



## Botany 2019 Symposia

Plan to attend these chosen symposia - schedule to be determined at a later date

### Phylogenomic Perspectives on Reproductive Isolation and Introgression

Submitted by: Deren Eaton, Columbia University

A growing body of genomic evidence supports the long-standing hypothesis that hybridization among plant species is relatively common, and that genomic introgression has played a significant role in shaping plant evolution. As genome-scale data sets continue to grow, the opportunity to investigate the consequences of reproductive isolation or introgression at the scale of large multi-species clades is increasingly possible. This symposium will present research on cutting-edge statistical, bioinformatic, and comparative methods for inferring introgression and/or examining its effects at the phylogenetic scale. Such analyses open the door for investigating replicated patterns, and thus for investigating the consequences of reproductive interactions on shaping plant evolution and phylogenetic inference more generally.

#### Speakers:

- Deren Eaton, Columbia University,
- Patrick McKenzie, Columbia University, PhD Student
- Robin Hopkins, Harvard University, Assistant Professor
- James Pease, Wake Forest University, Assistant Professor
- Paul Blischak, University of Arizona, Postdoc.
- Anahi Espindola, University of Maryland, Assistant Professor

### Life Without Water: Evolution and Adaptation of Xeric Plants

Submitted by: Karolina Heyduk, Yale University

Deserts and drylands cover 40% of all land on the planet and are expected to increase in area in the coming century. At the same time, some unique desert floras adapted to cooler climates - such as the high deserts of the Colorado Plateau - are likely to face extinction as species fail to cope with warming temperatures. The natural biodiversity in these ecosystems is immense, owing largely to the ability of many plant species to survive in some of the harshest conditions. Desert plants have a multitude of ways in which they have adapted to xeric conditions, including the use of alternate photosynthetic pathways, strategies to either avoid or tolerate drought, anatomical traits, and life history traits that allow for their survival. The rich cultural importance of desert species across the globe has implications for their future value and conservation. Charismatic desert flora have attracted scientific endeavors for decades, and the emerging feasibility of next-generation sequencing in non-model systems has pushed research on desert species into the genomics era. In this symposium, we hope to highlight, broadly, the diverse ways researchers are tackling questions of desert flora evolution and conservation. We include researchers working to understand extant diversity with phylogenomics, as well as those thinking about future ecosystem restoration. We also highlight the integration of genomics with physiology, as well as the ethnobotanical history of desert species. Our invited speakers cover a range of career stages, diversity in gender, institution, and country, and will undoubtedly serve to reinvigorate future research into our desert floras

#### Speakers:

- Jennifer Wai, Michigan State University
- Luis Eguiarte, University, Universidad Autónoma Nacional;
- Erika Edwards, Yale University
- Lesley De Falco, USGS
- Nicholas Kooyers, University of Louisiana
- Alberto Burquez-Montijo, Universidad Autónoma Nacional Mexico UNAM Hermosillo

# The Potential of Machine Learning for Plant Biology

Submitted by: Pamela Soltis, University of Florida

Machine learning approaches are highly promising technologies to help address a range of scientific questions in plant science. For example, deep learning technologies have recently achieved impressive performance on a variety of predictive tasks, such as species identification, plant trait recognition, plant species distribution modeling, weed detection, and mercury damage to herbarium specimens. They are also being applied to questions of comparative genomics and gene expression and to conduct high-throughput phenotyping for agricultural and ecological research. Moreover, novel approaches are poised to revolutionize studies of plant phenology and functional traits through application to more than 22 million images of herbarium specimens now available at iDigBio ([www.idigbio.org](http://www.idigbio.org)) as well as other digital repositories. As an example, extensive attempts to use deep learning to tackle the difficult taxonomic task of identifying species in large collections of herbarium specimens showed that convolutional neural networks trained on thousands of digitized herbarium sheets are able to learn highly discriminative patterns. These results are very promising for extracting a broad range of accurate annotations in a fully automated way. For example, such approaches could also be used to identify plant phenophase (important for assessing the effects of climate change on plant growth and reproduction and for comparing plant responses with those of pollinators, migratory birds, and other species that rely on plants for food and/or nesting sites) or to extract other evolutionary or ecological traits, such as leaf shape and size, leaf margins, and flower color, to name a few. However, despite the promise of applying deep learning to herbarium specimen images to address a range of questions, this emerging field also raises challenging methodological questions about how to avoid any bias and misleading conclusions when analyzing the produced data. Indeed, as for any statistical learning method, convolutional neural networks are sensitive to bias issues, including the way in which the training datasets are built. Moreover, as good as the prediction might be on average, the quality of the produced annotations can be very heterogeneous from one sample to another, depending on various factors such as the morphology of the species, the storage conditions in which the specimen was preserved, the age of the specimen, etc. Given both the opportunities and challenges, additional research into this topic is needed to enable greater applicability to a broad range of scientific questions.

## Speakers:

- Alina Zare and Matthew Collins, University of Florida;
- Erick Mata-Montero, Instituto Tecnológico de Costa Rica;
- Pierre Bonnet et al., CIRAD, France;
- Brian Stucky and Rob Guralnick, Florida Museum of Natural History;
- Rebecca Dikow, Eric Schuettelpelz, Smithsonian Institution;
- Arti Singh, Iowa State University

# At the Intersection of Applied and Academic Botany: Fertile Ground for an Interdisciplinary Botanical Renaissance

Submitted by: Scott Schutte, Western Pennsylvania Conservancy

Members of the botanical science community have for years bemoaned the loss of “botanical capacity” that has been witnessed over the last few decades. Meanwhile, the gap between the academic and non-academic botanical research communities (i.e. the places where most existing capacity resides) remains wide. Although collaborations between non-academic and university-based research groups are relatively uncommon, this symposium will highlight some of the better current examples and provide evidence for the notion that partnerships such as these are integral to not only building capacity but also to answering important questions and conserving plant biodiversity. Our speakers will present models of research programs/questions that have benefited from academic/non-academic partnerships, including ways in which research outcomes have been applied to conservation challenges – as well as ways in which conservation needs have informed and driven larger research questions. In addition to learning how they might build similar collaborations, attendees (especially students and junior scientists) will be introduced to numerous career tracks outside of academia.

## Speakers:

- Scott Schuette, Natural Heritage Inventory Manager, Western Pennsylvania Conservancy
- Chris Martine, David Burpee Professor, Bucknell University
- Wesley Knapp, Mountains Ecologist, North Carolina Natural Heritage Program.
- Cheyenne Moore, Master’s Student, Bucknell University
- Marian Chau, Manager, Seed Conservation Laboratory, Lyon Arboretum, University of Hawaii
- Rebecca Barak, Smith Conservation Fellow, and Postdoc at Chicago Botanic Garden

# Wild Relatives and Land Races: the Sky Islands of Southwest North American Agriculture

Submitted by: Laura Klein, Saint Louis University

The southwest region of North America is home to a unique flora, with multiple habitats that span the lowlands of the Sonoran Desert to mountainous sky islands. These distinctive ecosystems are rich with biodiversity and have provided for people of the region for thousands of years. The southwest is a major thruway for the movement of crops, including beans, maize, sunflowers, and pumpkins, among others. Modern indigenous knowledge and research suggests that many crop wild relatives and landraces may still persist in the diverse environments of southwestern United States and Mexico. To advance conservation of these important species, attention is refocusing on protecting indigenous knowledge, descriptive biodiversity assessments, and managing biodiversity collections through seed saving and germplasm management. The goal of this symposium is to explore conservation deficiencies and efforts of crop wild relatives and landraces, from southwest regional to international perspectives. Representing germplasm conservation to ethnobotanical knowledge of Sonoran Desert researchers, we will examine what work is being done in the region and in the United States. We will begin by considering the value of crop wild relatives and landraces in the face of a growing human population and global climate change. Next, we will probe the North American landscape which is home to many crop wild relatives and landraces. Then we will zoom in to focus on conservation efforts to characterize and protect the charismatic crop wild relatives and landraces of the southwest region. Finally, we will synthesize the themes of this symposium in a panel discussion on these efforts.

## Confirmed Speaker:

- Dr. Tracy Kahn, Curator, Givaudan Citrus Variety Collection Endowed Chair; University of California - Riverside Citrus Variety Collection Riverside, CA

## Potential Speakers

- Professor Nigel Maxted, Senior Lecturer in Genetic Conservation; University of Birmingham School of Biosciences Birmingham, UK
- Dr. Stephanie Greene, Supervisory Plant Physiologist and the lead scientist of the Seed Preservation Program; USDA-ARS National Laboratory for Genetic Resources Preservation, Fort Collins, CO
- Dr. Joy Hought, Executive Director; Native Seeds/SEARCH Tucson, AZ
- Dr. Jeffrey Ross-Ibarra, Professor, Department of Plant Sciences, College of Agricultural and Environmental Sciences; University of California – Davis Davis, CA
- Dr. Shannon Fehlberg, Dorrance family foundation conservation biologist, Desert Botanical Garden Phoenix, AZ

# Green Land: Multiple Perspectives on Green Algal Evolution and the Earliest Land Plants

Submitted by: Richard McCourt, Academy of Natural Sciences

Evidence from fossils, cell-wall biochemistry, nuclear and organellar genomes, and transcriptomes have clarified the evolutionary history of the green algae that share a most recent common ancestor with the first plants to succeed on land. This symposium will bring together evidence from each of these fields to provide a comprehensive view of the invasion of land by aquatic ancestors, and insights into the morphological, physiological, and genomic features that made this possible. Green algae and plants are key players in an evolutionary story that produced the atmosphere and terrestrial ecosystems that we live in today.

## Potential Speakers:

- Paul Strother, Boston College.
- Martha Cook, Illinois State University, and David Domozych, Skidmore College
- Jim Leebens-Mack, University of Georgia
- Charles Delwiche
- Louise Lewis, University of Connecticut
- Kenneth G. Karol, New York Botanical Garden