

Spring 2021 Newsletter

Department of Plant and Environmental Sciences | <https://aces.nmsu.edu/academics/pes/>



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Introduction

Welcome to the Plant and Environmental Sciences Newsletter for spring 2021. While the department has adapted nicely to operating in the pandemic environment, I look forward to the day when we will be back face to face.

In this issue, you will notice that the department meets the contemporary instructional needs of our students and provides training opportunities that are relevant to New Mexico. This is fully evident based on one of the articles in this newsletter that details how our students gain hands-on experience in growing hemp. As the hemp industry in New Mexico expands, these students will be poised to take advantage of employment opportunities in the hemp industry.

Plant and Environmental Sciences has a long history of earth science and space science-related research. On the earth science front, which is the study of planet Earth from space, read about the commentary of two of our researchers who hope to map every tree on earth using satellites. This commentary appeared in *Nature* - one of most cited journals in the scientific world. On the space science front, a team of faculty, graduate and undergraduate students from the departments of Plant and Environmental Sciences and Biology are competing in the NASA Plant The Moon Challenge. The team is investigating how plants can grow in a simulated lunar highlands growing substrate. Read about this fascinating project on Page 5.

For evidence that our students continue to excel at the local level and at the national level, please see pages 6-8. I am appreciative of the hard work of our faculty mentors who work alongside our students. Finally, many of our students have completed their ScholarDollar Scholarship applications. I thank our donors for the continued support of departmental scholarships. Your contributions are truly making a difference in the lives of our students.



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"Sources and Rates of Groundwater Recharge in Mesilla Basin Aquifer New Mexico, USA"

This paper, recently published in Water Resources Research, tests the hypothesis that MFR (Mountain-front recharge) components can be distinguished in long-screened, basin-fill production wells by (1) groundwater age and (2) the median elevation of recharge.

Katherine H. Markovich, Laura E. Condon, Kenneth C. Carroll, Roland Purtschert, and Jennifer C. McIntosh developed an MFR characterization approach by combining age

distributions in six wells using tritium, krypton-85, argon-39, and radiocarbon, and median recharge elevations from noble gas thermometry combined with numerical experiments to determine recharge temperature lapse rates using flow and energy transport modeling. They found that groundwater age distributions provided valuable information for characterizing the dominant flow system behavior captured by the basin-fill production wells.

Tracers indicated the presence of old (i.e., no detectable tritium) water in a well completed in weathered bedrock located close to the mountain front. Two production wells exhibited age distributions of binary mixing between modern and a small fraction of old water, whereas the remaining wells captured predominantly modern flow paths...

To read on, go to:
agupubs.onlinelibrary.wiley.com/doi/10.1029/2020WR027743



Tucson, Ariz., seen here with the Santa Catalina Mountains in the background, is one of many large urban areas dependent upon groundwater, a limited resource that must be carefully managed to ensure adequate supplies as the climate changes. Credit: JohnDiebolt/commons.wikimedia.org/wiki/File:View_of_Tucson_from_Sentinel_Peak.jpg

Agriculture Science Center at Clovis:

Did you know that in the USA, New Mexico is known for producing the Valencia type specialty peanuts? Valencia peanuts have 3-4 seeded pods, red skin, sweet taste, and good flavor. Plant and Environmental Sciences has three faculty at the Agricultural Sciences Center at Clovis, and one of them, Dr. Naveen Puppala, is engaged in the development of Valencia peanuts. NuMex-01, NuMex-308, and NuMex-310, which are peanut cultivars developed at Clovis, account for 90 percent of the peanuts grown

in the state today. A new high oleic peanut cultivar, namely NuMex-01, released in 2014, gained popularity among the growers due to high yield and extended shelf life. New Mexico's peanut production is valued at nearly \$5 million annually. In 2020, advanced cultivars release by NMSU, the peanut breeding program accounted for 70% of the total seed acreage cultivated in New Mexico and West Texas regions.

A New Model for Salt Tolerance in Tomatoes

Manoj Shulka and Hui Yang investigated the limits of salt tolerance in an important horticultural crop: tomatoes. Their research was published in a recent Vadose Zone Journal special section, "Transdisciplinary Contributions to Soil Physical Hydrology." They tested tomato yield and evapotranspiration in the greenhouse under irrigation with water of varying salinity and created a new, simplified model for predicting when salinity will negatively impact tomato growth..."

"The water content of the tomato fruit is as high as 93 to 95%" Yang says. "When the plant is under saline conditions, the first thing it decreases is the water content of the fruit." With a model hinged on only three parameters—water salinity, evapotranspiration, and yield—the researchers created a system that can work for many different crops, giving farmers and irrigation engineers insights into how much salinity they can use for irrigation before it will negatively impact their crops.

For more info, go to:
acsess.onlinelibrary.wiley.com/doi/10.1002/csan.20385



Dr. Dale Rucker Noted in a New York Times Article:

Possible Second Breach at Florida Reservoir Is Investigated and Ruled Out

Officials in Florida on Monday investigated and ruled out the possibility of a second breach in a leaking reservoir south of Tampa that was holding nearly 300 million gallons of wastewater.

Dale Rucker, chief technical officer for hydroGEOPHYSICS Inc., a company in Tucson, Ariz., that offers geophysical services to the environmental, engineering, mining and oil and gas industries, said Florida officials were facing extraordinary circumstances.

Dr. Rucker said it was possible that the reservoir might not be heavily contaminated, noting that

he had read reports that ducks and fish had been spotted in it. Still, Dr. Rucker said he hoped the water was being discharged into multiple bodies of water, so that not just one would be overloaded with nutrients that could be harmful to fish and plants.

As climate change brings more intense rains, Dr. Rucker said, consideration must be made for how such reservoirs are designed.

"If they're decades old," Dr. Rucker said, "the climate assessment and the risk is different now than it was then."

To read on, go to: www.nytimes.com/2021/04/05/us/florida-leak.html



The former Piney Point phosphate mine in Florida, where an infrared drone found signs of a possible second breach at one of its reservoirs. *Tiffany Tompkins/The Bradenton Herald, via Associated Press*

PES Faculty and Learning Games lab to produce Award-Winning Interactive Soil Water Learning Tool

The Association for Communications Excellence awarded the Bronze medal in Graphic Design for Illustration to NMSU's design and production team in the Department of Innovative Media Research and Extension. **Drs. KC Carroll and April Ulery** worked with the NMSU Learning Games Lab to create this interactive, online-learning tool focused on unsaturated soil-water relationships: (1).

Students often struggle with soil water potential concepts and have a hard time visualizing soil water movement and storage in unsaturated soils. But understanding the relationships between water pressure, content, and movement and how they relate to soil texture is important in both agriculture and environmental science.

The two computer tools include an interactive activity focused on matric potential: (2), and another one focused on water flow and pressure: (3).

The plots show soil-water pressure, water content, and hydraulic conductivity in three soil textures or types. The data points on the graph can be selected, which alters the conditions in the soils, showing how this relates to the water table and plant growth. Comparison between soil type is completed by clicking and switching the soil-texture arrows.

Posting interactive activities online at (4) and across the internet increases inclusion and access to educational tools supports online learning during this pandemic. Using computer graphical design is a great way to helping students visualize soil water concepts and keep them engaged in learning.

- [1. scienceofsoil.com/water-in-soils/index.html](http://scienceofsoil.com/water-in-soils/index.html)
- [2. scienceofsoil.com/water-in-soils/matric-potential/index.html](http://scienceofsoil.com/water-in-soils/matric-potential/index.html)
- [3. scienceofsoil.com/water-in-soils/flow-pressure/index.html](http://scienceofsoil.com/water-in-soils/flow-pressure/index.html)
- [4. scienceofsoil.com/](http://scienceofsoil.com/)

MOVEMENT & STORAGE OF WATER IN SOILS

Select one of the following interactive graphs to proceed.

Matriic POTENTIAL [Interactive Graphs >](#)

Flow & PRESSURE [Interactive Graphs >](#)

[Glossary](#) [Credits](#)

WATER IN SOILS Matriic POTENTIAL

Choose a soil type to get started:

Clay Soil

Loam Soil

Sand Soil

Screen Reader Instructions

If you are using a screen reader, clicking a starting soil button will launch the game itself and give it focus. Once it has focus, you can play the rest of the game using simple arrow keys, the space bar, and a few common keyboard commands. If you leave the game's focus, you may need to reload the page to continue playing.

At any time in the game, you may press 'H' for help, or you may press 'S' to summarize the current state of the game and the choice that is in front of you.

For instance, if you are being offered a choice, pressing 'H' will tell you to use the arrow keys to select items and space bar to confirm your choice. Pressing 'S' will re-speak the choice you are being offered.

Science of Agriculture

Short animations, interactives and videos teach math & science concepts crucial to the study of agriculture.

NMSU Students Grow, Study Hemp Cultivars on Campus:

Students in Geno Picchioni's upper-division greenhouse management class (HORT 488) grew hemp cultivars in a supervised classroom setting as part of a research project last fall.

"We intended to grow hemp vegetatively, not to grow flower buds for the medicinal part," he said. "Our main objective in the long-term is to evaluate salt tolerance because we're becoming more reliant on impaired water sources."

For the project, a group of five undergraduate students evaluated two hemp cultivars – "Cherry Blossom" and "Sweetened" – grown under two different nitrogen rates, 100 ppm and 200 ppm, using a commercial hydroponic water-soluble fertilizer.



Joshua Rich, president of Rich Global Hemp Corporation in Las Cruces, supplied the seeds.

To read on, go to:

news.nmsu.edu/2021/04/nmsu-students-grow-study-hemp-cultivars-on-campus.html



PES Student's Field Project at the Rio Grande:

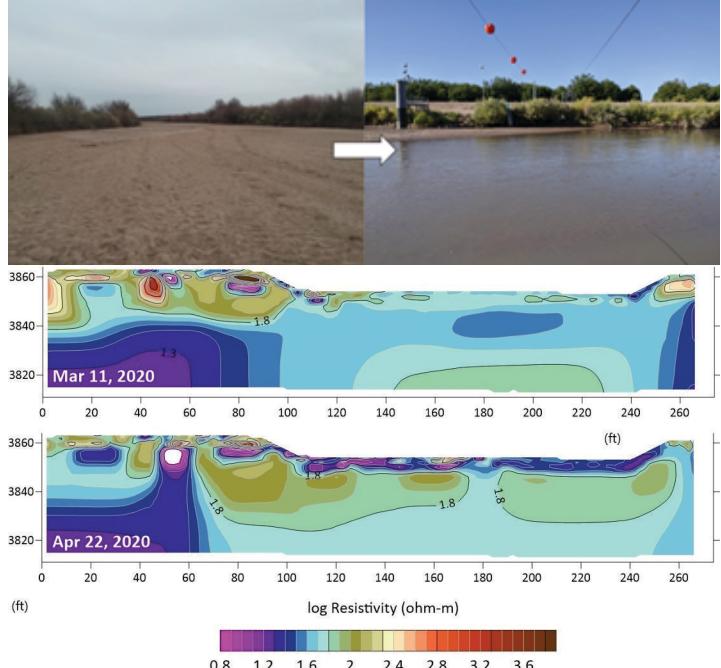


PES alumna and continuing graduate student, Autumn Pearson, has been using electrical resistivity mapping to research a cross section of the lower Rio Grande for her MS in Water Science & Management. This is an effective geophysical method of relating the resistivity of an electrical current injected into the subsurface, to other variables such as water saturation and salinity.

From two snapshots of the field as shown, one before the release of water and one after, you can map the location of the water table

from those captured changes in site resistivity.

Flow at this field site below Mesilla Dam is controlled by manual release, so interesting river dynamics from losing to gaining, disconnected to connected, and back- can be studied through time- and verified with nearby groundwater table monitoring well data. Better understanding of these river-groundwater interactions could support more sustainable water use.



Garden Club of America Awards Maria Alvarez Zavala for her Prickly Pear Research:

Maria Alvarez Zavala, master's student in Horticulture, received the Garden Club of America Montine M. Freeman Scholarship in Native Plants. The scholarship was established in 2017 and "encourages the understanding, development and use of underutilized native plants". Maria's love of plants, chemistry, sustainable farming, and food safety, led her to develop a prickly pear (*Opuntiaspp.*) project. Her research encompasses three objectives: 1) measure

medicinal compounds in prickly pear fruit from two cultivars "RojoPelon" and "BlancaCristalina"; 2) determine the amount of glyphosate residue remaining on the edible prickly pear pads after drift from a simulated herbicide application incident; and 3) simulate a human digestion of glyphosate-containing herbicide to measure bioavailability of the herbicide in the human gut. No known research has been done on this topic with herbicides and this could provide new knowledge to

existing cultivation practices. The scholarship provides \$3,000 for research supplies. Maria will be using the funds to purchase analytical solvents and sample prep consumables required to detect glyphosate and glyphosate breakdown compounds in her samples. Congratulations Maria for this exciting work on a native and sustainable crop for the southwest!

For more information, go to: www.gcamerica.org/scholarships/details/s/gca-montine-m-freeman-scholarship-in-native-plant-studies



Plant the Moon Challenge:

The "Plant the Moon Challenge" is a global science experiment, learning activity and inspirational project-based-learning challenge to see who can grow the best crops using lunar regolith simulant.

NASA began a 10-week international competition to see how plants could grow in a lunar highlands simulant. This competition was created looking forward towards future lunar explorations where astronauts could have a long term, self-sufficient, and sustainable food source.

Our NMSU team included:

Advisors:

- Pietrasik, Ulery, Romero-Olivares

Team Leaders (graduate students):

- Jessica Mikenas, Mikaela Hoellrich



Undergraduate Team:

- Daniela Palacios, Jessica Bennett, Sandy Arce, Nicholas Luke, Maya Gabitzsch, Taylor Watson, Christy Vasquez

The crops included:

- Green onions, Anasazi beans, and Lion's mane mushrooms

PES Staff's Commentary in Nature Article:

Our PES professors, Dr. Niall Hanan, and Dr. Julius Anchang published a commentary in Nature's article, "Satellites could soon map every tree on Earth."

An analysis of satellite images has pinpointed individual tree canopies over a large area of West Africa. The data suggest that it will soon be possible, with certain limitations, to map the location and size of every tree worldwide.

The authors analyzed more than 11,000 images, at a spatial resolution of 0.5 m, to identify individual trees and

shrubs with canopy diameters of 2m or more. The authors completed this giant task using artificial intelligence — exploiting a computational approach that involves what are called fully convolutional neural networks. This deep-learning method is designed to recognize objects (in this case, tree canopies) on the basis of their characteristic shapes and colours within a larger image.

For more information, go to: www.nature.com/articles/d41586-020-02830-3



Dr. Niall Hanan, pictured in Mali, West Africa.

Dr. Julius Anchang

Christina Perez wins the American Society for Horticultural Science (ASHS) Scholars' Award:

Undergraduate Horticulture major, Christina Perez has been selected as one of the two 2021 recipients of the ASHS Scholars' Scholarship Award by the American Society for Horticultural Science (ASHS).

As an award recipient, Christina will be honored with a poster announcement that is displayed at the ASHS Annual Conference in Denver, Colorado. In the fall, Christina will begin her PhD at the University of Minnesota.



NMSU Model U.N. Team Receives Highest Honors at Virtual National Conference:

The New Mexico State University Model United Nations team took home top honors from the virtual 2021 National Model U.N. Conference, continuing a strong track record of achievement since the 1990s. Last year's conference was unexpectedly cancelled due to the coronavirus pandemic.

NMSU's Model U.N. team earned the title Outstanding Delegation at the conference, which ran virtually from April 5-8. In receiving the Outstanding Delegation designation, the NMSU Model U.N. team achieved the highest recognition awarded at the conference. NMSU represented the United States during the mock summit, which focused on several major issues, including the establishment of a nuclear-free Middle East.

For more information, visit: news.nmsu.edu/2021/04/nmsu-model-u.n.-team-receives-highest-honors-at-virtual-national-conference.html



The NMSU Model United Nations Team members participated in the virtual 2021 national conference. Team members include (from left back row) Giovanni Cisneros (PES Student), Omar Ortega, Jay Hernandez, James Madrid, Rakim Stokes and Cole Vetter. From left front row, Jasmine Recinos, Iliana Viscarra, Citlali Benitez, and Neil Harvey, Model U.N. faculty adviser. (Courtesy photo)

Biosymposium Awards:

Each year, through the feedback and efforts of our volunteer judges, the Biosymposium committee selects top entries and honorable mentions for oral and poster presentations at both the undergraduate and graduate levels. Please join us in congratulating this year's top selections that came from many exemplary presentations.

Top Oral Presentations



Undergraduate entry: **Brett Moehn** (left) (Should It Stay or Should It Go: Fixation Versus Reversion of Acquired Drug-Resistance Mutations in Dengue Virus)



Graduate entry: **Eduardo Hernández-Acosta** (right) (Some Like It Hot: How Urban Microclimate Across a Tropical City Impacts *Aedes* Mosquitoes Life History)



Undergraduate entry: **Kyle Helms** (left) (Elucidating the Function of the Gene CG46385 During *Drosophila melanogaster* Eye Development)

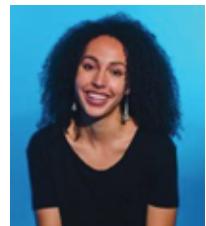


Graduate entry: **Mikaela Hoellrich** (right) (Biocrust Carbon Flux under Timed Light Incubation)

Honorable Mentions:



Undergraduate poster: **Valeria Perez** (left) (Effects of Sexual Dimorphism on the Capture Rate of Introduced Rosy-Faced Lovebirds, *Agapornis roseicollis*)



Graduate talk: **Savannah Meadors** (right) (Dryland Seed Mixes with Increased Functional Diversity Show Influence of Species-Level Competitive Interactions)

Additional Awards:

2020-2021 Plant and Environmental Sciences

Outstanding Teaching Assistant:

Michael Whiting was selected as the Outstanding Teaching Assistant for 2020-2021 academic year. Michael served as the lead teaching assistant for soils. Congratulations Michael!

2020-2021 Plant and Environmental Sciences

Outstanding Graduate Student Paper:

Vesh Thapa's paper titled 'Cover crop biomass and species composition affect soil microbial community structure and enzyme activities in semiarid cropping systems' was awarded the Outstanding Graduate Student Paper for 2020-2021 academic year. The paper appeared in Applied Soil Ecology. Congratulations Vesh!



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ASHS Collegiate Scholar Award Winners:

The following students were recently nominated and selected by the horticulture faculty at NMSU for the Collegiate Scholar Award given by the American Society for Horticultural Sciences (ASHS). The award recognizes the top 15% of the junior and senior horticultural classes at various institutions around the U.S., including NMSU. The award criteria include excellence in academic achievements, and involvement in extracurricular affairs.



Fausto Baranzini Rogel



Christina Perez



Skyler Stinson



Tyra Trumble

Other winners include Amelia Crossley (not pictured) and Stacy Oporto (not pictured).

The award recognizes the top 15% of the junior and senior horticultural classes at various institutions around the U.S., including NMSU. The award criteria include excellence in academic achievements, and involvement in extracurricular affairs. ASHS is the flagship organization for horticultural research, education, and extension nationally, and has a strong international reach.

For more information on the winners, go to: ashs.org/page/CollegiateScholarsAwardWinners

For more details on the award, go to: ashs.org/page/CollegiateScholars

2021 ASHS Outstanding Undergraduate Horticulture Student:



The horticulture faculty headed by Drs. Cramer and Guzman nominated **Adam Hopper** for the 2021 American Society for Horticultural Science (ASHS) Outstanding Undergraduate Horticulture Student Award. Each university around the country having a horticulture academic program may nominate their top horticulture student, including NMSU. Adam was recognized in the ASHS news along with numerous other outstanding horticulture undergraduates.

For more information, go to: ashs.org/page/OutstandingUndGraStu

2021 ASHS Outstanding Graduate Horticulture Student:



Subhankar Mandal was chosen as one of the 2021 ASHS Outstanding Graduate Horticulture students. Doctoral students are selected on the basis of academic achievements, quality of the dissertation research, leadership abilities, participation in departmental or program activities, and service to their departments. Congratulations Subhankar!

The College of Agricultural, Consumer and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research, and Extension programs. New Mexico State University is an equal opportunity/affirmative action employer and educator. NMSU and the U.S. Department of Agriculture cooperating.