Project Proposals for 2016-2017 DWRC Undergraduate Internships

Seven as of 2/19/2016

1. Creating a Seamless Mosaic of 1926 Aerial Photography for the State of Delaware (posted 2/2/16)

Interested in this internship?
Contact Dr. Thomas McKenna, mckennat@udel.edu, 302-831-8257
or Ms. Lillian Wang, lillian@udel.edu, 302-831-1096
Delaware Geological Survey
http://www.dgs.udel.edu/profile/thomas-e-mckenna
http://www.dgs.udel.edu/profile/lillian-t-wang

The oldest aerial photographs covering the entire state of Delaware that are readily available in digital format were acquired in 1937. An aerial survey was done for the Delaware Department of Transportation in 1926 but the hardcopies were apparently scattered into different locations so they were not easily accessible. Between 1926 and 1937, the U.S. Civilian Conservation Corps dug ditches in many of the tidal wetlands in Delaware and there are likely other changes in land use that will come to light with this "new" imagery. We have in-hand some digital scans of the aerial photo "tiles" for the coastal part of the state. These were voluntarily digitized by a gentleman in southern Delaware. The first part of the project would be to mosaic and georeference these digital tiles. Another set of the photos in a different format are in big binders at the Hagley Museum in Wilmington. The second part of the project would be to scan, mosaic, and georeference these images. The third task would be to combine the two. The first part of the work would take place at the Delaware Geological Survey Building on Academy St. The second part would be either at the DGS Building or the Hagley Library in Wilmington (DGS can provide transportation to the library).

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2. Sustained Water Quality Monitoring of Possum Creek and Noxontown Pond, Delaware (posted 2/9/16)

Interested in this internship?
Contact Ms. Maria Pautler, mpautler@udel.edu, 302-831-0847
UD Dept. of Plant and Soil Sciences
PLEASE NOTE THAT THIS INTERNSHIP BEGINS IN APRIL OF 2016 rather than June.

Environmental parameter monitoring has been an ongoing activity at St. Andrew's School (SAS) in Middletown, Delaware, which has linked water quality of Noxontown Pond (which flows into the Appoquinimink River) and the development of specific monitoring techniques to improve the understanding of the inflows of pollutants, such as nutrients, into the pond. Recent work has monitored stormflows into and out of the pond in the winter and fall of 2015. Monitoring of stormflows into and out of the pond will be done in the spring and summer months of 2016, continuing into the fall of 2016 if precipitation is greater than what was measured in the fall of 2015. Water samples will be collected after storm events from two locations along Possum Creek, a tributary to Noxontown Pond, and one location near the confluence of the creek with the pond. Established monitoring protocol will be used to continue sampling storm events from these three locations between April and August (and then potentially in September and October) to capture spring and summer (and fall, if precipitation is heavy) storm events. The aim is to collect from a minimum of eight storm events over this period with the goal of two storms during each of the summer months of June, July, and August.

In situ measurements, such as dissolved oxygen and pH, will be made in the field during or immediately following each storm event and a one-liter sample will be collected at each of the three locations for laboratory analysis. Each sample will be analyzed for nitrate, phosphate, total nitrogen, and total phosphorus. Results will be assessed and compared to previous water quality measurements from the tributary and pond to track trends. Training in all aspects of this internship will be given. The intern must be able to drive to St. Andrew's School during or just after storm events and must be willing to walk through terrain that tends to be muddy and not always clearly accessible.

Dr. Gerald Kauffman and Ms. Maria Pautler will advise the intern who will perform the water quality sampling, laboratory sample prep work, data management and analysis, and report drafting. All three will work closely with Dr. Peter McLean and SAS staff to inform them of activities and results.

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3. Designing an Automated System to Monitor O_2, CO_2 and CH_4 from Sediments in a Salt Marsh (posted 2/11/16)

Interested in this internship?
Contact Dr. Rodrigo Vargas, rvargas@udel.edu, 302-831-1386
UD Dept. of Plant and Soil Sciences
http://udel.edu/~rvargas/

Coastal wetlands are among the world's most biologically rich and economically important ecosystems, but they are threatened by the front lines of natural and human-induced change (e.g., sea-level rise, extreme events, land-use change). These ecosystems cover a small global area compared with terrestrial forests, but the contribution of coastal wetlands per unit area to carbon burial is much greater. Furthermore, organic carbon and nutrients are processed through lateral movement of dissolved organic carbon (DOC) and dissolved inorganic carbon, resulting in high carbon dioxide and methane emissions. Despite the importance of these ecosystems, there is a large uncertainty associated with the net balance of greenhouse gas (GHG) fluxes in coastal wetlands because baseline information is missing around the globe.

We look for a motivated student interested in studying biophysical processes regulating GHGs from wetlands, and eager to learn how to build environmental sensors. The student will learn how to use data loggers, how to make sensors weatherproof, and how to analyze the collected data. The student will use state-of-the-art sensors to continuously monitor O_2, CO_2 and CH_4 from sediments in a salt marsh located at the St. Jones Reserve, near Dover, DE. Basic knowledge of electronics and data analysis is welcome but not required, as emphasis will be made on motivation rather than expertise.

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4. Nutrient Loading in the Murderkill River (posted 2/11/16)

Interested in this internship?
Contact Mr. A. Scott Andres, asandres@udel.edu, 302-831-0599
Delaware Geological Survey
http://www.dgs.udel.edu/profile/scott-andres
Co-advisor is Dr. William Ullman, College of Earth, Ocean, and Engineering

The student will participate in a multi-disciplinary study to characterize and simulate physical and chemical conditions of streamflow and aquatic chemistry in the Murderkill River. Project components include: installation and routine maintenance of stream monitoring instrumentation, collection and field testing of water samples, compilation and assessment of water quality data, estimation of stream flow, discussion of findings with senior project personnel; and, compiling a report of findings.

Riverine ecosystems throughout the world are increasingly threatened by eutrophication caused by excess nutrients introduced by human land use and rapidly-growing coastal populations. Accurate quantification of nutrient loading is key information for assessing the severity of the eutrophication threat. Characterization of biogeochemical transformations of nutrient species in the stream is also a critical component in developing strategies to manage nutrients in the watershed and plans to remediate problems.

This project has three main components: A) field data acquisition and data compilation, B) analysis of data, and C) reporting of results.

A. Along with professionals, faculty, and graduate students, the intern will participate in installation and maintenance of field monitoring devices and assisting with water sampling. The intern will work with faculty advisors to develop a research proposal and conduct the proposed research.
B. The intern will get direct experience with analysis and interpretation of water quality data. The intern will learn steps routinely employed for automated and manual compilation of data, and data QA/QC tasks. This work is

done with spreadsheet and database software packages and requires constructing charts and tables and completing statistical evaluation of data. The intern will participate in research group meetings with professionals, faculty, and graduate students who are working on the project to discuss progress and findings.
C. The intern will be responsible for compiling data and communicating results in report and poster formats that are frequently used by practicing professionals, graduate students, and faculty researchers.

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5. Biogeochemical Controls on Metal and Nutrient Fluxes in a Protected Estuary in Delaware (posted 2/19/16)

Interested in this internship?
Contact Dr. Angelia Seyfferth, angelias@udel.edu, 302-831-4865
UD Dept. of Plant and Soil Sciences
http://udel.edu/~angelias/Seyfferth/Welcome.html

Estuaries are important ecosystems that serve as buffer zones between land and ocean where nutrients and carbon undergo cycling. Within an estuary, complex gradients exist both in space (vertically and horizontally) and in time (seasonally) with respect to salinity, redox, and nutrients. These small-scale biogeochemical processes influence large-scale ecosystem processes such as atmospheric carbon fluxes and export of nutrients and metals to the ocean. The overarching goal of this work is to understand how nutrients and metals are cycled within this estuary to help understand the controls on large-scale fluxes of carbon and transport of nutrients and metals to the ocean. Opportunities exist for field work and laboratory work to collect and analyze water and sediment samples.

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6. Biogeochemical Controls on Metal and Nutrient Fluxes in an Experimental Delaware Rice Paddy (posted 2/19/16)

Interested in this internship?
Contact Dr. Angelia Seyfferth, angelias@udel.edu, 302-831-4865
UD Dept. of Plant and Soil Sciences
http://udel.edu/~angelias/Seyfferth/Welcome.html

Rice is an important staple food for over half the global population, yet its yield and quality are threatened by arsenic, a toxic carcinogen. Arsenic is ubiquitous in soils and sediments and is phytoavailable in wet soils, such as those used in rice production. We are testing several ways to mitigate arsenic accumulation in rice which may impact the ability for mineral-arsenic sorption in rice soils and on rice roots with consequent impacts on water quality. These mitigation strategies in turn may influence nutrient cycling and export and greenhouse gas fluxes from rice agroecosystems. The overarching goal of this work is to understand how soil management impacts nutrient and arsenic cycling in flooded rice. Opportunities exist for field work and laboratory work.

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7. Agricultural Modeling Data Intern (posted 2/19/16)

Interested in this internship?
Contact Ms. Jennifer Volk, jennvolk@udel.edu, 302-730-4000
UD Dept. of Plant and Soil Sciences

The Agricultural Modeling Data Intern will support the BMP (Best Management Practice) Expert Panels for the Chesapeake Bay Program's water quality model.

Environmental computer models are mathematical representations of the real world that estimate environmental events and conditions. Models are used to simulate ecosystems that are too large or complex for real-world monitoring. Chesapeake Bay model simulations, which are called scenarios, project pollution loads and flow. Scenarios simulate how various changes or pollution-reduction actions could affect the Bay ecosystem, especially water quality, wildlife and aquatic life.

For more on the Chesapeake Bay Model, please visit: http://www.chesapeakebay.net/about/programs/modeling

The intern's duties will include collecting and analyzing data and information, attending conference calls and meetings, drafting reports and recommendations, and making presentations

Work will focus around the following priorities identified Panels:

Poultry Mortality Freezers – Poultry Mortality Freezers are a newly introduced BMP to Delmarva's poultry industry. There are currently several farms using freezers to manage their daily mortality on commercial broiler farms. Dead birds are placed in the outdoor freezers daily during the average 7 week grow out cycle. At the end of the flock, the frozen birds are picked up by tractor trailer and hauled to a rendering plant for further processing and alternative uses. It is expected that this BMP will grow in popularity over time and more farms will implement freezers over the traditional method of composting. Composting mortalities in chicken litter to later spread on crop fields for its nutrient value is currently the industry standard and most commonly used practice. Utilization of freezers reduces the nutrient load in the chicken litter, and redistributes those nutrients into alternative uses by rendering the carcasses. The goal is to provide data, information, and calculations to support the incorporation of Poultry Mortality Freezers into the Chesapeake Bay Model so that states can receive credit towards reducing their nutrient load to the Bay.

Soil Phosphorus Management and Modeling – A new effort is underway to collect and compile accurate soil phosphorus data in the state of Delaware. There are a number of needs that this data set would address. First is the need for baseline soil phosphorus data for the Chesapeake Bay Model. These data will be used in conjunction with data from other states in order to inform the Bay Model on soil phosphorus loss. In addition, after a few iterations of this data collection, growers, researchers and the public will be better informed about how phosphorus reduction efforts in the state are progressing. In practice, the data will be collected by consultants and conservation districts in the course of their nutrient management plan writing for growers (with the consent of the growers). The data will be stripped of identifying information by the consultants and conservation districts in order to protect grower's privacy and supplied to the Delaware Department of Agriculture where it will be compiled and analyzed. The specific duties of the applicant will be to assist with the DDA's data collection from consultants and conservation districts. In addition, the applicant will help with data management, analysis, and working with modelers to explain their process and summarize the data.

Experience in agriculture, excellent computer and communication skills, and understanding up basic statistics and data quality challenges a plus.

* Former Project Proposals through 2015 *

Browse to learn topics of interest to faculty and what has been researched in the past

1. Climate Change and Streams: The Effects of Extreme Weather on Carbon and Nitrogen Cycling in Streams (posted 1/28/15)

Dr. Shreeram Inamdar and Dr. Thomas Parr, UD Dept. of Plant and Soil Sciences
http://canr.udel.edu/faculty/inamdar-shreeram/

We are seeking an independent, self-motivated summer intern for an exciting project assessing the effects of extreme storms on watershed export of carbon and nitrogen. Climate change has altered storm intensity and frequency over the last century. The effects of these climatic changes may interact with stream ecosystems to change the ecosystem services they provide. The intern will learn about water quality, fluvial geomorphology, stream ecology, and watershed hydrology in this project. Specifically, the intern will look at how stream morphology and sediment characteristics change after extreme storms and what this means for the cycling of nutrient forms of carbon and nitrogen. The intern will use GPS instruments and GIS to map major morphological features of the Fairhill Study Watershed at the Fairhill Natural Resources Management Area. S/he will also be responsible for collecting and analyzing samples in response to extreme storm events. Finally, under the supervision of lab personnel, s/he will use

state-of-the-art electronic sensors to conduct nutrient additions and assess the effect of extreme storms on ecosystem functions like nitrate retention and uptake.

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2. Examining the Dynamics of Phosphorus Storage and Transport in Soils and Sediments (posted 2/3/15)

Dr. Amy Shober, UD Dept. of Plant and Soil Sciences
http://canr.udel.edu/faculty/shober-amy/

Pending regulation may limit or restrict future application of manure on many Delmarva agricultural fields due to an increased risk of phosphorus (P) losses that contribute to water quality degradation. We seek to understand how the forms of P in soils are affected by long-term application of manure. Similarly, we seek to understand how drainage ditches affect the transport of P from agricultural field soils to sensitive waters, like the Chesapeake Bay. We are conducting laboratory (chemical testing of soils and ditch sediments) and field studies to help us understand the behavior of P in manure-amended soils and the potential for P to be transported from the field to the water. The intern may assist with laboratory work (including preparing soil samples and performing chemical extractions) and/or field work (collecting soil and water samples, conducting storm sampling of soil and ditch water); data analysis/statistics experience is also available. Experience with outreach education is also a possibility if the intern is interested in interacting with farmers and crop consultants.

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3. Using Satellite Remote Sensing Data and Eddy Covariance Equipment to Create an Evapotranspiration Map in Sussex County (posted 2/27/15)

Dr. Changming He, Delaware Geological Survey
http://www.dgs.udel.edu/profile/changming-he

Evapotranspiration (ET), the sum of evaporation (E) from the soil and transpiration (T), is a main component of the water cycle. In Delaware, ET could account for approximately two-thirds of the annual average water budget. Estimates of ET at the monthly - or seasonal - and regional scales are valuable for irrigation scheduling and water management. ET can be measured directly in a small area using weighing lysimeters or the eddy correlation technique. In the regional scale, a variety of methods and models have been developed using remote sensing techniques to estimate ET.

The Delaware Geological Survey (DGS), collaborating with Delaware Environmental Observing System (DEOS), will soon install an eddy covariance instrument in Sussex County to measure the local ET at multiple time and spatial scales.

In this project, the student will use ArcGIS technology to process satellite data obtained from USGS, coupling with DEOS weather station data and eddy covariance measurements to create a regional ET map for Sussex County or Southern Kent County.

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4. Developing Online Tools to Plan for Flood-Ready Communities (posted 3/24/15)

Ms. Marcia Scott, UD Institute for Public Administration, School of Public Policy and Administration
http://www.ipa.udel.edu/directory/homepages/scott.html

Delaware is one of only three states in the nation in which all three of its counties are considered to be in coastal zones. Because many Delaware communities are located either along the coast or in low-lying topography, Delaware is more vulnerable than many states to the impacts of climate change and associated sea level rise. Preparing for and adapting to sea level rise is an unprecedented planning and policy challenge for Delaware local governments, one that presents unique circumstances and complexities. Planning and policy recommendations must be developed that effectively address those concerns. To assist Delaware local governments meet this challenge, IPA will develop a

section on "Flood-Ready Communities" within its online *Delaware Complete Communities Planning Toolbox* (completecommunitiesde.org). An intern will work on developing online *Toolbox* content that will build capacity and enable Delaware local governments to be more prepared and resilient through a recommended process of self-assessment; planning; and identifying resources, next steps, and future actions.

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5. Paired Comparison of Biofiltration Media for Treatment of Storm-Water Runoff (posted 3/5/13)

Dr. Carmine Balascio, UD Dept. of Plant and Soil Sciences
http://canr.udel.edu/faculty/balascio-carmine/

Two side-by-side bio-infiltration basins have been constructed on south campus in the Cool Run watershed, a tributary of White Clay Creek, which utilize a DNREC-recommended blend of bio-infiltration media in one basin and an advanced media formulation in the other that incorporates water treatment residuals for enhanced removal of phosphorus. The outlets are designed to promote denitrification. The goal of the project is to evaluate the effectiveness of these storm-water control measures.

Nutrient loads contribute to the degradation of White Clay Creek watershed, a federally designated "Wild and Scenic Watershed." Storm-water control measures such as the bio-infiltration basins that are the subject of this study have the potential to play an important role in protecting and improving the water quality of urbanized streams such as those that occur on the lower reaches of White Clay Creek watershed where this study is located.

Storm water sampling has been underway at this site for over six months and at least another six months of monitoring are anticipated. The student intern will acquire experience with automated storm-water sampling procedures and equipment. The intern will be responsible for storm-sampling set-up, sample collection, and data acquisition. Opportunities for lab work and data reduction also exist.

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6. How Dam Construction and Removal Influences Alluvial Sedimentation in the Christina River Basin (posted 3/4/11)

Dr. Jim Pizzuto, UD Dept. of Geological Sciences
http://www.ceoe.udel.edu/our-people/profiles/pizzuto

The Christina River Basin Critical Zone Observatory (www.udel.edu/czo) is a joint research program of the University of Delaware and the Stroud Water Research Center (www.stroudcenter.org). The research focus of the Critical Zone Observatory is to improve our understanding of how anthropogenic disturbance promotes carbon sequestration over decadal, centennial, and millennial timescales at the watershed scale. As part of this effort, Dr. Jim Pizzuto's research group has been studying the influence of hundreds (possibly thousands) of small mill dams on alluvial sedimentation in the Christina River Basin. These mill dams were initially constructed for water power in the 18th and 19th centuries, and many have either fallen into disrepair or are being removed through river restoration initiatives. Our approach combines mapping deposits behind existing and former mill dams, determining the ages of these deposits using radiometric dating methods, monitoring changes induced by contemporary dam removals, GIS analysis of aerial and LiDAR imagery, and numerical modeling. We aim to better understand how mill dam construction and removal influence sediment deposition and erosion and carbon sequestration through the Christina River Basin over the last several hundred years (and into the future).

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7. Analysis of Herbicides in Soil and Water Samples from Field Studies on Fate and Transport (posted 3/15/11)

Dr. Stacey Chirnside, UD Dept. of Entomology and Wildlife Ecology
http://canr.udel.edu/faculty/chirnside-anastasia/

The movement of atrazine, simazine, cyanazine and metolachlor was studied for two years under conventional and no-tillage corn production. Atrazine and simazine were detected in the ground water more frequently than metolachlor or cyanazine. During the first year of the study, all 4 pesticides were leached to the ground water shortly after application when a total of 31.5 mm of rainfall occurred. The frequency of the herbicides detected in the ground water was directly related to the soil half-life of the herbicide but related to their solubility.

Soil data showed that atrazine moved more rapidly in the soil profile in the conventional tillage than the no-tillage. Simazine was shown to move faster into the soil profile under no-tillage (91-152 cm depth) than under conventional tillage (0- 152 cm depth). Conversely, metolachlor moved more rapidly under the conventional tillage than no-tillage. Cyanazine moved below the root zone shortly after application for both tillage treatments. The frequency of herbicide detection was related to the soil half-life.

Parameters that affect degradation will have a significant effect on the movement of herbicides through the soil profile and into the ground water. The complexity of interactions within the soil makes it difficult to generalize what best management practices (BMPs) would reduce leaching of pesticide to the ground water. In order to investigate management practices, a study was initiated to assess the effect of managing the ground water depth on the movement of pesticide under minimum tillage corn production. Pesticides were monitored in the soil and ground water for 4 years. Analysis of the pesticide concentration within soil and water resulted in over 1000 samples. Calculation of pesticide concentrations for the last year of the study is needed to further define the effects of BMPs on the fate and transport of the herbicides.

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8. Zero-Valent Iron and Other Additives to Enhance Biofiltration of Water (posted 2/11/08)

Dr. Pei Chiu, UD College of Civil and Environmental Engineering
http://www.ce.udel.edu/directories/profiles.html?pei

Both locally and in third-world countries, methods for the treatment of well water often rely on filtration though a bed of sand. The removal of both bacterial and chemical constituents from the water is accomplished mainly by a bacterial film that forms on the upper layers of the sand. However, there is recent evidence that viruses are not efficiently removed, even though these can carry water-borne diseases.

A new method of removing (or, more accurately, inactivating) viruses in water has recently been developed at UD. It uses metallic iron, known as zero-valent iron (ZVI), which provides a chemical process shown to remove some contaminants and to inactivate viruses in water. The next step is to determine whether this ZVI can be added to a conventional sand filter to improve the removal of viruses and other contaminants. To apply the method in third-world countries, the method should also remove chemical constituents that impart undesirable tastes to water.

This project will assess the combination of biofiltration with the ZVI additive. To be successful, the modification should not impair the removal of bacteria as already achieved by the sand filter, and this will be assessed. The removal of viruses will be determined, and the removal of organic and inorganic substances contributing to poor taste will be evaluated. Different filter configurations must also be compared in order to optimize the process.