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Foreword

In this, the 4th volume of the Journal of Student Research in Environmental Science at Appalachian, we present a collection of non-peer-reviewed articles submitted by students of the Environmental Science Program at Appalachian State University in the Spring of 2014. As part of their “capstone” experience, each Environmental Science major learns to professionally disseminate his/her active learning project—the required research, outreach/education, or internship experience—by presenting his/her work to peers and faculty at the completion of the ENV 4100 Environmental Science Seminar course. Instructors and faculty assess the student’s presentation and provide feedback on content, organization, methods, analysis, and conclusions, as well as presentation, delivery, and elocution. After revision from the presentation feedback, their work is submitted for publication in this journal—manuscripts scoring a grade of ‘B’ or higher and adhering to the provided template and submission process are published in this journal. The Journal of Student Research in Environmental Science at Appalachian therefore represents an artifact in support of learning and programmatic assessment and continuous improvement in several ways:

- students learn to synthesize their active learning projects toward professional dissemination, which ultimately contributes to the dialogue within the scientific community;
- students are immersed in the dissemination process, which is focused on presentation and writing skills as well as the manuscript submission, review, and revision process;
- faculty across several disciplines participate in supporting the students’ active learning projects;
- faculty across several disciplines participate in the assessment and refinement of instruction and program development;
- faculty, program administrators, and external advisory board members are able to readily map the student learning outcomes to the program’s goals and strategic plan;
- alumni, family, friends, contributors, fellow researchers and educators, policy makers, and other interested stakeholders are given immediate and transparent access to student and program artifacts.

An active learning project is required for all Environmental Science majors at Appalachian and can take on several forms (R1, R2, R3, I, O, and C) as follows:

R: Research

1: Extended faculty-mentored project with external funding: The student participates in an externally-funded project that extends beyond the semester in which he/she took the capstone course.

2: Extended faculty-mentored project: The student participates in a project that extends beyond the semester in which he/she took the capstone course and/or in a project that extends beyond the scope of the capstone course.

3: External project: The student is/was involved in a research project undertaken at another institution or agency, domestic or international, under the guidance of mentors not at Appalachian, such as an REU experience, research-based internship, or a study abroad experience. The project may or may not be funded externally.

I: Internship – The student performs an internship at another institution, government agency, or in industry over one or more semesters.

O: Outreach/Education – The student participates in the development and delivery
of educational and/or outreach activities related to environmental science, either locally, regionally, nationally, or internationally.

C: Capstone project—The student selects his/her own capstone project, performs all necessary research, and disseminates the work, all within the scope of the capstone course, and under the guidance of university faculty and/or the capstone course instructor.

As a result of the wide range of options for student active learning projects, the student articles published in this journal reflect a correspondingly wide range of multi-disciplinary topics and may range from deeply investigated (R1-type) projects near completion to ‘term papers’ (C-type) based on secondary data sources.

This semester, the ENV 4100 class student research projects address, to some degree, the causes and effects of and mitigation strategies for global change from the planetary to the local scale. The student efforts presented also represent the enormous value of the spirit of collaboration among the various programs and departments in the College of Arts and Sciences at Appalachian.

Victoria Carpenter, in her paper An Historical Climate Change Projections Model for Boone, N.C. (C-type), frames the remainder of the articles. Using historical trends in global and local climate data since 1895, she projects mean annual temperatures and snow fall amounts for Boone, NC through 2100 based on the Intergovernmental Panel on Climate Change (IPCC) global projections for various greenhouse gas (GHG) emission rate scenarios.

Increased atmospheric loading of anthropogenic GHGs are the primary cause for the observed recent increases in mean global temperatures, especially since the 1950s. Soil CO₂ respiration is a significant control for CO₂ atmospheric concentrations. In his article entitled Analyzing CO₂ exchange between the soil/atmosphere interface in arid soils at the Wrigley Institute for Environmental Studies (WIES), Michael Cheeseman introduces a viability study performed during his REU experience with the University of Southern California on Catalina Island for measuring CO₂ capture/emission rates for various soil types and moisture conditions.

In addition to the causes and effects of GHG emissions, policy changes regarding the atmospheric loading of harmful toxic air pollutants, including volatile organics, must be informed by improved monitoring and accurate identification of the sources of such toxics. Working with Dr. Barkley Sive and Dr. Yong Zhou in the A. R. Smith Department of Chemistry, Megan Knuth in her paper PTR-MS Measurements of Air Toxics at Thompson Farm, NH, 2005-2010 (R2-type) and Carley Brunton in her paper Distributions of volatile organic compounds in the Greater Houston area: Influences of VOCs on air quality (R2-type) address this issue in urban and rural settings. Stephanie Hoelbling brings the discussion closer to home in her paper entitled Atmospheric measurements of formaldehyde in rural Western North Carolina (R2-type).

Eric Hill then discusses the effects of climate change in North Carolina in his paper Impacts of predicted sea-level rise on the North Carolina coast (C-type). In his paper Site suitability analysis for a solar farm in Watauga County, NC (C-type), Marcus McKinney performs geospatial analysis, under guidance from faculty in the Department of Geography and Planning, of the viability for Watauga County to reduce its dependence on conventional power sources via large-scale green energy installations. Hannah Hursey in her paper Overview of the Structural and Functional Condition of Watauga County, NC bridges (C-type) sheds light on the rapid decline of roadway bridges in Watauga County, due primarily to increasing heavy storm runoff and a growing population density in the region.

As part of an effort to expand the capabilities of Appalachian’s AppalAIR research team, Adam Scarborough presents his software package iMetOS log file to skew-T dia-
gram application (log2skewt) (C-type) which will allow the AppalAIR team to incorporate radiosonde meteorological data in their studies of aerosols and for boundary layer characterization.

Finally, the Spring 2014 most outstanding article from the junior-level Writing in the Discipline (WID) course was *Genetically Modified Maize (Bt corn) and Its Effects on Animals*, by Megan Linke. In her article, Megan investigates the results of multiple experiments aimed at determining the short term effects of genetically modified (GM) maize, specifically MON810 and MON863, on laboratory animals. She found that both of these strands were determined to cause possible damage to the liver and kidney of mammals, but these short term studies could not conclude if the symptoms would become life-threatening to the animals later in life. Long term studies on mammals have not been conducted; however, Megan found that researchers caution that GM maize may potentially be dangerous, if ingested in higher doses for long periods.

Other student work that was not included in this edition include the following. Virginia Gills addresses the possible impacts on endangered species in North Carolina due to changes in human population distribution and development in her paper *An analysis of the Endangered Species Act in North Carolina*. In conjunction with Dr. Shea Tuberty’s service learning courses in the Department of Biology and with support from Dr. Carol Babyak in the A. R. Smith Department of Chemistry, Michael Crawford in his paper *Assessment of an urban retention pond in a densely populated college setting* helps us to understand the effectiveness of current flood control Best Management Practices (BMPs) as solutions for retaining urban runoff of heavy metal pollutants here in Boone. N.C. Rachel Hibler, in her article *Ridge Law and wind energy potential in Watauga County, NC*, employs GIS techniques to assess the ideal locations for wind turbine installations in Watauga County, NC, in consideration of the NC Ridge Laws.

From research tool development, to clean energy viability studies for Watauga County, to impacts of human development and climate change on NC, to air toxic and GHG studies applicable across the globe, this semester’s ENV 4100 student scientific inquiries span a wide range of relevant topics from the local to the global scale.

We hope you enjoy the articles in this journal – they represent significant time and effort on the part of our dedicated students and faculty and speak clearly for the outstanding potential of our students to make significant contributions in their chosen careers in science.

Chris Thaxton, Ph.D.
Editors

Dr. Chris Thaxton
Chris Thaxton is the Director of the Environmental Science Program at Appalachian. He is also an Associate Professor in the Department of Physics and Astronomy and Director of the Professional Science Master's program in Engineering Physics. His major research interests include granular systems, fluid dynamics, electromagnetism, and electronics. His recent paper “Simple power law for transport ratio with bimodal distributions of coarse sediments under waves” (JGR 113, C03003, 2008) won the U.S. Navy’s Alan Berman Award for Outstanding Journal Article. In addition to environmental science undergraduate courses, he has taught physics courses ranging from theoretical classical mechanics, to electrodynamics, to advanced microprocessors and robotics.

Dr. Wendy Winn
Wendy Winn is an Associate Professor of science, technical, and professional writing in the Department of English at Appalachian State University. Her major research interests include visual communication, the rhetoric of science, and rhetorical theory. She is currently leading two interdisciplinary research groups at ASU: 1) Digitizing the Humanities and 2) the Pink Ribbons project. In addition to her undergraduate courses, she teaches a graduate course in technical writing for the Professional Science Masters (PSM) Program and serves on the PSM advisory board.