!Waters Collaborative
SSU Center for Environmental Inquiry / Sonoma County Water Agency

2016-17 WATERS COLLABORATIVE ACCOMPLISHMENTS
For additional details see www.sonoma.edu/waters

Students, Faculty, and Partners

- 547 students participated in 46 projects with 25 faculty. Participants included students in 26 courses, 11 departments, and 3 schools.
- WATERS engaged more than 950 additional students, faculty, staff and community members at three events:
    - 2017 SSU Symposium on Research and Creativity, May 3, 2017 - WATERS collaborated with the School of Science & Technology, the Office of Undergraduate Research and Creative Experiences (SOURCE), and others to host a campus-wide symposium that celebrated the achievements of SSU students engaged in inquiry. This year, 46 posters were submitted to the symposium on water-related topics and judged by a panel of community and SSU faculty judges.
    - WATERS at the Sustainable Enterprise Conference, April 5, 2016 - Waters Program Lead and CEI Director Claudia Luke moderated the Sustainable Water panel this year at the 2017 Sustainable Enterprise Conference, hosted at the Sonoma State Campus.
    - WATERS at SSU President Sakaki's Investiture, April 20, 2017 - Waters Program Lead and CEI Director Claudia Luke moderated a panel on SSU entities that undertake on-going multiple project partnerships, including the Waters Collaborative.
- Staff from 15 organizations worked with faculty and students on water projects: Sonoma County Water Agency, SSU Facilities, Center for Environmental Inquiry, SSU Garden Classroom, Daily Acts, California Department of Water Resources, Americorps, JUMP – Join Us Making Progress, Vintners Square, D'Argenzio Winery, Sonoma County Youth Ecology Corps, Lawrence Berkeley National Laboratory, City of Santa Rosa, US Fish & Wildlife, Sustainable SSU, Sonoma Mountain Ranch Preserve
- Two faculty curriculum development grants were awarded to faculty to revise courses to add inquiry-based service-learning projects on real-world watershed management challenges. The program, called "Sustainability in the Classroom" is funded jointly by the Waters Collaborative and Sustainable SSU. Award winners this year are Dr. Russ Scarola (Hutchins School for Liberal Studies) and Owen Anfinson (Geology).

Project Findings
For further information about each project, click on the links in each heading

Sediment and Erosion Projects

- **Long-Term Erosion Monitoring in the Copeland Creek Headwaters** – Copeland Creek migrated northward during the 2016-17 rainy season, resulting in an annual erosional estimate of 6 cm/yr. A seasonal drainage into Copeland Creek showed increased deposition on both banks and the creek jumped its banks and created a new channel (Ramirez 2017).
- **Trail erosion and remediation at the Osborn Preserve** - Students used adaptive management to remediate trail erosion at the Osborn Preserve (Freed and Nickolin 2017).
- **Erosion Patterns on Copeland Creek –** The unusually wet rainy 2016-17 season eroded streambanks and deposited sediment on three monitoring transects on the SSU campus portion of Copeland Creek (DeSilva et al. 2107).

- **Freshmen studies in erosion and sedimentation** - Between 2016 and 2017, the proportion of pebbles increased and proportion of boulders decreased in the section of Copeland Creek crossing campus (Clifford et al. 2017)

Habitat Management Projects

- **Copeland Creek Restoration Project** – This multi-year project engages students in developing grant applications, restoration planning and implementation, plant propagation, and monitoring of the portion of Copeland Creek that crosses campus. In 2017, students, staff and contractors removed blackberry from one acre of the riparian corridor and began monitoring (Johnston et al. 2017, http://web.sonoma.edu/waters/projects/vegmanagement/ssu_copeland.html)
- **Sonoma County Wineries and Their Quest for Sustainability -** This project reviews the effects of wine-growing on water and other natural resources. Biodynamic agriculture and other sustainable practices are recom Emended to reduce environmental impacts. Ethical issues are explored (Montes et al. 2017).
- **Copeland Creek Floodplain Health –** Students reviewed channelization and urbanization of the Copeland Creek floodplain (McGough and Montero 2017)
- **Road crossings of California tiger salamanders (*Ambystoma californiense*) near mitigation tunnels in Sonoma County, CA –** The number of California tiger salamanders crossing Stony Point Road showed a slight increase in the 2015-16 rainy season over the previous year but not as high as levels observed in 2012-13 (Bradbury et al. 2017)
- **Tiger Salamander Breeding Pools** – Preliminary data indicates that average growth rate of the largest cohort of salamander larvae is significantly associated with change in depth of each pool (Edwards et al. 2017a). A new study is planned to study the effects of elevation and drainage rates of vernal pools on California Tiger Salamander metamorphosis. (Edwards et al. 2017b). Tiger salamander eggs and larvae were found more often in ponds with higher nitrate levels (Miller et al. 2017)
- **A Habitat Suitability Model for California Tiger Salamander -** A habitat suitability model predicts areas in Sonoma County that contain suitable habitat for the California tiger salamander and highlights areas that may be needed to be maintain viable populations (Carlos 2017).
- **Carbon Storage in Saltwater Marshes** – The total carbon stored in Heerdt Marsh in Corta Madera is 128.67 g m-2 year. The sample site farther from the tidal channel sequestered more carbon than the area closer to the channel (Chandler et al. 2017)
- **Spread of Sudden Oak Death in the Copeland Creek Watershed** – Copeland Creek is possible vector for Sudden Oak Death spread from SSU's Fairfield Osborn Preserve to the SSU Campus. We found that SOD occurs in bay laurel and European sweet bay trees on SSU campus but that symptomatic leaves are lower on campus than at the preserve. Although tanoaks had visible symptoms (including stem cankers), tests found they were infected by a related species (*P. nemerosa*). (Avila and Wininger 2017)
- **Impacts of Cattle Grazing on Grassland Communities on Sonoma Mountain –** Despite decreased vegetation height, thatch depth, and increased soil compaction, cattle grazing did not decrease the observation rate of ground-dwelling grassland vertebrates. (Bradbury et al. 2017b)
- **Land Management Training -** CEI's Land Management Program trained 20 students in restoration techniques and they worked on five ecological restoration projects with partners in west Sonoma County.
- **Freshmen studies in habitat management**
    - Ten years after a restoration project in the Salmon Creek Estuary, density and abundance of invasive species were higher than native species (Cardinale et al. 2017).

- Areas adjacent to Himalayan blackberry patches have suitable habitat (wet, sunny areas) and blackberry is expected to spread at SSU's Osborn Preserve (Chesbrough et al. 2017)
- Soil nitrogen is higher in areas with Himalayan blackberry at a freshwater marsh at SSU's Osborn Preserve (Dantoc et al. 2017)
- Canopy cover had little effect on water and soil temperature in riparian zones along Copeland Creek. (Gonzales et al. 2017)
- Rooftop watershed catchments and an increase in riparian canopy cover are recommended to improve Coho salmon habitat on Dutch Bill Creek (Isidro et al. 2017)
- Soils in riparian areas with higher canopy cover dried out more slowly than those with lower canopy cover, suggesting that canopy cover may influence the abundance of slender salamanders (Lull et al. 2017)
- Water temperature and vegetation density suggested that three ponds at SSU's Osborn Preserve provided suitable red-legged frog habitat (Pinto et al. 2017)

Water Quality Projects

- **Quantification of phosphorus in sediments of the Laguna de Santa Rosa watershed** – Phosphorus concentration was measured in water and sediment samples in the Laguna de Santa Rosa and 3 upstream drainages: Coleman Cree (2 sites), Hinebaugh Creek (4 sites), Copeland Creek (3 sites). All sites exceeded EPA water quality standards for phosphorus with the highest concentration occurring in the Laguna itself. Phosphorus concentration in sediments ranged from 361-851 mg/kg. Sites with the highest concentrations (> 700 mg phosphorus/kg) were the Laguna de Santa Rosa, 2 sites on Copeland Creek and 1 site on Coleman Creek (Rai et al. 2017).
- **Wastewater treatment effects on antibiotics -** A growing concern is the fate of antibiotics that end up in our waterways after they are treated at wastewater treatment plants. By-products of the antibiotic Azithromycin are identified under conditions that simulate wastewater treatment (Avila and Avila 2017).
- **Copeland Creek water quality monitoring project -** In 2016, data showed an increase in TDS of about 150 ppm as Copeland Creek flowed through campus. In 2017, the size of this increase lessened to only about 100 ppm. With more sampling sites, we discovered that several point sources led to spikes. The TDS levels throughout Rohnert Park still continuously rise and have a more equal influence this year in comparison to SSU (Talley 2017)
- **Nutrient and *E. coli* levels upstream and downstream of the proposed detention and recharge basin -** In the fall (but not spring) of 2014 and 2016, Copeland Creek and the SSU campus ponds exceeded US Environmental Protection Agency limits (Soule 2017)
- **Freshmen studies in water quality**
  - Sunflowers, but not peas, grew faster when irrigated with rainwater than with reclaimed water (Castillo et al. 2017)
  - Water quality in SSU campus lakes was not high enough to allow the reintroduction of tule perch, a native California fish (Chastain et al. 2017)
  - Dissolved oxygen levels measured at multiple sites in the Russian River estuary varied by 0.5 mg/l (Cheng et al. 2017)
  - Reclaimed water improved radish growth but had little effect on sunflower growth (Grunwald et al. 2017)
  - Levels of nitrates, pH, alkalinity, hardness, and temperature increased and turbidity decreased one week after the removal of blackberries from the upper bank of Copeland Creek (Miles et al. 2017).

Water Availability and Use Projects

- **Rainwater Capturing System - *Winner of the 2017 Best Water Poster Award*** - We designed a rainwater capture system to provide water to the SSU Garden Classroom. The system, approved for installation in the summer of 2017, will be mounted on the roof of the Environmental Technology Center and is estimated to collect and store 4000 – 8000 gallons of water per year. The water will be distributed to the garden via a drip irrigation system (Rai 2017).
- **Underground Wireless Sensor Networks** – We developed and tested a wireless underground sensor network (WUSN) to better understand how this tool can be used to monitor soil temperature, moisture and composition (Palmerin et al. 2017)
- **The worth of water: drought perception and adaptation among Sonoma County farmers** – Interviews and on-line surveys reveal that age and farm size often guide how farmers define drought, while mitigation and adaptation efforts are dependent on crop type and land management decisions. Community-based support of environmentally friendly farming practices was important in incentivizing mitigation and adaptation, even when not cost-effective (Souza 2017).
- **Securing Our Water Future: Environmental Political Theory as a Framework of Sustainability for the Sonoma County Water Agency -** Municipalities, conservation districts and non-profits were asked about their role in using, managing, and protecting local water resources, and the ways in which they address sustainability of water resources. Results are discussed through the lens of four environmental political theories and recommendations are made for SCWA leadership (Finch et al. 2017).
- **An Integrated Land Use and Water Planning Tool** – An excel-based calculator was applied to 3 projects in Rohnert Park to assess how the tool can benefit development planning (Kelly et al. 2017).
- **Water Harvester** – We developed a prototype of a low-cost device that harvests water from the air at the rate of 400-500 mL per day using only direct solar power (Lynch 2017). Improving the device's efficiency was achieved through experimentation with various materials and environmental conditions. (Stepek 2017)
- **Students Learn About Water from a Social Robot** - More students retained water information when told by the social robot rather than a human (McCabe et al. 2017)
- **Development of a modular biotreatment system for winery and brewery wastewater** - A small-scale microbial fuel cell system, tested at the D'Argenzio winery, displayed efficiencies similar to full-scale high-efficiency anaerobic digesters but without the need for heating or mixing (Sacher et al. 2017). Winery wastewater is full of colored phenolic compounds that are difficult to degrade but must be removed before the water can be used for agriculture. We isolated microorganisms from the microbial fuel cell to investigate their ability to degrade phenolic compounds (Tenerelli 2017).
- **Predicting extreme rainfall in the Copeland Creek watershed -** Rainfall data from Bodega Bay can be used to predict extreme rainfall in the Copeland Creek headwaters, providing an opportunity for development of an early flood warning system for Rohnert Park (Sacher and Arco 2017).
- **Freshmen studies in water use and availability -** Installation of a rainwater catchment is not an economically beneficial alternative to using reclaimed water (Belote-Broussard et al. 2017).