SCHOOL OF GLOBAL
ENVIRONMENTAL SUSTAINABILITY

COLORADO STATE UNIVERSITY

2019-20 Annual Report

SCHOOL OF GLOBAL ENVIRONMENTAL SUSTAINABILITY

Photo: Colorado State University's Johnson Hall where the School is located.

Dear Friends of SoGES,

2019-2020 was very challenging. The rapid spread of COVID-19 and the actions that had to be taken in response had profound effects on our University and our entire set of research, education, and engagement activities, all of which shifted abruptly from in-person to online in March 2020, midway through the spring semester. Fortunately, SoGES had extensive experience in remote learning and had already developed online versions of most of our courses, which enabled a fairly smooth transition for both instructors and students, despite its suddenness. Research teams and individual researchers supported by SoGES had to alter their plans and develop new means of implementing projects through remote collaboration. Lectures, panel discussions, conferences, and other engagement activities likewise experienced significant impacts. Some of these had to be canceled or postponed, while others were converted to virtual online events.

As we reflect on the year, we are mindful that the pandemic has provided a compelling example of the deep connection of human society to global environmental conditions and the value of research in identifying, understanding, and mitigating environmental risks. We are very proud of the resilience, determination, teamwork, and creativity displayed by our students, faculty, colleagues, and staff, which enabled our School to maintain momentum and finish the year strong in the face of very difficult circumstances.

Diana Wall, SoGES Director
Peter Backlund, SoGES Associate Director

2019-20 AT A GLANCE

RESEARCH

pages 6-13

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

$90,000 was awarded by SoGES to CSU sustainability researchers
2 teams funded with **10** investigators from **8** departments across **5** colleges
4 resident faculty fellows funded from **3** departments across **2** colleges

EDUCATION & TRAINING

pages 14-19

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

648 students completed GES courses
307 students were enrolled in **4** undergraduate minors
94 students graduated with SoGES minors (**81** from GES, **2** from Energy, **7** from Water, and **4** from Peace and Reconciliation)
20 Sustainability Leadership Fellows from **18** departments across **6** colleges
The SoGES Curriculum Committee composed of faculty from all eight colleges completed the design of a new undergraduate major in Global Environmental Sustainability and the proposal is now moving through the university review process

CENTERS & PROGRAMS

pages 20-23

SoGES houses and supports four CSU centers and one international program.

The **Salazar Center for North American Conservation** held its inaugural International Symposium on Conservation Impact, attracting nearly 300 conservation thought leaders from the US, Canada, and Mexico
The **Future Earth *Anthropocene* magazine** won the 2019 Folio Eddie Award for editorial and design excellence across a full issue and amassed **$203,000** in membership donations
The **Student Sustainability Center** developed a digital Daily Sustainability Planner
The **Africa Center** initiated an interdisciplinary research project on the complexity of drought in African dryland systems and a white paper and policy brief are expected in the coming year
Global Biodiversity Center panels and networking events attracted **515** attendees

ENGAGEMENT

pages 24-25

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.

2,090 people attended **26** events organized and hosted by SoGES and collaborators
400 people attended the 20th Anniversary of Climate Action in Fort Collins event, co-organized by SoGES and the City of Fort Collins
178 stories in popular and scientific media mentioned SoGES, with a total estimated readership of nearly **97 million**

SCHOOL OF GLOBAL ENVIRONMENTAL SUSTAINABILITY

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.

SoGES brings together researchers, teachers, students, and stakeholders to address one of the greatest challenges of the coming century: preserving our planet's environmental quality while meeting the human and societal needs of today and tomorrow. Our approach to this challenge is centered on exploring, documenting, and explaining the links between environmental, societal, and economic sustainability, and fostering ongoing dialogue about choices, trade-offs, and solutions.

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**

The challenge of achieving sustainability is inherently interdisciplinary, requiring the development and integration of knowledge, perspectives, and understanding from the natural and social sciences, engineering, business, art, and the humanities. 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.

Diana H. Wall, Director

Diana is a University Distinguished Professor and Professor of Biology at CSU and Science Chair of the Global Soil Biodiversity Initiative. She is a world-renowned ecologist and the inaugural director of the School of Global Environmental Sustainability. Since the School's beginning in 2008, Diana has been a driving force for connecting CSU faculty, researchers, and students by providing innovative programs and tools to address the world's greatest sustainability challenges. Under her leadership, the School has become a strong platform for building an academic community at CSU that crosses boundaries to share knowledge and solve the most pressing environmental problems we face. Diana is an elected member of the National Academy of Sciences and the American Academy of Arts and Sciences. She is the 2013 Laureate of the Tyler Prize for Environmental Achievement and recipient of the President's Medal of the British Ecological Society. Her collaborative nature and pioneering global scale studies of soil biodiversity are hallmarks of her career. Diana has a Ph.D. from the University of Kentucky, Lexington.

Leadership

Peter Backlund, Associate Director

Peter 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 US 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 US 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

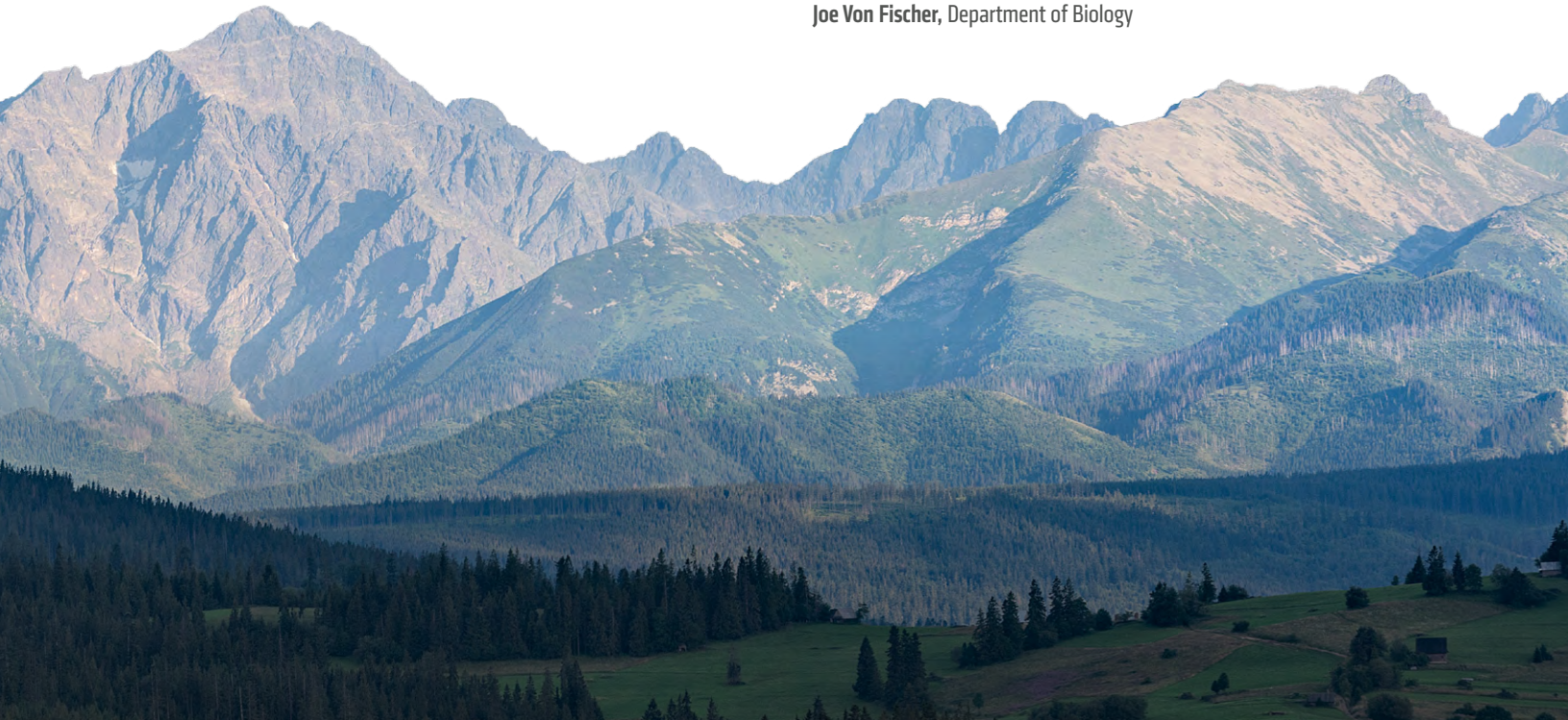
Kathy is a Professor of Anthropology, Senior Research Scientist at the Natural Resource Ecology Laboratory, Director of The Africa Center, and an advising faculty member in the CSU Graduate Degree Program in Ecology. She conducts interdisciplinary human-ecological research in Africa and Asia and is interested in pastoral land use, conservation, climate variability, resilience, dryland adaptation strategies, and household decision-making under environmental uncertainty. Kathy has served on many National Research Council and National Science Foundation panels and is an Aldo Leopold Leadership Fellow. She is a Lead Author on the 2019 Global Assessment on Biodiversity and Ecosystem Services for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Her B.A. and M.A. are from CSU and her Ph.D. is from Binghamton University.

Eugene Kelly,
Faculty Research Liaison

Gene is a Professor of Pedology, Deputy Director of the CSU Agricultural Experiment Station, Associate Dean for Extension in the College of Agricultural Science, and former head of CSU's Department of Soil and Crop Sciences. 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 current advisor to the US Department of Agriculture's National Cooperative Soil Survey and the National Ecological Observatory Network. He is a fellow of the Soil Science Society of America and a recipient of the prestigious 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.

Executive Council

Michele Betsill, Department of Political Science
Thomas Borch, Department of Soil and Crop Sciences
Joe Champ, Department of Journalism and Media Communication
Tom Dean, Department of Management
Brian Dunbar, Institute for the Built Environment
Emily Fischer, Department of Atmospheric Science
Chris Funk, Global Biodiversity Center
Alan Knapp, Graduate Degree Program in Ecology
Jan Leach, Department of Bioagricultural Sciences and Pest Management
Kelly Martin, Department of Marketing
Barry Noon, Department of Fish, Wildlife, and Conservation Biology
Dennis Ojima, Department of Ecosystem Science and Sustainability
Kenneth Reardon, Department of Chemical and Biological Engineering
Elizabeth Ryan, Department of Environmental and Radiological Health Sciences
Dave Thompson, Department of Atmospheric Science
Joe Von Fischer, Department of Biology



RESEARCH

SoGES invests in innovative research activities to advance global sustainability science, including cultivation of interdisciplinary partnerships, experimentation with new methods, and development of projects that integrate disparate knowledge and approaches.

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

In 2019-20, SoGES awarded $90,000 to CSU researchers and supported 2 research teams and 4 faculty fellows.

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. Since its inception, SoGES has funded 43 GCRTs with principal investigators (PIs) from 46 departments across all eight CSU colleges. **During the 2019-2020 academic year, SoGES provided funding and administrative support for 2 teams with 10 investigators, from 8 departments across 5 colleges.**

Sustainable Performance of Healthy and Efficient Residential Environments (SPHERE)

Principal Investigators: **John Volckens** (Department of Mechanical Engineering), **Delphine Farmer** (Department of Chemistry), **Sheryl Magzamen** (Department of Environmental and Radiological Health Sciences), **Ryan Scott** (Department of Political Science).

The indoor environment is often overlooked as a critical sustainability issue. People spend 90% of their lives inside and 70% at home. Housing, health, and interacting human rights and social systems strongly affect quality of life; the home, as a complex, social-environmental system, is ripe for human-centered, engineering optimization. The SPHERE GCRT is focused on measuring the indoor environment to promote human health and well-being in residential homes. The team is designing and developing a "Home Health Box" sensor package that will enable individuals – regardless of socioeconomic status – to measure air and water quality in their homes and to use this information to reduce or eliminate such hazards when detected. They also plan train people from health disparity populations (those living in poverty or from disadvantaged backgrounds) to deploy the "Home Health Box" within their homes for a one-week period. CSU researchers will analyze the data collected and share an info-graphic report of results with home occupants. The team achieved significant progress despite disruption from COVID-19.

Image: Digital rendering of the Home Health Box. Courtesy of John Volckens.

- The team developed a mission statement to guide their GCRT: SPHERE is a collaborative, inclusive movement to develop science, knowledge, and actions that promote healthy home environments, eliminate health disparities, and improve home efficiency.
- Two team members (Volckens and Carter) were invited to make symposium presentations at the Air Sensors International Conference, but the conference was canceled due to COVID-19.
- Successful proposals to outside funders resulted in a grant award from the National Institutes of Health (National Institute for Minority Health and Health Disparities) and a cooperative agreement with the Environmental Protection Agency.

Aerobiome Discovery Network

Principal Investigators: **Amy Charkowski** (Department of Bioagricultural Sciences and Pest Management), **Angela Bosco-Lauth** (Department of Biomedical Sciences), **Justin Lee** (Next Generation Sequencing Facility), **Steve Reynolds** (Department of Environmental and Radiological Health Sciences), **Paul DeMott** (Department of Atmospheric Science), **Tom Hill** (Department of Atmospheric Science).

DNA and RNA are ubiquitous throughout the atmosphere, and recent scientific advances have shown that air currents spread genetic material originating from microorganisms. The Aerobiome Discovery Network GCRT proposed to converge previously unlinked expertise in atmospheric science, aerosol physics, infectious diseases/pathogens of plants, animals, people, and ecology, epidemiology, and microbiome/genomic sciences at CSU to explore this fascinating intersection of biological and physical processes in the environment. A series of workshops, panels, and seminars was planned in 2019-2020 to identify the most relevant questions about this underexplored phenomenon that can be answered by the unique expertise at CSU, and will catalyze the formation of CSU expert teams who will seek external funding for these exciting research directions.

- The team organized and held an internal workshop in November 2019 to refine research strategies, plan a large-scale colloquium, and develop concepts for next steps and future proposals. They also submitted a National Science Foundation Biology Integration Institute Design proposal and is actively working on numerous other grants related to aerobiology and SARS-2.
- When COVID-19 safety concerns and event restrictions made it impossible to hold the major colloquium that was planned for spring 2020, the team successfully organized two online seminars from speakers who were slated to attend the in-person colloquium. This helped maintain momentum, and the GCRT aims to proceed with an in-person event when possible to further networking and community building around this topic.

Photo: Air quality sensory equipment. Courtesy of Kevin Barry.

SoGES made a significant change to the Global Challenges Research Teams program that will affect future years, changing from an annual opportunity awarding single-year funding to a bi-annual opportunity that provides two years of funding in order to allow larger and more complex projects. The three new GCRTs that were selected for funding in spring of 2020 will each be supported for the 2020-2021 and 2021-2022 academic years.

RESEARCH

Resident Fellows

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 37 Resident Faculty Fellows from 23 departments across all eight CSU colleges.

In 2019-20, SoGES provided funding and administrative support for 4 Fellows from 3 departments across 2 colleges.

Jason Frazier Department of Art & Art History

Jason Frazier's Resident Fellow work was to examine the role of visual communications in public discourse as it relates to issues of climate change and the environment through a series of new creative works that focus on renewable energy, climate change, and the spirit of future technologies for creating a better world. It aimed to recall and build upon the pivotal visual communications work from the time of the great American mobilization – the New Deal – with the goal to further a meaningful and progressive conversation on the challenges the entire world faces today. The Fellowship allowed Frazier time and resources to investigate historical elements of visual communication related primarily to the Works Progress Administration, Civilian Conservation Corps, and most importantly, the Federal Art Project (FAP). It also allowed him to develop, install, and use equipment for screen printing and relief platemaking for direct impression printing, and to begin developing a series of creative works based on this historical visual language that addresses environmental destruction, climate change, and the resulting impact on both our human condition and country's identity. These works have mostly taken form as posters (the most significant form created by the FAP), but also include placards, postcards, and similar print objects. Frazier was unable to proceed with the exhibit originally planned for the end of the year due to the COVID-19 pandemic, so is now aiming for an online exhibit of the works and the processes used to create them followed by a physical exhibit when possible.

Images: A selection of posters created during the Fellowship. Courtesy of Jason Frazier.

Laura Raynolds **Department of Sociology**

Laura Raynolds used her Fellowship to analyze intersecting social and environmental sustainability problems and the effectiveness of combined NGO, business, and governmental solutions. The COVID-19 pandemic issues and political unrest in Ecuador prevented the fieldwork originally proposed, so Raynolds revised plans and made significant progress, nonetheless. She evaluated the sustainable livelihood approach, initially proposed by Chambers & Conroy (1991), and analyzed how Fair Trade Certification links peasant assets, capabilities, resilience, and environmental sustainability via this approach in plantation sectors, with a particular focus on Ecuador's pioneering Buen Vivir (good living) and Pachamama (rights of nature) policies. Her project examined how Fair Trade's sustainable livelihoods approach is pursued in the plantation context to address pressing social and environmental concerns, including labor rights and agro-chemical contamination, identifying the key strengths and weaknesses of this approach. She also compiled a set of documents on the intersection between certification and Ecuadorian governmental initiatives to lay the groundwork for ongoing field research, analysis, and assessment of a new question: Can the Fair Trade sustainable livelihoods approach protect and empower plantation workers during this COVID-19 crisis? She joined the Rethinking Value Chains Network, a largely European-based group linking researchers, policymakers, and activists and participated in a May 2020 virtual meeting on "Advancing the Creation of Global Observatories on Sustainable Production Costs and Value Distribution in the Banana, Coffee, and Cocoa Sectors." Raynolds also presented her paper, "Fairtrade certification strategies and realities: Challenging buyer power and fostering worker wellbeing and labor agency in Ecuador," at the Development Sociology Annual Conference, Notre Dame, October 17-19, 2019.

Photo: Rose packing shed worker at a Fair Trade International certified farm in Cayambe, Ecuador. Courtesy of Laura Raynolds.

Joshua Sbicca **Department of Sociology**

Josh Sbicca's Resident Fellowship focused on studying the potential for prisons in the United States to advance food justice through gardening and food production. He launched the Prison Agriculture Lab, which includes a team of graduate and undergraduate students and a postdoc, to research the extent of agricultural activities in US prisons and create a database that specifies the name and location of the facility, the type of agriculture (e.g. horticulture, crops and silviculture, animal agriculture, and food production), and the purpose of the agricultural activities (e.g. work requirement, environmental, cost savings, etcetera). These data also contributed to a larger compilation of data that includes information on facility and prisoner data and crime statistics contained in the Census of State and Federal Adult Correctional Facilities and a handful of other national penal datasets. Sbicca also used qualitative information gathered during database creation to help design a survey that he plans to administer to both correctional officials and incarcerated individuals and started to develop networks with prison industry practitioners running agricultural operations. Future plans include administering the survey, creating a website, and examining the impacts and response to COVID-19 as it pertains to prison agriculture and "essential work" in prison. Sbicca also presented the paper, "Prison agriculture in the United States: The uneven terrain of exploitation and rehabilitation" (Sbicca, J., & Chennault, C.) at the American Association of Geographers 2020 Annual Meeting (virtual), April 6-10, 2020.

Photo: Lompoc Federal Correctional Complex in California. Courtesy of Joshua Sbicca.

RESEARCH

Jessica Witt **Department of Psychology**

Jessica Witt's Resident Fellow work focused on communication of scientific findings through visualizations. Despite their widespread use as a tool for describing results, little research has been done on what makes visualizations successful. Ineffective visualizations act as a bottleneck that limits transmission of scientific insights. Witt used her Fellowship to empirically evaluate the best visualizations for communicating research related to sustainability, with a particular focus on uncertainty and anticipating future events. Her work included three streams of analysis. The first examined different means of visualizing hurricane forecasts, showing that people tended to make more probabilistic decisions when presented with multiple possible hurricane paths, (called "Zoomies") as opposed to a "cone of uncertainty," which led to more threshold-like decisions. The second looked at stripplots vs. line graphs for displaying time series data and found that line graphs were more effective for when asking viewers to detect increasing or decreasing trends. She also found that using a single-color palette increased user's sensitivity to the information in the plot. The third stream of analysis investigated the choice and range of color palettes to display quantitative data in map form, finding that design considerations made little difference in comparing the mean of values shown in one map to those in another map, but a large difference when comparing whether the mean of a map was greater or less than an indicated threshold. Results from the first two streams are being reviewed for conference presentation and publication, and results from the third stream are being prepared for publication. The paper, " Dynamic ensembles versus cones of uncertainty: Visualizations to support understanding of uncertainty in hurricane forecasts" (Witt, J. K., Clegg, B., Wickens, C. D., Smith, C. A. P., Laitin, E. L., & Warden, A. C.) was accepted at the Human Factors and Ergonomics Society's 2020 International Annual Meeting.

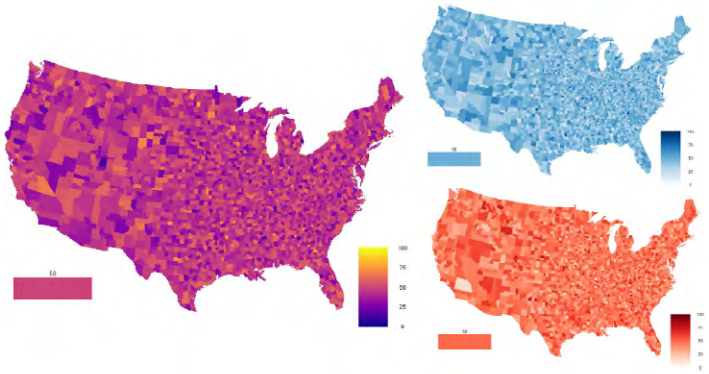


Image: Maps that show how single-hue colors and increased elements (color by county, not state or region) increase sensitivity to the information about the mean number represented in the map. Courtesy of Jessica Witt.

Image: "Zoomies" (the black dots) animate possible hurricane paths and better communicate increased risk along the coastline. Courtesy of Jessica Witt.

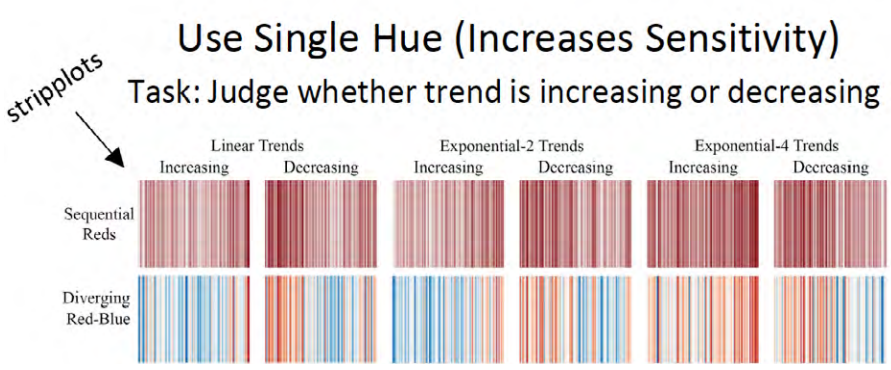


Image: Stripplots that show the use of single hue palettes to increase sensitivity to the information about direction of the trend. Courtesy of Jessica Witt.

Global Soil Biodiversity Initiative | globalsoilbiodiversity.org

An ongoing worldwide effort to plan and coordinate soil biodiversity research and support soil biodiversity for the benefit of people and ecosystems. The Global Soil Biodiversity Secretariat is housed in SoGES.

Leadership

Diana H. Wall (Scientific Chair), Colorado State University, United States
Monica A. Farfan (Executive Director), Colorado State University, United States
Carl Wepking (former Executive Director), University of Wisconsin-Madison, United States

Photos: Nematode (Heterorhabditis indica), earthworms, millipede (Cylindroiulus). Courtesy of (from left to right): Juan Morales-Ramos, Scott Bauer, M. A. Farfan.

It is estimated that more than 25% of biodiversity inhabits soil, but the contribution of soil organisms to all life has been largely ignored. The Global Soil Biodiversity Initiative (GSBI), headquartered at SoGES, leads and advances soil biodiversity science by supporting new ideas, international connections, and the mainstreaming the knowledge of soil life and ecosystem services for sustainable development. With more than 4,000 global scientists, the GSBI provides updated scientific information to partners such as the European Union Joint Research Center, Global Soil Partnership, Food and Agriculture Organization (FAO), Convention on Biological Diversity (CBD), as well as scientific societies and individual researchers and educators to further the goals to include soil biodiversity in all biodiversity. The GSBI encourages collaborative global data syntheses and research networks on soil biodiversity science and ecosystem services such as the launch of the Soil Biodiversity Observation Network (SoilBON, part of the Group on Earth Observations - Biodiversity Observation Network) in Germany, the Global Crop Microbiome in Australia, and continues to provide support to interdisciplinary teams on research proposals involving global soil biodiversity. In Fall 2019, the CBD requested the FAO, GSBI, and partners provide an assessment resulting in the report, "State of Knowledge on Soil Biodiversity Covering Current Status, Challenges and Potentialities." The GSBI community served as co-authors, reviewers and provided guidance on subject areas of this assessment, which is to be released in December 2020. Presently, the GSBI is planning for its third Global Soil Biodiversity Conference which, due to COVID-19, is postponed to 2023 in Dublin, Ireland.

2019-20 Activity

- GSBI Scientific Chair Diana Wall delivered presentations on global soil biodiversity in environmental policy at The UK Soil Security Programme (London, England). Wall was also interviewed for a short multimedia video by the FAO on the importance of soil biodiversity to society (see YouTube: https://www.youtube.com/watch?v=9Ro-1TiJy2A).
- Former GSBI Executive Directors Elizabeth Bach, Kelly Ramirez, and Tandra Fraser published with Wall on the importance of soil biodiversity to addressing sustainability goals in the journal Sustainability in March 2020.
- Former GSBI Executive Director Carl Wepking gave a presentation at the Green America Joint Network Meeting: Regenerative Supply Working Group & Carbon Farming Network titled “Agricultural decisions impact the environment, people and sustainability: Antibiotics, biodiversity, and transformation in Minneapolis, MN.”

Research Conducted by SoGES Personnel

Soil Ecology in Antarctica and Other Regions

SoGES Director Diana Wall also leads the Wall Lab, which is a joint effort of SoGES and the CSU Biology Department. 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. 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, indicating a latitudinal gradient in their roles in ecosystems. The Wall Lab's activities in 2019-20 include collaborative, interdisciplinary field work at Shackleton Glacier, Antarctica, and a study showing that the genetic diversity of soil microathropods corroborates timing estimates for the collapse of the West Antarctic Ice Sheet (*Proceedings of the National Academy of Sciences*, 2020, Collins et al.)

Photo: Diana Wall and Byron Adams (Brigham Young University), sampling soil in Cambridge Bay, Nunavut, Canada. Courtesy of the Wall Lab.

Photo: Diana Wall, Byron Adams, (Brigham Young University), and left back, Leopold Sancho (Complutense University of Madrid), at the Canadian High Arctic Research Station looking at soil invertebrates from soil samples. Courtesy of the Wall Lab.

Sustainability in the Anthropocene

SoGES Lead Scientist Pat Keys examines the ways in which human societies and the environment can lead to changes in the atmospheric water cycle, focusing on climate change impacts to recycling of moisture between land and air and the role of atmospheric water in contributing to global water security. Highlights of this year include publication of 'Anthropocene Risk' in the journal *Nature Sustainability*, which introduces the concept of inter-connected risks to our global system that operate across time and space, and presentation of an invited keynote address to the Second Committee of the United Nations General Assembly about inter-connected risk and whether a sustainable and just future is possible in the Anthropocene. Keys is also contributing to the Planetary Boundaries framework – an international effort to assess key tipping points in the Earth System. Part of this effort focuses on how lifecycle analysis can be incorporated into evaluations of land-use change. This effort also focuses on how to take a global boundary for water resources and scale it to local and regional levels. Finally, Keys continued his work on achievement of the United Nations Sustainable Development Goals (SGDs) in Kenya in collaboration with postdoctoral researcher Rekha Warrier. Warrier has developed an agent-based model that can realistically simulate how cattle herders in Kenya respond to environmental change. Her work contributes to the overall project goal of understanding how the SDGs may be achieved within complex, coupled social-ecological systems.

Photo: Pat Keys delivers the keynote address on sustainability in the Anthropocene to the 74th session of the Second Committee of the United Nations General Assembly. Courtesy of UN Web TV, used with permission.

Assessing the Impacts of Global Climate Change

As part of his ongoing work on assessing climate change vulnerability and impacts, SoGES Associate Director Peter Backlund is collaborating with colleagues from Cornell, Iowa State, Purdue, the University of Nevada, the Agriculture and Food Systems Institute, the USDA Agricultural Research Service, and the USDA Office of Energy and Environmental Policy to identify and document measurements and observations that can be used to describe, track, and understand the effects of global climate change on US agriculture over time. The team has identified a series of physical, agronomic, biological, phenological, and socioeconomic data sets that show how climate change interacts with various aspects of the agricultural system and how this system is responding. During 2019-2020, the team completed a final draft of a USDA technical report that describes 20 different indicators. The final draft was then peer-reviewed by academic and government experts, reviewed by relevant USDA agencies and offices, revised in response to the comments received, and approved for release in late summer of 2020. The team is organizing panel discussions at a number of scientific and stakeholder meetings to publicize the results and plans to work additional partners to incorporate the indicators into assessment and decision support tools for agricultural producers and land managers.

EDUCATION & TRAINING

The School is actively involved in educating and equipping students with knowledge and tools to tackle sustainability challenges.

SoGES continued to administer and oversee a set of undergraduate minors and graduate certificates in 2019-20. These include the SoGES Global Environmental Sustainability minor; minors in Sustainable Water, Sustainable Energy, and Sustainability and its role in Peace and Reconciliation; and graduate certificates in Applied Global Stability. The School also offered 12 Global Environmental Sustainability courses during the year. The proposed GES major is now in the approval process of the University and continues to move forward. 4,506 students have completed GES courses and 537 students have graduated with a GES minor since the initiation of SoGES education efforts in 2010.

In 2019-20, 307 students were enrolled in the 4 SoGES minors, 94 students graduated with a SoGES minor, and 648 students completed GES courses.

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 Committee

The SoGES curriculum committee provides oversight and advice for all SoGES educational activities, including development of courses and degree programs. The committee includes representation from all CSU colleges and the CSU library.

Kathleen Galvin (Chair), Department of Anthropology; The Africa Center; and SoGES
Meggan Houlihan, CSU Libraries
Rich Conant, Department of Ecosystem Science and Sustainability and Natural Resource Ecology Laboratory
Dale Lockwood, Department of Biology and SoGES
Suellen Melzer, Department of Soil and Crop Sciences and SoGES
Pinar Omur-Ozbek, Department of Civil and Environmental Engineering
Troy Mumford, Department of Management
Johnny Plastini, Department of Art and Art History
Howard Ramsdell, Department of Environmental and Radiological Health
Rodolfo Valdes-Vasquez, Department of Construction Management
Pat Aloise-Young, Department of Psychology

Global Environmental Sustainability (GES) Minor

The 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 2019-20, there were 268 students enrolled and 81 graduates from the Global Environmental Sustainability Minor.

Sustainability and its Role in Peace and Reconciliation 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 2019-20, there were 12 students enrolled and 4 graduates from the Sustainability and its Role in Peace and Reconciliation 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. The sustainable energy 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 2019-20, there were 4 students enrolled and 2 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. The Sustainable Water Interdisciplinary Minor (SWIM) provides students with the opportunity to gain detailed knowledge about the complex challenge of sustainable water management. *Collaborative with the CSU Water Center.*

In 2019-20, there were 23 students enrolled and 7 graduates from the Sustainable Water Interdisciplinary Minor.

Photo: Outgoing Student Sustainability Center Director Olivia Bruce celebrates her graduation on the Oval. Courtesy of Olivia Bruce.

EDUCATION & TRAINING

GES Courses

GES 101*
Foundations of Global Environmental Sustainability

GES 120
Water in the Western US

GES 130
Introduction to Sustainability Engagement

GES 141
Introduction to Sustainable Energy

GES 330
Sustainability in Practice

GES 441
Analysis to Sustainable Energy Solutions

GES 450
Sustainability and Health

GES 460
The Law and Sustainability

GES 465
Sustainable Solutions to Electronic Waste

GES 470*
Applications of Global Environmental Sustainability

GES 480A3**
Sea Level Rise and a Sustainable Future

GES 520*
Issues in Global Environmental Sustainability

GES 542
Bio Based Products

*** Face-to-face and online options**

**** Experimental courses**

Photo: Professor Dale Lockwood teaches GES 101.

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 as well as the global stability needs of other Department of Defense, USAID, Peace Corps, and development professionals. **There are 10 students currently enrolled and 5 certificates were awarded in FY20.**

Sustainability Leadership Fellows

2019-20 saw the 9th cohort with 20 Fellows from 18 departments across 6 colleges.

The year-long Fellowship 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. 180 Sustainability Leadership Fellows from 31 departments across 7 colleges have completed the program since it was founded in 2011.

Each cohort of Fellows begins the year with an orientation, followed by an intensive two-day science communication training workshop run by COMPASS, science communication specialists. Fellows then participate in six formal training sessions led by local and University experts on a range of topics including time management and workload optimization, interacting with policymakers, video interviewing, talking science with skeptical audiences, and creativity in research. Fellows also take part in additional skill-building and networking opportunities throughout the year, including practice pitching their ideas to the University provost and writing and peer-review for the SoGES blog.

Photo: 2019-20 Sustainability Leadership Fellow cohort.

2019-20 Sustainability Leadership Fellows

College of Agricultural Sciences

Hannah Berry, Ph.D. Candidate, Department of Bioagricultural Sciences and Pest Management and Cell and Molecular Biology graduate program, advisor: Cristiana Argueso

Courtland Kelly, Ph.D. Candidate, Department of Soil and Crop Sciences and Graduate Degree Program in Ecology, advisor: Steven Fonte

Jocelyn Lavallee, Postdoctoral Fellow, Department of Soil and Crop Sciences and Natural Resource Ecology Laboratory, mentor: Francesca Cotrufo

Kelvin Mulungu, Ph.D. Student, Department of Agricultural and Resource Economics, advisor: Dale Manning

Neeta Soni, Ph.D. Candidate, Department of Bioagricultural Sciences and Pest Management, advisor: Todd Gaines

College of Liberal Arts

Hyeyoon Park, Ph.D. Candidate, Department of Political Science, advisor: Michele Betsill

College of Natural Sciences

Tyler Ozvat, Ph.D. Student, Department of Chemistry, advisor: Joseph Zadrozny

Emily Stuchiner, Ph.D. Candidate, Department of Biology and Graduate Degree Program in Ecology, advisor: Joseph von Fischer

College of Veterinary Medicine and Biomedical Sciences

Molly Butler, Ph.D. Candidate, Department of Microbiology, Immunology, and Pathology, advisor: Joel Rovnak

Kristopher Parker, Postdoctoral Fellow, Department of Environmental and Radiological Health Sciences, mentor: Elizabeth Ryan

Walter Scott, Jr. College of Engineering

Kelsey Bilsback, Postdoctoral Fellow, Department of Atmospheric Science, mentor: Jeffrey Pierce

Cibi Vishnu Chinnasamy, Ph.D. Candidate, Department of Civil and Environmental Engineering, advisor: Mazdak Arabi

Wayne Chuang, Postdoctoral Fellow, Department of Mechanical Engineering and Atmospheric Science, mentor: Jeffrey Pierce

Jakob Lindaas, Ph.D. Candidate, Department of Atmospheric Science, advisor: Emily Fischer

Hailey Summers, Ph.D. Student, Department of Mechanical Engineering, advisor: Jason Quinn

Warner College of Natural Resources

Jasmine Bruno, Ph.D. Student, Department of Forest and Rangeland Stewardship, advisor: María Fernández-Giménez

Jemma Fadum, Ph.D. Student, Department of Ecosystem Science and Sustainability and Graduate Degree Program in Ecology, advisor: Ed Hall

Rina Hauptfeld, Ph.D. Student, Department of Ecosystem Science and Sustainability and Graduate Degree Program in Ecology, advisor: Greg Newman

Jenna Parker, Ph.D. Candidate, Department of Fish, Wildlife, and Conservation Biology and Graduate Degree Program in Ecology, advisor: George Wittemyer

Chris Vennum, Ph.D. Student, Department of Fish, Wildlife, and Conservation Biology, advisor: David Koons

Expanding Leadership Training Across North American Universities

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

More will be asked of our future expert leaders in sustainability. These experts will be expected to not only possess expertise in their chosen field, but also be adept at understanding, translating, and communicating that work in a larger context so it can have meaningful impact on the social-environmental-economic challenges the world faces. This means that we need expert 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 combine, expand, and share core contributions in novel and widely accessible ways to collaboratively broaden the training landscape and close sustainability leadership training gaps. The network leverages and shares resources and best practices among its network institutions and serves as mentors to other programs with a goal of expanding 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 member of ANGLES, SoGES is able to not only help and support emerging sustainability leadership programs, but also leverage internal resources for ideas to improve the SoGES Sustainability Leadership Fellows program, as well as a proof of concept for the program.

2019-20 Activity

SoGES's Aleta Weller was one of three ANGLES co-leads on a successful NSF proposal that resulted in an ANGLES network meeting on graduate training in sustainability leadership at the NSF National Socio-Environmental Synthesis Center (SESYNC) in Annapolis, Maryland on February 24-26, 2020. Experts and practitioners from across North America discussed how to bridge gaps in training and more effectively share lessons learned across programs. Participants created a list of key aptitudes and associated skills that should be included in a sustainability leadership curriculum for graduate students, designed a network map of sustainability leadership programs, and identified near and long-term opportunities for collaboration.

Building a Successful Leadership Program

SoGES Senior Research and Engagement Officer Aleta Weller and Director Diana Wall, with Nancy Baron of COMPASS, contributed a chapter to the book *Developing Change Agents: Innovative Practices for Sustainability Leadership*, published by the University of Minnesota. The book is a product of the ANGLES network. The chapter shares ideas and best practices from the SoGES Sustainability Leadership Fellows program, with an eye toward replicable strategies for new or nascent programs. The open access chapter and book can be found at open.lib.umn.edu/changeagents. See this report's publications section for citation.

CENTERS & PROGRAMS

SoGES houses four CSU centers and one international organization.

Salazar Center for North American Conservation | salazarcenter.colostate.edu

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

The Salazar Center for North American Conservation, which was created in 2016, made significant progress in developing its mission and organizational structure. The inaugural International Symposium on Conservation Impact, held in Denver during September 2019, attracted nearly 300 conservation thought leaders from the US, Canada, and Mexico. Notable speakers included center founder and former Interior Secretary Ken Salazar, Colorado Governor Jared Polis, Denver Mayor Michael Hancock, CSU Chancellor Tony Frank, and CSU President Joyce McConnell, as well as representatives of the Blackfeet Nation in northern Montana. The symposium explored opportunities to forge new partnerships and collaborations to address large landscape connectivity and climate resilience and demonstrate the benefits of this work for environmental and human health.

2019-20 Activity

- The Center announced its Connectivity Challenge at the symposium. This competition, open to teams throughout North America, awarded a $100,000 prize for innovative ideas to advance large landscape conservation and connectivity across the continent. Nearly 50 proposals were received from 20 US states, 4 states in Mexico, two tribal coalitions, and Canada. Finalists took part in a pitch fest at the Fall 2020 virtual symposium. One team wins the prize, but the larger goal is to build a community of interest around the issue and stimulate ongoing discussion among applicants, judges, symposium participants, and other potential funders.
- To help celebrate the CSU sesquicentennial, the Center partnered with the Office of the Provost & Executive Vice President to create a Conservation Impact Prize for CSU faculty and researchers. The $10,000 prize was awarded in June 2020 to Liba Pejchar, Associate Professor in the Department of Fish, Wildlife, and Conservation Biology in the Warner College of Natural Resources, for her work bringing an awareness of conservation science to land-use planning and development and her efforts to increase diversity, equity, and inclusion within the professional culture of her field.
- The Center also launched its Connecting for Conservation webinar series, which has covered a range of topics including indigenous conservation, community engagement, cross-border efforts, and equitable access to nature. Recordings of all webinars can be found at salazarcenter.colostate.edu/past-events.
- As part of its efforts to elevate diversity, equity, and inclusion (DEI) in conservation, the Center partnered with the Network for Landscape Conservation to produce several case studies from throughout the United States as a toolkit for practitioners. The toolkit will explore how the principles of DEI have—or, more often, have not—been prioritized in past work on large landscape conservation and how they have been meaningfully and intentionally put into action. The goal of the project, which was funded by the S.D. Bechtel, Jr. Foundation, is to support conservation organizations to deepen their engagement with DEI principles and practices.

Photo: Baltimore teens kayak at Masonville Cove, the first Urban Wildlife Refuge to be established in the US. Courtesy of Living Classrooms Foundation.

Global Biodiversity Center | biodiversity.colostate.edu

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

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. In all systems, aquatic to terrestrial and managed to natural, biodiversity maintains life on our planet and underpins the ecosystem services vital to human wellbeing, including food, carbon storage, climate regulation, and aesthetics and cultural support. The GBC works to maintain and enhance biodiversity through research, policy advancement, education, and outreach at CSU. The GBC had a productive year, albeit cut short by the COVID-19 pandemic. The center organized three events during fall and spring but then had to cancel several events after CSU switched to remote operations in mid-March.

2019-20 Activity

- 140 participants attended "Biodiversity, Bluegrass, and Brews" on September 26, 2019, which featured limited edition, conservation-themed beers created by three local breweries. This annual GBC event highlights the Center's activities and raises awareness of threatened ecosystems and species around the world.
- A panel discussion, "Borders and Biodiversity: The Global Impacts of Geographic, Political, and Cultural Borders on Biodiversity and Conservation," on October 15, 2019, attracted 130 participants. Panelists included George Wittemyer and Joel Berger from CSU's Department of Fish, Wildlife, and Conservation Biology, Stewart Breck from the USDA Animal and Plant Health Inspection Service, Harry Greene from Cornell University's Department of Ecology and Evolutionary Biology, and Kristen Ruegg from CSU's Department of Biology.
- The GBC, along with the Africa Center, co-hosted world-renowned conservation biologist Amy Vedder of the Yale School of Forestry and Environmental Studies on March 4-5, 2020. Vedder gave a talk titled "In the Kingdom of Gorillas: Forty Years and Counting" to over 200 people, had a lunch discussion with 20 graduate students, and gave a second presentation to an audience of about 100.
- GBC Director, W. Chris Funk, participated in the first ever World Biodiversity Forum in Davos, Switzerland during February 2020. He gave an invited talk in the session, "Aquatic Biodiversity – State and Challenges Ahead." He also co-authored a paper stemming from the meeting on a new, innovative framework for fostering gender balance, diversity, and sustainability at conferences that was published in *Nature Ecology and Evolution*. GBC was one of the official supporters of the event.
- The GBC was also the lead organizer of the first ever joint Conservation Genomics Strategic Planning meeting of the International Union for Conservation of Nature - Group on Earth Observations Biodiversity Observation Network (IUCN-GEOBON), which was originally planned to be held at the CSU Mountain Campus but moved to a remote meeting due to the COVID-19 pandemic.
- Finally, GBC Director W. Chris Funk was invited to participate in the "Colorado Emergence Series – Natural and Human Infrastructure and Transportation," and to join the associated Regenerative Recovery Coalition. The coalition is working with Colorado state government to craft a regenerative recovery from the COVID-19 crisis that advances our state's sustainability.

Student Sustainability Center

A University-wide, student run organization whose mission is to empower students to advance sustainability practices and principles.

The Student Sustainability Center (SSC) is a venue for student engagement with sustainability issues. The Center hosts events, organizes local tours, arranges meetings with industry professionals, and represents the student body on campus groups and committees, such as the President's Sustainability Commission. It also publishes the Green Bulletin weekly e-newsletter and works with other groups across campus to promote environmental initiatives. The SSC had 25 active club members in 2019-20. It increased its number of email subscribers to 2,476, has 960 Facebook followers, and 606 Instagram followers. Sara Van Hatten (major: Ecosystem Science and Sustainability) served as Director and brought on Molly Wharton (major: Apparel and Merchandising) as the Associate Director of Engagement. Andres Sweetland (major: Ecosystem Science and Sustainability) continued to serve as the Associate Director of Outreach.

Photo: Student Sustainability Club members at the first meeting of the semester in front of Johnson Hall. Courtesy of Sara Van Hatten.

2019-20 Activity

- Contributed student perspectives to the CSU strategic planning process and CSU Climate Action Plan.
- Continued leadership of the Coalition of Sustainable Student Organizations.
- Collaborated with community partners for virtual events, including Earth Day Fort Collins.
- Developed a digital daily sustainability planner.

Africa Center | africacenter.colostate.edu

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

The Africa Center maintained a high level of activity despite the disruption of COVID-19, including increased social media postings to keep interested stakeholders up-to-date on how African communities were reacting to the pandemic. The Center now has 262 Facebook followers (with 742 total impressions from Jan 2020-June 2020), 368 followers on Twitter, and 562 listserv members who receive a regular newsletter. An ArcGIS Storymap, updated weekly, currently describes 53 CSU research projects in Africa, including project summaries and contact information, while the Center's Field Notes blog continues to highlight the wide range of CSU faculty and student work in Africa. This year it included conversations with Bethy Astella on social equity in conservation in Ethiopia, Jenna Parker and Nathan Hahn on elephant conservation in Kenya, Brian Foy on malaria research in Burkina Faso, Dan Zimmerle on rural-green electrification in Rwanda, Nelson Mwangi on cross-cultural conservation research in Kenya, and Kevin Jablonski and Jasmine Bruno on rangeland management challenges and innovations across East Africa and the United States. The Center organized a luncheon for undergraduate students interested in study and research opportunities in Africa and also continued regular coffee and discussion hours, hosting four before the University closed in March.

2019-20 Activity

- Initiation of an interdisciplinary research project on the complexity of drought in African dryland systems. This project includes comparison of remote sensing data to social science data on the lived experience of drought from the perspective of local people. A white paper and policy brief are expected in the coming year.
- Organization and hosting of a panel of discussion, "Research in East and Central African Drylands: From the Local to the Global," as part of the International Symposium sponsored by CSU's Office of International Programs. Speakers included Matt Luizza (US Fish and Wildlife Service), Sarah Walker (CSU Human Dimensions of Natural Resources), Pat Keys (SoGES) and Kathleen Galvin (CSU Anthropology and Geography).
- Co-hosted (with the Global Biodiversity Center) a talk by Amy Vedder on 30 years of mountain gorilla conservation in Rwanda.

Future Earth | futureearth.org

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

The Future Earth program is focused on systems-based approaches to 1) deepen understanding of complex Earth systems and human dynamics across different disciplines, and 2) underpin the development and evaluation of evidence-based policies and strategies for sustainable development.

Future Earth has five global hubs based in Colorado, Montreal, Paris, Stockholm, and Tokyo. The Colorado Hub resides within the School of Global Environmental Sustainability at CSU and the Sustainability, Energy, and Environment Complex at CU-Boulder.

2019-20 Colorado Hub Activity

- The Colorado Hub and the CSU Global Biodiversity Center added the Future Earth Regional Center for Southern Africa as a new partner in the Program for Early-stage Grants Advancing Sustainability Science (PEGASuS), funded by the Gordon and Betty Moore Foundation. 2019-20 saw completion of two new projects on ocean sustainability, both in partnership with the National Center for Ecological Analysis and Synthesis at the University of California, Santa Barbara.
- The next stages of PEGASuS include working with the African Academy of Sciences and the Belmont Forum to support development of science-based targets and pathways to the Sustainable Development Goals for African nations and providing a "take it further" grant opportunity to the 15 international research teams on Sustainable Urban Food-Water-Energy funded through the Belmont Forum.
- The Future Earth Governing Council and the Leopold Leadership Program Board approved a new Earth Leadership Program and selected Sharron Collinge, Professor of Environmental Studies at the University of Colorado, Boulder (and former science director for the National Ecological Observatory Network), as Executive Director. The program aims to recruit a diverse cohort of 20 North American, mid-career sustainability researchers for 2021, grow its capacity to recruit and support fellows from a wider range of North American Institutions, and expand to additional regions around the world by 2025.
- *Anthropocene Magazine* continues to be a showcase for on-the-ground solutions to sustainability, combining a print edition (over 1,500 subscribers), a popular website, and a newsletter (over 20,000 subscribers). The website has over 50,000 visitors per month from more than 200 countries. In the two years since its start, *Anthropocene* has won four journalism awards – including the 2019 Folio Eddie Award for editorial and design excellence across a full issue – and amassed $203,000 in membership donations.
- Craig Starger continues to serve as a review editor for the journal *EcoHealth* and recently served as a guest editor for a special issue of the journal *Coastal Management*, focusing on learning networks for ocean sustainability.

ENGAGEMENT

Working with diverse stakeholders and audiences to discuss sustainability issues and ensure that research is informed by societal needs and concerns.

SoGES engaged in a wide variety of engagement activities. COVID-19 restrictions resulted in deferral of multiple events originally scheduled for spring 2020, including a large "climate change summit" for local high school students, while others were shifted to online formats.

In 2019-20, SoGES held 26 total events (9 SoGES-only, 17 collaborative) with an estimated 2,090 total attendees.

Communications

Website | sustainability.colostate.edu

84,237 visits, international traffic constituted **22%** of total visits

Media Mentions

178 mentions in the media, **69%** domestic, **31%** international

Social Media

4,105 email subscribers, **1,604** Facebook likes, **2,691** Twitter followers

Events

Managing the Planet Panel Discussions

Interactive public events that address a wide range of sustainability issues. Each features a panel of CSU experts who field questions from community members and students. **The five panels held during 2019-20 attracted about 590 participants.**

Sept. 11 **Changing the Mindset Around Climate Change: What We Know, How We Act, and Why It Takes So Long.** *Panelists: Pat Aloise-Young, Dept. of Psychology; Jeffrey Pierce, Dept. of Atmospheric Science; Stephanie Malin, Dept. of Sociology; Rebecca Niemiec, Dept. of Human Dimensions of Natural Resources*

Oct. 23 **Seeing Earth Through the Flames: How Climate Change Is Contributing to Catastrophic Fires.** *Panelists: Francesca Cotrufo, Dept. of Soil and Crop Sciences; Terrence Iverson, Dept. of Economics; Russ Schumacher, Dept. of Atmospheric Science; Camille Stevens-Rumann, Dept. of Forest and Rangeland Stewardship*

Nov. 13 **Climate Migrants: How Climate Change Is Shifting the Global Demographic.** *Panelists: Edward Barbier, Dept. of Economics; Amy Charkowski, Dept. of Bioagricultural Sciences and Pest Management; John Sanderson, Center for Collaborative Conservation; Pankaj Trivedi, Dept. of Bioagricultural Sciences and Pest Management*

Feb. 12 **Oceans and the Sustainable Development Goals.** *Panelists: Rebecca Gruby, Dept. of Human Dimensions of Natural Resources; Shane Kanatous, Dept. of Biology; Craig Starger, School of Global Environmental Sustainability; Jessie Creamean, Dept. of Atmospheric Science*

Mar. 11 **Microbiome Solutions and the Sustainable Development Goals.** *Panelists: Zaid Abdo, Dept. of Microbiology, Immunology and Pathology; Ed Hall, Dept. of Ecosystem Science and Sustainability; Erika Szymanski, Dept. of English; Mike Wilkins, Dept. of Soil and Crop Sciences*

Antarctic Lecture Series

Lectures featuring Antarctic researchers who describe various aspects of life, work, and conducting science "on the ice." Approximately **215 people attended** the 2019-20 lectures, held at the Old Town Library.

Sept. 17 **Spiraling Downstream: How Microbes Grapple for Nitrogen in an Antarctic Stream.** *Joel Singley, CU Boulder*

Oct. 15 **Alpine Glaciers of the McMurdo Dry Valleys: How Are They Changing and Why Do We Care?** *Anna Bergstrom, CU Boulder*

Nov. 19 **The Color of Ice.** *Dirk Hobman, Artist and Photographer*

Feb. 25 **A View From the Arctic Ocean: Lessons for Antarctica?** *Jessie Creamean, Colorado State University*

Symposia & Special Events

20th Anniversary of Climate Action in Fort Collins

Partnered event with the City of Fort Collins held November 14: **Gathered 400 people**, including CSU researchers, City of Fort Collins staff, and interested citizens, to celebrate 20 years of climate action in Fort Collins.

Photo: A panel discussion during the 20th Anniversary of Climate Action in Fort Collins event.

Guest Lecture Events with Amy Vedder

315 attendees from two lectures held March 3-4: "In the Kingdom of Gorillas: Forty Years and Counting," and "Through the Eyes of Wildlife: Single and Multi-Species Approaches to Conservation," co-sponsored by The Africa Center and Global Biodiversity Center.

Photo: Amy Vedder gives a guest lecture on mountain gorillas in March 2020. Courtesy of the Global Biodiversity Center.

Natural Gas Leaks, Air Quality, and the Push for Renewable Natural Gas

The School's first virtual panel with CSU researchers Joe von Fischer, Sybil Sharvvelle, and Dan Zimmerlee with KUNC's Grace Hood: June 17, **45 attendees**.

Photo: Panelist discussion via video conferencing platform during the School's first virtual event.

Society of Environmental Journalists Annual Meeting

SoGES helped bring the five-day Society of Environmental Journalists meeting to CSU on October 9-13, and contributed to organizing lectures, panel discussions, topical workshops and tours. More than 350 journalists attended, resulting in numerous media stories highlighting the breadth and depth of CSU environmental research and scholarship.

External Advisory Board

Rob Jackson (Chair), Michelle and Kevin Douglas Provostial Professor, School of Earth Sciences, Stanford University
Joyce Berry, Emeritus Dean, Warner College of Natural Resources, Colorado State University
Rosina Bierbaum, Professor, School for Environment and Sustainability, University of Michigan
William "Bill" Brennan, Water and Sustainability Investor
Thomas Dietz, University Distinguished Professor, Environmental Science and Policy, Sociology and Animal Studies, Michigan State University
Maggie L. Fox, Founder, MaggieFoxStrategies, LLC
Thomas Lovejoy, University Professor, Department of Environmental Science and Policy, George Mason University
James B. Martin, Senior Counsel, Beatty & Wozniak, P.C.
Jonathan Patz, Director, Global Health Institute, University of Wisconsin-Madison
Former Colorado Governor Bill Ritter, Jr., Director, Center for the New Energy Economy, Colorado State University
Osvaldo Sala, Julie A. Wrigley and Foundation Professor, School of Life Sciences, Arizona State University
Scott J. Sternberg, Former President, Vaisala USA, Inc.

Staff

Micha Bennett, Communications Specialist
Jarvis Choury, Fiscal and Operations Manager
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Kathleen Galvin, Assistant Director of Educational Programs & Curriculum Committee Chair; Director, The Africa Center; Professor, Department of Anthropology
Pat Keys, Lead Scientist
Dale Lockwood, Academic Coordinator; Assistant Professor, Department of Biology and SoGES
Suellen Melzer, Assistant Professor, Department of Soil and Crop Sciences and SoGES
Laurel Milliken, Information Technology Officer, Future Earth Colorado Global Hub
Matt Norton, Fiscal Assistant Manager
Laura Shaver, Event and Administrative Coordinator
Craig Starger, Science Officer, Future Earth Colorado Global Hub and SoGES Research Scientist
Sara Van Hatten, Director, Student Sustainability Center
Rekha Warrier, Postdoctoral Researcher
Aleta Rudeen Weller, Senior Research and Engagement Officer

Senior Scholars

Former Governor Bill Ritter, Jr., Director, Center for the New Energy Economy, Colorado State University
Edward B. Barbier, University Distinguished Professor, Department of Economics, Colorado State University
Josh Tewksbury, Director, Colorado Global Hub, Future Earth

Affiliate Faculty

Ruth Alexander	History
Patricia Aloise-Young	Psychology
Rick Aster	Geosciences
Peter Backlund	SoGES
Ken Barbarick	Soil and Crop Sciences
Edward Barbier	Economics
Jo Burgess Barbier	Economics
Jennifer Barfield	Veterinary and Biomedical Sciences
Elizabeth Barnes	Atmospheric Science
Jill Baron	Ecosystem Science and Sustainability
Dan Beachy-Quick	English
Del Benson	Fish, Wildlife, and Conservation Biology
Alexandra Bernasek	Economics
Autumn Bernhardt	University Honors Program
Michele Betsill	Political Science
Aditi Bhaskar	Civil and Environmental Engineering
Jens Blotevogel	Civil and Environmental Engineering
Thomas Borch	Soil and Crop Sciences & Chemistry
Cynthia Brown	Bioagricultural Sciences and Pest Management
Daniel Bush	Biology
Phil Cafaro	Philosophy
Martin Carcasson	Communication Studies
Jonathan Carlyon	Languages, Literatures, and Cultures
Michael Carolan	Sociology
Joseph Champ	Journalism and Media Communication
Suren Chen	Civil and Environmental Engineering
Tony Cheng	Forest and Rangeland Stewardship
Jane Choi	Horticulture and Landscape Architecture
Stephanie Clemons	Design and Merchandising
Doug Cloud	English
Rich Conant	Ecosystem Science and Sustainability
Daniel Cooley	Statistics
Francesca Cotrufo	Soil and Crop Sciences
Kevin Crooks	Fish, Wildlife, and Conservation Biology
Jennifer Cross	Environmental Affairs and Sociology
Sandra Davis	Political Science
Charles Davis	Political Science
Tom Dean	Management
Scott Denning	Atmospheric Science
Sonali Diddi	Design and Merchandising
Robert Duffy	Political Science
Brian Dunbar	Institute for the Built Environment
Colleen Duncan	Microbiology, Immunology, and Pathology
Maria Fernandez-Gimenez	Forest and Rangeland Stewardship
Emily Fischer	Atmospheric Science
Erica Fleischman	Director of CEMML
Steven Fonte	Soil and Crop Sciences
Brian Foy	Microbiology, Immunology, and Pathology
Jason Frazier	Art and Art History
Chris Funk	Biology
Kathleen Galvin	Anthropology
Cameron Ghalambor	Biology
Scott Glick	Construction Management
Susan Golicic	Management
Neil Grigg	Civil and Environmental Engineering
Elizabeth Hobbs	Horticulture and Landscape Architecture
Thomas Holtzer	Bioagricultural Sciences and Pest Management
Amy Hoseth	Library
Ruth Hufbauer	Bioagricultural Sciences and Pest Management
Michael Humphrey	Journalism & Media Communication
Becca Jablonski	Agriculture & Resource Economics
Kelly Jones	Human Dimensions of Natural Resources
Gene Kelly	Soil and Crop Sciences
R. Khosla	Soil and Crop Sciences
Julia Klein	Ecosystem Science and Sustainability
Alan Knapp	Biology
Mary-Ann Kokoska	Art
Boris Kondratieff	Bioagricultural Sciences and Pest Management
Sonia Kreidenweis	Atmospheric Science
Stephan Kroll	Agricultural and Resource Economics
Melinda Laituri	Ecosystem Science and Sustainability
Jan Leach	Bioagricultural Sciences and Pest Management
Dale Lockwood	Biology & SoGES
Sheryl Magzamen	Environmental and Radiological Health Sciences
Stephanie Malin	Sociology
Anthony Marchese	Mechanical Engineering
Katie McShane	Philosophy
Susan Melzer	Soil and Crop Sciences
Stephen Mumme	Political Science
Donald Mykles	University Honors Program
Troy Ocheltree	Forest and Rangeland Stewardship
Paul Ode	Bioagricultural Sciences and Pest Management
Dennis Ojima	Ecosystem Science and Sustainability
Svetlana Olbina	Construction Management
Erika Osborne	Art
Mehmet Ozbek	Construction Management
Merlyn Paulson	Horticulture and Landscape Architecture
Keith Paustian	Soil and Crop Sciences
Jennifer Peel	Environmental and Radiological Health Sciences
Graham Peers	Biology
Liba Pejchar	Fish, Wildlife, and Conservation Biology
LeRoy Poff	Biology
Jason Quinn	Mechanical Engineering
Howard Ramsdell	Environmental and Radiological Health Sciences
Dave Randel	Atmospheric Science
Anthony Rappe	Chemistry
Kristen Rasmussen	Atmospheric Science
Ravi Ravishankara	Chemistry
Laura Raynolds	Sociology
Kennneth Reardon	Chemical and Biological Engineering
Sarah Reed	Fish, Wildlife, and Conservation Biology
Elizabeth Ryan	Environmental and Radiological Health Sciences
Kyle Saunders	Political Science
Meagan Schipanski	Soil and Crop Sciences
Robert Schorr	Fish, Wildlife and Conservation Biology
Courtney Schultz	Forest and Rangeland Stewardship
Andy Seidl	Agricultural and Resource Economics
Sybil Sharvelle	Civil and Environmental Engineering
Kenneth Shockley	Philosophy
Melinda Smith	Biology
Bruno Sobral	Microbiology, Immunology, & Pathology
Dimitris Stevis	Political Science
Peter Taylor	Sociology
Dawn Thilmany McFadden	Agricultural and Resource Economics
David Thompson	Atmospheric Science
Bill Timpson	School of Education
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 Wall	SoGES & Biology
Reagan Waskom	Colorado Water Center
Ellen Wohl	Geosciences
Terry Yan	Design and Merchandising
Jill Zarestky	School of Education

Finance Report

Description	Budget	Expenses	Credits
FY 2019-20 Base Budget	$1,068,171 .00		
Salaries			
Director, Associate Directors		$471,316.00	
Staff		$478,989.00	
Student Hourlies		*$9,813.00*	
SALARIES TOTAL		**$960,118.00**	
Program Activities			
Research			
Global Challenges Research Teams and Working Groups		$50,000.00	
Resident Fellows		$40,000.00	
Total		**$90,000.00**	
Sustainability Leadership Fellows program			
Science Communication Workshop, Trainings, and Year Operations and Supplies		$33,192.00	
Total		**$33,192.00**	
Education			
GES Traditional and Online Courses (Professors, GTAs, Supplies, and Trips)		$138,452.00	
Total		**$138,452.00**	
Student Sustainability Center			
Salaries		$4,077.00	
Operations and Events		$5,162.00	
Total		**$9,239.00**	
PROGRAM ACTIVITIES TOTAL		**$270,883.00**	
General Administration			
Supplies		$47,934.00	
Operating Charges (Events, Phone, Data, Etc.)		$79,348.00	
Travel		$31,837.00	
General Administration Total		**$159,119.00**	
EXPENSE TOTAL		**$1,293,717.94**	
Miscellaneous Income			
1X Monies			$146,842.00
Differential Tuition			$36,653.00
2-3-6 Distribution			$1,808.00
FY19 Carryforward			$85,308.00
Online Courses Revenue			$38,895.00
Salary Savings From Grants			$38,317.00
Balance for Future Commitments in FY21			**$25,874.00**

SoGES continued to implement research projects during FY19-20 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

Director, Diana H. Wall

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Lead Scientist, Pat Keys

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Senior Research and Engagement Officer, Aleta Weller and Director, Diana Wall

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2019-20 Resident Fellows

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