State of Washington Water Research Center
Washington State University

Annual Technical Report
2019

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Institute: State of Washington Water Research Center (WRC)

Products

2019WA269B:

Alam, I., Guiney, L.M., Hersam, M.C., Chowdhury, I. (2020) “Pressure-driven Filtration and Antifouling Performance of Two-Dimensional Nanomaterial Functionalized Membranes”, Journal of Membrane Science, 599, 117812. (Journal Article)

Alam, I., Guiney, L.M., Hersam, M.C., Chowdhury, I. “Novel Graphene Oxide and Molydenum Disulfide Composite Membranes with Improved Desalination and Antifouling Performance”, presented at Sustainable Nanotechnology Conference, November 11-13, 2020. (Conference)

Chowdhury, I., “Two Dimensional Nanomaterial-based Membranes for Water Filtration”, webinar presented at USAID Center of Excellence for Water, September 1, 2020. (Invited Seminar)

Alam, I., Chowdhury, I. “Reuse of Food Processing Wastewater in Irrigation using Two-Dimensional Nanomaterial-Based Membranes”, presented at ACS Fall 2020 Virtual Meeting & Expo, August 17-20, 2020. (Conference)

Alam, I., Guiney, L.M., Hersam, M.C., Chowdhury, I. “Pressure-driven Filtration and Antifouling Performance of Two Dimensional Nanomaterial Functionalized Membranes”, presented at 8th Sustainable Nanotechnology Conference, November 7-9, 2019, San Diego, CA. (Conference)

Follow-on, Source and Amount of Funding for 2019WA269B.
USDA NIFA; $499,753 (Title: Reuse of Treated Food Processing Wastewaters in Irrigation) (Co-PI: Lynne Carpenter-Boggs) Funding period: Applied (2021-2024)

2017WA428B:

Fremier, A.K., Stahl, A.T., and Cosens, B. "Building ecological resilience through coordinated riparian conservation" linked below the page with the citation "2017: 2017. The Wildlife Society Annual Conference, Albuquerque, NM." (Conference)

Stahl, A. T., Fremier, A. K. and and Cosens, B. “Mapping legal authority for corridor conservation: local footholds for cross-boundary coordination”. Submitted to Joint Regional Conference of the Society for Ecological Restoration Northwest Chapter and the Society of Wetland Scientists Pacific Northwest Chapter: Restoring Resilient Communities in Changing Landscapes. (2018) Spokane, WA. (Chapter)

Stahl, A.T., Fremier, A.K. and Cosens, B.A. “Mapping legal authority for terrestrial conservation corridors along streams”. Conservation Biology, 34: 943-955. (2020)
https://doi.org/10.1111/cobi.13484 (Article)

2015WA394B:

Ted M. Uecke , Susan D. Kaspari, Keith N. Musselman, and S. McKenzie Skiles. “The Post-Wildfire Impact of Burn Severity and Age on Black Carbon Snow Deposition and Implications for Snow Water Resources, Cascade Range, Washington”. Journal of Hydrometeorology Volume 21 Issue 8 (2020). (n.d.). https://journals.ametsoc.org/view/journals/hydr/21/8/jhmD200010.xml (Journal Article)

Ted M. Uecke , Susan D. Kaspari, Keith N. Musselman, and S. McKenzie Skiles. Study links high-intensity fire and accelerating snowmelt in Cascades | Local | yakimaherald.com [WWW Document], n.d.9 (2020) URL https://www.yakimaherald.com/news/local/study-links-high-intensity-fire-and-accelerating-snowmelt-in-cascades/article_f6a451ba-6e4c-5810-88a9-86037918c0e3.html (Article)

2012WA344B:
Kaspari, S. D., Pittenger, D., Jenk, T. M., Morgenstern, U., Schwikowski, M., Buenning, N., & Stott, L. Twentieth century black carbon and dust deposition on South Cascade Glacier, Washington State, USA, as reconstructed from a 158-m-long ice core. Journal of Geophysical Research: Atmospheres, 125, e2019JD031126. (2020) https://doi.org/10.1029/2019JD031126

National Competitive Grants for which the State of Washington Water Research Center is the lead institute

NIFA Accession # 1016467 (“Technology for Trade”)
Yoder, Jonathan, Julie Padowski, and Kirti Rajagopalan. 2020. Coevolution of technology and law for water management in Washington State and beyond. In Washington Agribusiness Status and Outlook 2020. IMPACT Center. Washington State University. Pp. 37-41. http://ses.wsu.edu/impact-center/wp-content/uploads/sites/2/2020/01/WASO_2020_v2_nobleed.pdf.

Vargas, J.Q., L.R. Khot, R.T. Peters, A.K. Chandel, and B. Molaei. 2019. Low Orbiting Satellite and Small UAS based High Resolution Imagery Data to Quantify Crop Lodging: A Case Study in Irrigated Spearmint. Geoscience and Remote Sensing. 1545-598X: 1-5. DOI: 10.1109/LGRS.2019.2935830

Luri, Moses. Essays in Water Resource Management, Adaptation, and Economic Development. Completed in partial fulfillment of a Ph.D. in Economics. 9/2020.
Sonia A. Hall (WSU). Check it out: Measuring Water Use Rather Than Water Diversions. October 15, 2019. https://www.agclimate.net/2019/10/15/check-it-out-measuring-water-use-rather-than-water-diversions/

Sonia A. Hall (WSU). Check it out: Using the Climate Toolbox to Explain This Winter's Snowpack Dynamics. March 23, 2020. https://www.agclimate.net/2020/03/23/check-it-out-using-the-climate-toolbox-to-explain-this-winters-snowpack-dynamics/

WA Dept Ecology: Skagit Exempt Well Mitigation project.

Brady, M.P., Padowski, J., Yoder, J.K., Jessup, E., Christensen, D., Yang, Q. and Anderson, B., 2019. Mitigating Groundwater Impacts of Residential Wells through Small-Scale Distributed Storage in the Skagit River Basin. *JAWRA Journal of the American Water Resources Association*, *55*(6), pp.1464-1478.

NIWR: An Analysis of US Water Centers' Governance Structure and Past Performance,Phase 1.

Pickering, Nigel, Julie Padowski, and Jonathan Yoder. An Analysis of National Institutes for Water Resources Governance Structure Phase 1 Report. Submitted to NIWR Board of Directors, January 2020.

Information Transfer Program

The WRC did not request funding for information transfer in 2019. The following were supported by cost-share and other non-extramural grant funds. Other information transfer activities of all other categories supported by extramural grants are not included, though 104B funds provide critical base-funding as support for staff necessary for extramural grant success and productivity and information transfer.

WRC Director Yoder is on the Board of Directors of the Universities Council on Water Resources, and was President Elect of that organization during the reporting period. Padowski holds the following service positions: Northwest Climate Adaption Science Center, University Advisor; Consortium of Universities for the Advancement of Hydrologic Science, WSU Delegate; University Council on Water Resources, WSU Delegate; Engineers without Borders- Faculty Mentor, WSU.

Two undergraduate students were partially funded to conduct various activities related to the Outreach and Information Transfer function of the WRC, including further developing the information content of the website and help the administrative staff distribute news and information items.

WRC continues to improve upon our WRC website (https://wrc.wsu.edu/) by increasing the information content of the website, and the use of social network media to increase the visibility of WRC activities.

WRC co-administers the Graduate and Undergraduate Certificate in Water Resource Science and Management through the WSU School of the Environment. In addition, the WRC mentors the student-led formation of the Water Resources Club at WSU.

Student Support

The 2020 104B seed grant program directly supported 8 undergraduate, 1 Master's and 1 Ph.D. student. There will be one Dissertation/Theses resulting from student support but it has not been finalized yet.

Extramural grant funding indirectly supported by 104B funds provides support for an additional seven graduate students who would not have been funded without the indirect support of the 104B program.

Notable Achievements and Awards

The 104B base funding provided the necessary foundational support for extramural grant success.

WRC/Yoder
Title: "Water Markets for the Yakima Basin: Researching and Developing Strategies for Multi-Benefit Markets." Leveraging Agricultural Water Transactions to Increase Instream Flow
Agency: Trout Unlimited
Award Date: 5/20/2019
Award Amount: $47,483

Title: 2020 Modified Flows Irrigation Depletion Calculations
Agency: Department of Energy Sub Agency: Bonneville Power Administration
Award Date: 12/13/2019
Award Amount: $0

Title: An Analysis of US Water Centers' Governance Structure and Past Performance, Phase 1.
Agency: National Institutes for Water Resources
Award Date: 10/16/2019
Award Amount: $15,167

Title: PMU: 2021 Columbia River Supply and Demand Forecast
Agency: Washington State Department of Ecology
Award Date: 12/13/2019
Award Amount: $1,559,285

Title: PMU: Egyptian Center of Excellence in Water
Agency: The American University in Cairo
Award Date: 7/18/2019
Award Amount: $832,855
Yoder Lead PI

Title: PMU: Skagit Basin Supply and Demand Analysis
Agency: Washington State Department of Ecology
Award Date: 3/26/2020
Award Amount: $603,396
Yoder Lead PI

Title: PMU: Technology for trade: Improving water use and allocation efficiency in agriculture and beyond.
Agency: US Department of Agriculture Sub Agency: National Institute of Food and Agriculture
Award Date: 6/17/2019
Award Amount: $4,966,223
Yoder Lead PI

Padowski
Title: Assessing the need for fire-related decision-support tools for water management in the Pacific Northwest, USA
Agency: National Aeronautics & Space Administration
Award Date: 5/13/2020
Award Amount: $64,729
Padowski lead PI

Title; NW Climate Science Center Research Fellowship Program
Agency: University of Washington
Award Date: 5/19/2020
Award Amount: $93,445
Padowski lead PI

Title; SUSRN-Advancing Conference: The Next Urban Giants: Building Resilience and Equity into Growing Megapolitan Regions by Greening the Urban Human-Natural System
Agency: National Science Foundation
Award Date: 6/4/2019
Award Amount: $50,000

Title: Quantifying the state of groundwater in the Columbia Basin with stakeholder-driven monitoring" and fits within the Sustainable Resources Grand Challenge
Agency: Department of the Interior Sub Agency: Bureau of Land Management
Award Date: 10/30/2019 Pending
Award Amount: $299,940

Title: Flexible Biological and Chemical Catalysis Platforms for Transforming Urban Wastes into Biopower and Products
Agency: Johns Hopkins University
Award Date: 4/29/2020 Pending
Award Amount: $700,000

Reuse Of Food Processing Wastewater In Washington State

Project Type: Annual Base Grant
Project ID: 2019WA269B

Project Impact:

The objective of this study is to investigate the technical feasibility of treating food-processing wastewater to direct potable reuse in Washington State. The agriculture and food-manufacturing sector is a cornerstone of Washington's economy in both rural communities and metropolitan areas. Communities use in excess of 60 percent of their annual potable water to supply food processing industries. In this project, we developed two-dimensional nanostructure-based membranes for desalination of food processing wastewater. Two dimensional nanomaterials, one atom thick, can significantly reduce membrane thickness and reduce membrane fouling and increase water permeability. To address this need and produce effective nanocomposite membranes, we used a combination of graphene family nanomaterials and transition metal dichalcogenides to provide both antifouling and foul release properties. Results show that graphene oxide (GO)- molybdenum disulfide (MoS_2) nanocomposite membranes could be used for decreasing the TDS concentration of the Quincy industrial wastewater effluent to 500 mg/L required for irrigation usage. Further modification of the composite membrane (i.e., changing the ratio of GO and MoS_2 in the mixtures, increasing the amount of nanomaterials, etc.) could result in even higher TDS removal efficiency. Though the commercial RO membrane showed a maximum 95% TDS removal efficiency, water permeability through the RO membrane was very low and it was susceptible to fast-flux decline due to fouling. The results of this study will be useful for designing a membrane-based treatment system in the industries for producing high-quality effluent.

The Contribution Of Water Retention, Nutrient Loading And Microbial Community To Mosquito Breeding And West Nile Virus Transmission In Spokane County

Project Type: Annual Base Grant
Project ID: 2019WA270B

Project Impact:

Mosquitoes are the deadliest animals on the planet, due to the many diseases they transmit. In the US, the most common mosquito-borne disease is West Nile virus (WNV), transmitted by Culex mosquitoes. In urban environments, improperly draining storm-water infrastructure, such as catch basins and culverts, which contain polluted stagnant water, provide ideal habitat for these mosquitoes, creating localized foci of WNV transmission risk. This project surveys and identifies mosquito habitats in the City of Spokane and the City of Cheney, and examines the relationship between environmental conditions, mosquito productivity and WNV transmission risk. One potential conclusion of our study is that, as opposed to our assumption of a limiting nutrient level with a threshold above which mosquitoes can survive, mosquito larval density is instead determined as a complex function of the combination of a range of environmental conditions, such as water level and nutrient levels. It is possible that there is no combination below which mosquito larval density will be absolutely zero, as ovipositing female mosquitoes may lay their eggs into conditions that are not optimal for the survival and development of their offspring. It is also possible that there is not a single optimal combination of environmental conditions that will maximize mosquito larval density (and productivity), but rather that there is a range of combinations that provide similar conditions.