56th Annual Meeting of the Delaware Water Resources Center

University of Delaware
Water Resources Center
DGS Annex  261 Academy St.
Newark, Del.
May 13, 2021

Gerald McAdams Kauffman, Ph.D.
Director
University of Delaware
Water Resources Center

Martha B. Narvaez
Associate Director
University of Delaware
Water Resources Center

NIWR
THE NATIONAL INSTITUTES
FOR WATER RESOURCES

JOSEPH R. BIDEN, JR. SCHOOL OF PUBLIC POLICY & ADMINISTRATION
www.bidenschool.udel.edu
VIA ZOOM Call

• 56th Annual UDWRC Advisory Panel Meeting, May 13, 2021 10:00 am – noon

• Event details and find a time [https://udel.zoom.us/j/505147266](https://udel.zoom.us/j/505147266)
  Gerald Kauffman is inviting you to a scheduled Zoom meeting. Join Zoom Meeting [https://udel.zoom.us/j/505147266](https://udel.zoom.us/j/505147266)

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  Dial by your location
  +1 312 626 6799 US (Chicago)
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  +1 346 248 7799 US (Houston)
  +1 669 900 6833 US (San Jose)
  +1 253 215 8782 US
  +1 301 715 8592 US
  Meeting ID: 505 147 266
  Find your local number: [https://udel.zoom.us/u/abFZNbGTI](https://udel.zoom.us/u/abFZNbGTI)

  Join by Skype for Business
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MEMORANDUM

TO: Advisory Panel of the University of Delaware Water Resources Center
Undergraduate/Graduate Water Research Students and Advisors

FROM: Gerald J. Kaufman, Director
       Marta B. Narvaez, Associate Director
University of Delaware Water Resources

DATE: Center March 29, 2021

SUBJECT: 56th Annual UDWR Advisory Panel Meeting, May 13, 2021 10 am-12:15 pm

You are invited to the 56th Annual Meeting of the Advisory Panel of the University of Delaware Water Resources Center at 10 am on Thursday May 13, 2021 to be held via ZOOM call from the University of Delaware campus in Newark, Delaware. Our charge will be to review the research presentations of the FY20/21 water resources students, discuss the upcoming FY21/22 research projects, and establish water research priorities in Delaware for the upcoming year. Students will present a 3-slide powerpoint slide that presents their research to the DWRC Advisory Panel the morning of May 13, 2021. For guidance on the contents of student research presentations, please see our website here. https://www.wrc.udel.edu/education/internships/

Agenda

Delaware Water Resources Center
56th Annual Advisory Panel Meeting

10:00 am
May 13, 2021

University of Delaware
via ZOOM call

https://udel.zoom.us/j/505147366

1. Introductions
2. DWRC Strategic Plan for Diversity, Inclusion, & Environmental Justice
3. FY20/21 Undergraduate/Graduate Research Presentations
4. DWRC FY21/22 Budget Submittal to DOI/USGS
5. FY21/22 Undergraduate Water Internship Proposals (start Sep 2020)
6. DWRC Advisory Panel Membership
7. Federal Water Research Opportunities
8. Adjourn

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Authorizations

Water Resources Research Act Program (WRRA) activities are conducted under the authority of various pieces of authorizing legislation. Many of the primary authorizations that allow the USGS and WRRA to serve the American people are listed below, along with descriptions of either how the authorization relates to USGS or what WRRA activities are performed under a particular authorization.

General USGS Authorizations

The **Organic Act of March 3, 1879**, (43 U.S.C. 31 et seq.) that established the Geological Survey, as amended (1962); and restated in annual appropriation acts. This section provides, among others, that the Geological Survey is directed to classify the public lands and examine the geological
The Waer Resources Research Act of 1984, as amended. 42 USC 10301 et seq.

10301. Termination of Board

The Board shall cease to exist not later than 1 year after the date on which the Secretary designates disposal of high-level radioactive waste or spent nuclear fuel in a repository.

10270. Authorization of appropriations

Notwithstanding subsection (d) of section 10222 of this title, any section subject to subsection (c) of such section, there are authorized to be appropriated for expenditures from amounts in the Waste Fund established in subsection (c) of such section such sums as may be necessary to carry out the provisions of this subchapter.

CHAPTER 109—WATER RESOURCES RESEARCH

1001. Congressional findings and declarations.
1002. Congressional declaration of purpose.
1003. Water resources research and technology institutes.
1004. Development of water-related technology.
1005. Administrative costs.
1006. Development of water-related technology.
1007. Previous findings and declarations.
1008. New spending authority; amounts provided in advance.

10301. Congressional findings and declarations

The Congress finds and declares that:
1. The existence of an adequate supply of water of good quality for the production of materials and energy for the Nation’s needs and for the efficient use of the Nation’s energy and water resources is essential to national economic stability and growth, and to the well-being of the people;
2. The management of water resources is closely related to maintaining environmental quality, productivity of natural resources and agricultural systems, and social well-being;
3. There is an increasing threat of impairment to the quantity and quality of surface and groundwater resources;
4. It is necessary to provide for the research and development of technology for the conversion of salines and other impaired waters to a quality suitable for municipal, industrial, agricultural, recreational, and other beneficial uses;
5. The Nation must provide programs to strengthen research and associated graduate education because the pool of scientists, engineers, and technicians trained in fields related to water resources constitutes an invaluable natural resource which should be increased, fully utilized, and regularly replenished; and
6. Long-term planning and policy development are essential to ensure the availability.
of product water, considering the amortization of all components of the demonstration plan: and auxiliary facilities. Such report shall be accompanied by a proposed contract (or cooperative agreement) between the Secretary and a duly authorized non-Federal entity, in which each entity shall agree to provide not less than 15 per centum and not more than 35 per centum of the total cost of the demonstration, such cost to include, without being limited to, necessary water rights, water supplies, rights-of-way, power source interconnections, site disposal facilities, land, construction, ancillary facilities, and the operation and maintenance costs for a period of four years following final acceptance of the construction of the project. The contributions of the non-Federal entity under such proposed contract may be tied. During the participation by the Secretary in the construction and the operation and maintenance of such demonstration, access to the demonstration and the operating data will not be denied to the Secretary or his representatives. The period of participation by the Secretary in the operation and maintenance of any such demonstration shall be for four years. The Secretary is authorized to include in the proposed contract a provision for conveying, as appropriate, and in such amounts as are appropriate, rights, title and interest of the Federal Government in the demonstration project to the non-Federal public entity.

"(c) There is authorized to be appropriated, to remain available until expended, for the fiscal year ending September 30, 1978, and thereafter, the sum of $50,000,000 to finance the total Federal share of the cost of the demonstration projects authorized by this section. Such cost shall include, without being limited to, necessary water rights, water supplies, rights-of-way, power source interconnections, site disposal facilities, land, construction, ancillary facilities, and the operation and maintenance costs for the four-year period of Federal participation in such costs.

"(d) When appropriate opportunities are made for the commencement or continuation of design, construction, or operation and maintenance of any demonstration project authorized under this Act, the Secretary, in connection with such design, construction, or operation and maintenance, enter into contracts and cooperative agreements for miscellaneous services, for materials and supplies, as well as for construction, which may cover such periods of time as the Secretary may consider necessary but in which the backlog of the United States shall be contingent upon appropriate being made therefor.

For termination of Trust Territory of the Pacific Islands, see note set out preceding section 1061 of Title 48, Territories and Insular Possessions.

$10302. Congressional declaration of purpose

It is the purpose of this chapter to assist the Nation and the States in augmenting their water resources science and technology as a way to:

(1) assure supplies of water sufficient in quantity and quality to meet the Nation's expanding needs for the production of food, materials, and energy;

(2) discover practical solutions to the Nation's water and water resources related problems, particularly those problems related to impaired water quality;

(3) assure the protection and enhancement of environmental and social values in connection with water resources management and utilization;

(4) promote the interest of State and local governments as well as private industry in research and the development of technology that will reclaim waste water and to convert saline and other impaired waters to waters suitable for municipal, industrial, agricultural, recreational, and other beneficial uses;

(5) promote more effective coordination of the Nation's water resources research program;

(6) promote the development of a cadre of trained research scientists, engineers, and technicians for future water resources problems; and

(7) encourage long-term planning and research to meet future water management, quality, and supply challenges.


References in text

This chapter, referred to in text, was in the original "this Act", meaning Pub. L. 98-242, Mar. 22, 1984, 98 Stat. 67, known as the Water Resources Research Act of 1984. For complete classification of this Act to the Code, see Short Title note set out under section 10301 of this title and Table.

Amendments

1996—Par. (3). Pub. L. 104-117, §213, struck out "(c)", before "proposed" and "and" after "program".

Par. (4). Pub. L. 104-117, §203, substituted "the Secretary" for "and" for period at end.; and added par. (7).

1990—Par. (2). Pub. L. 101-397 substituted "to promote more effective coordination of its for "coordinate more effectively".

$10303. Water resources research and technology institutes

(a) Establishment; designation of site by State legislature or Governor

Subject to the approval of the Secretary of the Interior (hereafter in this chapter referred to as the "Secretary") under this section, one water resources research and technology institute, center, or equivalent agency (hereafter in this chapter referred to as the "institute") may be established in each State (as used in this chapter, the term "State" includes the Commonwealth of Puerto Rico, the District of Columbia, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Mariana Islands and the Federated States of Micronesia) at a college or university which was established in accordance with the Act approved July 2, 1962 (12 Stat. 503; 7 U.S.C. 301 et seq.), or at some other institution designated by act of the legislature of the State concerned. If there is more than one such college or university in a State established in accordance with such Act of July 2, 1962, the institute in such State shall, in the absence of a designation to the contrary by act of the legislature of the State, be established at the one such college or university designated by the Governor of the State. Two or more States may cooperate in the establishment of a single institute or regional institute, in which event the same otherwise allocated to institutes in each of the cooperating States shall be paid to such single or regional institute.

(b) Scope of research; other activities; cooperation and coordination

Each institute shall—
Delaware Water Resources Center (DWRC)

A unit of the Institute for Public Administration
in the Joseph R. Biden, Jr. School of Public Policy & Administration

DWRC Staff
- Gerald J. Kaufman, Ph.D.
  Director/Associate Professor
- Andrew R. Homsey
  Policy Scientist
  (GIS Services Manager)
- Nicole M. Minni
  Associate Policy Scientist
  (GIS Laboratory/Leaves Office)
- Martha C. Narvaez
  Associate Director/Policy Scientist
- Sherri D. Martinez
  Senior Grants Analyst
- Sophie Phillips
  M.S. Energy & Environment Policy
- Hayley Rost
  MPA Master of Public Admin.

Undergraduate and Graduate Research Fellows

What is DWRC?
Established on campus in 1965, the University of Delaware Water Resources Center (DWRC) is one of the 54 National Institutes for Water Resources (NIWRs) at land grant universities in the 50 states, District of Columbia, and island territories of Guam, Puerto Rico, and U.S. Virgin Islands. The DWRC is supported by the U.S. Geological Survey through Section 104 of the Water Resources Research Act signed into law by Lyndon Baines Johnson in 1964. The mission of the DWRC is to: (1) support water resources research, education, and public outreach programs in Delaware and (2) sponsor training of future water scientists, engineers, managers, and policy-makers in the First State.

What is WRA?
Established in 1977 and modified in 1990 and 1997, the Water Resources Agency (WRA) is a program of the DWRC and provides regional water resources assistance to governments in Delaware and the Delaware Valley through the University of Delaware's land-grant public service, education, and research role. The WRA is supported by federal, state, and local government partners, including the State of Delaware, New Castle County, City of Newark, and City of Wilmington.

Where is DWRC?
The DWRC is located in Newark, Delaware, on UD’s main campus at 266 Academy Street in the Delaware Geological Survey (DGS) Annex, behind Penny Hall and the UD Rain Garden.

DWRC Partners
- Brandywine Conservancy
- Brandywine Valley Association
- City of Wilmington
- City of Newark
- Delaware Nature Society
- Delaware Center for Horticulture
- Delaware Greenways
- Delaware Department of Transportation
- Delaware River Basin Commission
- Delaware Department of Natural Resources and Environmental Control
- FishAmerica Foundation
- New Castle Conservation District
- New Castle County
- National Oceanic and Atmospheric Administration
- National Park Service
- Partnership for the Delaware Estuary
- SUEZ Water Delaware
- The Nature Conservancy (Delaware)
- UD Colleges
- U.S. Environmental Protection Agency
- U.S. Geological Survey
- William Penn Foundation

DWRC is involved with...
- Christina Basin Clean Water Partnership
- City of Wilmington Green Jobs Program
- Delaware Flora Database
- Delaware Source Water Assessment and Protection Program
- Delaware Water Supply Coordinating Council
- Delaware Watersheds
- Economic Value of Watersheds
- GIS Services/Education/Outreach
- Sussex Economic Development Action Committee
- Sustainable Coastal Community Initiative
- White Clay Creek Wild and Scenic Management Committee

www.wrc.udel.edu
Mission

The University of Delaware Water Resources Center (DWRC), established in 1965, is one of the 34 National Institutes for Water Resources (NIWRs) at land-grant universities in the 50 states, District of Columbia and insular territories of Guam, Puerto Rico, and U.S. Virgin Islands. The DWRC receives funding through Section 104 of the Water Resources Research Act of 1964, which was originally signed into law by Lyndon Baines Johnson in 1964. The U.S. Geological Survey administers the provisions of the Act and provides oversight of the nation’s Water Resources Centers through the National Institute of Water Resources (NIWR).

As a member of the NIWR, the DWRC has two key missions related to Delaware’s water resources – our precious groundwater aquifers and our streams, ponds, lakes, and coastal waters – (1) support research, education, and public outreach programs that focus on water management issues of importance to Delaware citizens and (2) to foster and support training and education programs for the future water scientists, engineers, managers, and policy-makers.

Education

DWRC provides an important role in water resources education at the University of Delaware and to the greater public. The DWRC carries out its education role through participating in outreach activities, offering courses, seminars and forums with a water resources focus, and advising undergraduate and graduate students through funded assistantships.

Courses Offered
- UAPP 611: Regional Watershed Management
- GEOG 432: Environmental Hydrology
- CIEE 440: Water Resources Engineering
- UAPP 887: GIS Applications in Public/Nonprofit Sectors
- UAPP 952: GIS in Public Policy

Conferences
- Water Policy Forum
- Delaware GIS Conference

Community Events
- Delaware Clean Water Rally
- Delaware GIS Day
- University of Delaware Ag Day
- University of Delaware Coast Day

Public Service

DWRC provides water policy assistance to governments in Delaware and the surrounding region. This public service role is significant to the mission of the College of Arts & Sciences and the School of Public Policy & Administration (SPfA). DWRC takes a regional, intergovernmental approach to water management since watersheds and aquifers cross many political jurisdictions.

The Water Resources Agency, a project of the DWRC, receives support from Delaware, New Castle County, and the cities of Wilmington and Newark to provide water resources assistance to the public with regard to water supply, water quality, and watershed planning and management.

Water Supply
- Delaware’s Water Supply Coordinating Council
- Office of the State Water Coordinator
- New Castle County Water Resources Protection Areas, Technical Advisory Committee
- Delaware Source Water Assessment and Protection Program

Watershed Management and Planning
- Christina Basin Clean Water Partnership
- White Clay Creek Wild and Scenic Management Committee
- Nonpoint Education for Municipal Officials (NEMO)
- Floodplain/Stormwater Management

Mapping and Data Services
- Comprehensive Plan Mapping
- Mapping Applications
- Public and Private Education (K-12) Assistance
- Regional Watershed Mapping: Data Creation, and Analysis

Research

DWRC seeks opportunities to collaborate with University faculty, scientists, and students to fund, conduct, and publish water resources research.

University of Delaware Experimental Watershed
Development of an experimental watershed as an on-campus education and research laboratory.

Geospatial Analysis and Information Management
Repository of core DWRC data and information collaboration in water research with other groups on campus and beyond. Advancement of GIS and remote-sensing technologies for water resources management.

Publications and Presentations
Research on topics such as water policy, watershed management, water rates, and public-private water management at regional and national conferences.
The University of Delaware is fortuitously situated on campuses ideally suited by hydrology and geography to study water resources.
JFK signs 1961 DRBC Compact

LBJ signs 1964 Water Resources Research Act

Lyndon B. Johnson

XXXVI. President of the United States: 1963-1969

461 - Statement by the President Upon Signing the Water Resources Research Act.

July 17, 1964

THE Water Resources Research Act of 1964, which I have approved today, fills a vital need.

Abundant, good water is essential to continued economic growth and progress. The Congress has found that we have entered a period in which acute water shortages are hampering our industries, our agriculture, our recreation, and our individual health and happiness.

Assuming a continuation of current practices, by the year 2000 there will not be enough usable water to meet the water requirements of parts of Arkansas, California, Colorado, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Utah, Wisconsin, and Wyoming.

This legislation will help us solve this problem. It will create local centers of water research. It will enlist the intellectual power of universities and research institutes in a nationwide effort to conserve and utilize our water resources for the common benefit. The new centers will be concerned with municipal and regional, as well as with national water problems. Their ready accessibility to State and local officials will permit each problem to be attacked on an individual basis, the only way in which the complex characteristics of each water deficiency can be resolved. The bill contemplates a high degree of interstate cooperation, and I urge that this be encouraged.

In large measure, this legislation is a tribute to the vision and wisdom of Senator Clinton P. Anderson of New Mexico. He has long recognized the problems. He developed the program. He guided it through Congress. He has been in the forefront of the effort to see that adequate supplies of water are available in all parts of the Nation.
The University of Delaware Water Resources Center, established on campus in 1965 at the 8th oldest institution of higher learning in the nation (est. 1743), is now a research center within the Joseph R. Biden School of Public Policy & Administration.
The National Institutes for Water Resources (NIWR) partners with the U.S. Geological Survey (USGS) through the provisions of the Water Resources Research Act (WRRA) to address water-related concerns by providing a national platform for research, training, and collaboration. NIWR provides each institute with a grant to target local priorities, recruit researchers and leverage federal funds with state money and private funding. 04 NIWR member institutes are housed in the country's land-grant universities in all 50 states, three U.S. territories and the District of Columbia. NIWR is the only federally mandated research program that focuses on applied water resources research, education, training and outreach.

Maximizing Federal Impact
NIWR's ability to attract and match non-federal funds to USGS grant-sponsored research multiplies the federal investment in local water projects. The NIWR-USGS partnership also strengthens USGS's own funding model, as non-federal institutes allow USGS to pass through the institutes to USGS State Water Science Centers. The NIWR Institutes open doors for the USGS at the state- and federal-level to other funding sources that may require non-federal matching funds. In recent years, the USGS State Water Science Centers have benefited from funds that have flowed through NIWR institutes from external sources for technical assistance and scientific expertise on large-scale, multi-partner projects that address emerging water research needs.

Impact & Collaboration

- NIWR member institutes assist public and private sector groups in their mission to protect human health, environmental resources, and economic sustainability.
- Last year, NIWR member institutes sponsored more than 1,200 groundbreaking research projects.
- Grants from USGS and other sponsors are awarded through a competitive, peer-reviewed process.
- NIWR member institutes collaborated on projects with over 100 universities, 150 state agencies, 150 federal agencies, departments and divisions, and more than 150 local and municipal offices.

Wanted: Interns
The USGS is encouraging NIWR institutes to take advantage of its nationwide internship program, details of which follow.

- The interns are hired by the NIWR institute but work with USGS Water Science Center researchers.
SUCCESS FROM THE GROUND UP

in water-related practices and policies

The National Institutes for Water Resources (NIWR) plays a critical role in addressing water-related concerns by providing a platform for research, training, and collaboration at the state level. NIWR is the nation's land-grant universities and four U.S. territories, the 45 NIWR member institutes leverage university expertise in research, education, and outreach to find solutions for the water management challenges we face. Our funding and educational services, water-related professionals, and researchers receive support for the creation of local tools and policies to better manage our water. These successes start at the local level and have the ability to grow and make an impact across the United States.

In FY 2015, Congress appropriated $6.5 million in NIWR grants funding enabling cutting-edge research on the nation's most pressing water issues. This financial resource includes matching from non-federal sources from the public and private sector. This local financing significantly leverages the available federal dollars for water research.

NIWR BY THE NUMBERS

214 sponsored research projects
564 sponsored researchers
285 students in training

Our history started in 1964

Water Resources Research Act, USGS, and NIWR

The 1964 Water Resources Research Act (WRRRA) established the nation’s Water Resources Research Institutes. Pursuant to the WRRRA of 1964 as amended, the United States Geological Survey (USGS) within the U.S. Department of the Interior assumed responsibility for administering WRRRA funding, which targets local, regional, and national water priorities, helps plan and recruit researchers, and aids in the transfer of technology and best practices.

Coordination and interaction between the Institutes and USGS is facilitated by NIWR. A volunteer-led organization, the NIWR network represents the only authorized federal-state program that focuses on applied water resources research, education, training, and outreach.

Visit us at niwr.info

TOOLS FOR

Annual Base Grants

The impact of the USGS NIWR research grant programs in the 104(b) Annual Base Funding grant program is approximately $10 million in NIWR member institutes to help each institute plan and conduct applied and peer-reviewed research, education, and outreach activities on water.

National Competitive Grants

The 104(g) National Competitive Grants program funds research in water issues that are of a regional or interstate nature or relate to a specific program priority identified by the Secretary of the Interior and the Institute.

Approximately $2 million is available each year. In 2021, 104(g) funding was awarded to four research projects studying important national priority issues in water quality and quantity. These projects were:
- "Using bioremediation to assess pyrethroid insecticide toxicity in urban sediments" in Illinois
- "Human and Ecological Health Impacts Associated with Water Reuse: Engineered Systems for Removing Priority Emerging Contaminants" in South Carolina
- "Hydrologic Life Cycle Impact of Mountain Pine Bark Beetle Infestations" in South Dakota

TRAINING OUR FUTURE LEADERS IN WATER

The National Institutes for Water Resources supports learning opportunities for students with funded research projects. Both undergraduate and graduate students explore new ideas and learn new skills. This fosters successful entry into a competitive water resources job market and allows them to make lifelong positive water resource impacts.
The Network of Water Resources Research Institutes
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<tr>
<th>State</th>
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<td>Minnesota</td>
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<td>Department</td>
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<td>Environmental/Natural Resources Engineering</td>
<td>Stillwater</td>
<td>Dr. Garey Fox</td>
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<td>Tennessee</td>
<td>Institute for Secure and Sustainable Environment</td>
<td>Knoxville</td>
<td>Mr. Tim Gangaware</td>
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<td>Texas</td>
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<td>Texas A&amp;M</td>
<td>Institute of Renewable Resources</td>
<td>College Station</td>
<td>Dr. Roel Lopez</td>
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<td>Center for Water Resources Research</td>
<td>Utah State</td>
<td>Civil and Environmental Engineering</td>
<td>Logan</td>
<td>Dr. Mac McKee</td>
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<td>Vermont</td>
<td>Rubenstein School of Environment Resources</td>
<td>Burlington</td>
<td>Dr. Breck Bowden</td>
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<td>Virgin Islands</td>
<td>Water Resources Research Institute</td>
<td>Univ. of Virgin Islands</td>
<td>Water Resources</td>
<td>St. Thomas</td>
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<td>Pullman</td>
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<td>West Virginia</td>
<td>National Research Center for Coal and Energy</td>
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<td>Research/Economic</td>
<td>Laramie</td>
<td>Dr. Greg Kerr</td>
</tr>
</tbody>
</table>
April 3, 2019

Dr. Gerald Kaufmann
University of Delaware
Water Resources Center
DGS Annex, 261 Academy St
Newark, DE 19716

Dear Jerry:

I am pleased to announce that you have been elected by the delegates of the Universities Council on Water Resources to serve as a member of the Board of Directors. On behalf of the entire Board, congratulations!

Your term will commence with the UCOWR Board meeting to be held on Thursday, June 13 at 7:00 am, at the 2019 UCOWR/NWWR Conference at Snowbird, Utah. There will be an earlier Board meeting held the day before the conference begins on Monday, June 10 at 9:00 am, which you are encouraged to attend as a guest. Your term will extend for a period of three years, ending with the 2022 Annual Conference.

We hope that you will be able to attend this year’s conference in order to formally meet the other Board members, be introduced to the delegates at the Delegate Luncheon on June 11, and attend both of the Board meetings that will be held at the conference. Registration for the conference is available at https://ucowr.org/2019-conference/registration/. If you have questions regarding the conference, please contact Staci Eakins at seakins@siu.edu.

Thank you for your willingness to assume the responsibility of serving on our Board. We look forward to working with you to further the mission of UCOWR.

Sincerely,

Karl W.J. Willard
Executive Director
# FY20-21 DWRC Undergraduate Water Research Interns

<table>
<thead>
<tr>
<th>Water Research Student</th>
<th>Major</th>
<th>Research</th>
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<tbody>
<tr>
<td>Hayley Rost</td>
<td>Master of Public Administration, Biden School</td>
<td>White Clay Creek Wild and Scenic River Water Quality Sampling Network</td>
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<tr>
<td>Anna Singer</td>
<td>Environmental Studies/Public Policy</td>
<td>Water Quality Trends in White Clay Creek Nat'l Wild &amp; Scenic River, Delaware and Pennsylvania</td>
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<td>Emily Jimenez</td>
<td>Environmental Engineering</td>
<td>Frequency of Peak Flood and High Tide Events in Delaware with Climate Change and Sea Level Rise</td>
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<td>Karmyn Pasquariello</td>
<td>Environmental Engineering</td>
<td>Economic Value of Properties in the Coastal/Riverine Floodplain in Delaware with Sea Level Rise</td>
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<td>Delaney Doran</td>
<td>Environmental Engineering</td>
<td>Watershed Characterization of First Order Tributaries along the Brandywine River in Delaware</td>
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<td>Elizabeth DeSonier</td>
<td>Environmental Science</td>
<td>Stratigraphy of Valley Fill Deposits Upstream of a Small Colonial-Age Mill Dam, White Clay Creek, Pennsylvania</td>
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<td>Lillian Peterson</td>
<td>Environmental Engineering</td>
<td>Stream Habitat Sampling along Tributaries of the Red Clay Creek in Delaware</td>
</tr>
<tr>
<td>Tommy Breevold</td>
<td>Environmental Engineering</td>
<td>Stream Habitat Sampling along Tributaries of the Red Clay Creek in Delaware</td>
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<td>Sitlaly Avelino</td>
<td>Environmental Engineering</td>
<td>Watershed Characterization of First Order Tributaries along the Brandywine River in Delaware</td>
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<tr>
<td>Jady Perez</td>
<td>Environmental Engineering</td>
<td>Forest Hydrology and Stream Health in the Hickory Run Watershed at Mt. Cuba Center</td>
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<td>Grace Hussar</td>
<td>Environmental Studies</td>
<td>The Effects of Reforestation and Invasive Species Removal on Stormwater Flooding Events in Baltimore</td>
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<tr>
<td>Bridgette Kegelmua</td>
<td>Geography/Greek Roman Studies</td>
<td>Updating Land Use and Impervious Cover Change for the State of the Bays Report</td>
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<td>Alexis Cervantes</td>
<td>Environmental Science</td>
<td>Historic Significance of the Brandywine River as Drinking Water Supply in Wilmington, Delaware</td>
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<td>Brendan Benson</td>
<td>Environmental Engineering</td>
<td>The Effect of Biochar on Infiltration Rate and Soil Aggregation in Both the Field and Lab</td>
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<tr>
<td>Shannon Bushinsky</td>
<td>Environmental Engineering</td>
<td>Intergovernmental River Basin Management, the International Joint Commission Model</td>
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<td>Patrick McGay</td>
<td>Environmental Engineering</td>
<td>White Rot Fungi with Solid State Bioreactors to Reduce Pathogens in Dairy Manure Runoff</td>
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<tr>
<td>Brielle Bianchini</td>
<td>Environmental Engineering</td>
<td>Water Quality Trends in White Clay Creek Nat'l Wild &amp; Scenic River, Delaware and Pennsylvania</td>
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Figure 3. Federal water and climate agencies

- President of the United States
- Department of Agriculture
  - U.S. Department of Agriculture
    - U.S. Fish & Wildlife Service
      - National Fish & Wildlife Service Agency
    - U.S. Forest Service
      - Bureau of Land Management
    - National Park Service
      - Bureau of Indian Affairs
      - Bureau of Ocean Energy Management
      - Bureau of Reclamation

- Department of Energy
  - Federal Energy Regulatory Commission
  - National Energy Administration
  - Federal Energy Management Agency
   - U.S. Coast Guard
     - National Marine Fisheries Service
     - National Weather Service
  - Department of Commerce
    - NOAA
    - National Oceanic and Atmospheric Administration
  - Department of the Interior
    - U.S. Geological Survey
    - Bureau of Reclamation
    - Bureau of Land Management
    - Bureau of Ocean Energy Management
    - Bureau of Reclamation
March 17, 2021

Senator Tom Carper
515 Hart Senate Office Building
Washington, DC 20510

Re: Water Resources Research Act (WRRRA)
Fiscal Year 2022 Interior and Environment Appropriations Bill

Dear Senator Carper:

As Director of the University of Delaware Water Resources Center, I am respectfully requesting your support of the Senate Appropriations Committee to provide $15 million for the Water Resources Research Act program in the Fiscal Year 2022 Interior, Environment, and Related Agencies Appropriations Bill.

The Water Resources Research Act, signed by Lyndon Baines Johnson in 1964, established the National Institutes for Water Resources (NIWR) at 54 land grant universities (such as the University of Delaware) in the 50 states, Washington D.C., and three island territories of Guam, Puerto Rico, and Virgin Islands. Through the U.S. Geological Survey in the Department of Interior, these institutes provide foundational science and research to help solve problems of water supply and quality in partnership with universities, local governments, water industry, and the public. Each state contributes a minimum of $2.1 million, thus ensuring that local, state, and regional priorities are addressed and the impact of federal dollars is maximized. The University of Delaware Water Resources Center was established on campus in 1965 and since then we have supported the education, research, and training of thousands of students (many from Delaware high schools) who have focused on solving the significant water resources issues of the day in Delaware, the Delaware Valley, and the United States.

Please don't hesitate to contact me at jeremy@udel.edu or call 302-831-5171 if you have any questions about this important appropriation concerning our state and national water resources.

Warmly,

Gerald J. Kaufmann
Director
University of Delaware
Water Resources Center
Newark, Del. 19716

March 17, 2021

Senator Chris Coons
127A Russell Senate Office Building
Washington, DC 20510

Re: Water Resources Research Act (WRRRA)
Fiscal Year 2022 Interior and Environment Appropriations Bill

Dear Senator Coons:

As Director of the University of Delaware Water Resources Center, I am respectfully requesting your support of the Senate Appropriations Committee to provide $15 million for the Water Resources Research Act program in the Fiscal Year 2022 Interior, Environment, and Related Agencies Appropriations Bill.

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Please don't hesitate to contact me at jeremy@udel.edu or call 302-831-5171 if you have any questions about this important appropriation concerning our state and national water resources.

Warmly,

Gerald J. Kaufmann
Director
University of Delaware
Water Resources Center
Newark, Del. 19716
March 17, 2021

Hon. Chellie Pingree (ME), Chairwoman
Subcommittee on Interior, Environment, and Related Agencies
House Committee on Appropriations
2162 Rayburn House Office Building
Washington, DC 20515

Re: Water Resources Research Act (WRRA) Fiscal Year 2022 Interior, Environment, and Related Agencies Appropriations Bill

Dear Chairwoman Pingree:

I write to urge your continued support for the Water Resources Research Act (WRRA) program in FY 2022 and a request for an FY 2023 appropriation of $15 million. The WRRA is a proven and effective program since 1964 and is a vital resource for many constituencies, including regional water managers and local business leaders. The Water Resources Research Act (32 USC 109 et seq.) established National Institutes for Water Resources (NIWR) at 54 land grant universities in the 50 states, District of Columbia, and island territories of Guam, Puerto Rico, and Virgin Islands to research water-related phenomena, aid the entry of new research scientists into water resources fields, train future water scientists and engineers, and distribute the results of research to water managers and the public.

The U.S. Geological Survey administers the program that provides valuable support for water research critical to local, state, and regional communities. These state programs match federal funds with a 2:1 ratio that leverages federal support to address regional water planning and management. Although the WRRA program is responsive to water needs of states and regions, it also addresses major national concerns related to drought, harmful algae blooms, flooding, and water contamination. The institutes collaborate with over 150 state agencies, 180 federal offices, and more than 155 local and municipal offices. In a given year, Federal dollars are leveraged to support 500 students in over 300 research projects, and more than 750 researchers and trainees for the STEM labor market.

I appreciate the Subcommittee’s support for the Water Resources Research Act and request that you continue funding this program in the FY22 Interior, Environment, and Related Agencies bill.

Sincerely,

Gerald J. Kaufmann
Director
University of Delaware
Water Resources Center
Newark, Del. 19716

Cc: The Honorable Lisa Blunt Rochester

JOSEPH R. BIDEN, JR. SCHOOL OF PUBLIC POLICY & ADMINISTRATION
www.bidenschool.udel.edu

March 17, 2021

Senator Jeff Merkley (OR), Chair
Subcommittee on Interior and Environment Appropriations Committee
531 Hart Senate Office Building
Washington, DC 20510

Re: Water Resources Research Act (WRRA) FY 2022 Interior, Environment Appropriations Bill

Dear Senators Merkley and Murkowski:

Thank you for the Subcommittee’s continued support for the Water Resources Research Act (WRRA) program. I write to urge your continued support for the WRRA and request an FY22 appropriation of $15 million. The WRRA is a proven and effective program since 1964 and is a vital resource for many constituencies, regional water managers, and local business leaders. The Water Resources Research Act (32 USC 109 et seq.) established National Institutes for Water Resources (NIWR) at 54 land grant universities in the 50 states, District of Columbia, and island territories of Guam, Puerto Rico, and Virgin Islands to research water-related phenomena, aid the entry of new research scientists into water resources fields, train future water scientists and engineers, and distribute the results of sponsored research to water managers and the public.

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I appreciate the Subcommittee’s support for the Water Resources Research Act and request that you continue funding this program in the FY21 Interior, Environment, and Related Agencies bill.

Sincerely,

Gerald J. Kaufmann
Director
University of Delaware
Water Resources Center
Newark, Del. 19716

Cc: Senator Tom Carper, Senator Chris Coons

JOSEPH R. BIDEN, JR. SCHOOL OF PUBLIC POLICY & ADMINISTRATION
www.bidenschool.udel.edu
Figure 10. Congressional water and climate committees (Van Scyoc 2021)
Hi all,

As per the updated bylaws, today is my last day as President of NIWR. Tomorrow, May 1. Kevin Wagner will assume the position. Attached is a list of all of your board members as of May 1. It has been a pleasure being your President and I look forward to continuing to serve as Past-President.

In addition to our change in leadership, I’m happy to announce that our reauthorization has passed in the Senate. Thanks to some quick work from some of our supporters, our reauthorization was attached to the Drinking Water and Wastewater Infrastructure Act of 2021 (S. 914). This Bill was passed earlier this week with a vote of 89-2. The reauthorization in the Senate includes a 1:1 match, 5 year reporting, and a $15m authorization.

We continue to work on reauthorization in the House. Our House Bill has been introduced and we will be seeking your help to create support for it soon. The House Bill is essentially the same as the Senate Bill except with an $18m authorization.

Have a great weekend,
Doug

_Doug Parker, Ph.D._
Director, California Institute for Water Resources
University of California, Office of the President
1111 Franklin St., Oakland, CA 94607, (510) 418-4438 (cell)
doug.parker@ucop.edu, http://ciwr.ucanr.edu, @ucanrwater
U.S. Geological Survey
Department of the Interior

WATER RESOURCES RESEARCH ACT PROGRAM
ANNUAL BASE GRANTS FISCAL YEAR 2021 REQUEST FOR APPLICATIONS
under Section 104(b) of the
Water Resources Research Act of 1984, as Amended

ANNOUNCEMENT G21AS00517
Revised October 15, 2020

CLOSING DATE
June 4, 2021
5:00 P.M. Eastern Standard Time

OMB Number: 1028-0097
Expiration Date: 1/31/2023

PAPERWORK REDUCTION ACT STATEMENT: In accordance with the Paperwork Reduction Act (44 USC 3501), an agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid Office of Management and Budget control number. OMB has reviewed and approved this information collection and assigned OMB Control Number 1028-0097. You may submit comments on any aspect of this information collection, including the accuracy of the estimated burden hours and suggestions to reduce this burden. Send your comments to: Information Collections Clearance Officer, US Geological Survey, gs-info_collections@usgs.gov.
WATER RESEARCH GRANTS

The state water resources research institutes authorized by section 104 of the Water Resources Research Act of 1984 are organized as the National Institutes for Water Resources. The NIWR cooperates with the U.S. Geological Survey to support, coordinate and facilitate research through the Annual Base Grants, National Competitive Grants, Coordination Grants, and in operating the NIWR-USGS Student Internship Program. The Annual Base Grants, 104(b), and National Competitive Grants, 104(g), make up the backbone of the USGS 104 program. Below is a brief explanation of these two similar, but different grants:

State Water Research Grants - USGS 104(b) Program

These grants provide competitive seed grant funding opportunities for faculty members or affiliates at institutions of higher education. Applications must be submitted through your State Water Research Institute or Center. The Institutes or Centers may only consider project proposals from faculty members or affiliates at institutions of higher education in its State. To find out where your state’s Institute or Center is located visit the Institutes webpage [here](#) and click on your state.

Unique characteristics of this program include:

- Research priorities are set by each institute in consultation with its state advisory board.
- Research focuses on state and regional water resources problems that can be addressed by researchers at academic institutions in states with common problems.
- All federal funds must be matched by at least two non-federal dollars for each federal dollar.

For more information on the USGS 104 program visit the USGS Water Resources Research Institutes website [here](#).

National Water Research Grants - USGS 104(g) Program

The goals of the National Competitive Grants program are to promote collaboration between the USGS and university scientists in research on significant national and regional water resources issues; promote the dissemination and results of the research funded under this program; and to assist in the training of scientists in water resources. The USGS 104(g) Program provides the major mechanism to meet the growing needs not filled by state or federal research programs.

Unique characteristics of this program include:

- Research priorities are set jointly by the National Institutes for Water Resources and the U.S. Geological Survey.
- The program focuses on regional and interstate water resources problems beyond those of concern only to a single state.
- All federal funds must be matched by at least one non-federal dollar for each federal dollar.

For more information on the USGS 104 program visit the USGS Water Resources Research Institutes website [here](#).
Program Name: Water Resources Research Act Program (WRRA)

- **Program Purpose:** The Water Resources Research Act (32 USC 109 et seq.) established university-based institutes to research water and water-related phenomena, aid the entry of new research scientists into the water resources fields, train future water scientists and engineers, and distribute the results of sponsored research to water managers and the public. The U.S. Geological Survey administers the program that provides valuable support for water research that is critical to local, state and regional communities. In turn, these state programs match the federal funding—in some cases with a 2:1 match—that leverages federal support to address regional needs. These funds support superior long-term water planning and management, and foster the next generation of water scientists, managers and engineers.

- **Fiscal Year 2019 Funding Received:** $6.5 million
- **Fiscal Year 2020 Funding Received:** $9.0 million
- **Level of Funding Requested for Fiscal Year 2021:** $15 million
DWRC Water Resources Research and Education Priorities

- Water quality (nutrients, pathogens, public health), harmful algal blooms, PFOA contamination
- Storm water runoff (management and control)
- Water supply, demand, and conservation (infrastructure/technology)
- Water policy (governance and economics)
- Climate change, sea level rise, riverine/coastal flooding
- Groundwater (remediation and treatment)
- Watershed management
- Wetlands (protection and restoration)
- Wastewater management (treatment and reuse)
- Water, food, and energy nexus
March 27, 2020

Dr. Asia Dowin
Department of Forestry
Natural Resources Building
Michigan State University
480 Wilson Rd. East
Lansing, MI 48824

Dear Asia:

As Director and Associate Director of the University of Delaware Water Resources Center, we are pleased to invite you to serve on the DWRC Advisory Panel for a two-year term through May 1, 2022 based on your expertise in water issues of importance to Delaware and the Mid-Atlantic region. Established on campus in 1965, the DWRC is one of the 54 National Institutes for Water Resources (NIWR) supported by the U.S. Geological Survey at land grant universities in the 50 states, District of Columbia, and three island territories of Guam, Puerto Rico, and U.S. Virgin Islands.

Responsibilities of the NIWR include: (1) innovative research that fosters entry of new research scientists into water resources fields, training of future water scientists and engineers, exploration of new ideas that address water issues, dissemination of research to water managers and the public and (2) cooperate with other colleges to develop a statewide program designed to resolve state/regional water problems.

We are proud of our water research program that was begun by my predecessor Deputy Dean Dr. Tom Sims and has supported over 300 undergraduate interns and graduate fellowships since 2000. In accordance with the Water Resources Research Act of 1964, the DWRC Director appoints an advisory panel to assist in the review and ranking of research projects and establish priorities for center activities. We meet annually in the spring where our interns present the results of their research projects. In your role as an advisory panel member you would have responsibilities to (1) provide input to the Director regarding the successful mission of the DWRC, (2) assist in review of DWRC graduate fellowship and undergraduate internship applications, and (3) help promote interaction of the DWRC with other organizations in the state, region, and nation.

Please let me know if you wish to serve on the DWRC Advisory Panel and don’t hesitate to contact us at 302-831-4930 or jerryk@udel.edu/mcorozzi@udel.edu. Thank you for your consideration.

Warmly,

Gerald J. Kauffman
Gerald J. Kauffman, Director
University of Delaware
Water Resources Center
Newark, DE 19716

JOSEPH R. BIDEN, JR. SCHOOL OF PUBLIC POLICY & ADMINISTRATION
www.bidenschool.udel.edu
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Everyon is Equal on this Blue Earth

UDWRC Director’s Message

Dr. Gerald Joseph McAdams Kauffman, Jr., Director
University of Delaware | Water Resources Center

As I wrote the previous message during the pandemic summer, I was heartened by the support we received from Delaware State University, the University of Delaware, the Delaware Water Resources Board, and the Delaware General Assembly. The need for our work has never been greater, and I am grateful for the continued support of our funders.

Back during the pandemic summer, Martha, Nicole, Andrew, and I crafted an FY21 work plan to direct our efforts at maximum efficiency during the height of the pandemic. It is now the fall of 2021, and despite the challenges we have faced, we have made significant progress on our work plan.

I am writing here from the Biden School, a place of great hope and feeling that if we stick together and learn about the social and physical sciences and treat people with decency, civility, and diversity in background and opinion that this world will be alright again.

As school resumed last fall, the health of everyone we work with is of paramount importance as we fight this pandemic. Our fieldwork along the White Clay Creek National Wild and Scenic River near Newark and Brandywine River in Wilmington has been safely conducted by our research students distancing and with masks.

With support from Section 104b of the Water Resources Research Act of 1984 and the appropriation by Congress this fiscal year through the U.S. Department of the Interior and USGS, we are able to provide for the funded water resources research of 17 undergraduate and graduate students to examine the critical water issues of the day in Delaware and the mid-Atlantic region. In Delaware and on campus, we receive excellent guidance from the offices of the Governor and UD President about safe practices to stay healthy, and we are committed to following these practices and most importantly wearing masks when inside and out.

Now the UD nursing school is conducting vaccinations on campus, and it looks like there is light at the end of our watershed that is the home of Jennersville, Pennsylvania, after the young physician from Oxford who developed the smallpox inoculation in 1776 and saved the world!

With regard to our racial awakening and indeed my own personal reckoning, I have thought about this every day and looked into the mirror and we need to do better—much, much better. The scales are off my eyes now and at long last the stage is set for true racial equality where indeed all of humanity is created equal with certain unalienable rights endowed by our creator under the laws of nature.

The UDWRC will become more diverse, we will bring on more scientists and students of every color from Delaware and America and from every corner of the globe.

Four years ago I requested that our homepage fly the message from Amos 5:24 and MLK, Jr. that reminds us to “let justice roll on like a river, righteousness like a mighty stream” and these are the words that we live by and will continue to live by. I was taught to fight racism wherever it reared its ugly head up, but it’s not enough.

And so now I look back on my life almost a half century ago when as a young guy I learned about true courage from the amazing Olympians of Mexico City 1968. During the summer of 1977 my track coach was Larry James (the Mighty Burner) who ran at Villanova and was the AD at UD. He ran a 43.97 and won the silver in the 400m and gold in the world record 4x400 relay and his teammates were three amazing men, Lee Evans, John Carlos, and Tommie Smith. I met them one day at a training camp in the Pine Barrens and they told me...
About the UDWRC

Mission:
Established in 1965 as one of the 54 National Institutes for Water Resources (NIWR) at land grant universities in the 50 states, District of Columbia, and three island territories of Guam, Puerto Rico, and U.S. Virgin Islands. The DWRC is Congressionally-mandated by Section 104 of the Water Resources Research Act of 1984 and 1964 administered by the U.S. Department of the Interior and U.S. Geological Survey. As part of the NIWR network, the mission of the DWRC is to: (1) support research, education, and public outreach programs that focus on water supply, water management, and water quality - issues important to Delaware citizens and (2) foster/support training and education programs for future water scientists, engineers, managers, and policy-makers who will lead the water resources research, planning, and management efforts in our state.

Staffing:
The UDWRC hosts the following faculty, scientists and students to fulfill our mission: Gerald J. Kaufman -- Director/Associate Professor
Martha R. Narvaez -- Policy Scientist/Associate Director
Nicole M. Minni -- Associate Policy Scientist/GIS Laboratory Lewes Campus
Andrew R. Horsey -- Policy Scientist/GIS Manager
Sherri Martinez -- Sponsored Programs Coordinator
Sophie Philips -- Graduate Research Fellow (M.S. Energy & Environmental Policy)
Hayley Rost -- Graduate Research Fellow (Master of Public Administration)
Kelly Slabicki -- Graduate Student (M.S. Water Science and Policy)

Public Health:
In accordance with the Governor's and UD administration's directives concerning the pandemic, the DWRC will move toward a phased reopening of the office during Summer 2021 with more extensive reopening in the fall semester. The ongoing pandemic has borne out the fact that the DWRC is able to maintain a high degree of efficiency and efficacy through the recent disruptions to the physical parameters of the work environment. Most of the work undertaken has been and can continue to be effectively achieved from remote locations, using technology to remain in contact with co-workers, funders, colleagues, and students. All components of the phased reopening with regard to the pandemic will be closely guided by the University's own policies and time-table published here: https://www.udel.edu/home/coronavirus/ud-campus-phased-reopening-guidelines/

Diversity:
Diversity is essential in civil society and in our scientific mission at the University of Delaware. The DWRC will redouble efforts to reach out and recruit talented minority and economically disadvantaged students and researchers. In the scientific world diversity is necessary for the evolution of knowledge and thus protection of the environment which everyone's well-being depends. The UDWRC has long been dedicated to this ideal taking a leadership role with youth in Wilmington through the Green Jobs program to develop the skills of tomorrow's leaders. Certainly more can and needs to be done. Through the recruitment of an increasingly diverse population of faculty, policy scientist, and undergraduate and graduate research students, this diversity can be strengthened. In accordance with our mission as designated by Congress under the Water Resources Research Act of 1984, the DWRC will reach beyond the University of Delaware to strengthen partnerships across the state at research institutions of higher learning at Delaware State University, Wesley College, and Delaware Technical Community College. In this way DWRC will strengthen and broaden its research and scientific reach and enhance its ability to serve the needs of Delaware and all Delawareans, to whom water is a crucial resource and a prerequisite to health and happiness. We will focus on:

- Correspond with leadership of University of Delaware, Delaware State University, and Delaware Tech requesting nominations of diverse students for DWRC undergraduate water research internships.
- Re-examine UDWRC Advisory Panel for diversity and request feedback from the DWRC Advisory Panel on ways DWRC may be increase inclusiveness among its students, board and project work.
- Revisit with our UDWRC student alumni and celebrate their stories and their background. see https://www.wrc.udel.edu/about-wra/student-research-assistants/
- Incorporate demographics of race, ethnicity, gender, and income of the study area into our research reports. Assess how existing and future projects may be enhanced to improve diversity and inclusiveness through the University of Delaware Office of Diversity and Inclusion and Coalition for the Delaware River Watershed (CDRW). UDWRC has two Delaware offices, its main office on the University of Delaware Newark campus, between Penny Hall and the Perkins Student Center, and on the Hugh R. Sharp campus of the University of Delaware in Lewes. Detailed directions for both locations are here.
UDWRC Research Interns

FY19 Student Support
The University of Delaware Water Resources Center supported 11 undergraduate and graduate water research internships during FY19 through the annual base (104b) grants. The DWRC research students presented their research findings at the 55th annual meeting of the DWRC Advisory Panel on May 14, 2020 at the University of Delaware:

<table>
<thead>
<tr>
<th>Last Name</th>
<th>School</th>
<th>Degree</th>
<th>Research Advisor</th>
<th>Title of Proposed Research</th>
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</thead>
<tbody>
<tr>
<td>Sicily Bordrick</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Anastasia Chirnside</td>
<td>Optimization of HPLC Analysis of Ergosterol to Quantify Fungal Biomass within Bioreactors</td>
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<tr>
<td>Zach Burcham</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Anastasia Chirnside</td>
<td>Optimization of HPLC Analysis of Ergosterol to Quantify Fungal Biomass within Bioreactors</td>
</tr>
<tr>
<td>Zhendong Zhang</td>
<td>UD Environmental Science</td>
<td></td>
<td>James Pizzuto</td>
<td>Characterizing between MI Dam and Flood Deposits along White Clay Creek</td>
</tr>
<tr>
<td>Haithi Leary</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Jerry Kauffman</td>
<td>Hercules Red Clay Creek Watershed Monitoring Plan</td>
</tr>
<tr>
<td>Josephine Lin</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Jerry Kauffman</td>
<td>Duck River Creek Watershed Plan at Winterthur Gardens, Wilmington, Del.</td>
</tr>
<tr>
<td>Kelly Ni</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Jerry Kauffman</td>
<td>Brandonville Piedmont Field Monitoring Plan</td>
</tr>
<tr>
<td>Emily Jones</td>
<td>UD Geological Science</td>
<td></td>
<td>James Pizzuto</td>
<td>Soil Organic Carbon Fingerprinting of Red Clay Creek Watershed</td>
</tr>
<tr>
<td>Mary Kepley</td>
<td>UD Environmental Engineering</td>
<td></td>
<td>Jerry Kauffman</td>
<td>Water Quality Trends in New Castle County (Delaware) Streams, 2006-2016</td>
</tr>
</tbody>
</table>

FY20 Student Support
Beginning in June 2020, the DWRC has supported 18 undergraduate and graduate water research internships during FY20 through the annual base (104b) grants. The DWRC research students are scheduled to present their research findings at the 56th annual meeting of the DWRC Advisory Panel on May 13, 2021 at the University of Delaware:

<table>
<thead>
<tr>
<th>last name</th>
<th>school</th>
<th>major</th>
<th>research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hayley Rost</td>
<td>Master of Public Administration, Biden School</td>
<td>White Clay Creek Wild and Scenic River Water Quality Sampling Network.</td>
<td></td>
</tr>
<tr>
<td>Sitlaly Avelino</td>
<td>Environmental Engineering</td>
<td>Watershed Characterization of First Order Tributaries along the Brandywine River in Delaware.</td>
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<tr>
<td>Brendan Benne</td>
<td>Environmental Engineering</td>
<td>The Effect of Biochar on Infiltration Rate and Soil Aggregation in Both the Field and Lab.</td>
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<tr>
<td>Tammy Brookwild</td>
<td>Environmental Engineering</td>
<td>Shorebird Habitat Sampling along Tributaries of the Red Clay Creek in Delaware.</td>
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<tr>
<td>Shannon Buhin</td>
<td>Environmental Engineering</td>
<td>Streamer’s River Basin Management, the International Joint Commission Model.</td>
<td></td>
</tr>
<tr>
<td>Alex Cervantes</td>
<td>Environmental Science</td>
<td>Historic Significance of the Brandywine River as Drinking Water Supply in Wilmington, Delaware.</td>
<td></td>
</tr>
<tr>
<td>Elizabeth DelBro</td>
<td>Environmental Science</td>
<td>Stratigraphy of Valley Fill Deposits upstream of a Small Colonial Age Mill at White Clay Creek, Pennsylvania.</td>
<td></td>
</tr>
<tr>
<td>Delaney Donan</td>
<td>Environmental Engineering</td>
<td>Watershed Characterization of First Order Tributaries along the Brandywine River in Delaware.</td>
<td></td>
</tr>
<tr>
<td>Grace Hussey</td>
<td>Environmental Studies</td>
<td>The Effects of Retention and Invasive Species Removal on Stormwater Flooding Events in Baltimore.</td>
<td></td>
</tr>
<tr>
<td>Emily Jimenez</td>
<td>Environmental Engineering</td>
<td>Frequency of High Flood and High Tide Events in Delaware with Climate Change and Sea Level Rise.</td>
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<tr>
<td>Bridgette Keglen</td>
<td>Geography &amp; Greek Roman Studies</td>
<td>Upland Land Use and Persistent Cover Change for the State of the Report.</td>
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<tr>
<td>Kangyoo Park</td>
<td>Environmental Engineering</td>
<td>Economic Value of Properties in the Coastal Revenue Floodplain in Delaware with 30 Year Rise Level.</td>
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<tr>
<td>Lily Peterson</td>
<td>Environmental Engineering</td>
<td>Shorebird Habitat Sampling along Tributaries of the Red Clay Creek in Delaware.</td>
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<tr>
<td>Jady Perez</td>
<td>Environmental Engineering</td>
<td>Forest Hydrology and Stream Health in the Hickory Run Watershed at Mt. Cuba Center.</td>
<td></td>
</tr>
<tr>
<td>Anna Singer</td>
<td>Environmental Studies/ Public Policy</td>
<td>Water Quality Trends in White Clay Creek Wild &amp; Scenic River: Delaware and Pennsylvania.</td>
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</table>
DWRC Undergraduate Intern Research

Watershed Characterization of 1st Order Tributaries along Brandywine River in Delaware
Sitlaly Avelino and Delaney Doran
Home Watersheds: Santa Ana; Brandywine River

By focusing on 14 first order tributaries that flow into the Brandywine River, the study aims to better understand and characterize the waters that constitute a major source of drinking water for the state of Delaware. Field studies conducted at reaches along the tributaries will be analyzed to assess variables such as the flow and velocity of the tributaries as well as nitrogen, turbidity, and conductivity. The overall goal of the study is to examine the data to assess the ecological health of each tributary that drains to the Brandywine River.

The Effect of Biochar on Infiltration Rate and Soil Aggregation in Both the Field and Lab
Brendan Benson
Home Watershed: Raritan River

The study seeks to simulate biweekly artificial storm events to evaluate the response of laboratory soil columns with and without the presence of biochar. The samples are examined in order to measure steady-state runoff and percolation rates that result from each storm event as well as the cracking and swelling of each soil column before and after each storm event. The overall goal of the project is to determine, based on these factors, what the differences are between soil samples where biochar is present and samples where there is no biochar present.

Watershed Characterization of 1st Order Tributaries along the Red Clay Creek in Delaware
Tommy Breedveld and Lily Peterson
Home Watersheds: Passaic River Basin; White Clay Creek

By assessing stream geomorphology, stream habitat, and water quality, this research seeks to characterize the watershed of first order tributaries of the Red Clay Creek in Delaware. The study will classify each stream reach according to the EPA rapid stream bioassessment technique and collect water samples along each tributary to be analyzed for changes in turbidity, nitrogen, and conductivity over time.

Intergovernmental River Basin Management: The International Joint Commission Model
Shannon Bushinsky
Home watershed: Lehigh River

Analysis of the International Joint Commission (IJC), including its structure and policies, will provide an overview of how a large international agency can oversee several extensive river basins. Examining the role of the organization in river basin protection and international treaties concerning water quality and aquatic ecosystem health between Canada and the United States gives insight into how Canada and the United States negotiate policies based upon different views and regulations of water quality and environmental health. The overall goal of the study is to determine whether the organizational structure of the IJC would be successful if applied in other river basins such as the Delaware River and Chesapeake Bay basins.
Historic Significance of the Brandywine River in Wilmington, Delaware
Alexis Cervantes
Home watershed: Manasquan River

The Brandywine River is the largest river and sole drinking water supply for the city of Wilmington, Delaware and as such it is the goal of this project to determine its historic significance in context. The 2020 Brandywine Shad Project has identified resources listed by the National Register of Historic Places (NRHP) and properties that might be considered eligible for listing, located within the geographic area of the potential effect (APE) relevant to identifying the River’s historic significance. The study found that based on existing information Dam 2 and Dam 4, in particular, have contributed to the historical significance of the Brandywine River.

Milldam Deposits in White Clay Creek
Liz DeSonier
Home Watershed: Skippack Creek Watershed

By examining the sediments in White Clay Creek, the project works to identify how the soil profile of the area has changed since human settlement. The study looks to identify the presence of Milldam deposits, which are an indicator of the arrival of humans in the area. By noting the presence and location of Milldam deposits within soil layers, the study will be able to determine the characteristics of soil layers since the presence of Milldam deposits were detected and note the changes. These changes indicate how the soil has changed since humans entered the area and would provide insight for creek management going forward.

Environmental Justice & Stormwater Mitigation Through Reforestation in West Baltimore
Grace Hussar
Home Watershed: White Clay Creek

The purpose of this study is to utilize hands-on experience and a series of interviews to assess the positive impacts of forest restoration on a community in West Baltimore that has historically suffered the negative effects of stormwater. The study focuses on the 10-acre plot of land behind the West Baltimore Stillmeadow Community Fellowship Church. Hands-on experiences will include assisting in the establishment of a tree nursery and planting native species, clearing the plot of dead and fallen trees, invasive species, and litter. Interview subjects will include residents of the neighborhood, members of the Stillmeadow Church, and U.S. Forestry employees (the project is in partnership with the U.S. Forest Service).

The Relationship between the Severity of Peak Delaware Flood Events and Climate Change
Emily Jimenez
Home watershed: Chesapeake Bay

The goal of this project is to examine peak flood events and high tides and assess whether riverine and coastal flood conditions are increasing in severity, in terms of frequency and magnitude, over time in Delaware as a result of climate change. Utilizing data values collected from literature, as well as long-term precipitation data from three DEOS weather stations in New Castle, Kent, and Sussex counties, annual peak streamflow data from USGS stream gages, and annual peak high tide data from USGS and NOAA tide gages, the study will conduct statistical analysis to determine if peak streamflow and coastal high tides are changing with precipitation levels in Delaware watersheds.

Updating Land Use and Impervious Cover Change for the 2016 State of the Bays Report
Bridgette Kegelman
Home watershed: Brandywine Creek

By collecting data and create updated graphs and charts, this study works to make updates to the 2016 State of the Bays Report. Based on the findings, yielded from the latest available data, a decision will be made regarding which available data (collected from the National Oceanic and Atmospheric Administration (NOAA) or the state) would be the most appropriate. Utilizing various GIS tools, the report will generate buffers around bodies of water, agricultural areas, and developed areas to update the 2016 State of the Bays Report and datasets for variables such as bacteria levels, land use, nutrient concentration, dissolved oxygen levels, nutrient loads, and submerged aquatic vegetation (SAV).
Modification of Peroxidase Enzyme Analytical Methods for Solid State Bioreactors use to Reduce Pathogens in Dairy Manure
Patrick McGay
Home Watershed: White Clay Creek

The white rot fungi (WRF) Pleurotus ostreatus grown in small bench-scale bioreactors was able to reduce the number of E. coli naturally present in aqueous dairy manure. Currently, bioreactors containing both P. chrysosporium and P. ostreatus are being evaluated for their ability to degrade E. coli and antibiotics within aqueous dairy manure. The objective of this research is to monitor the fungal biofilm during treatment of dairy manure containing E. coli for both Lignin Peroxidase and Manganese Peroxidase. Once the tests are confirmed successful, the assays will be performed on samples taken from the bioreactors during the E. coli degradation experiments.

Economic Value of Properties in Delaware Coastal/ Riverine Floodplain with Sea Level Rise
Karmyn Pasquariello
Home Watershed: Pompton Lakes

By conducting research into the economic value of properties in the coastal/riverine floodplain in Delaware with sea level rise, this study assesses the real estate value of properties in Delaware and how the value has changed since 1975 in relation to sea level rise and flooding. The study examines flood insurance premiums, claims, and coverage in Delaware to find high-risk flood areas and determine whether the flood insurance program is adequately funded or subsidized by FEMA. ArcGIS will be used to overlay FEMA and NOAA flood inundation maps with parcel/property value maps to estimate the value of real estate at risk for flooding, given that nearly 20% of Delaware rests in the 100-year floodplain.

Forest Hydrology and Stream Health in the Hickory Run Watershed at Mt. Cuba Center
Jady Perez
Home Watershed: Panama Canal

In partnership with Mt. Cuba Center, this study works to conduct field studies, streamflow, and water quality monitoring along the Piedmont tributary of Barley Mill Run that flows east and joins Red Clay Creek near Hoopes Reservoir in Ashland, Delaware. The objective of the watershed-based research program is to quantify the benefits of reforestation at Mt. Cuba Center on the water quality and water quality of Barley Mill Run by analyzing field data collected at monitoring stations where the creek flows by roadway and railroad crossings. At the four water quality monitoring stations, water quality samples are tested for a base (low) flow and a storm (high) flow event.

Water Quality Trends in White Clay Creek National Wild & Scenic River, Delaware and Pennsylvania
Anna Singer
Home Watershed: Lake Champlain

The goal of the project is to evaluate the benefits of reforestation and other land cover changes on the creek and also to design best management practices (BMPs) to restore the watershed and the stream. The study will conduct water quality monitoring and analyze trends along the White Clay Creek in Delaware and Pennsylvania by establishing stream flow and water quality monitoring stations at 6 locations. Once per week and during storms over a 6-month period, flow depth and velocity will be recorded to estimate streamflow.
**Water Resources Graduate Research Assistant Research**

**Diversity in National Parks: How Understanding our Past Can Help Us Create an Inclusive Experience**
Sophie Phillips  
Home Watershed: Croton Watershed

Throughout the year, National Parks are busy with activity. From hiking and camping, to museum visits and ranger-led tours, there are options for everyone to enjoy. In 2019 alone there were 327,516,619 visitors to the National Parks (NPS, 2020). On the surface, it appears the National Parks are doing very well, but looking deeper, there are concerns about the demographics of visitors and employees. A survey by the National Park Service in 2016 showed only 7% of park visitors are African American, and only 20% of visitors are minorities, even though African Americans make up 13% of the U.S. population and minorities make up 40% (Rott 2016). The history of African American experiences with nature, forests, and national lands provides some insight as to why National Park engagement within this population is so low. The history of segregation in the United States national lands, the lack of representation of African Americans in the National Parks workforce, and a system that pushes kids out of environmental fields leave us with a lot of work to do. Creating programs within the park system that invite youth to become part of that space is an important first step. The creation of an app and podcast series about black history can build understanding and help address the knowledge gap around the history of this nation, while the hiring of more African American employees in leadership positions will allow for the increase of that vital representation. We are far from solving this problem, but those in leadership positions of our national lands are ready to make the changes needed to truly show that we all have ownership in this land.

**Critical Steps to Mitigating Climate Change and Addressing Climate Change Based Environmental Racism**
Hayley Rost  
Home Watershed: Perkiomen Creek

An analysis of the global average surface temperature conducted by the National Aeronautics and Space Administration (NASA) found that 2020 was the warmest year on record. Earth’s average temperature has increased by more than 2°F since the 1880s as a result of human activity, in particular, actions that release greenhouse gases (GHGs) such as carbon dioxide and methane into the atmosphere (NASA, 2021). States which border an ocean, such as Delaware, will be the first and most significantly impacted and many coastal communities have already been affected. It is critical that the Biden administration prioritizes the development of an effective and efficient plan to combat climate change by addressing GHG emissions in the United States. New environmental policies should focus on determining which industries and practices are the most significant sources of GHG pollution and creating regulations to ensure these sectors become environmentally sustainable in the near future. In the state of Delaware 27% of the state’s emissions are produced by industry, 23% by electricity production, and 31% by the transportation industry (ICF International, 2020). By transitioning towards the use of renewable energy resources in these three areas in particular, the United States, and the state of Delaware, will be able to reduce the amount of GHG emissions on a large scale. While it is critical to establish policies to reduce GHGs and mitigate future climate change, it is also vital that communities already affected by climate change are addressed such as communities that have been displaced due to climate change and communities that are impacted by environmental racism. President Biden must ensure that the policies and regulations enacted by his administration guarantee that environmental protections are afforded to all citizens and that policy changes are made so that communities of color are no longer disproportionately affected by climate change.
About the UDWRC Undergraduate Internship Program

How to Apply

Eligibility: For the spring 2021 application period, all undergraduate students enrolled at the University of Delaware, Delaware State University, or Delaware Technical and Community College may apply, except for those graduating at the end of the spring 2021 semester. All students must have the support of a faculty or scientist advisor and a minimum GPA of 3.0.

Program Details and Deadlines: Supported by the Water Resources Research Act of 1964 and 1984 through the U.S. Department of Interior and U.S. Geological Survey, the DWRC will pay up to $3,000 per undergraduate intern, paid as hours worked at $10 per hour, up to a maximum of 300 hours. Internship projects are expected to start with the fall semester in September 2021 and will be paid through May 31, 2022 with the final research report and poster presentation presented to the UDWRD Advisory Panel in May 2022. Some students may begin during the summer 2021 with the support of their research advisor.

To apply for this program, you must establish a water research topic and project with a faculty or scientist advisor at your school and agree on this research topic over the 2021 fall and 2022 spring semesters. Bundle the application, transcript, resume, and one page research proposal as a single pdf and submit by email to Martha Narvaez at mcorrozi@udel.edu and Gerald Kauffman at jerryk@udel.edu by May 11, 2021 at noon.

1. Completed application
2. Copy of current unofficial transcript
3. Current resume mentioning any special skills or experiences such as prior internships, research or education projects and laboratory or technical experiences
4. Brief description (1 page) of the research project proposal

Water faculty and scientists who may wish to advise your research are listed at https://www.wrc.udel.edu/faculty-and-staff/ and http://www1.udel.edu/watersciencepolicy/faculty.html.

For questions, please contact Ms. Martha Narvaez at mcorrozi@udel.edu or Gerald Kauffman at jerryk@udel.edu and 302-893-1571.

UDWRC Water Resources Research and Education Priorities

* Water quality (nutrients, pathogens, public health), harmful algal blooms
* PFOSA (PFOA) Storm water runoff (management and control)
* Water supply, demand, and conservation (infrastructure/technology)
* Water policy (governance and economics)
* Climate change, sea level rise, riverine/coastal flooding
* Groundwater (remediation and treatment)
* Watershed management
* Wetlands (protection and restoration)
* Wastewater management (treatment and reuse)
* Water, food, and energy nexus
UDWRC Advisory Panel

Jayme Arthurs  
USDA Natural Resources Conservation Service, Dover, DE 19904

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Ethan Robinson  
City of Newark, Dept. of Public Works  
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The Nation’s Founding Fish Returns to America’s Most Historic Small Watershed

Gerald Kauffman

With stories in the New York Times and NPR, word is getting out about Brandywine Shad 2020. Just a decade and a half ago the Brandywine Conservancy reinvigorated a 300-year old quest to bring back our nation’s founding fish to the Brandywine, the river that National Geographic called America’s most historic small watershed. In 2005, the Conservancy (est. 1971) conducted a river reconnaissance and explored the feasibility of restoring the American shad to the Brandywine by removing 11 dams that impeded their ancestral spawning runs on the 90 miles of the Lower Brandywine in Delaware. In 2012 the Conservancy was able to remove two dams that reopened 18 miles of the East Branch of the Brandywine up near West Chester, PA to fish passage.

Alosa Sapidissima (savory fish) is an anadromous species that lives in the ocean for much of its adult life and returns after 4 to 5 years to spawn in the freshwater rivers of their birth. The nation’s founding fish swam up the Delaware and the Schuylkill in the spring of 1778 at just the right time in American history to feed George Washington’s starving troops at Valley Forge. The American shad was so numerous in the Delaware Valley that the Brandywine was known as Fishkill by the Dutch who noted the glistening fish stacked from bank to bank and in 1880 hotels in Gloucester, NJ served 10,000 planked shad dinners to Victorian era diners. Stocks of this “poor man’s salmon” were decimated in the early 20th century due to overfishing, pollution from the Industrial Revolution, and precolonial dams that impede their ancestral spawning runs.

But with management of fish stocks and improved water quality from the 1970s Clean Water Act, a group known as Brandywine Shad 2020 is bringing the fish back to the river to swim in places they haven’t been in three centuries. Brandywine Shad 2020 was founded in 2017 by river-side residents Hunter Lott and Jim Shanahan of Wilmington with a consortium of the City of Wilmington, Delaware DNREC, Brandywine Conservancy, Hagley Museum and Gardens, Brandywine Red Clay Alliance, Conservation Fund, The Nature Conservancy, and the University of Delaware Water Resources Center. Using science from the Brandywine Conservancy 2005 neon study, the City of Wilmington removed century-old West St Dam No. 1 and remnants of a circa 1740s dam on the Brandywine River last fall and this spring shad are being caught in downtown Wilmington (the shad capital of Delaware) right underneath the main artery of the megalopolis the I-95 bridge.

With the momentum now regained, Brandywine Shad 2020 has secured a grant from the National Fish and Wildlife Foundation and Delaware River Basin Conservation Act to restore fish passage to the remaining 10 dams in Delaware and eventually allow the shad to swim up to Pennsylvania and reopen 24 miles of the river to spawning past the Brandywine River Museum in Chadds Ford and the forks of the Brandywine to West Chester, PA. The goal is for the shad to swim through the First State up to the Keystone State for the first time since the three lower counties of Delaware were part of the Pennsylvania colony. When this occurs the two states will indeed once again be joined by a common river.

The Brandywine River renaissance is falling into place. The remaining Delaware Dams 2 through 11 are numbered moving upstream from downtown Wilmington up past Hagley Museum to Rockland. The plan is to remove deteriorating Dams 3, 4, 6, and 11 in 2020 and install bypass fishways at structurally intact Dams 2 and 5 in 2021. Work on Hagley Dams 7 through 10 is slated for 2022. Fish passage at lower dams 2 through 6 will allow the shad to spawn from sea level 5 miles inland to 70 ft above sea level in the Piedmont (Italian for foot of the mountains) to the circa 1802 Hagley dams by 2021.

But the Brandywine Shad 2020 effort is not just about the fish it’s also about the history, culture, and environmental recovery of the beautiful and bounteous Brandywine. A cultural resources survey with the State Historic Preservation Office unwraps the fascinating names and places in American history that took place along this river. Canby, Baldwin, Williams, and Maynard all wrote about the Brandywine and told these fascinating stories about the river.

For millennia long before the Europeans set foot in the New World the indigenous people the Lenni Lenape knew the Brandywine as the river of the long fish (the Atlantic sturgeon). In 1688 the village of Queonemysing stood along the river near William Penn’s 1682 circular arc boundary near the present day covered bridge in present day Wilmington. The steep gradient of the Brandywine close to sea level was the ideal place for the Colonists to construct their mills to transport their goods on the scallops and sailing ships that would moor at the docks just yards away from the mills. In 1687 Swedish surgeon Dr. Tyman Stoham built the first barley mill along the Brandywine at the head of tide near the old Dam No. 1. By 1727 dozens of mills were along the lower Brandywine in Wilmington and the Lenape petitioned the British Governor to remove the dams to allow the shad to spawn again. In 1742 Oliver Canby sold his flour mill to Joseph Tatnall and the lower reach had 6 dams with 12 mills, 6 on each bank. By 1756 the Brandywine Commission began removed dams to restore the fishery in one of the first riparian water rights actions under British common law. In 1787 at the end of the American Revolution, Gilpin of Chadds Ford built the first grist mill. By 1793 Maynard recorded that the Brandywine was packed to the gills with 50 flour mills milling 91,500 barrels, 50 saw mills sawing 1000 plank feet, 8 forges, 4 grist mills, 4 paper mills, and one snuff mill.

In 1802 the DuPonts searched up and down the Eastern seaboard and settled on the Brandywine as the site of their gunpowder mills as the river fell from 160 ft above sea level to tidewater (higher than Niagara Falls) in just a few short miles. In 1825 the Marquis DeLafayette returned to the 1777 Battle of the Brandywine and toured the Hagley Mills with the DuPonts and marveled at the intricacies of American engineering. In 1883, the William Bancroft textile mills above Wilmington were thriving and with foresight the proceeds were used to secure open land in the upper valley for the workers on the Woolen
Trustees land that became Delaware’s first national park in 2015 when Barack Obama designated First State National Monument by Executive Order under the 1906 Antiquities Act. The Brandywine is the valley of Pyle and Wyeth and in the late 19th century the Wilmington commissioners asked Frederick Law Olmsted’s firm to weigh in on the design of Brandywine Park near Dam 2. The American Industrial Revolution began right here with hydropower from centuries old mill dams along the Brandywine, it was the Silicon Valley of their day.

Now the shad restoration effort envisioned by the Brandywine Conservancy in 2005 is fully underway. Dam removals spurred by Brandywine Shad 2020 will allow the shad to spawn there and their progeny will be born there and they in turn will return to the Brandywine of their birth for first time in centuries.

Alosine survey along Brandywine River, July 2020  
Field recon at Brandywine River Dam 3 (May 2020)
City of Wilmington Green Jobs Internship Program
Martha Narvaez

Until the ten youth stepped into the van on July 6, 2020 I was never quite sure we would have a program the summer of 2020. Like all things in 2020 I figured we just had to cut our losses and continue when Covid released its ugly grip on all of us. Yet, we were fortunate that through a lot of hard work on behalf of the City to ensure a safe program and many willing host organizations who reimagined a hands-on program virtually, we successfully and safely employed ten youth in the City’s Green Jobs Internship Program for the tenth successive year! The youth were as excited as we were to be able to get the program off the ground as this was a reprieve from the past four months of virtual schooling and they were now actively engaged with program hosts both virtually and outside doing hands on work in a safe environment.

For those unfamiliar with the program, the Green Jobs Internship Program engages the City of Wilmington’s youth by providing green-collar work opportunities. The youth participate in hands-on work experience, environmental career exploration and classroom environmental and civics education. Hands-on work may include activities such as: labeling storm drains to prevent pollution, installing rain gardens, removing invasive plant species, gardening in community gardens, canoeing and water quality sampling. The youth also learn about potential careers such as environmental engineering, environmental opportunities at nonprofit organizations, wastewater and drinking water employment and a variety of others.

In order to be eligible for the program, youth must be city residents that are 14-18 years old. The program is six weeks at 25 hours/week and participants earn minimum wage. The backbone and success of the program can be attributed to the organizations that host the youth over the six-week internship. After ten years, the program has had over twenty organizations involved in hosting the youth. These host organizations range from private firms, local and national nonprofit organizations, and local academic institutions.

This coming July (2021) will mark the eleventh year of the City of Wilmington’s Green Jobs Internship Program which has provided 138 youth with in-depth environmental hands-on activities and learning opportunities. Typically, the program hosts 14 youth but due to Covid restrictions the program will, like last year, host 10 youth in 2021. Like last year, this year’s program will be unique in that the program will be a hybrid of virtual and in-person activities. The City has developed safety protocol that ensures all youth are safe and participation is contingent on adhering to the safety protocol established by the City. If you or someone you know is interested in the program, the program application process is run through the City of Wilmington’s Department of Parks and Recreation. Applications are available on the City’s website and are typically due in mid-April. In late April/early May interviews are conducted to choose the program participants. In late May/early June the selected program participants are processed which includes drug screening and background checks. The 2021 program will begin on June 21st and will run until July 30th.

If you have any questions regarding the program, please contact Martha Narvaez (mcorrozi@udel.edu).
New Castle County Cares 4 Seniors

Nicole Minni

Through a grant provided by New Castle County Coronavirus Aid, Relief, and Economic Security (CARES) Act funding, professional staff members: IPA Policy Scientist's, Marcia Scott and Julia O’Hanlon worked with IPA’s GIS Specialist, Nicole Minni and Public Administration Fellow Christine Moore partnering with the Delaware Aging Network (DAN) and Delaware’s senior centers to create an online HUB. This HUB connected older adults with essential services designed to maintain their health, wellness, and independence during the pandemic. The team worked together to accomplish three key phases of research and development to improve health and equity for older adults in the county.

First, the project team surveyed county-area senior centers and other DAN affiliates on the primary challenges in serving older community members during COVID-19. A review of preliminary results indicated comparisons to national challenges (May 2020 National Council on Aging survey).

Second, the team gathered resources from across the county and integrated them into an Esri GIS HUB site called “New Castle County CARES 4 Seniors.” This HUB site integrates multiple interactive maps along with additional resources to help older adults and service providers better identify and coordinate essential services throughout the county. The site focuses on Food Security, Health and Wellness, Social Activities, Transportation Services, and Senior Services and is a one-stop-shop for providing older adults in New Castle County the information they need to stay connected and stay healthy. This information, combined with updated demographic data from the US Census; such as where higher concentrations of the 65 and older population are located, where older adults living in deep poverty are, and where the most vulnerable populations are. Mapping this information helps identify service and program gaps among the county’s older adults.

Third, a map-based survey (using Survey123 and ArcGIS technology) asked county community-based organizations to identify current in-person and virtual services being offered. Preliminary results from this survey can be found here as well as mapping of the results which can be found here. This HUB site directly supports the in-person and virtual social services of NCC nonprofits and social service providers affiliated with DAN agencies and other organizations. This includes the county’s senior centers, which provide critical, community-based services. Understanding and reaching the vulnerable senior population in New Castle County will help them through the pandemic and hopefully into the future.
Mapping Delaware’s Inland Bays

Andrew Homsey

Delaware’s Inland Bays—Rehoboth, Indian River, and Little Assawoman—form one of the state’s most diverse, fascinating, and fragile ecosystems. The area is well-known as the center of the world-renowned beach communities (sometimes known as the “Summer Capital” of the US for its popularity with many in the DC political elite), as well as a popular retirement and recreational destination for Delawareans and others. Host to a thriving poultry industry, the region is host to two of Delaware’s top economic sectors: agriculture and recreation. In the midst of this lie the estuarine bays, fed by a single, narrow inlet and home to countless creatures and their habitats, from nesting gulls, herons, and many other species of birds, to migratory fish, shellfish, and even a nascent but rapidly expanding commercial oyster fishery.

Fringing this aquatic ecosystem is a complex of tidal marshes—important engines of ecological diversity and production, supporting rich populations of flora and fauna. Given the heavy human use of the bays, there are a number of stressors that impel the tidal marshes of the Inland Bays. Sea level rise, human development, and other factors such as historical marsh ditching can cause degradation and loss of function of the marshes. A loss of function means a loss of their value as fish nurseries, protection against coastal floods, water purifiers, and critical habitat for birds and other creatures.

The Water Resources Center (WRC) has partnered with the Delaware Center for the Inland Bays (CIB) to determine the current status and understand the trends in these highly vulnerable yet critical habitats. Through support from the Delaware Sea Grant program, WRC, with the Center developed a project using GIS and Remote Sensing to map and quantify the extent and condition of these critical wetland habitats. After a highly competitive search process, an undergraduate UD intern, Katherine (Kat) Warner was chosen to perform the mapping and analysis using a combination of historic and current aerial photography, existing data layers, and many specialized techniques and procedures. The work, an extension of a previous study undertaken by WRC with the Center in 2009, seeks to map the extent of salt marsh (among other land cover types), and assess the degree to which the marsh remains intact.

Part of the problem with the marsh is not merely its total extent, but (perhaps more importantly) its condition. If the marsh platform (the “ground” layer of a wetland) cannot keep up with sea level rise and subsidence, the interior portions can begin to exhibit “pooling” as interior open water areas expand, and its ecosystem function declines. The assessment of marsh condition was undertaken using 2017 aerial imagery to delineate the areas of marsh collapse. This information was then compared with data derived from the 2007 imagery upon which the previous study was based. Andrew Homsey of the WRC and Andrew McGowan of the CIB supported Kat in her efforts, and helped in the development of the tools and procedures used in the mapping process. Currently the data are being analyzed and a report written, the conclusions of which will help develop the upcoming State of the Inland Bays report due for release later in 2021. Given the challenges of working during a pandemic (which precluded the ability for in-person collaboration), Kat exhibited a resilience and ability that resulted in an exemplary data product, providing an invaluable snapshot in the evolution of the marshes of Delaware’s Inland Bays.
UDWRC Director Dr. Gerald Kauffman was elected to the Board of the Universities Council on Water Resources (UCOWR) at the annual meeting in Little Cottonwood Canyon, Utah in June 2019.

In February 2021 at the annual meeting, UDWRC Director Dr. Gerald Kauffman was elected to the Board of National Institutes for Water Resources (NIWR) Board to represent the mid-Atlantic Region joining water institute directors from the universities of California, Alaska, Rhode Island, Wisconsin, New Mexico, Texas A&M, and Hawaii.
Andrew Homsey was appointed by County Executive Matt Myers to the New Castle County Resources Protection Area Technical Advisory Committee.

Andrew Homsey was elected as the 75th President of the Board of the Brandywine Red Clay Alliance (Est. 1945) as the oldest small watershed association in the nation.
Matt and Kelly at Delaware River Watershed Day March 2019

Jobs and Internships in Water Resources

UD College of Agriculture and Natural Resources - Jobs and internships are listed here.

UD College of Earth, Ocean, and Environment - Jobs and internships are listed here.

Delaware Environmental Institute (DENIN) - Jobs and internships are listed here.

Water Resources Information and Training

The Delaware Section of the American Water Resources Association events information can be found here.

The University of Delaware Section of AWRA - activities can be found here.

The DENIN events calendar is found here.

The State of Delaware public meeting and workshop information is found here.

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