Annual Report
Fiscal Year
2014-2015
Special CSU Facilities Edition
Over 250 CSU faculty and staff members are involved in water-related projects throughout the CSU system. A list of faculty and staff is available at http://www.calstate.edu/water/staff.shtml.
Introduction and Program Overview

Established July 1, 2008 under the leadership of Chancellor Charles B. Reed, the California State University (CSU) has identified the Water Resources and Policy Initiatives as an opportunity to leverage CSU’s system-wide academic excellence into an important resource for addressing the complex issues about water confronting California today and in its future. We are pleased that Chancellor White has expressed his continued support for the WRPI.

Many other states and countries look to California and the CSU system for leadership in developing and executing solutions for sustainable water resource management. CSU’s academic centers are recognized worldwide for contributing to next-generation policies, science and technology, and complex environmental, social, and economic solutions.

As the largest and most diverse university system in the country, the CSU system is uniquely qualified to provide practical leadership in helping to solve immediate and long-term water management issues facing California:

- The CSU has hundreds of scientists and technicians on 23 campuses that feature almost 450,000 students and 47,000 faculty and staff.
- A system-wide multidisciplinary academic program can serve as a platform for applying CSU and its resources to important sustainable water practices and policy initiatives.
- These resources can provide education, training, and expertise to individuals already in or wanting to pursue diverse careers in the water industry.

Vision, Mission, and Key Goals

**Vision**

The Water Resources and Policy Initiatives (WRPI) will help achieve a long-term, sustainable water supply for California through education, research, and policy development while balancing the needs of urban, agricultural, and environmental concerns.

**Mission**

The Water Resources and Policy Initiatives will link the capabilities and resources within the 23 California State University campuses to provide academic preparation, applied research, and policy development that addresses all aspects of water use. WRPI optimizes and links the many centers and programs of excellence within CSU on water issues. The scope of WRPI activities include:

- Provide critical faculty- and staff-based expertise to support California’s need for appropriate and sustainable water resources in the 21st century.
- Promote education, training, and professional capacity development with the water industry, governmental agencies, and the wider community.
- Develop new and advanced water technologies and services to help drive economic development and job creation.

WRPI will also enhance the universities’ ability to attract exceptional students and faculty by providing a culture of collaboration and innovation within a multidisciplinary water curriculum.

**Key Goals**

The goals listed below support the key elements in the WRPI mission. The goals reflect the CSU comparative advantage in addressing current and emerging statewide water issues. WRPI will be a leading resource for:

- **Partnerships with the water industry and government agencies** – WRPI will engage a broad group of water industry stakeholders and government agencies to leverage university resources to pursue the development of “good science” from which to base decision making and emerging water policy.

- **Education, training, and professional capacity building** – WRPI will raise awareness of careers in water and develop academic pathways for the next generation of professionals to meet the needs of businesses, government officials, tribal nations, water professionals, and the general public through outreach and training programs, professional capacity building, university curriculum development, and formal post-secondary and graduate education.

- **Technology and economic development** – WRPI will provide a strong science base and business development support to help commercialize new ideas in water industries, services, and professions in California. The outcome will be a creative climate of innovation, furthering economic growth in water technology.
Governance Structure

CSU Presidents

Jeffrey D. Armstrong  San Luis Obispo
Joseph I. Castro  Fresno
Robert S. Nelsen  Sacramento
Tomás D. Morales*  San Bernardino
Soraya M. Coley  Pomona
Lisa Rossbacher  Humboldt

*WRPI Advisory Board Chair

Advisory Board Members

David Aladjem, Water Attorney
Richard Atwater, Executive Director
Timothy Brick, Managing Director
Mark Cowin, Director
Mary Ann Dickinson, Executive Director
Rebecca Eisen, Partner
Greg Eidridge, Vice President
Ronald Gastelum, Special Counsel
David Guy, President
John Laird, Secretary
Shauna Lorance, General Manager
Debra C. Man, Assistant General Manager and COO
Gerald Meral, Retired Deputy Secretary
Tim Quinn, Executive Director
Sandra Schubert, Under-Secretary
Lester Snow, Consultant
Fran Spivy-Weber, Vice-Chair
Alexis Strauss, Deputy Regional Administrator
Mike Watson, Vice President
Peter Williams, Chief Technical Officer
Sunne Wright McPeak, President

Downey Brand, LLP
Southern California Water Committee
Arroyo Seco Foundation
California Department of Water Resources
Alliance for Water Efficiency
Morgan, Lewis & Bockius LLP
CH2M Hill of Sacramento
Water and Energy Service for Cordoba Corp
Northern California Water Association
California Natural Resources Agency
San Juan Water District
Metropolitan Water District of Southern California
California Natural Resources Agency
Association of California Water Agencies
California Department of Food and Agriculture
Resources Law Group, LLC
State Water Resource Control Board
Environmental Protection Agency, Region 9
West Division Director MWH
IBM Big Green Innovations
California Emergency Technology Fund

WRPI Financials

Chancellor’s Office / WRPI Funding Sources 2014-15

WRPI Funds 2014-15

- Students
- Faculty
- Staff
- Benefits
- Consultants
- Instructional Support / Other
- Indirects
Executive Director’s Message

Boykin Witherspoon III
Executive Director, WRPI
5500 University Pkwy
San Bernardino, CA 92407
909-537-7681
bwithers@csusb.edu

I will always remember the 2014-2015 academic year as the time California realized that something had to be done about how we use our water, and better yet, as the year California actually did something about it. Two landmark moments in California history, the passage of Proposition 1, the water bond, and the passage of the Groundwater Sustainability Act are already changing how we use our water. The current drought has no doubt contributed to the overwhelming support for these two initiatives. The drought will pass, but the infrastructure and policy changes resulting from the passage of Prop 1 and the Groundwater Sustainability Act will help insire the reliability and wiser use of water in California for years to come.

Now that the bond and act have passed, it’s time to roll up our sleeves and begin to implement the actions mandated by their passage. The WRPI is right in the middle of this effort. Over the last several years, the WRPI has gone from one of the best kept secrets in the state to an in-demand source of information, applied research, and creative solutions to challenging problems related to water. In the last year, through multiple conferences, new partnerships with industry, government outreach, and an active press campaign, the WRPI has helped put the CSU at the forefront of the water discussion in California.

Last year also saw the first steps in the development of a new WRPI program to provide technical assistance to disadvantaged communities throughout California. The WRPI’s creative solution to providing technical assistance has been noticed by multiple state agencies as a new model that provides multiple benefits to the state. Over the last year, the WRPI worked very closely with the State Water Resource Control Board, the legislature, and other partners to help shape a Prop 1 funding plan that can support CSU faculty and students to help provide this much-needed technical assistance to disadvantaged communities.

I would like to thank the WRPI Presidential Oversight Committee and the Chancellor’s Office for their continued support of the WRPI. I would also like to thank the CSU faculty and staff. Through your dedication and creativity, you make the job of promoting the water expertise of the CSU both enjoyable and easy.

Sincerely,

Boykin Witherspoon III

Associate Director

David Zoldoske
Associate Director, WRPI
5370 N Chestnut Ave M/S OF18
Fresno, CA 93740
559-278-2066
davidzo@csufresno.edu

David Zoldoske supports the activities of the WRPI by serving as Associate Director under the leadership of Executive Director, Boykin Witherspoon. As part of the FY14/15 activities, a couple of noteworthy events include the annual WRPI conference hosted by Fresno State staff and faculty. The all-day conference held April 9th highlighted a keynote presentation by Charles Fishman, author of “The Big Thirst.” The first day concluded with a wine and cheese reception at the WaterEnergyTechnology (WET) Center’s Hydraulic Testing Laboratory. The second day featured a bus tour which followed the many uses (urban, agriculture, and environmental) of water from the San Joaquin River. Stops included Friant dam, City of Fresno’s water treatment facility, Wawona Foods, and Meyers Farming, which demonstrated an on-farm groundwater recharge and water transfer operation.

On April 20th, the CSU held an Ag-Water Impact Day at the State Capitol. Staff and faculty from seven CSU campuses spent the day meeting with legislators to explain the vital role the CSU plays in the growth and sustainability of California’s agriculture industry and addressing the state’s water challenges. The group was broken into “teams” who were assigned various meetings with legislators and their staff. The visits were well received and helped raise awareness of the many contributions being made by faculty, staff, and students that directly benefit California.

Presentations
1. Zoldoske, D.F. 2014. Ag Water Update, Metropolitan Water District of Southern California, Board of Director’s, September 27, Fresno, CA.

Publications
## Campuses Served by WRPI in 2014-2015

One of our goals is to generate external funding, and to promote project opportunities for faculty and students. WRPI served the following number of individuals from each of the 23 CSU campuses:

<table>
<thead>
<tr>
<th>Campus</th>
<th>Bakersfield</th>
<th>Channel Islands</th>
<th>Dominguez Hills</th>
<th>East Bay</th>
<th>Fresno</th>
<th>Fullerton</th>
<th>Humboldt</th>
<th>Long Beach</th>
<th>Los Angeles</th>
<th>Maritime</th>
<th>Monterey Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Research Incentive Award Applicants</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Faculty Research Incentive Award Awardees</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>Watershed Management Internship Applicants</td>
<td>2 Faculty</td>
<td>1 Faculty</td>
<td>4 Faculty</td>
<td>0 Faculty</td>
<td>0 Faculty</td>
<td>19 Faculty</td>
<td>3 Faculty</td>
<td>6 Faculty</td>
<td>3 Faculty</td>
<td>2 Faculty</td>
<td>0 Faculty</td>
</tr>
<tr>
<td>Watershed Management Internship Awardees</td>
<td>4 Students</td>
<td>1 Student</td>
<td>7 Students</td>
<td>0 Students</td>
<td>0 Students</td>
<td>30 Students</td>
<td>3 Students</td>
<td>9 Students</td>
<td>7 Students</td>
<td>5 Students</td>
<td>0 Students</td>
</tr>
<tr>
<td>Annual Conference</td>
<td>2 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>1 Faculty</td>
<td>3 Students</td>
<td>1 Faculty</td>
</tr>
<tr>
<td>Also served 7 individuals from agencies, etc. and 2 from the CSU Chancellor’s Office.</td>
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<td></td>
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</tbody>
</table>

For more details on these programs and projects, please continue to pages 12-25.
Disadvantaged Communities Center ..................................................................................... 24-25
Water Technology Hub ........................................................................................................ 22-23
WRPI Annual Conference ..................................................................................................... 19
FACULTY RECIPIENTS:     California State University Northridge
California State University Chico
Colleen Bronner
Sergei Fomin
California State University Dominguez Hills
Jose Martinez
California State University East Bay
Tyler Evans
California State University Fresno
Samendra Sherchan
Humboldt State University
Andrea Achilli
Margaret Lang
California State University Long Beach
Pitpreet Asvapathanagul
Rebeke Sultana
California State University Monterey Bay
Aparna Sreenivasan
Cheryl Logan
Michelle Goman
California State University Monterey Bay
Michael Cohen
Rebeka Sultana
Pitiporn Asvapathanagul
California State University Long Beach
California State University San Marcos
Margaret Lang
California State University Stanislaus
Matthew Cover
Faculty Research Incentive Award Program

The WRPI Faculty Research Incentive Award Program supports CSU faculty members in developing and submitting full proposals to external funding agencies and organizations for water-related research and educational projects. WRPI solicited a competitive Request for Applications for assigned time funding for the 2014-2015 academic year. Applications to develop full proposals on any fundable topic were eligible, provided they sought to advance or promulgate knowledge of California’s water-related issues and the processes that affect them. In accepting an award, a Principal Investigator (PI) committed to develop and submit a full proposal for external funding through their host campus research office. Applications involving faculty from multiple CSU campuses that promote interdisciplinary, integrative research and/or educational initiatives and that include regional and disciplinary diversity were preferred.

This fiscal year, WRPI received 23 applications from 16 different campuses. Eighteen proposals were funded for a total of $110,911. Even with funding constraints, 78% of the submitted applications were approved.

FACULTY RECIPIENTS:

California State University Northridge
Shawna Dark
Michael Summers
California State Polytechnic University Pomona
Keith Forward
Mingheng Li
Ali Sharbat
Sacramento State University
Saad Merayyan
San Francisco State University
Leora Natus
California Polytechnic State University San Luis Obispo
Daniel Howes
California State University San Marcos
Robert Brown
Sonoma State University
Michael Cohen
Farid Farahmand
Michelle Goman
California State University Stanislaus
Matthew Cover

Awarded Proposals by Faculty on WRPI Release Time

Michael Cohen and Farid Farahmand, Sonoma State University (cohenm@sonoma.edu, farid.farahmand@sonoma.edu)
Agency: Sonoma County Water Agency; Okinawa Institute of Science and Technology; and Sonoma State Research, Scholarship and Creative Activity Program
Amount: $17,042
Title: Development of Modular Bioretreatment System for Winery Wastewater.

Arlene Haffa, California State University Monterey Bay (ahaffa@csumb.edu)
Agency: California Department of Food and Agriculture FRERP Special Proposal
Amount: $270,000
Title: Quantifying N₂O Emissions under Different On-farm Irrigation and Nutrient Management BMPs that Reduce Groundwater Nitrate Loading and Applied Water.

Eric Houk and Steffen Mehl, California State University Chico (ehouk@csuchico.edu, smehl@csuchico.edu)
Agency: USDA Non Land Grant Colleges of Agriculture (NLGCA) Program
Amount: $150,000
Title: Enhancing Education and Outreach to Improve Agricultural Resilience Amid Uncertain Water Supplies.

Mingheng Li, California State Polytechnic University Pomona (minghengli@cpp.edu)
Agency: American Chemical Society Petroleum Research Fund
Amount: $70,000
Title: Analysis and Optimization of Energy Consumption in Reverse Osmosis Desalination.

All Sharbat, California State Polytechnic University Pomona (sharbat@cpp.edu)
Agency: Bureau of Reclamation
Amount: $99,994
Title: Development of a Photovoltaic Electro Dialysis Desalination System.

Shanju Zhang, California Polytechnic State University San Luis Obispo (szhang05@calpoly.edu)
Agency: National Science Foundation
Amount: $300,000
Title: New Paradigms of Reverse Osmosis Membranes for Seawater Desalination and Purification.

$110,911 investment
by the Chancellor’s Office resulted in $1,065,222 in research dollars.
The WRPI sees the benefits to the CSU system in obtaining outside funding, and we continued to apply for new grants on behalf of the CSU this fiscal year. The submitted applications include:

- Environmental Protection Agency (EPA) Small Public Water Systems
- EPA National Center for Sustainable Water Infrastructure Modeling Research Science to Achieve Results (STAR) Program
- Excelencia in Education
- Food, Agriculture, Natural Resources, and Human Sciences Education and Literacy Initiative
- James Irvine Foundation Leadership Awards
- National Institute of Food and Agriculture (NIFA), Agriculture and Food Research Initiative (AFRI) Water Challenge
- Rose Foundation
- Southern California Association of Governments (SCAG) Palm Springs
- USDA Education and Literacy Initiative (ELI) Grant
- Volunteers in Service to America (VISTA)

Submitted Proposals by WRPI

The CSU/WRPI continued its partnership with the U.S. Environmental Protection Agency Region 9 to encourage students to participate in environmental fields of study and to help EPA attract a workforce as diverse as the public it serves. This MOU has promoted equal opportunity in EPA's workforce, contributed to CSU's capacity to provide high-quality education, and encouraged the participation of CSU students and faculty in EPA's programs. This Internship Program offers CSU students for-credit, volunteer learning opportunities at the EPA in a wide range of discipline areas while strengthening their leadership, technical, research, communication, networking, and other job skills, as well as allowing them to become familiar with the EPA and its structure. Students work closely with a CSU faculty advisor and an EPA mentor to develop an overall learning project plan, which guides the internship. Various internship projects are offered each semester/quarter and are on an on-going basis, with most internships based at the student's home campus.

Eligibility Requirements:
- Enrolled at a CSU campus at least half time
- Minimum GPA of 2.5 (unless the EPA project requires a higher GPA)
- Enrolled in an internship course at a CSU campus

Students from all 23 CSU campuses are eligible.
Accepting applications on an on-going basis.

featured Intern

CSU Monterey Bay student, Alexandria Thornton, completed the “LEED Green Education” project during spring semester 2015. The primary goal of the project was to create educational materials that would demonstrate how EPA Region 9 would attain a LEED platinum certification for sustainable building renovations. She researched green social marketing and created signs highlighting sustainable features of Region 9’s renovation. Her supervisor was able to add additional tasks to Alexandria’s internship that were relevant to her career interests. She also analyzed over 700 surveys regarding greening grant awardees’ participation in sustainable practices and updated flowcharts of the organization of four federal agencies, focused on the Chief Sustainability Officers. Over the course of the project, Alexandria developed sign templates that could be easily used and modified by future interns and EPA staff. Based on her analysis of the surveys, future grants will focus on obtaining more detailed feedback from awardees and minimizing perceived barriers of participation. Through this internship, Alexandria was able to sharpen her research and analysis skills and also expanded her knowledge of a variety of career options within her field.

Project website: http://wri.csusb.edu/epa-csuInternshipProg.html
Contact Info: Michele Penilla, Program Manager mpenilla@csusb.edu (909) 537-3687
WRPI in the final year of a four-year award of $2 million targeting students at the CSU. During the 2014-2015 academic year, 57 students were placed in internships. See more details below.

**Project Summary:**

2011-2015 Grant Amount: $2,195,695 (total to date)

The primary objective of this project is to measurably increase the awareness, retention, and graduation rate of qualified underrepresented California State University (CSU) students, leading towards USDA career attainment. This annually renewable 4-year USDA/NIFA Regional Collaboration project was awarded to CSU’s Watershed Resources and Policy Initiatives (WRPI) and is managed by the Water Resources Institute at CSU San Bernardino.

The strategic goal of this project is to measurably increase student research skills that ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while simultaneously enhancing the sustainability of the Nation’s water resources.

This project provides funding for 50 paid Watershed Management Internships per year for a total of 200 internships over four years. The internships provide an experiential approach to learning in the field of watershed management, which helps students gain real-world experience in natural resource protection while developing new knowledge, skills, and abilities in problem-solving from a watershed perspective. The total salary paid to each Watershed Management Intern is $4,500 with undergraduate-level students earning $12.50 per hour for 360 total hours and graduate-level students earning $15.00 per hour for 300 total hours. The project also provides up to $560 per student for the purchase of approved supplies, materials, and mileage reimbursement. Competitive internships may be eligible for $40,000 scholarships in furtherance of their Doctorate-level students earning $15.00 per hour for 390 total hours and graduate-level students earning $15.00 per hour for 300 total hours.

Activities performed by interns during their Watershed Management Internships are related to natural resource protection, restoration, and research. Participating in this internship was a great pathway for my career experience which led to my current employment with USDA-RD. Having Roberto Gonzalez Jr. as my mentor was one of the best things that happened to me during my internship. He is a great role model... and has the best interest of students in mind. I hope more students look to the USDA and WRPI/CSU internship opportunities because aside from being a great learning experience, they have the possibilities of opening doors toward [previously unconsidered] career options. — Roberto E. Palominio, San Diego State

WRPI helped me to acquire the real world GIS experience I was seeking to gain. It was incredible to know that I was able to work in my field while finishing my degree. As a struggling college student... there was great confidence knowing that I was obtaining experience and valuable skills with some financial support to go along with it. — Marianne Jara, CSU Northridge

The opportunity to work alongside Dr. Ali Sharbat on developing a protocol for inland water desalination has been one of the greatest experiences of my college career... Our report has given me great insight to various industries that use water recovery systems, increasing the breadth of my personal and professional knowledge on the subject matter. Dr. Sharbat and I have been working closely with undergrad students who will take this project to the next level and reach out to public and private entities... to decrease water desalination and provide low-cost water with minimal environmental footprint to both rural and urban communities. — Lucas De Buren, Cal Poly Pomona

“Participating in this internship was a great pathway for my career experience which led to my current employment with USDA-RD. Having Roberto Gonzalez Jr. as my mentor was one of the best things that happened to me during my internship. He is a great role model... and has the best interest of students in mind. I hope more students look to the USDA and WRPI/CSU internship opportunities because aside from being a great learning experience, they have the possibilities of opening doors toward [previously unconsidered] career options.” — Roberto E. Palominio, San Diego State
Andres Carrillo is the recipient of a $40,000 scholarship from the Water Resources and Policy Initiatives/USDA Watershed Management Doctoral Scholarship program, created to provide financial assistance to underrepresented students enrolled in the natural and social and behavioral sciences to increase retention and graduation rates, as well as address the underrepresented workforce in professional careers in the food, agricultural, and natural resource systems.

As an undergraduate student at CSU Fullerton, Carrillo was admitted to the Southern California Ecosystems Research Program, in which he studied swimming performance in white seabass raised in aquaculture for the purpose of stock enhancement. During his undergraduate program, he was invited to train students to cultivate live zooplankton for seahorse restoration efforts and survey artisanal fishing practices in collaboration with the reef ecology lab at the Federal University in Paraba, Brazil. He then traveled to Thailand to survey methods of aquaculture for tilapia and freshwater shrimp. After receiving a BS in Biological Sciences, Carrillo enrolled in an MS program at CSU Fullerton to study fish physiology while also working at Cabrillo Marine Aquarium as an animal caregiver and marine educator. While completing his master’s project, he was selected as a Sally Casanova pre-doctoral scholar, which allowed him to present his research on the development of the California grunion, where he could identify a potential PhD advisor.

Carrillo will use the $40,000 scholarship toward his doctoral studies at the University of California, Irvine under the supervision of Dr. Matt McHenry. He will also investigate the development of lateral line system and how it mediates feeding in larval fish. As a side project led by Dr. German’s research lab at UC Irvine, he will also examine how temperatures influence digestive diseases in abalone.

Upon completing his PhD, Andres Carrillo would love to work for the USDA as a researcher who integrates various techniques to monitor growth and development of fishes in both aquaculture and natural fisheries.

For more information regarding the internship and scholarship program, please contact Michele Penilla at 909.537.3687 or mpenilla@csusb.edu.

“When I received my WRPI/USDA award notice, I was so excited I nearly fell out of my chair. I immediately shared the news with my family and they were so happy and proud.

I have always been interested in fish aquaculture, particularly how baby fish are raised. With this award I will be able to concentrate more time on my dissertation. I am truly grateful for the support provided by the WRPI and USDA. Many happy thanks!”

- Andres Carrillo

COAST-WRPI Student-Faculty Research Poster Reception

The Council on Ocean Affairs, Science & Technology (COAST), a sister affinity group, held a joint student-faculty poster reception at the Chancellor’s Office on March 24, 2015. Student researchers and their faculty mentors from each of the 23 campuses were present to discuss their marine, coastal, and freshwater research as it related to climate change, environmental quality, resource management, and policy development. The event coincided with the CSU Board of Trustees meeting, so many BOT members, Presidents, and Chancellor’s Office Staff were in attendance.
The 7th Annual WRPI Conference was held on April 9, 2015 at the Alice Peters Auditorium at Fresno State. This year’s theme was “Three Years into the Drought: Assessing California’s Agriculture.” Fresno State’s President Joe Castro and Provost Lynnette Zelezny welcomed 88 attendees and the day was filled with networking time, a student poster session, and valuable insight from our speakers. Attendees included 42 faculty, 10 staff, and 24 students representing 21 CSU campuses, 2 attendees from the Chancellor’s Office, plus 7 industry guests from the Forest Service, Community Colleges, and other federal agencies.

**Bay Delta Panel:**
- Meredith McKenzie (Cal Poly Pomona), Jim Beck (Kern County Water Agency), Charles Gardner (Hallmark Group, Inc.), Curt Schmute (Metropolitan Water District of Southern California)

**Guest Speaker:**
- Charles Fishman (Author, The Big Thirst and A Curious Mind)
  
  Imagining a New Water Future

**CSU Presentations:**
- Michael Cohen, Faculty, Sonoma State University
  Application of Mircobial Fuel Cells for Recycling Distillery and Winery Wastewaters
- Eric Houk, Faculty, CSU Chico
  Water Transfers From Agriculture: Estimating the Impact of Foregone Production and Aquifer Decline in Northern CA
- Lillian Rubi and Gurleen Kaur, Grad Students, CSU Bakersfield
  California State University Bakersfield Campus Water Audit
- Fresno State Faculty Panel: Provost Zelezny, Antonio Avalos, Neil Chowdhury, Matt Jendian, Fazyul Pasha, Samendra Sherchan, Jes Therkelsen, Chih-Hao Wang
  Economic Impact of the Drought for the San Joaquin Valley
- Valerie Mellano, Chair/Professor, Cal Poly Pomona
  Water-Wise Farming

**Student Poster Presentations**

Cindy Castaneda, CSU Los Angeles
Roxana Coreas, CSU Northridge
Jay Ichapurapu, Fresno State
Andrew Kennedy, Cal Poly Pomona

Jurancce Liao, Fresno State
Navreel K Mahal, Fresno State
Gwen Miller, CSU Monterey Bay
Andrew Renshaw, CSU East Bay

Josue Samano, Fresno State
Touyee Thao, Fresno State
Emily Wieber, CSU Fullerton
Rosemarie Wrigley, CSU Long Beach

Thirty-two students and faculty attended a post-conference field trip on April 10, 2015 to the Friant Dam, City of Fresno Surface Water Treatment Plant, Wawona Frozen Foods, and Meyers Farm.

“The conference just gets better and better each year.”

“I was impressed with the various speakers presenting different perspectives on the water issue, especially the breaks which allowed time to think or share thoughts with other attendees.”

“For me, having the students speak was the most valuable. I, as a student, get to see the types of things they’re doing that are water related and it helps me decide what I’d like to do in the future.”

“The presentations gave everyone a feel about how bad of a drought California is in, but the field trip made that notion concrete by letting us see it for ourselves. That part was important to me.”
Disadvantaged Communities Center

"Serving communities and training our next generation of water leaders."

The CSU Water Resources and Policy Initiatives and its partners are forming the Disadvantaged Communities Center (DACC), a new CSU system-wide center dedicated to supporting water-related technical assistance and capacity building in economically disadvantaged communities (DACs) throughout California. This will be accomplished through applied research teams consisting of professional staff, faculty, and paid student interns. Teams will be recruited across the California Public Higher Education system – University of California (UC), California Community Colleges (CCC), and California State University (CSU) – and in collaboration with non-governmental organizations (NGOs) and industry partners. The CSU Chancellor’s Office supports the establishment of this system-wide center that will focus on providing technical, financial, managerial, and organizational assistance to DACs.

In California, rural and urban DACs are facing drinking water insecurity as the drought worsens their already dire conditions of water quality and supply. The California Public Higher Education system has a great capacity to meet this increasing need through our existing administrative structure, students and faculty, external partnerships, statewide geography, and a long history of experience in working with DACs.

GOALS:
- Community resiliency and sustainability
- Student experiential learning
- Partnerships

Many of our students come from the very communities we are aiming to serve. Having these students bring their skill sets back into their own communities will help build trust, resiliency, and sustainability.

Current Partners:

- Student-Centered Learning
- Partnerships
- Team Embedding
- Observation & Measurements

http://www.calstate.edu/water/disadvantage.shtml
mariaelenakennedy@icloud.com
www.facebook.com/CSUDACC

Pillars:

Phone: 909-537-7681
Fax: 909-537-7682

Disadvantaged Communities Center Conference

WRPI held a conference on the DAC Center on April 23, 2015 at the CalEPA building in Sacramento, CA. Fran Spivy-Weber from the State Water Resources Control Board (SWRCB) welcomed over 40 attendees. Thirteen CSU faculty and staff gathered with seven representatives from the SWRCB, five from the Department of Water Resources (DWR), four representatives from the UC system, and over 10 from other government agencies to learn about what the CSU is doing to assist DACs and provide support for our students and faculty through the new DAC Center.

Challenges Facing Rural Disadvantaged Communities:
- Moderator - Maria Kennedy (WRPI), Martha Guzman-Aceves (Office of the Governor), Susana De Anda (Community Water Center), Paul Boyer (Self-Help Enterprises), Corine Li (Region 9, U.S. EPA), Karen Larsen (SWRCB)

RUS Case Studies:
- Moderator - Dr. Karl Longley (Fresno State)
  - Presenter - Dr. Ali Sharbat (Cal Poly Pomona)
  - Water meter studies in London and Sultana in Tulare County, Dr. Shikha Rahman, Cal Poly, San Luis Obispo
  - Evaluation of the effectiveness of Point-of-Use devices in Monson (Tulare County), Dr. Ali Sharbat, Cal Poly Pomona
  - Conducting engineering/hydrogeological/environmental assessments of proposed DAC projects and preparing technical reports to support pre-applications and applications for DAC water/wastewater projects in Perry Colony in Fresno County, Dr. Rebekah Oulton, Cal Poly San Luis Obispo

- Presenter - Dr. Mathew Schmidtlein (Sacramento State)
  - Refinement of CalEnviroScreen Mapping

A California State Director’s Perspective:
- Moderator - Dr. David Zoldoske (Fresno State), Anthony Rendon (Assemblymember, 63rd Assembly District, D-Lakewood), Fran Spivy-Weber (SWRCB), Dr. Glenda Humiston (California State Director of USDA, Rural Development)

Challenges Facing Urban Disadvantaged Communities:
- Moderator - Boykin Witherspoon (WRPI), Maria Kennedy (WRPI), Dr. Carolina Balazs (UC Davis)

Networking Lunch

Karen Larsen, Martha Guzman-Aceves, Paul Boyer

Assemblymember Anthony Rendon
The Water Technology Hub's mission is to:
• Engage Innovative Thinking
• Target Effective Investments
• Launch Collaborative Initiatives
• Commercialize New Water Technologies

We would like to share some early success stories from our involvement in the Water Technology Hub. The partnerships that have been formed have already been productive, and we see these relationships benefitting college students, universities, industry, and citizens within California and throughout the country and world.

The WRPI connected with ABR Process Development, an Australian company with mobile filtration technology that can be used to remove toxins from water. Their end product is actually the chemicals, with clean water being a byproduct. We are working on an agreement to use their equipment in the CSU Bakersfield Energy Lab to test the technology on oil well water.

We’ve also been working with the Water Environment Research Foundation (WERF) group, which includes representatives from WERF, Waste Water Management Inc, and Burns & McDonnell. This group will be testing Electro Chemical filtration technology at a location in Newport Beach, and the WRPI will supply (and fund) a student intern to participate in testing, measuring, and collection of data.

These partnerships are in formative stages, but we are working on co-writing grants and getting MOUs in place. These projects allow CSU students to experience hands-on learning and contribute to innovative research, while industry taps into the academic and research expertise available at the CSU.

It is with profound sadness that we announce that Bill Lyte passed away on Sunday, August 9, at the age of 62. We will miss our friend, colleague, and mentor.

Mr. Lyte represented Burns & McDonnell, a global environmental, engineering, and construction services firm with a strong capability in the marine sciences. A native of the Los Angeles area, he had a broad spectrum of experience within the marine, industrial, and technology sectors. This includes 25 years of business development and technical experience with major U.S. consulting engineering firms, focused on the San Pedro Bay and California ports and their goods movement systems.

WRPI commends our partner for a lifetime of achievement and sends its best wishes to the Lyte family and to all who knew and loved him.
On May 19, 2015, Elvyra F. San Juan and Boykin Witherspoon presented on behalf of the WRPI about "Drought Response and Water Conservation" during the Board of Trustees meeting at the Chancellor’s Office. They presented a system-wide summary of utility, well, and reclaimed water consumption, as compared to the Governor’s goal of 25% reduction by 2016. They also shared summaries of CSU Campus Action Plans, which include the implementation of projects and raising of awareness about water conservation.

Boykin Witherspoon then presented specific information about how the WRPI is partnering with the Chancellor’s Office in creating a Water Working Group. This group will discuss campus water consumption with the goal of offering recommendations for ways to reduce water use. Looking at preliminary data, when the Maximum Applied Water Allowance and Estimated Total Water use is compared to the actual use at campuses, it is clear that there is room for improvement and reduction of water consumption.

Boykin was then given the opportunity to share WRPI’s mission and goals along with new initiatives such as the Water Bond, Disadvantaged Communities Center, Water Technology Hub, PUC, EPIC, and Cap and Trade funding.

As the governor’s goal is based on personal water consumption, we are in discussion with campuses regarding their ability to separately meter agriculture and landscaping uses in order to better track personal consumption. Until we can better identify these uses of well water and utility provided water, the graphs for the governor’s goals will overstate the CSU’s per capita consumption because we know we use well water for agriculture. We have funded the installation of some water meters over the past two years and will continue to pursue avenues to correct our data.

The patterned column to the right shows the governor’s goal to reduce personal consumption by 25% by 2016 from 2013 consumption levels. As compared to the 25% reduction goals for 2016, the graph shows the CSU reduced potable water consumption 7% in 2014. So we still have a way to go, but have made measurable progress.

San Francisco combats drought with “Brown is the New Green” Water Conservation Campaign

If we have missed anything that your campus is working on, please let us know, and we will keep this information updated online.

Thank you!
CSU Water Consumption Reduction Summary

Elyva F. San Juan, Assistant Vice Chancellor
Capital Planning, Design and Construction:

In 2014, the CSU reduced total water use 5% compared to 2013. As completed in our 2013-2014 Annual Report, campuses committed to water conservation plans and implemented projects to reduce water use in facilities, landscaping, and agriculture. In 2014-2015 CSU made $5M available for energy and water projects in addition to debt financing for infrastructure improvements, for an estimated total of $150M to fund projects.

CSU Best Practice Award for Water Efficiency and Site Water Quality was awarded to Cal Poly San Luis Obispo in July 2015. They reduced water consumption by 23% from 2013 to 2014. Nine campuses were awarded funds to redesign courses to include campus water use as part of the curriculum, along with funds to install metering, irrigation controllers, and other related items to support student learning and applied research. The Chancellor’s Office is partnering with the WRPI and Metropolitan Water District to audit campus water use. The goal is to increase use of reclaimed water while reducing use of potable water.

Boykin Witherspoon, WRPI Executive Director:

To help meet water use reduction goals, the WRPI is working with the Chancellor’s Office to develop recommendations for how to calculate baseline water consumption. One of the challenges is to begin to compare what our facilities currently consume, what they are allowed to consume, and what they should consume. The WRPI is facilitating a work group consisting of facilities managers, industry, and faculty to address these issues. Initial analysis of our water consumption data shows that there are inconsistencies in how we measure water with meters and what water consumption types we meter at all. One of the goals of this work group is to identify these inconsistencies and recommend strategies to become more consistent as a system.

The actual water use at the Chancellor’s Office (as an example) is much higher than the recommended use amount. This is due to the fact that the building water use is not metered separately, and landscape is often overwatered. The goal of this work group is to provide this analysis for all 23 campuses.

Water Action Plan Accomplishments

As the drought has continued, Governor Brown’s January 2014 executive order for a voluntary 20% reduction in personal water usage has jumped to 25%. At that time, CSU was not specifically ordered. However, in May, we passed the sustainability policy that mandated a 10% reduction of all water use by 2016, and a 20% reduction by 2020. The second executive order by Governor Brown ordered a mandatory reduction of urban potable water usage for this year. Campuses fall between 4-36% reductions.

CSU policy differs by mandating reductions in total water consumption, rather than potable water use. The CSU has responded with immediate changes as well as long-term planning for conservation. Nearly all campuses currently use basic water saving measures such as monitoring and repairing leaks and decreasing watering schedules, while also updating and improving fixtures, landscaping, and irrigation systems on campus. While it’s impossible to highlight all the positive efforts that CSU campuses are making to conserve water, the following examples are encouraging and showcase some preliminary projects.

Disseminating Information – Several CSUs have taken action to educate students, faculty, staff, and campus visitors about the consequences of the drought and ways they can help.

- Decorative fountains across Sacramento State’s campus have been turned off, and signs have been posted, explaining this is due to the drought. Reminders of water conservation continue inside buildings, with “Save our Water” stickers placed on mirrors in restrooms.
- San Francisco State has taken advantage of many avenues of communication, such as publishing news articles through University Communications and the student newspaper, sending water saving tips by campus email, and posting best practices on social media.

Landscaping – Many campuses are using advanced, computerized irrigation systems to monitor leaks and control watering.

- CSU Dominguez Hills is just one of several campuses that has installed native plant bioswales, which collect and filter parking lot stormwater runoff. Drought-tolerant ground cover has been installed in multiple areas on campus to mitigate stormwater runoff and enhance ground filtration.
- Fresno State injected an organic hydrogel into lawns to retain water and reduce watering.
- CSU Los Angeles has reduced water usage by about 27 million gallons over an 18-month period by using Water-2-Save, a wireless technology that controls irrigation clocks based on regional weather conditions.

Staffing –

- Fresno State hired an additional Irrigation Specialist to better address irrigation repairs.
- Sacramento State has also reassigned a Lead Groundsworker to a Lead Irrigation Specialist, so that more focus can be placed upon water cycle times, spray pattern analysis and repair, leak correction, and overall system performance.

Buildings –

- In 2012, new student housing, which earned a Platinum LEED certification, was built at CSU Fullerton. The new buildings are energy efficient inside and out, and the landscaping uses native, drought-resistant plants, along with a drip and subsurface irrigation system. The landscaping and irrigation reduce potable water usage by 50% and also helps mitigate storm water runoff by diverting the water to rain gardens and bioswales. These bioswales absorb and filter water before it reaches storm drains.

Reclaimed/Recycled Water –

- CSU Northridge is utilizing fuel cell heat recovery unit condensate for cooling tower makeup.
- San Jose State has used recycled water in their Central Plant Cooling Tower, South Campus Athletic Fields, and main campus for irrigation, and Martin Luther King Jr. Library for toilet flushing, saving a total of 61-72 million gallons per year.
- CSU Channel Islands has converted their irrigation water from domestic to reclaimed.
Sacramento

Given the severe drought conditions in California, it is appropriate that our state university system make adjustments necessary to conserve one of our most precious resources. Sacramento State has been enacting a number of measures to pare water consumption immediately, and creating longer term plans to enable the campus to serve our students while minimizing water consumption. They have reduced campus-wide irrigation water use by 63% since 2013 and continue to seek additional measures and technologies to further reduce water consumption on campus.

Stanislaus

While the Reflecting Pond and the campus lakes are the heart of the water system at CSU Stanislaus, the conservation effort encompasses dozens of processes and procedures, all of which fall under the guidance of the university’s Facilities Department. These photos show just a few of the many ways the university is being a responsible steward of the water that not only is stored on campus but comes from the Turlock municipal water supply. They also highlight much of the technology in place that helps to make the university a leader in the CSU-wide water conservation effort.

The Reflecting Pond, maintained at a depth of around 5.5 feet, is the largest water storage basin on campus and is the heart of the irrigation system. Estimated capacity, 4.5 million gallons.

This pipe serves to fill the Reflecting Pond. Note the cut-off valve at the right, which allows water to be diverted to fire crews in case of emergency.

Cooling tower is the heart of the campus a/c system. This evaporative cooler is being converted to use water from the campus irrigation system, saving about 5 million gallons of water annually.

This meter under the cooling towers measures the particulate content in parts per million. Once the particulate level reaches 1,000, the water is blown through the cooling tower and returned to the campus irrigation system.

While CSU Stanislaus remains one of the most beautiful campuses in the state university system, the most prudent way to address the drought is to allow some areas of grass to turn brown.

http://www.csus.edu/aba/sustainability/water-conservation-efforts/index.html

https://www.csustan.edu/water
Humboldt students continue to support and raise awareness of water reduction. At WRPI’s 2013 Annual Conference, Professor Eileen Cashman presented on Campus Water and Stormwater Management. HSU is working on a number of projects related to water sustainability such as:

- Parking lot retrofits between the City of Arcata, HSU, and Arcata High School. Capstone projects include students for pre- and post-monitoring, design review, and analysis.
- Environmental Resources Engineering students designed a permeable pavement lot and evaluated two subsurface designs.
- Campus restroom faucets retrofit with aerators that reduce flow from 2.2 gpm to 0.5 gpm.
- Grounds Department increased the use of natural mulch as ground cover.
- First public university in CA and in the nation to stop selling plastic water bottles.

HSU is working to make campus events “Zero-Waste Events.” Photo credit: Kellie Brown, HSU.

No bottled water available at HSU graduation ceremonies. The Campus Center for Appropriate Technology rents graduation caps and gowns made out of recycled plastic bottles. Photo credit: Kellie Brown, HSU.

Bakersfield

Grad students Lilian Rubi and Gurleen Kaur presented their research on the California State University Bakersfield Campus Water Audit at the 2015 WRPI Annual Conference. They previously examined the water table at three wells at CSUB during their Hydrogeology class and found a consistent downward trend. This brought awareness of water conservation efforts at large and the water management policies on their campus. They identified potential “water smart” areas for turf elimination and alternative landscaping. They also conducted a campus-wide survey to determine the general attitude of the campus community towards xeriscaping and water conservation. The survey provided very positive feedback. Students often observed broken sprinklers, turf being watered at the wrong time of the day, overwatering, and/or sprinklers watering the walkways. After discussion with the Facilities Management office, they expressed an interest to balance water conservation with cost and aesthetics.

CSUB Possible Turf Elimination Zones

- Cost and Aesthetics
  - Water loving trees that were donated.
  - Changing surrounding landscape would shock trees or drought-tolerant vegetation.
  - Costly to remove resulting dead vegetation.
- Drip systems for trees
  - Problems with animals (Kit foxes and squirrels)
  - Costly to replace/repair
- Removing turf we face issues with destroying habitat and disturbing the endangered species on campus.
  - Costly to remove as biological consultations have to be done before it is removed.
- Long-term benefits

Progress

- Our Facilities office is doing their best to improve conditions and conserve water.
- As each new building is developed on campus, water usage and conservation are taken into account.
- Installation of native vegetation and creating a reporting page for broken sprinklers or overwatering areas.
- Conservation Efforts:
  - Four zones are being surveyed for xeriscaping.
  - Artificial turf being installed.
  - Drip systems in some areas.

Surveys revealed that while students and faculty would report and aid in informing the facilities office of any broken sprinklers, they just do not have the information on where to report these issues. For future effort, they would like to open communication between the campus community and the facilities office to promote efficiency in maintaining irrigation equipment.

Humboldt

Humboldt students continue to support and raise awareness of water reduction. At WRPI’s 2015 Annual Conference, Professor Eileen Cashman presented on Campus Water and Stormwater Management. HSU is working on a number of projects related to water sustainability such as:

- Parking lot configuration increases number of parking spaces and preserves trees.
- Environmental Resources Engineering students designed a permeable pavement lot and evaluated two subsurface designs.
California's regional geological environments, such as aquifers with a granitic basement or sedimentary basins with oil reservoirs, constrain the groundwater's chemical composition. The geological complexity of California generates aquifer systems that contain a wide range of sediments, recharge mechanisms, dissolved oxygen quantities and additional regional to sub-regional geochemical differences. A spatial analysis of ten hydrologic regions, with particular interest in Kern County, provides regional average distributions of chemical constituents with respect to mixing of deeply sourced waters associated with organic sedimentary deposits and shallow groundwater used for drinking water supply. In addition, the analysis provides a representation of the patterns in background concentrations that could aid in the determination of anthropogenic effects on groundwater chemistry, including well stimulation treatment or WST.

The statistical and spatial analysis was conducted through inputting and interpreting a large query of supply well data into a geographic information system data frame. The primary constituents of interest are radionuclides: radium and radon and related anions and cations. Sedimentary organic deposits typically contain high concentrations of naturally occurring radioactive materials, such as $^{232}$Th and $^{238}$U. Furthermore, groundwater that interacts with the sedimentary organic deposits generally has high activities of $^{232}$Th and $^{238}$U decay products $^{228}$Ra and $^{226}$Ra. Previous studies have indicated that the ratio of $^{228}$Ra/$^{226}$Ra in groundwater correlates with the ratio of $^{232}$Th/$^{238}$U in the aquifer materials providing evidence for the source of radium in groundwater. Comparing the hydrogeologic setting and the groundwater chemistry demonstrates the usefulness of the $^{228}$Ra/$^{226}$Ra ratio in the determination of the mixing of groundwater between deep-seated aquifers with shallow drinking water supply aquifers. Establishing a background database of certain anions, cations and radionuclides associated with sedimentary organic material will provide local, regional and state authorities and water-resource managers with information that could prove useful when examining future effects of conventional or non-conventional energy resource development.

A significant amount of land in the Central Valley is cultivated not only for different types of crops, but also for animal grazing. For both purposes, water and nutrients are the key components. The question that seeks an answer is: can the nutrient or the effluent produced from the animal grazing or dairy farm be used as fertilizer for other crops? Just discharging this effluent containing a high concentration of nutrient to a stream or a lake can impair the quality of stream or lake water, causing severe environmental impacts. Preserving water for a sustainable future is not a slogan anymore; it is a burning question for all water users, including agricultural communities who are embracing various water resources management practices to preserve the water for a sustainable future. On-farm drainage management can be such a practice in which the effluent full of nitrate and other nutrients from rangeland or dairy farms can be used as fertilizer for other crops. This practice not only provides irrigation water, but also supplies nitrate and other nutrients to the crops, which are necessary for their high yields. This measure reduces the environmental wastes to the air and surface water and groundwater. This study calculates the total nutrients available in the effluent from the rangeland including the dairy farm and also the nutrients required for various types of crops at their different stages of life. A mass balance model is set up to quantify the available and required mass. The mass balance model is capable of quantifying the mass at different points of time and space. This model is applied to the University Agricultural Laboratory (UAL) of California State University, Fresno.
**Sonoma**

The effect of the Sonoma State University campus and the City of Rohnert Park on the water quality in the Laguna de Santa Rosa

Amanda Appel, Colleen Daley, Felix Desperrier, Pauline Espinoza, Paul George, Roman Gomez, Maya Hoholick, Kara Kelly, Christopher March, Justine Minyard, Thanh Quach, Ashleen Rai, Justin Regester, Cameron Revere, Taylor Swain, Daniel Tehrani, Byron Williams, and Dr. Jacquelyn Guilford

Department of Environmental Studies and Planning

The Laguna de Santa Rosa is the largest freshwater wetlands complex in northern California, and is listed as a wetland of international significance. During urbanization that began in the late 1800s, water quality and biodiversity in the Laguna deteriorated significantly. Despite recent restoration efforts, the Laguna de Santa Rosa is listed as impaired under the Clean Water Act for sediment, nitrogen, phosphorus, temperature, mercury, and dissolved oxygen, making it the most impaired water body on the northern California coast. Sonoma State University (SSU) is working with the Sonoma County Water Agency to identify possible sources of contaminants that are delivered to the Laguna via the Copeland Creek tributary. From September 2014 to February 2015, undergraduate students sampled Copeland Creek water as it left the SSU campus, at downstream sites within the City of Rohnert Park, and at the Laguna downstream of its confluence with Copeland Creek. The water samples were analyzed for temperature, pH, dissolved oxygen, and nutrient levels (i.e. nitrogen and phosphorus). This project is part of WATERS, a collaborative endeavor between the Sonoma County Water Agency and SSU that facilitates interdisciplinary student research projects in watershed management.

**Humboldt**

Integrated Mapping of Drought-Impacted Areas in the Sierra-Nevada Foothills Region of California Using Landsat Imagery

Mahesh Rao, Humboldt State University

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In its fourth year, California’s drought condition has seriously impacted not just the agricultural sector, but also the natural resources sector including forestry, wildlife, and fisheries. Some of the ecological implications that are predicted to worsen include water conservation, forest health (pest and disease), fire risk and severity, and other societal implications such as farm labor, livestock, and food prices. In the last three decades, remote sensing has provided a useful tool for drought monitoring and a variety of remotely sensed drought indices based on vegetation indices, land surface temperature (LST), albedo, etc. have been developed. Several drought indices have been proposed based on the normalized different vegetation index (NDVI) to monitor drought severity such as Anomaly Vegetation Index (AVI) and Vegetation Condition Index (VCI), Modified Perpendicular Drought Index (MPDI), Temperature Drought Vegetation Index (TDVI) and Vegetation Temperature Condition index (VTCI).

The main goal of the project is to characterize the spatio-temporal nature of the drought-impacted areas within the agro-forested regions of the Central Valley/Sierra Nevada Foothills.

This project is ongoing and additional analysis slated for this fall includes correlation with microenvironmental variables including soil moisture.

Specific objectives of the project include:

- Develop a geospatial database for study area to include satellite imagery and GIS data for the pre-drought 2006 time period and the current drought year 2014.
- Analyze the geospatial database using image processing and related classification procedures involving spectral indices to delineate drought-impacted areas.
- Interpret and evaluate the severity of the drought map produced.
New Paradigms of Reverse Osmosis Membranes for Seawater Desalination and Purification

Shanju Zhang and Xiaoying Rong, California Polytechnic State University, San Luis Obispo
szhang05@calpoly.edu; 805-756-2591
http://chemweb.calpoly.edu/szhang05/

It is hypothesized that vertically aligned nanotube-polymer composites are effective as new osmosis membranes with less energy consumption. This research project was funded by the National Science Foundation (NSF), and allowed two research students (Jacob Parkinson and Evan Scherzinger) to participate in the project. Our efforts have been making a significant progress in the following aspects.

First, we synthesized a series of liquid crystalline monomers that could be polymerized into the polymers under photo-radiation. The liquid crystalline behaviors and phase diagrams of the monomers have been investigated using polarized optical microscope. The single-walled carbon nanotubes have been dispersed in the liquid crystalline monomers. It is found that the nanotubes followed the orientation of liquid crystal molecules. Introduction of nanotubes into liquid crystals did not change the liquid crystal structures. After polymerization, the phase structure of liquid crystals changed little based on the optical textures and small-angle X-ray scattering data.

Second, we applied the simple shear force to study the effect of the shear flow on alignment of nanotubes in the liquid crystal matrix. The system showed the single-domain liquid crystal order with micelle-wrapped nanotubes aligned along the shear direction. After polymerization, nanotube alignment was maintained in the resulting nanocomposites. To apply the screen-printing technology to generate vertically aligned nanotube-polymer composites, we updated the printing setup. It is hypothesized that screen-printing will generate vertical shear flow that induces vertically aligned nanotube polymer composites.

Third, students presented oral talks and posters in the national and regional research conference meetings. In particular, one undergraduate student gave a talk in the American Chemical Society (ACS) national annual meeting in 2014. This three-year NSF award will allow us to continue working on the project and provide students with opportunities for learning success.

Optical images of a liquid crystal monomer (a) without nanotubes, (b) with nanotubes and (c) after photo-polymerization.

Sonoma

Development of Modular Biotreatment System for Winery Wastewater

Michael F. Cohen and Farid Farahmand, Sonoma State University
cohenm@sonoma.edu, farid.farahmand@sonoma.edu; 707-664-3413

Rationale: Wastewater treatment can be a major cost for local wineries. We are investigating the potential application of microbial fuel cells (MFCs) to cost-effectively lower organic components in winery wastewater to levels that are suitable for use in on-site irrigation while producing electricity from the oxidation process.

Accomplishments and Findings:

• In January 2015 our collaborator David Simpson from the Okinawa Institute of Science and Technology assembled two MFCs with the assistance of Sonoma State student Gabriella Arango and initiated operation of the MFCs.
• Students involved in maintaining and monitoring the MFCs during the Spring 2015 semester were Gabriela Arango, David Brennock, Elanna Stemfeld, and Sierra Young in the Department of Biology and Frank Monforte.
• The MFCs have been continuously maintained on various mixtures of winery wastewater-derived feed for eight months, switching between an open and closed circuit path approximately every 24 hours. Retention times have been varied from one to five days.
• An automated system has been constructed for monitoring electricity from the MFCs and switching the MFC circuits from closed to open path; it has recently been linked to the MFCs.

Future plans:

• We will continue to feed the MFCs with winery wastewater-derived AD and monitor current production, and have recently begun conducting COD assays on MFC inflow and outflow to determine the extent of organics utilization by the MFC microbial communities.
• Based on our results, in October 2015 with our colleagues at the Okinawa Institute of Science and Technology we will be deploying a pilot-scale system at Vintners Square, Santa Rosa. SSU students will be closely involved in all aspects of the project, from installation to maintenance, monitoring and data analysis.

Funding: Secured from the Sonoma County Water Agency, the Sonoma State Research, Scholarship and Creative Activity Program, and the Okinawa Institute of Science and Technology.
Spotlight on a New CSU Institute

The CSU Bakersfield California Energy Research Center (CERC) is our newest institute. CERC engages in collaborative research efforts focusing on maximizing the efficient development of a host of energy resources available in their service region. Their expertise and experience cover a wide range of topics including:

- Energy conservation and sustainability
- Petroleum engineering and geology
- Reservoir modeling and characterization
- CO2 enhanced oil recovery and sequestration
- Water resources and quality
- Electrical engineering
- Control systems
- Energy efficiency in agriculture
- Energy-related education
- Energy economics
- Network security
- Solar and wind technologies

Research in these areas is commonly incorporated into curriculum, resulting in a large population of engineering and science students capable of engaging in activities. Students are thus ideally suited to step into well-paying industry and agency jobs after graduation.

California Energy Research Center (CERC) leverages the university’s academic resources and the expertise of Kern County energy industries to address technical, economic and public policy issues associated with energy production and generation in Kern County and California. The CERC will serve as a catalyst to expand the university’s capacity in key energy-related disciplines while benefiting vital regional and statewide energy assets and economic drivers.

Vision

CSU Bakersfield is recognized in California and the nation as a leader in addressing issues associated with energy production and generation. The CERC expands our capabilities in this area with a collaboration between CSU Bakersfield faculty and students with our local energy-related industry and agencies for the benefit of the local community, the region, and the state of California.

WRPI Collaboration

$150K was awarded to CSUB students through the Africa Array Program, housed at Pennsylvania State University, and through fellowships and internships funded in part by the NSF and a USDA internship program administered by the CSU Water Resources Policy Institute.

Rob Negrini, CSUB CERC Director
http://www.csub.edu/energycenter/index.html
(661) 654-3969
rnegrini@csub.edu

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California Energy Research Center

Research Facilities

- Scanning Electron Microscopy Laboratory
- Computer Mapping/Simulation Laboratory
- Sediment Analysis Laboratory
- Mineral/Elemental Composition Laboratory
- Materials Testing Laboratory
- Fab Lab (Fabrication Laboratory) http://www.csub.edu/fablab/
- Plant Physiology Laboratory
- California Well Sample Repository http://www.wellsample.com/

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Institutes, Centers, and Programs

The CSU system is home to a number of institutes, centers, and programs that focus on water-related issues, technology, and solutions. If we have missed any, please let us know, and we will keep this list updated online.

Bakersfield
California Energy Research Center
(661) 654-3969
Rob Negrini
http://www.csusb.edu/energycenter/index.html

Chico
Center for Water and the Environment
(530) 898-5205
Jennifer Rotnem
http://www.csuchico.edu/cwe/

Fresno
California Water Institute
(559) 278-2066
David Zoldoske
http://www.californiawater.org

Humboldt
River Institute
(707) 826-3438
Dr. Alison O'Dowd and Dr. William Trush
http://humboldt.edu/riverinstitute/

Monterey Bay
The Watershed Institute
(831) 582-3689
Laura Lee Lenik and Lars Pierce
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Northridge
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(818) 677-3532
Michael Antos
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Sacramento
Center for Collaborative Policy
(916) 278-6142
Susan Sherry
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San Bernardino
Water Resources Institute, San Bernardino
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Boykin Witherspoon III
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San Diego
Coastal and Marine Institute
(619) 594-0995
Todd Anderson
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San Luis Obispo
Irrigation Training and Research Center
(805) 756-2434
Stuart Styles
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Sonoma
WATERS Collaborative
(707) 644-3416
Dr. Claudia Luke
http://www.sonoma.edu/waters
Outlook and Planning for FY 2015/2016

The proposed fiscal year 2015-2016 workplan is as follows:

1) Boykin Witherspoon and David Zoldoske will continue visits to CSU campuses. The visits will include as appropriate:
   a. Meeting with campus President and/or representatives
   b. Meeting with faculty/staff active in water research and education
   c. Presentation on WRPI program goals and activities
   d. Listening to faculty/staff interests, needs, and ideas
   e. Meeting with Advancement and Government Outreach staff

2) Initiate system-wide request for proposals and identify faculty proposals for assigned time release and to support WRPI core initiatives. Monitor and support activities.

3) Manage the WRPI-related internship programs, including marketing of the programs, reviewing internship proposals, identifying host faculty and organizations, administering the programs, and exploring additional funding opportunities.

4) Identify and enter into appropriate interagency agreements for internship and other research opportunities.

5) Conduct meetings and work with WRPI Advisory Board to achieve program goals.

6) Review and actualize WRPI strategic plan, consulting widely within the CSU.

7) Plan and conduct WRPI conference; continuing the practice of involving selected government agencies, broader water community and CSU-faculty/staff to increase networking opportunities, build relationships, and articulate how WRPI can contribute to the state’s ability to analyze and solve its water resource and policy issues.

8) Plan and conduct WRPI-COAST student-faculty research poster reception; continuing the practice of involving CSU-faculty/staff/students, as well as the CSU Chancellor’s Office Board of Trustees, to increase awareness, provide networking opportunities, build relationships, showcase research projects by CSU faculty and our future water leaders, and articulate how WRPI can contribute to the state’s ability to analyze and solve its water resource and policy issues.

9) Manage the recently signed MOU with the Environmental Protection Agency (EPA), working with faculty and the Chancellor’s Office to reach agreed upon activities.

10) Continue to monitor the progress of the water bond, working closely with the CSU AIR office in Sacramento. Prepare to be responsive to future changes in funding mechanisms.

11) Continue to establish and find resources for a state-wide Disadvantaged Community Center (DACC).

12) Continue to work with the Chancellor’s Office and CSU campuses on the development of standards and protocols for measuring baseline water and utility consumption.

13) Continue to engage with venture capitalists in water technology.

14) Continue to encourage grant development and submittal; prepare both federal legislative requests and support CSU applied research special project requests.

15) Work with University Advancement staff to identify and secure foundation gifts/donations to support water-related applied research.

16) Continue to work with Government Relations staff to brief federal, state, and local officials on applied research capacity of the CSU system, and continue to seek opportunities to expand on this messaging to a broader community, conference panels, and regional and state forums.

17) Continue to develop strong ties to other CSU affinity groups particularly with respect to large-scale grant and contract activities and federal and state requests for support as appropriate.

18) Continue to explore/develop system-wide initiatives to share faculty research expertise as well as nascent equipment and facility-sharing initiatives.

19) Continue to develop WRPI website, marketing material, and newsletters including branding the WRPI as an Institute.

20) Write and publish annual report.
Water-Related Degrees and Certificates

Visit [http://www.calstate.edu/waters/degreescourses.shtml](http://www.calstate.edu/waters/degreescourses.shtml) for current list.

**CSU Bakersfield** - BA/BS in Geology; BS in Engineering Sciences with Biosystems and Agricultural Emphasis; BS in Environmental Resource Management; MS in Geology; Professional Certificate in Hydrogeology

**CSU Channel Islands** - BS in Biology; BS in Environmental Science and Resource Management

**CSU Chico** - BS in Agricultural Business; BS in Agriculture; BS in Biological Science; BS in Civil Engineering; BS in Environmental Science in Hydrologic Science; BA in Geography; MA in Geography, option in Environmental Policy and Planning; MS in Hydrology

**CSU Dominguez Hills** - BS in Biology, Ecology and Environmental Option; BS in Earth Science; MS in Environmental Science

**CSU East Bay** - BA in Environmental Studies; BS in Environmental Science; BA/BA in Geography; BA/BS in Geology; MS in Geology

**CSU Fresno** - BS in Civil Engineering; BS in Environmental Science; BS in Geology; BS in Plant Science, (Crop Production Management); BS in Plant Science, option in Plant Health; MS in Civil Engineering; MS in Plant Science; MS in Water Resource Management

**CSU Fullerton** - BA in Earth Science; BS in Geology; MS in Geology; MS in Environmental Engineering; MS in Environmental Studies

**Humboldt State** - BS in Environmental Resources Engineering; BS in Fisheries Biology (Freshwater); BS in Forestry (Forest Hydrology); MS in Environmental Systems (Environmental Resources and Engineering); MS in Natural Resources (Fisheries); MS in Natural Resources, Forest, Watershed, and Wildland Science

**CSU Long Beach** - BS in Civil Engineering; BS in Earth Science; BA/BS in Environmental Science & Policy; BA/MA in Geography; MS in Civil Engineering; MS in Geology; MS in Hydrogeology

**CSU Los Angeles** - BS in Civil Engineering, Hydraulic and Water Resources Engineering; MS in Civil Engineering; MS in Environmental Engineering Science; MS in Environmental Hydrology; Extended Learning partnership w/ Cal Poly SLO, Water Leadership & Management

**Cal Maritime Academy** - BS in Marine Engineering Technology; BA in Global Studies and Maritime Affairs

**CSU Monterey Bay** - BS in Environmental Science Technology & Policy, Watershed Systems Concentration; BA in Environmental Studies; BS in Marine Science; MS in Applied Marine and Watershed Science

**CSU Northridge** - BS in Biology; BS in Civil Engineering; BS in Geology; BS/MS in Environmental and Occupational Health

**CSU Fullerton** - BS in Agriculture; BS in Environmental Biology; BS in Plant Science; BS/MS in Geology; BS/MS in Urban and Regional Planning; MS in Civil Engineering, Environmental & Water Resources Emphasis

**SACRAMENTO STATE** - BS in Civil Engineering; MS in Geology; MS in Civil Engineering, Environmental Emphasis; MS in Civil Engineering, Water Resources Emphasis; Water Treatment Plant Operation Specialist Certificate; Wastewater Treatment Plant Operation Specialist Certificate (Continuing Education - The Office of Water Programs)

**CSU San Bernardino** - BS in Environmental Geology; BA in Environmental Studies; BS in Health Science, Environmental Health Concentration; MS in Environmental Science; MA in Interdisciplinary Studies; Master of Public Administration; Certificate in Geographic Information Systems (GIS); Certificate in Urban Planning

**San Diego State** - BS in Biology, Emphasis in Marine Biology or Ecology; BS in Environmental Engineering; BS in Environmental Sciences, Emphasis in Watershed Science; BS/MS in Civil Engineering, concentration in Water Resources Engineering; MS in Geography, Emphasis in Watershed Science; BS/MS in Geological Sciences, Specialization in Hydrogeology; BS/MS/PhD in Ecology

**San Francisco State** - BS in Earth Science, Hydrology Emphasis; BS in Environmental Studies in Earth Science Systems; BS in Environmental Studies, Concentration in Natural Resource Management and Conservation; BA in Geography; MA in Geography, Concentration in Resource Management and Environmental Planning; MS in Geographic Information Science; MS in Geosciences

**San Jose State** - BS in Biology, Concentration in Marine Biology; BS in Civil Engineering; MS in Water Resource Engineering

**Cal Poly San Luis Obispo** - BS in Agriculture, Minor in Water Science; BS in Bioscience & Agricultural Engineering, Concentration in Water Engineering; BS in Environmental Earth Science, Concentration in Land and Water Resources; BS in Environmental Soil Science; BS/MS in Civil and Environmental Engineering; MS in Agriculture, Specialization in Irrigation; MS in Agriculture, Specialization in Soil Science; MS in Water Engineering; Extended Learning, Water Leadership & Management

**CSU San Marcos** - BS in Biology, Concentration in Ecology; BA in Environmental Studies; Extended Learning, Survey of Water Management in Southern California

**Sonoma State** - BA/BS in Environmental Studies and Planning, Concentration in Water Resource Management; BA in Geography, Concentration in The Biophysical Environment; BA/BS/MS in Biology

**CSU Stanislaus** - BS in Agriculture; BS in Sustainable Agriculture; BS in Agriculture, Concentration in Agricultural Biology; BS in Biology, General; BS in Biology, Concentration in Organismal Biology, Molecular and Microbial Biology, and Ecology; BS in Geology; BA in Liberal Studies, Concentration in Earth Sciences; MS in Ecology and Sustainability; MS in Marine Science

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