Department of Geography and the Environment

Projects Day

Tuesday, 26 April 2011
2:30 – 7:00 p.m.

Mendel Science Center
Villanova University
Department of Geography and the Environment
Villanova University

Projects Day Program 2011

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• Angela Bagnasco

Summer Village: Sustainable Urban Renewal for a Philadelphia Neighborhood

West Philadelphia, one of Philadelphia’s original affluent suburbs has fallen into poverty and ruin. This forgotten community desperately needs a radical redevelopment plan. This paper explores the history and current situation of the area as well as methods for redevelopment. The product is a land-use redevelopment plan that should it be implemented it would improve human quality of life, economic prosperity, and environmental impact. The model is based on the principles of New Urbanism, European city design, the East Lake Foundation model, and ideals of sustainability. The resulting development, named Summer Village, will be a mixed-use area with emphasis placed on pedestrian use and a strong public life. Another goal is attracting people of mixed monetary means. The model I have laid out should be a viable eco-friendly redevelopment project that would be able to be replicated across the forgotten areas of Philadelphia to revitalize the historic city.

• Lisa Clark

Potential Impact of the Invasive Ash Borer Beetle If Introduced into Ridley Creek State Park’s Upland Forest

The invasive emerald ash borer beetle (EAB) (Agrilus planipennis) has been identified in western and central Pennsylvania and poses a threat to the remaining counties within the state. Pennsylvania’s Ash tree (Fraxinus spp.) species, which makes up 3.6% of Pennsylvania’s forests and is scattered throughout the urban landscape, is at risk as the beetle establishes itself in new regions of the state. Ridley Creek State Park is one of those areas that could potentially see the beetle’s impacts since white ash occupies its mixed hardwood, Upland forest. The intrusion of the emerald ash borer beetle could exacerbate an already existing invasive species problem by diminishing the canopy structure and allowing a more conducive environment for an invasive plant understory. By selectively surveying three 20 meter by 20 meter plots and determining the tree diameter and species, a general estimation of ash density can be projected. The total diameters of the three plots showed that white ash makes up 28.62% of the surveyed sections. The other 71.38% of the plots were mainly composed of northern red oak (Quercus rubra) and American beech (Fagus grandifolia). Over the 520.8-acre Upland community, mostly comprised of older trees, the effects of the EAB would be apparent even if a fraction of the Upland forest...
were invaded by the beetle. Canopy thinning or dieback could allow sunlight to the understory and thereby encourage preexisting invasives to the Upland forest. This could move the Red oak-mixed hardwood forest from an invasive species “apparently secure” area to possibly a “vulnerable” or “imperiled” status.

Lindsay DeFusco

GIS in Law Enforcement and Spatial Analysis of Crime

Geographic Information Systems are an invaluable resource in the field of law enforcement because of their capability to allow officers to spatially analyze crime incidents. Using this technology can make predicting incidents of crime much easier, allowing law enforcement officials to streamline their processes. This study describes GIS and its functionalities, capabilities, and uses as it relates to the field of law enforcement. From these findings, a basic spatial analysis is undertaken for Pennsylvania counties and constructed for rape and robbery, which are violent crimes, along with arson and burglary, which are considered property crimes. This analysis proves the hypothesis that higher risk factors in each county lead to a higher rate of these crimes through the use of spatial analysis and a linear regression model. The spatial patterns and risk factors for these selected crimes in Pennsylvania counties are first described, and a linear regression analysis on the risk factors and the frequency of crimes determines whether or not higher risk factors lead to certain crimes. Though the statistical model suggests the predictors are not statistically significant, the spatial patterns suggest the occurrences and their predictors are not random. The only predictor that is statistically significant is the percent of poverty for predicting the occurrence of burglary, where the higher the percent of poverty, the more burglary occurs. While there are no statistically significant variables for predicting the incidence of arson, a spatial pattern exists where metropolitan area counties have the highest amount of occurrences and predictors.

Elizabeth Dias

Sprawl In Chester County – The Price of Population Growth in Pennsylvania’s Fastest Growing County.

Suburban sprawl has been a growing problem in southeast Pennsylvania since the early 1950’s. Sprawl has many different characteristics including land fragmentation, car dependent communities, and low-density housing developments. Because there are a variety of environmental and socioeconomic consequences associated with sprawl, it has become an important topic of discussion in the past twenty years. This project evaluates sprawl as it pertains to Chester County, PA. Chester County’s population has more than doubled since the 1970’s. From 2000 – 2010, the county’s population increased by an astounding 15.1%. There are many implications associated with such a dramatic spike in population within a short period
of time; some of which include (but are not limited to) unsustainable development, infrastructure degradation, and loss of green space. This project uses both quantitative and qualitative data provided by the U.S. Census Bureau, the Chester County Planning Commission, local interest groups, and local newspapers to evaluate the effects of sprawl in Chester County. This paper also evaluates both long term and short-term plans implemented by Chester County and local non-profit organizations to preserve green space and negate the negative effects of sprawl. The goal of this project is to demonstrate the importance of managing sprawl by examining its effects on Chester County.

• Luis Dominguez

**Observing Concentrations of Nitrates and Phosphates in the Rio Grande at Dams from the Rio Grande Reservoir, Colorado to the American Dam, El Paso, Texas.**

Water scarcity is a common and well-known problem in the region surrounding the Rio Grande. There is a heavy demand for water and a substantial use of pesticides and fertilizers in order to increase agricultural yield. As use of this limited resource, fertilizers, pesticides, and population increase, rivers such as the Rio Grande and other local sources of surface water become more vulnerable to pollutants. Nitrogen and phosphorus are two of the pollutants that are particularly problematic since they can lead to eutrophic conditions and the overall decline of water quality. An increase in pollutants due to agricultural practices, runoff, and discharge from water plants, with the combined effects of alterations such as dams can affect water quality dramatically. Therefore, it is imperative to maintain a constant watch on pollutant concentrations and the sources of these pollutants. The purpose of this project was to compare the concentrations of nitrogen and phosphorus in samples taken from specific dams starting at the Rio Grande Reservoir in Colorado and ending at the American Dam in El Paso, Texas. Concentrations varied from site to site and some abnormalities were indentified through the laboratory tests performed. A further investigation of land use surrounding these sites could be beneficial in determining the source of these pollutants as well as what could be done to prevent further contamination.

• Michele Jordan

**To Be Announced**

Abstract unavailable at time of publication.
Julia Kallmes

**Greener Partners Environmental Education Internship**

During the course of the spring semester, I completed an environmental education internship with a local nonprofit organization, Greener Partners. For the poster presentation, I will describe my duties and what I gained from the experience.

Si Xue Lin

**Land Use and Mutualism: Investigating Intercropping Pairings**

Intercropping allows for more economical land use, and the exploitation of mutualism between crops. I investigated maize *Zea mays* and common bean *Phaseolus vulgaris* where the bean will provide nitrogen for the maize, and the maize will offer a stable structure for the bean to climb, and I also investigated radish *Raphanus sativus* and lettuce *Lactuca sativa* where the fast-germinating radish will protect fragile newly germinated lettuce from rain fall, and can be quickly harvested before outcompeting lettuce for sunlight. The study was conducted at Villanova, Pennsylvania in a green house for 12 weeks from 20 January to 14 April 2011. Each pair was planted as an intercrop, and a sole-crop. Sole and intercropped maize both struggled to grow after week 4. Intercropped bean struggled, but sole bean flourished. Sole and intercropped radish had large broad leaves, and limited intercropped lettuces’ growths. Sole lettuces grew large broad leave and began to compete amongst themselves. Bean buds were significantly greater in sole-cropped than intercropped. Maize mass was no significantly different. Lettuce mass was significantly greater in sole-cropped than intercropped. Moreover, radish mass was not significantly different. The study showed interspecific and intraspecific competition rather than mutualism and economical land use due to limited space and nutrients.

Alexander Lundy

**You Eat What You Know: Food Traceability and Labeling in the College Setting**

The industrial, technological, and economic gains of the past two centuries also saw the arrival of new pollution, resource, and prosperity challenges. Concerned with the increasing size and scope of these challenges environmentalists have also been broadening their critiques. Agriculture and food production remained on the fringe of the conversation for some time but now are front and center, thanks in part to the amorphous, decentralized Food Movement. This movement’s concern for the origin of food has placed an emphasis on traceability—tracing food from the fork to the farm. A survey was distributed to approximately 165 freshman and 165 seniors at Villanova University to gather useable traceability data. The study had three goals:
determine Villanova students’ awareness of traceability as measured by their understanding of common food labels, determine the origins of their food knowledge, and see if this knowledge affects their food preferences. The results revealed that the Bioengineered, Local and Organic labels are comprehensively understood by around 1/3 of students, while these numbers are lower for the Cage-Free and Fair Trade labels. The majority of students learned about these labels through the media and word of mouth, and to a lesser extend conscientious food retailers like Chipotle and Whole Foods. The results also indicated that the Organic and Fair Trade labels are the most widely recognized and sought after food labels on campus, while off-campus all food labels received greater acceptance. These results suggested a relationship between food knowledge and consumer preference, with increased knowledge of a food label increasing the demand for that product, most vividly in the case of Organic and Fair Trade. Lastly, the study revealed that the majority of students lack a firm grip of the meaning of food labels and are unaware of many of these foods.

- Neil Mehta

**The Microbial Degradation of Crude Oil in Fresh and Saltwater Marsh Soils**

A study was conducted to observe the degradation of crude oil in fresh and saltwater marsh sediment. Wetlands are one of the most ecologically productive ecosystems in the world; this is in part due to the many microbial processes that occur in wetland sediment. In light of recent events such as the Deepwater Horizon oil-spill in the Gulf of Mexico BP oil spill, understanding the effects of crude oil on microbial processes in marsh soils is important to gain insights into both bioremediation processes and the overall environmental impact of oil in marsh ecosystems. This experiment was conducted by collecting fresh and saltwater sediment from two tidal marsh sites in the Delaware River Estuary. Varying concentrations of oil (0, 0.02, 0.08, 0.42, and 1.67%) were placed incubation jars and incubated for 40 days. Concentrations of methane and carbon dioxide were measured X times during the incubation to determine rates of natural soil organic matter and petroleum hydrocarbon degradation. I found that methane production was highest in the freshwater soil. Carbon dioxide production was measured in both soils for all oil concentrations, indicating that microbial respiration was not inhibited at any concentration of oil used here. By comparing the total rates of respiration to the amount of oil, I found that microbes at the salt-marsh site were more sensitive to higher concentrations of oil, but were also more efficient at oil respiration at lower concentrations. By understanding how microbes at both fresh and saltwater sites utilized the crude oil as an organic matter substrate, we are better able to understand how the overall impact of oil spills in marsh ecosystems. This preliminary data could be used to find new bioremediation techniques for oil spill in marshes and help us to better understand the effects of crude oil on microbial processes.
• Christopher Miller

**Production of Mycosporine-like Amino Acids in *Aiptasia Pallida* When Exposed to Oil**

*Aiptasia pallida* are small organisms that live in tropical seas, and in the Gulf of Mexico; they range in size from 1.5-5 cm and tend to live on dead rock, and coral. With the recent oil spill in the Gulf, it is prudent to understand the effect oil has on these organisms. Understanding the level of oil exposure that *A. pallida* are able to withstand would enable researchers to know the extent of clean up that would need to take place in order to save them and other marine life. This experiment is to understand the level of oil exposure it would take to inhibit the production of mycosporine-like amino acids (MAA’s) when *A. pallida* are exposed to oil. This was performed by using five oil concentrations: 0, 1, 2, 3, and 4% oil to water ratio. Five tanks are set with these parameters with living *A. pallida* within each; after a 48-hour exposure period samples were examined to determine effects. For each wavelength, measured a different result was found per tank. 2% oil to water ratio showed the highest percent difference from the control under all 6 wavelengths used in this experiment. Under the conditions in this experiment, no living *A. pallida* were found except for the control tank. Understanding the percent oil to water concentration where *A. pallida* could survive could help researchers, and clean-up crews during an oil spill by knowing the extend they need to clean before moving on to more critical areas. ★

• Caitlin O’Donnell

**The Geography of Poppy Agriculture in Afghanistan**

Afghanistan has long been the pariah of the international community, a country rife with the lasting scars of civil war, security concerns and widespread underdevelopment. One of the central concerns facing the country is its persistent opium economy that provides the world with 90% of its supply and feeds a global heroin market worth more than $55 million annually. For governments all over the world this has meant problems with substance abuse and drug trafficking, for Afghanistan it has meant dependency on a precarious agriculture industry for survival and national underdevelopment. This paper will examine Afghanistan’s opium agriculture through the lens of physical geography by exploring the state of the country’s lithosphere, hydrosphere, and atmosphere, and determining how the natural landscape has shaped opium agriculture to become as pervasive as it is today. Finally, this paper will evaluate possible solutions to the problem of opium agriculture in Afghanistan in terms of the country’s natural resources and physical geography. ★
Michael Patson

Mineralization in Two Wetlands

As sea level continues to rise, the fate of wetlands is becoming increasingly unclear. In a healthy marsh, several different metabolic pathways are being utilized by microbes to produce energy. Different microbial colonies will thrive depending on different carbon sources and available substrates. The different metabolic pathways occur at different rates. It is unclear if the total amount of carbon mineralized, depends on which metabolic pathways are utilized. This study aims to isolate these different metabolic pathways and determine any differences between different metabolic pathways. While aerobic respiration typically is more productive that anaerobic respiration, there has not be extensive research into the different types of anaerobic respiration. Since only the top layers of a wetland are exposed to oxygen, much of the wetland can only perform anaerobic processes. This study investigates denitrification, sulfate reduction and methanogenesis in both a freshwater and saltwater marsh. Total microbial respiration can be calculated by using gas chromatography on sealed vials. The sum of carbon dioxide and methane indicate the total amount of carbon mineralization. Conventional wisdom dictates that freshwater marshes are more mineralize organic carbon at a greater rate than saltwater marshes. This study demonstrates, as have other recent studies, this may not be the case.

Justin Stephens

Acid Deposition in Mountaintop Peat-Wetlands, PA, USA: Concentrations and Implications

Acid deposition in the northeastern United States is a well-known phenomenon. High regional SO$_4$ and NO$_3$ emissions pose problems to plants via soils saturated beyond buffering capacity, leading to decreased pigments, decreased adsorption of macronutrients and prone to heavy metal uptake. Pennsylvania retains relict boreal peat lands in areas of high elevation and low disturbance. These wetlands contribute to water quality and species diversity, but face uncertain future as a relict ecosystem and as such are ideal to study ecosystem impacts of acid deposition. Three mountaintop peat-wetlands in Loyalsock State Forest were selected for study, representing an eastern hemlock (*Tsuga canadensis*) canopy with *Sphagnum* moss groundcover. Atmospheric deposition during the summer of 2010 produced a pH of 4.22 ± 0.24 with associated S, Cl and Fe deposition 2, 4 and 2x higher than comparable literature, while N deposition was slightly lower than published rates. Canopy through-fall deposition was significantly higher than open deposition, which strongly correlated to tree health. *Tsuga* health was rated overall as “fair” with variance. Wetland outflow was less-acidic than precipitation at two sites, while outflow at a third site did not decrease acidity, suggesting that mountaintop peat-wetlands are near critical deposition values which even the high CEC of peat cannot adsorb.
• Erin Wade

To Be Announced

Abstract unavailable at time of publication.

• Mae You

The Growth of Organic Farms

Conventional farming practices produce high yields of crops but at the expense of the environment. Over the years, society has become more aware of the effects of high input techniques and is now looking for a more sustainable way of farming. The markets for organic products have grown and have caused producers to expand in order to meet the high demands for organically grown produce. The main problem that producers face when it comes to operating organic farms is that the regulations placed on them are difficult to maintain. Organic Farms are concentrated along the East and West Coast and not as many organic farms are in the Mid-West. Wyoming and Vermont are the two states with the largest percent farmland that is dedicated to organic farms even though California and Wyoming have the largest total acres of organic farmland. In addition, although some states have the largest number of certified or organic farms, it does not mean that they have the most acreage dedicated to organic farming. The demand of organic products has increased, but the number of acres devoted to organic farming is still much lower than the amount of land for conventional farming.