and facilitates to provide for those students. UC Merced is growing in philanthropic support from both private and public foundations and organizations. Recently, UC Merced received the largest single, unrestricted gift in its history – a gift of \$20 million from philanthropist and author MacKenzie Scott and her husband Dan Jewett. With their efforts focused on supporting historically underfunded organizations, Scott and Jewett asserted their belief in funding higher education as a proven pathway to opportunity; their advisors searched out institutions in underserved areas significantly effecting positive social change and equity and producing and encouraging leaders of color and economic mobility. This gift is complemented by another nearly \$10 million raised from philanthropic support. The California legislature, as well, has taken note of UC Merced's achievements and mission-driven successes and has offered significant new funding for the campus.

At the start of the 2020-21 academic year 9,018 students were enrolled at UC Merced, 8,276 are undergraduates and 742 are graduates. The student body is among the most diverse and underserved in the nation. Currently the student body is ranked eighth among all universities in economic diversity. UC Merced has double the national average of first-generation students and the highest percentage of undocumented students enrolled on any UC campus.

Not only is UC Merced building the future in the heart of California, it is doing so in a way that speaks to the university's commitment to innovation in research and education that uplifts the region and results in a new generation of leaders.

2. Explain the rationale for adding this institution.

As a part of the UC system, UC Merced is committed to the University's overall mission of excellence in teaching, research and public service. UC Merced's campus leadership and faculty recognize that knowledge increasingly depends on links that transcend the traditional disciplines and the campus research programs foster and encourage cross-disciplinary inquiry and discovery.

UC Merced is attracting academic leadership and innovative researchers nationwide who want to be a force for change in fields such as water quality, alternative energy, hydrology, agricultural and mechanical technology, immunology, data science, and public health. Our faculty and students are identifying solutions to the region's most pressing problems - many of which also plague the nation and regions across the globe.

Interest and investment in the STEM fields are particularly keen: UC Merced is tied for first in the UC system in the percentage of students graduating with STEM degrees – currently 52% of our undergraduates are STEM majors. At the graduate level, 83% of our students are in STEM fields. Our graduate students are increasingly being recognized for their research, including applied mathematics graduate student, Shayna Bennett, who captured first place at the UC Grad Slam competition with her presentation on predicting and preventing the arrival of invasive species in California. Since Grad Slam began seven years ago, UC Merced graduate students have earned third place, People's Choice and now, for the first time, first place. Grad Slam is a UC system-wide competition that provides graduate students with a forum to explain the methods, results and significance of their research via a three-minute presentation to a non-specialty audience and panel of judges.

Diversity and interdisciplinarity are touted by many institutions, but rarely manifested to the degree they are at UC Merced. Upon these twin pillars of graduate education, we are laying the foundation for the workforce of the future – academics, scientists and engineers well-equipped to address the complex problems of our age in the academy, national laboratories, industry and other venues.

In less than two decades, UC Merced has become the home of several prominent STEM institutes and centers, including the Sierra Nevada Research Institute (SNRI), the Health Sciences Research Center (HSRI), the Center for Information Technology Research in the Interest of Society (CITRIS – we are one of four UC campus sites), the University of California Advanced Solar Technologies Institute (UC Solar), and most recently the new UC Center for Climate Justice, system-wide initiative to address climate change as a social justice and equity issue (see Appendix 2 for details).

UC Merced has active awards in every one of the National Science Foundation's seven directorates (a total of 87 active awards currently). In addition, it has garnered awards from 10 of the 27 National Institutes of Health (32 active awards). Twenty-eight members of the faculty have been awarded NSF CAREER or other distinguished young investigator grants while at UC Merced. Professor Sarah Kurtz was elected to the National Academy of Engineering (NAE) in recognition of her contributions to the development of gallium indium phosphide/gallium arsenide photovoltaic cells and for her leadership in solar-cell reliability and quality. Research expenditures have continued to grow since 2006, from \$7,527,000 with 45 faculty to \$29,668,000 in 2015, when UC Merced last applied for ARCS, and now (FY2020) sits at \$45,966,000 with 290 faculty. UC Merced is continuing to create a legacy of innovation and garner recognition with every passing day. Just yesterday, July 29, 2021 UC Merced became one of four core institutions of NSF's newly announced AgAID Institute, the collaborative

USDA-NIFA Institute for Agricultural AI for Transforming Workforce and Decision Support. This multi-institutional research collaborative will develop artificial intelligence (AI) solutions to tackle some of agriculture's biggest challenges related to water management, climate change and integration of new technology into farming.

Area of Study

1. Specify the ARCS approved Area(s) of Study, under which this discipline falls.

Environmental Studies

2. If the Department/Program or primary Multidisciplinary Program does not fall within our approved Areas of Study, please provide the following information:

- Is this a sub-category of an area(s) we do fund? If so, demonstrate how it relates to this area(s).

NA

- If this is an entirely new area of study, confirm that the research being done in the Department/Program or Multidisciplinary Program is “hard” or “bench” science and not comparative or clinical research. Cite examples.

NA

- Explain how this area of study supports the standards of excellence essential to the ARCS mission.

NA

Overview of Department/Program or Multidisciplinary Program

Provide an overview of the departments/programs

The Environmental Systems (ES) Graduate Group focuses on understanding the earth as an integrated system that includes the atmosphere, hydrosphere, lithosphere and biosphere in order to address environmental consequences and develop sustainable solutions to providing food, energy and other basic services to the earth's ever-growing population. Recognizing that solutions to local, regional and global environmental problems cross traditional academic departments, domain knowledge is complemented by an interdisciplinary shared curriculum that provides a foundation in the fundamental ideas and methods of the earth, environmental and social sciences. ES students are uniquely poised to address critical research needs of the environment and its sustainability and are prepared for careers in academies, research government and industry that integrate expertise from across engineering, natural sciences and social sciences. Environmental Systems faculty, staff and students are dedicated to excellence in teaching, research and services and strive to develop an atmosphere of transparency, inclusiveness, rigor, integrity and environmental awareness.

Research Areas:

- Water Resources and Climate
- Environmental and Ecological Engineering
- Sustainable Energy
- Biogeochemistry and Environmental Chemistry
- Ecology, Evolution and Biodiversity
- Conservation and Resource Management

Research Centers and Facilities: (see Appendix 2 for details)

- Sierra Nevada Research Institute (SNRI)
- Merced Vernal Pools and Grassland Reserve
- Environmental Analytical Laboratory
- Yosemite Wawona Field Station
- Southern Sierra Critical Zone Observatory
- University of California Advanced Solar Technologies Institute (UC SOLAR)
- Center for Information Technology Research in the Interest of Society (CITRIS)

Facts, including ranking

1. How does this **institution** rank nationally among its peers? Give two rankings from different sources, including dates and names of the sources.

US News & World Report Rankings:

#97 overall (2021) (First time in Top 100 schools; jumped 7 spots since 2019; jumped 68 spots in the last three years)

#40 among public institutions (2021)

#1 among public universities in Outperforming Expected Graduation Rates (2021)

#5 for Social Mobility (2021)

#8 for Economic Diversity (2021)

Times Higher Education Rankings:

Times Higher Ed ranked UC Merced #3 among U.S. universities in the Young University Rankings; #57 in the world (2021). The *Times Higher Education* Young University Rankings list the world's best universities that are 50 years old or younger. The ranking includes institutions that were founded between 1971 and the present, UC Merced was founded in 2005.

2. How does this **department/program** rank nationally among its peers? Give two rankings from different sources, including dates and names of the sources. If the multidisciplinary primary program is not ranked, provide the rankings of the relevant departments and any quantitative and qualitative comparative information for the program as a whole.

US News & World Report rankings:

The Environmental Systems (ES) graduate program was ranked #77 by the *US News & World Report* in the category of Environmental Engineering in 2021.

The School of Engineering in which the program resides was ranked #119 by the *US News & World Report* in the category of Graduate Engineering in 2021.

College Factual Rankings:

UC Merced was ranked #13 by College Factual for Colleges Most Focused on Environmental Engineering in the U.S. in 2021.

3. How old is the **department/program** or multidisciplinary program and why was it established?

The Environmental Systems Graduate Group, was established and had enrolled graduate students in 2004, predating the opening of campus in 2005. It was established alongside the Sierra Nevada Research Institute and represents a strategic emphasis area of environmental research, given the proximity of the campus to the Sierra Nevada Mountains.

Degrees Granted

1. Name the degrees awarded in the department/program or multidisciplinary program (e.g., Ph.D. in Chemistry).

PhD – Environmental Systems

MS – Environmental Systems

2. For which of the degrees named above are you seeking approval?

PhD – Environmental Systems

3. For each degree named in two, please indicate the number of degrees that are granted per year per faculty.

With 35 core faculty members and 7 students graduate from the ES program in FY20 there were 0.2 degrees conferred per faculty last year.

4. For each degree named in two, please indicate the non-completion rate.

PhD 7-Year Non-Completion Rate (3-year average): 37%

PhD 8-Year Non-Completion Rate (3-year average): 29%

These non-completion rates are well below the national average. In the 2015 Doctoral Initiative on Minority Attrition published by the Council of Graduate Schools, it is noted that 54% of all students in all PhD fields, including U.S. citizens and permanent residents and temporary residents, did not complete their doctoral programs after seven years, and even after ten years 43% still had not completed their degrees. The non-completion rates were higher for underrepresented minorities.

The campus-wide goal is to reduce our PhD 7-year non-completion rate down to 35% in five years. The ES graduate program is already nearly at this target.

5. For each degree named in two, what is the average length of time a student invests to receive a terminal Masters or Doctoral degree in the department/program or multidisciplinary program being considered (using data from the past 10 years, if available)?

Average years to PhD: 5.5 years

Students

1. How many students are in the department/program or multidisciplinary program?

Fall 2020 PhD Enrollment: 56

2. Explain the student mentoring effort and/or graduate support to enhance retention in the department/program or multidisciplinary program. Explain why if none is available.

At UC Merced, student success results from collaboration and shared responsibility among students, faculty, staff and administration. With 48% of the Fall 2020 Graduate cohort being first-generation college students, the university understands that providing support, guidance, and resources that equip students to continue their educational journey is essential to their success. The Graduate Division provides a number of programs, mentorships and trainings including:

Academic Counseling – Graduate academic counseling is available to support students on their academic journey with in-person meetings, phone meetings and workshops. Areas of support can include: one-on-one counseling, academic and personal support, developing effective communication skills, time management strategies and work/life balance, overcoming self-doubt

and imposter syndrome and facilitating good mentoring relationships and healthy research communities.

GRAD EXCEL – The GRAD-EXCEL program is designed to promote early success in first-year doctoral students through coaching and engagement with a community of advanced doctoral peer mentors. Each incoming doctoral student is guided by a GRAD-EXCEL Peer Mentor (matched by research discipline) as they acclimate to UC Merced and their graduate studies during their first academic year.

Competitive Edge Summer Bridge – This program is designed to ensure that first-generation students or those from backgrounds typically underrepresented in higher education are better equipped to complete their degrees and go on to successful careers. Graduate students who participate in this program:

- Move to campus two months early for better acclimation
- Are placed in a cohort to build early support structures
- Begin work with advisors to get a head start on research techniques and projects
- Attend tailored workshops and seminars designed to give them a broad foundation of professional knowledge

Graduate Enrichment and Advancement Resources and Services (GEARS) – The Graduate Division’s multi-track professional development series is designed to prepare students for success while at UC Merced and beyond. Our GEARS tracks are as follows:

- **Preparing Future Faculty** – Topics range from how to prepare for the academic interview, discussions of post-doctoral fellowship opportunities, making the transition from graduate student to faculty and how to thrive as faculty of color or international faculty.
- **Preparing Future Professionals** – This series allows students to explore business, government and non-profit sectors as potential career paths after graduation. Topics include how to choose between the academy and industry, how or if you should prepare for a postdoctoral position, the transition away from graduate school, and discussions of careers and opportunities in specific fields.
- **Grant and Fellowship Workshops** – Topics include preparing your application materials, what specific committees may be looking for, and how to best market yourself for particular opportunities. Appropriate for those working on pre-doctoral, dissertation, or post-doctoral fellowship applications or various grant applications.
- **Publishing Your Research** – This series of forums and workshops help scholars navigate the publication process and identify outlets for their scholarly work. Some sessions in this track are geared to specific fields, while others offer broader topics applicable to all students interested in publishing their research.
- **Dissertation Boot Camp** – Open to students working on dissertations, theses, articles, or grant/fellowship proposals, this intensive 4- to 6-day workshop helps to kickstart or revitalize students’ writing process. As Boot Camp participants, students work in a small cohort to support and motivate each other to meet their writing goals. In addition to lots of quiet writing time, Dissertation Boot Camp offers elective group sessions that address common pitfalls and issues that many students encounter, stress and time management, and dissertation and thesis formatting at UC Merced. Individualized writing help is also offered.
- **Grad Slam** – A UC-wide competition among graduate students in which students have three minutes to present their research in an interesting, informative manner. Grad Slam programming includes public-speaking workshops during the weeks leading up to the start of the multi-round competition. UC Merced’s first ever Grad Slam winner came this spring via Shayna Bennett, an applied mathematics graduate student.

Research Support – Students have access to funding and training opportunities through several associated research centers and programs including: (see Appendix 2 for details)

- UC Water Security and Sustainability Research Initiative
- UC Advanced Solar Technologies Institute
- Center for Information Technology Research in the Interest of Society
- Sierra Nevada Research Institute
- Spatial Analysis and Research Center
- UC Merced Natural Reserve System

NSF Research Traineeship (NRT) Program – This program is designed to encourage the development and implementation of bold, new potentially transformative models for STEM graduate education training. Students in the training program participate in a computational basecamp, custom course modules on intelligent adaptive systems, communication skills development workshops and industry networking opportunities.

Graduate Student Association (GSA) – The official student government of the graduate student population at UC Merced. Among many roles, the Association advocates on behalf of the graduate student population, organizes graduate student representation among various campus committees, encourages graduate student life, and organizes a small travel reimbursement award for graduate student presenters.

The Graduate Student Association of the University of California, Merced is established:

- To provide a forum where the matters of concern to graduate and professional students may be discussed
- Where opinions on actions and proposals of the university administration and graduate groups may be expressed
- Where proposals of the Administration and graduate groups may be initiated
- To conduct programs and services of special interest to graduate students

3. On average, what financial assistance is available to each student? ARCS Scholar financial awards are unrestricted, and not to be included in the financial package awarded by the institution.

Nearly all ES PhD students receive 12 months of funding per year for each year that they are in the program. The 12-month total stipend is about \$30,000 per student, including remission of all tuition and fees except a small amount of campus-based fees (<\$500).

Additionally, nearly all PhD students are funded by the program for summer research.

Faculty

1. What is the size of the faculty? How many faculty members are in the department(s)/ program(s) or will be engaging with the scholar(s) in the multidisciplinary program?

There are currently 35 active core members of the ES graduate group who will be engaging with ARCS scholars.

2. What percentage of the faculty is full-time, part-time?

100% - All active core faculty are full-time

3. What is the faculty/student ratio for the department/program or multidisciplinary program?

With 56 graduate students currently enrolled and 35 faculty members, the student/faculty ratio is 1.6. Note that several faculty members also advise students in other related graduate programs, such as Quantitative and Systems Biology and Management of Complex Systems.

4. Cite national awards received by current faculty teaching in the department (s)/program(s) or multidisciplinary programs in the past 5 years. (Additional rows should be added as needed.)

Faculty Name	Award
Sora Kim	2020 Emerging Scholar by Diverse Issues in Higher Education
Asmere Asefaw Berhe	Joanne Simpson Medal from the American Geophysical Union and Bromery Award from the Geological Society of America
Marie Odile-Forgier	NSF CAREER Award
Jessica Blois	NSF CAREER Award
Michael Beman	NSF CAREER Award

5. Cite national offices held by current faculty teaching in this departments/programs in the past five years. (Additional rows should be added as needed.)

Faculty Name	National Organization	Office Held
LeRoy Westerling	American Geophysical Union, American Association for the Advancement of Science	Member
Asmeret Asefaw Berhe	American Geophysical Union and Geological Society of America	Fellow
Roger Bales	American Geophysical Union, American Society for the Advancement of Sciences, American Meteorological Society	Fellow
Tom Harmon	American Society of Civil Engineers	Associate Member

6. How many and what percentage of current faculty in this department(s)/program(s) hold research grants from the National Institutes of Health (NIH), the National Science Foundation (NSF) and/or other nationally recognized scientific bodies?

Twenty-two of the 35 faculty members (63%) in ES have current grants from national funding agencies.

7. How many current faculty have been elected to membership in the relevant organizations of: National Academy of Sciences; National Academy of Engineering; Institute of Medicine. (Additional rows should be added as needed.)

Faculty Name	Organization
Sarah Kurtz	National Academy of Engineering

8. List the 15 most important current grants, including amounts, dates of funding, funding agency and role of faculty member (e.g., PI or Co-PI).

NSF Integrative Organismal Systems Cluster, "The Risks of Safety: Xylem Anatomy and Trade-offs between Reproduction, Growth, and Drought Survival in Sierra Nevada Conifers" Emily Moran PI, \$417,579 (2019-23).

NSF, "Dimensions: RET: Taxonomic, Genetic and Functional Biodiversity of Above-ground Bacterial Endophytes in Subalpine Conifers," Carolin Frank PI, \$364,682 (2019-2021).

CA Fish & Wildlife, "High Resolution Temporal and Spatial Mapping of Mercury in Surface Waters of the San Francisco Bay Delta," Erin Hestir PI, \$1,708,782 (2019-2023).

NSF, "NSF Engineering Research Center for Internet of Things for Precision Agriculture (IoT4AG)," Catherine Keske PI (collaborative with Univ of Pennsylvania), \$489,916 (2020-2021).

NSF, "Collaborative Research: The Risks of Safety: Xylem Anatomy and Tradeoffs Between Reproduction, Growth, and Drought Survival in Conifers," Emily Moran PI, \$417,579 (2019-2023).

National Institute of Food and Agriculture, "San Joaquin Valley Food and Agriculture Cyberinformatics Tools and Science (FACTs) Bridge," Colleen Naughton PI, \$399,945 (2020-2024).

NSF, "CAREER: From Genes to Assemblages: Causes and Consequences of Spatiotemporal Population Variation Across Millenia in Small Mammals," Jessica Blois PI, \$758,794 (2019-2024).

Department of Energy, "CERC for Water-Energy Solutions and Technologies (CERC WEST)," Josh Viers PI, \$902,761 (2017-2021).

NSF, "CAREER: Geospatial Life Cycle Climate Change Impacts of Solar and Ocean Renewable Energy Systems," Marie Odile-Fortier PI, \$500,000 (2021-2026).

National Institute of Food and Agriculture, "INFEWS/T1: Sustaining California's Food Production Through Integrated Water and Energy Management," Martha Conklin PI, \$1,371,400 (2018-2022)

NSF, "Collaborative Proposal: Selection and Genetic Succession in the Intertidal -- Population Genomics of *Pisaster ochraceus* During a Wasting Disease Outbreak and its Aftermath," Michael Dawson PI, \$699,480 (2017-2021).

USDA, "Early detection and growth tracking of *Aspergillus flavus* (A. *Flavus*) in pistachios using E-nose technology," Reza Ehsani PI, \$411,160 (2021-2022).

NSF, "Collaborative Research: Shark FEST-Fusing Eocene Shark Tracers: paleoecology, ocean circulation, and Antarctic glaciation with geochemistry and climate modeling," Sora Kim PI, \$297,395 (2019-2022).

NSF, "INFEWS:T2: Saltwater Greenhouse System for Agricultural Drainage Treatment and Food Production," Yanbao Ma PI, \$2,500,000 (2019-2022).

Department of Energy, "The Internal Compound Parabolic Concentrator (ICPC) - a Novel Low-Cost Solar Thermal Collection System for Desalination Processes," Roland Winston PI, \$1,081,793 (2018-2021).

9. State the number of published articles per faculty attributed to the department/program under consideration during the past two years (provide full citations for 10 examples, underlining or bolding faculty names) as well as the number of articles published by the department/program's faculty in the journals "Nature", "Science" and/or the journals that constitute the top three peer reviewed publications in your field/s during the past two years (cite 10 examples).

ES faculty members published about 4.5 articles per year per member for the past two years. They also have six publications in *Nature*, *Science*, and the top-three journals in their fields in the last two years. Ten examples are as follows, including those from top journals.

Tóth, A. B., Lyons, S. K., Barr, W. A., Behrensmeyer, A. K., **Blois, J. L.**, Bobe, R., ... & Alroy, J. (2019). Reorganization of surviving mammal communities after the end-Pleistocene megafaunal extinction. *Science*, 365(6459), 1305-1308.

Alcántara-Ayala, I., **Berhe, A. A.**, Derry, L., Ganti, V., Horton, A. A., & Sim, M. S. (2021). Reflections on Earth surface research. *Nature Reviews Earth & Environment*, 2(1), 15-20.

Rapacciuolo, G., **Beman, J. M.**, Schiebelhut, L. M., & **Dawson, M. N.** (2019). Microbes and macro-invertebrates show parallel β -diversity but contrasting α -diversity patterns in a marine natural experiment. *Proceedings of the Royal Society B*, 286(1912), 20190999.

McKuin, B., Zumkehr, A., Ta, J., **Bales, R.**, **Viers, J. H.**, Pathak, T., & Campbell, J. E. (2021). Energy and water co-benefits from covering canals with solar panels. *Nature Sustainability*, 1-9.

Carlisle, A. B., Allan, E. A., **Kim, S. L.**, Meyer, L., Port, J., Scherrer, S., & O'Sullivan, J. (2021). Integrating multiple chemical tracers to elucidate the diet and habitat of Cookiecutter Sharks. *Scientific Reports*, 11(1), 1-16.

Fatichi, S., Or, D., Walko, R., Vereecken, H., Young, M. H., **Ghezzehei, T. A.**, ... & Avissar, R. (2020). Soil structure is an important omission in Earth System Models. *Nature Communications*, 11(1), 1-11.

McNicol, G., Jeliazovski, J., François, J. J., Kramer, S., & **Ryals, R.** (2020). Climate change mitigation potential in sanitation via off-site composting of human waste. *Nature Climate Change*, 10(6), 545-549.

Kottler, E. J., Dickman, E. E., **Sexton, J. P.**, Emery, N. C., & Franks, S. J. (2021). Draining the swamping hypothesis: little evidence that gene flow reduces fitness at range edges. *Trends in Ecology & Evolution*.

Reinoso-Maset, E., Perdrial, N., Steefel, C. I., Um, W., Chorover, J., & **O'Day, P. A.** (2020). Dissolved Carbonate and pH Control the Dissolution of Uranyl Phosphate Minerals in Flow-Through Porous Media. *Environmental Science & Technology*, 54(10), 6031-6042.

Avanzi, F., Maurer, T., Glaser, S. D., **Bales, R. C., & Conklin, M. H.** (2020). Information content of spatially distributed ground-based measurements for hydrologic-parameter calibration in mixed rain-snow mountain headwaters. *Journal of Hydrology*, 582, 124478.

If this is a Multidisciplinary/Program, please complete the following:

1. Provide a listing of multi-investigator grants and their size and source of funding relating to this department(s)/program(s).

NSF Integrative Organismal Systems Cluster, "The risks of safety: xylem anatomy and tradeoffs between reproduction, growth, and drought survival in Sierra Nevada conifers" Emily Moran PI, \$417,579 (2019-23).

NSF, "Dimensions: RET: Taxonomic, Genetic and Functional Biodiversity of Above-ground Bacterial Endophytes in Subalpine Conifers", Carolin Frank PI, \$364,682 (2019-2021).

CA Fish & Wildlife, "High Resolution Temporal and Spatial Mapping of Mercury in Surface Waters of the San Francisco Bay Delta", Erin Hestir PI, \$1,708,782 (2019-2023).

NSF, "NSF Engineering Research Center for Internet of Things for Precision Agriculture (IoT4AG)", Catherine Keske PI (collaborative with Univ of Pennsylvania), \$489,916 (2020-2021).

NSF, "Collaborative Research: The Risks of Safety: Xylem Anatomy and Tradeoffs Between Reproduction, Growth, and Drought Survival in Conifers", Emily Moran PI, \$417,579 (2019-2023).

National Institute of Food and Agriculture, "San Joaquin Valley Food and Agriculture Cyberinformatics Tools and Science (FACTs) Bridge", Colleen Naughton PI, \$399,945 (2020-2024).

NSF, "CAREER: From Genes to Assemblages: Causes and Consequences of Spatiotemporal Population Variation Across Millennia in Small Mammals", Jessica Blois PI, \$758,794 (2019-2024).

Department of Energy, "CERC for Water-Energy Solutions and Technologies (CERC WEST)", Josh Viers PI, \$902,761 (2017-2021).

NSF, "CAREER: Geospatial life cycle climate change impacts of solar and ocean renewable energy systems", Marie Odile-Fortier PI, \$500,000 (2021-2026).

National Institute of Food and Agriculture, "INFEWS/T1: Sustaining California's Food Production Through Integrated Water and Energy Management", Martha Conklin PI, \$1,371,400 (2018-2022).

NSF, "Collaborative Proposal: Selection and Genetic Succession in the Intertidal -- Population Genomics of *Pisaster ochraceus* During a Wasting Disease Outbreak and its Aftermath", Michael Dawson PI, \$699,480 (2017-2021).

USDA, "Early detection and growth tracking of *Aspergillus flavus* (A. *Flavus*) in pistachios using E-nose technology", Reza Ehsani PI, \$411,160 (2021-2022).

NSF, "Collaborative Research: Shark FEST-Fusing Eocene Shark Tracers: paleoecology, ocean circulation, and Antarctic glaciation with geochemistry and climate modeling", Sora Kim PI, \$297,395 (2019-2022).

NSF, "INFEWS:T2: Saltwater Greenhouse System for Agricultural Drainage Treatment and Food Production", Yanbao Ma PI, \$2,500,000 (2019-2022).

Department of Energy, "The Internal Compound Parabolic Concentrator (ICPC) - a Novel Low-Cost Solar Thermal Collection System for Desalination Processes", Roland Winston PI, \$1,081,793 (2018-2021).

2. What entity gives the degree? (What does the diploma say?)

Environmental Systems

3. Does the institution reward cross-over faculty (with tenure, resources, etc.)? If so, how?

The Graduate Group is separate from academic departments that oversee faculty promotion, tenure, and resources. Faculty members from multiple departments are members of ES, but they do not cross-over departments.

4. Are there recruitment efforts in common between the multidisciplinary program and related departments/programs? If so, what are they?

The departments recruit undergraduate students through the schools and various campus administrative units, whereas graduate students are recruited through the Graduate Groups and the Graduate Division. These efforts overlap to the extent that undergraduates go on to graduate school.

5. If the multidisciplinary Program involves more than one university or institute, please name all participating entities.

NA

6. Are all institutions participating approved by ARCS?

NA

7. Please confirm that the degree granting university is approved by ARCS.

UC Merced is submitting an application to ARCS for approval, with Environmental Systems being one of the initial graduate programs. Applications Physics and Cognitive and Information Sciences are also being submitted for consideration.

SECTION II

*(Additional questions to be completed if the Department(s)/Program(s) or Institution housing it is **not** ranked within the top 50 in the nation. Many of these questions are answered in regard to the institution.*

1. Is the doctoral degree regularly awarded from this institution in the sciences, engineering, and/or medicine? Please state the number of degrees granted for each area, what degrees they are, and from what departments for the past 3 years.

Total PhDs Awarded from 17-18, 18-19 and 19-20

Cognitive and Information Sciences: 12

Applied Mathematics: 9

Chemistry and Biochemistry: 7

Physics: 23

Quantitative and Systems Biology: 25

Bioengineering: 5

Electrical Engineering and Computer Science: 18

Materials and Biomaterials Science and Engineering: 6

Mechanical Engineering: 11

Environmental Systems: 18

2. What are the top three science, engineering and/or medical research departments at the institution?

Environmental Systems, Cognitive & Information Sciences and Physics

3. Indicate the total expenditures at the institution for research activities in fields relevant to the department.

FY 2020 - \$9,706,000. This includes UC Merced federal and non-federal expenditures in the fields of civil engineering and geological and earth sciences for FY 2020, as reported by the University of California Office of the President in the National Science Foundation's Higher Education Research and Development Survey FY 2020.

4. Indicate the total expenditures in the department for research activities in the fields of science, engineering, and medicine.

FY 2020 - \$43,421,000 (for institution in fields of sciences, engineering and medicine). This includes federal and non-federal research expenditures in all fields except “non-S&E fields” for FY 2020, as reported by the University of California Office of the President in the National Science Foundation’s Higher Education Research and Development Survey FY 2020.

Attachments

Please list attachments

Appendix 1. List of Program Faculty

Appendix 2. Description of Library, Laboratories, Institutes and Research Centers

Appendix 1

List of Program Faculty

Listing of Environmental Studies Graduate Core Faculty 2020-21

John Abatzoglou, Associate Professor
Roger Bales, Professor
John Beman, Assistant Professor
Asmeret Berhe, Associate Professor
Marc Beutel, Associate Professor
Jessica Blois, Assistant Professor
Abel Chuang, Assistant Professor
Martha Conklin, Professor
Michael Dawson, Associate Professor
Gerardo Diaz, Associate Professor
Reza Ehsani, Professor
Marie-Odile Fortier, Assistant Professor
Carolin Frank, Associate Professor
Teamrat Ghezzehei, Associate Professor
Thomas Harmon, Professor
Stephen Hart, Professor
Erin Hestir, Assistant Professor
Jeff Jenkins, Assistant Professor
Catherine Keske, Associate Professor
Sora Kim, Assistant Professor
Crystal Kolden, Assistant Professor
Sarah Kurtz, Professor
Valerie Leppert, Associate Professor
Claire Lukens, Assistant Professor
Yanbao Ma Assistant Professor
Emily Moran, Assistant Professor
Colleen Naughton, Assistant Professor
Peggy O'Day, Professor
Wolfgang Rogge, Associate Professor
Rebecca Ryals, Assistant Professor
Jason Sexton, Assistant Professor
Joshua Viers, Associate Professor
Anthony (Leroy) Westerling, Associate Professor
Roland Winston, Professor
Xuan Zhang, Assistant Professor

Appendix 2

Description of Library, Laboratories, Institutes and Research Centers

Campus Buildings, Offices and Research Space

Classroom & Office Building 1

Classroom & Office Building 1 is a 3-story, 105,435 gross square-foot building with classrooms, offices, and laboratories. COB was awarded LEED Gold Certification in March of 2008. The building is located in the core section of campus. The COB also houses a performance auditorium with high-quality acoustic features, a system for state-of-the-art sound and lighting equipment and backstage rooms for performers, musical and performance equipment and general storage.

Classroom & Office Building 2

Classroom & Office Building 2 is a 3-story, 88,505 gross square-foot building located in the core section of campus. COB2 has LEED Platinum certification. COB2 provides approximately 51,000 assignable square feet of flexible classroom, academic support, research and office space.

Science & Engineering Building 1

SE1 is a 4-story plus basement, 212,344 gross square-foot building located in the core section of campus. The SE1 building was awarded LEED Gold certification in February of 2009. The building includes laboratories, laboratory support space, teaching laboratories and offices and administrative office space for the PI and named senior personnel. Faculty members are assigned space in modern collaborative inter-disciplinary suites equipped with state of the art equipment. Sophisticated shared equipment is located in dedicated rooms within a suite with similar research needs or across-suites to encourage efficient utilization of resources and foster inter-disciplinary interactions.

Science & Engineering Building 2

Science & Engineering Building 2 is a 3-story plus basement and roof, 131,279 gross square-foot facility overlooking the next phase of campus development. The building opened in 2014. It provides space for the School of Engineering Dean suite, School of Natural Sciences and School of Engineering faculty offices, graduate student and trainee offices, research and instructional laboratories, and core facilities. Architectural features include several significant outdoor spaces, such as a pedestrian plaza; a solar-panel shaded promontory that can serve as an event venue; and a porch for outdoor learning opportunities. In addition to offices and labs on the upper levels, breakout rooms with adjacent balconies will provide collaboration space featuring sweeping vistas of the undeveloped landscape and future campus expansion.

Lab 2A: Sustainability Research & Engineering

Lab 2A: Sustainability Research & Engineering is a 4-story plus basement, 179,937 gross square-foot building. It is one of three teaching and research buildings that anchors the new Academic Quad as part of the 2020 Project campus expansion initiative. The building consists of four floors above grade with a partial basement. This basement nestles into UC Merced's existing topography and links the laboratory to the shaded loading dock.

Within the building, the wet/dry laboratories are organized around modular planning principles that will enable the configuration of the building to evolve over time. At the intersection between research and class laboratories, building users will find conference rooms, break rooms, and colloquy spaces arranged to bring people together across divisions and departments to create dynamic learning environments.

The architectural expression of the building builds on the contextual legacy of UC Merced's initial buildings with the use of materials familiar to the Valley, but employed in service of the functional needs of the building. Primary exterior building materials consist of cast-in-place architectural concrete, corrugated metal, and high-performance glazing—all materials that can be found throughout existing University buildings. Colored cement plaster is used as a highlight in select locations at the ground floor and exterior stairs.

Lab 2B: Arts & Computational Sciences

Lab 2B: Arts & Computational Sciences is a 3-story plus basement, 113,364 gross square-foot building. This building creates a relationship between the Academic Quad on its northern side and the natural landscape to the south.

Active program is clustered around activity nodes and interconnected outdoor spaces. These features ease wayfinding, and foster impromptu meetings and collaboration for students, faculty and staff. Exterior circulation articulates the pedestrian experience at the ground and upper levels facing the Academic Quad. This allows all levels of the building to participate in the campus experience, and helps the building display its function. Balconies and exterior gathering spaces denote major pedestrian pathways.

Lab 3A: Biomedical Sciences and Physics

Lab 3A is a 302,173 gross square-foot building. It is one of three teaching and research buildings that anchor the new Academic Quad as part of the 2020 Project campus expansion initiative. The building consists of five floors above grade with a partial basement. This basement nestles into UC Merced's existing topography and links the laboratory to the shared loading dock.

3A BSL-3/ABSL-3

The BSL-3/ABSL-3 facility occupies the new Lab 3A-Biomedical Sciences and Physics building (part of the Merced 2020 initiative).

The facility contains three laboratory rooms and two animal holding rooms with adjoining procedure rooms. Each lab room contains a Class II A2 and Class II B2 safety cabinet. One lab room has a glove box. The animal holding rooms contain two biocontainment rodent racks and a Class II A2 in the procedure space.

The facility contains the necessary equipment to perform animal infections, process tissues and cells, and prepare samples for analysis, prior to fixation and/or storage. Shakers and incubators are available for fungal growth and longer-term cellular stimulation experiments.

3A2: Greenhouse

The Greenhouse is a 2,560 gross square-foot research greenhouse adjacent to the Lab 3A building. Designed by Skidmore, Owings and Merrill, it was completed in Fall 2020 as part of the campus expansion. The building has been sited in a location well-suited for future expansion as funding becomes available.

Access to plant-growth facilities is essential for the controlled, hands-on research carried out by many UC Merced faculty members and students. The potential for research performed in this facility includes areas such as food and water security, biodiversity, climate change, renewable energy, and ecosystems.

Kolligian Library

Kolligian Library is a 4-story, 215,961 gross square-foot building that houses the campus library and meeting rooms in the four-story east wing, and administrative offices and student services space in the three-story west wing. Additionally, executive campus leadership and administration, a large public gathering space and common dining area, and the campus bookstore are located within the building. The library has 17 group meeting rooms, and dedicated study space as well as library instructional space. As part of the University of California, UC Merced Library shares resources with other campuses and has developed much of its electronic collection in conjunction with the California Digital Library (CDL). The library offers 48 laptops for instruction, 10 public workstations that visitors can use to access library information online, and two high resolution book scanners.

Major Equipment

Students, researchers, and faculty have access to major equipment at UC Merced in the following shared, centralized facilities:

Imaging and Microscopy Facility

The Image and Microscopy Facility is a laboratory that provides essential resources around the clock for faculty members, students and researchers in the area of light and electron microscopy. This laboratory provides an infrastructure that can serve campus researchers in the physical sciences, biological sciences and engineering, with a particular focus on nanotechnology. The IMG hosts optical, Scanning and Transmission Electron Microscopes, Wide Angle X-ray Diffraction, X-ray Photoelectron Spectroscopy, in addition to equipment for preparing specimens for examination. The objective is to provide high-end, state-of-the-art instrumentation to campus members at a modest cost.

Stable Isotope Laboratory

The Stable Isotope Laboratory at UC Merced includes two ThermoFisher Delta V Plus isotope ratio mass spectrometers (purchased in 2014) each with Conflo IV interfaces. Both have collectors for measuring hydrogen, oxygen, carbon, nitrogen, and sulfur isotopes; one of the instruments includes the collectors for measuring 33S and 36S. Peripheral devices include the TCEA and a GC Isolink with RSH autosampler equipped for carbon, nitrogen, and hydrogen isotope measurements, along with a Costech elemental analyzer with a zero blank autosampler. In addition, the laboratory includes a Sartorius microbalance, freeze drier, muffle furnace, ovens, sol-

vent storage freezer, refrigerator, standard gases, Labconco drying system, and analytical balances.

Environmental Analytical Laboratory

The Environmental Analytical Laboratory (EAL) is one of core facilities supported by the Office of Research and Economic Development. The EAL is equipped with an array of state-of-the-art instrumentation and sample preparation equipment located at S&E I Room 201 (partial space) at the UC Merced main campus. It offers rapid and accurate measurements in environmental materials—including water, soil and biological samples—for major and trace elements, selected chemical species, nutrients and stable isotopes to meet a wide range of analytical needs in support of diverse research and education programs in environmental, chemical, biological, the Earth systems, ecological sciences and engineering. A list of major instruments and their capabilities is included below:

Environmental Analytical Laboratory (EAL) Instrument Capabilities
Office of Research & Economic Development, UC Merced

Instruments Available	Compounds or Elements Analyzed	Sample Types	Concentration Range
ICP-OES	Typical metals: K, Na, Ca, Mg, Fe, Mn, Al, Cu, Zn, As, S, P, Si, and more	multi-element capabilities and high dynamic ranges	mid-ppb to ppm level
ICP-MS	Typical metals: K, Na, Ca, Mg, Fe, Mn, Al, Pb, Cu, Zn, As, Sr, Se, Cs, U, Hg and more	multi-element speed with high sensitivity and dynamic ranges	sub-ppt to ppm level
GF-AA	Typical Elements: Na, K, Ca, Mg, Fe, Mn, Cu, Zn, As	single element analysis, relatively high sensitivity, small sample size required	sub-ppb level
Multiwave digestion	Acid digestion of solid samples for metal analysis	soil, sediments, biological samples	
Ion Chromatography	Major cations: Li, Na, K, Ca, Mg, NH ₄	Lake, river, snow, drinking, & wastewater, soil extracts	sub-ppb to ppm level
Ion Chromatography	Major anions: F, Cl, Br, NO ₃ , SO ₄ , PO ₄ . Small organic acids including acetate, formate, MSA	Lake, river, snow, drinking, & wastewater, soil extracts	sub-ppb to ppm level
Flow Injection Analyzer	Nutrients: NO ₃ , NH ₄ , orth-PO ₄ , SO ₄ , SiO ₄ , TKP and TKN	river, snow, drinking, wastewater, soil extracts	sub-ppb to ppm level
TOC Analyzer	DOC or NPOC, TN and IC in solution samples	river, snow, drinking, wastewater, soil extracts, sediments, soils	mid-ppb to ppm level
Water isotope analyzer	² H and ¹⁸ O isotopes in liquid samples	any water-based samples	
Mercury Analyzer	Total Hg & Methyl-Hg	Liquid and solid samples for total Hg; Liquid samples for Methyl-Hg.	sub-ppt to ppm level

Please contact Dr. Liying Zhao for any inquiry at 209 233 1728 or via Email: lzhao4@ucmerced.edu
Physical address: Science & Engineering Building I, Room 201, University of California, Merced, 5200 North Lake Road, Merced, CA 95343

Natural Reserve System

The UC Natural Reserve System is a library of ecosystems throughout California. Most of the state's major habitat types are represented, from coastal tidepools to inland deserts, and lush wetlands to redwood forests. No other network of field sites can match its size, scope, and ecological diversity. The NRS offers outdoor laboratories to field scientists, classrooms without walls for students, and nature's inspiration to all.

Rapid Prototyping Lab

It includes Replicator Z18 3D Printer capable of creating objects as large as 12×12×18 inches

out of ABS/PLA plastic, Form 2 3D Printers capable of creating features as fine as 25 microns out of a variety of material properties (e.g., high-temperature, tough, flexible), and 1,000 DPI 30 Watt Laser Cutters that can accommodate objects up to 12×16" and cut through and engrave upon a variety of materials (e.g., paper, plastics, acrylic, leather, wood). The lab has many smaller Afinia, Creator Pro, Makergear 3D Printers; Logitech, MakerBot 3D Scanners; Othermill CNC Mills. It also has soldering workstations equipped with 21 Velleman soldering irons, test equipment and electronics tools. This facility is located in the main campus and open to all School of Engineering faculty and students, providing that they compensate for the materials used in the project (\$0.15-0.50 per gram) and pay an hourly rate of \$10.00 for prepping 3D Printers and pos-processing 3D printed parts.

Machine Shop

The machine shop is located on the 1st floor of the SRE building. It has a HAAS VF2 CNC milling machine, HAAS TL1 CNC Lathe, and two Tormach PCNC1100 CNC Milling Machine. The new SRE machine shop is expected to be up and running soon. The machine shop has a manual machine shop located in SE 1 Rm #143. There are also three Bridgeport manual mills, three Leblonde Manual lathes, a Vertical Band saw, a Horizontal band saw, a Drill Press, a Belt sander, a Mini CNC Machine, a Pedestal Grinder, one MIG welder, one TIG welder, and various types of precision Measuring devices.

Illumina MiSeq

With support from the University of California Office of the President, UC Merced's School of Natural Sciences has invested in an Illumina MiSeq to facilitate Next-Generation Sequencing as a shared faculty resource. This instrument is currently overseen by Prof. Carolin Frank, with day-to-day management and support provided by Lolo Cardenas.

In collaboration with individual labs, the core provides sequencing for smaller scale projects (i.e. on an Illumina MiSeq) as well as quality control and library preparation for larger-scale sequencing projects at other UC core facilities (i.e. on the Illumina HiSeq). The core has developed expertise in targeted gene sequencing, metagenomics, small genome sequencing, targeted gene expression, and amplicon sequencing, and maintains the following equipment; an Illumina MiSeq, a 2100 Agilent BioAnalyzer, a Qubit fluorometer, and a Covaris M220 focused ultrasonicator.

Nuclear Magnetic Resonance (NMR) Facility

The facility provides access to Nuclear Magnetic Resonance Experiments for the UC Merced community and others and houses several major NMR instruments at two sites, on-campus and at Castle, including 400 MHz, 500 MHz and 600 MHz NMR spectrometers, a Horiba Fluorolog 3 fluorimeter, a Bruker Vertex 70 FT-IR spectrometer with a diamond crystal ATR accessory, a high resolution Thermo Electron Exactive Plus LC-MS for detecting small molecules, and a Q Exactive quadrupole Orbitrap LC-MS for high resolution detection of macromolecules.

Research Institutes and Centers

Sierra Nevada Research Institute

The mission of the Sierra Nevada Research Institute (SNRI) is to discover and disseminate new knowledge that contributes to sustaining natural resources and promoting social well-being in the San Joaquin Valley and Sierra Nevada regions of California, and related regions worldwide, through integrated research in the natural, social and engineering sciences.

The mission of the Sierra Nevada Research Institute is accomplished through:

- Collaborative, multidisciplinary, fundamental research conducted by faculty, students, staff and affiliated scientists in natural sciences, engineering, and social sciences.
- Strong interactions with related research units within the UC system and close collaborative relations with scientists and managers at national laboratories, and local, state and federal agencies, including the National Park Service.
- Connecting objective, science-based data and information with public and private stakeholders.

The Sierra Nevada Research Institute is organized around an Environmental Systems model. A particular emphasis is on the physical and biological connections that exist between the Central Valley and Sierra ecosystems. Through these balanced research efforts, the Sierra Nevada Research Institute serves as a source of objective scientific information for public policy makers as California faces the growing challenge of sustaining the integrity and quality of its resources into the future.

Through the Sierra Nevada Research Institute our students and faculty have access to a variety of biological field stations in Yosemite, Sequoia, and Kings Canyon National Parks. In May 2004, Yosemite National Park and the Sierra Nevada Research Institute dedicated the first of these stations, located in Wawona. The Wawona station gives logistical support for academic field research and outreach activities in Yosemite National Park. In addition, the Virginia Smith Trust Reserve adjacent to the UC Merced campus provides additional sites for research.

UC Merced faculty currently affiliated with the Sierra Nevada Research Institute are working on climate change and ecosystem health, contaminant transformations in soils and aquatic systems, development of environmental sensors, hydrologic processes in the Sierra Nevada, nutrient transport in agricultural and natural systems, water and air quality in the Valley basin and Sierra Nevada Range, and computational ecology and biodiversity.

Health Sciences Research Institute

The Health Sciences Research Institute (HSRI) was established in June 2012 as UC Merced's second Organized Research Unit, with the aim of fostering world-renowned research with student involvement and community engagement.

San Joaquin Valley regional health issues include asthma, obesity, diabetes, cancer, hypertension, heart disease, risky teen behaviors, teen tobacco use, sexually transmitted diseases, hepatitis, and many others.

HSRI has more than one hundred affiliated faculty members across UC Merced's three schools (Engineering, Natural Sciences, and Social Sciences, Humanities & Arts) covering a range of health and medical research. HSRI also allows Graduate Student Members, Clinical Affiliate Members and Community Affiliate Members as part of its commitment to diversity and inclusiveness. The opportunities to address the growing and complex health issues of the San Joaquin Valley and beyond require inter- and multidisciplinary team and, as such, HSRI members are organized by primary research interest:

- Health Disparities
- Environmental Health
- Biomolecular Research
- Biosimulation and Modeling
- Cancer Control and Prevention
- Immunity and Infectious Diseases
- Basic & Behavioral Neuroscience, Learning and Development

- Health Decision Making

HSRI members are also engaged in research on evaluation and effectiveness research, and public health systems and services research.

HSRI's collaborative multidisciplinary research clusters and community emphasis provide an opportunity to rapidly develop, test, and disseminate new ways of improving health and delivering healthcare. This will help establish UC Merced as a world-renowned research university while improving the health of the people in the San Joaquin Valley.

University of California Advanced Solar Technologies Institute (UC Solar)

The University of California Advanced Solar Technologies Institute (UC Solar) is a multi-campus, multidisciplinary research institute made up of faculty from the University of California's Merced, Berkeley, and Santa Barbara campuses. Headquartered at UC Merced, UC Solar creates technologies that make solar energy systems more efficient, more affordable, and the best choice for the people of California and the world. In addition, UC Solar educates and develops tomorrow's solar energy leaders and entrepreneurs.

Initial UC Solar research areas include advancing the state-of-the-art in solar concentration (for photovoltaic and thermal systems), employing nanotechnology in both collector/concentrator and device structures, and developing new devices that capture usable energy in the UV portion of the solar spectrum.

Through collaboration with industry and other stakeholders, UC Solar researchers are challenged to create solar technologies that can be brought to the marketplace quickly. UC Solar researchers partner with industry participants through the UC Solar Industry Consortium, which attracts companies that design, produce, implement, manage and invest in solar technologies.

Spatial Analysis Research Center

The goal of the Spatial Analysis Research Center (SpARC) Centralized Research Center is to add value and capabilities to UC Merced's existing and planned research, teaching, administrative, and community outreach efforts in the area of spatial analysis and spatial science. Many UC Merced faculty are engaged in spatial sciences including historians and archaeologists, social and cognitive scientists, engineers, computer scientists, environmental scientists, and biologists. SpARC's mission extends across all three academic Schools and has connections with the Sierra Nevada Research Institute, the Great Valley Center, Yosemite National Park, the Center for the Study of Health Disparities, and the Division of Administration. SpARC aims to foster new intellectual collaboration, stimulate new sources of funding, further innovative and original research, supply research techniques and services to faculty groups, perform services and outreach to the public and support student learning.

Center for Information Technology Research in the Interest of Society (CITRIS)

CITRIS was created "to shorten the pipeline" between world-class laboratory research and the creation of start-ups, larger companies and whole industries. CITRIS facilitates partnerships and collaborations among more than 300 faculty members and thousands of students from numerous departments at UC Berkeley, Davis, Merced and Santa Cruz, with industrial researchers from more than 60 corporations.

At UC Merced the corporate partnerships created through CITRIS sponsor the Mobile App Challenge, in which student teams design applications that help real people solve real problems;

projects like a smart tiny-home power system; helping program robots to express emotions; precision agriculture; and the digital preservation of a historic California ghost town; as well as working to improve health outcomes and access to cost-effective care through the development and integration of innovative technology in telehealth, sensors, analytics and mobile devices.

UC Center for Climate Justice

The Center for Climate Justice is a University of California system wide initiative to address climate change as a social justice and equity issue.

The center's mission is to leverage and harness the power of the university to support, strengthen and build an emergent climate justice ecosystem and social movement that solves the climate crisis through science, systems thinking and social-ecological justice. It does this through innovative broader-impact research, transformative education and public engagement. The center seeks not only to address the root causes of climate change, but also the broad range of associated social, racial and environmental injustices.

Merced Vernal Pools and Grassland Reserve

The Merced Vernal Pools and Grassland Reserve (MVPGR) consists of 415 plant species (over 25 of which are rare and protected plants), endemic and endangered fairy shrimp, 83 bird species, 4 species of amphibians and reptiles and 13 species of mammals. MVPGR is an official member of the 750,000-acre UC Natural Reserve System (UCNRS). By joining NRS, MVPGR is part of a network of 39 permanently-protected open spaces found across California.

This living laboratory plays an integral role at UC Merced, supporting graduate and undergraduate research, hands-on teaching for grad students and faculty, and opportunities to study climate science, ecology, landscape science, soil research and act as a test site for autonomous vehicles.

Yosemite Wawona Field Station

Established in 2006, Yosemite Field Station in Wawona is located in the historic village of Wawona near the south entrance to Yosemite National Park. It is dedicated to facilitating synergistic links among science, art, education and natural resource management.

Nestled in an open, old-growth pine forest along the South Fork of the Merced River and only 5 miles from the Giant Sequoia Grove, the Yosemite Field Station at Wawona is ideally situated to support field research projects in Yosemite and the adjacent Sierra National Forest, class field trips, small workshops, writing retreats and interdisciplinary collaborations.

Southern Sierra Critical Zone Observatory (CZO)

The Southern Sierra Critical Zone Observatory is a platform for research on critical zone processes, with ongoing investigations and measurements at several sites on the western slope of the southern Sierra Nevada. Our Critical Zone Observatory has developed five long-term critical-zone research sites in areas operated by the USDA Forest Service and National Parks Service.

UC Water Security and Sustainability Research Initiative (UC Water)

UC Water is the newest multi-campus organization headquartered at UC Merced and is focused on strategic research for better water resources management. UC Water has more than 40 re-

searchers approaching water from three perspectives: information, institutions and infrastructure.

The group's initiatives include:

- Developing innovative, quantitative water accounting and analysis methods, and introducing modern information systems into California's aging infrastructure. Current water policy lacks salient, credible and legitimate water information, forcing policymakers to rely on century-old technology and analysis techniques.
- Weaving legal and policy research into its findings. The research will help facilitate more integrated water management institutions in California and aid in the development of the capacity to adapt to 21st-century stressors.
- Improving understanding of how water is extracted, conveyed and stored in built and natural infrastructure. This initiative also contributes to research by developing understanding of land-cover changes on source water areas, and tools and techniques for better groundwater management.