Food – Energy – Water Nexus Initiative

Agrivoltaics At Scale

Tuesday, April 25th to Thursday, April 27th, 2023

University of Arizona Biosphere 2

32540 S Biosphere Rd | Oracle, AZ 85623

Meeting Goals and Agenda

The University of Arizona and the French National Center for Scientific Research (CNRS) created an International Research Center (IRC) in April 2021. One of the main research themes of the IRC is the Food-Energy-Water nexus in the face of climate change. Agrivoltaics – the combination of agricultural and solar farming – is an exciting topic at the Food-Energy-Water nexus with potential to advance food, energy, and water security around the globe. The grand challenge is, how can we achieve this? We need interdisciplinary global research to push the boundaries of all dimensions of the Agrivoltaics solution, rooted in co-production of knowledge and involving stakeholders from the start – ranging from biomass production and photovoltaic technology to ecological services, social acceptance and integration, economic impact, and public policy and governance. This meeting organized by CNRS and UArizona through the France-Arizona Institute for Global Grand Challenges, gathers a multi-disciplinary team to identify specific research areas where the UArizona-France collaboration can make a difference, and lay out the program that will integrate across disciplines and turn agrivoltaics from local experiments to a global solution for sustainability and resilience.

Meeting goals

We are an incredible and diverse group, and we are coming together for these 3 days to meet a series of immediate and longer-term goals. You will notice that throughout our agenda, we are weaving in time to make sure we make progress towards each. We recognize that everyone doesn't share every priority, but by seeing how our collaborative work will be contextualized both locally and globally, the significance of our efforts in developing agrivoltaics at scale to create a more sustainable food, energy, and water future will be clearer. Specifically, we aim to:

- Identify specific collaborative projects around agrivoltaics at scale that can be supported by the IRC.
- Pinpoint projects were a cohort of 10 PhD students across the UArizona and CNRS can advance the cutting edge and solidify the IRC.
- Utilize specific projects to prioritize grant writing that build innovation within and across the fields of experiential education, biophysical sciences, socio-political sciences, economics engineering, and national security – such as NSF PIRE, NSF Global Centers, and NSF Partnership for Innovation.
- Solidify burgeoning international partnerships with Morocco, Mexico, and Israel towards a shared objective of agrivoltaics at scale.
- Lay the groundwork for creating our International Academy for Resilience.

Monday, April 24th

All Day	Arrival at Biosphere2
7:00pm-8:00pm	Dinner provided at Biosphere2

Tuesday, April 25th

7:30am – 8:30am	***Breakfast***
8:30am – 8:45am	**Welcome and opening remarks** - *Zoom available.* Dr. Joaquin Ruiz/John Adams
8:45am – 9:15am	**Plenary talk: Overview of Agrivoltaics** Dr. Greg Barron-Gafford
9:15am – 10:15am	**Introductions** - *Zoom available.* Two-minute introduction per guest: what are you working on? And why are you interested in Agrivoltaics?
10:15am – 10:30am	***Coffee break***
10:30am -11:15am	**Introductions** (cont'd)
11:30am – 12:30pm	**Sharing Questions and Collaborative Goals** **Sticky-note activity during lunch time** *We've heard about the state of the science and each other. Now we need to identify shared interests and questions and goals to pursue collaboratively. We'll make sure everyone has a chance to share thoughts by using sticky notes.*
12:30pm – 1:30pm	**Tour of B2 Agrivoltaics Plot**
1:30pm-2:00pm	**Sharing Questions and Collaborative Goals** ***Presentation of sticky notes synthesis by conveners***
2:00pm – 3:30pm	**Breakout Session I: Deepening our Focus.** *We are a diverse group, and there are some discipline-specific questions and some integrating interdisciplinary questions: Work with your closer peers to identify: (1) Motivations, (2) Driving questions, (3) Hypotheses, (4) Methodologies, and (5) Objectives of potential projects where a PhD student could create the right synergies*.
3:30pm – 3:45pm	***Coffee break***
3:45pm – 5:00pm	**Breakout Groups Reporting and General Discussion**
5:30pm – 7:30pm	***Happy hour and dinner***

Wednesday, April 26th

7:30am – 8:30am	***Breakfast***
8:30am – 9:15am	**Summary of Previous Day** *Zoom available.* Workshop conveners
9:15am – 10:00am	**Plenary talk and Q&A: Economic Tradeoffs of Utility-Scale Agrivoltaic Configurations in the U.S.** Dr. James McCall
10:00am – 10:15am	***Coffee break***
10:15am – 11:30am	**Agrivoltaics in Action: National Initiatives and Development** *One of our goals for this meeting is to solidify partnerships between our IRC and Morocco, Mexico, and Israel to establish an International Academy with global sites. We will hear from these partners to identify shared motivations and goals.* Presenters (some by Zoom): TBD (France), TBD (Israel), TBD (Mexico), TBD (Morocco), TBD (Canada), Paul Brierley (U.S.)
11:30am – 1:30pm	***Lunch and tour of Biosphere 2***
1:30pm – 2:30pm	**Funding Opportunities and Mechanisms** Emily Kotay
2:30pm – 4:00pm	**Breakout Session II: Deepening our Focus** *Continue to develop our discipline-specific questions and integrating interdisciplinary questions. Remember to identify: (1) Motivations, (2) Driving questions, (3) Hypotheses, (4) Methodologies, and (5) Objectives of potential projects where a PhD student could create the right synergies.*
4:00pm – 4:15pm	***Coffee break***
4:15pm – 5:00pm	**Breakout Groups Reporting and General Discussion**
6:00pm – 8:30pm	***Reception and Dinner***

Thursday, April 27th

7:30am – 8:30am	***Breakfast***
8:30am- 9:15am	**Summary of Previous Day** *Zoom available.* Workshop conveners
9:15am – 10:30am	**General Discussion: Review of Emerging Projects and Priorities** Moderators: Greg Barron-Gafford, Gilles Pinay
10:30am – 10:45am	***Coffee break***
10:45am – 12:00pm	**General Discussion: Projects Coordination and International Actions** Moderators: Joaquin Ruiz, Sylvette Tourmente
12:00pm – 1:00pm	***Lunch***
1:00pm – 2:00pm	**Presidential Commission on Agriculture** **International Feedback Session with Commission Members** Commission Chair, Paul Brierley, and commission members
2:00pm – 3:30pm	**General Discussion: Project Communication and Publications** Moderators: TBD
3:30pm - 3:45pm	***Coffee break***
3:45pm – 4:30pm	**Next Steps Recap and Closing Discussion** Moderators: TBD
5:30pm – 7:00pm	***Dinner***

cnrs

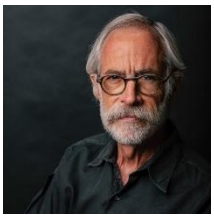
THE UNIVERSITY OF ARIZONA

CONVENERS AND PARTICIPANTS BIOS

Conveners & Participants Bios

Color code: University of Arizona
CNRS
Partners and Affiliates

Conveners



Joaquin Ruiz

Director, France-Arizona Institute for Global Grand Challenges, Vice President, Global Environmental Futures, Director, Biosphere 2.

Joaquin Ruiz received his B.S. (1977) in Geology and Chemistry from the University of Miami and his M.S.(1980) and Ph.D. (1983) in Geology from the University of Michigan. He was Assistant Professor at the University of Miami from 1982 to 1983. In 1983, he joined the University of Arizona Geosciences Department as Assistant Professor and was promoted to Associate Professor in 1989 and Professor in 1993, serving as head of the Department of Geosciences from 1995 to 2000. He served as Dean of the College of Science from 2000-2019, Executive Dean of the Colleges of Letters, Arts and Science from 2009-2018, and Vice President for Innovation from 2013-2019. He was appointed Vice President of Global Environmental Futures in 2019 and has served as the Thomas R. Brown Chair and Director of Biosphere 2 since 2013. Dr. Ruiz served as President of the Geological Society of America (2010-2011). He is also a Fellow of the Society of Economic Geologists, and a member of the American Geophysical Union, the American Chemical Society, the Geochemical Society, and the National Research Council of the National Academies of Science. He is a member of the Mexican Academy of Sciences and was named a National Researcher by the Mexican government in 2010, when he was recognized for his outstanding scientific contributions and efforts to enhance Mexico's scientific and technological capacity through collaborations with the UA and research institutions in Mexico. In 2018, the Mexican Secretary of State named Dr. Ruiz one of forty distinguished Mexican citizens living abroad who have brought distinction to the country. He has served as Secretary of the Volcanology Section of the American Geophysical Union, Councilor of the Geological Society of America, and as a National Science Foundation Panel Member for the Instrumentation and Facilities Program and the Centers for Excellence in Science and Technology Program. He has served as Associate Editor of the American Journal of Science, Geology, Revista, and Geofísica International of the Institute of Geology, UNAM. As a scientist with equal abilities in chemistry and in geology, Dr. Ruiz addresses many first-order problems in the Earth Sciences, such as the development of new isotope systems for studying ore deposits and the tectonic processes involved in the growth and evolution of Mexico. His research team addresses problems ranging from the origins of life to present-day climate change.

Regis Ferriere

Deputy Director, France-Arizona Institute for Global Grand Challenges, Director, CNRS International Research Laboratory iGLOBES, Associate Professor, Ecology and Evolutionary Biology.

Dr. Ferriere is a mathematical ecologist who studies a broad array of questions about life on Earth and off Earth. He is particularly interested in how ecological systems emerge and evolve, how they adapt to environmental challenges and how their adaptation reshapes the environment. He obtained his doctoral degree in mathematical ecology at Paris University and subsequently worked as a research associate at the University of Arizona and the International Institute for Applied Systems Analysis in Laxenburg, Austria. With collaborators in Austria and The Netherlands, Dr. Ferriere pioneered the field of eco-evolutionary mathematics, that he has been expanding ever since. As a professor at Ecole Normale Supérieure in Paris, France, Dr. Ferriere was the founding director of the CNRS-ENS Ecotron IleDeFrance. In 2012, Dr. Ferriere was appointed as an Associate Professor at the University of Arizona. With support from the Partner University Fund, he established a collaboration bridge through research and advanced training between UArizona and ENS. In 2017, he extended the cooperation program as he became director of the iGLOBES (Interdisciplinary and Global Environmental Studies. iGLOBES has been instrumental in the creation, in 2021, of the France-Arizona Institute for Global Grand Challenges.

Sylvette Tourmente

CNRS Research Director; Director CNRS Office for the USA and Mexico; Embassy of France.

Between 1997 and 2013, Sylvette Tourmente, CNRS Research Director in Life Sciences, was the PI of a team composed of 15 people, entitled: Establishment, maintenance, and epigenetic regulation of Heterochromatin, in the GReD (Genetics, reproduction and Development) laboratory in Clermont-Ferrand (France). Meanwhile, she was the communication- correspondent for the GReD, in charge of the international affairs for the doctoral school in Life Sciences, Health, Agriculture and Environment and scientific delegate for the Hceres (Research and Higher Education Evaluation Committee). In 2013, she joined the French Embassy in Budapest (Hungary) as attaché for science and higher education cooperation and was assigned in Germany as scientific attaché at the French Embassy in Berlin in 2017. Since October 1st, 2019 she is Director of the CNRS Office for the USA and Mexico, in Washington, DC.

Gilles Pinay

Scientific Deputy Director, National Institute of Ecology and Environment (INEE).

For the last 30 years, Dr Pinay has been working in the scope of ecosystem functioning. He studies the relationships between physical and biogeochemical processes and their contribution to ecosystems' resistance and resilience to natural and anthropogenic disturbances. He is specialized on river and wetland ecosystems with a watershed perspective. He has led researches in Europe and USA on the consequences of human disturbances in river catchments basins on the functioning of stream and wetlands ecosystems. He is working on the quantification of landscapes features such as soils, riparian and hyporheic zones to regulate diffuse nitrogen fluxes and assessing their contribution at the catchment level. He is also interested in deciphering the consequences of particular and cumulative human activities in drainage basins on the water quality of their outlets.

Greg Barron-Gafford

Professor, Associate Director of the School Garden Workshop, School of Geography, Development & Environment.

Dr. Greg Barron-Gafford is a Biogeographer and has largely been based in the drylands of the world. He has worked for the last 18 years in the southwestern US studying Earth System science, plant ecology, and the impacts of climate and land use change. Since 2011, he has been building the field of 'Agrivoltaics' - the concept of collocating agriculture and photovoltaics (renewable energy from solar panels). Professor Barron-Gafford and his team began working in southern Arizona with the Community & School Garden Program to study the benefits across the food-energy-water nexus, and over the years have developed a national and international program connecting with researchers in Colorado and Oregon (USA), and in Africa and the Middle East. Helping develop science-based solutions to help people adapt to the increasing pressures that come from a changing climate being a personal and professional goal.

Sky Dominguez

France-Arizona Institute, Assistant Director, Development and Engagement

Sky Dominguez completed her Master's degree in environmental microbiology in 2008 at the University of Arizona in Tucson, U.S.A. After completing her master's degree, Sky transitioned out of the lab and to the administrative side of research programs – combining her passion for science with her desire to play a critical role in envisioning the supporting research programs. After joining the University of Arizona as a staff member, she has managed multiple international research programs and has been the Manager of Administration for the School of Anthropology at the University of Arizona. These positions focused on relationship building, program strategy, budget management, grant submissions, staff management, event coordination, and field campaign manager (Northern Sweden and Amazon Forest in Brazil). In addition, Sky has been the Owner/Founder of an organizing and goal couching business since 1997. Sky joined the France-Arizona Institute in March 2022.

Support team

Jennifer Chamblee

Executive Associate, Coordinator, University Research Institutes.

Jennifer began work at The University of Arizona in 2017 as an Executive Assistant. She currently is the coordinator for University Research Institutes and Centers and is the Executive Associate to Dr. Elliott Cheu, Associate Vice President, University Research Institutes.

Erell Gloaguen

Project Manager, CNRS office Washington DC.

Erell is a scientific officer at the CNRS office in Washington for the United States and Mexico and works with Sylvette Tourmente. She holds two master's degrees in international relations from the Institut d' Études Politiques de Rennes and the Université Panthéon Sorbonne. As part of her studies, she has spent a year in the United States as an exchange student at San Diego State University and in Mexico as an intern at the French Embassy. Erell's academic background and professional experiences have allowed her to develop skills in different communication fields. She is delighted to return to the United States to put them to good use at the CNRS office in Washington, DC.

Kim Land

Biosphere2, Event Operations Coordinator

Kim Land has worked at Biosphere 2 since 2011. Kim manages all aspects of Biosphere 2's Conference Center, including sales, logistics and operations. If you're looking for a unique venue for your next conference, workshop, or private event, contact Kim to see just how Biosphere 2 Conference Center can accommodate your needs to create a memorable experience.

Morgane Noel

France-Arizona Institute, Manager Academic Programs and Communications.

Morgane Noel completed her Master's degree in 2011 in Marketing & Management at the Excelia Business School in France. Morgane has a non-linear background, nourished by international experiences, in diverse industries, from start-ups to Fortune 500 companies. This diverse background includes being head of the marketing department for the start-up epermarket.com in Shanghai, China; Area manager of marketing and sales in France for Brioche Pasquier, Unilever, and Heineken; and founder/owner of "Et Voila!", a catering business in the Bay Area; and as a Production Coordinator at the Apple Steve Jobs Theater. With this extensive skill set, Morgane joined the FA Institute in 2022.

Participants

Andrea Achilli

Associate Professor Chemical and Environmental Engineering.

Andrea Achilli is an Associate Professor in the Chemical and Environmental Engineering Department at the University of Arizona (UA) and affiliated faculty at the UA Water and Energy Sustainable Technology (WEST) Center. He received a PhD in Civil and Environmental Engineering from the University of Nevada, Reno where he developed the osmotic membrane bioreactor and investigated pressure retarded osmosis. He has almost 20 years of research experience in membrane processes for desalination and water reuse, including membrane distillation and energy recovery. His research focuses on process integration, modelling, and optimization for advanced water and wastewater treatments. Dr. Achilli is the PI or Co-PI of several funded research projects for membrane contactor processes and hybrid systems for desalination and water reuse. Current and past funding sources include the Bureau of Reclamation, the Electric Power Research Institute (EPRI), the Department of Energy RAPID program, the Department of Defense ESTCP program, and the EPA.

Looking to learn about the food/energy/water nexus in this application and willing to contribute to the discussion with my expertise in water processing and water/energy nexus.

Mélanie Auffan

Senior scientist, CEREGE, Aix en Provence, Adjunct Professor Civil & Environmental Engineering Department, Duke, NC-US.

The CEREGE (European Center for Research and Teaching in Environmental Geosciences) is a joint research center that brings together multi-disciplinary fields in environmental geoscience research. Mélanie Auffan leads the Sustainable Environment group, which conducts studies on the life-cycle (from production, use and end of life) of materials and contaminants to understand bio-physico-chemical processes driving their reactivity, emission, transfer and impacts in different ecosystems. The Sustainable Environment group coordinated the LABEX SERENADE dedicated to the safe(r) and ecological design and development of nanomaterials from 2012-2020 and the IMAGINE² platform (IMAGINg and analytical national platform for the Environmental and Energy transition). Mélanie research addresses the physico-chemical properties and surface reactivity of inorganic advanced (nano)materials in contact with living organisms. She has developed aquatic mesocosm tools for exposure-driven environmental risk-assessment and material aging in relevant exposure conditions. She is also specialized in developing advanced nanomaterials and processes using a Safer and Sustainable by Design approach (SSbD). Mélanie is the PI of the iNOVE International Research Program funding by the CNRS (INEE and INSU) for "innovations for environmental sustainability" in cooperation with Mark Wiesner Duke University, NC-US.

As the interest in renewable energy is growing, the fouling of photovoltaic modules is becoming a major issue. Particulate matter deposition reduces light transmittance to the panel, and the energy output up to 25%, with peak losses of reaching 75%. Cleaning PV modules can cost up to multimillion dollars per year, therefore it is important to study the reversibility of the soiling process. There is also a clear interest in preventative approaches, for example (super)hydrophobic or hydrophilic antireflective coatings. However, most hydrophilic, or hydrophobic coatings do not take into account the fact that adhesion depends on the particle properties too, not only the surface characteristics. Since adhesion force varies highly as a function of particle size, shape, and chemical properties, it is important to recognize the need for a more throughout investigation into the influence of particle characteristics on their soiling potential depending on the climate, soil nature, humidity, industrial activity, … This subject would aim to fill the gap between particle characteristics and their soiling potential, so that findings can be used to develop an appropriate soiling mitigation approach based on regional atmospheric particulate matter composition: what mechanisms govern particle deposition on PV ? Can this information be used to anticipate the soiling potential of a certain pollutant particle? What environmental factors (radiation, precipitation, temperature, biofilm etc.) influence the aging of a PV surface? Do they have an impact on particle deposition? When developing an effective soiling mitigation approach, what factors should be prioritized (for example regional dust composition, surface roughness etc.) ?This subject could also benefit from the international dynamic of the IRP iNOVE and on our complementary expertise (2D and 3D chemical, structural, and textural characterization of the particles (M Auffan), particles/biofilm interactions, deposition modeling (M Wiesner), geochemical and isotope fingerprinting of sources and processes (A Dia)).

Sophie Ayrault

Deputy executive director of CNRS-Universe Sciences Institute (Continental interfaces and surfaces)

Alicja Babst-Kostecka

Assistant Professor, Environmental Science & co-Director of Center for Environmentally Sustainable Mining

Dr. Alicja Babst-Kostecka is an Assistant Professor in the Department of Environmental Science at the University of Arizona and a co-director of the Center for Environmentally Sustainable Mining (CESM) at the University of Arizona. The Center develops research and educational initiatives and brings together academia, regulators at both the State and Federal levels, and the mining industry to develop innovative solutions to environmental issues related to mining (https://cesm.arizona.edu/). Dr. Babst-Kostecka's research combines genetic, phenotypic, and environmental information in an integrated framework to study plant-microbial interactions and plant adaptation to changing environmental conditions. Dr. Babst-Kostecka is particularly interested in the mechanisms that allow certain plant species to colonize industrially contaminated habitats at former mining sites. These species thereby undergo rapid genetic and physiological adaptation. Specifically, they have evolved the ability to tolerate and sometimes accumulate remarkable amounts of metal trace elements – traits that Dr. Babst-Kostecka is studying in both field and controlled laboratory experiments. Her interdisciplinary work sets the stage for mitigating the legacies of industrial exploitation. By advancing the molecular basis of phytoremediation and biofortification efforts, she strives to contribute to improving environmental and human health.

I would like to initiate work towards establishing Agrivoltaics as a solution not only for Food-Energy-Water sustainability, but more generally for dryland ecosystem restoration and resilience, involving, for example, soil decontamination by phytoextraction and the production of harvestable plant biomass that is rich in certain metals. Such optimized plant biomass would be then "recycled" and harvested metals would return to the supply chain through green chemistry and ecocatalysis. The remediation of metal-contaminated areas and clean energy production are among the most pressing challenges facing humanity and the environment today. Legacy mine sites often contain toxic metals, posing a danger to the environment and human health. However, certain plant species can tolerate or even (hyper)accumulate metals. This capacity makes them promising organisms for the remediation of contaminated lands (phytoremediation). Around 50% of all legacy mine sites are in arid or semi-arid regions where plant growth is additionally challenged by heat and drought stress. The combination of selected plant species and solar panels offers a series of reciprocal benefits that can be capitalized upon to increase solar panel efficiency and at the same time support phytoremediatio.

Aaron Bamba

Management Consultant, Mechanical and Electrical Engineer, UNAM.

Aaron Bamba is a Mechanical and Electrical Engineer, graduated with honors from Universidad Iberoamericana in Mexico City, and received a national academic award. During his studies, he was actively involved in student life and academic programs, as well as sustainability projects, such as building the first fully-electric formula-type car in Mexico and working on a green farm with energetic and economic regional challenges.

With over 14 years of professional experience, Aaron has a horizontal background in consulting, training, and operations, particularly for the automotive industry, including e-mobility for South America, and healthcare industries. He has implemented growth-focused, scalable, and sustainable processes and teams as a Deputy Director of Operations for over 20 companies and projects. With his diverse background and knowledge, Aaron enjoys innovative (disruptive) thinking and a problem-solving approach for the industry, merging his engineering background with a human-centric focus.

Carl Bauer

Director, School of Geography and Development

Dr. Bauer research is about the legal, policy, and political economic aspects of the water/energy nexus. He works in the Western U.S. and in Latin America, particularly Chile. As a geographer, Dr. Bauer focuses on the relationship between humans and the natural environment in historical context. As a legal scholar and public policy analyst, he focuses on water rights, environmental regulation, and electric power. His MA and PhD students generally work in the area of water governance.

Dr. Bauer expectations for the meeting at B2 are to listen and contribute what he can from the perspective of law, public policy, and social sciences generally.

French Embassy & National Research Institute for Agriculture, Food and Environment (INRAE) Team.

Karim Belarbi

Attaché for Science and Technology, Office for Science and Technology, Embassy of France in the United States.

Laura Goncalves-De-Sauza

Scientific cooperation officer for INRAE in Canada and the United States.

Jean-Paul Lalles

Research Director, Department of Nutrition, Chemical Food Safety and Consumer Behavior, INRAE

In France, the law of March 10, 2023 on the acceleration of renewable energy (RE) production aims to meet the European objectives of a 23% share of renewable energy in its energy mix, while the multi-year energy program adopted in 2020 sets a rate of 40% of electricity produced by RE in 2030. In this context, the development of photovoltaic energy represents one of the major challenges to meet the objectives of the multiannual energy program by 2030 and to contribute to achieving climate neutrality by 2050. Partly meeting these aspirations, Agrivoltaics represents a promising option to encourage electricity production and allow agronomic benefits, without affecting food production. Article 54 of the law on the acceleration of renewable energy production enshrines and provides a framework for this emerging sector and includes it among the sustainable solutions to be explored to supplement French electricity production. According to the ADEME (the Agency for the Environment and Energy Management), more than 100 "Agrivoltaic" projects have emerged in France in recent years, with varying degrees of success.

For the CNRS, the development of a large-scale Agrivoltaic industry is in line with the global challenges to which the organization is committed, particularly those related to environment/climate change and natural resources. Agrivoltaics is thus an important component of the Integrated Food-Energy-Water Solutions at Scale, one of the priority areas of scientific cooperation defined within the framework of the IRC between the CNRS and the University of Arizona in September of 2022". Developing and testing Agrivoltaics in Arizona, faced with extreme temperatures and water shortages seems obvious, will involve the entire international scientific community, and will benefit everyone in a context of global climate change.

Laurel Bellante

Assistant Professor of Practice and Director, Food Studies Degree Program, Assistant Director, Center for Regional Food Studies.

Laurel Bellante, Ph.D., is an assistant professor of practice and director of the B.A. in Food Studies and the assistant director of the Center for Regional Food Studies (CRFS) at the University of Arizona. She is a human-environment geographer specializing in global environmental change, sustainable food systems, food justice, and agrarian questions in the Southwestern U.S., Mexico, and Latin America more broadly. Her research centers on supporting the creation of more just and sustainable food systems using qualitative, ethnographic, and applied research methods. She has researched rural livelihoods, farmer movements, and alternative food networks in Mexico, poverty and climate change in the Southwestern U.S., carbon forestry programs in Latin America, and food security and food justice in the U.S.-Mexico borderlands. Her ongoing research projects focus on the impacts of the COVID-19 pandemic and other challenges in the regional food system of southern Arizona, strategies for building food system resilience, and understanding the potential and limitations of farmer movements to address the dual challenges of neoliberalism and global environmental change. Bellante has been involved in food advocacy work in the Tucson region since 2010, including service as a board member to the Pima County Food Alliance, the Tucson City of Gastronomy nonprofit, and the Arizona Food Systems Network. She has continually leveraged university resources to convene food system practitioners to understand research needs, share findings, and to envision pathways for change. Her efforts have contributed to several key successes in Pima County, including Tucson's designation as an UNESCO City of Gastronomy; the revision of City of Tucson's local zoning ordinances to encourage greater urban food production; and the creation of the UArizona's Food Systems Research Lab, which is dedicated to mobilizing university-community partnerships and training students to create food systems change in southern Arizona. Bellante completed her PhD in Geography and Development and her MA in Latin American Studies at the University of Arizona. She also holds a BA in Latin American Studies and Environmental Analysis from Pomona College.

My interest in Agrivoltaics is focused on the social questions that arise whenever a new technology is introduced. While Agrivoltaics promises to revolutionize how we attend to challenges in the food-energy-water nexus, there are also many human-environment and political economic questions to be explored. The kinds of questions that interest me include: 1) technology adoption and use (e.g., What are the pros/cons of adopting this technology from a farm owner and/or farmworker perspective? What are the barriers to accessing and adopting this technology? What social, environmental, and/or political economic factors facilitate or constrain the adoption of Agrivoltaics?); 2) justice implications (e.g., Who is interested in and able to adopt this technology? Who is left out and why? What kind of ripple effects (positive or negative) might this technology have throughout the food system?);3) Consumer implications (e.g.,How might food produced using Agrivoltaics change how food products are certified and/or marketed and with what impacts for consumers and food justice?).

Paul Brierley

Executive Director, Yuma Center of Excellence for Desert Agriculture

Paul Brierley was raised on a family farm in central California. After earning an Electrical Engineering and Computer Science degree and conducting applied telecommunications research, he returned to production agriculture in Southeast Arizona and then served as Director of Organization at the Arizona Farm Bureau. Paul is a Flinn-Brown Fellow, a Project CENTRL (Center for Rural Leadership) graduate, and has served in leadership positions with many organizations including the Arizona Farm Bureau, Arizona Crop Improvement Association, Arizona Department of Agriculture Food and Agriculture Policy Advisory Committee, Yuma Multiversity Campus Corporation, Arizona Town Hall, Arizona District Export Council, Aerospace Arizona, Yuma County Chamber of Commerce, and the Greater Yuma Economic Development Corporation. With a background in agriculture, research, leadership and politics, Paul was chosen to serve as the inaugural Executive Director of the University of Arizona's Yuma Center of Excellence for Desert Agriculture (YCEDA), which he has built into a highly effective research organization focused on usable results that impact the desert agriculture industry's pressing problems. Paul has managed over $6M of highly collaborative grant-funded research projects. He works directly with researchers and the desert agriculture industry to solve pressing problems by nimbly managing university and other resources to work on irrigation management, precision Ag, broadband infrastructure, plant disease, food safety, public health and other urgent issues. Paul is currently chairing the University of Arizona's Presidential Commission on the Future of Agriculture and Food Production in a Drying Climate,

with a charge to summarize the threats of drought and climate change to Arizona's agricultural production systems, conduct a comprehensive review of expertise and resources that can be brought to bear on the problem, provide recommended actions UArizona can take to address the issue and turn threats into opportunities, and identify stakeholders who will support and grow these efforts on an ongoing basis.

My interest in Agrivoltaics is to figure out whether and how Agrivoltaics could work in a commercial production setting like Yuma, AZ. There are many complications, from making room for equipment, crop uniformity, different crops grown at different times, crop dusting, etc. Yet, more must be grown with fewer inputs, so this and other production methods must be explored. In a future with scarce and expensive water and power, it could be an answer. I also want to figure out how Agrivoltaics and other production methodologies fit into the recommendations that the UA Presidential Commission on the Future of Agriculture and Food Production in a Drying Climate will make to the president this summer.

Jim Buizer

Strategy Advisor to the Senior Vice President for Research, Innovation and Impact, Professor, School of Natural Resources and the Environment.

Jim Buizer is Senior Strategy Advisor to the Senior Vice President for Research Innovation and Impact, Associate Director of the Aegis Consortium for a Pandemic Free Future, and Professor of Climate Adaptation in the School of Natural Resources and the Environment at the University of Arizona. He also serves as Senior Advisor to the Research Faculty Foresight Council, on the President's Commission for the Future in Agriculture & Food in a Drying Climate, on the Steering Committee for the France-Arizona Institute for Global Grand Challenges, and on the Board of Directors of the Biosphere2, among others. Externally, he serves as Chairman of the Blue Ribbon Advisory Committee for the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia, on the Advisory Council for Planet Forward, on the Board of Directors of the Thomas Lovejoy Amazon Biodiversity Center, and as Senior Sustainability Scientist at Arizona State University. He has held leadership roles for U.S. National Climate Assessments and as U.S. Government reviewer of reports of the Intergovernmental Panel on Climate Change. From 2019 – 2022, he was Founding Director of the Arizona Institute for Environments and Societies. From 2003-2011 Jim served as Senior Advisor for Institutional Transformation to the President at Arizona State University, where he led the establishment of 10 new research Institutes and Schools. Prior, Jim was Director of the Climate and Societal Interactions Division at NOAA in Washington, D.C. He has worked in over 20 countries throughout his career and has published extensively on the science-to-action interface, integrating climate information into decisions, and climate assessments. His degrees are in Oceanography, and Marine Policy & Economics from the University of Washington, Seattle.

Elliott Cheu

Associate Vice President, University Research Institutes, Professor, Physics.

Dr. Cheu completed his Ph.D. degree in High Energy Physics at Cornell University. Dr. Cheu is working in the Experimental High Energy Physics group where they search for the most fundamental particles in nature. His current research interests involve searches for dark matter and physics beyond the Standard Model. If they were to discover such phenomenon, it would have a profound impact on understanding the origins of matter, as well as improving our knowledge of the Universe. Dr. Cheu's research takes place primarily at the ATLAS detector, which is one of the experiments at the Large Hadron Collider or LHC. Dr. Cheu serves as the Associate Vice President for University Research Institutes in which he oversees the University-wide centers and institutes. Elliott served as the interim Dean for the College of Science from 2019 to 2021. Dr. Cheu also helped co-chair the 2018 Strategic Planning process for the University of Arizona. From 2008-2019, he was the Associate Dean for the College of Science and in 2017 helped guide the Honors College as interim Dean.

Mohammed VI Polytechnic University Team

Ngonidzashe Chirinda
Professor in Sustainable Tropical Agriculture

Mohamed EL Gharous
Senior Consulting Scientist

Bruno Gerard
Dean, college of sustainable agriculture and environmental sciences

Mohamed Louay Metougui
Scientist in Agroforestry and Rehabilitation

Mohamed VI Polytechnic University (UM6P), through its College of Sustainable Agriculture and Environmental Science, is highly interested in joining the Agrivoltaics Consortium. Being part of the Consortium will be instrumental in serving our research mandate and developing implementable and scalable solutions around the food-water-energy nexus for Morocco and Sub-Saharan Africa. Recognizing that impact at scale of technologies needs to be integrated with financial and social innovations, we are convinced that the Agrivoltaics research needs to be multi-faceted, systemic, multi and interdisciplinary and context-specific.

Challenges to be tackled by Agrivoltaics: - Increased temperatures (micro-climate creation, shading optimization for crops and/or livestock, selection of best crops and varieties under micro-climate, use of our state-of-the-art phenotyping platform for precision crop physiology research). - Access to water. Local use of solar energy generated for groundwater pumping and drip irrigation (research on WUE, EUE, plant x water x shading optimization, economic analysis). -Water & soil salinity issues are possibly tackled by solar-powered small desalination units in various soils and environments. - Ex-ante framework for feasibility and profitability (multi-criteria analysis) to develop recommendation domains for Agrivoltaics development in Morocco and Sub-Saharan Africa. - Contribution to technological advances (solar energy, batteries, drip system, desalination processes) along with our Material Science and Nanoparticle (MSN) Department and Mechanical and Electronic Laboratory. - Develop entrepreneurship models for Agrivoltaics. - Include Agrivoltaics in UM6P courses.

The pilot project at UM6P experimental farm – Technology: Mohammed VI Polytechnic University (UM6P) is establishing a replicated Agrivoltaics (AV) platform at its experimental farm in Benguerir. The Agrivoltaics research platform is a fixed system with a chess-board structure. The platform will generate evidence of the potential to co-produce energy and crops under semi-arid conditions. Specifically, different crop types will be grown on soil with and without photovoltaic modules, and the dynamics of different climate, soil, and crop variables will be monitored. Changes in soil carbon and soil greenhouse gas emissions will also be monitored. Productivity data generated from the platform, initial investment and operational costs will be used to inform economic analyses, which will inform scaling. Through collaborations with other consortium partners, we will work on collectively standardizing AV evaluation protocols. The platform can also be used for several other initiatives highlighted in the section above.

Expectations of the meeting – thoughts, challenges, ideas about Agrivoltaics from the perspective of your discipline: Discussions on crop selections: shade-tolerant crops; Discussions on a standard evaluation protocol that considers energy and crop variables; Discussions on an exhaustive list of the crop, soil, climate, environmental and economic variables to be monitored for holistic evaluations; Discussions on suitability maps and scaling requirements.

Andrew Comrie
Professor, School of Geography and Development

Dr. Comrie is a geographer, interdisciplinary climate scientist, and former Provost at the University of Arizona. He currently serves as the Chief Academic Officer for the Arizona Board of Regents, where he is responsible for system strategy in academic affairs, including fostering academic access and excellence at all three of Arizona's public universities. In addition to his academic appointment as Professor in the School of Geography, Development & Environment, Dr. Comrie has joint appointments in Hydrology & Atmospheric Sciences and in Public Health. His research is in two broad areas. The first links climate with health, pathogens, and vectors as well as with broader atmospheric environmental issues, and focuses on questions such as 'How do disease patterns shift in space and time with changes in climate?' The second draws on his experience as a senior institutional leader, and examines questions in higher education such as 'How do resources flow to support the university's multiple missions?' He has served as editor and editorial board member for respected international scholarly journals and on many national and international professional committees and boards. He is the author of the open-access book 'Like Nobody's Business: An Insider's Guide to How US University Finances Really Work.'

Grenoble University & UArizona Team

Jean-Martial Cohard
hydrologists, Institute of Environmental Geosciences (IGE), Grenoble University

Laura Condon
Associate Professor, Hydrology / Atmospheric Sciences

Thierry Pellarin
hydrologists, Institute of Environmental Geosciences

We are hydrologists who primarily work on integrated hydrologic models that can simulate the full water and energy balance of both the subsurface and the land surface. Dr. Laura Condon from the University of Arizona will be representing our team for this meeting. Dr. Condon co-leads the development of a national hydrologic model for the US which simulated the hydrology of the contiguous US from bedrock to treetops at 1km resolution. She is also part of the development team for the ParFlow model which this work is based. Dr Cohard and Dr Pellarin from Institute of Geoscience and Environment (Grenoble) are part of the Parflow team they develop for water resource issues in West Africa, from local to continental scales. More specifically, Dr Cohard (University Grenoble Alpes) is interested in surface energy budget spacio-temporal variability including evapotranspiration and its dependencies with vegetation. Dr Cohard is heading the hydro-meteorological observatory AMMA-CATCH in West Africa and have connections with Water-Energy stakeholders in West Africa. Dr. Pellarin is interested in soil moisture monitoring in semi-arid regions and its relationship to crop yield. Through the joint UArizona CRNS program our team is collaborating to support a PhD student at the University of Grenoble who is working on coupling the CLM5 land surface model with the integrated hydrologic model ParFlow. Our team has not worked on Agrivoltaic specifically. However, we are interested in the possibility of using ParFlow-CLM5 to model the water and energy balance for these systems, and further on the vegetation productivity through the CLM5 dynamic vegetation scheme. We think it would be feasible to develop a representation of solar panels within our existing modeling framework. This new capability could be used to build simulations that could explore system performance in the water/energy/food Nexus. Simulations could be done at the field scale with column models or potentially also done within larger watershed to scale up Agrivoltaic strategies. To develop this capability, we would need access to system measurements in order to test our conceptual models and validate performance. We would welcome the opportunity to work with others with experience in this area to learn more about the most important questions that we could use models to answer, and the data that is already available (or could be generated) to help with model construction. Our team also has experience with model coupling approaches. We would welcome conversations with others who may be modeling different aspects of the system (e.g. power generation, economics, crop yield) on how we could couple approaches to answer holistic questions about system performance and scalability.

Joel Cuello

Professor, Agricultural-Biosystems Engineering

Joel L. Cuello is a Professor of Agricultural and Biosystems Engineering and Director of the Global Initiative for Strategic Agriculture in Dry Lands (GISAD) at The University of Arizona. A globally recognized expert in the engineering of sustainable biological and agricultural systems, his technical expertise in both engineering and biology provides the platform for engineering designs in various agricultural and biological systems with emphasis on optimizing biological and agricultural productivities while fostering resource sustainability and environmental protection. Prof. Cuello has designed, constructed and implemented varied types of engineered agricultural or biological systems, including those applied in bioregenerative space life support, hydroponics, tissue culture, and industrial mass production of algae, plant cell and microbial cultures for production of biomass, nutraceuticals, pharmaceuticals, etc. He is the Principal Inventor of the patented algae photobioreactor series -- the Accordion photobioreactors -- and is the creator of the Minimally Structured, Modular and Prefabricated Vertical Farm design (the Vertical Greenbox® Solution) that is considered an archetypal design for Vertical Farming 2.0. Prof. Cuello conducted his postdoctoral research in the Controlled Ecological Life Support System Division at NASA John F. Kennedy Space Center in Cape Canaveral, Florida as a U.S. National Research Council Postdoctoral Research Associate. He earned his Ph.D. in Agricultural & Biological Engineering, with Minor in Chemical Engineering, from The Pennsylvania State University in 1994. He also earned two M.S. degrees (Agricultural & Biological Engineering; Plant Physiology) from The Pennsylvania State University. He obtained his B.S. in Agricultural Engineering (*cum laude*) from the University of the Philippines at Los Banos. He is a lifetime Visiting Professor at Zhejiang University in Hangzhou, China, a Faculty Fellow at the Innovation Center of the Ateneo de Manila University in the Philippines, and a Visiting Professor at De La Salle University in Manila, Philippines.

Cherie De Vore

Assistant Professor, Chemical and Environmental Engineering

Dr. Cherie De Vore, Diné, is from Tsinyaalk'id near Crownpoint, NM in the eastern Navajo Nation. Her clans are Red Bottom People, Atop the Mountain Towering House, Salt People and Tangle People. She is currently a postdoctoral scholar in Earth System Science at Stanford University. She received her Ph.D. in civil & environmental engineering at the University of New Mexico under the mentorship of Professor Jose Cerrato. Cherie was awarded an NSF Earth Science Postdoctoral Fellowship to conduct research under the guidance of Professor Scott Fendorf. Her current research is related to better understanding biogeochemical mechanisms affecting the mobilization and bioavailability of metals in soils and plants near Indigenous communities.

Kirsten Engel

Professor, Law.

Kirsten Engel is an attorney, law professor, and a former Arizona state legislator. During her five years in the legislature, Ms. Engel served on the Natural Resources committees of the Arizona House and Senate, introducing numerous bills to safeguard Arizona's water security and capitalize on the state's capacity to be a world leader in renewable energy. Since 2005, Ms. Engel has been a member of the law faculty of the University of Arizona, where she directs the Environmental Law Certificate program. Engel is the co-author of an environmental law textbook, book chapters and articles. Her work appears in journals such as the UCLA Law Review Discourse, the Minnesota Law Review, and the Ecology Law Quarterly. Prior to joining the law faculty at the University of Arizona, she held numerous permanent and temporary appointments within academia and in the public and nonprofit sectors, including the U.S. Environmental Protection Agency, the Massachusetts' Attorney General's Office, and Harvard, Vanderbilt, and Tulane Law Schools.

Alfonso Gardea

Professor of Food Sciences CIAD, Sonora Mexico

Alfonso A. Gardea is a horticulturist by training working at Research Center for Food and Development in North West Mexico. At present involved in two conservation projects: a). Jaguars conservation conflicts with small-scale ranchers. b). Stingless bees (Melipons) rescue in Sonoran Sierra Madre. His role is to develop productive strategies to improve wellbeing conditions in isolated rural communities with the aim to increase chances for conservation programs to succeed. The objective they are pursuing is to establish family-operated small-scale greenhouses for hydroponic green forage production. Shadow provided by solar panels will protect against high irradiation and will improve growing conditions and power production for greenhouse operation and other tasks in far-away communities without access to power lines. Should green forage be available, then cattle will be moved from the mountain to nearby pastures, so that milking may add value by cheesemaking. Traditional mountain cheeses are becoming extinct, although they reach top prices, and pretend to rescue those aged, salty, hard cheeses and already have a group of women interested in participating. If cattle is removed from the mountain, habitat and wildlife will recover, therefore wild carnivores will have a better chance and predation on domestic stock may be prevented. Stingless-bee (Meliponins) honey has been part of traditional medicine in rural communities in the Sierra Madre, although never domesticated as in southern Mexico. They also play a role in pollinating native species, therefore have an impact in the ecosystem floristic composition. The population of this harmless bee species has declined in NW Mexico mostly because the destructive methods used to extract honey from hives located deep inside tree trunks. Pesticides used in illegal crops played a role as well. The best chances to rescue this species is to develop small isolated meliponaries (between five and ten hives) per site. Technology developed in Brazil calls for improved hives to facilitate management, however in their extreme conditions such design may not be enough; therefore, thermal isolation is of paramount importance and solar panels may create the shadowy environment required. In their work they have identify a group of women interested in learning how to manage these meliponaries, considering the high demand and high prices this product reaches in local markets.

Gregg Garfin

Director, AIR Science Translation and Outreach, Professor and Extension Specialist, School of Natural Resources, and the Environment

Skills that I bring to the project: I have worked for the last two decades on efforts to bridge the science-society interface through dialogues and collaborative research among scientists, practitioners and decision makers—including community organizations, cultural resources managers, ecosystem/fire/forest managers, Indigenous natural resources managers, municipal planners, public health officials, water managers…and…to a lesser extent, farmers. My research and teaching both focus on preparedness planning for adaptation to a changing climate, drought planning, and the development of climate services. In recent years, I have focused on building resilience to heat waves, adapting cultural and natural resources management to climate change, and public participation in urban flood management. Experience in working in multidisciplinary research and practitioner teams, science communication, coproduction of science and policy.

My aspirations for this project is that we are collectively able to: Train cohorts of graduate students in transdisciplinary research, that is grounded in holistic thinking and mutual respect for partners in research, practice, and policy formation. Make the most of individual and mutual knowledge and experience to develop cutting-edge and culturally-appropriate technologies and governance approaches to the application of Agrivoltaics. Analyze multiple kinds of trade-offs, governance challenges and unintended consequences in a way that fosters the development of a model for Agrivoltaic-based food-energy-water-land solutions that is just and equitable and that can be applied in many contexts. Make a positive impact in Agrivoltaic applications in pilot communities, states, countries. Make important contributions to the array of solutions for FEW and climate change challenges.

My expectations for the meeting: Rich discussions and development of plans for addressing challenges of governance of Agrivoltaics, economic/societal/energy/environment trade-offs, unintended consequences of widespread implementation of Agrivoltaic solutions. Develop a mutually agreed upon process for the governance of the initiative. Define how societal partners will participate in collaborative research and in the governance of the initiative. Discuss and develop a vision for scoping individual projects in a manner that leads to research and societal impacts that are more than the simple sum of the individual projects. Develop mutual understanding among the participants and foster a sense of camaraderie.

Andrea Gerlack

Director, Udall Center, Research Professor, Environmental Policy Programs, Udall Center, Professor, School of Geography, Development and Environment.

Andrea K. Gerlak is Director at the Udall Center for Studies in Public Policy and Professor in the School of Geography, Development and Environment at the University of Arizona. Her research agenda focuses on cooperation and conflict in water governance, including questions of equity and access, institutional change, learning and adaptation. Much of her research focuses on institutions and policy processes for governing water resources including governance around transboundary waters, green infrastructure, and urban restoration. She is also leading social science research efforts around Agrivoltaics to better understand how different actors, like farmers, solar companies, and government officials, view benefits and opportunities, as well as challenges and barriers, associated with Agrivoltaic adoption. She is an author or co-author of more than 100 publications. She serves as a co-editor for the Journal of Environmental Policy and Planning and as a senior fellow with the Earth Systems Governance network. Andrea has more than two decades of experience leading interdisciplinary environmental studies programs and university-community environmental partnerships. She has consulted on water governance & climate resilience efforts for UNESCO and the WMO.

David Godfrey-Thomas

CEO, Afina International

Afina, founded in 2011, is a business-building and venture investment team designing and executing eco-centric growth strategies, investing in and accelerating commercialization for companies which solve global problems. As a company investing in sustainably produced, alternative food and nutrition, scalable agricultural practices which support productivity in the context of environmental security are of high interest.

Interest in Agrivoltaics: To gain a greater understanding of this technology, efficacy, scalability and costs. Make personal connections which will enable incorporation of Agrivoltaics into our investment and operating company planning.

José Ángel Gutiérrez-Pabello

Professor in Veterinary Microbiology, Associate Dean for Partnership, Facultad de Medicina Veterinaria y Zootecnia (FMVZ), Universidad Nacional Autónoma de México (UNAM)

In academics, I teach immunology for veterinary students. I am the Principal Investigator of a laboratory that do research in bovine tuberculosis. Our research aims to answer basic questions related with the pathogenesis of bovine tuberculosis. In this host-pathogen interaction, we use an in vitro model infecting bovine macrophages with Mycobacterium bovis. We interrogate this system in different areas including cell death induction, macrophage gene expression, cytokine production, phagocytosis, bacterial intracellular survival, among others. I am also interested in natural disease resistance of cattle and strategies for bovine tuberculosis diagnosis. In the partnership office, I work with my team to look for different interactions with academia, the livestock industry, policy makers, veterinary associations, and several key stakeholders related with environmental sustainability and circular economy in livestock production.

During the last 5 years the FMVZ has undertaken different actions to impulse the use of ecotechniques in our teaching centers. The idea is to become a showcase for livestock farmers around our area of influence. In one of our teaching centers, we practice the silvopastoral system for herds composed of cattle, goats, and swine. It is clear for our neighbors that our practices provide a big advantage in animal production. At the present time, we are collaborating with the de Institute of Renewable Energies (IER) from our university and with the Agrivoltaics group from The University of Arizona in a project that aims to set up a 300 m2 of solar panels to evaluate agricultural crops that help to decrease the greenhouse gas emissions in ruminants. In the future, we would like to integrate more ecotechniques related to water use, rainwater harvesting, manure treatment for mitigating air emissions and composting biological residues in animal production.

Kerri Hickenbottom

Assistant Professor, Chemical and Environmental Engineering

Kerri Hickenbottom is an Assistant Professor in the Department of Chemical and Environmental Engineering at the University of Arizona. She completed her B.S. degree in Civil and Environmental Engineering at the University of Nevada, Reno, and her M.S. and Ph.D. degrees in Environmental Science and Engineering at the Colorado School of Mines. Her research is centered on the development of novel engineered systems for resource recovery and reclamation of concentrate streams. She has investigated the technical, economic, and environmental life cycle impacts of a hybrid, membrane-based process (pressure retarded osmosis-membrane distillation) for energy generation from low-grade heat, forward osmosis for advanced treatment and recovery of drilling wastewater from hydraulic fracturing, and membrane distillation for management of concentrate streams. She looks forward to continuing her research and taking an interdisciplinary to solving our grand environmental challenges by collaborating with other researchers across campus.

Marie Hrabanski

Ph.D. political sciences and sociology, HDR Sociology, Umr Artdev, CIRAD (The French Agricultural Research Centre for International Development).

Marie Hrabanski works on agricultural adaptation policies to climate change, and on the « climatisation » of agricultural policies. From 2019 to 2022, Marie was coordinator of the TYPOCLIM research project (ANR-16-IDEX-0006). This collaborative and interdisciplinary project is focused on policy instruments to facilitate agricultural adaptation to climate change in 8 countries (France, Senegal, South Africa, Spain, Colombia, Brazil, France-Guadeloupe, USA-California) from Global North and South. Marie is interested in the emergence of policy norms and instruments, and policy narratives at the international on the "climatization of agriculture", and the implementation of these norms, instruments, and narratives at the local level. Marie is involved in the Interface program (ADEME APR ClimFi). In this project, Marie analyzes the implementation of Agrivoltaic projects in Occitanie (South of France) and observed the diversity of these projects and the different way to regulate them in different territories.

As social scientist, 3 points are very important to analyze in Agrivoltaics :First, we have to analyze the extreme diversity of Agrivoltaic projects developed in global north (France, USA) and south (Morocco, and if it's possible, we have to compare also with Senegal or others African countries). These Agrivoltaic projects differ in size (capacity, surface area…), governance and financing (large/small energy companies, cooperatives, local authorities, etc.). Second, we have to analyze 1. The Agrivoltaics policies (reglementation and narratives) and policy instrument to promote it in different countries, and 2.also the regulation of Agrivoltaics (certification, regulatory framework…) at the national and territorial levels. The regulation of Agrivoltaic projects questions both the distribution of power between the State and the territories, and the role of the sectors (energy/agriculture) in the regulation of these projects. Third, we have to analyze the dynamics of territorialization of the projects. Some critics of Agri-voltaic projects believe that agricultural and food security issues are neglected in favor of energy objectives. Questions of land grabbing and ecological issues arise. In other territories, Agrivoltaics are accepted. The territorialization of Agrivoltaics projects could develop some reject, some acceptation, some diffusion etc. How can we explain the different territorialization of Agrivoltaics projects? What are the conditions to accept the project (by who?) and reject it ? I'll be interested in supervising a PhD in sociology/political sciences to compare the dynamics of territorialization of Agrivoltaics projects in US-Arizona, France-Occitanie and an African country (west Africa preferred).

Gary Jones

Independent Investor and Board Member

Gary holds two degrees from UArizona, BSc in Geological Engineering and MSc in Geophysics and worked 24 years in the seismic and well logging industries from 1980-2004. Since 2005, Gary has worked independently as a board member, chairman or director & investor at a variety of technology based start up companies, including Novadrill, Ingrain, Wireless Seismic and Western Alaska Copper & Gold. Novadrill developed an extensive patent portfolio and successfully sold the company based on the technology developed. Western Alaska Copper & Gold is a start up mineral exploration company recently listed on the Toronto Exchange. Gary currently serves on the advisory board to a technology incubator in Utah, Hall Labs as well as a consultant to Western Alaska Copper & Gold.

Stephen Jordan

CEO, Institute for Sustainable Development

Stephen Jordan leads the Institute for Sustainable Development, a 501c3 non-profit organization headquartered in Alexandria, VA. ISD's mission is to catalyze resilience so that communities can thrive long-term. The Institute has helped uncover obstacles faced by inner cities and small towns to access disaster recovery resources post-Hurricane Harvey, built a pioneering public-private collaborative for small business recovery in Los Angeles in response to COVID-19, and is supporting an initiative to center innovation as a key strategy for addressing climate change and other environmental challenges in the U.S. and Sweden. For more information, visit www.isdus.org. In May 2000, Jordan founded and served for 12 years as executive director of the Center for Corporate Citizenship of the U.S. Chamber of Commerce. He created the Corporate Citizenship Awards, developed public-private partnerships with six different government agencies including FEMA, HUD, and the Small Business Administration, established the Business Education Network, the workplace volunteerism program Business Strengthening America, and the launch of the Global Development Alliance. The Wall Street Journal recognized the Center's work after Hurricane Katrina as "the private sector's FEMA". The World Economic Forum recognized the Center's small business disaster program as best in class, and facilitated its expansion to Turkey, the Philippines and Mexico. Jordan has also worked in management consulting, publishing, Congress, and international trade. He is a fellow of the Caux Roundtable and Babson College's Lewis Center for Social Innovation. He is married to Roxana Chahin Jordan and has two daughters in college.

Emily Kotay

Assistant Director, International Research, Fulbright Scholar Liaison, Research Development Services, RII.

Emily has a breadth of experience developing programs in higher education and public management. Prior to joining the Research Development Services (RDS) team in RII, Emily focused on partnership development to enhance international collaborations and has assisted UArizona faculty and students in applying for the Fulbright program. She also served as a Peace Corps Volunteer in Ukraine, where she taught English and conducted youth development and community engagement projects for more than two years. Within RDS, Emily focuses on international research opportunities and scholar exchange. Emily helps UA researchers and scholars identify funding opportunities for international collaborations, form effective teams, and craft winning proposals, with the ultimate goal of increasing the quality and quantity of externally funded research and scholarly activity at UA. Emily holds a Master of Public Administration from the University of Kansas, and a Bachelor of Arts from Mount Holyoke College in cultural anthropology.

Michael Kotutwa Johnson

Assistant Specialist, Indigenous Resilience

Dr. Michael Kotutwa Johnson is a member of the Hopi Tribe in Northern Arizona. Dr. Johnson holds a Ph.D. in Natural Resources from the University of Arizona, a Master of Public Policy from Pepperdine University, and a B.S. in Agriculture from Cornell University. Dr. Johnson is a faculty member and Assistance Specialist within the School of Natural Resources and the Environment. His primary work is with the Indigenous Resiliency Center. Michael is also a co-author on the Indigenous Chapter in the National Climate Assessment Five. His newest initiative is the call for the Restoration of the American Indian Food System based on the stewardship principles of Indigenous conservation. Most importantly, he continues to practice Hopi dry farming, a practice of his people for millennia.

Alexandra Langlais

CNRS Research Director, Rennes University.

I am a research director at the CNRS in environmental law at the Institut de l'Ouest: Droit et Europe (Rennes). Since joining the CNRS in 2008, I have been working on the legal aspects of agriculture as an environmental lawyer. My work focuses on the link between agricultural production and livestock effluents in terms of water protection, but also in terms of the fight against climate change and planetary boundaries. It is particularly the issue of climate change that led me to work on carbon sequestration in agricultural soils. Agricultural soils play an important role in my research at different scales of action (local, national, European and international) from the point of view of the ecosystem services they provide but also from the point of view of the threats they face, whether these threats are linked to climate change or to the erosion of biodiversity. I am also working on a more strictly environmental aspect on ecological and climatic emergencies and the associated scientific uncertainties. More broadly, this intersection between the environmental and agricultural dimensions has led to work on the agro-ecological transition. The European Common Agricultural Policy is one of my fields of observation. More recently, the impact of the digital transition on the agro-ecological transition is also part of my research field. This point is at the heart of a research project in which I am involved, and which aims to reduce the use of plant protection products.

I have not yet had the opportunity to work on Agrivoltaics. I have, however, worked on other renewable energies (such as methanisation). However, the many legal questions that arise are not strictly related to Agrivoltaics, such as the articulation between different issues (food security and environmental protection), but also the questions of the relevant scale of action or the quantitative and qualitative protection of soil for agricultural production.

Laboratoire Nanotechnologies et Nanosystems, Sherbrooke, Canada

Jean-Francois Lerat

LN2 research coordinator. Extended experience in Agrivoltaics R&D

Michael Canva

LN2 CNRS researcher, Sensing systems

The LN2, Nanotechnologies Nanosystems Laboratory, is a research organization associating the University of Sherbrooke (Québec, Canada) and the National Center for Scientific Research, CNRS (France) under the status of IRL (International Research Laboratory / IRL 3463). We are a Franco-Quebec team made up of a hundred+ people. The LN2 is organized into 5 main research axes: Energy on chip, Nano-electronics, Integrated photonics, Packaging, as well as Impacts, Uses and Society. Furthermore, one of its 3 interface domains is related to Sensing for Environment. In the framework of the Food-Water-Energy nexus specifically, the CNRS-LN2 has access to the largest solar park dedicated to research in Canada (1MW).

Agrivoltaic-related activities: Lab's projects currently focus on developing knowledge on photovoltaic systems performance in outdoor environment, including snow management specific to our northern region. Year 2023 comes with the building of an agrivoltaic greenhouse, to establish multiphysics models of an autonomous greenhouse, develop energy-management algorithms and simulate the behavior of the autonomous greenhouse over a typical year. Through this new research building-platform, the lab's activities are expanding to all-source energy management, and collaboration with experts in agriculture at Bishop's university will move to more specific agrivoltaic projects. LN2 also develop new materials, cell, and module designs for better photovoltaic performances. Dedicated sensors will allow the monitoring of physico-chemical parameters (temperature, humidity, luminosity, CO_2 level, etc.). These sensors will be developed by the LN2 in a frugal innovation strategy.

Eric Lichtenheld

CEO, Heliae

Eric has spent his career as a Chemical Engineer in operations, moving things from test tube scale into railcar-scale production volumes. His expertise over the last four decades has been in high volume, low-cost manufacturing, turning operational challenges into new growth opportunities. He has experience with pharmaceutical, biotech and consumer product industries in both North America and Asia. Eric worked in the 1980's with the godfather of microalgal phototrophic raceway systems, Dr William Oswald, building and operating the algae facility in Southern California that Exxon uses today for development of their biofuels program. After leadership roles in ADM and Tate + Lyle, he returned to his roots in microalgae as CEO of the Mars Family-funded company Heliae in Phoenix Arizona. Heliae is driven to find solutions to critical issues for survival of the planet, cleverly using classical strain development tools to manipulate secondary metabolic pathways which allows growth of phototrophic strains in dark fermenters. Microalgae produces proteins, carbohydrates and lipids and is the best platform for the creation of next gen food ingredients, reflected in our new food ingredient company "The Algae Company". He also is a founding member of Heliae's new SynBio partnership "Allagi Biotechnology". Eric has recently been collaborating with other innovative plant-based food companies as a member of the Google Food Alt Protein advisory group with the primary goal of increasing public acceptance of new plant-based foods.

Ronan Marrec

Associate Professor, Université de Picardie

As a landscape ecologist, I am interested in evaluating the role of the spatial structure and temporal dynamics of landscapes and human activities on biodiversity and ecosystem services. I am tackling my questions by using a blend of field studies, taking place in different human-modified landscape contexts, from local to regional and national scales, and considering various taxonomic groups, from population to metacommunity levels. I develop an increasing interest in using remote sensing data to inform landscape heterogeneity and understand macroecological patterns and processes. In recent years, I have been particularly interested in the impact of ecological and anthropogenic infrastructures on the microclimate and its consequences on biodiversity. In this context, I am co-supervising a PhD thesis in partnership with the Agri photovoltaic company OKwind, aiming to study the impact of solar trackers implanted in cultivated fields and mowed meadows on biodiversity. In this nexus, I represent my research laboratory, EDYSAN, which includes about 40 professors, researchers, engineers and technicians, whose research themes are interested in the effects of so-called "global" changes on ecosystems and agrosystems. We are developing approaches around three research axes: (1) ecophysiology of insects and plants in the face of thermo-hydric constraints, (2) species reassemblies and interaction networks in the face of biological invasions and climate change, and (3) landscape integration and spatio-temporal connectivity.

Expectations of the meeting – thoughts, challenges, ideas about Agrivoltaics from the perspective of your discipline

The initiative proposed by the creation of this consortium is a great opportunity to develop a global multi-disciplinary collaboration. It would be interesting, in this context, to write an opinion article or a multi-disciplinary synthesis on the technologies and issues associated with Agrivoltaics in the world (technic, energy availability and security, social, environmental, ecological, law…). In regards with biodiversity, there are at least two challenges that can be addressed: (1) evaluate the impact on the local below and above-ground biodiversity as well as the cultivated plants (ecophysiology, interaction networks, species diversity, including crops, pests, weeds and diseases) and livestock, and (2) evaluate how Agrivoltaic systems fit into the landscape, and what impact they have on biodiversity moving over greater distances (e.g., birds, bats, pollinators).

James McCall

Distributed Energy and Environment Analyst, National Renewable Energy Laboratory

James is a senior analyst at NREL who specializes in modeling the economic and environmental tradeoffs of Agrivoltaics and renewable energy projects. His areas of interest include dual-land use solar configurations, energy-water-food nexus, land use change impacts, and RE siting and economic modeling. He is a long-term member of the InSPIRE research project coordinating Agrivoltaics research at 25+ sites across the U.S., the SCAPES project researching the economics of Agrivoltaics with corn and soy crops, the PHASE project researching pollinator habitat implementation at large scale PV sites, and is the PI of the PV-SMaRT project investigating stormwater runoff differences at PV sites. He has worked with many stakeholders across the Agrivoltaics landscape including universities, agricultural advocates, solar graziers, PV developers, vegetation and prairie management contractors, state and local policy makers, communities, and community members.

Meeting Expectations:
- Learn more about UofA and CRNS research project.
- Learn about differences of Agrivoltaics implementation in different regions/countries.
- Share knowledge of past DOE-funded Agrivoltaic research projects.
- Present on economic modeling and tradeoffs of Agrivoltaics systems.
- Highlight potential international opportunities for research.
- Assist with development of "fit for location" solutions and designs of Agrivoltaics research implementation.
- Be surrounded by thought leaders and contribute to larger research objectives.

Sharon Megdal

Director, Water Resources Research Center

Sharon B. Megdal, Ph.D. is Director of the University of Arizona Water Resources Research Center and Professor of Environmental Science. She also serves as C.W. & Modene Neely Endowed Professor, and Distinguished Outreach Professor. Dr. Megdal aims to bridge the academic, practitioner, and civil society communities through water policy and management research, education, and engagement programs. Applied research projects include analysis of water management, policy, and governance, groundwater recharge, and transboundary groundwater assessment. Dr. Megdal teaches the multi-disciplinary graduate course "Water Policy in Arizona and Semi-arid Regions." Her Reflections essays and other information about her work can be found at https://wrrc.arizona.edu/director. In 2020, she was awarded the Warren A. Hall Medal for lifetime achievement in water resources research and education by the Universities Council on Water Resources. She serves on the board of the Kasser Joint Institute for Food, Water, and Energy Security and is a member of the Leadership Team for the Colorado River Basin Water & Tribes Initiative. Dr. Megdal is also a member of the University of Arizona President's Advisory Commission on the Future of Agriculture and Food Production in a Drying Climate. Sharon B. Megdal holds a Ph.D. degree in Economics from Princeton University.

My interest in Agrivoltaics is not so much from a disciplinary research perspective. As a member of the Board of Governors of the Kasser Joint Institute for Food, Water, and Energy Security (KJI), I am excited about KJI's Agrivoltaics efforts to date. As a member of UArizona President Robbins Advisory Commission on the Future of Agriculture and Food Production in a Drying Climate, I am interested in how Agrivoltaics fits in as a solution. I am interested in the performance of Agrivoltaics in different conditions (water, soils, crops, etc.) and at different scales. What are the factors that will determine the scale at which it can be deployed? What is its potential as a solution to enable more food production using less water? What issues arise in terms of the harvesting of the crops? What is the potential and durability (longevity) of Agrivoltaics as a solution to those off the electric grid? I come to this workshop to learn about what is known to date and what kind of research will be forthcoming. As someone who communicates with water users, food producers, agency personnel, professionals with varied backgrounds, and the public, I am eager to learn where the research will be heading.

Laurent Nicolas

Scientific Deputy Director of the CNRS Division of Engineering and Systems Sciences

Laurent Nicolas is born in 1960. He is a Research Director at the French National Center for Scientific Research (CNRS). He is Scientific Deputy Director of the CNRS Division of Engineering and Systems Sciences (INSIS), in charge of International Affairs. He is also supervising the IRC (International Research Center) development for the CNRS. He graduated as an engineer from the Ecole Nationale Superieure d'Ingenieurs Electriciens in Grenoble. He holds a Ph.D. degree in Electrical Engineering in Lyon. Laurent Nicolas joined the CNRS in 1986 as researcher in the Electrical Engineering Center of Lyon (CEGELY). His field of interest was computational electromagnetics, electromagnetic compatibility, and bio-electromagnetism. He became director of the CEGELY in 2003 and set up in 2007 the Ampere Lab which he headed until 2011. From December 2011 to July 2022, he was Scientific Deputy Director of the CNRS-INSIS, in charge of the fields related to micro-and nanotechnologies, micro-and Nanosystems, electronics, photonics, electromagnetism and electrical energy.

Kim Ogden

Department Chair, Department of Chemical and Environmental Engineering

Kimberly Ogden is a professor of Chemical and Environmental Engineering at the University of Arizona (UA). She received her bachelor's degree from the University of Pennsylvania and her master's and doctorate degrees from the University of Colorado. Before joining the UA in the fall of 1992, she was a postdoctoral fellow at Los Alamos National Laboratory. She is currently the president elect for the American Institute of Chemical Engineers and on the managing board of the International Society for Water Solutions. Her research focus includes bioreactor design for production of alternative fuels from algae and sweet sorghum, and microbiological water quality.

Erin Ratcliff

Co-Director, Institute for Energry Solutions, Associate Professor, Chemical and Environmental Engineering

Erin L. Ratcliff is an Assistant Professor of Materials Science and Engineering at the University of Arizona, with joint appointments in the Departments of Chemical and Environmental Engineering and Chemistry and Biochemistry. She also has a joint appointment with the National Renewable Energy Laboratory in Golden, CO. Dr. Ratcliff's research group – the Laboratory for Interface Science of Printable Electronic Materials - is focused on the application of electrochemistry and spectroscopy to better understand the functionality of printable electronic materials, interfaces, and devices. The majority of her research efforts target understanding the structure-property relationships that govern charge transfer kinetics and transport of electronic and ionic species, with connections to energy conversion devices and biosensors.

Robert Robbins

President, University of Arizona

Dr. Robert C. Robbins assumed his position as the 22nd president of the University of Arizona on June 1, 2017. Previously, he served as president and CEO of the Texas Medical Center (TMC) in Houston from 2012 to 2017. In this role, he significantly enhanced TMC's commitment to collaboration, introducing five cross-institutional research initiatives centered on innovation, genomics, regenerative medicine, health policy and clinical research. Prior to his time in Houston, Dr. Robbins served as professor and chairman of the Department of Cardiothoracic Surgery at Stanford University School of Medicine, founding director of the Stanford Cardiovascular Institute, president of the International Society of Heart and Lung Transplantation, president of the Western Thoracic Surgical Association, president of the American Heart Association Western States Affiliate, president of the Bay Area Society of Thoracic Surgeons, and chair of the American Heart Association Cardiovascular Surgery and Anesthesia Council, among other roles. In 2016 he served as president of the American Heart Association Southwest Affiliate. An internationally recognized cardiac surgeon, Robbins has focused his clinical efforts on acquired cardiac diseases with a special expertise in the surgical treatment of congestive heart failure and cardiothoracic transplantation. His research work

includes the investigation of stem cells for cardiac regeneration, cardiac transplant allograft vasculopathy, bioengineered blood vessels, and automated vascular anastomotic devices. Robbins is the author of more than 300 peer-reviewed articles and a former guest editor of the Circulation Surgical Supplement. While at the University of Arizona, Dr. Robbins has led the creation and implementation of a strategic plan focused on the opportunities and challenges presented by the Fourth Industrial Revolution, the convergence of biological, digital and physical technologies and sectors. Designed to amplify Arizona's competitiveness on the world stage, the plan emphasizes the university's strengths as a public, land-grant research university with global reach and a rich history of international collaboration. In addition to his role at the University of Arizona, Dr. Robbins serves on the boards of the Arizona Commerce Authority, Southern Arizona Leadership Council, Tucson Metro Chamber of Commerce, United Way of Tucson and Southern Arizona, and the Greater Phoenix Economic Council. He is also a member of the Chairman's Circle of Sun Corridor, Inc., and a member of greater Phoenix Leadership. while at TMC, Robbins served on the Houston branch of the Dallas Federal Reserve board, the board of directors of the Welch Foundation, and the American Heart Association Southwest Affiliate in 2016. He served on an independent blue ribbon committee to evaluate the Veterans Affairs health system, and the World Affairs Council of Greater Houston honored him as the 2016 International Citizen of the Year. His educational background includes a B.S. in chemistry from Millsaps College, medical degree from the University of Mississippi, general surgical training at the University of Mississippi, cardiothoracic training at Stanford University, postdoctoral research at Columbia University and the National Institutes of Health, and congenital heart surgical fellowships at Emory University and Royal Children's Hospital.

Channah Rock

Professor and Specialist, Environmental Science

Rock is a Water Quality Extension Specialist and Professor in the Department of Environmental Science at the University of Arizona. Her background in both microbiology and civil and environmental engineering has focused her work on better understanding how pathogens and indicators survive water treatment and what factors can affect their persistence in the environment. Her research interests include microbiology, parasitology, virology, molecular biology, wastewater, and biosolids. Rock has a BS in Microbiology from New Mexico State University, and both an MS and PhD in Civil and Environmental Engineering from Arizona State University. She conducted post-doctoral research at the US Department of Agriculture, Agricultural Research Service.

Philip Schulz

Research Director, Institut Photovoltaique d'Ile de France (IPVF)

My area of research is at the interface between materials science, physical chemistry and condensed matter physics. I work on the development of novel and future PV technologies to overcome the limits of current technologies that are mainly based on single-junction crystalline silicon cells. We aim at making modules with higher power conversion efficiency, i.e. the fraction of absorbed light converted into electricity, to gain higher energy yields and thus enhance the economic feasibility and industrial fabrication of emerging PV technologies for agrivoltaic applications. The most promising photovoltaic designs in this regard are thin-film multijunction devices, also called tandem cells, based on perovskite solar cells as a low-cost alternative that is adapted for large-scale production. Not only does this novel technology yield higher efficiencies but it also opens up new avenues with semitransparent modules that for instance allow for partial shading in an agricultural context. This new PV technology is also based on abundant materials, but comes with greater chemical complexity than silicon. This has further ramifications on its possible application space, module reliability and long-term stability, all of which require significant efforts in basic research. Particularly the deployment in an environment with a significant amount of potentially corrosive specimen (fertilizer, herbicides, etc.) might require specific adaptation of the module composition and encapsulation.

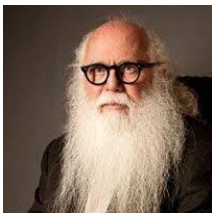
Expectations of the meeting and projects:

1) Gain general insights into the requirements of solar cells in agricultural environment. What type of physical adaptations are needed to efficiently integrate new technologies in agrivoltaics (transparency? Area covered? Flexible substrates?)
2) Understand limitations in the agrivoltaic application space. Do the modules need to sustain specific wear? Are further protective measures and specific encapsulation required?

Proposition for a joint PhD project focused on the adaptation of thin-film-based tandem technologies for agrivoltaic applications for the next-gen agrivoltaic devices at low TRL (1-5):

Approach: Advanced characterization of the interaction between typical environmental species in the agricultural space with the components of the novel device architecture and development of protective interlayers to maintain device functionality under these conditions and after accelerated ageing.

Production of samples and prototypes at IPVF and partner institutes. Joint advanced characterization at IPVF and at the UoA Chemistry, Physics and Materials Science departments (potential contacts: Oliver Monti, Erin Ratcliff, Neal Armstrong).



Howard-Yana Shapiro

Senior advisor for the Center for International Forestry Research, Rockefeller Foundation Fellow and previously Head Agriculturalist for Mars Corporation.

Howard-Yana Shapiro is a senior advisor for the Center for International Forestry Research – World Agroforestry (CIFOR-ICRAF) and its initiative Resilient Landscapes and a Senior Fellow in the Plant Sciences department at the University of California, Davis. He was previously Chief Agricultural Officer of Mars, Incorporated, and a former co-owner of Seeds of Change. At Mars, he encouraged the company's commitment to sustainable sourcing of its cocoa bean supply. Shapiro has been a Fulbright Scholar, Ford Foundation Fellow, and has won the National Endowment for the humanities Award. In 2007 he was awarded the Organic Leadership Award by the Organic Trade Association, and in 2009 he was honored with UC Davis' College of Agricultural and Environmental Sciences Award of Distinction. Shapiro was born in America in 1947 to Lithuanian and Russian parents. Brought up in New York, Shapiro was a conscientious objector during the Vietnam War. In the 1960s he worked with a number of African-American colleges in the South on earning accreditation. In 1995 Shapiro, his wife Nancy, and others took over Seeds of Change, an organic seed producer and supplier. The company was originally founded in 1989 by Gabriel Howearth and Kenny Ausubel; Shapiro became an investor in 1992 and the company's Director of Agriculture in 1995. Seeds of Change was sold to Mars Inc. in 1997, in part through its connection with Stephen M. Badger. Shapiro took on the role of Senior Scientist in plant science and agroforestry/agroecology for M&M, Mars. He went on to become Research Manager for plant science in 2000 and Global Director of Plant Science and External Research in 2005. Shapiro is Adjunct Professor in the College of Agriculture and Environmental Sciences at the University of California, Davis, and leads the Multi-Disciplinary Research Unit, a collaborative effort between Mars, UC Davis and The University of Nottingham. He also serves on the external advisory board of UC Davis' Agriculture Sustainability Institute. Shapiro has worked with Google X and other groups on a project to end human stunting through better nutrition worldwide, starting in Africa. Through partnerships between University of California, Davis; Mars, Incorporated; and others, he helped to establish the African Plant Breeding Academy in Nairobi in 2013.

Stephanie Slinski

Associate Director, Yuma Center of Excellence for Desert Agriculture

Stephanie Slinski is the Associate Director of Applied Research and Development at the Yuma Center of Excellence for Desert Agriculture, a public-private partnership between the desert agriculture industry and the University of Arizona. She has degrees in Plant and Soil Science, Microbiology, and a PhD in Plant Pathology. Dr. Slinski started her plant pathology career in a plant disease diagnostic clinic working with fungal, bacterial, viral, and nematode diseases of vegetables, herbs, and ornamental crops at the University of Massachusetts, Amherst. She continued her studies at the University of California working with the fungal pathogen of conifers, Fusarium circinatum. She received postdoctoral training at the Forestry and Agriculture Biotechnology Institute at the University of Pretoria in South Africa, before returning to working in the US with the Florida citrus industry. She currently works to develop projects and foster collaborations in support of the desert agriculture industry in the southwestern US.

My interest in Agrivoltaics: I have an interest in any technology that may have a role in the future of desert agriculture. I would like to learn more about people’s experiences with Agrivoltaics and plans for the future.

Catalina Stern

Director of UNAM Center for Mexican Studies, and previous Dean of Science UNAM

The National Autonomous University of Mexico takes as a mission to teach higher education courses to educate professionals, researchers, university professors, and technicians who will provide a useful service to society; to organize and to carry out research, primarily on the national conditions and problems, and to extend with generosity the benefits of culture to all sectors of the population. Its substantive functions are teaching, research, and dissemination of culture. Its organizational structure is divided into three sub-systems to achieve its task. These are: on the one hand, education, which includes undergraduate, master and doctoral programs; research, which is done in its schools, and in its institutes and centers of natural and exact sciences, and on the other hand, humanities and social sciences as well as cultural dissemination. The National Autonomous University of Mexico has two high schools: The National Preparatory School with nine facilities, and the Sciences and Humanities School with five facilities. High school in Mexico corresponds to prep school, and it is studied in three years after middle school and before the undergraduate degree. Undergraduate programs are taught in 29 schools and national schools located in Mexico City and its Metropolitan Area, and in some institutes, centers and units located in different states of Mexico. This infrastructure enables UNAM to offer 133 programs in all disciplines of human knowledge. UNAM has five Higher Education Schools, four in the State of Mexico and one in Mexico City, which were established in the seventies within the framework of an education decentralization project in order to benefit a larger number of students, introduce educational innovations, to impel inter-discipline and multi-discipline, to link research and teaching, to integrate theory and practice and to relate to its environment. Through the Open University and the Distance Education System, UNAM offers twenty-two undergraduate programs, one technical program, one distance high school, four doctoral and fourteen master programs, in twelve schools, two national schools, and one extension center in the University itself, as well as in the states of: Chiapas, Mexico, Guerrero, Oaxaca, Tabasco, and Tlaxcala. UNAM offers 41 postgraduate programs with 83 curricula for master and doctoral programs, with the advantage that these are jointly taught by diverse academic entities of the National University schools, institutes, and centers offering the students a major variety of expert tutors in different branches of the discipline of their choice. It also offers 30 programs in 167 specializations. The Coordination of Humanities encourages the development of humanistic disciplines and of social sciences disseminating the knowledge generated by the researchers of ten institutes. seven centers. three programs, and an academic unit outside Mexico City which constitute UNAM Subsystem of Humanities. Research in scientific areas is done in nineteen institutes; ten centers, and five programs gathered in the Coordination of the Scientific Research. The Coordination of Culture Dissemination is the area of UNAM in charge of fostering and disseminating culture and of managing the university extension activities. To achieve this, UNAM counts with the Cultural University Center, in University City, the Tlatelolco Cultural University Center, Radio UNAM, as well as with thirteen museums inside and outside of University City.

Bryan Willson

Executive Director, CSU Energy Institute, Professor, Department of Mechanical Engineering, Colorado State University

Dr. Bryan Willson is Executive Director of the Energy Institute at Colorado State University, holds the Presidential Chair of Energy Innovation, and serves as a Professor of Mechanical Engineering. He is the Founding Director of CSU's Engines & Energy Conversion Laboratory, it's Powerhouse Energy Campus, and is currently guiding the development of Powerhouse 2, focusing on decarbonization technology. Dr. Willson's linkages to biological systems include serving as co-founder, CTO and CSO for Solix Biofuels (algae biofuels & bioproducts company – now a nutritional products company), and founding member of the Soil Carbon Solutions Center at CSU, a joint initiative between the College of Agriculture, Dept. of Soil & Crop Sciences, and the Energy Institute. He is currently funding / involved in the design / development of a rhizotron controlled growth facility for the Soil Carbon Innovation Laboratory that will be built at Powerhouse 2. Powerhouse 2 will also include a rooftop Agrivoltaics test & evaluation facility. Dr. Willson served as a Program Director at ARPA-E (Advanced Research Projects Agency – Energy) from 2012-2016 and continued as an advisor to the agency from 2016-2019. As an entrepreneur, he has co-founded energy four companies: Envirofit International, Solix Biofuels, Factor(e) Ventures, and Xpower. He has helped other entrepreneurs launch numerous companies through the Energy Institute and through a DOE-funded energy incubator. His research laboratory, the Engines & Energy Conversion Laboratory, has made important contributions in many areas, including hydrogen energy systems, internal combustion engines, oil & gas production technology, advanced electrical grids, advanced biofuels, technology for the developing world, and advanced building technologies. Dr. Willson has worked in over 40 countries.

Researcher staff & Graduate students

Team Agrivoltaics – Greg Barron-Gafford's Team and Students

Kai Lepley

Ph.D. student in the School of Geography, Development and Environment

Kai Lepley is a Ph.D. student in the School of Geography, Development and Environment at the University of Arizona. He studies the ways land use is linked to global fluxes of carbon, water, and energy. His focus is on the intersections of renewable energy, agriculture, built environment, and natural ecosystems. He has led research on remote sensing and precision irrigation at the Biosphere 2 Agrivoltaic research site and has carried out studies of soil moisture distribution and plant ecophysiology at Jack's Solar Garden Agrivoltaic farm in Longmont, Colorado. His academic background in ecology, ecohydrology, and climate science complement real-world experiences managing a biofuels research facility and working in the residential and commercial photovoltaics industry. Kai has participated in and helped instruct international field courses and workshops around the world. He has presented paleoclimate and Agrivoltaics research at conferences around the world. And, he has been an invited speaker at events including South by Southwest, TENWEST, and TedX. He has recently debuted a new project, the Agrivoltaic Atlas, with an open invitation to contribute to this digital atlas of Agrivoltaic projects across the globe.

I am broadly interested in understanding the ways Agrivoltaic systems can help mitigate and adapt to climate change while providing sustainable access to food and energy with reduced water consumption. A long-term goal would be to integrate this data from across geographic locations and climates to quickly and accurately model potential benefits for any region or climate. I am interested in developing, leading, and participating in novel Agrivoltaic research projects, and I have a strong interest in communicating research findings to interested stakeholders. I hope that a strong international network of Agrivoltaic researchers and partners will inform a strategic applied research agenda that benefits a swift and intelligent adoption of Agrivoltaics.

Talitha Neesham McTiernan

Ph.D. student in the School of Geography, Development and Environment

As a first-year PhD student in Dr. Greg Barron-Gafford's lab, my research interests focus on Agrivoltaics and its impact on resilience building for various communities in the face of climate change. Currently, I am mapping elements and impacts of Agrivoltaics using spatial and participatory modeling. I am also exploring the effect of Agrivoltaics on the nutrient content of crops to better understand how this technology can impact those who depend on it.

Nesrine Rouini

Senior Research Specialist, School of Geography, Development and Environment

Nesrine is a research specialist and PhD student at the University of Arizona (UA). She works with Greg Barron-Gafford and leads research coordination for the UA Agrivoltaics team. At Biosphere2 and Jack's Solar Garden, she facilitates the deployment and maintenance of microclimate sensor networks and organizes crop physiology field campaigns. Nesrine's enthusiasm about studying Agrivoltaic systems stems from her concerns about the climate crisis and global food security. Her background in biology and plant ecology informs her research directions. She focuses on uncovering the eco-physiological mechanisms influencing crop responses to shade and water stress in novel Agrivoltaic conditions.

Iglobes interns Team

The IRL Iglobes -- Interdisciplinary and Global Environmental Studies -- is a CNRS international and interdisciplinary research laboratory and is designed to strengthen international cooperation between French and American researchers, in social, physical, and natural sciences. Essential to Iglobes' vision is its role in training the next generations of interdisciplinary global researchers at the interface of social and environmental sciences. At the core of Iglobes scientific agenda is the question of sustainable life and living in extreme environments, in the regional and historical context of arid lands and transboundary systems. Iglobes' mission is therefore to support research and training on major environmental issues by hosting French scientists "in residence" for long-term collaborative projects with UA researchers, as well as short-term visiting scholars and students.

Alice Agblekey

Consequences of environmental changes on human health and how they influence the perception of the environmental crisis and pro-environmental actions.

Sophie Guiraud

Desert plant traits and their relationship to each other. My goal is mostly to understand what strategies plants adopt to survive in an arid environment.

Gabriel Guyader

How does solar power generation fit into Arizona's electricity debates?

Alfred Monneret

Tucson: a citizen's energy transition in the spider's web of TEP.

Pauline Urbain

I am working on the impact of urbanization on snake communities at the Stone Canyon site.

Boris Wieczorek

Economics researcher, studying the role of social norms in pro-social and pro-environmental behaviors.

France-Arizona Institute for Global Grand Challenges

Thank you!