



Program and Abstracts  
THE 13<sup>TH</sup> INTERNATIONAL  
INTERDISCIPLINARY CONFERENCE ON THE  
ENVIRONMENT

*JUNE 30 - July 3, 2007  
Portland, Maine USA*

*Organized By  
The Interdisciplinary Environmental Association*

## WELCOME

*Dear Participant:*

*On behalf of the Interdisciplinary Environmental Association, I would like to welcome you to Portland, Maine and the 13<sup>th</sup> International Interdisciplinary Conference on the Environment. Once again, we meet in a location where environmental systems, some more “pristine” and others more “human-dominated”, meet, merge, and sometimes clash. And humanity, being in many ways a coastally dependent species, derives both biological survival and psychological solace from coastal areas. We look forward to learning more about the local environmental challenges of this region of the world even as we discuss global (and globally applicable) issues with colleagues from many continents and fields of study. If you look over this program, I am sure that you will be pleased and impressed with the breadth of locations and topics awaiting us over the next few days. And, in addition, this is the year where the reigns of the organization get passed along to a new President and new Councilors; always a time for the celebration of accomplishments to date and a look forward to new challenges for the organization (and there are several, from the administrative home for the IEA to the accreditation of environmental programs)!*

*Each year we attempt to bring together specialists, practitioners, and interested citizens from all corners of the globe in order to exchange ideas and approaches to the environmental issues that we face. It is an underlying philosophy of this organization and this conference that we have the best chance for success in our attempts to both understand and address environmental topics when we are free to discuss them without limitations to particular philosophies, political boundaries, or disciplinary constraints. If this is a return trip to our conference, we hope that you find us more vital and active. If this is your first IICE, we hope that you will find our unusual (even distinctive) approach to environmental work challenging and stimulating, and that you will network with our global membership to mutual benefit. And if you get caught up in your experience at the IICE, we hope that you will join the Interdisciplinary Environmental Association and become a part of the effort we are building.*

*Good luck in your sessions, we look forward to meeting each of you, and Welcome to Portland and the 13<sup>th</sup> IICE!*



*Michael A. Reiter*  
President, 2005-2007



*Anthony B. Lumby*  
VP and President-Elect

*The Interdisciplinary Environmental Association*  
[www.ieaonline.org](http://www.ieaonline.org)

# CONFERENCE SCHEDULE SUMMARY

	Saturday 30	Sunday 1	Monday 2	Tuesday 3		
7:30 AM		Registration (to 3PM): Vermont	Registration (to 10am) Vermont	Gather Vermont	7:30 AM	
8:00		1) New Approaches in Environmental Education I Connecticut	9) Climate Change Connecticut	16) Health 3: Control Connecticut	8:00	
8:30			10) International Agreements Rhode Island	17) Community Resource Strategies Rhode Island	8:30	
9:00		2) Green Business Strategies Rhode Island	11) Health II: Biological New Hampshire	18) Ethics New Hampshire	9:00	
9:30						9:30
10:00		Break Vermont	Break Vermont		10:00	
10:30		3) Environmental Policy Connecticut	12) Workshop: Transformative Education for Sustainability Connecticut	Business Meeting, Vermont	10:30	
11:00						
11:30		4) Urban Development Rhode Island	13) GIS Strategies Rhode Island	Break Vermont	11:30	
12:00 PM						12:00 PM
12:30	Boothbay Harbor & Eastern Egg Rock Field Trip	Sunday Brunch TBA	Plenary Address Vermont		12:30	
1:00					1:00	
1:30			5) New Approaches in Environmental Education II Connecticut	Conference Luncheon and Presidential Address TBA	Casco Mail Run Field Trip	1:30
2:00			6) Land-Use Rhode Island			
2:30						2:30
3:00			7) Coastal and Oceans Management I Connecticut	14) Coastal and Oceans Management II Connecticut		3:00
3:30						
4:00			8) Contaminants and Health I: Chemical Rhode Island	15) Changes in Watershed Flow and Community Rhode Island		4:00
4:30						4:30
5:00			Break, Vermont Poster Authors Available	Break, Vermont Poster Authors Available		5:00
5:30		Colloquium I: Accreditation of Environmental Programs Vermont	Colloquium II: Climate Change: Data from the Past and Projections for the Future Vermont		5:30	
6:00						6:00
6:30					6:30	
7:00					7:00	
7:30	Social Vermont				7:30	

# CONFERENCE SCHEDULE

## Saturday, June 30

8:30am – 5pm Field Trip to Eastern Egg Rock and Boothbay harbor

All registered participants should wear comfortable attire for a boat outing and some village walking and bring rain gear. Water is recommended. We will stop for lunch in the area. Meet in the hotel lobby; vans depart at 7 AM.

7pm – 9pm Informal Social Mixer, Vermont Room

## Sunday, July 1

7:30am – 3pm Registration  
Vermont

8am – 9:45am Session 1: New Approaches in Environmental Education I  
Connecticut

Moderator: *M. Kuha, Ball State University*

Discussant: *M. Shrivastava, Athabasca University*

### **M. Anderson**

Using the New Ecological Paradigm (NEP) to Assess Attitudinal Change in Higher Education Courses on the Environment

### **L. Zahvoyska**

Towards Sustainable Communities: Role of Universities in Shaping Environmentally Sound Development (Case of Ukraine)

### **B. Barker**

Using Superfund Sites as an Instructional Tool to Teach Environmental Racism

8am – 9:45am Session 2: Green Business Strategies  
Rhode Island

Moderator: *J. Becker, Pennsylvania State University*

Discussant: *G. Denton, University of Guam*

### **S. MacDougall**

The Bottom Line of Going Green: Corporate Investment in Pollution Abatement

### **R. Bouvier**

Determinants of Environmental Performance: Pulp and Paper Mills, Environmental Regulations, and Community in Maine

**S. Ram. Vemuri**

Business Planning for Environmental Management

9:45am – 10:15 am Break

Vermont

10:15am – 12 pm Session 3: Environmental Policy

Connecticut

Moderator: *D. Pokrajac, Delaware State University*

Discussant: *D. Kantarelis, Assumption College*

**P. Barresi**

Navigating the Ideological Landscape of Environmental Politics and Policy-Making in the United States

**E. Fitch**

Federal Environmental Protection and Management in the 21st Century: The Need for a U.S. Department of Environmental Protection

**A. Agrawal**

Seasonal Variation in Characteristics of Indian Municipal Solid Waste –A Case Study

10:15am – 12pm Session 4: Urban Development

Rhode Island

Moderator: *G. Steinhoff, Utah State University*

Discussant: *J. Carroll, University of New Hampshire*

**E. Houk**

Residential Water Demand in the Absence of Volumetric Water Pricing

**T. Wagner**

Examining the Contribution of Historical Sources of Lead in Urban Soils of Portland, Maine

**D. Parsons**

Unnatural Selection: the Inevitability of Inequitable City Centres

12 – 1:15 pm: SUNDAY BRUNCH

1:15 pm – 3 pm Session 5: New Approaches in Environmental Education II

Connecticut

Moderator: *M. Saintil, Delaware State University*

Discussant: *K. Hickey, Assumption College*

**B. Allen**

Interdisciplinary Learning for Sustainability

**J. Challandes**

Developing Video-Based Outreach for Public Education: The Delaware National Estuarine Research Reserve

**J. Lyon**

Enhancing Community-Based Partnerships: Integrating Undergraduate Colleges in Interdisciplinary Environmental Assessment Projects

1:15pm – 3 pm Session 6: Land-Use Policy

Rhode Island

Moderator: *M. Reiter, Bethune-Cookman University*

Discussant: *S. Baker, NOAA*

**M. Williams**

Landscape Function and Land-Use Policy in a Karst Landscape

**D. Laband**

Water Filtration Services from Forested Landscapes: Economic Valuation of Ecosystem Services and Optimal Land Use

**L. McGlenn**

Land Trusts and the Visual Landscape

3:00pm – 4:45pm Session 7: Coastal and Oceans Management I

Connecticut

Moderator: *J. Walmsley, Jacques Whitford, Ltd.*

Discussant: *D. Parsons, Sheffield Hallam University*

**G. Herbert**

Implementing Canada's *Oceans Act*: Experiences with Integrated Ocean and Coastal Management on Canada's East Coast

**D. Walmsley**

Evaluation of Integrated Oceans Management Programs: A Canadian Perspective Using the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative as a Case Study.

**G. Moscardo**

Exploring Public Awareness of Threats to the Great Barrier Reef Environment

3:00pm – 4:45pm Session 8: Contaminants and Health I: Chemical

Rhode Island

Moderator: *A. Lumby, University of the Witwatersrand*

Discussant: *S. Gill, University of Pennsylvania*

**G. Deka**

Assessment of some heavy metals in drinking water, soil and rice in the vicinity of a textile mill

**D. Sassan**

Management Implications of Increased Chloride Concentrations in Surface and Ground Waters of the Northern United States

**S. Bevins**

Environmental Health Threats and Concerns for Women and Children: An Interdisciplinary Perspective

4:45pm – 5:15pm Break: Poster Authors Available  
Vermont

5:15pm – 6:45pm Colloquium I  
Vermont

## **Accreditation of Environmental Programs**

### Convener

Michael Reiter, Bethune-Cookman University

### Panel Members

#### **Robert Sanford**

Associate Professor, University of Southern Maine  
Issues, Challenges, and Driving Forces behind the Move for Accreditation

#### **Larry Robinson**

Director of the Environmental Cooperative Science Center, Florida A&M University  
Accreditation Issues Related to Undergraduate Programs

#### **Susan Gill**

Director of Education, Stroud Water Research Center  
Accreditation Issues Related to Graduate Programs

#### **Will Focht**

Director of the Environmental Institute, Oklahoma State University  
Administrative Needs and Issues Related to Accreditation

## **Monday, July 2**

7:30am – 10am Registration  
Vermont

8am – 9:45am Session 9: Climate Change  
Connecticut

Moderator: *J. Carroll, University of New Hampshire*  
Discussant: *B. Barker, Nova Southeastern University*

#### **E. Fitch**

Land Use, Infrastructure and Climate Change: Effects on Population Distribution and Infrastructure

#### **A. Lumby**

The Economics of Climate Change: A Review of the Stern Report

#### **I. Dubro**

Paleoclimatic Reconstruction of Southwest Ukraine during the Holocene from Pollen data

8am – 9:45am Session 10: International Agreements  
Rhode Island

Moderator: *E. Houk, California State University, Stanislaus*  
Discussant: *A. Lumby, University of the Witwatersrand*

**D. Kantarelis**

Environmental Treaties and Evolutionary Game Theory

**M. Kuha**

Acceptance and avoidance of responsibility in world leaders' statements about climate change

**I. Soloviy**

The World Environmental Constitution as an Instrument of International Environmental Governance

8am – 9:45am Session 11: Contaminants and Health II: Biological

New Hampshire

Moderator: *S. Baker, NOAA*

Discussant: *S. Bevins, Florida Gulf Coast University*

**G. Denton**

Solid Waste Disposal on Guam: The Impact of an Unsanitary Landfill on the Heavy Metal Status of Adjacent Aquatic Community Representatives

**J. Okonedo**

Sublethal Toxicity of Crude Oil Dispersant Corexit-9527 on Freshwater *Tilapia guineensis* Fingerlings using Biomarkers

**S. Jones**

Optimized Use of Ribotyping for Tracking Bacterial Pollution Sources in Northern New England Waters

9:45am – 10:15am Break

Vermont

10:15am – 12:00pm Session 12: Workshop: Transformative Education for Sustainability

Connecticut

Moderator: *P. Morgan, West Chester University*

10:15am – 12:00pm Session 13: GIS Strategies

Rhode Island

Moderator: *E. Fitch, Marietta College*

Discussant: *M. Reiter, Bethune-Cookman University*

**J. Earls**

Using the Fractal Dimension to Differentiate Between Natural & Artificial Wetlands

**B. Hu**

Geotechnologies and Environmental Studies

**M. Agrawal**

GIS Based Biological Impacts Assessment of a Highway Project Using Public Perception

12pm – 1:15pm Plenary Address

**KEYNOTE ADDRESS**

**Dr. Richard Brooks**  
**Vermont School of Law**

Vermont

1:15pm – 3pm: Conference Luncheon

Location TBD

**PRESIDENTIAL ADDRESS**

**Dr. Michael Reiter, Outgoing President**  
**Dr. Anthony Lumby, Incoming President**

3pm – 4:45pm Session 14: Coastal and Oceans Management II

Connecticut

Moderator: *D. Walmsley, Bedford Institute of Oceanography*

Discussant: *C. Simpson, SUNY Plattsburgh*

**M. Saintil**

Derivation of a Watershed-Scale Conceptual Model for the St. Jones River Using the Habitat-Scale Conceptual Metamodel

**J. Walmsley**

Comparison of Frameworks for Measuring Integrated Management in Large Ocean Management Areas

**S. Baker**

Ecosystem Approach to Management and Integrated Assessments: Implementation in Ocean and Coastal Management

3pm – 4:45pm Session 15: Changes in Watershed Flow and Community

Rhode Island

Moderator: *G. Denton, University of Guam*

Discussant: *I. Dubro, Odessa State Academy of Refrigeration*

**D. Pokrajac**

Regularities and Trends in the Water Level of the St. Jones River, Delaware and Their Influence on Ecosystems

**C. Button**

Assessment of Physical Integrity Using Stream Channel and Riparian Zone Attributes

**S. Stotts**

Quantifying Vegetation Changes in the St. Jones River, Delaware: an Examination of Flow, Community Structure, Sea Level Rise, and Salinity

4:45pm – 5:15pm Break: Poster Authors Available  
Vermont

5:15pm – 6:45pm Colloquium II  
Vermont

## **CLIMATE CHANGE: DATA FROM THE PAST AND PROJECTIONS FOR THE FUTURE**

**Kevin L. Hickey**

Department of Economics & Global Studies  
Assumption College

**Demetri Kantarelis**

Department of Economics & Global Studies  
Assumption College

**Tuesday, July 3**

7:30am - 8am Gather  
Vermont

8am – 9:45am Session 16: Contaminants and Health III: Control  
Connecticut

Moderator: *M. Shrivastava, Athabasca University*

Discussant: *D. Pokrajac, Delaware State University*

**C. Mba**

Environment and Health: Malaria Control among Women in the Volta Region of Ghana

**K. Murugan**

Biopesticides as an Environmentally Soft Tool for the Sustainable Management of Insects/Mosquito Vectors

**S. Thareja**

Correlation of Trace Metals Emitted in Energy/Metal Production Processes and Environmental Health

8am – 9:45am Session 17: Community Resource Gathering Strategies  
Rhode Island

Moderator: *C. Sian-Denton, University of Guam*

Discussant: *R. Bouvier, University of Southern Maine*

**J. Carroll**

Local Agriculture as a Tool for Community Sustainability and Open Space Protection in New England

**C. Simpson**

Food Paradigms: Sustainability in Artisan and Industrial Food Systems

**M. Siddique**

Eco-friendly Sustainable Shrimp Aquaculture in Bangladesh: A Way of Minimizing Coastal Degradation

**B. Murray**

Vegetative Species Richness and Composition on the Conservation Lands of Kent County, Delaware

8am – 9:45am Session 18: Environmental Ethics

New Hampshire

Moderator: *D. Kantarelis, Assumption College*

Discussant: *E. Fitch, Marietta College*

**G. Steinhoff**

Compensatory Mitigation and the Possibility of Restoring Natural Wetlands

**S. Baker**

Humans and the Environment: A Wiccan Perspective

**P. Bruno**

Nature as Resource, Nature as Mystery

9:45am – 11:15am Business Meeting

Vermont

All participants are welcome to attend.

11:15am – 11:45am Break

Vermont

2-5pm Field Trip on Casco Mail Run

All registered participants should wear comfortable attire for a boat outing and some village walking, and bring rain gear and/or sunscreen. Water and a jacket/sweater are recommended for the boat. Meet in the hotel lobby; vans depart at 2 pm.

## ABSTRACTS

### 1. KEYNOTE BIOGRAPHIES AND ABSTRACTS (\*Presenter/Contact)

#### **Richard O. Brooks**

*Professor of Law and Founding Director  
Environmental Law Center  
Vermont Law School  
South Royalton, VT 05068 USA  
rbrooks@vermontlaw.edu*

Professor Richard Brooks, founding director of Vermont Law School's Environmental Law Center and a past coordinator of Vermont Law School's Foreign, International and Comparative Law Program, is an internationally recognized scholar of environmental law and policy. Professor Brooks earned his B.A. degree in 1956 and his M.A. degree in social and political philosophy in 1958, both from the University of Chicago. He received his LL.B. degree from Yale Law School in 1962 and his Ph.D. degree in planning from Brandeis University in 1974. Professor Brooks' legal career began as an associate with Parker, Badger & Fisher in Greenwich, Connecticut, and as director of program analysis and legal counsel with Community Progress, Inc. in New Haven. He served for three years as executive director and legal counsel with Thames Valley Council for Community Action, Inc. and for ten years as an urban legal planning consultant. From 1971 to 1978, Professor Brooks maintained a private law practice, taught planning and law at the University of Rhode Island, and directed the Connecticut College Urban Studies Program. During that time, he argued a case for the Natural Resources Defense Council, which upheld the Connecticut coastal management permitting program, and drafted legislation, revisions, and amendments for state and municipal coastal zone management. Professor Brooks founded Vermont Law School's Environmental Law Center in 1978 and remained its director until 1990. Throughout his career, Professor Brooks has served as a consultant for various environmental groups, State of Vermont agencies, and for the United States Department of Energy. He has also served since 1980 as visiting professor in environmental studies at Dartmouth College and as visiting professor of law at McGill and at the University of Trenton.

#### **“Hermes’ Ruse”**

#### **Sustainable Ecosystem Regimes and the Interdisciplinary Venture**

Hermes was the son of Jupiter, and the god of sciences and thieves and rogues, the guardian of borders and the messenger god; his name is immortalized in “hermeneutics”: the art of interpretation. We know him by his Roman name, “Mercury”, and have named one of the elements and planets after him. Hopefully, my talk about Hermes and mercury will shed some light on our common interdisciplinary venture.

I will begin with my autistic grandchild, and Minimata, both victims of mercury pollution. I will proceed to a more general description of mercury deposition, its sources, and pathways through the environment. The cycling and transformation of mercury is one example of tricky Hermes at work. I shall review the current legal efforts to control mercury, and the response of industry. These legal responses are efforts to cage Mercury.

I shall suggest that this cage is usefully denominated an “ecosystem regime”. To construct such an ecosystem regime requires a variety of disciplines - ethics, ecology, economics, political science, biology and law. Each discipline is an interpretation of the reality of the deposition of mercury in nature and current efforts to control it. (In a second link to the myth of Hermes, these disciplines may be regarded as “children of Hermes”, works of interpretation.)

Organizing these many disciplines begins by again remembering “Hermes’ Ruse” - the trickery of Hermes. Hermes makes us believe that each of our interpretations is the same as reality. An economist sees the world of price, supply and demand of mercury (and the coal which contains it); the lawyer sees the world of the Clean Air Act, its violation and resulting court cases; the ecologist sees a web of nature, composed of cycling mercury and its transformation in the food web. The ethicist sees a world needing justice between generations. All these disciplines are efforts to reach the truth about mercury and our

interaction with it. But we must reject Hermes' Ruse - the belief that any one interpretation is the dominant reality.

One way to escape Hermes Ruse is to "fit" these disciplines within the notion of a sustainable ecosystem regime. To "fit" it requires argumentation, such as the kind of argumentation found in Byram Norton's Sustainability. Hopefully, "sustainable ecosystem regime" might defeat the "Ruse of Hermes", allowing for a genuine interdisciplinary venture. And building such a sustainable regime may lead to the construction of the cage not only for Hermes and her competing disciplines, but also for the compounds of mercury, to prevent future harm to other grandchildren and to avoid future Minimatias.

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## **A Panel and Discussion: Accreditation of Environmental Programs**

### **Convener:**

**Michael Reiter**

*Department of Agriculture and Natural Resources  
Delaware State University  
Dover, DE 19901-2277 USA  
mreiter@desu.edu*

### **Tentative Panel Members and Their Perspective:**

**Will Focht**

*Director of the Environmental Institute, Oklahoma State University  
Administrative Needs and Issues Related to Accreditation  
will.focht@okstate.edu*

**Susan Gill**

*Director of Education, Stroud Water Research Center  
Accreditation Issues Related to Graduate Programs  
sgill@stroudcenter.org*

**Larry Robinson**

*Director of the Environmental Cooperative Science Center, Florida A&M Univ.  
Accreditation Issues Related to Undergraduate Programs  
larry.robinson@famu.edu*

**Robert Sanford**

*Associate Professor, University of Southern Maine  
Issues, Challenges, and Driving Forces behind the Move for Accreditation  
rsanford@usm.maine.edu*

With the advent of efforts to create interdisciplinary/transdisciplinary environmental programs at colleges and universities across the country, one of the more difficult issues to arise involves the content and accreditation of these programs. In particular, the wide array of approaches and topics within environmental fields would provide a challenge to an accrediting organization, making it potentially difficult to define the role of an accrediting agency and requiring an equally broad (if not broader) pool of expertise from which to draw in order to provide such a service. However, accrediting could play a significant role in providing credence and legitimacy to interdisciplinary/transdisciplinary environmental programs, particularly in the current academic climate of discipline-specific programs and majors.

The Interdisciplinary Environmental Association (IEA) has been approached by a member of the Council for Environmental Deans and Directors (CEDD) concerning the accreditation of interdisciplinary environmental programs. The CEDD has developed guidelines for a potential accreditation process but has not had a vehicle for implementing their recommendations. The IEA, as an interdisciplinary environmental organization with an academic focus, is one of the few organizations positioned to perform such a role, and we have been asked to consider taking on the

responsibility of offering accreditation of environmental programs. This panel and discussion will consider the issues, positive and negative, concerning the accreditation of environmental programs with the goal of leading to a discussion of prospects for devising an accreditation process and the potential for a role for the IEA.

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## **2. CONTRIBUTED ORAL PRESENTATIONS (\*Presenter/Contact)**

*Alphabetical by Indicated Presenter*

### **Seasonal Variation in Characteristics of Indian Municipal Solid Waste –A Case Study**

Anita Agrawal\* and Rama Pandey  
*Department of Chemistry*  
*Pt. R. S. University, Raipur, INDIA*  
*anita\_raipur@yahoo.co.in*

M. L. Agrawal  
*Civil Engineering Dept.*  
*National Institute of Technology, Raipur, INDIA*

In developing countries like India, rapid urbanization and uncontrolled population growth have lead to the socio-environmental problem of ill-managed municipal solid waste. While municipal solid waste management (MSWM) is an essential service, it is given least priority due to a lack of financial resources, institutional weaknesses, improper choice of technology and a lack of public concern towards MSWM, making the service unsatisfactory. The current practice of uncontrolled dumping of waste on the outskirts of towns/cities has created a serious environmental and public health problem. Evaluating the characteristics of municipal solid waste is an important aspect of MSWM because the selection of effective management strategies depends on the types and variation in the characteristics of the waste to be managed. The focus of the present paper is to determine the variation in characteristics of municipal solid waste for Indian conditions. A case study is presented for Raipur city to determine the seasonal variation in waste characteristics. In India, the community bins to collect MSW are kept open at the top and thus the season affects the characteristics of MSW. A remarkable variation of 30-150% is found in different characteristics of MSW (i.e. bulk density, moisture content, percentage composition of waste, calorific value, volume of waste generated etc.) by season (Summer, Rainy and Winter). Also, an approach is presented to design a sustainable MSWM system to meet the future challenge.

### **GIS Based Biological Impacts Assessment of a Highway Project Using Public Perception**

M. L. Agrawal\* and B. Maitra  
*Department of Civil Engineering,*  
*National Institute of Technology, Raipur (Chhattisgarh), INDIA 492010*  
*mohanlalagrawal@yahoo.com*

M. K. Ghose  
*Regional Remote Sensing Service Center (ISRO),*  
*Kharagpur (W.B.) INDIA 721302.*

Economic development of a country highly depends upon the efficient road network. Highway development provides an easy access to goods and passenger traffic. However, it may have an adverse affect on the biological attributes of the region due to increase in traffic volume. Assessment of impact on biological attributes is an essential component of environmental impact assessment (EIA) that is required for the planning of all major road projects. Most of the ecological attributes are spatial in nature and for a rational assessment of ecological impacts it is necessary to quantify the impacts on individual attributes considering their spatial variations. In this paper a

methodology is presented for the quantification of impact on individual ecological attributes based on the perception of public in the influence area of the project, and the spatial variation of impacts is captured with the help of Geographic Information System (GIS). The spatial distribution of the impact is considered along with the intensity of impact in estimating impact values for different biological attributes. Aggregation of impacts on biological attributes is demonstrated with reference to a case study by considering the relative weights of different biological attributes. The stretch of National Highway (NH-60) from Jaleswar to Kharagpur in India, having a length of 56 km, is selected for the present work. This part of National Highway is in the process of being upgraded from two lanes to four lanes. For the case study considered in the present work, all the biological attributes are found to have high adverse impact at or near the highway. The adverse impacts on all attributes are found to decrease with an increase in distance from the highway.

### **Interdisciplinary Learning for Sustainability**

Barry Allen\*

*Department of Environmental Studies*

*Rollins College*

*Winter Park, FL 32789 USA*

Rollins College has been teaching sustainability and sustainable development since 1984. Over the past 23 years a number of different pedagogical strategies have been employed. First came discrete courses in the interdisciplinary Environment Studies Department. Then, for 10 years the Associated Colleges of the South sponsored a multi-institutional interdisciplinary field program in sustainable development in Costa Rica administered by Rollins. In 1999, a unique interdisciplinary minor in sustainable development linking the Rollins Departments of Environmental Studies and International Business was established. In addition to on-campus courses from both departments, students are required to enroll in two international practica to examine specific questions of sustainable development. Costa Rica, Dominica, Peru and Vietnam have all been practica field sites. Now, in the fall of 2007 Rollins will launch a new semester long multi-course program in sustainability for first-year students. This innovative new program will create an interdisciplinary learning community modeled on the total immersion concept common in the teaching of foreign languages. This paper will examine the benefits, costs, successes, and failures of each stage in this evolving pedagogy.

### **Using the New Ecological Paradigm (NEP) to Assess Attitudinal Change in Higher Education Courses on the Environment**

Mark Anderson\*, Mario Teisl, Caroline Noblet, and George Criner

*School of Economics*

*University of Maine*

We have shown that courses designed to meet university General Education requirements in the area of population and the environment do affect student attitudes, as measured with before and after administration of the New Ecological Paradigm (forthcoming in *The Journal of General Education*). Additional assessment research using the NEP is now being conducted to determine if there are differential effects from differences in course content or in instructor, even when the overall course learning outcomes goals are the same for purposes of general education. Initial data assessing outcomes from three different courses and four different instructors suggest that such differential effects exist. Different instructors and/or courses appear to make students more “green” or more “brown.”

This provides further evidence for the value of the NEP as an instrument for measuring attitudinal change in higher education. Assessment of learning outcomes should not be limited to factual or conceptual knowledge or to skill sets such as effective writing or problem solving. Attitudinal change is also an important effect of higher education and faculty should be aware of the attitudinal effects of their course content and pedagogy.

This research also forces consideration of difficult issues of the desirability of attitudinal changes from individual courses or complete curricula. Are there desirable attitudinal effects that should be specified by faculty? If so, should presence of such effects be targets of assessment? Should faculty be accountable for such change? Further research should explore the usefulness of attitudinal change in assessment of programmatic effects and the durability of attitudinal change from higher education over time.

### **Implementing Canada's *Oceans Act*: Experiences with Integrated Ocean and Coastal Management on Canada's East Coast**

Joe Arbour\*, Jason Naug and Glen Herbert  
*Oceans and Coastal Management Division*  
*Fisheries and Oceans Canada (Maritimes Region)*  
*Dartmouth, Nova Scotia, CANADA*

The 1996 *Oceans Act* and its supporting policy statement, *Canada's Oceans Strategy*, provide the national legal and policy context for integrated ocean and coastal management in Canada. Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is the lead federal authority for ocean affairs and is charged with leading and facilitating the development and implementation of integrated management plans for all marine waters. This paper provides an overview of several integrated ocean and coastal management efforts involving DFO on Canada's east coast, with an emphasis on experience gained through work on the Scotian Shelf, in the Bras d'Or Lakes, and in the Bay of Fundy/Gulf of Maine region. These area-based examples highlight the requirement for flexible approaches based on the context and scale for planning and management. In the case of the Scotian Shelf, there is a clear federal leadership role for offshore planning. In contrast, the Bras d'Or Lakes illustrate the complexities of multiple government jurisdictions at the federal, provincial and municipal levels, as well as the strong leadership role of First Nations and adjacent community groups. In the Bay of Fundy/Gulf of Maine, a transboundary and multi-jurisdictional planning effort is required. While each of these areas exhibit significant differences, there are a number of common elements and features among them, lending support for maintaining common planning approaches and tools at the broader regional scale. Using the experiences of the three integrated management efforts, this paper discusses the design of regional collaborative governance processes, the development of integrated management plans, and the application of scientific, technical and planning tools for ocean and coastal management.

### **Ecosystem Approach to Management and Integrated Assessments: Implementation in Ocean and Coastal Management**

Susan Baker\*  
*Coordinator for Outreach and Education*  
*NOAA's National Centers for Coastal Ocean Science*  
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Coastal managers at the Federal, state, tribal, and local levels must respond to the negative impacts of ecosystem stressors while balancing environmental, sociocultural, and economic goals. Historic management paradigms for coastal and ocean ecosystems focused on single resource management and failed to reflect the complexity of ecological and management environments. In contrast, an ecosystem approach to management considers a wider range of relevant ecological, environmental, and human factors bearing on societal choices regarding resource use. It provides a comprehensive framework for marine and coastal resource decision making. The application of EAM to ocean and coastal management is relatively new and is ramping up in response to the recommendations of the Pew and Ocean Commissions. A major tool to accomplish EAM is the integrated assessment (IA), a formal mechanism for linking science and management. IAs summarize the status of ecosystem components, screening and prioritizing potential risks, and evaluating alternative management strategies against a backdrop of environmental (e.g., climatic, oceanographic, seasonal) variability. They provide a means of evaluating tradeoffs in management objectives among

potentially competing ocean use sectors. Importantly, an IA integrates, not merely collects, the best available science across multiple disciplines. A successful IA responds to relevant policy questions, quantitatively identifies uncertainties in existing data and information, includes public participation and peer review, integrates and synthesizes data and information across multiple disciplines, uses existing high-quality data and information, and forecasts future conditions and outcomes. The aim of this presentation is to inform participants on EAM and IAs and how they are being applied to ocean and coastal management.

### **Humans and the Environment: A Wiccan Perspective**

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This presentation continues a series of IEA talks on the relationship between religion and the environment. Modern Wicca is a Neo-Pagan religion which is based on pre-Christian Earth religions. Wicca may be the fastest growing religious movement in the United States. It is not based on dogma or scriptures, but takes its teachings from nature. While there are many different versions of Wicca, there are commonalities, including regarding the individuals' relationship with the environment. To Wiccans, all things – humans, plants, animals, stones, and stars – are all part of one whole, and respect for nature is a sacred duty. This leads to a great concern for the environment, in many cases to active environmentalism. There are no 'formal' writings (such as the Bible or Koran) for Wicca, however there are grey literature materials available for analysis. This presentation will review some of the 'mainstream' Wiccan literature and discuss how this religious belief affects human activities and their environmental impacts.

### **Using Superfund Sites as an Instructional Tool to Teach Environmental Racism**

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EPA Superfund Sites become identified through a massive compilation and analyses of publicly available scientific data collected by governmental engineers and environmental scientists. Since a majority of these sites are located in urban areas adjacent to low-income and/or ethnically diverse communities, they also provide unique opportunities for undergraduate students to evaluate public policy as it relates to environmental justice, examine environmental health issues, and assess the scientific basis of remediation.

One of these CERCLA designated sites, the Wingate Landfill and Incinerator EPA Superfund Site located in Ft. Lauderdale, Florida, is a resource providing instructional opportunities for students to examine long-term consequences of environmental health issues relating to minority residents living within a mile radius of the site; to collect, evaluate, and interpret their own data and dispute local, state, and federal governmental decisions made on behalf of the community; and question the politics of remediation and cost-control.

### **Navigating the Ideological Landscape of Environmental Politics and Policy-Making in the United States**

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As the political pundits have it, Democrats support environmentally protective public policies but Republicans don't, the former because they are "liberal" and the latter because they are "conservative." Although this conventional wisdom offers a useful rule of thumb for the casual observer of environmental politics and policy-making in the contemporary United States, the reality is much more complex. Understanding this reality is essential for understanding how and why environmental politics in the United States play out as they do, and for predicting how any given political actor is likely to behave in any given environmental policy-making context, with profound consequences for policy outcomes at both the domestic and the international levels. This article offers a framework for mapping the ideological landscape within which environmental politics and policy-making take place in the contemporary United States as an aid to analyzing their dynamics and predicting their outcomes. It focuses on three contemporary political ideologies (traditional conservatism, modern conservatism, and modern liberalism) and four contemporary environmental ideologies (anti-environmentalism, anthropocentric environmentalism, biocentric environmentalism, and ecocentric environmentalism), which together form a complex motivational matrix of which fully informed analysis and prediction must take account.

### **Environmental Health Threats and Concerns for Women and Children: An Interdisciplinary Perspective**

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Women and children are at particular risk for serious impacts on their health and well being through exposure to environmental toxins. It is critically important that through education, access to research findings on known and postulated threats to the health and the development of children and their mothers is improved so that the chance of negative outcomes is reduced. Environmental threats to the development and health of children and their mothers are numerous and provide an example of the unique intersection of the disciplines of health and the environment. The session will include a presentation and discussion of the most serious threats from an introductory environmental toxicology perspective. Topics covered will include an overview of terminology, classification of toxins, routes of absorption in the body, the process of metabolism, resulting organ toxicity, impact on developing systems, and risk assessment. With hundreds of new chemicals released monthly for use in our daily lives, it is imperative that the risks of exposure and the consequences and impacts on development and health are known. Because we live in times of rapid change with numerous threats to health and development, our understanding of the environmental health must be dynamic as well. It is our responsibility to remain informed of current threats to health and development as these risks are identified. Although introductory in nature, the session is suitable for all levels of learners from a variety of disciplines. The provision of a salient bibliography of current resources to participants will assist in dissemination of information.

### **Determinants of Environmental Performance: Pulp and Paper Mills, Environmental Regulations, and Community in Maine**

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Traditional economic theory describes a firm's decision to comply with environmental regulations – and to what degree, as compliance is not always an either/or decision – as maximizing an expected utility function. That is, a firm estimates the likelihood of "getting caught," estimates the probability of being fined if discovered, and compares the expected cost of non-compliance to the costs saved by not complying. If the firm determines that it

saves more money by not complying with an environmental regulation than it would expect to pay in fines, it will flout the regulation.

However, as in so many other cases, traditional economic theory does not adequately capture the more complex reality. New theories of firms' environmental behavior propose that numerous factors influence a firm's environmental decision-making process. Economic considerations play a central role, of course, but interactions between the economic climate, regulatory structure, and social culture in which a firm operates are more important than economic considerations alone. This paper investigates the conditions surrounding fifteen existing pulp and paper mills across the state of Maine that influence the level of compliance: the regulatory, economic, and social "license to operate." Factors unique to Maine's economy, history, and relationship between people and their environment, come together to influence the firms' environmental performance and attitude.

### **Nature as Resource, Nature as Mystery**

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This paper seeks to explore our western habits and attitudes towards the environment and nature. Aristotle observes that habits (*ethos* in Greek) and ethics (*ethike* in Greek) are intimately related. Ethics, thus, is not a discipline distinct from practice; ethics is the practice of any activity. Our practices of studying, investigating, and talking about the environment reveal our ethic. This is the case whether someone reflects or asks questions about the practice or not—the ethic is embodied in the doing. Even though it is through investigation and study that we have learned about global warming and the depletion of the ozone, a scientific attitude or worldview—whether adopted from a social science or the natural science point of view—cannot bring about the change in attitude that is necessary for a more sustainable future. To paraphrase Nietzsche, the problem of science, science cannot solve. Consideration will be made of the historical roots of our relationship with nature, as well as possible ways to change our relationship.

### **Assessment of Physical Integrity Using Stream Channel and Riparian Zone Attributes**

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Human activities have had a profoundly negative impact on the water quality of the flowing streams and rivers of the world. In the United States, the Water Pollution Control Act of 1972 (PL 92-500) established a goal to "restore and maintain the physical, chemical, and biological integrity of the nation's waters." Since then, most of the science and methods employed to assess the quality of flowing waters have focused on chemical and biological integrity. An assessment system proposed here uses a series of stream channel and riparian zone attributes to evaluate the quality of the physical integrity of numerous stream and river reaches within the Farmington River watershed located in Connecticut and Massachusetts. This study has furthered the development of the Index of Physical Integrity, a multi-metric model that can be used to assess the vitality of overall stream/river health.

## **Local Agriculture as a Tool for Community Sustainability and Open Space Protection in New England**

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Small-scale farming and the movement toward local food and "relationship agriculture" has been called the greatest tool New England has for preserving its remaining open space. Demand for local (and often organic) food is growing rapidly throughout the northeastern United States, particularly in New England, as is the direct marketing of food, farmer to consumer and farmer to institutional food buyers. Such food includes a full range of mixed vegetables, dairy products, meat, and even grains. New England has one of the best environments in the nation for grazing and thus has high potential for a significant increase in its ability to feed itself, insofar as dairy and meat product are concerned. Rising energy prices affecting far-away food production and transport also herald high agricultural potential for the region. The extent to which New England can feed itself, and thereby gain a degree of food security, remains an open question to be explored in this paper, as does the impact of the growth of New England agriculture on land use across the region.

## **Developing Video-Based Outreach for Public Education: The Delaware National Estuarine Research Reserve**

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As the number of relatively undisturbed areas decreases, public support for protecting the remaining undeveloped areas needs to be encouraged, particularly for locations important for their intrinsic value and ecological functionality. Coastal wetlands, with their ability to buffer change, cleanse water supplies, and absorb toxins in addition to their unique communities and aesthetic richness, fit this category. Unfortunately, there is a historic tendency to view estuaries and wetlands as cheap land more valuable for development than for its ecological function. Although public support to protect "natural" areas from development is generally high, there is limited public knowledge of the reasons for maintaining healthy coastal regions and the organizations charged with this task. Multimedia outreach and education efforts are one way to help enhance the knowledge base of the general public on the importance of protecting coastal areas. To enhance public and grade school education concerning one such location, the Delaware National Estuarine Research Reserve (DNERR) in central Delaware (consisting of relatively untouched wetlands in largely agricultural and developing watersheds), the ecological and historic significance of the reserve was studied in order to develop a video presentation for use in public education and outreach efforts. The video combines information on the social, programmatic, aesthetic, and environmental value of DNERR with the goal of making the public more aware of the reserve, its habitats and programs, and the value of the resources it attempts to protect. The techniques utilized are portable, relatively simply, and need not be highly technical, allowing for the development of educational and promotional video outreach for almost any location.

## **Assessment of some Heavy Metals in Drinking Water, Soil and Rice in the Vicinity of a Textile Mill**

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Textile processes require large volumes of water all of which are released later as effluent. One major group of contaminants in this effluent is dyestuffs which makes it aesthetically unacceptable and also toxic depending on the chemicals. When effluent water comes in contact with open land affect soil, water and vegetation. The textile mill run by the Assam Polyester Co-operative Society Limited (APOL) is situated at Rangia, which is 55 km. from Guwahati (26<sup>0</sup>11' N, 91<sup>0</sup>47' E) in the northern bank of river Brahmaputra, Assam (India), have installed capacity for producing 8000m cloth per day for which the mill uses viscose, polyester and acrylic fibers. The yarn production of the mill is 1 lakh kg. per month and for weaving the mill uses 70 tonnes of yarn per month. The western side of the mill is a vast agricultural land and scattered human population is there in far northern and southern side of the mill. The eastern side of the mill contains the main road for communication. The mill releases its effluents into the agricultural land in the western side of the mill. Our present study was under taken to assess the impact of the textile mill on soil, drinking water and rice grown in agricultural land in western side of the mill. For that we have studied the presence of heavy metal in surface soil (Fe, Cu, Mn, Pb) rice seed (Fe, Pb, Cu, Zn) and drinking water (Fe, Pb) in the vicinity of the mill. The study also includes a control sample for soil, rice and water to compare the affected area with a non-polluting site. The finding of study in each case reveals high amount of the metal, which indicate discharge of mill waste to the surrounding, had contributed raise level of heavy metals near the mill. This type of alteration may have some definite affect on living organism in that locality.

### **Solid Waste Disposal on Guam: The Impact of an Unsanitary Landfill on the Heavy Metal Status of Adjacent Aquatic Community Representatives**

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Guam's only civilian landfill has been in continuous use for over 50 years and has been operating at over capacity for the last 20. The western borders of the landfill encroach on wetlands that drain into the Lonfit River. This rather picturesque stream converges with the Sigua River further downstream to form the Pago River, which in turn drains into Pago Bay on the eastern side of the island. Local residents fish all three rivers and the bay for food, and the adjacent lands support a variety of agricultural activities including subsistence farming. The landfill is unlined and does not have a leachate retention system in place. As a result, streams of brown, foul smelling leachate flow intermittently from the dump's perimeter during wet weather conditions and course their way down gradient into the Lonfit River valley below. Past chemical characterization of the leachate indicates that heavy metals are the contaminants of primary concern both from an ecological and human health perspective. This fact has promoted speculation that fisheries resources from these waters are heavy metal enriched to the point of being unfit for human consumption. In light of this, recent chemical analyses of abiotic and biotic components from the rivers and bay were surprising and indicate that local topographic and climatic conditions continually conspire to produce natural cleansing processes that prevent heavy metal accumulation from occurring within the watershed.

### **Paleoclimatic Reconstruction of Southwest Ukraine during the Holocene from Pollen Data**

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Studies and predictions of climate are strongly related to research on climatic conditions in the past. One of the most important branches of Quaternary paleoclimatology is pollen analysis or palynology. Southwest Ukraine is a region of high climatic sensibility, where the deviation amplitude of regional temperature is 2.5 times higher than annual global temperature. This unique peculiarity is of particular interest in paleoclimatic research. The regional vegetation of the Late Pleistocene and Holocene has been studied insufficiently due to the rare occurrence of peat and lake sediments. Our aims were the pollen and spore analysis of soil samples in Southwest Ukraine and paleoclimatic reconstruction during the last 12,000 years. Dating of the pollen samples was based on archaeological and geomorphological dating of the site. The standard laboratory procedure of analysis was modified to separate the pollen grains in gravity solution. This approach is suitable for highly mineralized soil and allows extraction of the pollen grains, especially in steppe soil where the conventional method is ineffective. The pollen of the trees *Salix* and *Tilia*, and the herbs *Artemisia*, *Geranium*, Poaceae, Caryophyllaceae, *Centaurea cyanus* L., and *Ambrosia* were identified. We have defined the topographic features and geomorphologic characteristic for Southwest Ukraine, and formed plant functional types and classified biomes in the Holocene based on pollen data. The obtained results well match with previous pollen data for this region (Arap, R.Y., Pashkevich, Bezusko, L.G. et al.) and show the main trend in global climate changes during the Holocene. The link between vegetation and hydrological changes has been shown along the steppe and temperate deciduous forests in Southwest Ukraine. Our results are valuable for the assessment of anthropogenic impact on global climate and can be useful in developing regional ecological policy.

### **Using the Fractal Dimension to Differentiate Between Natural & Artificial Wetlands**

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Existing environmental regulation requires the monitoring of artificial (man-made) wetlands over time. Using fieldwork alone to accomplish this routine monitoring can be quite expensive. The application of remote sensing tools can provide a viable alternative to monitor the constructed wetlands for compliance. However, classification based on spectral signature alone may not be adequate to monitor the wetlands since the spectral signature of artificial and natural wetlands theoretically should be similar. Therefore, there is a need to find less expensive/man-hour intensive but reliable ways to distinguish between natural and artificial wetland using methods other than spectral signature. In order to develop a monitoring tool for artificial wetlands without using spectral signatures requires innovative methods such as fractal dimension analysis. The inherent difference between natural and artificial wetlands is due to the very nature of man creating wetlands: the lines of planting and digging show up as much less wiggly (viz., shape index, fractal dimension and perimeter area ratio) than naturally derived wetlands and therefore should be distinguishable in the fractal dimension. This study reports development of a new tool using remote sensing and fractal dimension analysis to determine 1) if we can differentiate between the naturally an anthropogenic wetlands non-invasively, 2) if we can determine if any sort of definable fractal dimension threshold exists that will help other researchers or local agencies to distinguish these landuse types using repeatable methods we developed. The image used was a 2004 color-infrared (CIR) digital ortho-quarter quadrangle (DOQQ) at 1m resolution for a recently urbanized are of Tampa, FL, U.S.A. Software programs utilized include: ERDAS Imagine<sup>®</sup>, ArcView 3.2 with Patch Analyst Extension, and ESRI<sup>®</sup> ArcGIS 9.1.

## **Federal Environmental Protection and Management in the 21st Century: The need for a U.S. Department of Environmental Protection**

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Arguably, the United States has been a leader in the use of power in its federal government to protect the national and the global environment. One problem that has hamstrung environmental initiatives has been the lack of Cabinet level status of its lead environmental unit. From the time of its creation by executive order in 1972, the United States Environmental Protection Agency has been a sub-cabinet independent agency. Discussion of and proposed legislation to elevate EPA to cabinet status began almost immediately, Although administrations since Nixon have treated EPA as part of the Cabinet, the status and resources that go with being a Department have not followed. The efficiencies that Nixon envisioned never came to be because capacities for research, regulation and management are still spread out across units in dozens of agencies. Additionally, the U.S. is the only major developed nation that does not have a formal ministerial level department dedicated to the Environment. This puts it at a disadvantage in international forums. This paper presents both a rationale and a structure for a new cabinet level Department of the Environment. It would be composed of the current EPA and NOAA (the National Oceanographic and Atmospheric Agency - from Commerce), the U.S. Fish and Wildlife Service as well as the Biological Survey, the Geological Survey, and research units from Energy, Agriculture, Health and Human Services, and other sections of the bureaucracy. It would retain all of the oversight and research responsibilities that it has now as well as existing relationships with units such as NASA and the Army Corps of Engineers. It would be organized under three directorates: Science, Regulation and Service. Other nations' models of environmental oversight will be examined.

## **Land Use, Infrastructure and Climate Change: Effects on Population Distribution and Infrastructure**

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Three significant trends are on a collision course throughout the world. First, population growth continues to concentrate in urban areas, on coastal zones, in deserts, and in other fragile areas. Second, climate change is affecting these areas requiring additional infrastructure investment. Third, critical resources will continue to become ever more strained as demand and climate stresses reduce availability of critical resources (water, food, energy). Impacts can already be seen in areas as diverse as Vanuatu, African Sahel, and Nunavut. Environmental displacement is becoming common for peoples in the developing world, but the developed world isn't going to be immune. Over half of U.S. residents live in coastal counties and the numbers are growing. Most models predict sea level rise reducing habitability of these areas within a century. In the U.S. interior, drying has already begun a cycle of depopulation comparable to the Dust Bowl. Australia is experiencing a decade long drought more intense than recent past conditions. Rationing and reuse of water is becoming the norm. Low-lying areas in Great Britain, the Netherlands and other European nations are implementing "retreat from the shore". Additional issues of investment, development and maintenance of public and private infrastructure must be considered. Cost for lost infrastructure and replacement rises into the range of trillions of dollars in these nations. Availability of public infrastructure (roads, power, water and wastewater) facilitates population growth. Public funds are placing people in harm's way, and funds will be spent bailing them out. Pilkey, Godschalk, Beatley, Brower and others address the need to engage in strategic retreat from coastal hazards. The Poppers and others have advocated strategies to address lands abandoned due to drying. Comprehensive long term planning and implementation must take place in response to climate change.

## **Roundtable: Climate Change: Data from the Past and Projections for the Future**

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Indisputably, the global climate is changing: average air and ocean temperatures, melting of snow and ice and the mean sea level are all on the rise. Some Questions for Brainstorming:

- Is the historical data accurate?
- How about arctic vs global annual temperature anomalies?
- Changes in precipitation?, Droughts?
- Has anthropogenic forcing contributed?
- Hurricanes? SEA LEVEL? EL NINO?
- Is it true that warm nights are increasing and cold nights are decreasing?
- Heat waves?
- How about the facts that snow cover and arctic sea ice are decreasing?
- How about the facts that glaciers and frozen ground are receding?
- How come we have observed no changes in Tornadoes, Dust Storms, Hail, Lightning and Antarctic Sea Ice?
- Do we have good data for a paleoclimatic perspective?
- Are our projections plausible, wrong, ...?
- Are human to blame? Volcanic aerosols?
- Is the un report valuable or doomsday?
- Why do many still not believe? what is missing from the data?
- Does it matter who is to blame? should it?
- Can solutions be an economic boom?

## **Residential Water Demand in the Absence of Volumetric Water Pricing**

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Rapid population growth has significantly increased the magnitude of water shortages in California. Although wildlife is already being threatened by inadequate water supplies, some of the state's utility systems are still not providing their residents with financial incentives for water conservation. Instead of using water meters to charge households according to their actual water usage, they are charging a flat fee for unlimited water service. When flat fees are charged for unlimited water service, the per-unit cost for additional water becomes zero and the decision to consume more water is determined by other factors. Although water meters may reduce water consumption, there are opponents to water metering who believe it is not fair to manage water demand by pricing water so it is too expensive for some households to afford. Opponents also site how the substantial cost associated with installation and maintenance of water meters may prevent them from being cost-effective. Although numerous studies have estimated the impact that water prices have on water demand and water conservation, few studies have estimated the

demand for water in the absence of per-unit water prices. When the decision has been made to forgo water meters it is important to understand what factors are influencing the demand for water. This study estimates the factors that influence residential water demand in a city that is currently charging flat fees for unlimited water service. This is accomplished by analyzing a unique set of data that contains a variety of household characteristics that were collected from a survey and monthly water usage data that was collected from water meters that were installed for research purposes. The study provides valuable information and analysis regarding residential water usage and should help decision makers better understand the factors affecting our decision to conserve or consume society's scarce water resources.

### **Geotechnologies and Environmental Studies**

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Geotechnologies, as one of the three fastest growing fields in the world, provides a powerful tool for environmental studies. This paper discusses how geotechnologies can help us to understand environmental and resource problems using examples of Global Positioning Systems (GPS), airphotos, remote sensing, and Geographic Information Systems (GIS). GPS is a revolutionary system for determining accurate positions in 3D (latitude, longitude and elevation) on the earth's surface by computing positions using signals received by a radio receiver from a series of satellites. It can also store the attribute data of a spatial object in the field. Airphotos and remote sensing provide images of the earth's surface within certain electromagnetic spectra detected by a camera and remote sensors. A GIS is a computer-based technology and methodology for collecting, managing, manipulating, analyzing, modeling, and presenting spatially referenced data and the attribute data for a wide range of applications. These geotechnologies can be widely applied for the management and analyses of the environment and natural resources. For example, GPS may be used to collect sample data of water quality in the field, while a remote sensing image detected by a thermal sensor can effectively show an area of pollution. GIS can be applied in land use/cover analysis and habitat suitability analysis to preserve endangered species, etc. Through application examples, this paper will demonstrate the value of these technologies in environmental studies.

### **Optimized Use of Ribotyping for Tracking Bacterial Pollution Sources in Northern New England Waters**

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Microbial Source Tracking (MST) methods have been used for tracking sources of bacterial pollution in northern New England's shellfish growing waters since 2001. The main MST method used at the University of New Hampshire has been ribotyping of *Escherichia coli*. Despite well-documented limitations, the approach as modified through continued usage and cumulative findings has proven to be successful in most studies. *E. coli* strains isolated from surface water and oyster samples have been ribotyped and their patterns compared to patterns of strains from known source species, including humans (septage, wastewater effluent, human feces) and up to 35 species of birds, pets, livestock and wild animals. Studies have included research to test method assumptions and surveys to identify pollution sources in areas of concern. Results show humans, pets, birds, different kinds of wild animals and livestock to be significant types of pollution sources in different areas of the region. Use of *E. coli* ribotyping has become progressively more focused and integrated into more comprehensive efforts to open more shellfish harvesting areas and improve water quality at ocean beaches by eliminating pollution sources.

## **Environmental Treaties and Evolutionary Game Theory**

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As nations continue to grow in a freer global economy, more and more environmental problems “cross” national boundaries. In this paper, with the assistance of evolutionary game theory, an attempt is made to show how, in light of ineffective enforcement policies, the likelihood of increasing global pollution may increase. More specifically, it will be shown that in an increasingly global environment, non-complying treaty signatories can more easily escape detection and punishment and that, as the game evolves, only opportunistic agents become “fit” enough to survive. The paper concludes with a discussion of possible solutions ranging from global governance to command and control to market approaches. The countries of Denmark (an energy self-sufficient nation), Norway (the first nation to build a hydrogen high-way) and Brazil (a nation mostly dependent on biofuels) are discussed as case studies for lessons in drafting environmental treaties.

## **Acceptance and Avoidance of Responsibility in World Leaders’ Statements about Climate Change**

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Who is responsible for environmental problems and for finding and implementing solutions? Complex, systemic relationships between causes and results underlie the answer. The words and linguistic structures chosen to express these relationships can influence who or what we highlight as the agent carrying out an action: do we mention the agent at all? If so, do we present the agent as an individual, an unspecified group of people, an institution, a process, or a force of nature? These ways of constructing agency, together with other aspects of discourse, might affect what solutions to environmental problems occur to us. Nominalizations--structures that express actions or processes as nouns (for example, “Acme Company destroyed the rainforest” as “the *destruction* of rainforest”)--make processes and participants less explicit (Halliday and Martin 1993). Passive voice also allows the omission of agents (for example, “no one can say (...) what constitutes a dangerous level of warming, and therefore what level *must be avoided*”). The most obvious problem in agentless discourse is that parties responsible for unethical actions may be hidden. A less obvious risk is that responsibility may be “diffused” to a generic “we”, blaming individuals inappropriately for systemic problems caused primarily by institutions (Schlepppegrell 2001). In this paper, I investigate the construction of responsibility and agency in speeches by world leaders (particularly George W. Bush, Tony Blair, and John Howard) on their stance on climate change. I argue that, superficially, the speakers seem to take responsibility, as passives or other linguistic resources that could either emphasize or background agency are carefully used. To fully understand the impact of these structures, we have to consider them in a larger discourse context. It is hoped that increased awareness of relevant discourse mechanisms will give readers more tools for identifying manipulative attempts to background agents in environmental discourse.

## **Water Filtration Services from Forested Landscapes: Economic Valuation of Ecosystem Services and Optimal Land Use**

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We suggest an interdisciplinary methodology for using real-world data to value water filtration services provided naturally by forest cover. This methodology links observable land-cover/contaminant profile relationships with landowners' willingness to accept payment to retain/develop forested over on their property. This leads naturally to development of a cost-effective management strategy for municipalities, in terms of contracting with landowners to maximize the value of the water quality services provided per dollar spent on acquiring natural forest cover. We discuss field implementation of both the valuation methodology and the management strategy using approximately 2 dozen sub-watersheds in western Georgia.

### **The Economics of Climate Change: A Review of the Stern Report**

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In November 2006, Sir Nicholas Stern presented his report on 'The Economics of Climate Change' to the British government. At 575 pages, the Stern Report constitutes the most comprehensive investigation of the likely impact of climate change, and the recommended mitigative steps that need to be taken, that has ever been undertaken. This paper seeks to provide a review of the main tenets of the Stern Report. Particular attention will be paid to three key issues: (1) the physical impact of climate change on the economy, on human life and on the broader environment, as well as the cost of different strategies to reduce the emissions of greenhouse gases; (2) the economic impact of climate change, including the use of macro-economic modeling to demonstrate the transition to low-carbon energy systems; and (3) the use of comparative analysis to demonstrate the costs of current and projected levels of greenhouse gas emissions with the marginal abatement costs associated with reductions in the emission of greenhouse gases. The foregoing analysis will be shown to support the broad-based conclusion contained in the Stern Report – that the benefits of decisive, early action outweigh the costs. Moreover, the Stern Report concludes that tackling climate change now can be achieved in a manner that does not necessarily impede the growth aspirations of rich or poor countries.

### **Enhancing Community-Based Partnerships: Integrating Undergraduate Colleges in Interdisciplinary Environmental Assessment Projects**

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Small undergraduate institutions represent incompletely utilized and potentially valuable resources for many environmental projects, especially projects that share a common environmental geography with local institutions. Effective inclusion of undergraduate institutions in environmental partnerships requires identifying relevant disciplinary, multi-disciplinary and/or interdisciplinary objectives of the project and matching that with expertise and interest at the institution. Equally importantly, there needs to be a strong community-based center for the collaboration such that the undergraduate institution is acting in service to key project stakeholders, is guided by clearly identified community-based goals and is accountable to the community-based partners. This paper discusses examples of how undergraduate institutions can be folded into existing partnerships and explores the successes and shortcomings of such inclusions. The paper also presents a working model for similar collaborations in New

England. These collaborations can be applied to a host of environmental issues, including land use planning, assessing and/or controlling invasive species, habitat assessments, mapping and environmental education. Undergraduate institutions can offer expertise, labor, equipment, laboratory analytical capacity, grant writing skills, as well as an opportunity to engage students and faculty in experiential and real-world applications in their respective disciplines. The institution may also help coordinate other partnerships, such as with analytic and engineering firms, media outlets or discipline specialists. There are real limits to the capacities of the undergraduate institutions and they need to be openly acknowledged and addressed by all project partners prior to forming collaborative relationships. Whatever the project specifics, it is essential that these collaborative partnerships be community-based in the sense that project objectives reflect real needs in the community and that projects already have organized or semi-organized groups of stakeholders who have identified an issue or issues on the ground and who can define the role of the undergraduate institution and develop an achievable scope of work and timetable.

### **The Bottom Line of Going Green: Corporate Investment in Pollution Abatement**

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Legislation is often necessary to 'level the playing field' before companies will invest in pollution abatement. Such investments may be large and irreversible and may increase operating costs or reduce output capacity. The costs of green investment often exceed the financial benefits, making responsible companies less competitive. For business decision-makers, accountable to shareholders for bottom-line profitability, green investment presents a dilemma. Why, then, are companies investing in pollution abatement? Are there sufficient benefits garnered from the investment without the government incentives? Are companies hedging against fossil fuel prices or future legislation? Are companies acquiring carbon emission reduction credits, speculating on their future value? Is it simply good corporate citizenship? There are often some financial benefits that defray the cost of green capital investment. However, for the first mover, strategic benefits may exceed the costs through green goodwill, learning advantages and raising of competitors' costs.

At the operational level, pollution can reflect wasted inputs from poor product design, choice of inputs or inefficient manufacturing processes. Taking a hard look at the pollutants and their source, one may envision savings or revenues such as raw material and energy reductions and saleable byproducts. Ironically, carbon emission reduction credits may present an incentive to delay investment. With decreasing emission limits year after year, the value of the carbon credits may be greater in the future, so waiting may be more cost-effective. Pending legislation may also deter investment until uncertainty is resolved.

Reducing pollution in a competitive industry, in the absence of legislation, requires creative corporate thinking. Understanding the rationale behind corporate investment in pollution abatement is important for government policy makers. This study reviews the disparate literature identifying the financial benefits, costs, risks and risk reduction of investing in pollution abatement and describes investments in Maritime Canada that satisfy environmentalists and shareholders alike.

### **Environment and Health: Malaria Control among Women in the Volta Region of Ghana**

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The study assessed the patterns and dynamics of malaria prevalence among women aged 15-49 years in Volta Region, one of Ghana's ten administrative regions and which has the highest prevalence of malaria in the country. Data from 2003 Ghana Demographic and Health Survey, and the Volta Regional bio-statistical office, Ho, the region's capital, were used. Malaria cases were prevalent in the Jasikan, Hohoe, Kpando, Ho and Keta Districts. Although pregnant women owned more bed nets and used it more than all other women, they, with their dependent children, are the most vulnerable groups because of their low immunity and nutritional status. Ownership of bed nets and its usage are more pronounced in the rural areas. Availability and the affordability of insecticide treated nets in the country is still low due to widespread poverty. We argue that proper management of the environment will go a long way in improving the health status of the women. The effectiveness of malaria control measures depends not only on the potency of the control measures themselves but also upon the influence of variables associated with the environment. Mosquito control programs and personal protection are two lines of defense against mosquito bites. In this respect, draining of swamps, ditches and depressions, as well as eliminating standing water should be pursued as malaria is inextricably tied to water. Efforts should be seriously made by the major players in the health sector to make the insecticide treated nets readily available in the communities at low prices to enable the ordinary Ghanaian woman to purchase it.

### **Land Trusts and the Visual Landscape**

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Land trusts are private organizations dedicated to land conservation and preservation. The number of land trusts and the amount of land protected by them in the United States has skyrocketed in the years since 2000. The bulk of land trust activity has been in two types of transitional areas: 1) the urban fringe where exurbs are sprawling as more intensive land uses locate in suburbs closer to cities, and 2) the surroundings of government-protected land such as national parks or state parks. This paper focuses on the geographic distribution of land trusts, i.e. why they have developed where they have. It also explores the ethos of land trusts as part of a broader effort to understand the visual landscape. That is, the background scenery of human lives, what we see as we work, travel, vacation, etc. In environmental literature, the visual quality of landscape is usually considered secondary to such issues as watershed preservation, ecosystem sustainability, or endangered species protection. Nevertheless, the visual perception of landscape is fundamental to land-use decisions such as conserving farmland or preserving wilderness, activities central to the work of land trusts. Aesthetics are important to affluent urban dwellers who seek the counterbalance of open, quiet spaces, and donations to land trusts are among the most direct ways to preserve such spaces. The recent success of land trusts reveals the sometimes underestimated importance of the visual in conservation efforts.

### **Workshop: Transformative Education for Sustainability**

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What principles and practices should guide educators who want to catalyze the emergence of sustainable communities? The premise of this workshop is that the movement for sustainability is different from other social movements because it has been trying to do what has never been done before – deliberately and rapidly facilitate our transition into a new worldview. Though genuine worldview change is non-linear and possibly beyond our ability to manage, a look at the history of worldview transition suggests that the present is ripe. There are signs that we are in the early stages of another long, slow period of change that could rival the shift from the medieval to the scientific-industrial. This ripeness, driven primarily by the looming planetary catastrophe, is reason enough to attempt the unprecedented task of deliberately speeding up the process through transformative education. Unfortunately, even our best educational modes (environmental education, education for sustainability) lack the mythic vision and transformative practices needed to catalyze a shift. So what kind of education will help us grow out of the mode of consciousness that sees itself as separate from the rest of the planet and universe, that perceives the natural world primarily in terms of use value, and that is driven by the self-defeating “Technozoic” vision of consumption and total control of nature? This workshop will present the foundations of ‘Education for Worldview Transition’ and then offer participants an experiential sampling of practices and materials designed to facilitate this shift in consciousness. Following an introduction, workshop participants will experience a non-dual, video account of the universe story, which could become the integrating narrative for all education. We conclude with dialogue on how to imagine and enact an inspiring new human destiny, which has been called the New Hold, the Great Work, the New Renaissance, and the Great Turning.

### **Exploring Public Awareness of Threats to the Great Barrier Reef Environment**

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A key element in understanding public support for environmental conservation is awareness and understanding of the relevant environmental threats. This paper will present the results of a five year research program including surveys of more than 6000 residents living adjacent to, and visitors to, the Great Barrier Reef (GBR) in Australia and content analyses of media coverage of this protected area. The overall aim of the research program was to provide social science information to the managers of this World Heritage Area to assist in the development and delivery of more effective public education campaigns and to enhance management strategies for tourist and recreational users. The paper uses social representations theory to analyse and link these two data sets. Social representations theory combines constructs from sociology and psychology to explain the development and consequences of shared social realities (Pearce et al, 1996; Moscardo, 2005 & 2006). It is argued that social representations shape social realities and guide behaviour especially in contested areas such as conservation actions and government environmental policies. In particular, the analysis sought to identify key social representations of the GBR and its conservation, and demonstrate how these are related to the coverage of perceived threats in the media. The research critically examined the relationships between characteristics of the survey respondents, actual visitation to the area, perceived threats to this environment and overall attitudes towards the environmental health and conservation needs of the GBR. Implications of the results for public education campaigns and support for conservation policies will be explored.

### **Vegetative Species Richness and Composition on the Conservation Lands of Kent County, Delaware**

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In Delaware, 462 properties encompassing approximately 82,175 acres have been permanently protected through the purchase of agricultural preservation easements; 45,168 acres, or 55% of this total, has occurred in Kent County. Agriculture has generally contributed to a decline in biodiversity as forested lands have been converted to agricultural use. Yet, when compared to suburban development, farmers in Kent County often leave remnant wooded tracts which present an opportunity to preserve patches of vegetation that may have value for maintaining the biodiversity of an area. I used stratified vegetation sampling to compare vegetative species richness on land preserved for parks and reserves with land protected by agricultural conservation easements for two upland forested communities: beech-oak and pine-mixed hardwood. Species richness was higher on agricultural lands for the forested overstory on beech-oak sites, but lower for the combined overstory and understory layers. On pine-mixed hardwood sites, species richness was higher on agricultural land for all strata. There were few significant differences in species between agricultural tracts and parks/reserves, and those differences found can be attributed to moisture gradients and to disturbance. However, ordination did not reveal any real distinction between forests on agricultural land and in parks/reserves. Analysis revealed that several of the larger forested tracts remaining in the county occur on lands with conservation easements. These results suggest that the agricultural woodlands could play a role in preserving the biodiversity of the area if protected, which is especially relevant in light of the rate of forest loss in the county at the present time.

### **Biopesticides as an Environmentally Soft Tool for the Sustainable Management of Insects/Mosquito Vectors**

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India is the second largest manufacturer of pesticides in Asia and ranks twelfth globally. In India has long experience using a variety of synthetic pesticides belonging to the organochlorines, organophosphates, carbamates, pyrethroids, fumigants etc., Use of synthetic pesticides causes some unfortunate consequences such as environmental pollution, pest resistance, and toxicity to other non-target organisms including human beings. There is an urgent need for developing biological pesticides from plants, microbes and other living organisms. The phytochemicals derived from the family Meliaceae appear to provide promising alternatives such as neem, which has antifeedant, growth regulation, and anti-reproductive properties in insects; while the plants themselves can provide water purification.

In the present investigation attempts to evaluate the comparative toxicity of synthetic pesticides, chlorpyrifos, and neem extract on several insect pests and sensitive indicator species including cotton bollworm (*Helicoverpa armigera*), the malarial vector *Anopheles stephensi*, *Hippodamia convergens* (a beetle predatory on aphids), the hymenopteran parasitoid *Trichogramma chilonis*, the butterfly *Pachliopta hector*, and the honey bee (*Apis dorsata*). Lethal concentrations (LC<sub>50</sub> and LC<sub>90</sub>) were determined for target insects and other non-target organisms. The present paper discusses the use and environmental advantages of botanical pesticides for insect pest management, and potential toxicity to human beings. Moreover, India is a nation of extraordinary diversity in plants and animals, suggesting that there will be good potential for identifying new insecticidal phytochemicals for development as biopesticides.

### **Sublethal Toxicity of Crude Oil Dispersant Corexit-9527 on Freshwater *Tilapia guineensis* Fingerlings using Biomarkers**

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The toxicity of the crude oil dispersant Corexit-9527 was investigated using a biomarker assay. Dispersants are cleaning agents that act as detergents to break up oil into tiny droplets so that it mixes with water. Twenty one day old fingerlings were exposed to concentrations of 0.275 ppm to 2.2 ppm for 10 days, and toxicity estimated. The toxicity indicators monitored include Glutamic Pyruvic Transaminase (GPT), Lactate Dehydrogenase (LDH), Glutamic Oxaloacetic Transaminase (GOT), and physiological behaviors such as erratic, gyrating, skittering movements coupled with hemorrhaging and mucous at the integument. These biomarkers are found in heart muscle, gills, brain, liver, kidney, and in blood sera as injury indices with increased activities, thereby acting as indicators of tissue injury or tissue death before the actual symptoms appear. Significant differences at  $p < 0.05$  between the control (dilution water) and test chemicals were observed. The LDH showed elevation at 0.275 ppm for gill and muscle, and GOT at 0.275ppm and 2.2ppm for gill and at 0.275 ppm and 1.1 ppm for muscle. GPT impacts were detected in gill at 0.275 ppm and 0.55 ppm, liver at 0.275 ppm through 1.1 ppm, and muscle at 0.275 ppm and 2.2 ppm. Indications of injuries to fish internal organs were more pronounced in the gills and muscle at the lowest concentration of 0.275ppm. It was concluded that GPT activities were the most pronounced as biomarkers of dispersant exposure. This research aids in assessing and studying the sublethal effects of chemical stressors in fish as part of a larger monitoring strategy for aquatic ecosystems of the Niger Delta region of Nigeria, particularly with the incessant use of dispersants to clean up oil spills in the ecological zone.

### **Unnatural Selection: The Inevitability of Inequitable City Centres**

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This year marks a threshold in the evolution of humanity when most people live in cities. We have become an urban species. This can be seen as the culmination of the process through which we have lost our roots in nature. But what is natural? Since their rapid growth fuelled by the industrial revolution, cities have been portrayed by a range of critics as unnatural. But from an evolutionary perspective any change that occurs is an experiment and the most successful are adopted into the constant ebb and flow of life on earth.

This paper is concerned with the evolution of the governance and management of post-industrial western cities. There is a body of literature suggesting that since cities all operate in the same globalised economic environment they will all respond in similar ways. It's only natural. Here we see another strand in the issue of what is natural, where natural is the normal and almost pre-determined response to stimuli from the environment.

There is a wide body of current academic commentary suggesting that in postmodern post-industrial times urban administrations are controlled by globalised economic forces to the extent that in order to prosper they must all adopt similar neo-liberal forms of governance. This paper challenges this proposition.

One of the features suggested as a necessary part of neo-liberal urban governance is a harsher and more inhumane attitude to marginal groups such as the homeless and dispossessed. The paper uses a case study of the regime in Sheffield UK to suggest that there is still scope for choice in this area. Interviews with City Council officers, homeless people, and street drinkers in the centre are used to suggest that while exhibiting many of the features of this form of governance, the city still maintains a humane and inclusive approach in keeping with its radical, liberal political heritage.

### **Regularities and Trends in the Water Level of the St. Jones River, Delaware and Their Influence on Ecosystems**

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Data mining is a field of computer science that combines methods and techniques from machine learning, databases, and statistics in order to discover interesting non-trivial patterns in data routinely collected for some (possibly unrelated) purpose. In this study, a multidisciplinary approach combining signal processing, interpolation techniques, data mining, and statistics was used to determine patterns and trends in water levels measured at two locations along the St. Jones River (a tidal river in central Delaware) and to investigate their potential impact upon the nearby coastal ecosystem. The original dataset consists of 57,127 measurements taken approximately every thirty minutes from January 31, 2002 through October 31, 2005. After interpolation to compensate for missing measurements and signal processing to remove tidal periodicity, we performed linear and non-linear regressions of downstream water levels as a function of delayed upstream water levels. The obtained results indicate that the regression residuals are significantly and positively correlated with time. Since the downstream water level is correlated with sea level, we estimate that the average rise in sea level at the observation location was about 2.5 cm yr<sup>-1</sup>, which compares favorably with other estimates and measurements in the central Atlantic region. We discuss the potential impact of this finding on the low-lying coastal ecosystems of Delaware.

### **Derivation of a Watershed-Scale Conceptual Model for the St. Jones River Using the Habitat-Scale Conceptual Metamodel**

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Conceptual modeling is a useful tool for identifying pathways between drivers, stressors, valued ecosystem components (VECs), and services that are central to understanding how an ecosystem operates. The St. Jones River watershed in Delaware is a complex ecosystem, and because management decisions must include ecological, social, political, and economic considerations, a conceptual model remains the best tool for accommodating the full range of inputs. Beginning in 2002, a Four-Component, Level 1 conceptual metamodel was formed for the key habitats of the St. Jones River watershed. However, since the habitat level of resolution is too fine for some important watershed-scale issues, I attempted to develop a functional watershed-scale model using the existing narrowed habitat-scale models to determine whether a watershed-scale model would lead to potentially different management or research conclusions. The narrowed habitat-scale conceptual models and associated matrices were combined with data from the 2002 land use/land cover GIS-based maps of Kent County in Delaware to assemble a diagrammatic and numerical watershed-scale conceptual model incorporating the calculated weight of each habitat within the watershed. The narrowed numerical representation of the model was used to generate forecasts for changes in the parameters "Agriculture" and "Forest", showing that land use changes in these habitats propagate through the results of the model by the weighting factor. Also, the narrowed watershed-scale conceptual model identifies some key parameters upon which to focus research attention and management decisions at the watershed scale. The forecast and simulation results seem to indicate that the watershed-scale conceptual model does lead to different conclusions than the habitat-scale conceptual models for some issues at the larger watershed scale.

### **Management Implications of Increased Chloride Concentrations in Surface and Ground Waters of the Northern US**

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In recent decades, chloride contamination of surface and ground water resources has become an increasingly prevalent environmental issue. Elevated chloride levels not only threaten aquatic organisms and ecosystems, but also human drinking water supply. While multiple factors contribute to chloride influx, correlations drawn in previous studies point to deicing applications of sodium chloride on roads and parking lots as the leading cause of sharp upward trends in aquatic chloride concentrations detected in many northern US locations. Though increases in paved surfaces have certainly led to intensified chloride contamination, road salt use over the past 25 years has inflated by a much greater factor than have lane miles. This suggests that another dynamic relating to changing public expectations of post-storm road conditions may also be at play. In some communities, consistent water quality violations are bringing into question the watershed's ability to sustain increased development. Planning boards, already facing conflict between sustainability and economic growth, face further challenges and legal issues. Mitigation of high chloride will require changes in development density, modification in the imperviousness characteristics of future development, altered winter maintenance, and/or new chemical approaches to ice control. For these changes to occur however, a shift in public perception of the true costs of "black pavement" may be necessary.

Currently, in Southern New Hampshire, a chloride TMDL is being conducted in response to water quality violations recorded in four heavily-developed watersheds. We are compiling data on salt use in private deicing applications to compare to public applications. Unique challenges associated with gathering data from private contractors have given rise to creative strategies in determining loads. In conjunction with the TMDL, public outreach efforts are focused on educating municipalities, contractors and homeowners about the effects of salt use and the realm of options they have in addressing the issue.

### **Eco-friendly Sustainable Shrimp Aquaculture in Bangladesh: A Way of Minimizing Coastal Degradation**

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Coastal shrimp aquaculture contributes significantly to the world food supply despite its potential adverse environmental effects on coastal ecosystems. In spite of socio-ecological degradation, coastal shrimp farming in Bangladesh is shifting from improved traditional extensive methods to semi intensive methods in order to increase perceived economic benefit through increasing production. But this recent trend forces managers to consider precautionary management policies to ensure the long term sustainability of the industry. Both arguments for and against semi-intensive shrimp farming are important in the context of defining environmental and social as well as economic sustainability for this sector. Lack of regulation governing the establishment of shrimp farms has led in some places to improper siting, overcrowding, changes in land use patterns and conversion of other habitats. Generally, issues raised focus on the social and ecological consequences of shrimp farms. Coastal habitat changes, nutrient and organic release and water quality issues, and biodiversity issues such as collection of wild seed, are raised in addition to social issues of equity and multi-stakeholder conflicts. Such problems emphasize the importance of identification and promotion of best management practices. Therefore, a sustainable shrimp farming system has to be bio-technically feasible, environmentally sound and socio-economically viable in Bangladesh. On the other hand, an institutional reform is required to put environmental security and social equity as primary

objectives. All these things may happen in identifying and execution of best management practices with appropriate institutional arrangements, which will materialize the eco-friendly sustainable shrimp aquaculture.

### **Food Paradigms: Sustainability in Artisan and Industrial Food Systems**

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Two systems of food production have characterizing human society: artisan and industrial. The first, with a long history but continuing relevance, contains environmental and social subsystems. Each is a feedback loop of information and mutual adjustment among components. Humans have survived because of their ability to discern, exploit, and reproduce the nutrient potential of the surroundings. Plant and animal species, as well as the landscape, were domesticated, their evolution shaped to promote nutrient flow based on symbiosis among participants. Neither wild organisms nor waste is outside the artisan paradigm. Its social subsystem revolves around local subsistence, mutual aid, and reciprocity. As surpluses permit, the local economy expands geographically to include barter and impersonal cash markets. By contrast, the industrial model introduces factory techniques, specialization, and purchased inputs. It responds to market information, not need, and treats locality as a site where comparative advantages are aggregated to service a global system.

This paper analyses industrial agriculture as parasitic of artisan practices for its inventory of food species while radically simplifying the agrarian paradigm. As factory farming suppresses place-based interdependencies among species and soil organisms, complexity and diversity decline. Without the mutual adjustment of organisms, food production relies on industrial externalities that consume rather than replicate soils and treat waste as exogenous. Socially, factory farming substitutes market dynamics for community-based reciprocities and their culturally imbedded ability to reproduce farm labor. While artisan systems mitigate risk through diversity, industrial agriculture rewards a concentration of land tenure, market leverage, and intellectual property, generating scarcity. Its production volume cannot feed the poor; its technological approach renders it unable to recycle its waste, steward soil fertility, or address pest control. Appropriating the last vestiges of “free” inputs from nature, it consumes the artisan alternatives upon which sustainable food production relies. Yet two cases of local food production, a village-based system in Yavasa, Mexico, and urban horticulture in Burlington, Vermont, suggest the artisan system continues to have viability and relevance today.

### **Compensatory Mitigation and the Possibility of Restoring Natural Wetlands**

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Considering wetlands that are “waters of the United States,” one may not place dredged or fill material within these wetlands unless one obtains a Section 404 permit from the U.S. Army Corps of Engineers (or other authorized agency). Routinely, a Section 404 permit requires the restoration or creation of an equal or greater number of acres of wetlands to compensate for the wetlands that are lost. Such “compensatory mitigation” is encouraged within Corps’ policy. I wish to raise a philosophical problem: Is it possible to restore a natural wetland? I will argue that the answer is no. Wetland “restoration” is not restoration in the strict sense. It is actually the creation of a new ecosystem of a distinct kind. A “restored” wetland is causally determined to be as it is by human desires and beliefs. “Restored” wetlands typically include artificial structures and devices for delivering and regulating water such as

dikes, pumps, valves, drains, etc. Many “restored” wetlands require regular maintenance for the life of the wetlands. All “restored” wetlands should be monitored for years after the restoration project is completed to ensure that the promised functions are provided. “Restored” wetlands are human-designed and -constructed counterparts to natural wetlands.

I will argue that compensatory mitigation involves replacing natural wetlands with such artificial, human-dependent wetlands. Unfortunately, under compensatory mitigation we are gradually losing wetland functions. Another problem is that within our society we may not have the interest and the resources to properly support these new ecosystems. The restoration of nature has been addressed within the philosophical literature. Light (2000) adopts a pragmatic environmental philosophy that is highly supportive of certain restorations of nature. I will argue that Light should adopt a more pragmatic approach that highlights the distinction between nature and artificial nature, and clearly recognizes the losses and risks we face as we replace the former with the latter.

### **Quantifying Vegetation Changes in the St. Jones River, Delaware: An Examination of Flow, Community Structure, Sea Level Rise, and Salinity**

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The riparian plant communities along the banks of the St. Jones River near Dover, Delaware are potentially subject to serious impacts from the dual pressures of sea level rise and land use changes. As sea level rises it is common for the vegetative zones within riparian communities to shift inland (transgression). Since land use changes tend to encroach on riparian communities from the landward side while sea level rise tends to impact riparian communities from the seaward side, there is the potential to constrict these ecologically important riparian communities to the point of loss. GIS was used to perform virtual transects, digitization, and calculation of vegetative zones on historical aerial photographs of the St. Jones River watershed, Delaware from 1937, 1961, 1968, 1992, 1997, 2002, and 2006. Significant changes in land use and community composition were detected as the upper half of the river transitioned from a forested area to development, agriculture, and grassland. The occurrence of sea level rise was documented using depth data collected within the river by Delaware National Estuarine Research Reserve and from a nearby USGS tidal station. This sea level rise appears to be impacting riparian communities, with woody vegetative zones being replaced by grasses. However, transgression is not allowed to proceed normally within the study location because the St. Jones River watershed has experienced significant changes in land use, with an increase in development preventing inland migration of riparian vegetation. This downstream progression of development is acting in the opposite direction of the sea level rise, blocking normal transgression and squeezing out the areas of woody vegetation. The end result of these processes is likely to be a more flood-prone system with less vegetative diversity.

### **Correlation of Trace Metals Emitted in Energy/Metal Production Processes and Environmental Health**

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Trace metals (TM) in environment can bio-accumulate and move around causing chronic and toxic effects to the nervous system, kidney heart and intestines, etc. Since the specific hazardous metals in the environment are very large in number it is imperative to look for ways to reduce the number of variables for any model. We have used a correlation matrix (CM) technique for TM emitted from the combustion of fuels in stationary sources (STS),

anthropogenic sources (ANS) and non-ferrous metal (NFMP) production processes. Thus comparing the information about highly correlated metals from the CM we have found fuel combustion/metal production harmful to human health. STS represented by CM1 reveals five group variables of elements, (Cr, Cu, Mn, Mo), (Sb, Se), (Mo, Ni, Pb), (Tl, Zn) and (As, Cd), ANS represented by CM2 reveals five group variables of elements, (Mo, Ni, Pb), (Pb, Sb, Se, Sn), (Mn, Mo), (V, Zn) and (As, Cd), NFMP represented by CM3 reveals five group variables (As, Cd, Cu), (Zn, Hg, In), (Pb, Sb, Se), (Se, Sn, V) and (Mn, Ni) with highest correlation coefficient of 0.92 to 1.0 respectively. With the help of grouping of emitted TM present in different CM, we have made an attempt to compare STS, ANS and NFMP in assessing the health risk to living organism by emitted TMs. (Hg, Pb, Se, Cd, Cu) affect the kidneys or liver, CM3 contains (Cd, Cu) and (Pb,Se) as group variable while these are absent in CM1, (Pb, Se) is present in CM2 This shows that the kidney, liver of living organism will be most/least affected by NFMP/STS emission. (Ni, Sb, Cd, Se, Cu, Cr) affects the skin, bones or teeth, CM1 contains (Cr, Cu) while CM1, CM2 and CM3 has common group variable (Sb, Se) it means STS will effect skin, bones or teeth more than, ANS and NFMP emission.

### **The World Environmental Constitution as an Instrument of International Environmental Governance**

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The unacceptable implementation of the decisions ratified at the world summits Stockholm-72, Rio-92, “Rio+5 and Rio+10 forced the creation of the concept of a “World Environmental Constitution (WEC)” as a basic law for the survival of humanity and sustainable development. This idea was the outcome of intensive scientific research and debate in response to the deepening environmental crisis and instability of socio-economic systems on the worldwide scale. The essence of the WEC is to outline the rights and responsibilities of national governments, multinational corporations and international organizations (WTO, NATO, World Bank, etc) and citizens for the conservation of the world’s common heritage. Furthermore, the idea of the WEC foresees creation of control organs in the UN structure. Such bodies would include: the Environmental Security Council, the World Environmental Organization, the World Environmental Monitoring and Enforcement Council and the World Environmental Bank.

The idea of the WEC was initiated at an international scientific conference at Hofstra University (New York, 1992), and declared at the 19th Special Session of the United Nations General Assembly (1997) where it was presented by the President of Ukraine, Leonid Kuchma, and by the Chancellor of Germany, Helmut Kohl, on behalf of the governments of Brazil, Germany, Singapore and the South African Republic. Since 1992, this idea has been systematically developed by scientists from Ukraine, Belgium, Germany, United Kingdom and United States. The WEC is a radically new and important concept because this document stresses the pressing need to define the legal status of a human being not only as a citizen of a state but also as a citizen of the world with basic environmental rights and privileges. While the basic objectives of a traditional constitution is to acknowledge basic human rights and freedoms of citizens for life and the pursuit of happiness, the WEC must guarantee rights and freedoms for every citizen of the planet for healthy environmental conditions and for the sustainable use of the world’s natural resources.

### **Business Planning for Environmental Management**

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This paper relates to preparing a business plan for establishing a new business venture for environmental rejuvenation after mining. The paper proposes that business plans have to be prepared that take into consideration more than conventional features such as financial aspects of a business. In short, there is a need to consider business plans in an interdisciplinary way. The interdisciplinary nature of business will be explored in detail in this paper.

Business plans need to be worked out based on the context, content, connection, capability, continuity and cooperation. Context here refers to spatial, geographical, historical and socio-cultural aspects. Content relates to the way organizational architecture is formed. Business plans need to have sense of connectivity with the members of the community in which these businesses are being established. The capability of members of the community is a further consideration because business plans need to build on a fundamental principle of continuous improvements. Finally business plans need to address how cooperation is to be elicited for business practices to evolve to ensure operational procedures that will promote sustainable institutions.

### **Examining the Contribution of Historical Sources of Lead in Urban Soils of Portland, Maine**

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Many soils of the urbanized Portland, Maine peninsula are contaminated with high concentrations of lead. Lead contamination is a great concern in Portland because of the exposure potential to children in addition to brownfield implications. While the presence of lead in urban soils from lead-based paint and leaded gasoline are well documented, the relative contribution of lead from localized, historical industrial activities is not well documented. This study attempted to correlate historical (1850 to 1960) industrial sources of lead to current, spatial distribution of lead based on sampling data. Between 2001 and 2006, more than 1100 surface and 120 sub-surface samples were collected in accordance with EPA's Lead Safe Yard Protocols. Soils were extracted using EPA Method 3050b and analyzed on an ICP. Lead concentrations varied from 32 mg kg<sup>-1</sup> to 43,000 mg kg<sup>-1</sup>. The majority of these concentrations were greater than U.S. EPA's critical value for lead, 400 mg kg<sup>-1</sup>. Lead concentrations were then mapped using GIS. Using historical maps and directories, locations of known and highly probable sources (manufacturing, processing, use, and sale) of lead also were mapped. Based on these two data sets, there is no clear relationship between current soil lead concentrations and historical sources. The findings were hampered by the inability to sample under impervious areas and at commercial properties. However, because of lead's immobility in soil, we would expect decreasing concentration with depth, but we found varying lead concentrations with depth. This suggests that fill used to expand the peninsula during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries utilized lead-contaminated waste from the historical sources. These findings suggests that in urban areas where historical sources of lead may have existed, surficial sampling to determine presence of lead may not be sufficient, which has potential implications for public health and urban redevelopment.

### **Evaluation of Integrated Oceans Management Programs: A Canadian Perspective using the Eastern Scotian Shelf Integrated Management (ESSIM) Initiative as a Case Study**

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Integrated coastal and oceans management (ICOM) is concerned with developing and implementing a joint stakeholder approach to the planning and management of human activities within defined coastal and ocean areas, taking into account the relevant ecological, social, cultural and economic dimensions and the interactions between them. Many countries have embraced the concept of ICOM into their national policy and practice. However, despite a plethora of literature and guidelines on how to practice ICOM and assess its progress, few initiatives have incorporated meaningful and effective formal program evaluation and reporting at the operational level. Canada is no exception to this and there are many reasons why this is the case. This paper discusses a Canadian perspective on the topic of evaluation of ICOM using the experiences gained from the Eastern Scotian Shelf Integrated Management (ESSIM) initiative. ESSIM was initiated in 1998 and progress towards the development of an agreed stakeholder-endorsed plan has been slow. The role of evaluation in assisting progress in ICOM program development and implementation is discussed within the context of Canadian federal policies and guidelines. Some evaluation practices and procedures for ESSIM are discussed and proposed. It is surmised that progress in ICOM is definitely accelerated if attention is given to instilling a culture of evaluation at the onset of any initiative. This is because evaluation plays a multi-faceted role in key program elements of strategy, planning, performance management, and product and outcome assessment. It is important however for stakeholders to appreciate that program evaluation is not a simple one-off event, but rather a continual process requiring a series of different tests which formally, and informally, assess the level of progress in key areas of a program.

### **Comparison of Frameworks for Measuring Integrated Management in Large Ocean Management Areas**

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Integrated management of large ocean management areas (LOMAs) represents an approach to managing ocean resources by integrating environmental, economic, and social issues. It is aimed at deriving sustainable benefits for future generations, while protecting natural resources and minimizing possible adverse social, economic, and environmental consequences. Indicators of sustainable development, which summarize information for use in decision-making, are invaluable when trying to assess the diverse, interacting components of ocean processes and resource management actions. Two approaches for identifying sustainability indicators are evaluated for applicability in ocean management. They include: the Driving Forces–Pressure–State–Impact–Response (DPSIR) framework and the objectives-based approach. The DPSIR framework, developed by the European Environmental Agency in 1999 is useful for identifying and developing indicators for state-of-the-environment reporting and has been expanded in recent years as an analysis tool to assess and manage environmental problems. Driving forces are considered to be the socio-economic and socio-cultural forces driving human activities, as well as natural occurrences, which increase or mitigate pressures on the environment. Pressures are the stresses that human activities place on the environment. State is the condition of the environment and impacts are the effects of environmental degradation. Responses refers to the responses by society to the environmental situation. The objectives-based approach identifies management goals and objectives for an area, and develops indicators to measure the state of the ecosystem prior to during and after management activities are implemented. Eastern Scotian Shelf Ocean Management Area, off the east coast of Nova Scotia, provides a case study to evaluate the two indicator development frameworks. The Eastern Scotian Shelf Integrated Management Initiative (ESSIM) has been ongoing for several years and has recently finalized management plan for the area based on stakeholder-accepted goals and objectives. In this paper, sustainability indicators have been developed using 1) the DPSIR framework and 2) the objectives developed for ESSIM, and a comparison of the resultant indicators is presented.

### **Landscape Function and Land-Use Policy in a Karst Landscape**

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Sustainable land use is slowly gaining momentum in land planning environments due to social concerns, environmental objectives and socioeconomic needs. These decisions are becoming increasingly dependent upon best available science, typically encompassing multiple scientific areas such as hydrogeology (water issues), ecology (environmentally sensitive areas) and public health (pollution abatement). Less utilized in land planning environments are holistic, landscape-level views of how local or regional landscape areas function to maintain and service a healthy physical, ecologic and socioeconomic environment for humans, wildlife and ecosystems. This study lists identified important landscape functions and ecosystem services in a karst landscape delineated by Wabasha County, Minnesota. Municipal ordinances from the county and several cities within the county were examined for coverage of all or part of these functions and services. Only a few, such as water quality, were found to be referenced in policy. Even less referenced in policy were protections of karst features such as sinkholes which exist as direct conduits to ground-water aquifers. Identified landscape functions and ecosystem services are presented along with policy instruments referencing some of these elements. Policies and landscape planning practices are presented as alternate ways to conduct land planning in this region. Several karst policies are also proposed which exist and work in other karst landscapes to directly address and protect this sensitive karst landscape.

### **Towards Sustainable Communities: The Role of Universities in Shaping Environmentally Sound Development (Case of Ukraine)**

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Sustainable community development could serve as a quite realistic everyday example and an encouraging environment for developing, providing and implementing environmentally and socially responsible actions. Universities play the important role in this vital process as intellectual centers for creating new knowledge, disseminating efficient means and investigating stakeholders' attitudes regarding them. Obviously Ukrainian universities were not outside this process. The first reaction of the Ukrainian scientific community on challenges of unsustainable growth was widening educational programs by including points of environmental quality and social responsibility. The next step was creating holistic educational programs underpinned by idea of sustainable development. One of the first in this list was the masters' program "Environment and Natural Resource Economics", originated in 1997 by UNFU in collaboration with the University of Freiburg (Germany), Ghent (Belgium) and Padova (Italy) (Essmann and Pettenella, 1998). This master degree program was aimed to prepare high-level specialists to combine economic efficiency, environmental integrity and social equity ([www.enareco.narod.ru](http://www.enareco.narod.ru)).

The appearance of such educational programs induce shaping scientific schools working in the field of sustainability, fulfilling applied research and, indeed, delivering new way of thinking and acting to communities. The most interesting of them are:

- Investigation of stakeholders' perceptions regarding forest and urban forest ecosystems goods and services
- Investigating local population's willingness to pay for environmental goods and services
- Developing environmental policy and management for local enterprises
- Sustainable technological development
- Sustainable natural resource modeling and management
- Sustainable community development.

All these research provide local community with realistic, fresh and useful messages regarding its ecological footprint and lifestyles. They force the community to reshape its way of thinking and acting towards making sustainability more feasible, operational and tangible.

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### 3. CONTRIBUTED POSTERS (\*Presenter/Contact)

*Alphabetical by Indicated Presenter*

#### **The Effect of Greenway Establishment on Environmental Attitudes and Stream Health**

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A greenway is a corridor of protected land that usually flanks a stream, and is set aside for conservation and recreation. Greenways provide many things to the human community, including outdoor recreation opportunities, alternative routes of transportation, associated educational initiatives, and protected water and biological resources. We are exploring the effectiveness of the Davidson Greenway, part of a proposed interconnected greenway system in Mecklenburg County, NC, in restoring and preserving ecosystems and changing local environmental attitudes. We are not only investigating whether and how attitudes towards the environment impact the environment, but also the relationships between the establishment of greenways, environmental attitudes, and ecosystem health. We hypothesize that those living in a community with a greenway will be more aware of the environment and their influence upon it. Further, greenways will serve to protect the natural populations living within their borders. In order to effectively investigate this broad, interdisciplinary thesis, an ecological study of the Rocky River watershed in Davidson and a psychological study of the environmental attitudes of watershed residents are being conducted. To accomplish the latter, we will circulate a survey to assess environmental attitudes and awareness, and talk to various local policy makers and environmental groups. For the former we are collecting data on the benthic insect community from the South Prong of the Rocky River, along the Davidson Greenway. While data are still being collected, we plan to present analysis of macroinvertebrate diversity and water chemistry along the length of the Greenway, over time, and in comparison to a control stream that runs through a suburban subdivision.

#### **Microbiological Contaminants in Guam's Groundwater Past and Present: The Benefits of Sound Management Practices**

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Karst limestone aquifers are rapidly recharged during major storm events. This characteristic is certainly of benefit to communities dependent upon such systems for their drinking water supplies. Unfortunately, contaminant transport into these aquifers can be equally rapid, making such systems especially vulnerable to pollutants discharged or

disposed of on land. Guam has one of the finest limestone aquifers in the world. This natural and vital resource provides local residents with approximately 80% of their drinking water needs (~45 MGD). Located in the northern half of Guam, the aquifer lies beneath some of the most densely populated rural, residential and commercial areas on island. It thus requires very careful management to protect and preserve its chemical and biological integrity. Guam Waterworks Authority (GWA) monitors Guam's groundwater quarterly for all contaminants listed under the Safe Drinking Water Act. Records indicate the island's groundwater is currently in good shape from a chemical standpoint. Of far greater concern are the potential health risks associated with the many sewage spills, leaks, and overflows that have intermittently occurred over the years. Data for total and fecal coliforms (E. coli) measured in Guam's groundwater over the last 10 years are presented here, and clearly highlight the benefits of the recently improved maintenance and management strategies in preventing disease causing microorganism from contaminating the aquifer.

## ACKNOWLEDGEMENTS

Many thanks to Keith Young and the Holiday Inn by the Bay for the careful attention to detail they have given to the meeting.

Thanks also to Delaware State University for printing programs, assembling and printing name tags, and other useful details.

Thanks also to this year's President and Vice-President, Dr. Michael Reiter of Delaware State University (soon to be of Bethune-Cookman University) and Dr. Anthony Lumby of the University of the Witwatersrand, for their hard work in organizing this year's conference.

The Conference also wishes to recognize:

Jennifer Certo, my office assistant

Barbara Murray, Stephanie Stotts, Max Saintil, Jason Challandes, and Rachel Melvin:  
on-site conference assistants and Gofers Extraordinaire

Delaware State University and Stetson University for Audio-Visual Equipment  
Kevin Hickey of Assumption College for managing the Association over many years



Dr. Kimberly D. S. Reiter  
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