

PENNSTATE



College of Agricultural Sciences

L.W. SCHATZ CENTER FOR TREE MOLECULAR GENETICS

ANNUAL REPORT

July, 2017 – June, 2018

Prepared August 23, 2018, by

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Gordon Schatz presenting an overview of the LW Schatz Demonstration Forest and Visitors Center to attendees of the Redwood Genome Workshop.

**L.W. SCHATZ CENTER FOR TREE MOLECULAR GENETICS
ANNUAL REPORT, 2017-2018**

For the past 15 years, The Louis W. Schatz Center for Tree Molecular Genetics at Penn State has been one of the world’s foremost forest genetics and genomics research centers, thanks to the generosity and foresight of Dr. Schatz’ endowment gifts, and the continued support and interest of the Schatz family. The endowment supports research projects, post-doctoral fellows, visiting scholars, undergraduate researchers, student field trips, and faculty travel. The Schatz Center Colloquium fund at the Mont Alto campus also continues to have a major impact forest genetics through sponsorship of meetings by researchers on important topics such as forest health. We are pleased to provide this update on activities and accomplishments in The Schatz Center for the past academic year.

UNIVERSITY PARK CAMPUS ENDOWMENTS

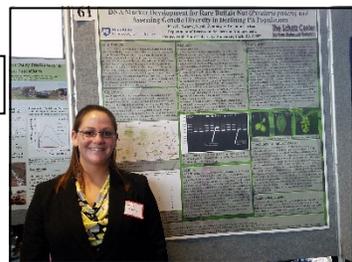
THE SCHATZ UNDERGRADUATE RESEARCH AWARD IN TREE GENETICS:

The Schatz Awards for Undergraduate Research provide students from various undergraduate programs across the university with opportunities to conduct research on molecular genetics with forest trees. In the 2017/18 academic year, two students in Animal Science and Arboriculture programs participated in research projects in the Schatz Center. Animal Science student Krystle Swartz continued assisting in our research on a part-basis after graduating at the end of 2017. She is now in a professional master’s program at Penn State. Maureen Mailander was awarded a College of Agricultural Sciences undergraduate research grant to conduct research on soil ‘microbiomes’. She presented a poster on her project at the College’s annual research day in March, 2018. Recipients of Schatz Awards for Undergraduate Research this past year were:

Krystle Swartz

Schatz Center period: September 2016 – July, 2018
Penn State Major: Animal Science
Graduation: December, 2017
Project: DNA markers to assess genetic diversity in buffalo nut.
Plans: Attending Masters in Biotechnology program at Penn State

Krystle



Maureen Mailander

Schatz Center period: March 2016 – present
Penn State Major: Arboriculture
Graduation: May, 2019
Projects: 1) Assisted with establishment of, and collection of data from, green ash genetics field trial; 2) Sequencing of soil DNA to determine microbial community composition; 3) Tissue culture regeneration of poplar plants and establishment of bioenergy field trial.
Plans: Graduate School, or employment in plant tissue culture field.

Maureen



THE SCHATZ VISITING SCHOLARS PROGRAM:

The Schatz Center continues to serve a very important role in hosting scholars and scientists from industry and academia around the world, for training and collaborative research through the Schatz Visiting Scholars Program. **During the 2017-18 academic year, The Schatz Visiting Scholar was Dr. Colleen McMichael** from the bioenergy R&D company LignoLink, Inc. Dr. McMichael worked with the Schatz Center director to establish a field trial of hybrid poplar plants expressing genes that enhance extraction of sugar from wood for more efficient production of lignocellulosic bioethanol. Dr. McMichael also tested protocols for establishing black walnut tissue cultures for use in developing and propagating walnut trees resistant to the devastating thousand-cankers disease. Dr. McMichael has returned to industry, as project leader for the start-up company PhylloZyme, which develops pharmaceuticals from plant enzymes.

The Schatz Visiting Scholars fund also supported part-time wages for The Schatz Center's lab manager Nicole Zembower. Ms. Zembower provided both administrative and research support to the Center's Director and to the Visiting Scholar, making arrangements for travel, housing, university appointments, safety training, inventory, ordering supplies, and research assistance. Ms. Zembower also managed the Schatz Center's extensive greenhouse and field trials, including transplanting of seedlings and endless vegetation management (mowing).

Dr. Albert Abbott, co-Director of the Forest Health Research and Education Center at The University of Kentucky, was also recruited as a **Schatz Visiting Scholar for 2017-18**. Dr. Abbott previously held the prestigious Robert and Lois Coker Endowed Chair in Molecular Genetics at Clemson University, as well as serving as department chair in Genetics there. Dr. Abbott served the entire year on a part-time basis, officially as a contracted consultant for The Schatz Center. This arrangement will continue for the 2018-19 academic year. Dr. Abbott and Schatz center Director Carlson, are forging new research collaborations, and a strong working relationship between The Schatz Center and the Forest Health Research and Education Center at the University of Kentucky, which Dr. Abbott co-directs. We have prepared research publications together, and three grant applications for cutting-edge hardwood genomics research projects were submitted together in 2017-18, to the National Science Foundation and the USDA.

For the 2018-2019 academic year, we have recruited Dr. Tatyana Zhebentyayeva to serve as an Associate Research Professor in The Schatz Center for Tree Molecular Genetics in the Department of Ecosystem Science and Management. We will also host a Fulbright Scholar, Dr. T. Dorothy Tchabda from the University of Maroua in Cameroon. Dr. Zhebentyayeva and Dr. Tchabda will both join The Schatz Center August 1, 2018. Dr. Zhebentyayeva previously served as a resource scientist in the Clemson University genomics Institute, and is an expert on tree genetics and genomics. Dr. Tchabda is establishing a tree improvement program for white acacia (*Faidherbia albida*). She will test DNA markers, conduct genetic diversity studies, and develop gene sequence databases for *Faidherbia albida* during her visit to The Schatz Center.

SCHATZ POST-DOCTORAL FELLOWSHIP IN TREE GENETICS:

Recruitment of a Schatz Post-Doctoral Fellow for the 2017-18 fiscal year was not successful, in part because the fellowship was reserved for hiring Ph.D. student Nathaniel Cannon after his graduation, which has not yet occurred. He continued as a PhD student during this fiscal year. The Schatz Post-Doctoral fellowship fund served an important role during the 2017-2018 year, however. All four of the Ph.D. students in The Schatz Center (Nathaniel Cannon, Di Wu, Wanyan Wang, and Casey Weathers) were partially supported while completing their dissertations. Wanyan Wang defended her thesis and graduated in May, 2018, with a Ph.D. in Plant Biology. Wanyan was immediately recruited by the R&D company Indigo Agriculture, in Boston. Di Wu defended her thesis and graduated in August, 2018 with a Ph.D. in Bioinformatics and Genomics. She is weighing job offers while submitting publications. Casey Weathers will defend his Ph.D. thesis in September, 2018. Nathaniel Cannon accepted an instructor position at Southern Utah University, starting August, 2018.

SCHATZ CENTER FACULTY TRAVEL FUND:

The Louis and Merry Schatz Faculty Travel Fund supported several trips in the 2017-2018 fiscal year by Dr. Carlson to participate in research meetings relevant to the Schatz Center goals. Attending such meetings is an important national and international outreach component of the Schatz Center. We inform the research community about results from the projects underway in the Schatz Center, we learn the latest research results and approaches from other forestry and molecular genetics groups, and we meet with colleagues to plan current and future projects.

For the 2017-18 fiscal year, Dr. Carlson will, as always, entertain requests for travel support from other faculty in the ESM department. In the event of no such requests Dr. Carlson will use the funds to attend the international Plant and Animal Genome Conference in San Diego in January, 2018, or other relevant meetings such as The American Chestnut Foundation meeting.

THE SCHATZ STUDENT FIELD TRIP FUND:

We enjoyed a wonderful trip to visit Gordon and Karen Schatz and The L.W. Schatz Demonstration Tree Farm again in 2018. Four undergraduate students and 3 faculty members participated in the trip. This field trip coincided with the 100th anniversary meeting of the Save The Redwoods League annual meeting in CA in 2018, which was co-sponsored by the Schatz Tree Genetics Colloquium fund, which is an endowment at the Mont Alto campus of Penn State University. Please refer to the attached annual report from Dr. Beth Brantley of the Mont Alto campus for additional information and for photos from the field trip and colloquium, please see the online photo albums <https://photos.app.goo.gl/seAUBzpbSYrhDveYA>.

THE LOUIS W. SCHATZ CENTER FOR TREE MOLECULAR GENETICS ENDOWMENT:

This new fund was created on May 24, 2018, by combining the endowments for three previously separate funds: the Schatz Undergraduate Research Award, the Schatz Visiting Scholars fund, and the Schatz Post-Doctoral Fellowship in Tree Genetics fund. The combination of these funds into a single endowment will provide greater flexibility and impact in the research and training objectives of the center. The endowment will still be oriented towards research conducted by students, visiting scientists, and post-doctoral fellows, accounting will be greatly simplified. This new fund is expected to have a combined total annual increment (yield) of app. \$180,000.

SCHATZ CENTER RESEARCH UPDATE FOR 2017-2018:

The Schatz Center endowments continue to support a wide variety of research projects ranging from preliminary projects that provide data for grant applications to one semester undergraduate research projects and PhD thesis dissertations projects. During the past year, The Schatz Center continued our research to complete assembly of the Chinese chestnut chromosomes, which will soon be published. We are working with The American Chestnut Foundation to integrate our genomic tools into the chestnut blight resistance breeding program. The American Chestnut Foundation also provided us with support to develop a reference genome sequence for an additional Chinese chestnut tree, the Mahogany cultivar, which has also played a major role as a source of disease resistance genes for American Chestnut restoration. Dr. Carlson is a participating faculty member in the grant “Graduate Training in the Exploration and Manipulation of Agricultural Microbiomes for Food Productivity, Quality, Safety, and Human Health (mBiome)” which was awarded September 1, 2017, to provide interdisciplinary graduate assistantships in the College of Agricultural Sciences. Dr. Carlson is advising on a new project “Case Study to Assess the Costs of the Appalachian Regional Reforestation Initiative’s (ARRI) Forest Reclamation Approach”, led by Michael Jacobson, in the Department of Ecosystem Science and Management, which started October 1, 2017. Dr. Carlson and students in The Schatz Center also completed 2 projects in December, 2017. The “Genetics and reproduction of buffalo nut (*Pyralia pubera*): Conservation implications for rare PA populations at the northern-most extent of the species range” project was funded by the Carnegie Museum of Natural History. The “Identification of genes and alleles for blight resistance in *Castanea* spp.” project was funded by a USDA National Institute of Food and Agriculture grant.

During the 2017-18 academic year, Dr. Carlson and Schatz Center members produced the following scientific papers, invited talks and conference posters:

Peer-reviewed publications:

1. Scully E., Geib SM, Mason CJ, Carlson JE, Tien M, Chen H-Y, Harding S, Tsai C-J, Hoover K. 2018. Host-plant induced changes in microbial community structure and midgut gene expression in an invasive polyphage (*Anoplophora glabripennis*)” Scientific Reports, 8(1), p.9620, 16 pages.
2. Harmon M, Lane T, Staton M, Coggeshall MV, Best T, Chen CC, Liang H, Zembower N, Drautz-Moses DI, Hwee YZ, Schuster SC, Schlarbaum SE, Carlson JE, and Gailing O. 2017. Development of novel genic microsatellite markers from transcriptome sequencing in sugar maple (*Acer saccharum* Marsh.). BMC Research Notes, 10(1), p.369.
3. Čalić I, Koch J, Carey D, Addo-Quaye C, Carlson JE, Neale DB, 2017. Genome-wide association study identifies a major gene for beech bark disease resistance in American beech (*Fagus grandifolia* Ehrh.). BMC genomics, 18(1), p.547.

Books, Book Chapters

Pereira-Lorenzo, S., Costa, R., Anagnostakis, S., Serdar, U., Yamamoto, T., Saito, T., Ramos-Cabrer, A.M., Ling, Q, Barreneche, T, Robin, C., Botta, R., Contessa, C., Conedera, M., Martín, L.M., Martín, A., Laranjo, J., Villani, F., Carlson, J.E. 2016. Chapter 15 - Interspecific hybridization of chestnut. In: Polyploidy and Hybridisation for Crop Improvement. Published May 15, 2016 by CRC Press, 440 Pages.

Conference Proceedings

Konar, A., Choudury, O., Gailing, O., Coggeshall, M.V., Staton, M.E., Emrich, S., Carlson, J.E. and Romero-Severson, J., 2016. A genetic map for the Lobatae. International Oaks, 27, pp.181-189.

Abstracts for Posters and Presentations at Research Conferences

- Wanyan Wang, John E. Carlson, Eric S. Fabio, Lawrence B. Smart, 2018, Plant-Microbe Communication in the Shrub Willow Rhizosphere: Microbiome Structure, Function and Crop Yield, Plant and Animal Genome XXVI Conference, San Diego, CA, Phytobiome workshop, Jan. 17, 2018.
- Di Wu, Jennifer Koch, Mark V. Coggeshall, Nicole Zembower, John E. Carlson, 2018, A genetic linkage map for *Fraxinus pennsylvanica* and synteny analysis with Asterid and Rosid species, Plant and Animal Genome XXVI Conference, San Diego, CA, Jan. 13-17, 2018, poster abstract.
- Carlson, JE, Staton, ME; Addo-Quaye, C; Cannon, N; Tomsho, LP; Ficklin, S, Saski, C, Zhebentyayeva, T, Burhans, R, Drautz, D, Islam-Faridi, N, Wagner, TK, Zembower, N, Schuster, SC, Abbott, AG, Westbrook, J, Georgi, L, Holliday, J, Dana, NC, Hebard, FV, 2017, The Chinese Chestnut Genome Project, IUFRO Genomics and Genetics of Fagaceae Conference, Shanghai Botanic Gardens, Shanghai, China, Nov. 1 – 3, 2017.
- Wanyan Wang, Craig Carlson, Eric S. Fabio, Larry Smart, and John Carlson, 2017, Genotype-by-Environment Interactions: Insect Herbivore – Shrub Willow Genotype Interactomes, and Soil Microbe Community – Shrub Willow Genotype Interactomes, Mid-Atlantic Bioenergy Expo, Sept. 14, 2017.
- T. Casey Weathers, Dave Kazyak, Matt Kulp, John Carlson, and Steve Moore, 2017, Brook Trout (*Salvelinus fontinalis*) Retain Similar Phenotypes Despite Isolation and Neutral Genetic Drift, 2017 Wild Trout Symposium, West Yellowstone, MT, Sept. 26-29, 2017.



PennState
Mont Alto

SCHATZ ENDOWMENTS AT PENN STATE MONT ALTO
ANNUAL REPORT
July 2017 – June 2018

Prepared August 12, 2018, by
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SCHATZ
TREE GENETICS
COLLOQUIUM

SCHATZ ENDOWMENTS AT PENN STATE MONT ALTO ANNUAL REPORT, AUGUST 12, 2018

Penn State Mont Alto is privileged to have the gifts of Dr. Louis W. Schatz, enhancing educational opportunities, undergraduate research, student and faculty travel, and program development. The Schatz Tree Genetics Colloquium endowment enables genetics researchers to meet and share their knowledge.

We continue to manage these funds consistent with the wishes of the donor. Endowment guidelines were significantly revised in August 2017 to meet the changing needs of the Forest Technology academic program, faculty and students at Penn State Mont Alto. This report highlights uses of these endowments for the 2017-18 fiscal year.

MONT ALTO CAMPUS ENDOWMENTS

09-048-03MA 19400 Schatz Tree Genetics Colloquium

“The purpose of this fund shall primarily be to provide for colloquia for tree genetics researchers and practitioners from around the world to review the state of the science in advanced tree genetics, propose the most promising avenues of future research, and consider joint research programs and agendas for funding by industrial, government and private sources.”

Fiscal year 2017-18 was busy for the Schatz Tree Genetics Colloquium fund. We co-sponsored the Save The Redwoods League annual meeting in September 2017 and hosted the 2018 Schatz Tree Genetics Colloquium with the Save The Redwoods League in June 2018 in Eureka, CA. This enabled Gordon and Karen Schatz to attend and participate in a Colloquium. This was a wonderful opportunity for all attendees, including four Penn State University students who attended; two from Mont Alto and two from University Park. Funds for student travel to this event were covered through Dr. John Carlson’s Schatz endowments at University Park. We continue to provide funding for research projects, travel, supplies and salary support related to colloquia, for example, the upcoming (September 2018) NE-1333 (multi-state research project) meeting featuring chestnut researchers hosted by Dr. Carlson at University Park.

The 2018 Schatz Tree Genetics Colloquium in northern California brought together international tree genetics researchers and practitioners for an opportunity to share cutting-edge advancements and to see genetics in action on the landscape. Participants visited the L.W. Schatz Demonstration Tree Farm (Humboldt State University) and were hosted by Gordon Schatz as part of the Colloquium.



Gordon Schatz (left and center images) leading the tour of the Schatz Demonstration Tree Farm and a National Park Service employee (right image) presenting applied genetics in the Redwood National Park.

We are co-sponsoring The American Chestnut Foundation annual meeting in October 2018, and will host the 2019 Schatz Tree Genetics Colloquium with The American Chestnut Foundation in October 2019 in Gettysburg, PA.

Colloquia are typically held every other year, but the timing and location of The American Chestnut Foundation meeting in 2019 is appropriate for our involvement. Partnering with organizations such as the Save The Redwoods League and The American Chestnut Foundation has proved the most cost-effective way to remain consistent with endowment guidelines and to increase exposure to multi-partner genetics research.

09-048-04MA 19400 Schatz Program Support Fund for Forestry

“The purpose of this fund shall be to enrich Penn State Mont Alto by providing monies to support the Forestry/Forest Technology programs, or successor programs.”

We paid off the Forest Technology program bus in December 2017. Forest Technology has an aging fleet of heavy equipment that requires replacement in the 2018-19 fiscal year. We rely on this fund to keep our program current and to purchase new equipment.

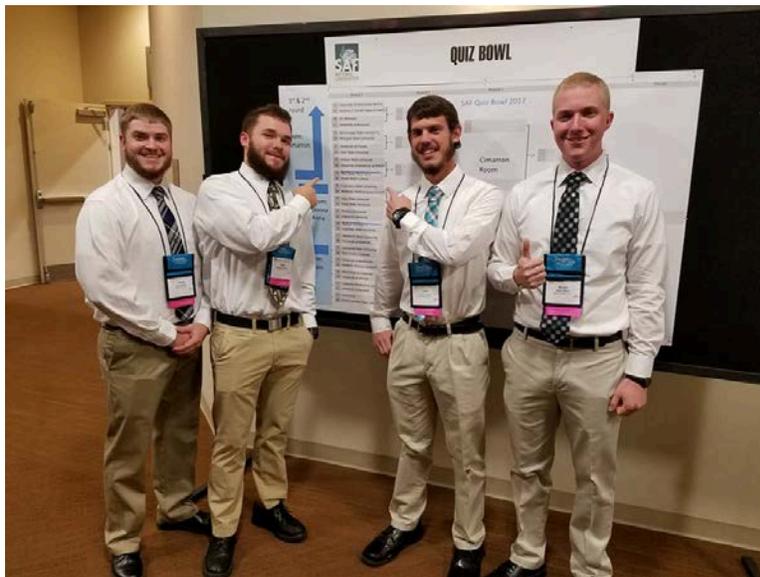


09-048-27MA 19400 Louis W. Schatz Fund for Forestry

“First preference should be given to fund student and faculty travel when it is used to engage Forestry/Forest Technology students at both Penn State Mont Alto and Humboldt State University.”

This fund is spent on student travel (registration, airfare, group meals, lodging, and related costs) to attend the Society of American Foresters (SAF) National Convention.

Beth Brantley and Peter Linehan took four students to participate on a quiz bowl team and attend educational sessions of the Convention in Albuquerque, NM in November 2017. This provides an opportunity for Penn State Mont Alto students to interact with students from Humboldt State University; whom they meet at the quiz bowl and at additional student-focused events. We will take four students to the SAF National Convention in Portland, OR in October 2018.



09-171-74 MA 1904/1940 SCHATZ PROGRAM SUPPORT FUND FOR RESEARCH IN TREE GENETICS AT PENN STATE MONT ALTO

“The purpose of this fund shall be to enrich Penn State Mont Alto by providing monies to support student research in the forestry, forest technology programs, or related or successor programs.”

The guidelines of this fund were significantly changed to accommodate program needs for supporting research endeavors. Previously, this fund was restricted to student research awards. In 2017-18, the following students participated in undergraduate research projects with awards from this fund. The research projects culminated in oral or poster presentations at the annual Mont Alto Academic Festival in April 2018.

Fall 2017

Dylan Black, Levi Negley: Influence of genetics, pathogens and site on sugar maple (*Acer saccharum*) health and fall coloration

Garrett Hamilton, Christopher Neuffer: Evaluating a genetically diverse American chestnut orchard for education and research

Levi Canon, Nicholas Malone: Pear trellis rust, research plot expansion, and phenology of cultivars in the Bartlett Landscape Tree Research Plot at Penn State Mont Alto

Derrick Wenrick, Brady Williams: Soil temperature and mulch research plot

Lydia Blinn, Alexa Rudisill, Karl Sowders: Monitoring barred owl behavior and improving aviary design

Allison Wilson, Brooke Wilson: Phenology of cultivars in the Bartlett Landscape Tree Research Plot at Penn State Mont Alto

Spring 2018

Levi Canon: Pear trellis rust, research plot expansion, and phenology of cultivars in the Bartlett Landscape Tree Research Plot at Penn State Mont Alto

Karl Sowders, Shaina Walker: Phenology of cultivars in the Bartlett Landscape Tree Research Plot at Penn State Mont Alto

Derrick Wenrick, Brady Williams: Soil temperature and mulch research plot

We will continue to provide undergraduate research awards from this fund and are in the process of creating a facility using this endowment to further support research on campus.