SCHOOL OF GLOBAL
ENVIRONMENTAL SUSTAINABILITY
COLORADO STATE UNIVERSITY

2020-2021 Annual Report

SCHOOL OF GLOBAL ENVIRONMENTAL SUSTAINABILITY

Dear Friends of the School of Global Environmental Sustainability,

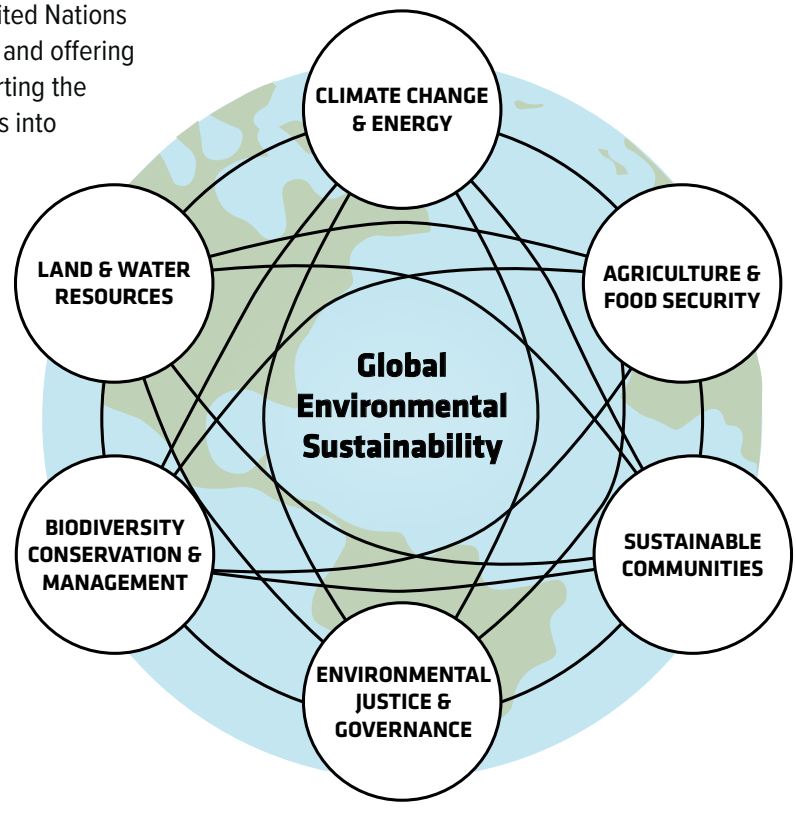
2020-2021 was an academic year unlike any other. The coronavirus crisis has demonstrated the vulnerability and adaptability of human society, the deep connections between human well-being and environmental conditions, and the value of research and science for understanding and responding to multifaceted global threats. These powerful lessons are directly applicable to the research, education, and engagement activities of the School of Global Environmental Sustainability (SoGES).

Overcoming interlinked global sustainability challenges like climate change, loss of biodiversity, food insecurity, poverty, and pandemic disease requires the creative integration of multiple disciplines to generate new insights and understanding. Over the last decade, our School has responded to this need by pioneering an effective model for galvanizing research and educational activities across disciplinary and departmental lines. During the past year, we continued to build and nurture local and global networks, working with CSU faculty, staff, and students, and video conferencing with collaborators around the world – all of whom are energized by the urgency of focusing research and education on creating a sustainable campus, city, and world.

SoGES is supporting CSU experts who are connecting research on climate change and biodiversity loss, illuminating the impacts of these interacting changes on human society and the natural environment. We are bringing this understanding to local, national, and global efforts to develop effective responses, including international negotiations on biodiversity, climate change, and the United Nations Sustainable Development Goals. And we are developing and offering innovative coursework and degree programs and supporting the wider infusion of new sustainability content and concepts into CSU's curriculum.

We welcome your ideas and thoughts this next year as SoGES continues to work with faculty, students, and interested stakeholders to strengthen, catalyze, and build the collaborations that are needed for continued progress towards global environmental sustainability.

Diana Wall, SoGES Director
Peter Backlund, SoGES Associate Director



SoGES is focused on sustainability grand challenges.

ABOUT THE SCHOOL

The School of Global Environmental Sustainability (SoGES) was created in 2008 to advance sustainability research, education, and engagement at Colorado State University. The school is a Special Academic Unit attached to the Office of the Provost and Executive Vice President that works with and across the University's eight colleges.

Humanity depends on – and is part of – the Earth's environment. We rely on it for clean air and water, food, materials, and energy, as well as inspiration and comfort. We are vulnerable to natural hazards and rapid changes in environmental conditions. How we organize society and the way we behave as individuals has sweeping environmental impacts. The challenge of achieving sustainability is inherently interdisciplinary and requires insights from many perspectives and deeper understanding of the way that societal, economic, and environmental dimensions of problems are connected. This is why SoGES welcomes expertise from across the University, spanning the natural and social sciences, arts and humanities, business, and engineering.

The CSU faculty members who are affiliated with and contribute to SoGES include experts from all of these intellectual domains. Promoting and supporting discussion, connection, diversity, inclusivity, and collaboration across disciplinary and institutional boundaries is one of our School's most important functions.

The SoGES Mission

- Conduct innovative research that transcends boundaries and leads to new and deeper understanding of sustainability issues
- Provide a challenging, integrative, and provocative education that gives future leaders knowledge and tools that enable them to contribute to environmental sustainability
- Engage with the public and decision-makers in translating discoveries into useful information and practical solutions to pressing environmental problems

Justice, Equity, Diversity and Inclusion

Justice, equity, diversity, and inclusion are fundamental to achieving a sustainable world. Sustainability can only exist at the intersection of healthy environments, social equity, and economic fairness and therefore these goals are integral to our work in pursuing sustainability. To achieve them, SoGES is dedicated to embodying and exemplifying the Colorado State University Principles of Community: Inclusion, Integrity, Respect, Service, and Social Justice.

Inside Colorado State University's Johnson Hall, where the School is located.

2020-2021 AT A GLANCE

RESEARCH

SoGES provides funding for CSU research teams and faculty fellows and conducts research supported by outside sponsors.

$50,000 was awarded by SoGES to CSU sustainability researchers
3 teams funded with **11** investigators from **8** departments across **5** colleges
2 resident faculty fellows funded from **2** departments in **2** colleges

EDUCATION & TRAINING

SoGES offers the Global Environmental Sustainability minor and three additional focused sustainability minors, runs a graduate student leadership training program, and oversees a set of graduate certificates.

439 students completed GES courses
318 students were enrolled in **4** undergraduate minors
110 students graduated with SoGES minors **(85** from GES, **5** from Peace and Reconciliation, **5** from Energy, **15** from Water**)**
20 Sustainability Leadership Fellows from **13** departments across **6** colleges
5 Sustainability Curriculum Innovation Grants awarded with **12** faculty from **6** departments across **5** colleges. These grants are created in partnership with the CSU President's Sustainability Commission.

ENGAGEMENT

SoGES works with the media and diverse stakeholders to identify, discuss, and increase awareness of sustainability issues and ensure that sustainability research is informed by societal needs and concerns.

3,213 people were reached by **35** events organized and hosted by SoGES and collaborators
265 stories in popular and scientific media mentioned SoGES, with a total estimated readership of over **85 million**

CENTERS & INITIATIVES

SoGES houses four CSU centers and supports two international initiatives.

The **Global Soil Biodiversity Initiative** served as partner organization on the United Nations Food and Agriculture Organization global soil biodiversity assessment, "State of Knowledge of Soil Biodiversity: Status, Challenges, and Potentialities," a first of its kind. The **Africa Center** initiated a monthly newsletter featuring emerging research on sustainability in Africa. The **Student Sustainability Center** held a sustainability-focused election forum with the Fort Collins 2021 mayoral and city council candidates. The **Global Biodiversity Center** helped develop the United Nations Convention on Biological Diversity post-2020 global biodiversity framework and the activities of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. The **Salazar Center for North American Conservation** awarded its first conservation impact prize of $100,000 to the Connectivity Challenge winner, the Borderlands Restoration Network. **Future Earth** helped organize the inaugural meeting of the Sustainability Research and Innovation Congress, attracting over 2,000 attendees from 100 countries.

PROGRAM HIGHLIGHTS

Climate Indicators for Agriculture

SoGES Associate Director Peter Backlund co-authored the U.S. Department of Agriculture technical report titled *Climate Indicators for Agriculture*, which presents an overall view of how climate change is influencing U.S. agriculture. The report presents 20 indicators of climate change that were carefully selected to provide useful and relevant information across a range of agricultural production systems in the U.S.

Adding New Sustainability Content to the Colorado State University Curriculum

In partnership with the CSU President's Sustainability Commission, SoGES implemented the inaugural Sustainability Curriculum Innovation Grants. Open to all CSU faculty, the grants develop creative approaches that integrate interdisciplinary sustainability content into existing and new coursework to elevate both the quality and quantity of student exposure to complex sustainability concepts. The grants also provide a mechanism to share expertise and tools across colleges and courses through initial development of a sustainability teaching toolkit for campus.

The Sustainability Happy Hour

The Sustainability Happy Hour began as an experiment to build community online when the COVID-19 pandemic shut down in-person events and networking. Each episode streamed live to the SoGES social media channels and featured conversational interviews with special guests about their area of sustainability expertise, as well as commentary on sustainability news and questions from the audience.

Virtual Seminar on Strengthening Sustainability Programs in Higher Education

In October 2020, the National Academies of Sciences, Engineering, and Medicine released a consensus study report with recommendations on how to strengthen sustainability programs and curricula in higher education. In a virtual seminar co-sponsored by the Department of Ecosystem Science and Sustainability and SoGES, committee member Chris Boone (Dean of the College of Global Futures and Professor in the School of Sustainability, Arizona State University) discussed the report's recommendations. He was joined by Madeline Tyson, Senior Associate with the Rocky Mountain Institute.

Soil Without Detectable Life Discovered in Antarctica

SoGES Director Diana Wall co-authored the paper, "Exploring the Boundaries of Microbial Habitability in Soil," published in the *Journal of Geophysical Research: Biogeosciences*. The paper explores the boundaries of microbial habitats in the soil of one of the most extreme places on Earth. They found that soils from high elevations and rocky ridges at the center of Antarctica seem to contain no microbes at all.

Using Artificial Intelligence to Reveal Humanity's Global Footprint and Track Sustainability

SoGES Lead Scientist Pat Keys and his collaborators Elizabeth Barnes (Department of Atmospheric Science) and Neil Carter (University of Michigan) used machine learning to produce a map that reveals where abrupt changes in the landscape have taken place around the world. The resulting article was published in the journal *Environmental Research Letters* and SoGES produced a video abstract for the paper.

2020 Virtual Symposium on Conservation Impact

The Salazar Center for North American Conservation held its second annual International Symposium on Conservation Impact, which virtually convened more than 300 thought leaders from the U.S., Canada, and Mexico. The symposium highlighted best-in-class examples in North American cities of enhancing natural systems to improve community health and support climate resilience.

RESEARCH

SoGES invests in innovative research activities focused on cultivating new connections among academic disciplines, fostering individual creativity, and developing innovative responses to sustainability problems. We bring together experts from diverse perspectives.

Our School supports interdisciplinary projects conducted by teams of CSU researchers (Global Challenges Research Teams) and individual faculty members (Resident Fellows). SoGES leadership and staff are also conducting a variety of sustainability research projects, all of which are done in collaboration with researchers from CSU colleges and departments and/or other academic institutions.

In 2020-2021 SoGES awarded

$50,000 to CSU researchers

Supporting **3** research teams & **2** faculty fellows

13 investigators | **9** departments | across **5** colleges

Global Challenges Research Teams

Development of creative and innovative approaches to interdisciplinary sustainability scholarship and application of these approaches to real world problems are important overarching goals for SoGES. One way we pursue these is through competitively awarded support of our **Global Challenges Research Teams** (GCRTs), which are collaborative teams of faculty that build cross-campus partnerships to address the world's most pressing regional and global sustainability issues.

Starting in 2020, SoGES changed the GCRT program from an annual opportunity awarding single-year funding to a bi-annual opportunity that provides two years of funding. This allows for larger and more complex projects and additional time for interdisciplinary team development. The projects listed here will continue their work through the 2021-2022 academic year. **Since its inception, SoGES has funded 46 GCRTs with principal investigators from 48 departments across all eight CSU colleges.**

ASSESSING "GREEN" SOLUTIONS TO FASHION'S CARBON FOOTPRINT

PRINCIPAL INVESTIGATORS:
Sonali Diddi, Department of Design and Merchandising; **Zac Rogers**, Department of Management; **Richard Conant**, Department of Ecosystem Science and Sustainability; **Lumina Albert**, Department of Management; **Anders Fremstad**, Department of Economics

Clothing rental services are one example of an alternative business model in the fashion industry.

Textile production is very resource intensive.

The fashion industry is resource intensive and with a growing global demand for clothing, it is poised to have even larger negative environmental impacts. To combat this, some modern textile producers have come up with alternative business and production models that incorporate restorative and regenerative approaches in their business strategy, for example, fashion rental services, carbon farming, and online resale of used clothing. However, while these strategies may potentially pose a "green" solution, there is very little empirical research that demonstrates the benefits of such practices.

This research team, **Measuring Carbon Footprint of Alternative Business Models in the Fashion Industry**, is focused on developing an online tool to quantify the carbon impact of such alternative business models and compare them to the traditional 'take-make-use-dispose' system of the fashion industry.

In 2020-2021, the team completed a systematic literature review to help them understand the present state of alternative business models that exist within the fashion and consumer goods industries. They also developed a database of all prevalent tools related to life cycle analysis in relevant industries to understand the data points required to build the team's carbon footprint tool. In addition, the team secured an agreement with a fashion rental service technology company that will provide data support for creation of the team's tool, and brought on one student to work on the project.

CREATING RESILIENT INDUSTRY SUPPLY CHAINS

PRINCIPAL INVESTIGATORS:
Erin Arneson, Department of Construction Management; **Rodolfo Valdes Vasquez**, Department of Construction Management; **Hussam Mahmoud**, Department of Civil and Environmental Engineering

Roofing, like many industries, is vulnerable to supply chain disruptions caused by natural hazards.

Climate change amplifies the risk of extreme weather and disaster events, affecting the way business is conducted around the world. The characteristics that make modern supply chains speedy and cost-effective (e.g. global resource networks, specialized inputs produced in specific geographic locations, and reduced inventories as part of just-in-time production strategies) also render global supply chains more susceptible to disaster disruptions. Therefore, industries must adapt their global supply chains to become more sustainable and resilient to disaster disruptions.

The **Resilient Industry Supply Chains (RISC)** research team is focused on examining the U.S. roofing industry and developing a framework for empirically assessing its resilience that can be applied to other U.S. industries, improving global supply chain sustainability.

In 2020-2021, the team met weekly to share data and build connections amongst members. They also brought on and mentored five students, each with projects that related to the team's overarching research goals. In fall 2020, the team completed preliminary data collection and analysis. One pilot study examined how commercial construction roofing supply chains in Colorado were disrupted by COVID-19. Results were published and presented in the peer-reviewed proceedings of the Associated Schools of Construction conference (Klimm et al., 2021). Another study used geographic information system mapping that provided insight into how demand for construction labor and materials can surge unexpectedly after disasters. Results were published in the American Society of Civil Engineering *Journal of Management in Engineering* (Pradhan & Arneson, 2021). In spring 2021, the team further developed their supply chain model by conducting extensive literature reviews and collecting longitudinal data for regional and national roofing supply chains. They then developed two supply chain concepts for submission to the National Science Foundation for external funding.

USING ANALYTICS TO REDUCE PACKAGING WASTE

PRINCIPAL INVESTIGATORS:

Steven Simske, Department of Systems Engineering; **John Macdonald**, Department of Management; **Elizabeth Parks**, Department of Communications Studies and Dialogue and Diversity Specialist with the Center for Public Deliberation

The average cardboard box only uses 50% recycled material.

One of today's sustainability challenges is the waste that accompanies packaging, usually corrugated cardboard, from the increased prevalence of online purchasing. Since the average corrugate box contains only 50% recycled materials, half of the fiber must still be produced anew each time a package is shipped. Moreover, online ordering leads to smaller, more frequent "one off" orders which requires more packaging compared to the bulk orders that are sent to big-box, brick-and-mortar stores and then resold. Given these factors, reusing packaging materials is more efficient than recycling, however, this is not a common practice.

The **Re-use Efficiency Packaging with Analytics for Customized Knowledge (REPACK)** research team is focused on investigating consumer willingness to participate in packaging reuse programs. The team is using a social-psychological model that relies on persuasion, personality types, behavior conditioning, incentives, and systems engineering to develop a systems model that encourages packaging reuse. Concurrently, the team is conducting a life cycle analysis of the corrugated packaging industry to ensure that the preferred behavior of incentivized consumers will result in a sustainable improvement in the packaging arena.

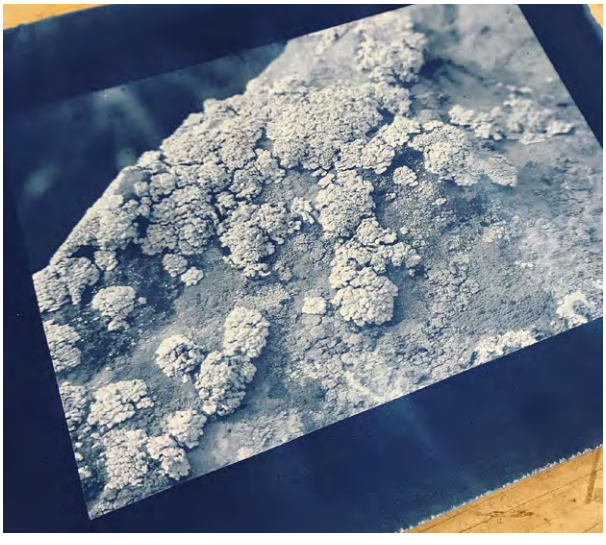
In 2020-2021, this research team implemented an online questionnaire to collect data on social-psychological factors related to packaging reuse and recycling. The survey included questions to assess how an individual is most likely to be persuaded, what type of behavior reinforcement would most likely affect them, and what their personality type is according to the Myers-Briggs Type Indicator. The team will follow up with participants in the coming year for a second questionnaire about incentives. The team also began the planning stages of an initiative with Liviri, which are OtterBox-brand reusable shipping boxes, in collaboration with former Fort Collins Mayor Wade Troxell, and brought on one student to work on the project.

SoGES **Resident Fellows** are CSU faculty members who engage in creative sustainability research and problem solving. SoGES provides seed funding to enhance scholarly contributions to sustainability, accelerate progress, and participate in the academic life of the School. **Since its inception, SoGES has funded 47 Resident Faculty Fellowships from 23 departments across all eight CSU colleges.**

CONVEYING THE CLIMATE CRISIS THROUGH ARTISTRY AND CREATIVE RESEARCH

Johnny Plastini, Department of Art and Art History

Digital documentation of lichens from Devil's Backbone Open Space, Loveland, Colorado. Photo courtesy of Johnny Plastini.



Solar cyanotype print on handmade recycled paper from digital source image. Photo courtesy of Johnny Plastini.

Johnny Plastini's Fellowship work used visual communication strategies to effectively and poetically convey the reality of our current climate crisis through artistry and creative research. Plastini photographed lichens along the front range and alpine tundra ecosystems of Colorado, amassing over 2,000 photos, which were cataloged with specific longitude, latitude, and altitude coordinates for each specimen, creating an "impression of place." Eighteen of these photos were then printed onto handmade, recycled papers using historically significant and sustainable printmaking methods and featured at BOLT gallery in Fort Collins, Colorado.

Lichens are composite organisms of fungi, algae, and cyanobacteria and are some of the first pioneer species to reengage with a landscape after ecological devastation has occurred. Plastini's images aim to narrate symbiotic lichen cultures through the lens of both scientific and anthropological definitions of culture: (1) a collection of cells in a suitable condition for growth, (2) the customs, arts, social institutions, and achievements of a particular people or social group. Plastini also began a collaboration with Erin Tripp of the University of Colorado Boulder to identify and catalog previously unidentified lichen species in the Devil's Backbone Open Space, which connects Fort Collins to Loveland along the Colorado Front Range. Based on his Fellowship research, Plastini was awarded a two-week residency in Crete, Greece to document lichens in relation to ancient Minoan architecture through the American Alliance of Artist Communities MUDHOUSE program.

ESTABLISHING SUSTAINABILITY STANDARDS FOR FRESHWATER AQUACULTURE

Ed Hall, Department of Ecosystem Science and Sustainability

An aquaculture operation in Lake Yojoa, Honduras. Photo courtesy of Ed Hall.

Hall collects samples from a stream that leads into Lake Yojoa. Photo courtesy of Ed Hall.

Ed Hall's Fellowship work assessed the impact of net pen aquaculture, also known as fish farming, on lake ecosystems and laid the groundwork for establishing the first set of science-based sustainability standards to mitigate the impact aquaculture has on inland water ecosystems. Freshwater aquaculture is a potential sustainable solution to meet growing food demands but it can have a substantial negative effect on surrounding freshwater ecosystems, such as eutrophication, which is an overabundance of algae and other plant life caused by excessive nutrients in the lake. Hall used historical and present-day data sets from Lake Yojoa, a large tropical lake in Honduras, to estimate the daily nutrient input from tributaries to the lake and compare that to the nutrient input of aquaculture operations. Results found that aquaculture is responsible for 65% of the annual reactive nitrogen load to the lake and 95% of annual phosphorus load. This shows that ongoing eutrophication of Lake Yojoa is principally caused by aquaculture.

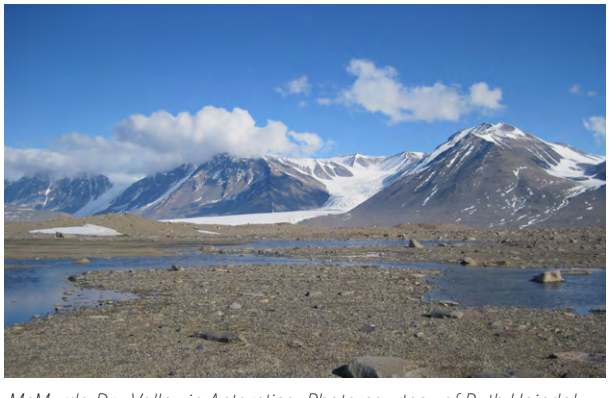
Hall and the graduate students in his lab wrote a manuscript on these results that is in review for publication and currently available as a preprint. The group also presented their findings in a webinar for the Natural Resource Ecology Laboratory at CSU. This talk focused on linking the fish (tilapia, specifically) available in certain Fort Collins grocers with the environmental impact on the ecosystem from which is sourced. Hall also presented a brief overview of this work at a CSU Faculty Council meeting. Finally, Hall began a collaboration with two local artists to create a short, animated video on how aquaculture and stratification interact to impact the eutrophication of lakes.

SUSTAINABILITY IN THE ANTHROPOCENE

Keys runs a 'sustainable futures' workshop for community leaders and Lutheran clergy.

SoGES Lead Scientist **Pat Keys** examines sustainability in the Anthropocene, or the so-called age of humans. A NASA-funded analysis of Sustainable Development Goal achievement in Kenya was one major highlight of the year. For this, Keys collaborated with SoGES Postdoctoral Fellow **Rekha Warrier**, and Professors Kathleen Galvin (Department of Anthropology) and Randy Boone (Natural Resource Ecology Laboratory) to better understand how changes in forest cover impact both the atmospheric water cycle and pastoralist livelihoods throughout Kenya. Another highlight was a machine-learning investigation into global human footprint patterns. For this, Keys collaborated with Professor Libby Barnes (Department of Atmospheric Science) to develop a machine-learning based human footprint index for the entire planet. They used deep learning (a type of machine learning) to interpret satellite data, which revealed where humans are impacting the planet. In some cases this data revealed new patterns related to deforestation, expansion of road networks, and artisanal and large-scale mining. This work was published in the journal *Environmental Research Letters* (Keys et al., 2021). Keys also collaborated with colleagues on an analysis of Greenland's glacier moisture sources and an interdisciplinary project examining the future of fisheries conflict. Finally, Keys delivered invited seminars to the University of Maryland, the University of Oslo (Norway), University of Reading (UK), and Stockholm University (Sweden).

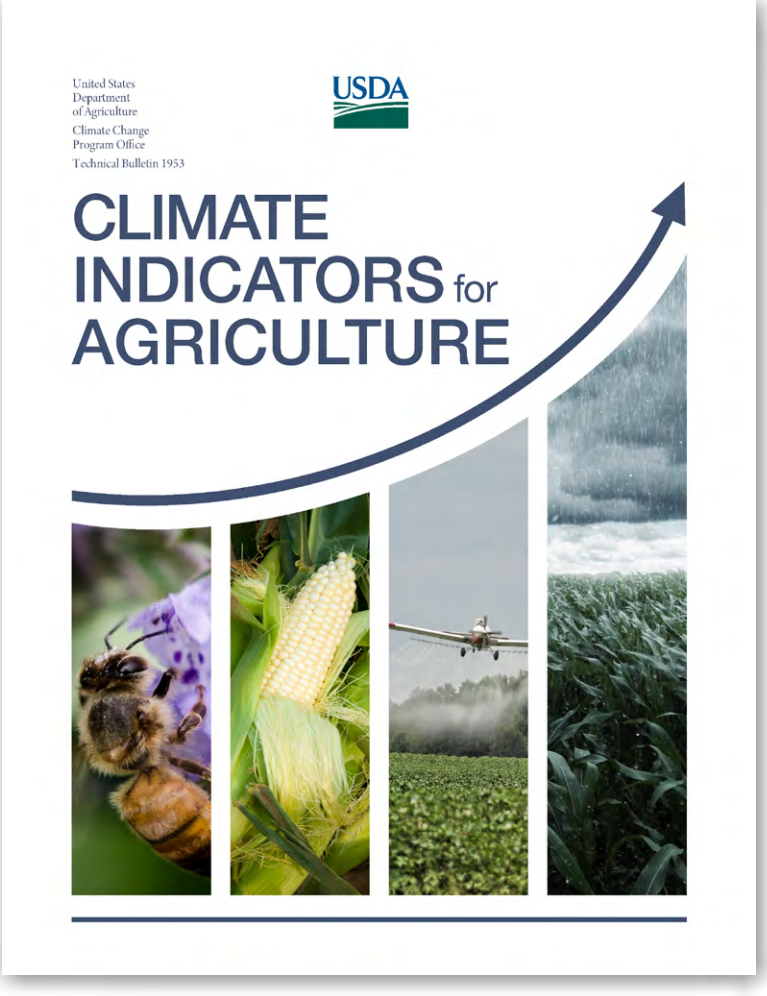
SOIL ECOLOGY IN ANTARCTICA AND BEYOND



McMurdo Dry Valley in Antarctica. Photo courtesy of Ruth Heindel.

SoGES Director **Diana H. Wall** also leads the Wall Lab in CSU's Department of Biology. The lab is focused on soil ecology and the intersection of soil biodiversity and climate change. Wall's research has emphasized how life in soil, from microbes to invertebrates, contributes to ecosystem services and benefits life on Earth. Her more than 25 years of research in the Antarctic continues to clarify the critical links between climate change and soil biodiversity. Her interdisciplinary research with the McMurdo Dry Valley Long Term Ecological Research Project has uncovered dramatic impacts to invertebrate communities in response to climate change, the key role nematode species play in soil carbon turnover, and how they survive such extreme environments. Wall has combined her Antarctic research, a place where species diversity is much reduced and physical limits to life are extreme, with tropical, grassland and global field studies - places which have immense and abundant soil biodiversity and species. These global scale field studies demonstrate that soil animals increase decomposition rates more in temperate and moist tropical climates than in cold and dry conditions and that climate change (drought) can tip the nematode predator-prey balance in arid grasslands and promote root herbivores (Franco et al., 2019). The Wall Lab's activities in 2021 include publications from collaborative, interdisciplinary field work at Shackleton Glacier, Antarctica, exploring the response of Antarctic soil fauna to climate-driven changes since the Last Glacial Maximum at ~85°S (Diaz et al., 2021).

ASSESSING THE IMPACTS OF GLOBAL CLIMATE CHANGE



Cover page of the report Climate Indicators for Agriculture.

SoGES Associate Director **Peter Backlund** continued his work on several projects focused on climate change adaptation and selection of indicators that can be used to describe, track, and understand the effects of global climate change on U.S. agriculture over time. He was co-author of a U.S. Department of Agriculture technical report titled *Climate Indicators for Agriculture*, released online in July 2020, with colleagues from Cornell University, Iowa State University, Purdue University, Columbia University, the University of Nevada, the Agriculture and Food Systems Institute, the USDA Agricultural Research Service, and the USDA Office of Energy and Environmental Policy. This was followed by a series of talks and panel discussions at the American Geophysical Union annual meeting in December 2020 and the annual meeting of the National Council for Science and the Environment in January 2021. The team is now working with collaborators from Florida State University and USDA regional climate hubs on a system to make indicator information and data streams more easily available to agricultural producers around the nation. Backlund is also a member of the CSU Climate Adaptation Partnership project funded by the office of the CSU Vice President for Research and is one of the leaders of the newly formed climate response working group at CSU, both of which are focused on enhancing and promoting the University's climate change research efforts.

SoGES education efforts are interdisciplinary, with learning options that include individual courses, undergraduate minors, and leadership training and certificates for graduate students and postdocs. The School educates and equips students with knowledge and tools to tackle sustainability challenges.

INTERDISCIPLINARY CURRICULUM

Curricula for the School's minors focus on a comprehensive understanding of the linkages between society, economics, and the environment, upon which sustainable human actions can be based. Students who complete the curriculum will be able to determine solutions to problems that have developed from human interactions with the environment.

Curriculum development and strategy is overseen by the SoGES Curriculum Committee. It includes representatives from all eight CSU colleges and the CSU library and sets educational priorities for the School.

Curriculum Committee

Kathleen Galvin (Chair), Anthropology; The Africa Center; and SoGES
Pat Aloise-Young, Psychology
Joe Cannon, Marketing
Meggan Houlihan, CSU Libraries
Dale Lockwood, Biology and SoGES
Susan Melzer, Soil and Crop Sciences and SoGES
Pinar Omur-Ozbek, Civil and Environmental Engineering
Johnny Plastini, Art and Art History
Howard Ramsdell, Environmental and Radiological Health Sciences
Sara Rathburn, Geosciences
Rodolfo Valdes Vasquez, Construction Management

Global Environmental Sustainability Minor

The Global Environmental Sustainability (GES) minor addresses the inter-related issues of environmental, societal, and economic sustainability, including climate change, pollution, biodiversity loss, public health, environmental justice, food security, and global-scale development. Students gain deeper understanding of sustainability problems and tools to bring sustainability into their career paths. The GES minor is also available as an online option for students. **In 2020-2021 there were 277 students enrolled and 85 graduates from the GES Minor.**

Sustainability in Peace and Reconciliation Studies Minor

Peace and reconciliation are an important component of – and contributor to – societal and economic sustainability. This minor provides students with extensive background in the social, philosophical, and educational aspects of peace and reconciliation and explores their intersection with environmental sustainability. **In 2020-2021 there were 8 students enrolled and 5 graduates from the Sustainability in Peace and Reconciliation Studies Minor.**

Sustainable Energy Minor

Improving the sustainability and reducing the negative environmental impacts of energy systems requires a broad understanding of technical, environmental, and social science issues. This minor equips students with the skills and knowledge necessary to understand the challenges and opportunities in transitioning to a sustainable energy future. *Collaborative with the CSU Energy Institute*. **In 2020-2021 there were 19 students enrolled and 5 graduates from the Sustainable Energy Minor.**

Sustainable Water Interdisciplinary Minor

Issues surrounding water supply, water quality, and ecological water relationships are increasingly important as population growth continues, water uses multiply, and competition for water increases. This minor provides students with the opportunity to gain detailed knowledge about the complex challenge of sustainable water management. *Collaborative with the CSU Water Center*. **In 2020-2021 there were 14 students enrolled and 15 graduates from the Sustainable Water Interdisciplinary Minor.**

Course Offerings 2020-2021

Foundations of Global Environmental Sustainability
(GES 101) - 270 students

Water in the Western U.S.
(GES 120) - 23 students

Introduction to Sustainability Engagement
(GES 130) - 11 students

Applied Community Sustainability
(GES 135) - 6 students

Introduction to Sustainable Energy
(GES 141) - 43 students

Sustainability in Practice
(GES 330) - 9 students

Sea Level Rise and a Sustainable Future
(GES 440) - 15 students

Analysis to Sustainable Energy Solutions
(GES 441) - 11 students

Sustainable Solutions to Electronic Waste
(GES 465) - 14 students

Issues in Global Environmental Sustainability
(GES 520) - 1 7 students

Bio Based Products
(GES 542) - 17 students

Assessing the Food, Energy, Water Nexus
(GES 580B5)* - 3 students

*Experimental Courses

SoGES has proposed a major in Global Environmental Sustainability that is moving through the University approval process. A new course, Systems Thinking in the Anthropocene (GES 380A1), was developed this year and will be a required class for the major as well as a valuable option in the GES minor program.

In 2020-2021...

439 students completed GES courses

318 students enrolled in the 4 SoGES minors

Since the initiation of SoGES education efforts in 2010...

4,945 students have completed GES courses

622 students have graduated with a GES Minor

Graduate Certificates

The graduate certificates in Applied Global Stability are designed to meet the global stability needs of senior non-commissioned officers and mid-career officers in the Special Operations Forces community, Department of Defense, USAID, Peace Corps, and other development professionals. **In 2020-2021 there were 9 students enrolled and 2 certificates were awarded.**

Core Faculty

Dale Lockwood is the Academic Coordinator for SoGES and holds a joint appointment as Assistant Professor in SoGES and the Department of Biology. A population ecologist, his work involves the analysis of complex population dynamics of rangeland grasshoppers, modeling larval dispersal in marine organisms to better implement marine reserves, and work on the ecological genetics of plant species related to storage in seed banks. His research has been honored with one paper being named the Outstanding Paper in Genetic Resources by the Crop Society of America and another named one of the most important papers in the *Journal of Range Management* in the last 50 years. Lockwood teaches GES courses for SoGES and in the Biology Department and has been nominated for Honors Professor Award, CSU Teacher of the Year, and Greek Life Outstanding Faculty.

Susan Melzer holds a joint appointment as Assistant Professor in SoGES and the Department of Soil and Crop Sciences. Her research focuses on quantifying weathering rates and examining the impact of climate change and land-use on soil genesis, soil quality, and system resilience. She works in close collaboration with the USDA Natural Resources Conservation Service, U.S. Forest Service, and National Park Service to develop accessible educational resources and experiential learning opportunities that are data driven and will enable an integrated, applied, and transdisciplinary link between educators, researchers, managers, and students. In 2020, Melzer was named a Provost Teaching Scholar as part of the Celebrate! Colorado State Awards.

ADDING NEW SUSTAINABILITY CONTENT TO THE COLORADO STATE UNIVERSITY CURRICULUM

Future professionals will both affect and be affected by sustainability's global grand challenges, no matter their vocation. It is CSU's ultimate goal that all graduating students understand and appreciate the complex and interconnected sustainability concepts that define our global future. These **Sustainability Curriculum Innovation Grants**, new in 2020-2021, modify existing and develop new coursework that offer creative approaches to interdisciplinary sustainability content, elevating both the quality and quantity of student exposure to social-environmental-economic sustainability concepts. The grants also provide a mechanism to share expertise and tools across colleges and courses through initial development of a sustainability curriculum toolkit for campus. These grants are created in partnership with the CSU President's Sustainability Commission.

IN 2020-2021...

5 projects | **12** faculty | **6** departments | across **5** colleges

ADMINISTRATION OF SUSTAINABILITY: A CASE STUDY ON PUBLIC VS. PRIVATE PROVISION OF ENERGY SERVICE

PROJECT LEAD:

Ryan Scott, Department of Political Science

Local governments face complex decisions when considering renewable energy programs that are publicly and privately owned.

This project developed a new case study that will help political science students better understand the sustainability implications of complex decisions facing local governments when considering renewable energy programs that are publicly and privately owned.

Policy courses commonly address whether cities should choose public, investor-owned, or cooperative provision of energy services solely from a price-of-service perspective. The political science curriculum does not generally address whether public or private utilities can best promote sustainability in terms of environmental and social outcomes, in addition to price. This case study for use in POLS 103: State and Local Government and Politics, as well as other University courses, combines interviews of energy managers with analysis of energy data to facilitate student-generated recommendations on how ownership structure can impact adoption of sustainability goals and economic, social, and environmental outcomes. The information is provided in data and narrative forms, allowing for use across undergraduate and graduate curriculum, and across a variety of CSU courses that discuss management, uncertainty, and sustainability.

Bringing a Sustainability Focus into the Composition Course 301B: Writing in the Sciences

PROJECT LEADS:

Erika Szymanski, Department of English; **Kristie Yelinek**, Department of English; **Ryan Campbell**, Department of English

Sustainability, science writing, and civic engagement go hand in hand.

This project strengthened connections between composition and STEM by redesigning CO 301B: Writing in the Sciences to emphasize the mutual relevance of sustainability science, writing, and civic engagement.

CO 301B is a popular science writing course at CSU which fulfills the intermediate writing requirement for many STEM majors across campus. Its curricular role and learning objectives are intrinsically connected to sustainability, but sustainability topics are not yet formally part of the course. This project developed a sustainability-focused version of the class (syllabus, lesson plans, and assignments) that makes explicit the course's implicit sustainability connections. Responding to student interests and cross-college strengths in climate, water, and land use, this new version of the course foregrounds how scientific expertise alone is insufficient to engender productive societal dialogue around complex challenges. The project also generated better tools for training new CO 301B instructors, supporting current instructors, and elevating the quality and cohesiveness of instruction across course sections, as well as providing a benefit to instructors in other departments who are interested in incorporating more writing in their sustainability-minded courses.

Preparing Students to Improve the Sustainability of Animal Protein Production Using Systems Thinking & Interactive, Dynamic Models

PROJECT LEADS:

Jasmine Dillon, Department of Animal Sciences; **Kevin Jablonski**, Department of Forest and Rangeland Stewardship; **Jason Ahola**, Department of Animal Sciences; **Shawn Archibeque**, Department of Animal Sciences

Livestock like cattle provide high quality protein to the human diet, but they also contribute to negative impacts on the environment.

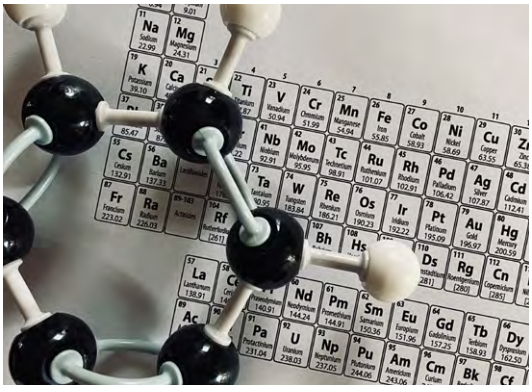
This project developed a series of web-based, interactive models to help students explore systems thinking principles and the role of animals in sustainable food systems in the context of challenges such as climate change, reduced water availability and quality, rural vitality, and changing local and global markets.

While ruminant livestock contribute high-quality protein to the human diet, they also contribute to negative impacts on the environment. Students must be better trained to apply systems thinking principles to sustainably produce animal protein in the face of these challenges. The dynamic models describe common sustainability problems in livestock production systems and bridge passive with active learning; the interactive model approach allows students to systematically and simultaneously explore relationships between social, environmental, and economic factors, and how manipulation of one or more at a time affects outcomes.

Sustainability Profiles in General Chemistry

PROJECT LEADS:

Terry Gray, Department of Chemistry; **Kerry MacFarland**, Department of Chemistry; **Harmony Tucker**, Department of Chemistry



Foundational chemistry work has extensive implications for sustainability.

This project developed a suite of learning tools that were integrated into all four levels of general chemistry at CSU, that better illustrate the extensive sustainability implications of foundational chemistry work.

Chemical concepts are foundational to issues involving air, climate, food, soil, and water. Basic chemistry is integral to much of society's quality of life, including production of materials and modern medicine; at the same time, it generates waste with damaging impacts to the environment and health. For students to understand the connection between science, society, and economics, chemistry curriculum must move beyond merely using sustainability issues as examples of fundamental chemical principles, to include and examine the social-environmental-economic issues surrounding the chemistry as formal learning goals. This project expanded the development of a toolbox for chemical sustainability profiles, adjustable in scope, of learning goals, essays, PowerPoint and keynote presentations, lecture recordings, and sample exam questions on sustainability topics that can be used across chemistry courses and courses in other departments. Sustainability profiles were created for the following topics: Simple Substances; Greenhouse Gases; Fossil Fuel Combustion and CO2 Emissions; NOx and SOx; Ammonia; Acid Rain; Ocean Acidification; Nuclear Reactors.

Sustainability Systems Farm

PROJECT LEAD:

Steven Conrad, Department of Systems Engineering

Systems thinking can help students develop a holistic understanding of sustainability issues.

This project developed the Sustainability Systems Farm — a suite of simple, open-source, systems thinking models with exercises. The Sustainability Systems Farm is meant for integration into existing course curriculum to extend students' perception of sustainability concepts beyond the lens of their particular discipline.

Students are increasingly exposed to specific concepts of sustainability and global environmental issues in their education (such as climate change, food security, and economic growth and disparity), however they often continue to view these through the lens of their individual coursework, rather than develop a more holistic understanding of the issues and how they are connected. The Sustainability Systems Farm models demonstrate complex socio-environmental-economic interactions and dynamic behavior while illustrating the subtleties of sustainability principles. The farm includes five online system dynamics exercises for undergraduate and graduate coursework on common system structures (such as economic capital growth constrained by environmental resource and population dynamics) that are encountered frequently in sustainability concepts. This project provided a framework for future exercises and five more modules began development.

EXPANDING LEADERSHIP TRAINING ACROSS NORTH AMERICAN UNIVERSITIES

SoGES co-leads and is the administrative home of ANGLES – a network of universities in the U.S. and Canada that are working together to accelerate and improve sustainability-focused leadership development in graduate education.

Making progress on sustainability challenges depends on people who have both deep expertise and leadership capabilities. The world needs leaders with additional skills beyond those in their degree program; skills that can help them apply their knowledge effectively, understand stakeholder needs, work collaboratively, communicate outside their discipline, make decisions in the face of ambiguity, be adaptable and resilient, affect policy, foster equity and justice, and more.

ANGLES aims to align diverse efforts to develop graduate students as sustainability leaders and societal change agents. By providing a framework for mentorship, sharing best practices and curriculum, expanding and combining ideas in novel ways, and more, the network raises the impact of individual graduate leadership programs and expands the landscape of training opportunities.

SoGES believes there can never be too many experts with the tools and skills to fight for a more sustainable world. As a leader of ANGLES, SoGES is able to not only help and support emerging sustainability leadership programs, but also leverage the network for ideas to improve the SoGES Sustainability Leadership Fellows program.

The seven key aptitudes of graduate sustainability leaders, developed by ANGLES.

2020-2021 Highlights:

- The ANGLES network migrated its website to be housed at SoGES. SoGES' **Aleta Rudeen Weller** continued to lead network meetings and activity, including a series of discussions focused on adapting leadership programs to the COVID-19 pandemic. Universities shared strategies, successes, failures, ideas, and advice.
- The network, with the help of SoGES website and communication staff, developed and populated two web-based databases that were conceptually designed by the network during its synthesis meeting in February 2020. These databases are open access and intended to help people and programs find one another, capture institutional knowledge, and facilitate information exchange:
  - A network map of the programs in the U.S. and Canada with leadership training for grad students in sustainability – with particular focus on helping existing and new programs find often difficult-to-locate programmatic data.
  - A skills and aptitudes database, designed using seven co-created aptitudes, moves beyond prescriptive ideas of what should be taught to also show how different programs are teaching these leadership skills. It is intended for sharing resources, ideas, curriculum, and approaches to better teach these skills.
- The network also worked on writing a manuscript that collectively captures the seven aptitudes that were co-created by the network, and summarizes both databases.
- **Aleta Rudeen Weller** (SoGES) and **Nicole Motzer** (National Socio-Environmental Synthesis Center) led an opinion piece titled "Tackling Global Problems Through Cooperation" published in *Inside Higher Ed*. Other authors were **Rebecca Vidra** (Duke University), and **Diana H. Wall** (SoGES). The op-ed draws on their experience through ANGLES, working to improve and expand access to leadership training, and calls for a re-thinking of academic culture within and across institutions to better incentivize collaborative work and prioritize shared goals around sustainability.

SUSTAINABILITY LEADERSHIP TRAINING FOR EARLY CAREER SCIENTISTS

2020-2021 saw the 10th cohort with 20 Fellows from 13 departments across 6 colleges.

The year-long **Sustainability Leadership Fellows (SLF) program** provides early career scientists with training to effectively communicate science to the media and public, professional development skills and techniques, and strategies to build meaningful careers that incorporate engagement and interdisciplinarity. The program helps the scientists that will be solving tomorrow's grand challenges of sustainability have greater impact, reach broader audiences, and think more expansively about their work and its role in the world.

Fellows took part in an intensive science communication training workshop run by COMPASS, science communication specialists, which in 2020-2021 was spread out into five separate sessions over the course of the year. Fellows also participated in five formal training sessions led by experts on a range of topics including time management and workload optimization, interacting with policymakers, balancing science and advocacy, talking science with skeptical audiences, and creating an inclusive team culture. Fellows also took part in additional skill-building and networking opportunities throughout the year, including the program orientation and writing and peer-review for the SoGES blog. New in 2020-2021, Fellows are assigned to five-person pods. These pods meet more frequently than the large group and help create strengthened connections and camaraderie within the program.

Honors and Recognition

Laura van der Pol, **Clara Tibbetts**, and **Danielle Lin Hunter** authored the policy memo "Removing Barriers and Creating Opportunities for Climate-Resilient Agriculture by Optimizing Federal Crop Insurance," which was published in the *Journal of Science Policy & Governance*. Their article was selected as one of three outstanding publications in the issue and the authors were invited to present their work to the British Embassy as part of the 2021 United Nations Framework Convention on Climate Change Conference of Parties.

Lyndsey Gray was one of two CSU graduate students to win a prestigious $20,000 Philanthropic Educational Organization (P.E.O) Scholar Award. P.E.O is a nonprofit focused on helping women advance though education.

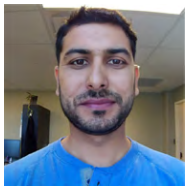
SINCE INITIATION OF OF THE SLF PROGRAM IN 2011...

200
Fellows trained

from
33
departments

across
7
colleges

College of Agricultural Sciences



Janak Joshi
Postdoctoral Fellow, Dept. of Horticulture and Landscape Architecture, mentor: Adam Heuberger

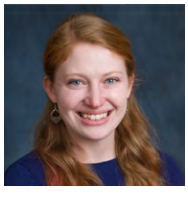
Shelby McClelland
Ph.D. Candidate, Dept. of Soil and Crop Sciences and Graduate Degree Program in Ecology, advisor: Meagan Schipanski

Laura van der Pol
Ph.D. Student, Dept. of Soil and Crop Sciences, Graduate Degree Program in Ecology and Natural Resource Ecology Laboratory, advisor: Francesca Cotrufo

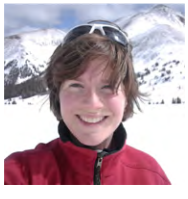
College of Liberal Arts

James Hale
Postdoctoral Fellow, Dept. of Sociology, mentor: Michael Carolan

College of Natural Sciences



Erin Boedicker
Ph.D. Candidate, Dept. of Chemistry, advisor: Delphine Farmer



Rebecca Cheek
Ph.D. Candidate, Dept. of Biology and Graduate Degree Program in Ecology, advisor: W. Chris Funk

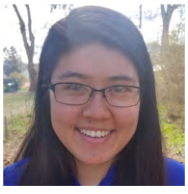
Carrie Chennault
Postdoctoral Fellow, Dept. of Statistics, mentor: Melissa McHale

College of Natural Sciences (cont.)

Lauren Hoskovec
Ph.D. Student, Dept. of Statistics, advisor: Ander Wilson

Cassidy Jackson
Ph.D. Candidate, Dept. of Chemistry, advisor: Joseph Zadrozny

Pascal Jundt
Ph.D. Candidate, Dept. of Physics, advisor: Jim Sites



Danielle Lin Hunter
Ph.D. Candidate, Dept. of Biology and Graduate Degree Program in Ecology, advisor: Meena Balgopal

Alexander Mauro
Ph.D. Candidate, Dept. of Biology and Graduate Degree Program in Ecology, advisor: Cameron Ghalambor

Clara Tibbetts
Ph.D. Candidate, Dept. of Chemistry, advisor: Amber Krummel

College of Veterinary Medicine and Biomedical Sciences

Lyndsey Gray
Ph.D. Candidate, Dept. of Microbiology, Immunology, and Pathology, advisor: Brian Foy

Walter Scott, Jr. College of Engineering

Ali Akherati
Ph.D. Candidate, Dept. of Mechanical Engineering and Atmospheric Science, advisor: Shantanu H. Jathar

Michael Cheeseman
Ph.D. Candidate, Dept. of Atmospheric Science, advisor: Jeffrey Pierce

Zachary Labe
Postdoctoral Fellow, Dept. of Atmospheric Science, mentor: Elizabeth A. Barnes

Zane Martin
Postdoctoral Fellow, Dept. of Atmospheric Science, mentor: Eric Maloney

Warner College of Natural Resources

Kristin Davis
Ph.D. Student, Dept. of Fish, Wildlife, and Conservation Biology and Graduate Degree Program in Ecology, advisor: Liba Pejchar

Nathan Hahn
Ph.D. Candidate, Dept. of Fish, Wildlife, and Conservation Biology and Graduate Degree Program in Ecology, advisor: George Wittemyer

SoGES houses four CSU centers and supports two international initiatives.

GLOBAL SOIL BIODIVERSITY INITIATIVE | globalsoilbiodiversity.org

An ongoing worldwide effort to support soil biodiversity research and advocate for its inclusion in education, policy development, and land management for the benefit of people and ecosystems.

Collembola (springtails) are one example of the many diverse soil organisms on Earth. Photo courtesy of Monica Farfan.

LEADERSHIP

Diana H. Wall (Scientific Chair), Colorado State University, United States
Monica A. Farfan (Executive Director), Colorado State University, United States

It is estimated that more than 25% of biodiversity inhabits soil, but the contribution of soil organisms to all life on Earth has been largely ignored. The Global Soil Biodiversity Initiative (GSBI) leads and advances soil biodiversity science by supporting new ideas, international connections, and the mainstreaming of knowledge of soil life and ecosystem services for sustainable development. The GSBI has over 4,000 members who participate in science, education, and policy initiatives focused on soil biodiversity.

2020-2021 Highlights:

- Served as a partner organization on the U.N. Food and Agriculture Organization (FAO) global soil biodiversity assessment, a first of its kind. The report, *State of Knowledge of Soil Biodiversity: Status, Challenges, and Potentialities*, was published in 2020. The GSBI secretariat, along with 300 scientists, were contributors. **Diana H. Wall** was on the report's editorial board.
- Contributed as a key organizer for the FAO "Global Symposium on Soil Biodiversity" in April 2021. Over 5,000 participants representing 160 countries attended the four-day symposium. **Diana H. Wall** gave a keynote address on the first day welcoming attendees. **Monica Farfan** moderated the scientific plenary session on day three.
- Launched the monthly webinar series "GSBI Speaks," focused on global topics in soil biodiversity science, which attracted over 1,000 international attendees. The GSBI YouTube channel, created to archive webinar sessions, grew to nearly 400 subscribers and garnered over 3,000 views of the first five webinars combined.
- Continued to publish the GSBI blog, *Beneath our Feet*, which focuses on all topics in soil biodiversity science and policy. The blog is widely read by scientists and policymakers around the globe and republished by other soils and biodiversity-related societies, including the International Union of Soil Science.
- Organized sessions at the Ecological Society of America meeting (August 2020) and The American Geophysical Union meeting (December 2020).

THE AFRICA CENTER | africacenter.colostate.edu

Advancing innovative interdisciplinary and transdisciplinary research to tackle the continent's environmental and sustainability issues.

Screenshot from the virtual event, "Conducting Field Research in Africa During a Global Pandemic." Image courtesy of the Africa Center.

The Africa Center is comprised of CSU faculty, students, community members, and African partners addressing issues of sustainability of environments and societies across the African continent. The Center's mission is to foster environmental, economic, and social sustainability in Africa through teaching, research, and engagement. The Center's Executive Committee of seven makes recommendations and provides guidance to the Center. Ongoing activities include Global Symposia featuring leaders from Africa, talks by CSU and non-CSU scholars, panel discussions, networking discussions, and an end-of-year Africa and Ale event. Center participants are also leading "The Drought Project," an interdisciplinary research initiative focused on the complexity of African drought in dryland social-ecological systems and the implications for development and environmental policy.

2020-2021 Highlights:

- Initiation of a monthly newsletter (circulation ~600) featuring emerging research on sustainability in Africa and increased use of Facebook and Twitter (~700 followers) to provide stakeholders with up-to-date information on African country responses to the COVID-19 pandemic.
- A virtual presentation on drought and livelihood adaptation in Southern Africa from Karen Bailey from CU Boulder (50+ people attended).
- A panel of faculty and students discussed how to continue conducting research in Africa during a pandemic that addressed issues like completing dissertation field research, innovative technologies, and building local capacity (60+ people attended).
- Continued production of *Field Notes*, a platform that highlights CSU researchers and promotes discussion of issues like ethical cross-cultural research, interdisciplinary collaboration, and community-based research. In 2020-2021 *Field Notes* featured five different scientists in podcasts or blogs.

STUDENT SUSTAINABILITY CENTER

A University-wide, student-run organization that empowers students to advance sustainability practices and principles on and beyond CSU's campus.

Trash clean-up on the CSU campus. Photo courtesy of the SSC.

2021 mayoral and city council candidates attending the SSC's Fort Collins Candidate Sustainability Forum on March 22, 2021. Image courtesy of the SSC.

The Student Sustainability Center (SSC) helps shape the culture and practice of sustainability on campus and in the local community by leading projects, hosting topical events, distributing information, and building community relationships. The SSC is committed to improving sustainability at CSU and growing the skill sets of students, empowering them to address the pressing social, economic, and environmental sustainability challenges of our time.

The Center grew its presence significantly with 59 club members, 884 Instagram followers, and 2,659 email subscribers. Director **Sara Van Hatten** (major: Ecosystem Science and Sustainability) graduated from CSU and **Sam Moccia** (major: Agriculture and Resource Economics) is the new SSC Director. **Molly Wharton** (major: Apparel and Merchandising) continued to serve as Associate Director of Engagement, leading the Center's digital outreach efforts.

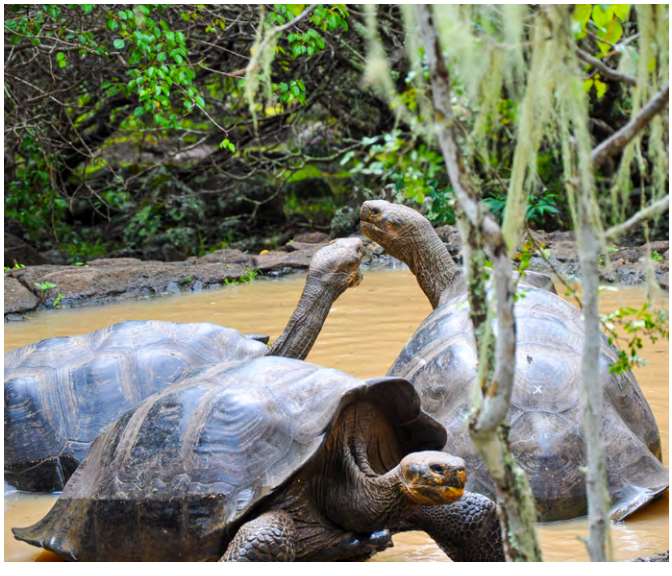
2020-2021 Highlights:

- Continued leadership of the Coalition of Sustainable Student Organizations, which is a partnership of sustainability-oriented student organizations across campus, chaired by the SSC.
- Hosted regular club meetings, gave student outreach presentations across CSU classrooms, and held sustainability-relevant events including the Center's first sustainability-focused election forum.
- Continued representing the student body on campus groups and committees, such as the President's Sustainability Commission, and contributed student perspectives to the CSU strategic planning process and CSU Climate Action Plan.
- Expanded outreach to on-campus organizations, partnering with campus student government to accelerate student-built sustainability efforts.
- Connected with numerous local sustainability advocacy organizations and supported student outreach for the 2021 Earth Day Fort Collins event.

GLOBAL BIODIVERSITY CENTER | biodiversity.colostate.edu

A network of faculty working on biodiversity research at the University encouraging knowledge transfer and cross-campus collaboration.

Old growth temperate rainforest, H.J. Andrews Experimental Forest, Blue River, Oregon. Photo courtesy of Chris Funk.



San Cristobal Island tortoise, Cerro Colorado Tortoise Reserve, San Cristobal Island, Galapagos Islands, Ecuador. Photo courtesy of Chris Funk.

Biodiversity maintains life on our planet and underpins the ecosystem services vital to human well-being, including food, carbon storage, climate regulation, and aesthetics and cultural support. The mission of the Global Biodiversity Center (GBC) is to advance understanding, conservation, and appreciation of life's variation, ranging from genetics and organisms to ecosystems and their interactions. The Center works to maintain and enhance biodiversity through research, policy advancement, education, and outreach at CSU.

2020-2021 Highlights:

- During fall, the GBC worked with filmmaker Ryan Killackey to develop and disseminate a video about his feature documentary "Yasuní Man," which examines how resource extraction and the emergence of COVID-19 are threatening the Huaorani people of Amazonian Ecuador.
- In April 2021, the GBC and the CSU Climate Adaptation Partnership (CAP) project held an online policy workshop on sustainability and biodiversity policy in the U.S. and science communication with policy makers and the public. Approximately 20 CSU faculty members and other researchers participated.
- The GBC was also very involved in developing the U.N. Convention on Biological Diversity (CBD) post-2020 global biodiversity framework and the activities of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), focusing on improving the incorporation of genetics in both efforts. The Center hosted seminars, contributed to peer-reviewed papers for stakeholders, and helped review the National Reports to the CBD from 57 countries.
- GBC Director **Chris Funk** also commented on the IPBES draft report on the sustainable use of wild species and was invited to speak at the 2021 Genetic Diversity Monitoring Workshop by ETH Zürich, Switzerland.

SALAZAR CENTER FOR NORTH AMERICAN CONSERVATION

| salazarcenter.colostate.edu

Building bridges that connect scientific research, community practice, and policy development.

Perin McNelis and Francesca Claverie of the Borderlands Restoration Network, winner of the Connectivity Challenge. Image courtesy of the Salazar Center.

Speakers from the 2020 Symposium on Conservation Impact. Image courtesy of the Salazar Center.

The Salazar Center for North American Conservation was created in 2016 to build bridges that connect scientific research, community practice, and policy development. It began operation at CSU in late 2018. The major activity of 2020-2021 was the second annual International Symposium on Conservation Impact, which virtually convened more than 300 thought leaders from the U.S., Canada, and Mexico in September 2020 for a discussion of nature, climate resilience, and racial equity in cities. Notable speakers included founder, former Interior Secretary, and U.S. Ambassador to Mexico Ken Salazar; then-Congresswoman and now Interior Secretary Deb Haaland; environmental justice activist Mustafa Santiago Ali; and CSU President Joyce McConnell.

2020-2021 Highlights:

- The symposium featured award of the Center's first conservation impact prize, the Connectivity Challenge. The Borderlands Restoration Network won $100,000 for their innovative proposal to conserve agaves, increase agricultural sustainability, and protect bats in the U.S.-Mexico borderlands.
- The Center also announced its second annual impact prize, which focuses on innovative nature-based solutions to improve the equity, health, and resilience of urban communities in North America. The Thriving Cities Challenge will provide funding awards to up to five teams, which will be announced at the next annual symposium in fall 2021.
- Other 2020-21 highlights include an intergovernmental agreement with the City and County of Denver, publication of *Weaving the Strands Together: Case studies in inclusive and equitable landscape conservation*, in partnership with the Network for Landscape Conservation, and production of the Conservation Conversations webinar series to explore conservation challenges and identify specific steps to secure the long-term health of the nation's natural resources, wildlife, landscapes and people. This series culminated in a report of lessons learned, which was shared with the Biden-Harris transition team.

In June 2021, the Salazar Center was transferred to its new home in the CSU Office of Engagement and Extension.

FUTURE EARTH | futureearth.org

A global research program designed to provide the knowledge needed to support transformations towards sustainability.

CSU and the University of Colorado - Boulder, have worked together in hosting the U.S. global hub of Future Earth since 2014. Future Earth is a global platform for international scientific collaboration, providing the knowledge required for societies to face risk posed by global environmental change and to seize opportunities in a transition to global sustainability. The program's network of scientists, researchers, and innovators are deepening our understanding of complex Earth systems and human dynamics across different disciplines to underpin the ongoing development of evidence-based policies and strategies for sustainable development.

Future Earth works to deepen our understanding of complex Earth systems and human dynamics.

2020-2021 Highlights:

- Helped organize the inaugural meeting of the Sustainability Research & Innovation (SRI) Congress series, a transdisciplinary gathering and space for advocacy of sustainability scholarship, innovation, collaboration and action. SRI2021 was a live virtual event with a diverse and innovative program that included over 150 sessions and events. More than 2,000 people from 100 countries attended, making it the largest virtual sustainability convening in the world.
- Continued implementation of the Program for Early-stage Grants Advancing Sustainability Science program (funded by the Gordon and Betty Moore Foundation) in partnership with the CSU Global Biodiversity Center and the Future Earth Regional Office for Southern Africa. A 'Take-It-Further' grants program was initiated to advance research into Food-Water-Energy Nexus across four new projects, with research teams from 14 countries and study locations across 12 countries.
- Continued development of the Earth Leadership Program, the global successor to the renowned Leopold Leadership Program. The first North American cohort of 22 fellows was selected this year, and is the most diverse in the program's 20-year history. The program is now preparing a second regional cohort focused on collective leadership in the Arctic and working with other Future Earth projects to expand leadership training to sustainability researchers in additional geographies.
- Further growth of *Anthropocene Magazine*, which has the largest reach among Future Earth products. Its weekly newsletter, Science Dispatch, now has over 32,000 subscribers worldwide and its website attracts 230,000 unique users every month. A fifth print edition was released, receiving national and international commendations—most recently, a 2020 Eddie Award for editorial and design excellence, a 2020 World-Changing Ideas Award from Fast Company magazine, and a 2020 CASE Silver Award for a university-based special interest magazine.

This was the final year of CSU participation in the U.S. global hub.

SoGES places high priority on identifying and addressing societal needs, both within our local region, and at the national and global level. Maintaining a robust dialogue among students, faculty, and stakeholders beyond the University helps us understand problems and investigate potential solutions.

COMMUNICATIONS

Website
70,545
visits to sustainability.colostate.edu (24% international traffic)

News & Media
265
mentions in the media (76% domestic, 24% international) with a total estimated readership of over **85 million**

Social Media
4,089 Email Subscribers
1,626 Facebook Likes
2,890 Twitter Followers
74 YouTube Subscribers

EVENTS

All events in 2020-2021 were held virtually due to the COVID-19 pandemic.

Guest Lectures

Each lecture includes a Q&A session at the end of the main presentation. Approximately 200 attendees.

Sep. 22 **FEWtures: Innovative solutions for sustaining rural America**. Speaker: **Mary C. Hill**, University of Kansas

Oct. 06 **Sustainability: There is no solution. There are SOLUTIONS**. Speaker: **Thomas Dietz**, Michigan State University

Nov. 10 **Strengthening Sustainability Programs in Higher Education**. Speakers: **Christopher Boone**, Arizona State University; and **Madeline Tyson**, Rocky Mountain Institute. Co-hosted with the Dept. of Ecosystem Science and Sustainability.

Managing the Planet Panel Series

Each panel features CSU experts who field live questions from community members and students. Approximately 250 attendees.

Feb. 25 **Regenerating Colorado's Rangelands: One Acre at a Time?** Panelists: **Kevin Jablonski**, Dept. of Forest and Rangeland Stewardship; **Richard Knight**, Dept. of Human Dimensions of Natural Resources; **Melinda Smith**, Dept. of Biology and Semi-arid Grassland Research Center; **Kim Stackhouse-Lawson**, Dept. of Animal Sciences and Sustainable Livestock Systems Collaborative

Mar. 25 **Planning for Climate Change: Lessons from the Dust Bowl**. Panelists: **Becky Bolinger**, Dept. of Atmospheric Science and Colorado Climate Center; **Alan Knapp**, Dept. of Biology and Graduate Degree Program in Ecology; **Susan Melzer**, Dept. of Soil and Crop Sciences and SoGES; **Douglas Sheflin**, Dept. of History and Public Lands History Center

Apr. 29 **Changing Times in Washington DC: Opportunities and Challenges for CSU**. Panelists: **Mary Pedersen**, CSU Provost and Executive Vice President; **Blake Naughton**, CSU Vice President for Engagement and Extension; **Alan Rudolph**, CSU Vice President for Research

Antarctic Lecture Series

Featuring Antarctic researchers who describe various aspects of life, work, and conducting science "on the ice." Approximately 150 attendees.

Feb. 23 **What can Antarctic soils tell us about landscape development in extreme desert environments?** Speaker: **Melisa Diaz**, Woods Hole Oceanographic Institution

Mar. 23 **Microscopic legacies: 5 Million years of isolation in Antarctica**. Speaker: **Gemma Collins**, University of Waikato, New Zealand

Apr. 27 **Dynamic Antarctica, More Than Just a Slab of Ice**. Speaker: **Andrew Fountain**, Portland State University

Sustainability Happy Hour

The Sustainability Happy Hour began as an experiment to build community online when the COVID-19 pandemic shut down in-person events and networking. Each episode streamed live to the SoGES social media channels and featured conversational interviews with special guests about their area of sustainability expertise as well as commentary on sustainability news and questions from the audience. As of July 2021, the Sustainability Happy Hour 2020-2021 episodes have a combined 2,323 views on Facebook.

Jul. 10 **Kelly Ramirez**, University of Texas at El Paso

Jul. 17 **Zachary Labe**, Dept. of Atmospheric Science

Jul. 29 **Julie Kallenberger**, Colorado Water Center

Aug. 12 **Elizabeth Barnes**, Dept. of Atmospheric Science

Aug. 28 **Erin Dougherty**, National Center for Atmospheric Research

Sep. 11 **Rebecca Gruby**, Dept. of Human Dimensions of Natural Resources

Sep. 25 **Christopher (Kit) O'Conner**, USDA Forest Service Rocky Mountain Research Station

Oct. 09 **Peter Backlund**, SoGES

Oct. 23 **Mary C. Hill**, University of Kansas

Nov. 06 **Carrie Chennault**, Dept. of Statistics

Nov. 20 **Scott Denning**, Dept. of Atmospheric Science

Dec. 04 **Erika Osborne**, Dept. of Art and Art History

Jan. 29 **Sonali Diddi**, Dept. of Design and Merchandising

Feb. 12 **Aleta Rudeen Weller**, SoGES

Feb. 26 **Tony Cheng**, Dept. of Forest and Rangeland Stewardship & Colorado Forest Restoration Institute

Mar. 12 **Lynn Badia**, Dept. of English and CSU Energy Institute

Mar. 26 **Aude Chesnais**, Native Lands Advocacy Project

Apr. 09 **Rob Schorr**, Colorado Natural Heritage Program and Climbers for Bat Conservation

Apr. 23 **Rekha Warrier**, SoGES

May 07 **Sam Moccia**, Student Sustainability Center

Symposia and Special Events

Fort Collins Candidate Sustainability Forum

March 22, co-hosted with the Student Sustainability Center - 92 attendees

This public forum, held ahead of the April 6th Fort Collins elections for mayor and city council, provided a space for the candidates to share their stances on sustainability issues and participate in a dialogue with CSU students and community members.

Climate Change and One Health Workshop

May 4th, co-hosted with the CSU One Health Institute - 70 attendees

Session 1: Drought impacts on livestock production in rural communities

Panelists: **Ragan Adams**, Dept. of Clinical Sciences; **Retta Bruegger**, Regional Extension Specialist of the Western Region; **Russ Schumacher**, Dept. of Atmospheric Science and Colorado Climate Center.

Session 2: Forest fire impacts on human, animal, and environmental health

Panelists: **Sheryl Magzamen**, Dept. of Environmental and Radiological Health Sciences; **Colleen Duncan**, Dept. of Microbiology, Immunology and Pathology; **John Volckens**, Dept. of Mechanical Engineering and the Center for Energy Development and Health; **Tony Cheng**, Dept. of Forest and Rangeland Stewardship and the Colorado Forest Restoration Institute.

Session 3: Fleas, Ticks, Mosquitoes: Change in vector-borne disease

Panelists: **Christie Mayo**, Dept. of Microbiology, Immunology and Pathology and Veterinary Diagnostic Laboratory; **Greg Ebel**, Dept. of Microbiology, Immunology and Pathology and Arthropod-Borne and Infectious Diseases Laboratory; **Daniel Olson**, Colorado School of Public Health and Center for Global Health; **Jim Hurrell**, Dept. of Atmospheric Science.

Demystifying Building Energy Conservation: A Panel Discussion with Fort Collins Experts

May 6th, hosted by students in GES 520: Issues in Global Environmental Sustainability and sponsored by SoGES - 30 attendees

Panelists: **Carol Dollard**, CSU Facilities Management; **John Phelan**, City of Fort Collins Energy Services; **Josie Plaut**, CSU Institute for the Built Environment

In 2020-2021 SoGES held 35 events which reached over 3,000 people.

Diana H. Wall, Director

Diana Wall is a CSU University Distinguished Professor, Professor of Biology, and Director of the School of Global Environmental Sustainability (SoGES). Since the founding of SoGES in 2008, Diana has been a driving force for connecting CSU faculty, researchers, and students to address the world's greatest sustainability challenges. An ecologist, she is recognized for her work on soil biodiversity and climate change impacts in the Antarctic dry valleys. Wall Valley, Antarctica was designated for her contributions. Diana was president, Society of Nematologists and the Ecological Society of America. She received the 2013 Tyler Prize for Environmental Achievement, the Ulysses Medal, University College Dublin, the 2019 President's Medal of the British Ecological Society and is an elected member of the National Academy of Sciences. She earned her Ph.D. at the University of Kentucky.

Peter Backlund, Associate Director

Peter Backlund is a science and policy researcher whose primary interests include the intersection of global change and environmental sustainability, use of scientific information for decision-making, assessment of climate change vulnerability and impacts, and evaluation of adaptation and mitigation options. His recent work has focused on understanding and documenting the impacts of climate change on food systems and food security. Before joining CSU, he held senior positions at the U.S. National Center for Atmospheric Research, the White House Office of Science and Technology Policy, and NASA. Peter is a fellow of the American Association for the Advancement of Science and a 2016 recipient of the Abraham Lincoln Honor Award from the U.S. Department of Agriculture. He received his B.A. from the University of New Mexico and his M.A. from The George Washington University.

Kathleen Galvin, Assistant Director of Educational Programs

Kathleen Galvin is a Professor of Anthropology and Director of The Africa Center at CSU. She is also an Advising Faculty member for the Graduate Degree Program in Ecology. She has conducted interdisciplinary social-ecological systems research in the drylands of Africa. Galvin has worked with local communities on issues of land use change, biodiversity conservation, food security, and climate change impacts and adaptations. She works with local communities, ecologists, modelers, remote sensing, and GIS experts to understand human-environmental interactions. Professor Galvin is co-author of the American Anthropological Association Task Force Report on Global Climate Change. She is the 2017 award recipient of the CSU John N. Stern Distinguished Professor Award and received the 2017 award for Resident Distinguished Ecologist from the Graduate Degree Program in Ecology at CSU. She is a lead author on the 2019 Global Assessment on the United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

Eugene Kelly, Faculty Research Liaison

Eugene Kelly is a Professor of Pedology and Deputy Director of the Colorado Agricultural Experiment Station at Colorado State University. He conducts research and lectures on various aspects of soils as related to global change issues. His scientific specialization is in Pedology and Geochemistry and his current research centers on the influence of climate change and land use on soil degradation and sustainability in water-limited systems. He is a member of the U.S. National Committee for Soil Science with the National Academy of Sciences. He serves as an advisor to the U.S. Department of Agriculture with the National Cooperative Soil Survey, National Institute of Food and Agriculture, the National Science Foundation and several major research programs. He is a Fellow of the Soil Science Society of America and the recipient of the 2016 Soil Science Society of America Research Award. He received his B.S. and M.S. degrees from CSU and his Ph.D. from the University of California-Berkeley.

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Joe Champ, Journalism and Media Communication
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Brian Dunbar, Institute for the Built Environment
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Alan Knapp, Biology
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Pat Keys, Lead Scientist
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Susan Melzer, Assistant Professor, Department of Soil and Crop Sciences and SoGES
Laurel Milliken, Information Technology Officer, Future Earth Colorado Global Hub
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Sara Van Hatten, Outgoing Director, Student Sustainability Center
Rekha Warrier, Postdoctoral Researcher
Aleta Rudeen Weller, Senior Research and Engagement Officer

Robert Jackson, Chair, External Advisory Board

Robert Jackson is the Michelle and Kevin Douglas Provostial Professor in Stanford's School of Earth Sciences and Senior Fellow at the Woods Institute for the Environment and at the Precort Institute for Energy. While at Duke University, he and his colleagues published the first studies examining drinking water quality and shale gas extraction, as well as several studies on wastewater disposal and naturally occurring radioactive materials. He also examines hydrocarbon emissions upstream from wellpads and downstream in cities, including the first maps of natural gas leaks across urban pipelines in Boston and Washington, D.C. In recent years, Jackson directed the U.S. Department of Energy National Institute for Climate Change Research for the southeastern U.S., co-chaired the U.S. Carbon Cycle Science Plan, and currently co-chairs the Global Carbon Project.

AFFILIATE FACULTY

Ryadi Adityavarman	Interior Architecture and Design
Ruth Alexander	History
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Mary-Ann Kokoska	Art and Art History
Rick Aster	Geosciences
Peter Backlund	SoGES
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Jens Blotevogel	Civil and Environmental Engineering
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Cynthia Brown	Agricultural Biology
Jo Burgess Barbier	Economics
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Ruth Hufbauer	Agricultural Biology
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David Thompson	Atmospheric Science
Craig Trumbo	Journalism and Media Communication
Rodolfo Valdes Vasquez	Construction Management
Sue VandeWoude	Microbiology, Immunology, and Pathology
Subhas Venayagamoorthy	Civil and Environmental Engineering
Chandrasekar Venkatachalam	Electrical and Computer Engineering
Diana H. Wall	SoGES & Biology
Ellen Wohl	Geosciences
Terry Yan	Design and Merchandising
Jill Zarestky	School of Education

FINANCE REPORT

Description	Budget	Expenses	Credits
FY 2020-21 Base Budget	$1,099,760.00		
Salaries			
Director, Associate Directors		$471,317.00	
Staff		$475,410.00	
Student Hourlies		$2,900.00	
SALARIES TOTAL		**$949,627.00**	
Program Activities			
Research			
Global Challenges Research Teams and Working Groups		$30,000.00	
Resident Fellows		$20,000.00	
Total		**$50,000.00**	
Sustainability Leadership Fellows program			
Science Communication Workshop, Trainings, and Year Operations and Supplies		$15,731.00	
Total		**$15,731.00**	
Education			
GES Traditional and Online Courses (Professors, GTAs, Supplies, and Trips)		$156,414.00	
Total		**$156,414.00**	
Student Sustainability Center			
Salaries		$5,112.00	
Operations and Events		$1,298.00	
Total		**$6,410.00**	
PROGRAM ACTIVITIES TOTAL		$228,555.00	
General Administration			
Supplies		$14,665.00	
Operating Charges (Events, Phone, Data, Etc.)		$35,146.00	
Travel		$1,752.00	
Total		**$51,563.00**	
EXPENSE TOTAL		**$1,229,745.00**	
Miscellaneous Income			
1X Monies			$56,589.00
Differential Tuition			$30,245.00
FY20 Carryforward			$25,897.00
Online Courses Revenue			$27,727.00
Salary Savings From Grants			$32,227.00
Balance for Future Commitments in FY22			**$42,700.00**

SoGES continued to implement research projects during 2020-2021 that are supported by grants and cooperative agreements awarded in previous fiscal years by NASA, NSF, USDA, and The Gordon and Betty Moore Foundation.

PUBLICATIONS

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