

## **21<sup>st</sup> International Interdisciplinary Conference on the Environment June 10-13, 2015 – San Juan, Puerto Rico, USA - Schedule**

*The IEA wishes to thank Universidad de Puerto Rico Río Piedras, IGERT Program under NSF Grant # 0801577, for their support during this conference.*

Wednesday, June 10, 2015, Breakfast in hotel (free for registered hotel guests)

9:30 am – 10:30 am, Registration in front of Conference Rooms

10:30 – 12:00, Conference Room A, *Energy & Environment in Focus*, Moderator: Penny Seymoure

**Felix Olufemi Ogele**, The Nigerian Governance of Oil/gas Sector: Threats to Biodiversity and Ecosystem Services in Niger Delta Region

**John A. “Skip” Laitner**, Reframing Energy for the 21st Century: Understanding the Economic Imperative of Energy Efficiency

**Greg Cronin**, Will the Caracol Industrial Park bring Progress or Environmental Disaster?

10:30 – 12:00, Conference Room B, *Environmental Progress*, Moderator: Kalim U. Shah

**Linus Nyiwul**, Structural Transformation, the Environment, and Policy Performance in Africa: A Qualitative Assessment

**Derren Rosbach**, Local Water Governance: Building Capacity through Transdisciplinary Collaboration and Citizen Science

**Jesse Sherry**, Community Supported Sustainability: How Ecovillages Model a More Sustainable Community

12:00 – 1:00 Conference Luncheon in Commons Area, Welcome from IEA President, Jeffrey L. Roberg

1:00 – 2:30, Room A, *Urban Factors and the Environment*, Moderator: Linus Nyiwul

**Pooja Kumar**, Protecting Urban Wildlife: A Case Study of Charlottetown

**Amani Joseph Ishemo**, Urbanization and Fire Hazards in Small Island States: The Jamaican Experience

**Nyainbau Iwueke**, Urban Agriculture: An Informal Sector of Activity of Residents of Enugu Nigeria

1:00 – 2:30, Room B, *Solution-focused Approaches*, Moderator: Michael Reiter

**Tomomi Maekawa**, Coordination for Assisting Stakeholders to Collaborate on Addressing Local Environmental Issues: Learning from the Australian Landcare System for Application in Japan

**Yu Sugiyama and Eriko Kimura**, Effectiveness of Microcredit on Women’s Empowerment: A Case Study in Nepal

**Bai Tian**, Enhancing Understanding of Environmental Problems and Finding Solutions with GIS Technology

2:30 – 3:00 *Coffee Break*

3:00 – 4:30, Keynote: **Dr. Arturo Massol-Deyá**, Science, Community, and Environmental Struggles in Puerto Rico

Patio Reception from 5:30 – 7:30, Tapas, Beer and Wine

Thursday, June 11, 2015, Day Trip to [Casa Pueblo in Adjuntas](#)

Meet in the hotel lobby at 8:00 am. Depart for Casa Pueblo via carpool. The road to Adjuntas is curvy and narrow—yet amazingly beautiful. We should arrive about 10:00.

Keynote Talk - **Dr. Alexis Massol**  
The Evolution of Casa Pueblo, Puerto Rico: From Mining Opposition to Sustainable Development

12:00 – 1:00, Lunch at local restaurant (not provided)

1:00 - 3:00, Visit [Forest School, La Olimpia](#)

3:00, Return to San Juan

5:00 – 6:00, Room A, Round Table Discussion (all are welcome)

Kevin Hickey, Demetri Kantarelis

**Droughts: To Care, or Not to Care – That is the Question**

6:00 – 7:00, Patio, Business Meeting, all are welcome

Dinner: on your own. Individuals are encouraged to form groups in the lobby. The front desk is happy to provide suggestions.

Friday, June 12, 2015

9:00 am – 11:00 am, Room A, *Issues in Climate Change*, Moderator: Greg Cronin

**Mai Kuha**, Climate Change Framing on Doppelgänger Websites

**Eric J. Fitch**, A Concatenation of Distrust and Denial: The Success of Special Interests in Controlling the Discourse about Climate Change in American Public Policy

**Geoff Beattie**, Why Don't We See the Arguments for Climate Change? How Cognitive Biases Affect the Processing of Climate Change Messages

**Laura McGuire**, Breaking Bad: How to Change Consumer Habits in the Fight against Climate Change

11:15 am – 12:00 pm, Poster Session

**Brenda Martinez**, Electro-mineral Accretion Process of Efficient Structural Forms for the Production of Carbon-neutral Building Material of Low-embodied Energy

**Nora L. Alvarez-Berrios**, Global Demand for Gold is another Threat for Tropical Forests

**Leslie Sherman**, An Investigation of Sediment Trace Metal Concentrations in a Rural Sub-watershed of the Chesapeake Bay, U.S.A

**Adaíl Alicea-Martínez**, Capacity Development Progress on 48 Small Community Water Systems in Puerto Rico

**Betzaida Ortiz-Carrión**, Land Use Change and the Hydrology of the Santa Isabel, Puerto Rico Aquifer

**Amanda Peters**, The Birds And The Bees: A Study Of Anti-Predator Behaviors In Ruby-Throated Hummingbirds

**Anna Young and Rebecca Fox**, The Effectiveness of Best Management Practices to Reduce Nitrogen Levels to the Total Maximum Daily Load Goals in the Choptank River, Maryland, U.S.A.

12:00 – 1:00, Lunch Provided in the Commons Area

1:00 – 2:30, Room A, *New Directions in Environmental Thought*, Moderator: Mai Kuha

**Richard Hutchins**, It is Right to Pity the Weak – The Animal Contract in Lucretius

**Eric J. Fitch**, Greening the Global Catholic Church: The Legacy of Pope Benedict XVI and the Leadership of Pope Francis

**Ellen Jackson**, A Language Analysis of the Guerrilla Gardening Movement

1:00 – 2:30, Room B, *Pedagogy Issues*, Moderator: Kevin Hickey

**Robin Aspman-O'Callaghan**, Developing original case studies of successful small businesses for use in sustainable business classes

**Kimberly D. Reiter & Michael Reiter**, Designing a Field Course for Interdisciplinary Engagement: The Early English Landscapes

**Temola Olayemi Thomas**, An Assessment of Toilet Facilities in Public Secondary Schools in Owo, Ondo State, Nigeria

Saturday, June 13, 2015

9:00 am– 10:30 am, Room A, *Tourism and Conflict*,  
Moderator: Eric Fitch

**Jeffrey L. Roberg and Penny Seymoure**, The Impact of Environmental Tourism in Western Cuba

**Takumi Arai**, A Survey on Present Tourism and its Ripple Effects on other Industries in Nepal

**Bashir Mohamed**, Environment and Conflicts in West Darfur

10:30 – 11:00, **Poster Session (continued)**

11:00 – 1:00, Room A, *Environmental Considerations*,  
Moderator: Kim Reiter

**Petrová Šárka**, Fast Test for Flame Retardants Toxicities to Plants

**Okwu-Delunzu Virginia Ugoyibo**, Assessment of the Environmental Impact of Gully Erosion in Eke, Udi Local Government Area of Enugu State

**Kalim U. Shah**, Aligning Corporate Sustainability to Green Economy Development Pathways in Developing Countries

1:01, End of Conference

*For participants that are staying in town, a suggested field trip is to [Tropical Rainforest in El Yunque](#)*

Meet in the hotel lobby at 10:00 am, form carpools, and head to the Rainforest for a hike (at your own risk). Bring water and snacks (perhaps mosquito repellent). Stop for a late lunch at [Luquillo Kiosks](#) on the way back to the hotel.

## Conference Abstracts

### **The Nigerian Governance of oil/gas Sector: Threats to Biodiversity and Ecosystem Services in Niger Delta Region**

*Felix Olufemi Ogele, Newcastle University, [felixogele2006@yahoo.co.uk](mailto:felixogele2006@yahoo.co.uk)*

As global demand for oil/gas as major source of energy continues unabated notwithstanding the available alternatives, it will continue to put extraordinary pressure on the world's poorest countries as fallout of production that has already peaked or plummeted in many developed countries. Oil/gas exploitation thus confronts developing countries like Nigeria where the resource remains the economic bastion of the nation with alarming risks and great opportunities. The Nigeria oil/gas sector concentrated in Niger Delta Region (NDR) where it has arguably orchestrated myriad of problems to the coastal communities. This paper investigates the governance of the oil/gas sector in Nigeria with regards to conservation of Biodiversity and Ecosystem Services (BES) through the application of Interactive Governance Theory.

### **Reframing Energy for the 21<sup>st</sup> Century:**

#### **Understanding the Economic Imperative of Energy Efficiency**

John A. "Skip" Laitner, Economic and Human Dimensions Research Associates

The evidence continues to mount. Energy efficiency is not just a way to save big money for households and business, or to achieve cost-effective and very big reductions in greenhouse gas emissions; it is also a critical resource if the United States is to maintain the robustness of its economy. In short, the efficient use of energy plays a more prominent role in the economic process than is generally understood. But the role of high-quality energy as it enables economic activity is badly defined and poorly tracked within the standard national economic accounts. New research indicates that, based on 2010 data, the U.S. economy is only 14% energy efficient. In other words, our economic activity wastes 86% of the energy used in the production and distribution of goods and services. This level of energy inefficiency imposes an array of costs that constrain the robustness of the American economy. This presentation explores new terms and concepts—many of which are familiar to physicists and engineers, but have not generally become part of normal

policy discussion. As a result, the current system of economic accounts limits insights and understanding about: (1) the current dynamics of productivity improvements and routine economic activity; and (2) the mix of price signals, policies, and incentives designed to redirect purposeful effort and productive investment. Applying these insights has the potential to transform the economy into one that provides both social and environmental well-being, and that is also sustainable over the long run.

**Will the Caracol Industrial Park Bring Progress or Environmental Disaster?** Greg Cronin, University of Denver and Yon Sel Lanmou, gregory.cronin@ucdenver.edu

The \$350M Caracol Industrial Park (CIP) in Northeast Haiti was constructed in 2011-2012 by the Inter-American Development Bank (IDB), United States Agency for International Development (USAID), and Clinton Foundation. Environmental consideration were largely overlooked when the 246 ha site was selected. CIP is 5 km from an estuary with extensive mangrove forests and 10 km from the largest coral reef in Haiti. An ecological assessment of the area found the Trou du Nord River to be degraded by agricultural activity, poor sanitation, and deforestation in the watershed, resulting in high TSS, nutrient concentrations, and fecal coliform. Rapid habitat assessment and biomonitoring of macroinvertebrates showed fair to poor conditions. The estuary and reef were heavily over-fished, but were otherwise healthy. CIP is expected to create 60,000 jobs and attract 300,000 to the rural coastal community. Electricity, from the new powerplant, is the only basic service provided to today's 30,000 residents. Plumbed water, wastewater treatment, fuel, and roads remain poor or non-existent. As a result, the river is used for bathing and laundry, and the mangrove forests are illegally cut for charcoal. The current situation does not bode well for a population expected to grow 10-fold to 300,000. I am unaware of plans to build infrastructure to support 300,000 people in the area, and aside from ~100 homes built for CIP employees, no major infrastructure development is taking place. In 2013, the Haitian government declared 90,000 ha of coastal environment a marine protected area, creating the 3 Bays Marine Park. This important step could offer protection to coastal habitats, minimizing impacts of CIP. The MPA could be managed in a way that enhances regional fisheries. Education and enforcement are needed, as highlighted by the killing of a humpback whale.

**Structural Transformation, the Environment and Policy Performance in Africa: A Qualitative Assessment**  
Linus Nyiwul, Gettysburg College, lnyiwul@gettysburg.edu

This article examines the state of environmental policy in Africa in the context of nascent evidence and recent projections of structural transformation in many African countries. The objective is to examine the nature and effectiveness of environmental policy in Sub-Saharan African countries. A partial but comprehensive analytical assessment of the current state of environmental policy and performance for African countries in the face of growing economic changes is presented. It is illustrated that existing environmental policies and institutions are largely incapable of addressing the kind of environmental externalities associated with structural transformation of the types being projected for African countries.

**Local Water Governance: Building Capacity through Transdisciplinary Collaboration and Citizen Science**  
Derren Rosbach, Worcester Polytechnic Institute, drosbach@wpi.edu

Global freshwater resources are currently facing an intensifying crisis. While regional issues may vary, widespread pressures from increased agricultural production, urbanization, and climate change induced variable weather patterns present new challenges for securing sustainable water resources. Collaborative interdisciplinary approaches to water governance are widely presented as means to achieve better water resource outcomes. However, the process by which success can be achieved is less apparent. This paper examines transdisciplinary and citizen science approaches as potential ways to enhance local water governance efforts. Strengths and challenges of each approach are evaluated in order to suggest a hybrid approach to local water governance. Further, an emerging collaborative urban watershed governance effort in Worcester Massachusetts is presented as an example of the need for this type of approach. Local residents, city government, university faculty and students, and non-profit organizations are actively working together to improve the stewardship of nearby ponds, streams, and parklands. But they face significant challenges to achieving their goals. This emerging collaboration relies on an ad hoc process to guide their collective actions and could benefit from the hybrid approach presented here in order to transform their

growing enthusiasm and actions into more effective long-term water governance.

Community Supported Sustainability: How Ecovillages Model a More Sustainable Community

**Jesse Sherry**, Eckerd University, sherryjl@eckerd.edu

Ecovillages are small, intentional communities which focus on reducing environmental impact while creating a community that incorporates the natural world. Despite varying approaches, each ecovillage attempts to create a community that integrates the social, economic, and environmental dimensions of sustainability. This study investigates several of these communities to better understand two key questions: 1) to what extent do ecovillage residents have a lower environmental impact than residents of nearby communities and the national average? and 2) how is the reduction in environmental impact achieved? These questions are addressed through the use of life cycle assessment and qualitative case studies of three sites, specifically one suburban and two rural ecovillages. Comparisons with nearby communities and the national average are made, and the results show that the case study ecovillages have a much lower per capita environmental impact. The qualitative case studies suggest that this is achieved through a combination of physical (village building and planning) and behavioral adaptations supported by community ideals and norms.

**Protecting Urban Wildlife: A Case Study of Charlottetown,**

Pooja Kumar, University of Prince Edward Island, pokumar@upei.ca

A neighbour feeds crows in the backyard. A classmate feeds foxes off a front porch. A cabbie carries roast beef for wild animals he chances upon during a night shift. Charlottetown is home to less than 40,000 people: too small a municipality, perhaps, to be expected to outfit itself with a formal structure that guides human-wildlife interactions as the urban area expands. With a population density of just under 780 people per square kilometer, it is packed enough for such interactions to occur frequently. This ongoing Island Studies graduate project reviews multi-disciplinary literature regarding wildlife conservation and island life, to understand how the City of Charlottetown (Prince Edward Island, Canada) may augment existing efforts to manage and protect non-domestic animal species that reside in the urban area. Perspectives from within relevant governance divisions orient the research focus, resulting

in a consideration of biocentric and anthropocentric realities as also jurisdictional challenges. The play off between synanthropic and native species, resident behaviors towards the wildlife they encounter on a day-to-day basis, and capacity constraints are some such, respectively. The aim is to develop a high-level framework for urban wildlife conservation in Charlottetown.

**Urbanization and Fire Hazards in Small Island States: The Jamaican Experience,** Amani Joseph Ishemo University of Technology, Jamaica.

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Fire hazards have become a frequent source of disasters in Jamaica, but have received little attention by researchers and policy makers. Property loss, social displacement and the accumulated cost associated with fire hazards have prompted the need to give fire hazard research equal priority with hurricane, landslide, flooding and earthquake. This paper examines the root causes of fires in the Jamaican urban space and provides recommendations for a holistic disaster mitigation.

**Urban Agriculture: an Informal Sector of Activity of Residents of Enugu Nigeria,** Nyainbau Iwueke, Enugu State University of Science &

Technology, ntiwueke2010@yahoo.com

Urbanization is increasing in most countries of the world and especially in Nigeria. In 2000 the United Nations reported that 38 % of Africans lived in urban areas. This figure is expected to increase to 55% by 2030. Consequently, many migrants to urban Nigeria face the reality of unemployment. In the face of an increasing unemployment rate in the urban formal sector, many urban dwellers get involved in informal sector activities to sustain themselves. Urban agriculture is a popular informal sector activity practiced by urban dwellers in Enugu. The study made use of the survey research method. It was carried out in Enugu metropolis. Data were subjected to ANOVA and Simple Linear Regression analysis. The major urban agricultural activities are mixed crop cultivation (38.8%), vegetable farming (27.2%), and production of fruits (1.7%), fish farming (6.5%), floriculture (1.6%), poultry production (14.3%), pig farming (6.6%), and goat farms (3.5%). Women (52%) were found to be more involved in urban agricultural activities than men (48%), perhaps because of their established central and cultural roles in household food delivery. Most cultivation in Enugu town heavily depends on organic fertilizer (poultry or pig manure).

There is also a well-established exchange system between poultry keepers and vegetable producers, who sell poultry and pig manure in 50kg bags with incomes adding up to 300,000.00 naira (\$1800) a month, but at times the demand is higher than the supply. The use of poultry entrails in aqua culture was also established with generated incomes as high as 15 000.00 naira (\$900) monthly. The study concluded that the contribution to food security is arguably the most important asset of urban agriculture world-wide. This study aptly corroborated this argument. With over 60% of house hold expenditure accounted for by earnings from urban agricultural activities, urban agriculture remains a veritable informal sector activity of urban dwellers in Enugu.

**Coordination for Assisting Stakeholders to Collaborate on Addressing Local Environmental Issues: Learning from the Australian Landcare System for Application in Japan**

Tomomi Maekawa, Tokyo Institute of Technology  
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The decision making process can be an essential part of any environmental project. Organising and coordinating various stakeholders and their different opinions and interests in projects can prove a challenge. Australia has a movement of community based natural resource management, conservation, and regeneration called Landcare which offers some solutions to the actual implementation and decision making problems associated with bottom-up based approach. Landcare has been recognised as a successful approach for increasing environmental awareness in individuals, and has been changing the landscape of Australia through promoting local activities managed and practiced by groups of local residents with a particular focus on farmers and private landowners. In this study, we shall focus on Landcare coordinators and their roles within the movement. We will show that Landcare has built a network of partnership among various stakeholders through linking information, human resources, funding, training for capacity building, and how a network of partnership has been built. Then, based on in-field research in Australia and in Japan, we will discuss the potential for adapting this focus on the use of coordinators to other countries using a case study of a network from Nagano prefecture, Japan. Through research undertaken in both Australia and in Japan we will use case studies to discuss how coordinators within the Landcare movement have played a role as a hub

for promoting collaboration among individuals and organisations. We will also discuss how having respect for the voice of stakeholders is the key for assisting to collaborate on addressing local environmental issues and how the use of coordinators factors in to this.

**Effectiveness of Microcredit on Women's Empowerment: A Case Study in Nepal**, Yu Sugiyama, University of the Sacred Heart,

Tokyo,1013c0401@u-sacred-heart.ac.jp,, Eriko Kimura University of the Sacred Heart, Tokyo, 1b0130169@u-sacred-heart.ac.jp

Microcredit (MC), a banking service providing small loans, is considered one of the effective strategies for women's empowerment, particularly in low-economic economies such as Nepal. Research indicates that MC has the potential to enable women to gain more decision-making power, greater self-confidence, and ultimately, provide them more freedom in society. However, the effectiveness of MC depends on women's position in the family, their control over their loan, as well as their individual ability, educational background, and social status. Furthermore, many women have difficulty doing business as they also have household responsibilities. And there is a persistent stereotype that women's work is only housework. This research focuses on women's empowerment in Nepal through MC, and aims to identify the profile of women who can benefit best from MC in terms of their economic empowerment, as well as their domestic and social position. A pilot study was conducted at Laxmi Mahila Credit and Cooperative, which has over 1,300 registered women, and provides collateral free loans, a savings program, and also offers skill training for women. A total of 32 women were interviewed through random selection using a structured questionnaire. Findings suggest that married women who have not had formal education may benefit best from the cooperative; however, several barriers are identified that impede their empowerment.

**Enhancing Understanding of Environmental Problems and Finding Solutions with GIS Technology**

Bai Tian, Parsons Government Services, Bai.Tian@parsons.com

Environmental problems can be large-scale, long-term, and complicated. Large amount of data have to be gathered to understand them, evaluate their current and possible future impacts, make educated decisions, and find effective strategies to solve them. Geographic Information System (GIS) technology offers powerful tools for collecting, storing, managing,

processing, analyzing, modeling, and visualizing large volumes of data to help scientists, decision makers, stakeholders, and the general public to better understand environmental problems, find solutions, and protect environment. In the past 20 years, our company have worked on more than 1,000 environmentally impacted project sites in USA, its territories, and overseas, especially the Middle East region. The contaminations of soil, surface water, and groundwater were mainly caused by past military activities, such as training for use of chemical and conventional weapons, and transporting, storing, distributing, and disposing of military munitions, fuel, and other related materials. Chemical warfare materials (CWM), unexploded ordnance (UXO), munitions debris (MD), Munitions constituents (MC), and abandoned fuel facilities are safety hazards that may constitute an imminent and substantial danger to the public, the environment, and ecosystems. GIS technology is used to locate impacted areas by analyzing historical aeriels and LiDAR data, delineate extents of pollution on surface and underground through 3D modeling, assess environmental and ecological risks through data mining and analysis, help scientists to understand the problems accurately through data visualization, design remedial strategies, and inform and educate the public. The massive GIS datasets from these projects are easily shared by various government agencies, industries, and the public through GIS web applications with appropriate security and access controls. They can also be re-used for future studies and investigations on these sites.

### **Climate Change Framing on Doppelgänger Websites**

Mai Kuha, Ball State University, mkuha@bsu.edu

As public awareness and understanding of climate change grows, the well-funded and well-organized climate change counter-movement scrambles to get its increasingly untenable ideas heard. To this end, recent years have seen counter-movement websites which mimic the web presence of established climate change-related agencies and organizations. Most notably, the NIPCC (Nongovernmental International Panel on Climate Change), linked to the Heartland Institute, aims to parallel and critique the IPCC. The EPA (Environmental Policy Alliance), which has been linked to the PR firm Berman & Company, critiques the Environmental Protection Agency. The NAS (National Association of Scholars), which might be confused with the National Academy of Sciences, tries to combat campus “political correctness” and sustainability. Scam websites aimed to divert consumers have been

discussed in scholarly research; also, journalists and bloggers have described politically motivated counterfeit websites (Nicks 2014; Steinmetz 2013) more generally and the NIPCC (Newton 2013) and the Environmental Policy Alliance (Gerken 2014) more specifically. However, scholarly research on these climate-related doppelgänger websites has not been published yet. After an overview of these websites, I will argue that they try to present themselves as a legitimate alternative to established climate-related organizations, and to maintain a web presence that looks superficially reputable so that they can distribute reports and press releases that seem to be authored by reliable experts. For example, the NIPCC sent its “Climate Change Reconsidered” report to K-12 physical science teachers in the U.S. As others (Newton 2013) have noted, educators might be too busy to notice that the report is endorsed by the NIPCC, not the IPCC. Finally, I offer an analysis of the linguistic implementation of these websites’ issue-defining frames: climate change mitigation and adaptation are framed as a threat to liberty and the economy, supposedly due to nefarious environmental groups manipulating the government.

### **A Concatenation of Distrust and Denial: the Success of Special Interests in Controlling the Discourse about Climate Change in American Public Policy**

Eric J. Fitch, Marietta College, fitche@marietta.edu

Just as in earlier times in American history, those who have had success in controlling the discourse and debate regarding issues of public policy were the ones who most often controlled the direction of policy. Exceptions were accomplished through political courage and/or changes in circumstance (e.g. the bombing of Pearl Harbor overcoming isolationist intransigence in Congress and entering WWII). With regard to public policies aimed at protecting the natural environment, economic interests have always pushed back fighting against Preservation (why tie up resources and forbid their use?), Conservation (privatize these resources and they will be managed much better by the free market) and Environmental Protection (proposed responses are too expensive and will destroy profitability). Moving through the fifth decade of active national Environmental Policy in the U.S., the counter arguments both remain the same (proposed solutions are too expensive; they will destroy profitability) and are different (the science is wrong, the technology to adapt doesn’t exist, the solutions are unworkable). Strategies also aim at pushing back on timely responses;



more research needs to be done, there is not a strong enough consensus in the scientific community, solutions need to be developed which fall with a “reasonable” cost-benefit scenario. This paper will examine the often counterfactual arguments that are used by representatives of economic interests and their allies against Environmental protection/regulation and their success in delaying or denying action on critical environmental issues, particularly Climate Change.

**Why Don't We See the Arguments for Climate Change?: How Cognitive Biases Affect the Processing of Climate Change Messages**  
Geoff Beattie, Edge Hill University (Beattieg@edgehill.ac.uk), Dr. Melissa Marselle, University of Salford, Dr. Damien Litchfield Edge Hill University, and Laura McGuire, Edge Hill University

According to the latest IPCC report, human factors are a significant factor in the rise of global CO<sub>2</sub> emissions, and therefore a major driver of climate change. So why do people not respond more to the various climate change messages that have been delivered over the past few years? Are there cognitive biases influencing the processing of these messages? Research has shown that, in other domains, dispositional optimists have an unconscious bias to focus on more positive information versus negative information, compared with pessimists. This selective processing of information can allow them to remain optimistic in a world with many negative features. Using the latest eye-tracking technology we tested whether optimists unconsciously avoid fixating arguments outlining the dangers of climate change. We tracked participants' gaze fixations, 25 times a second, as they considered arguments for climate change and its potentially devastating effects on flooding, food scarcity and conflict (negative messages). They also read sceptical arguments against climate change which attempted to undermine the scientific arguments and which suggested more benign outcomes (positive messages). We measured overall fixation time, dwell time and number of individual fixations and found that optimists did spend significantly less time fixating on the arguments for climate change (negative message) rather than the counter arguments (positive message) compared to pessimists. In other words, there does seem to be a systematic bias related to dispositional optimism which affects whether we 'see' the arguments for climate change in the first place. In society's pursuit of 'positive thinking', we may well have 'undermined preparedness' to deal with real threats, like climate change, that exist in

the world, and created a psychological barrier to behaviour change that we must now overcome.

### **Breaking Bad: How to Change Consumer Habits in the Fight against Climate Change**

Laura McGuire, Edge Hill University, Mcguirel@edgehill.ac.uk,  
Geoff Beattie, Edge Hill University

There is growing recognition of the role of consumer behaviour in the dramatic increases in global CO<sub>2</sub> emissions and, therefore, on consumers being a major influence on climate change itself. However, these consumer habits seem strangely resistant to change and many governmental, commercial, and educational campaigns have not had the desired, or anticipated, effects. One reason for this might be that there has been too much focus on assessing and changing explicit and self-reported attitudes rather than implicit attitudes, measured using various associative tasks. This paper will outline new experimental data on attitudes and consumer behaviour, which examines the relative importance of implicit and explicit attitudes in determining consumer choice in 'supermarket shopping' (in a simulated experimental task), in which the environmental consequences of the different product choices are made clear to shoppers through the inclusion of various environmental labels on the products, including features like carbon footprint, organic and Fairtrade. It also considered additional variables like the influence of product choice under time pressure, the social context of the behavioural choice, and relevant budgetary concerns. The research demonstrates that underlying implicit attitudes are a better predictor of actual consumer choice in supermarket shopping, especially under certain circumstances, where the behaviour becomes more "automatic." The paper will argue that it is crucial to understand how such implicit attitudes originate and evolve if we are to deal effectively with anthropogenic climate change. *Acknowledgement: This work was supported by project LD13028 (COST MP 1105).*

**Electro-mineral Accretion Process of Efficient Structural Forms for the Production of Carbon-neutral Building Material of Low-embodied Energy**, Brenda L. Martínez Quiñones, University of Puerto Rico, Rio Piedras, brenda@bmass.com

The production of calcium oxide (CaO) for cement manufacture is a major contributor of anthropogenic carbon dioxide (CO<sub>2</sub>) emissions.



Calcium oxide is typically produced by calcination of limestone, composed largely of different crystal forms of calcium carbonate (CaCO<sub>3</sub>). Molecules of carbon dioxide are released by the reaction itself of converting limestone into lime, but also as a result of fuel combustion – the most common source of heat used by the processes to achieve this chemical reaction. Some advances are being made in the field of cement manufacturing by tapping renewable energy resources for heat production (such as solar-thermal concentrators), but CO<sub>2</sub> is still being released as part of the chemical reaction.

My research explores an alternate way of achieving a specific form with a given structural capacity by using the same raw material, limestone, without requiring its transformation into calcium oxide. The process is based on the mineral accretion technology first developed by Architect and Marine Scientist, Prof. Wolf H. Hilbertz. On his projects, Prof. Hilbertz establishes a direct electrical current between electrodes in seawater, provoking the precipitation of calcium carbonates, magnesium hydroxides and hydrogen at the cathode, while producing oxygen and chlorine at the anode. Through my project I seek to achieve a more efficient and controlled way for the electro-mineral accretion process that results in a consistent product with various applications on the building industry. Instead of using seawater as the electrolyte, a calcium bicarbonate and magnesium hydroxide solution will be used. An early experimentation phase has been performed to confirm the feasibility of the project and I would like to share the up-to-date findings through this poster.

### **Global Demand for Gold is another Threat for Tropical Forests**

Nora L. Alvarez-Berrios, University of Puerto Rico, Rio Piedras

Soaring gold prices and neoliberal development policies have spurred a gold rush in many Amazonian regions with significant social and ecological costs including rapid deforestation. I analyze how international gold prices, national mining policies and local land tenure and access rules influence deforestation associated with mining in Madre de Dios, Peru. I map forest conversion due to placer mining (both artisanal and highly mechanized) using Landsat satellite images from 1999 to 2014 and use multiple regression models to test which combination of factors best explain the extent and rate of gold mining-associated deforestation in the region. Interviews with miners, conservationists and government officials provide additional insight on the processes underlying the observed deforestation patterns. I

conclude with recommendations for using remote sensing to assess placer gold mining impacts in the Amazon.

### **An Investigation of Sediment Trace Metal Concentrations in a Rural Sub-watershed of the Chesapeake Bay, U.S.A.**

Leslie Sherman, Karl Kehm Washington College, and Christian Krahforst, University of Massachusetts/Boston

Population growth and industrial development in the Chesapeake Bay watershed has led to major challenges with water and sediment quality of the Bay and its tributaries over the last century. Trace metals, one source of contamination, have been investigated in many regions of the Bay, but not in great detail in some of its tributaries. Surface sediment samples were collected throughout the Chester River, located in a rural agricultural sub-watershed of the Bay, to evaluate the sediment quality with respect to trace metals. Strong acid microwave-assisted digestions were conducted on the sediment samples and the extracts analyzed for trace metals by inductively-coupled plasma mass spectrometry. Sediment data were compared to trace metal concentrations reported by EPA for the main stem of the upper Bay and to national sediment threshold effects level (TEL) toxicity guidelines (NOAA, 2008). In addition, trace metal enrichment factors of the sediments were calculated based on published average crustal abundances of trace metals, using aluminum as a normalizing element. These enrichment factors give an indication of enhancement of metals above natural crustal abundances. Cadmium, chromium, copper, nickel and lead were present in concentrations above TEL values in several regions of the river. The concentration of lead in the sediments was very similar to those measured in the sediments of the Upper Chesapeake Bay (EPA, 2006). In the Chester River, higher metals concentrations were found in regions of finer-grained sediments, as compared to sandy sediments in the river, likely adsorbed to sediment organic matter. In addition, some hotspots were detected in several of the small creeks. The enrichment factor calculations revealed that of these five metals that exceeded TEL values, cadmium and lead were the most enriched, suggesting the presence of significant sources of these elements beyond weathering of natural minerals in the watershed, such as organic fertilizers, marinas, or legacy uses of the metals in the region.

## **Capacity Development Progress on 48 Small Community Water Systems in Puerto Rico**

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In Puerto Rico, 3% of the population (125,000 persons) gets its drinking water from approximately 250 small community water systems. These aqueducts are managed by the communities but still have to fully comply with the Safe Drinking Water Act and state regulations. This study had a duration of two years and its objective was the evaluation of 48 community water systems in Puerto Rico with a Capacity Development Evaluation Form (CDEF) which measures their technical, administrative and financial capacity and combines it into a total capacity rating. There was an initial and final evaluation to measure changes in capacity once the needs were identified at the beginning and a circuit rider program was implemented. A scale from 0 to 100% was used to measure each capacity. It was found that on average the aqueducts had a total capacity of 47% at the beginning, but at the end they improved on the three categories. We determined if these systems had in common similar areas of concern and at the end made recommendations. The level of improvement varied with factors like the level of commitment of the community leader with the aqueduct, the economic means of the community and the education of its members. These factors, which are numerically intangible because they have to do with environmental justice more than with numbers, were not assessed by the CDEF.

## **Land Use Change and the Hydrology of the Santa Isabel, Puerto Rico Aquifer**

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Much has been said about global food security, but about water security very little. The climate change models predict a shortage of rain to Puerto Rico and the Caribbean. The water issue is further complicated when we obtain water from coastal aquifers, which are generally very susceptible to salinization due to over pumping. The municipality of Santa Isabel has the largest agricultural production of vegetables in the country, generating 15% of all vegetables produced in Puerto Rico with vital to national food security role. However, 100% depends on which aquifer is located. The water quality of this aquifer is already compromised by saline intrusion due to over extraction of the resource

and the geographical location of the area near the coast. Our study aims to analyze land use change and study how varying the amount of water extracted in place is affected for various land uses. In addition, we intend to take stock of water for agricultural and urban areas to compare the contribution to aquifer recharge. Finally, we study human perceptions of how much knowledge they have about the resource, if they have identified a deterioration in water quality and if they would participate in groups created to protect water for the future.

## **The Birds And The Bees: A Study Of Anti-Predator Behaviors In Ruby-Throated Hummingbirds**

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Ruby-throated hummingbirds (*Archilochus colubris*) are common birds that require a large amount of energy intake daily to survive. Although hummingbirds feed constantly throughout the day, there may be a variety of factors that impede or disrupt their optimal foraging. When vision of the surrounding area was obstructed by a cone while feeding, birds were more vigilant, which is energetically costly. Vigilance behaviors, such as probing in and out of a feeder, indicate that ruby-throated hummingbirds may perceive and respond to predation risk. A number of previous studies and accounts document bees deterring birds from foraging. To examine whether hummingbirds perceive these insects as threats, hummingbirds were exposed to wild yellow jackets while feeding at vision impeding cone flower feeders and non-impeding flat feeders. The birds probed more often when vision was impaired at cone flower feeders, but did not show a greater proportion of time spent vigilant at either feeder type. Additionally, the yellow jackets had an effect on hummingbird vigilance by increasing the amount of probes at either type of feeder and increasing the proportion of time spent vigilant when compared to vigilance in the absence of yellow jackets. The hummingbirds altered their behavior in response to the bees by avoiding bee-infested feeders, probing in-and-out of feeders more frequently, being chased from the feeders, or not attempting to feed at all. Ruby-throated hummingbirds may perceive bees as a potential threat, which causes the birds to alter their normal foraging patterns and may inhibit their energy intake. This research may have potential implications for energy management, physiological stressors, as well as conservation considerations for threatened or endangered hummingbird species.

**The Effectiveness of Best Management Practices to Reduce Nitrogen Levels to the Total Maximum Daily Load Goals in the Choptank River, Maryland, U.S.A.**

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The Chesapeake Bay, located in the Eastern United States, is the nation's largest estuary. Excess nutrient loads to the Bay from industry, agriculture and the rising population in the watershed have resulted in eutrophication and low dissolved oxygen concentrations. In order to improve water quality, the Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL) in 2010. This regulatory pollution limit requires significant reductions in nitrogen, phosphorus and sediment loadings from the watershed. Best management practices (BMPs) are known to reduce nutrient and sediment loads to waterways and are being implemented in order to comply with the TMDL. In this study, four BMPs were evaluated in terms of their effectiveness for reducing nitrogen in the Choptank River, a tributary to the Chesapeake Bay, located on the Delmarva Peninsula. The TMDL for the Choptank requires a 39% reduction of nitrogen. Riparian buffers, controlled drainage structures, precision agriculture and denitrifying septic systems have been documented in the literature to reduce nitrogen loads by 62%, 57%, 33% and 48%, respectively. Realistic nitrogen reductions were calculated based upon these values for the Choptank River watershed and took into consideration the specific hydrology and land use of the area. The implementation of riparian buffers, controlled drainage structures, precision agriculture and denitrifying septic systems could reduce the nitrogen loads to the Choptank River by 25%, 8%, 66%, and 1%, respectively. This supports the concept that sufficient implementation of BMPs will reduce nitrogen loads to the Chesapeake Bay. Realistically, a combination of the four BMPs should be implemented in the Choptank River watershed to reduce nitrogen loads from both agriculture and residential land. Implementation of BMPs is dependent on the available economic incentives and the specific landscapes suitable for each BMP.

**It is Right to Pity the Weak – The Animal Contract in Lucretius**

Richard Hutchins, Princeton University

"In the simplest terms, our relationships with animals were once contractual..." writes Barry Lopez. "If we could reestablish an atmosphere of respect in our relationships, simple awe for the complexities of animals' lives, I think we would feel revived as a species." Lucretius—Roman philosopher, atomist, hedonist, and author of the epic Latin poem, *De rerum natura* (On the Nature of Things)—agrees and offers an account of human prehistory to speculate about when the animal contract arose, why we broke it, and why this is bad for us. I offer close-readings of two passages from Lucretius' account of prehistory—1) *De rerum natura* 5.855-877, the forging of the animal contract, and 2) 5.1011-1027, the forging of the human social contract. The main goal is to recuperate arguments for thinking about how to renew our contract with animals now, by paying close attention to Lucretius' account of the origins of human-animal justice in prehistory. In Lucretius' account, humans have a natural feeling of justice towards animals, because we evolved over a long period of time as a species contracting with animals for mutual pleasure, benefit, and survival. To paraphrase: In prehistory, when humans were just another weak animal, regularly preyed upon by those stronger than us, we learned to work together with other peace-seeking species to avoid extinction. To abuse animals then causes us pain precisely because we have evolved as a species with a deeply embedded sense that, as Lucretius puts it, "it is right for all to pity the weak." This is importantly not an abstract concept for Lucretius, but one that humans have evolved to feel. The abuse of animals, then, in war and sacrifice is a violation of a long-lasting friendship of mutual benefit and pleasure formed with animals in deep historical time. To violate that contract by harming animals, then, is to act against our own nature, as well as the contractual nature of the origin of our species.

**Greening the Global Catholic Church: The Legacy of Pope Benedict XVI and the Leadership of Pope Francis**

Eric J. Fitch, Marietta College

One of the great and pleasant surprises of the reign of Pope Benedict XVI in the Catholic Church was his sincere and enlightened dedication to the protection of the natural environment as God's creation and gift to humankind. Pope Benedict was first and foremost throughout his career a scholar/theologian. Considering the pontificate of Benedict lasted less than seven years, his pronouncements and writings on the environment were numerous. Pope Francis, although a scholar in his own right, has

set the tone in his first couple of years as Pope of being much more of a pastoral leader with an emphasis on reform of the institutional Church and a reemphasis on the clergy being servant leaders; shepherds who “smell like their sheep”. He has emphasized justice for the poor, the downtrodden, and the sinner. He’s highlighted the duty of all to protect the natural environment, the great gift from God. Climate Change has been emphasized; it not only harms Creation, but disproportionately negatively impacts the poor. Although the Catholic Church in the Americas, in Europe and Oceania have stressed the need for action to Steward the Natural Environment through their national and regional churches, never before has the Vatican put this much emphasis on the Environment. This paper will examine the key thoughts and pronouncements of Popes Benedict XVI and Francis on the natural environment, how upcoming global Synods may do more to instill Environmental Stewardship in official Church Doctrine, Dogma and Catechesis. It will also address why and how these concepts meeting resistance in some parts of the world/church, and especially in some part of the Church hierarchy.

### **A Language Analysis of the Guerrilla Gardening Movement**

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This paper examines language and framing surrounding the guerrilla gardening movement. There is a thorough explanation of what guerrilla gardening consists of, and the warfare frame that shapes the language used in the community. Guerrilla gardening is the use of public or private land in an urban area for gardens which help to improve the community. Guerrilla gardening aims to fix neglected areas and create more public green space. A significant portion of the language in the guerrilla gardening community uses warfare terminology to describe and refer to regular activities. The significance of the use of warfare terminology is apparent in the way it encourages action. The paper also investigates the relationship between guerrilla gardening and eco-terrorism, and explains the dramatic differences. There is also a deeper analysis of specific terminology used in the guerrilla gardening community with a focus on phrases like “guerrilla”, “war on neglect”, and seed “bombs”. The essay also looks at the reasoning behind the use of a warfare frame establishing the purpose of the frame. A main purpose behind the use of a warfare frame in a positive ecological movement is as a response to passivity and apathy. A very active frame will use language aimed to engage participants in actual change. The

guerrilla gardening movement is very effective at accomplishing their goals due to the language they use within the community.

### **Developing Original Case Studies of Successful Small Businesses for use in Sustainable Business Classes**

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Case studies have long been used as a valuable tool to help students envision their own strategies for dealing with complex events. They are especially of value when students are tasked with the development of their own project. This is because case studies can demonstrate to the reader what an organization or individual did or did not do to tackle a complex situation for their organization. When students read case studies that relate an organization's success in a new area of interest, such as sustainable business, it shows the student that 'it can be done' and their potential project has merit. When the case studies have been developed based upon the success experienced by small to medium businesses, students can better envision the success of their own efforts. This presentation focuses on the development of original case studies based upon three small to medium businesses dedicated to the principles of sustainability. These case studies are used in both undergraduate and graduate level Sustainable Business courses. For the undergraduate course, the case studies introduces the student to successful sustainable business models; for the graduate student, the studies provide templates for their own sustainable business project. By developing case studies that involve local, small, growing businesses students are able to see the possibilities of success at the ground level.

Case studies to be discussed:

- Ocean Organic Vodka --the Hawaii Sea Spirits Story
- From surf to table on Lummi Island-the Lummi Wild Fishery Cooperative

When local delights become world sought-- the Willows Inn

### **Designing a Field Course for Interdisciplinary Engagement: The Early English Landscapes**

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The typical short (< 3 weeks) international course focuses heavily on cultural experience, reducing or eliminating more intensive research

and learning approaches for the sake of time. This is unfortunate, because field courses of any type (and international field courses in particular) offer valuable opportunities for interdisciplinary engagement. Since 1998, we have offered a team-taught May interdisciplinary environmental field course titled The Early English Landscapes, which focuses on the interaction of the British pre-modern human and natural landscape over 6000 years of history. The course presents students with an intensive and interactive experience that combines more typical socio-cultural interactions with written interdisciplinary research, on-site active and experiential learning, student-faculty collaboration and teamwork, evidence-based interpretation, and experience approaching past and present environmental topics from multiple disciplinary plus holistic perspectives through space and through time. Student outcomes from the field course have been very strong as evidenced by student achievement after completion of the course, in particular for developing an interest in topics and locations specific to the course that leads to future learning. Students also show a strong interest in the course both beforehand and afterward, as evidenced by interest lists for the course despite the cost, social media groups pertaining to the course, multiple students who have participated more than once, and students who have chosen to continue their education in course-related topics on their own in England or other countries. The template can be used in any similar location or context to enhance learning across the curriculum within team taught interdisciplinary field courses

**An Assessment of Toilet Facilities in Public Secondary Schools in Owo, Ondo State, Nigeria,** Temola Olayemi Thomas, Rufus Giwa Polytechnic, olayemi.temola@gmail.com

Toilet facilities among many other facilities ought to be present in schools to promote hygiene and meet the physical and emotional needs of members of staff and students. This research therefore assess the toilet facilities in public secondary schools in Nigeria. Case study of Owo, Ondo State. Data obtained and analysed shows that 60% of toilet facilities in the schools are not good and substandard. This in view of the risks associated with poor sanitary conditions necessitate the call on the government and private individuals to do more to safeguard the health and overall wellbeing of staff and students.

**The Impact of Environmental Tourism in Western Cuba**

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Cuba is currently undergoing major changes due to tourism. Tourist visits grew from 2.8 million in 2013 to 3.0 million in 2014. Tourists are visiting Cuba for a variety of reasons including hiking, scuba diving and exploring places off the beaten path as well as for cigars, rum and sunbathing. This has meant that some parts of Cuba are experiencing high-impact tourism in the name of “ecotourism”. This presentation explores the impact of tourism on environmental sites in Western Cuba such as Las Terrazas, Candelaria, the Viñales valley, and the Guanahacabibes Peninsula, including Cabo San Antonio and Maria La Gorda. While increases in tourism have brought more money to the country, the local impact of tourism on Cubans has had mixed results. Additionally, while these unique environmental areas have been successfully preserved, we question what will happen when United States citizens are fully allowed to travel to Cuba.

**A Survey on Present Tourism and Its Ripple Effects on other Industries in Nepal,** Takumi Arai, Waseda University Brenda Bushell, Email: brenda@u-sacred-heart.ac.jp University of the Sacred Heart, Masayuki Goto, masagoto@waseda.jp Waseda University

Tourism is one of the most important industries in Nepal. With many tourism resources such as world heritage sites, rich nature, cultural diversity, etc., the number of tourists has been increasing in Nepal, year-by-year. Based on trend, some good effects by developing tourism can be expected for people working in various occupations. The local people can also receive benefits from infrastructure development and sanitation improvement. On the other hand, there are various benefits that only people working in the tourism industry can receive. Therefore, it is necessary to identify the difference of the benefits in order to expand the ripple effects on the other industries, for the further promotion of tourism development in Nepal. In this research, the consciousness and opinions of local people in Nepal are investigated through a field survey, using a questionnaire. To identify the difference of consciousness between different occupations, the survey was targeted at Nepalese respondents having three kinds of occupations’ people working in the tourism industry targeting international travelers’, people working in the tourism industry targeting Nepalese people; and people working in other industries, such as farming.

Through the result of the field survey, the differences of consciousness of the local people are clarified, and the differences of the effects and the benefits by occupation are identified. Through the analysis, the problems of the differences and the ripple effect from tourism development on other industries are also pointed out. Based on the results of the analysis, we propose the way forward for people working in various industries to receive the benefits from tourism development.

### **Environment and Conflicts in West Darfur**

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In West Darfur, the conflict started in 2003 for many political and other reasons. Hundreds of thousands of people fled from their villages and farms and lived in camps. This huge displacement affected the area and caused the following problems such as forest destruction, reduction of cultivated lands, and an increase of dead livestock. These problems are increasing every day, becoming normalized. The damage is happening slowly and sometime in the future will be out of control.

### **Fast Test for Flame Retardants Toxicities to Plants**

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Fires are a common cause of damage to people and property, and also create a wide variety of acute and chronic pollutants, including acid gases and persistent organic chemicals. Flame retardants improve the thermal resistance of the material. Nowadays, there are six main groups of chemicals that can be added to various kinds of polymers or materials. These include phosphorus (phosphine phosphonates, phosphates), silicon (linear silanes, siloxanes), boron (boric acid, borates, carboranes), nitrogen (melamine derivatives), metal hydroxides (aluminum and magnesium hydroxides) and nanomaterials. Generally used halogenated flame retardants are characterized by high efficiency, but due to their toxicity and bioaccumulation, they are limited in recent years. Still, more information especially regarding to their toxicological profile is definitely required to define their hazard to the environment. In the Czech Republic, the root elongation toxicity tests are performed according to Czech Environmental Ministry Directive. The assay was developed to test the effect of wastewater for irrigation. However, this test examines only short-term effects. Therefore, more tests are usually applied. One of the main responses of

plants to stress is an increase of production of reactive oxygen species (ROS). This led to a temporal sequence of physiological reactions (changes in chlorophylls contents, antioxidative enzymes activities, etc.). The aims of this study were to determine the levels of E50, and the influence of FRs on plant growth - biomass, and morphology of the root system. The results demonstrated that, despite the inconsistency of test results, the toxicities of individual retardants were measurable. *Acknowledgement: This work was supported by project LD13028 (COST MP 1105).*

### **Assessment of the Environmental Impact of Gully Erosion in Eke, Udi Local Government Area of Enugu State**

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This paper assessed the environmental impact of gully erosion in Eke, Udi Local Government Area of Enugu State, South East Nigeria. Data on the gully sites were collected using measuring instrument; Observations were made with regards to the effects of the hazard on the study areas. Simple random sampling techniques were used to select respondents, total number of 150 questionnaires returned out of 200 questionnaires distributed. Findings shows that the gully in Enugu Eke has a mean cross-sectional dimension of 15.67 + 14.01m, that of Oma Eke 13.00 + 12.49, while that of Ogui Eke has a mean cross-sectional dimension of 7.60 + 5.70. From the mean values, differences was observed among the various study sites, however, with very high standard deviations and standard errors for Enugu Eke and Oma Eke, This was supported by the ANOVA results; Having calculated F-value of 0.395, which is less than the critical F-value of 5.14, and the p-value of 0.69 > 0.05, the difference observed among the three study sites is not significant. Hence, the null hypothesis is accepted. The study revealed that the initiation and development of erosion gullies in the area is facilitate by nature (rainfall, topography, engineering geological properties of soil especially texture, etc) and anthropogenic factors especially road construction, excavation, drainage structure, farming, animal grazing. The study observed that gully erosion have caused a lot of pain and damage such as loss of life's, properties, communication routes, roads and has also modified the topography of the area. Recommendation made include planting of vegetative cover, construction of erosion channels, educating the populace and creating awareness on adequate practices to curtail the menace.

## **Aligning Corporate Sustainability to Green Economy Development Pathways in Developing Countries**

Kalim U. Shah, Indiana University Northwest

Corporate sustainability (CS) can be conceptualized as mechanism through which private sector investment aligns with and shapes sustainable development. In recent years the new economic paradigm of the green economy has been adopted by many developing countries and forwarded by government and multilateral institutions. It is in this burgeoning socio-economic context, that firms will practice their CSR. Here I explore the determinants of such CS in a green economy by using Structural Equation Modeling techniques to analyze empirical data collected from five Caribbean countries already on the green economy pathway. I find that firm level environmental policies and to a lesser extent relationships with external stakeholder networks are the main determinants of CS in the green economy. Firms' environmental practices and internal practices also influence CS in the green economy, but only indirectly when mediated by their environmental policies. The findings suggest that firm level environmental policies are critical to successfully aligning CS to sustainable development in the green economy context.