RUTGERS ENVIRONMENTAL STEWARD PROGRAM CURRICULUM AT DUKE FARMS

http://envirostewards.rutgers.edu/

For more information or to sign up for classes contact Pat Rector at rector@njaes.rutgers.edu

RUTGERS ENVIRONMENTAL STEWARDS

The Rutgers Environmental Stewards (RES) (offered annually since 2005) program is designed to provide participants with a basic science background in soil health, water quality and protection, renewable energy, geology, climate, land use management and invasive species to enable them to have a more informed grasp of environmental issues. After course work, a participant receives a Certificate of Completion. The program also requires a 60-hour volunteer internship for certification as a Rutgers Environmental Steward. For further information about the Rutgers Environmental Steward Program, see http://envirostewards.rutgers.edu/.

The RES program is currently in a period of expansion; expanding the number of faculty coordinating the classes, the number of locations, the time slots the classes are scheduled, the audiences targeted, and the technologies utilized for teaching. We now offer evening classes at the Middlesex, Passaic and Somerset County locations to accommodate professional working people who would like to join in our fun and educational program. Classes are offered at the Rutgers Earth Center North Brunswick, Middlesex County, Passaic County Cooperative Extension Office, Passaic County; Duke Farms, Somerset County and Atlantic County Utilities Authority, Atlantic County. We welcome you to join us during this exciting time in the Rutgers Environmental Steward program.

NJAES Mission Statement

To enhance the vitality, health, sustainability and overall quality of life in New Jersey by developing and delivering practical, effective solutions to current and future challenges relating to agriculture; fisheries; food; natural resources; environments; public health; and economic, community, and youth development.

NJAES Non-discrimination Statement

Rutgers New Jersey Agricultural Experiment Station Cooperative Extension educational programs are offered to all without regard to race, religion, color, national origin, ancestry, age, sex, sexual orientation, gender identity and expression, disability, atypical hereditary cellular or blood trait, marital status, civil union status, domestic partnership status, military service, veteran status, and any other category protected by law. Rutgers Cooperative Extension encourages individuals with disabilities to participate in its programs and activities. If you need special accommodations, have questions about physical access, or require alternate means for program information, please contact your local Extension Office. Contact the State Extension Director's Office if you have concerns related to discrimination, 732-932-5000, ext. 584.

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This curriculum was developed based on the work of the lecturers from the Duke Farms Rutgers Environmental Stewards Program. As has been true for each year these lecturers have given beyond measure. In 2016, speakers provided lectures and review of this curriculum, simply to assist in creating an outstanding adult environmental education program.

Geographic Information Systems: Pat Rector, Environmental and Resource Management Agent. Rutgers Cooperative Extension of Morris/Somerset Counties, Rutgers, N.J.

Geology of New Jersey: Don Monteverde, Ph.D., Research Scientist 2, New Jersey Department Environmental Protection, Bureau of Water Resources and Geosciences, Trenton, N.J.

The Physical, Chemical and Biological Aspects of Soils: Daniel Kluchinski, Assistant Director, Rutgers Cooperative Extension, New Brunswick, N.J.

Water, Watersheds and Water Resources: Pat Rector, Environmental and Resource Management Agent, Rutgers Cooperative Extension of Morris/Somerset Counties, N.J.

Moving Water: Water Supply and Wastewater Infrastructure in New Jersey: Daniel J. Van Abs, PhD, PP/AICP Associate Research for Water, Society & Environment Department of Human Ecology School of Environmental and Biological Sciences

The Evolution and Devolution of Environmental Law and Policy of New Jersey: Michael Catania Esq., Executive Director, Duke Farms

Renewable Energy: David Specca, Assistant Director for Controlled Environment Agriculture and Bioenergy, Rutgers EcoComplex, New Jersey Agricultural Experiment Station, Bordentown, N.J.

How Duke Farms Does Sustainability: Clifford Berek, Volunteer Coordinator, Duke Farms.

Protection of Public Lands: Emile DeVito, Manager of Science and Stewardship, New Jersey Conservation Foundation. Far Hills, N.J.

Water Resources and Open Space: Kenneth Klipstein, New Jersey Water Supply Authority. Clinton, N.J.

Ecology, Ecosystems and Invasive Species: Bruce Barbour, Rutgers Cooperative Extension, Rutgers, The State University, New Brunswick, N.J.

Stream Restoration: Grace Messinger North Jersey Resource Conservation & Development Program (RC&D)

ANJEC /Local Actions for Environmental Protection: Dave Peifer, Association of New Jersey Environmental Commissions. Mendham N.J.

Climate Change: Dave Robinson, Ph.D. New Jersey State Climatologist, Rutgers University. Professor Geography, Rutgers, The State University, New Brunswick, N.J.

Greening the DPW Yard: Pat Rector, Environmental and Resource Management Agent. Rutgers Cooperative Extension of Morris/Somerset Counties, N.J.

Environmental Chemistry: Amy Rowe, Ph.D. Environmental and Resource Management Agent, Rutgers Cooperative Extension of Passaic/Essex Counties, N.J.

Impervious Cover Assessments: Dr. Christopher Obropta, Ph.D., P.E. Rutgers Water Resources Program, Rutgers Cooperative Extension, Rutgers, The State University, New Brunswick, N.J.

Environmental Property Rights: Jack Rabin, Rutgers Cooperative Extension, Director of Farm Programs, Rutgers The State University, New Brunswick N.J.

Camden Initiative: Urban Restoration: Frank McLaughlin, Environmental Specialist, Site Remediation Programs, Office of Brownfields Reuse, New Jersey Department of Environmental Protection, Trenton, N.J.

Intern Project Development and Impact Evaluation: Daniel Kluchinski, Assistant Director, Rutgers Cooperative Extension, New Brunswick, N.J.

Conflict Resolution: Rachel Lyons, Interim Department Chair, Rutgers Cooperative Extension, 4-H Program, Rutgers Cooperative Extension, New Brunswick, N.J.

Methods for Water Quality Sampling: Bureau of Surface Water Permitting Staff, New Jersey Department of Environmental Protection, Trenton N.J.

Geographic Information Systems

Topic Statement: Environmental resources are located in space and time. Contaminants and degradations; current, past and potential are also located in space. Geographic Information Systems (GIS) provides a methodology for understanding relationships between various attributes, allowing for a better understanding of the influences and impacts in a given space and time. GIS is a powerful database that allows for decision making on many issues based on the interplay of various layers of data; for example streams; roads; known contaminated sites; depth to groundwater; soil type; Category-1 streams (exceptional value); and habitat for endangered species. This ability to place various data in one geographic location is a powerful tool. The Curriculum for the Geographic Information Systems l Lecture (GIS) includes: 1) Power Point Presentation; 2) NJ-GEOWeb on the Internet: Primer and Tutorial December 23, 2008; (New Jersey Department of Environmental Protection, Office of information Resources Management, Bureau of Geographic Information Systems http://www.nj.gov/dep/gis); 3) Tutorial lesson on GEOWeb in class; 4) At home practice assignment on GEOWeb; 5) At home practice assignment on Environmental Planning; designing how GIS might be used in actual applications.

Learning objectives:

- Students will learn the importance of spatial reference in environmental analysis
- Students will learn some basic terminology related to Geographic Information Systems (GIS)
- Students will learn how to access the New Jersey Department of Environmental Protection's (NJDEP's) on-line NJGeo-Web mapping tool and to utilize it for various applications
- Students will be comfortable with the hands-on use of the NJGeo-Web mapping tool
- Students will have a greater understanding of how GIS can be utilized in various efforts that their township and/or county might utilize
- Students will realize the wealth of information that is available on GIS
- Students will realize that the power of GIS is NOT in pretty maps

Presentation Outline

1. Overview
2. Why is geography important?
    a. Environmental resources
    b. Pollutants and degradation
    c. Environmental decisions
3. What is GIS?
    a. Vector data
    b. Raster data
    c. Tabular data
    d. Images
    e. Polygons
4. What can maps tell us?
5. Resources available for further training
6. GIS
    a. Fully GIs proficient
    b. DEP GEOweb
7. Potential Applications
    a. Evacuation of a barrier island
    b. Redevelopment opportunities

Geology of New Jersey

Topic Statement: Geology and Environmental Studies overlap and a basic understanding of geology concepts is critical for certain aspects of environmental science. The study of geology, as with many other scientific disciplines has many specialties. This lecture will cover several topics, specific to New Jersey, to provide Rutgers Environmental Stewards with a basic understanding of geology as related to environmental subject areas that may arise as they move forward as volunteers in the environmental arena. The topics covered include the physiographic provinces of New Jersey and how they impart distinctive traits to each area; groundwater and aquifers and how they are formed, and influenced by the physiographic province they are in, and some of the sampling devices that provide accurate knowledge of the flow and quality of the groundwater. The lecture covers rocks and their formation, changes and characteristics; geologic time scale and processes; and our coastal plains area with its defining factors, problems of salt water intrusion and sand loss and how the New Jersey Geological and Water Survey is responding. The glacial history of New Jersey which imparts topography and aquifer capacity to the northern area of our state is discussed. An understanding of geology guides or impacts many of the future topics that follow including for example; soils, restoration practices, infiltration of best management practices, climate, and water resources.

Learning objectives:

- Students will learn the different types of pressures that form rocks
- Students will be able to identify the different physiographic provinces in New Jersey, their ages, the different rock types, and the processes that formed them
- Students will learn the three types of rocks – igneous, metamorphic, and sedimentary, and the processes that form them
- Students will have a greater understanding of the difference between relative and absolute dating and the limitations of both
- Students will have a better understanding of plate tectonics and the different movement of plates where crust is being created and destroyed
- Students will understand our current topography and the weathering processes that are eroding them down.
- Students will understand how each physiographic province, with its specific geologic characteristics, is reflected in environmental issues such as salt water intrusion in the Coastal Plain, subsidence in the karst areas of the Valley & Ridge area or ground water aquifers in fractured rock areas of the Piedmont
- Students will understand the Private Well Testing Act and the information it contains
- Students will understand a few of the tools and field testing protocols that NJGWS employs to collect information on the geology and water of New Jersey

Presentation Outline

8. Overview
9. Rocks
    a. Formation
    b. Igneous rock
    c. Weathering,
    d. Sedimentary rock
    e. Metamorphic rock
    f. Rock cycle
10. Geologic time scale and processes
    a. Faults types, folds, anticlines and synclines
    b. Hutton
    c. Oh what a beautiful world. Which one?
11. Physiographic Provinces: Highlands; Valley & Ridge; Piedmont; Coastal Plain
    a. Differences in age of rocks
    b. Types of rocks
    c. Ground water resources
    d. Geology as resources
12. Private Well Testing Act of New Jersey
    a. What is it?
    b. What are some of the results?
    c. What do the results indicate?
13. Coastal Plains
    a. Major defining factors
    b. Aquifers and confining layers
    c. Salt water intrusions
    d. Sand loss from Sandy
    e. Response of NJGWS
14. Glacial geology
    a. History and resulting record in New Jersey
    b. Glacial moraine map
    c. Glacial sediment thickness map
    d. Pre-Illinoian till
    e. Late Wisconsinan till
    f. Glacial lakes
    g. Glacial aquifers

The Physical, Chemical, and Biological Aspects of Soils

Topic Statement: Rutgers Environmental Stewards receive a basic class in soils that provides information on the formation of soils, soil physical, chemical and biological properties, and the relationships between soils and ecology and environmental science. Soils provide ecosystem services such as filtration of water, providing a habitat for billions of organisms (biodiversity), and ecological benefits such as bio infiltration and green infrastructure. An understanding of soil texture can be applied to review of a potential site for the installation of green infrastructure practices, which often requires soil that percolates well. Soils are important to understand as more people become interested in organic farming and organic land care. The understanding of soil texture and fertility and the methods to improve those soil characteristics are important for review of land use plans and site evaluations for septic systems. Knowing how to access and read a Soil Survey are important techniques for a Rutgers Environmental Steward to enhance their environmental knowledge.

Learning objectives:

- Students will learn soil formation and soil components
- Students will learn soil profiles, their relationship to soil formation, geology and soil surveys
- Students will learn how to access soil surveys through various means including a web-based app
- Students will have a greater understanding of the connections between soils and the study of environmental science
- Students will learn the physical, chemical and biological processes that occur in soil and are essential for understanding soil and the environment
- Students will understand some of the basic ecosystem services that soils perform in functioning ecosystems, including agriculture and wetlands

Presentation Outline

1. Overview
2. Soils – the Basics
    a. Definition
    b. Components
    c. Formation
    d. Profile
    e. Soil forming factors
3. Soil Surveys
    a. Soil Survey Map
    b. The legend and the narrative
    c. How to find a soil survey map
    d. Smart phone app
4. Soil Characteristics - Physical
    a. Texture
    b. Sand, Silt, clay - sizes
    c. Sand, Silt, clay - mineralogy
    d. Textural classes
    e. Water infiltration and percolation
    f. Drainage
    g. Water holding capacity
    h. Tilth
5. Soil Characteristics – Organic Matter
    a. Defined
    b. Formation
    c. Carbon cycle
6. Soil Characteristics – Chemical
    a. Cation Exchange Capacity
    b. Nutrients required for plant growth
    c. Sources of nutrients
    d. Role of nutrients
    e. pH
7. Soil Characteristics – Biological
    a. Characterized by size, diet, requirements for oxygen or activity
    b. Microorganisms, Mesoorganisms, Macroorganisms
    c. Diversity and Abundance
    d. Roles in Nutrient cycling
    e. Roles in disease prevention
    f. Symbiotic relationships
    g. Role in breakdown of contaminants
8. Soil Management
    a. Soil fertility planning
    b. Soil testing

c. Improving Tilth
d. Increasing organic matter
e. Long-term Planning

Water, Watersheds, and Water Resources

Topic Statement: Rutgers Environmental Stewards receive a basic class in water, watersheds, streams and lakes. This class provides information on stream ecosystem dynamics from the headwaters to the mouth with discussion of discharge, flooding and baseflow. The lecture discusses water pollutants common in New Jersey including sediment, nutrients, and pathogens and the chemical properties of water that make it a universal solvent. Changing landscapes and the impacts of impervious surfaces and stormwater runoff are an important topic in many local and state conversations and this topic is broached to prepare the way for more in-depth discussion in a future lecture. Lakes and aquatic invasive species in New Jersey complete the water course. Rutgers Environmental Stewards are provided with federal and state websites where they may find data about water quality or other relevant water information.

Learning objectives:

- Students will understand what a watershed is and how they are delineated. Students will understand the different Hydrologic Unit Codes (HUC) in use in N.J. (HUC 12 and HUC 14 watersheds) and the larger HUC 8 watersheds
- Students will understand the concept of stream order. Students will understand the connection between stream order and watersheds
- Students will learn basic water chemistry and understand how this contributes to water's fundamental necessity to life. Students will understand how this chemistry also allows water to be the great dissolver, transporting many things in solution into our streams and lakes. Students will learn of typical pollutants found in our streams in N.J.
- Students will understand basic flow characteristics to help with understanding stream ecology
- Students will gain understanding of lakes; their formation, zones and trophic designations.
- Students will learn some of the aquatic invasive plant species found in N.J. lakes

Presentation Outline

1. Overview
2. Streams
    a. Rivers flow
    b. Stream order
3. Headwaters Characteristics
    a. Flow
    b. Temperature
    c. Biological adaptations
    d. Hetrotrophic
    e. Fish
    f. CPOM
4. Mouth of a river
    a. Flow and discharge
    b. Number of species
    c. Autotrophic
    d. Planning
    e. Dilution is the solution?
    f. TMDLs
    g. Common Pollutants
    h. Pathogen versus indicator
    i. Sediment
5. Watersheds
    a. What is a watershed?
    b. Hydrologic cycle
    c. Natural versus developed conditions
    d. Stormwater runoff
    e. Infiltration versus developed conditions
6. Changing landscape
    a. Hydrologic effects
    b. Linking land use to runoff and waterway condition
    c. Flood peaks
    d. Flooding, small frequent floods
    e. Typical N.J. rain events
    f. Lower dry weather flow
    g. Baseflow
    h. Examples of measured baseflow
    i. Solutions for small frequent flooding
7. Lakes
    a. Origins
    b. Zones of a lake
    c. Dissolved oxygen and Dissolved O_2 profiles
    d. Trophic levels
    e. Role of phosphorus in lake ecology

   f. Sediment in lakes
   g. Dredging
   h. Buffers
8. Aquatic Invasive Species
   a. What is an AIS?
   b. Characteristics of an AIS
   c. Eurasian watermilfoil
   d. Water chestnut
   e. Curly leaf pondweed
   f. Water lettuce
   g. Hydrilla
   h. Algae blooms
   i. Blue-green algae
   j. Control methods
   k. Costs

Moving Water:
Water Supply and Wastewater Infrastructure in New Jersey

Topic Statement: Water infrastructure is fundamental to sustainability in New Jersey (economic, social and environmental), as roughly 90 percent of all residents rely on one or more water infrastructure system: public water supply, sewer and stormwater. Understanding water infrastructure issues requires knowledge of where we get our water and the environmental stresses that result; where our wastewaters go and the environmental stresses that result; the basic nature of water infrastructure, how it developed over time, and its current condition; the financial implications of proper management; and the costs of failing to act. The session will also address how concerned residents and decision-makers can improve the potential for successful action on these issues.

Learning objectives: Students will learn:

- How water supply availability is determined for ground and surface waters
- The basic structure of water supply and wastewater infrastructure
- The historic development patterns for water infrastructure in New Jersey
- The need for water infrastructure upgrades and replacements in the next decades
- Financial implications of our infrastructure needs
- Opportunities for public involvement in the decision-making process

Presentation Outline

1. Overview
2. Sustainability and Water Infrastructure
    a. Economic Importance
    b. Environmental Importance
    c. Social Importance
3. Water Supply Infrastructure
    a. First, the Source – Water Availability
    b. Meeting Demands
    c. Evolving Treatment Needs
    d. Water Delivery to Customers
4. Wastewater Infrastructure
    a. Sewage Collection Systems
    b. Stormwater Collection Systems
    c. Combined Sewer Systems
    d. Finally, the Sink
5. Creation Cycles in Water Infrastructure
    a. Early Urban Cities
    b. Post World War II Suburbs
    c. Modernization of Treatment Facilities
    d. The Coming of Obsolescence?

6. Costs of Infrastructure Maintenance and Upgrades
    a. Combined Sewer System Upgrades
    b. Water Supply Systems
    c. Sanitary Sewer Systems
    d. Separate Stormwater Systems
7. Can We Afford Our Infrastructure?
    a. Can't Afford to Avoid the Costs
    b. Socioeconomic Disparities
    c. Who Pays?
    d. How Do They Pay?
    e. When Do They Pay?
    f. Can't We Get Someone Else to Pay?
8. Thoughts for Environmental Stewards and Other Thinking People
    a. Know Your Water Supply Sources
    b. Know Whether the Water Sources Are Stressed
    c. Know Where Your Sewage Goes
    d. Know Where Your Stormwater Goes
    e. Know Whether the Receiving Waters are Stressed
    f. Know Who Owns and Is Responsible For Water Systems
    g. What is Currently Being Done to Manage Assets?
    h. What Future Risks Exist (e.g., Climate Change)?
    i. Engage the Public in Thinking About These Issues
    j. Engage Decision Makers
    k. Be Prepared to Pay – Failure Isn't an Option

https://www.youtube.com/watch?v=0BLCXlNpadk&feature=youtu.be

The Evolution and Devolution of Environmental Law and Policy of NJ

Topic Statement: In order to understand the environmental arena in New Jersey it is critical to understand the various levels of government and different aspects of environmental law and policy. New Jersey was unique in many ways and often led the way in developing and enacting landmark environmental legislation. This lecture covers legislation enacted over many decades; federal and New Jersey-specific, in order to provide Rutgers Environmental Stewards with a basic overview of environmental law and policy. The course begins with pre-Earth Day legislation and shows how New Jersey had several significant pieces of legislation in place prior to Earth Day, due to the issues s that shaped it as the state that was destined to become an environmental leader. The topics covered begin with traditional conservation of public lands and wildlife designation. The lecture illustrates how these laws reach back to our history of origin as English subjects, and then move into the incredible array of landmark laws that followed. Since April 22, 1970, New Jersey has enacted more than 1,200 pieces of environmental legislation, including the law that created the New Jersey Department of Environmental Protection. This class takes the Rutgers Environmental Stewards on a journey through the creation of much of this legislation; but more importantly sets the backdrop for why and how this legislation was enacted created and what issues were in play at the time. The role of various levels of government, the role of the public, and how the role of the private sector has evolved over time are all critical factors to understanding the intricacies of environmental law in New Jersey. Where we are now with environmental law and policy, emerging issues, and the potential future of the New Jersey environmental law and policy are also covered in this lecture.

Learning objectives:

- Students will gain an overall sense of how environmental law and policy developed on both the federal and state levels
- Students will learn how New Jersey was one of a handful of states where this development took place well ahead of the pace in other states, and why that happened
- Students will become familiar with the specific, definable phases in the development of environmental law and policy
- Students will understand where environmental law and policy are likely to going in the future

Presentation Outline

1. Overview
2. Early Development
    a. Lands Conservation- early beginnings of U.S. conservation movement
    b. Public Trust Doctrines and relationship to English System
    c. Pre-Earth Day Doctrines –N.J. Case Studies
3. Earth Day and the Dawn of the Modern Environmental Movement
    a. Federal Law
    b. Principal Federal Environmental Regulatory Programs
    c. State Level
    d. Creation of New Jersey Department of Environmental Protection
4. Dawn of the Modern Environmental Movement –N.J.
    a. Critical Area Protections
    b. Regulating Private lands
    c. Open Space
    d. Environmental Management
    e. Pollution
    f. Environmental Responsibility
    g. Proactive versus reactive
5. Major Themes in New Jersey Environmental Laws
    a. Public wants to be protected
    b. Relationship between federal and state programs
    c. Pre-emption
    d. Citizen empowerment and standing to sue
    e. Best available technology
    f. Criminalization, Liability; strict, joint and several, and personal
    g. Deputization of private sector
    h. Home rule versus Regionalization
    i. Pollution Prevention
    j. Risk assessment
    k. Non-point source pollution and individual responsibility
    l. Funding
6. Current Issues
    a. Economic concerns and Great Recession
    b. Over-regulation and the Tea Party
    c. Anti-science sentiment
    d. Downsizing NJDEP
    e. Waiver Rule
    f. Promoting economic development
7. New Issues and Themes
    a. Environmental Justice
    b. Sustainability
    c. Resiliency
    d. Developing new technologies

e. Climate change mitigation and adaptation
f. Carbon trading and reducing carbon footprint
g. Terrorism
h. Cultural shifts
i. Right-sizing government
j. Adapting to a smaller role of government
k. New emphasis on private sector action in lieu of traditional regulatory approach
l. New Jersey's environmental future?

https://www.youtube.com/watch?v=ds3kfpxc_bo&feature=youtu.be

Renewable Energy

Topic Statement: This lecture provides an overview of all energy sources and uses in the nation and New Jersey. From this larger view, a detailed discussion of renewable energy technologies is provided. Based on a Rutgers University biomass assessment for NJ, greater insight into biomass and its current and potential uses in energy production is also included. The EcoComplex, one of Rutgers University's outlying research stations, has been conducting research into the use of biomass for energy in New Jersey, especially waste-based biomass. This lecture discusses some of the results of this research along with current and future opportunities, barriers and economics for renewable energy.

Learning objectives:

- Students will learn about the Program Areas of the Rutgers EcoComplex – Clean Energy Innovation Center
- Students will learn about current energy consumption, nationally and New Jersey specific
- Students will understand renewable energy systems
    - Solar Electric
    - Solar Thermal
    - Wind turbines
    - Geothermal
    - Small-scale Hydropower
    - Biomass

- Students will learn about the New Jersey Clean Energy Program; its history and current status
- Students will learn the factors for economics of biomass
- Students will learn about potential Municipal Solid Waste (MSW) for use as energy and where biomass is concentrated in the state
- Students will learn there are various pathways for biomass conversion to usable energy
- Students will understand what the Bioenergy Calculator is and how it can assist with energy decisions

Presentation Outline

1. Overview
2. Rutgers EcoComplex Facilities
    a. Program Areas
    b. Environment
    c. Alternative/Clean Energy
    d. Agriculture

3. Estimated Energy Use
    a. National Source (by %)
    b. National Usage (%) in sector (transportation, electricity, residential, industrial)
    c. New Jersey Capacity by fuel type (%)
    d. New Jersey Energy Generation by fuel type (%)
    e. New Jersey electricity profile
    f. New Jersey fuel consumption

4. Renewable Energy Technologies - Solar
    a. Solar Resources nationally
    b. New Jersey ranking
    c. Photovoltaic systems
    d. Solar Electric Energy
    e. Solar Thermal Collector
    f. Solar Thermal Design

5. Renewable Energy Technologies – Wind Turbines
    a. Wind Resources nationally
    b. New Jersey ranking
    c. Relative sizes of wind turbines
    d. How wind turbines work
    e. Disturbance of wind
    f. Wind Energy - Advantages
    g. Wind Energy - Disadvantages

6. Renewable Energy Technologies – Geothermal
    a. Geothermal Resources - nationally
    b. Geothermal heat pump configurations
    c. Stockton University Demo project

7. Renewable Energy Technologies – Small scale hydropower
    a. What is small scale hydropower?

   b. New Jersey specifics
   c. Hydropower – Advantages
   d. Hydropower – Disadvantages

8. Biomass- Introduction
   a. Bioenergy
   b. Biopower
   c. Bioheat
   d. Rutgers – NJAES Assessment of Biomass Energy Potential in New Jersey July 2014

9. Categories of biomass
   a. Sugars and starches
   b. Lignocellulosic biomass
   c. Fats and oils
   d. Solid wastes
   e. Other wastes

10. Municipal Solid Waste New Jersey
   a. Individual MSW
   b. MSW generation New Jersey compared to nation on a density basis
   c. MSW county by county
   d. Practically recoverable biomass
   e. Total MSW by components

11. MSW as biomass
   a. Food waste by county
   b. Landfill gas by county
   c. Landfill gas
   d. Where is biomass concentrated?

12. Other biomass possibilities in New Jersey
   a. Agriculture and forestry
   b. Biomass by feedstock category statewide
   c. Biomass to energy conversion pathways
   d. Bioenergy potential by county

13. Status of Biofuels Technologies
   a. Market Maturity - Ethanol
   b. Market penetration - Biogas
   c. Pilot scale- Cellulosic Ethanol; Fisher-Tropsch fuels; 2nd generation gasoline
   d. Demonstration – Cellulosic Ethanol; Fisher-Tropsch fuels; 2nd generation gasoline
   e. Research & Development – Algae & Duckweed

14. Ethanol- Feedstocks
    a. Corn
    b. Sorghum and Milo
    c. Hull-less barley
    d. Sugar beets
    e. Sugarcane
    f. Cellulosic Feedstocks

15. Biodiesel- Feedstocks
    a. Soybeans
    b. Canola or rapeseed
    c. Sunflower seeds
    d. Palm Oil
    e. Yellow grease and animal fats

16. Ethanol- Feedstock's environmental impacts
    a. Corn
    b. Sorghum and Milo
    c. Hull-less barley
    d. SW county by county
    e. Practically recoverable biomass
    f. Total MSW by components
    g. Cost/benefits
    h. Carbon debt

17. Landfill gas
    a. 2nd largest anthropogenic source of methane
    b. Waste Management Demonstration Project
    c. LNG as a fuel

18. Bioenergy Calculator
    a. Solid waste-based biomass county by county
    b. Ag based biomass
    c. Forestry based biomass
    d. Practically recoverable biomass
    e. Total MSW by components

19. Current and Future Technology Review
    a. Opportunities
    b. Barriers
    c. Funding
    d. Anaerobic Digester
    e. Co-generation

f. Biomass Pyrolysis
g. Subsidies
h. Production
i. Full Bioenergy Assessment Report and Bioenergy Calculator
   http://njaes.rutgers.edu/bioenergy

How Duke Farms Does Sustainability

Topic Statement: The mission of Duke Farms is to be a model of environmental stewardship for the twenty-first century, and to inspire visitors to become informed stewards of the land. This drive is what motivated Duke Farms to renovate their Orientation Barn to meet LEED certification standards, promote renewable energy, green roofs, sustainable transit and a myriad of other sustainable operation standards. Rutgers Environmental Stewards will learn more about the history of Duke Farms, why sustainability matters, and about Duke Farm's experiences with becoming more sustainable, including lessons learned in the process. Students will gain an understanding of what is required to meet LEED certification standards, and will leave with a knowledge of what they can do at home and in their everyday lives to live more sustainably.

Learning Objectives:

- Students will learn about the history of the Duke Farms estate, including how the Duke Endowment was created and about the life and times of the Duke Family.
- Students will learn what sustainable technology is, and why it matters.
- Students will learn why sustainability matters in a modern society.
- Students will learn what LEED Certification means and how Duke Farms was able to create the only LEED certified green house in the country.
- Students will learn about all of the sustainable measures Duke takes on a daily basis including adaptive reuse and using reclaimed materials.
- Students will learn about the solar arrays, solar thermal, and geothermal systems as well as the radiant heating and reliance on natural lighting.
- Students will learn about water conservation efforts including rain water harvesting, green roofs, bioswales and constructed wetlands.
- Students will learn about sustainable transportation options and what they can do at home to be more sustainable.

Presentation outline:

1. The history of Duke Farms
2. Sustainable Technology
   A. What is it?
   B. Why do we do it?
3. LEED Certification
   A. What is it?
   B. LEED Measures
   C. Lessons Learned
4. Sustainable Operations as Duke
   A. Adaptive Reuse
   B. Reclaimed Materials

   C. Solar Technology
   D. Solar Thermal
   E. Geothermal Wells
   F. Radiant Heating
   G. Water Consumption
   H. Rainwater Harvesting
   I. Green Roofs
   J. BioSwales
5. Constructed Wetlands
   A. How they were built
   B. How they function
   C. Components of constructed wetlands
6. Other Sustainable Efforts
   A. Natural lighting
   B. Costs of LED vs. Conventional lighting
7. Building Management System
   A. What is it?
   B. How does it work?
8. Transportation at Duke
   A. Electric Trams
   B. Walking paths
9. What's Next, What can you do at home?

Protection of Public Lands

Topic Statement: One of the biggest threats to native vegetation in the state of New Jersey is excessive deer browse. Public lands throughout the state are under tremendous pressure from large populations of white-tailed deer which have become difficult to manage and as a result, their numbers have continued to swell. Additionally, development of critical lands and multi-use access to public lands have placed pressure on critically sensitive habitats and the flora and fauna that call them home. One method of protecting these fragile habitats is through outright purchase of the land, which serves to protect them from further encroachment. Many organizations throughout the state collaborate with one another in order to maximize their collective efforts and increase efficiency and purchasing power.

Learning Objectives:

- Students will learn about how excessive deer browse is negatively affecting our native forests, while aiding the spread of invasive plants.
- Students will learn some of the means in which invasive species become established.
- Students will understand how historical land uses such as agriculture can impact soils and influence the types of plants that reestablish themselves.
- Students will learn what a floristic quality index is and how it can be used by botanists to determine the resiliency of a forest.
- Students will learn about competing land uses and how various organizations can sometimes have opposing points of view on how best to manage public lands.
- Students will learn about NJCF's role in protecting open space in the Pine Barrens, including work that has been done to protect the habitat of the endangered pine snake, and swamp pink.

Presentation Outline:

1. The impact of over-grazing by white tailed deer on our native forests
   A. Loss of shrub layer
   B. Preferential grazing of native plants over invasives.
   C. Impact of fencing in protecting native plants.
2. Historical land uses and Impacts.
   A. Agricultural soils vs. native forest soils.

3. Floristic Quality Index
   A. What a floristic quality index is.
   B. Why they are done and what they could indicate about potential forest resiliency.

4. Opposing viewpoints on the conservation of public lands
   A. The Sparta Mountain Wildlife Management Area
   B. Weldon Brook WMA
5. Protection of critical habitat in the Pinelands
   A. Radio-tracking pine snakes
   B. Restoring habitat for Swamp Pink
   C. Natural cycles and wildfires in the Pinelands.
   D. Acquiring open space and expanding Franklin Parker Preserve
6. The Wetlands Reserve Program
   A. Restoring wetlands topography and hydrology
   B. Creation of vernal ponds and wetland features
   C. Stream corridor restoration and increased bog copper butterfly habitat
   D. Invasive plant removal and native plantings.

Water Resources and Open Space

Topic Statement: Protecting headwater streams is the single most important strategy for ensuring that the water supplied to drinking water treatment plants is of the highest natural quality. The best method of implementing this strategy is through purchasing parcels of land that include these headwater streams and other sensitive water resource features such as vernal pools, wetlands and prime groundwater recharge areas. Using a unique GIS based assessment methodology; the New Jersey Water Supply Authority is able to target parcels of land for purchase, which contain the highest percentage of sensitive water resources.

This presentation introduces you to online mapping tools, the GIS based evaluation tools and methodologies used by the Authority to prioritize sensitive water resource properties and an overview of how a land acquisition program fits into the larger water supply complex in the Raritan River Watershed.

Learning objectives:

- Students will learn about free GIS programs that are available to them online and how they can use this data to make informed decisions about conservation.
- Students will learn what a minimum passing flow is and how it is regulated.
- Students will learn how preserving open space is more effective overall and a more cost effective means of protecting water quality than mitigating against contamination.
- Students will learn how a critical area assessment can be used to ensure that only the most ideal parcels of land get preserved.
- Students will hear examples of how a water supply authority may choose certain areas of land in order to protect water quality.

Presentation Outline

1) Free GIS programs
   A. Google maps
   B. Google Earth
   C. ArcGIS Explorer
   D. ArcGIS Online
   E. Data Sources

2. New Jersey Water Supply Authority

   A. Who we are/what we do
   B. The water supply system
   C. Minimum passing flow requirements

3. Management Plans

   A. Land Use/Land Cover

B. Cost effectiveness of Preservation vs. Mitigation on water quality.

4. Critical Area Assessments for Open Space Acquisitions

A. Proximity to riparian areas
B. Erodibility of the soil
C. Threatened and endangered critical habitats
D. Forest density
E. Primary groundwater recharge areas
F. Isolated wetlands

5. NJWSA properties and our partners

Ecology, Ecosystems and Invasive Species

Topic Statement: Included in the background discussions of geology, soils and water is the discussion of ecology and ecosystems as one of the basic realms in environmental studies. This discussion, occurring at the current time in New Jersey, invariably leads us to invasive species. This lecture first explains major ecological concepts to provide a broad understanding of how an ecosystem functions. The lecture then proceeds to provide information on the problem of invasive species both in New Jersey and in the nation. Students will understand how invasive species impact our ecosystems, how native flora or fauna are at a disadvantage, the type of habitat that is most hospitable to invasive species, common N.J. invasive terrestrial species and finally what are some common native plants that can be utilized in planting in place of invasive species.

Learning objectives:

- Students will gain an understanding of how the main ecological concepts of
  - Time
  - Catastrophe
  - Succession & climax
  - Energy flow
  - Nutrient flow
  - Niche
  - Specialist & Generalists

  relate to an ecosystem and each other.

- Students will learn global causes of the invasive species problem.
- Students will learn many of the impacts invasive species have on the native flora and/or fauna, including on threatened and endangered species.
- Students will understand some of the common means of access that have allowed invasive species to flourish in N.J., the U.S. and globally. Students will understand what makes a good home for an invasive species (e.g. disturbed habitat).
- Students will learn the origin (%) of N.J. plants currently.
- Students will learn to identify some common terrestrial invasive species in N.J.
- Students will learn planting alternatives to invasive species (i.e. natives) and other homeowner solutions to combat invasive species.
- Students will learn resources for information on invasive species in N.J.

Presentation Outline

1. Overview
2. History of destruction from Invasive species (few examples of those covered)
    a. Chestnut blight
    b. Dutch elm
    c. Emerald Ash borer
    d. West Nile Virus,
3. Ecological Concepts
    a. Time
    b. Catastrophe
    c. Succession and climax
    d. Energy flow
    e. Nutrient flow
    f. Niche
    g. Specialists and generalists

4. Factors that exacerbate the invasive species problem now
    a. Homogenization of world's flora and fauna
    b. Alteration of community/structure, successional processes and ecosystem functions
    c. Decline of native species from a variety of factors
    d. Introduction rate rising
5. Invasion
    a. Impacts on Threatened and Endangered Species
    b. Modes of Entry
    c. What makes a non-native plant invasive
    d. Can a native plant become invasive

6. New Jersey
    a. Origin of plants in New Jersey currently
    b. New Jersey Invasive Species Council

7. Resources and Information
    a. Plant Invaders of Mid-Atlantic Natural Areas
    b. Select profiles of invasive species
    c. Alternative plants to invasive species
    d. Garden and lawn design with natives

Stream Restoration

Topic Statement: This lecture provides a detailed view of the process of stream restoration. Stream restoration is a complicated subject in the environmental field that varies stream by stream. Stream restoration requires putting into place methods and materials that will go beyond conserving into the realm of restoring a moving, sometimes slow and sometimes very fast system to become a well-functioning ecosystem. Stream restoration requires understanding of geomorphology, engineering, stream dynamics and biology and design. This lecture provides a video of a case study that shows how this was done with great success on a New Jersey stream. This lecture also provides students with an ability to understand the impacts to streams that can occur and the process that may need to occur to remedy situations. This lecture also covers watershed management planning and restoration through a case study.

Learning objectives:

- Students will learn about the Program Areas of the North Jersey Resource Conservation and Development (RC&D) and its focus areas
- Students will understand what Stewardship of Open Space entails and how it might be funded
- Students will learn the components of watershed restoration and protection planning.
- Students will begin to learn, through a case study what watershed management, protection and restoration planning encompasses
- Students will learn the goals of watershed restoration
- Students will learn what a Stream Visual Assessment Protocol (SVAP) is and how it can be helpful to an organization
- Students will understand the function of riparian areas
- Students will understand how streambank stabilization projects are implemented and how they contribute to water quality, biological health and reduction in flooding

Presentation Outline

1. Overview
2. What is North Jersey Resource Conservation & Development (RC&D)?
    a. Program Areas
    b. Attributes of areas covered
    c. Partnerships
    d. Community support/Community development
    e. Stewardship of Open Space (S.O.S.)
    f. Water Resource Protection
    g. Watershed Management

3. What are stream restoration project goals (Neshanic River example)
    a. Address channel instability
    b. Address ecological instability
    c. Reconnect stream to flood plain/provide storage for higher flows
    d. Stabilize banks/reduce erosion
    e. Provide habitat
    f. Direct flow away from the bank
    g. Slow down the velocity of flow
    h. Provide grade control/safely transition grades
    i. Must consider the site and watershed conditions and select practices to match your site

4. Stream Visual Assessment Protocol
    a. U.S.D.A. and N.R.C.S. developed and approved
    b. New Jersey revised by Rutgers Cooperative Extension Water Resources Program
    c. Protocol used to assess the health of a stream
    d. Identify pollutant sources
    e. Identify management measures to control pollutant sources
    f. Data assessment by trained volunteers and project partners
    g. How mapping a watershed with SVAP data provides an important overview
    h. How to prioritize SVAP assessment data

5. Riparian areas
    a. What is a riparian area?
    b. 3-zone forest buffer
    c. Example Rutgers Environmental Steward riparian buffer project

6. Walnut Brook Riparian Restoration
    a. Restoring stream corridors in urban areas
    b. 2005 Streambank Stabilization
    c. Understanding the history of the river

d. Why stabilize streambanks?
e. Stabilize versus restore; actual funds versus dream funds
f. Reconnect the floodplain

ANJEC/ Local Actions for Environmental Protection

Topic Statement: State and Federal legislation provide some protective measures for the environment and our natural resources but fall short in critical areas such as groundwater recharge, controlling erosion on steep slopes, and protecting our trees and floodplains to name a few. While all forms of land use effect the environment, they are not all regulated. The Constitution gives authority to regulate land use to the State legislature, which in turn delegated that power to local governments through the Municipal Land Use Law. Important ordinances are thus written and enforced on a local level through Municipal planning boards, zoning boards and environmental commissions in a number of various ways. Understanding more about which type of local government exists in your town, and how the ordinances and legislation they pass can affect the environment and your natural resources is a key component in being an effect environmental steward.

Learning Objectives:

- Students will learn which areas of environmental protection are covered by state and federal law and which areas fall under the supervision of local government.
- Students will learn about how local governments are made up of a hierarchy of governing bodies, and various boards which all play an integral part in determining policies.
- Students will learn how local governments came to have the authority to regulate land use planning and enforce local level ordinances.
- Students will learn the duties and roles of the zoning board, the municipal planning board and the Environmental Commission, and how each plays an important part in affecting land use regulations.
- Students will learn about environmental resource inventories, and what their basic elements consist of, as well as how towns can use this information effectively.
- Students will learn the power of maps, how they can influence decision making.
- Students will learn how a town's master plan, ordinances and zoning can all protect natural resources when state and federal legislation cannot.
- Students will learn about how towns can purchase areas of land through public acquisition and protect it from being developed through planning ordinances.

Presentation Outline:

1. Why local action matters
   A. Areas not protected by state and federal provisions
   B. Partially protected areas
2. Structure of Local Government
   A. The role of the governing body
   B. The role of Municipal Planning Boards
   C. The role of the Zoning Board of Adjustment
   D. The role of the Environmental Commission
3. Environmental Resource Inventory
   A. Basic elements of an ERI
   B. How an ERI can be used

4. The power of maps
   A. Various layers of information
   B. How maps can be manipulated
   C. How maps can provide rapid analysis.
   D. Environmental information in maps
5. Geologic Data and planning
   A. Groundwater hydrology
   B. Impervious cover
   C. Soils
   D. Surface water hydrology
   E. Topography
   F. Steep slopes
6. The Master Plan
   A. What it is, and how it's used
   B. How it can establish goals/ policies to protect natural resources
7. Ordinances and Zoning
   A. How they can protect natural resources
   B. How they can limit growth
   C. How they can affect lot sizing
   D. How they can dictate usable areas
   E. How they can impact site designs
   F. How they can impact individual lots
8. Open Space and Recreational Plans
   A. Definition of open space
   B. Acquisition of public space
   C. Methods of funding public acquisition
   D. Restrictions in use to land purchased through Green Acres
   E. Protection by planning.

Climate/ Weather or Not?

Topic Statement: There may be no more debated topic in the realm of environmental discussion than climate and climate change. This course is the study of the science of climate. It provides participants with the scientific study of climate and weather. The lecture provides both the overall global data and the local New Jersey data. Participants will learn about past and present climate. The causes of climate change, past and present, and the projected future climate with the associated impacts of climate change will be discussed, with management options.

Learning objectives:

- Students will understand that climate is a system. In New Jersey,
    - Various air masses affect N.J.'s climate
    - Local factors affect N.J.'s climate within the state
    - The North Atlantic Oscillation, El Nino and other global systems impact New Jersey's climate
- Students will learn the difference between climate and weather
- Students will learn and have an appreciation of past weather and climate events or episodes
- Students will have an understanding of climate change and how it may be affecting New Jersey's weather
- Students will learn how weather and climate events can severely impact daily life
- Students will learn about key factors causing climate change, including the greenhouse effect
- Students will understand the scientific evidence used to monitor variability and change with the climate system including:
    - Rising global temperatures
    - Rising sea level
    - Shrinking sea ice
    - Shrinking glaciers
    - Shrinking snow cover
- Students will learn about potential environmental and societal impacts of climate change
- Students will earn how they may participate in efforts to mitigate factors contributing to climate change
- Students will better understand where weather and climate changes may be headed within the 21st century
- Students will learn the "perfect storm" scenario of Sandy and also the implications of future devastating storms

Presentation Outline

1. Overview
2. Resources
    a. Data→ Information →Knowledge→Decision
    b. NJclimate.org
    c. NJ weather & Climate network; NJweather.org
    d. Other links,
    e. CoCoRAHS

3. Climate or Weather
    a. Weather factors
    b. Factors in New Jersey weather
    c. Polar vortex
    d. New Jersey climate zones
    e. Latitude
    f. Maritime
    g. Variations and extremes
    h. Temperature departures from average

4. Climate and Weather Past
    a. Glaciers in New Jersey
    b. New Jersey 1888
    c. 1944 Hurricane
    d. 1962 N'or Easter
    e. 1960's Drought
    f. 1999 Floyd
    g. 2011 Irene
    h. October 29, 2011 Snow Storm
    i. October 29, 2012 Sandy

5. Sandy "The Perfect Storm"
    a. Wavy jet stream
    b. Blocking high
    c. Deep trough
    d. Warmer than average sea temperatures
    e. Landfill close to high tide
    f. Astronomical high tide
    g. Higher sea level
    h. Barometric Pressure
    i. Wind gusts
    j. Total precipitation

6. Sandy Human Impacts

7. View of New Jersey
    a. What impacts weather to cause temperature variations?

8. Changes: New Jersey and globally
    a. Changes in Global temperature since 1880
    b. Changes in New Jersey temperature since 1900
    c. Changes in New Jersey winter and summer temperatures
    d. Precipitation annual means in New Jersey
    e. Seasonal snowfall
    f. Seasonal snowfall anomalies globally
    g. Sea ice extent
    h. Ice loss
    i. Sea level Rise in New Jersey

9. Changing climate
    a. Evidence
    b. Greenhouse effect
    c. Radiation absorbing gases
    d. Natural and anthropogenic influences
    e. Surface air temperature and solar energy

10. Climate Future New Jersey
    a. Temperatures
    b. Precipitation
    c. Sea level
    d. Vulnerable sections

Greening the Department of Public Works Yard

Topic Statement: This lecture provides Rutgers Environmental Stewards with information on various types of Green Infrastructure and how implementation at an often overlooked municipally operated Department of Public Works (DPW) yard can provide opportunities for implementation. Interlocking pavers, cisterns, vegetated bioswales, rain gardens and sedimentation chambers are discussed through the case study with maintenance and costs. This lecture enables participants to view their municipal DPW with fresh ideas.

Learning objectives:

- Students will learn how Greening a DPW facility is a different opportunity than a Municipal building or library.
- Students will learn what pervious pavement is, how it functions, what its benefits, limitations, and costs. Students will learn what maintenance is required to keep it functioning properly.
- Students will learn about rainwater harvesting utilizing Cisterns. They will learn the basics of sizing cisterns.
- Students will learn about vegetated swales and what their purpose is for stormwater management.
- Students will learn about sedimentation chambers and how they were they customized in this case study.
- Students will learn about rain gardens. How can they be used in a DPW setting?
- Students will learn how all these assist in helping a DPW yard reduce its impervious footprint.
- Students will learn how working with DPW staff minimize costs

Presentation Outline

1. Overview
2. Case study of Parsippany-Troy Hills Department of Public Works program
    a. Site is approximately 3 acres
    b. Approximate impervious cover is 2.1 acres
    c. Site is adjacent to the Troy Brook
3. Municipal environmental projects
    a. Grant requirements
    b. Acquiring volunteers

4. Troy Brook Regional Stormwater Plan
    a. Modeling
    b. Monitoring
    c. Field visits
    d. Stakeholder input
    e. DPW
5. The DPW yard
    a. Challenges
    b. Impervious surfaces
    c. Amount of impervious surface at case study
    d. Benefits to environment
6. Interlocking Pavers
    a. Emergency access road
    b. What are interlocking pavers
    c. Installation
    d. Benefits to environment
    e. Maintenance
    f. Costs
7. Vegetated Bioswale
    a. What is a bioswale?
    b. How much of area drains to the bioswale?
    c. Phytoremediation
    d. Jute fabric
    e. Grasses
    f. Check dams
    g. DP
    h. DPW staff as partners
    i. Entrance to the swale
    j. The berm
    k. Rock apron
    l. Partnerships
    m. Maintenance
    n. Costs

8. Cistern
    a. What is a cistern?
    b. What is the purpose of the diverter?
    c. How does a cistern disconnect impervious surfaces?
    d. Maintenance
    e. Costs

9. Sedimentation Chambers
    a. Entrance to the bioswale
    b. What is a sedimentation chamber?
    c. Opportunities working at and with the DPW
    d. Installation
    e. Maintenance
    f. Costs

10. Opportunities
    a. Reduced costs for installation
    b. Potential for reduced costs for materials
    c. Create a trained cadre of Municipal Workers
    d. Environmental benefit accomplished on an often overlooked municipal property
    e. Sense of accomplishment for DPW workers
    f. If volunteers join in help to create sense of community between DPW and community
    g. Pollutant load reductions for Total Suspended Sediment, Total Phosphorus and Total Nitrogen
    h. Reduction in runoff

11. The Borough of Mtn. Lakes DPW
    a. Located within the Troy Brook watershed
    b. Drainage at the DPW site
    c. What is a rain garden?
    d. Amount of roof runoff captured
    e. Partnership with the Mtn. Lakes DPW and the Garden Club
    f. Maintenance
    g. Costs

12. Building a rain garden
    a. Percolation tests

b. Site selection
c. Determining slope
d. Drainage calculations
e. Parts of a rain garden
f. NJ One Call
g. Rain garden sizing
h. Depth of rain garden
i. Guide to amount of amendments
j. Guide to amount of plants
k. Guide to amount of mulch
l. Plants
m. Rain Garden Manual of New Jersey

Environmental Chemistry

Topic Statement: A substance or condition that contaminates air, water or soil is considered a pollutant. Pollutants can be artificial, manmade substances or naturally-occurring substances that are in concentrations that make them a concern in the environment. Understanding the source of these substances requires an understanding of: how the environment chemically functions under "normal" or uncontaminated conditions; the source of the chemical of interest; pollutant transport; how the chemical changes during that transport; the rate of these changes; and how long the chemical remains in the specific environmental medium (lifetime). This lecture provides the basic knowledge to understand the chemical reactions that occur during pollutant transport with a focus on atmospheric chemistry.

Learning objectives:

- Students will learn about the three environmental reservoirs, their relative sizes, and the relative speed of mixing.
- Students will learn the differences between primary and secondary pollution and why that difference is important.
- Students will learn about the greenhouse gas effect, acid rain, and holes in the ozone layer.
- Students will learn about the fate and transport of pollutants in the environment and which mechanisms are most important in moving between environmental reservoirs.
- Students will learn the difference between bioaccumulation and biomagnification.

Presentation Outline

1. Overview
2. What is environmental chemistry?
    a. Chemical and biochemical reactions
    b. Sources, reactions, transport, effects and fates of chemical species in air, soil and water
3. Interdisciplinary
    a. First understand how uncontaminated environment works
    b. Anthropogenic inputs
    c. New chemicals
    d. Natural chemicals with changes in concentrations
4. Atmosphere
    a. Smallest of Earth's geologic reservoirs
    b. Mixing happens rapidly compared to soil or ocean
    c. Contamination spreads quickly

5. Composition of Atmosphere
6. Residence times
    a. Lifetime of gas before it breaks down or reacts
    b. Can be used to predict accumulation of pollutants in atmosphere
    c. Persistent versus short-lived contaminants
7. Primary versus secondary pollution
    a. Primary pollution – London smog
    b. Secondary pollution – Los Angeles smog
8. Ozone
    a. Ground level ozone
    b. Ozone in the stratosphere
    c. Ban on CFCs
    d. Hole in ozone layer
9. Atmospheric Deposition
    a. Dry deposition
    b. Wet deposition
    c. Contaminants of concern
    d. Mercury
    e. Lead
    f. Polychlorinated biphenyls (PCBs)
    g. Polycyclic aromatic hydrocarbons (PAHs)
    h. Pesticides
10. Acid Rain
    a. What is acid rain?
    b. What damage does acid rain cause?
    c. How is acid rain formed?
11. Greenhouse gases and effects
    a. Which gases are “greenhouse gases”?
    b. What are the effects of greenhouse gases?
12. Hydrosphere
    a. How much freshwater is there on Earth?
    b. How quickly do contaminants mix in the ocean?
    c. Water cycle
    d. Sources of N.J. water
13. What are the sources of surface water pollution?
    a. Non-point source pollution
    b. Point source pollution
    c. Stormwater runoff
    d. What are the pollutants found in stormwater runoff?
    e. What are the impacts of stormwater runoff?
14. What are the sources of groundwater pollution?
    a. Sources
    b. Ground water contaminant plumes
15. What are the phases of water pollution?

   a. Dissolved phase
   b. Particle phase
   c. Colloidal phase
16. What is the fate and transport of water pollution?
   a. Fate and transport
   b. Bioaccumulation
   c. Biomagnification
   d. Properties of pollutants that biomagnify
17. How does contamination spread in the Earth's crust?
18. What are the percentages of major elements in the Earth's crust?

Impervious Cover and Green Infrastructure

Topic Statement: Pervious and impervious are terms that are used to describe the ability or inability of water to flow through a surface, respectively. When rain water hits a surface it can soak into the surface or flow off the surface. Pervious surfaces are those surfaces which allow stormwater to readily soak into the surface and recharge groundwater. When rain drains from a surface, it is called stormwater runoff. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the volume of stormwater runoff. New Jersey is one of the most developed states in the country with 12.1% of its total area assessed as impervious cover and many of these surfaces drain directly to our waterbodies. The majority of water quality and much of the water quantity concerns in New Jersey now are a result of the impacts of increased impervious surfaces draining to our streams, rivers and lakes. Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. This lecture will provide understanding of impervious cover and how to assess the amount of impervious area in a town. The class will cover conceptually the various methods of green infrastructure implementation.

Learning objectives:

- Students will learn what storm water runoff is and how it increases with increasing impervious surfaces
- Students will understand how the hydrologic cycle changes under an urban /suburban regime
- Students will learn the two categories of pollution sources: point and non-point sources
- Students will learn the impacts of non-point source pollution
- Students will learn what green Infrastructure is and how it reduces the impacts from impervious surfaces
- Students will learn, conceptually, how to assess a township and develop an Impervious Cover Assessment Reduction Plan

Presentation Outline

1. Overview

2. Watersheds
    a. Hydrologic cycle
    b. Precipitation and: photosynthesis; percolation; evaporation; runoff
    c. Development and stormwater runoff

3. Urban Hydrologic Cycle
    a. Combined Sewer overflows (CSOs)
    b. Water pollution sources
    c. Point sources: specific source, regulated, monitored, permit
    d. Nonpoint Source Pollution; stormwater runoff, cannot be traced back to source, collects pollutants
    e. Examples of non-point sources
    f. Impacts of non-point sources

4. History of Stormwater Management
    a. Up through the 1970's
    b. Mid-1970's- 2004
    c. Post 2004 - new stormwater rules

5. Controlling runoff from impervious surfaces
    a. What is Green Infrastructure
    b. Types of Green Infrastructure
    c. Pervious pavement
    d. Disconnection
    e. Rain gardens
    f. Examples of Green Infrastructure
    g. Examples of programs

6. Impervious Cover assessments
    a. Desktop
    b. Site visit
    c. Photos
    d. Narratives
    e. Recommendations
    f. Funding sources
    g. Partners
    h. Load Reductions

i. How to utilize the plan
j. Plans online
k. Example
l. Resources

Environmental Property Rights

Topic Statement: Clearly defined private property rights are an essential means of regulating and protecting environmental resources. Property rights help to conserve natural resources by providing a more accurate resource price allocation signal to users of those resources. These signals help society to allocate scare resources in order to best satisfy human needs. However, when property rights are vague or unclear, it can often lead to resource degradation, abuse and ultimately those undefined public resources can become receptacles for pollution. This concept has been coined the "tragedy of the commons" by Garrett Hardin, which referred to the practice of village settlers collectively allowing their cattle to graze in the common area of town, which in turn lead to the depletion of the grassland in the absence of a clearly defined private property owner to care for it and preserve its value. The argument can be made that those who do not own the resources they are exploiting often place little or no value on the resource and conversely, it is often in their best economic interest to exploit that resource before anyone else has the opportunity. This lecture will explore several case studies in which private property rights laws have protected vulnerable resources as well as several examples of where society fallen victim to the lack of protections afforded by clearly defined private property rights laws.

Learning Objectives:

- Students will learn how private property rights can produce a cleaner and safer environment, conserve natural resources, and produce a more tolerant and prosperous society, while protecting human freedoms.
- Students will learn how environmental issues were once settled through legal property rights disputes and how this was often more effective at protecting scarce resources by giving the government a role of protecting those resources.
- Students will learn how private property rights can protect ordinary citizens from governmental abuse resulting from, "partial takings," and the Public Interest Doctrine
- Students will learn what fugitive resources are and how scare natural resources can become receptacles for pollution when private property rights are unclear or not clearly defined.
- Students will learn how private property rights laws are a mechanism for determining how power is meted out within a societal framework.
- Students will learn some of the consequences which can occur when private property rights are not protected under law.
- Students will learn about four different social theories which explain the relationship between government regulations of the environment and property rights.

Presentation Outline:

1. Exploring the essential role of PPR
    A. Role of PPR on the environment
    B. Role of PPR on conserving natural resources
    C. Role of PPR on society
    D. Role of PPR on protecting human freedoms

2. PPR from an agriculturalist perspective
   A. Case studies and examples
   B. Analyzing PPR from a non-legal perspective
3. Tensions between governmental protection of resources vs. PPR
   A. Common law vs Statutory Law and regulation
   B. Governmental law and fugitive resources
   C. Types of govt. environmental PPR regulation
   D. Public Interest Doctrine
   E. Ordinary people vs special interests and government
4. Private Property Rights and Fugitive Resources
   A. Parable of the whale
   B. Buffalo vs. Dairy Cattle
   C. Dairy Farm vs. Paper Mill
   D. "Tragedy of the Commons"
   E. Perceived value of resources with and without PPR
5. Why PPR is necessary
   A. Meting out power within a society
   B. Existing case studies
   C. Pending NJ Acts in the State Legislature
6. Outcomes when PPR is not protected
   A. Lack of economic efficiency
   B. Failure to preserve natural resources
   C. Lack of adequate protection for safety
   D. Freedoms and the environment suffer
   E. Decrease in societal tolerance
   F. Governmental abuses of power and oversight
7. Defining property rights
   A. The three D's of PPR
   B. PPR as an institutional relationship
8. Managing the world's property
   A. Two paths to take
9. The Big Tension
   A. Partial environmental regulatory takings
   B. Downzoning and PPR
   C. Coercion and abuses
10. Richness in resources or Property Rights?
    A. Prosperity of nations
    B. Freedom: toleration of different cultures
    C. Tolerating individual freedoms
11. Moral and Genetic Basis for PPR
    A. Biblical
    B. Childhood
    C. Poetry
    D. Agriculture

   E. Native Americans
12. Summary: Why PPR Matters
   A. Tolerance of others
   B. Conservation of scare resources
   C. Protection of freedoms and prosperity.
13. Non-renewable vs renewable resources &PPR
   A. Speed of depletion
   B. Ownership of Non-renewable resources
   C. Undistorted price signals
14. Fugitive resources
   A. What they are
   B. How they are frequently degraded, polluted and depleted
   C. Role of the Government
   D. Right to farm conflicts
   E. Economic externalities
   F. Community resource vs right to farm
15. Four social theories of Environmental PR Regulations
   A. Public Interest Theory
   B. Capture Theory
   C. Economic or Special interest theory
   D. Baptist and Bootleggers theory
16. Take away concepts
   A. Which Way out?
   B. PPR as a heady topic

Camden Initiative: Urban Restoration

Topic Statement: Our urban centers have experienced much of the environmental degradation of the past century. During the suburbanization of New Jersey much of the base of the cities was lost, in terms of people, jobs and functioning social systems. The impact of that was greater environmental degradation. Many of these areas have come to be known as "Environmental Justice" areas; areas with a disproportional amount of environmental problems, typically placed in areas where the inhabitants are poor and often people of color. This class discusses the problems in these cities, the progress being made in many of these cities, the partnerships formed and the outlook. The demographics are changing in New Jersey, our cities are gaining population. This leads to further discussion regarding infrastructure and funding. Predominately this class is about partnerships and how far good partnerships can take you in changing the world.

Learning objectives:

- Students will learn about suburban sprawl. What does it mean? What does it equate to?
- Students will understand that Suburban Sprawl has peaked in New Jersey and the evidence that supports that statement
- Students will learn what a Brownfield is and the extent of Brownfields both nationally and in New Jersey
- How is the redevelopment of Brownfields an environmentally friendly practice?
- Students will understand that a city's economic and social history play a major role in its environmental story
- Students will recognize the role of partnerships and collaborations in environmental work, especially in urban areas
- Students will understand the major undertakings that urban restoration may be, and the possibilities and outcomes that can be achieved through case studies of several Camden projects

Presentation Outline

1. Overview
2. The health of our environment, economy and society are linked
    a. Water use/reuse
    b. Land use/reuse
    c. Healthy and available foods
    d. Energy with minimal carbon emissions

3. Unsustainable development of 20th century
    a. Suburban sprawl
    b. North Camden loses 50% of population
    c. Camden loses 1/3 of population
    d. What are the symptoms of sprawl?
    e. End of Sprawl?
    f. What are the signs of the end of sprawl?
    g. Where are they going?

4. Brownfields
    a. Definition of a Brownfield site
    b. Number of Brownfield sites in U.S. and in N.J.
    c. Who wants to live on a Brownfield site?
    d. How does utilizing Brownfields promote sustainability?

5. Camden – what is its history and how does that play into its environmental story?
    a. Waterfront -Led growth; led decline
    b. Infrastructure
    c. Stormwater runoff
    d. CSO's

6. Camden Partnerships
    a. Camden SMART initiative (Stormwater Management and Resource Training)
    b. Partners Camden SMART: City of Camden; Cooper's Ferry Partnership; Camden County Municipal Utilities Authority; Rutgers Cooperative Extension, Water Resources Program; NJ Tree Foundation; N.J. Department of Environmental Protection
    c. Camden SMART came up with Community Based Green Infrastructure for the City of Camden
    d. Camden SMART projects > 55 million gallons of stormwater captured annually
    e. Urban Waters Federal Partnership Delaware River Watershed

7. Understanding Urban Restoration through Camden Case Studies
    a. Waterfront South Rain Gardens
    b. Cramer Hill
    c. Harrison Ave. Landfill
    d. Phoenix Park
    e. Baldwin's Run and Von Nieda Park Restoration

8. Why Collaboration is critical in our cities
9. What will our future coastline cities look like?

Intern Project Development and Impact Evaluation

Topic Statement: This lecture provides an introduction to developing an internship project and the planning process that will assist in developing a completed project that has objectives and outcomes that are tangible and can be quantified or shown to have impact. Learning how to plan out a project in a thoughtful method, whether for this internship or in other arenas, is a tool that can lead to meaningful programs and projects. Often the difference between what is seen as a highly successful project or a project that receives a tepid review is the planning that occurred prior to implementation. Learning what this planning entails is a valuable tool.

Learning objectives:

- Students will learn how to develop project goals and SMART objectives
- Students will understand project/program development
- Students will understand different evaluation levels and methods that can be used
- Students will learn necessary steps for successful program evaluation

Presentation Outline

1. Overview
2. What are Goals and Objectives?
    a. Attributes of objectives
    b. SMART objectives
    c. Steps for developing SMART objectives
3. Logic Model
    a. Inputs
    b. Outputs
    c. Outcomes/Impact
    d. Places where evaluation can occur
4. Bennett's Hierarchy
    a. Inputs
    b. Activities
    c. People Involvement
    d. Reactions
    e. KASA Change
    f. Practice change
    g. End Results
    h. Evidence of outcomes is stronger as you go up the hierarchy
    i. Evidence is strengthened by showing evidence at several levels of the hierarchy

5. 10 EASY steps to Impact Evaluation
    a. Make the commitment
    b. Define the objectives of the program
    c. Set up the appropriate mechanisms
    d. Alert clientele of your intentions
    e. Determine which short-term outcomes or impacts will be measured
    f. Determine which medium-term outcomes or impacts will be measured
    g. Evaluate short and medium-term outcomes/impacts
    h. Record, analyze and interpret results
    i. Make Mid-stream corrections
    j. Report the impact of your program

Understanding Your Conflict Resolution Style

Topic Statement: Conflicts arise in our daily lives and are unavoidable, in the workplace, in the field or at home, we must strive to deal with conflicts in a positive and constructive manner. Understanding the various behavioral responses to conflicts, and gaining valuable insight into our own conflict resolution strategies is one means of addressing these issues. By understanding both active and passive responses to conflict and recognizing both the pros and cons of each style of coping with conflict stewards will be able to develop and apply new methods for handing conflicting opinions and circumstances. This lecture will provide increased personal awareness about our own coping methods and will provide the tools necessary to manage conflicts as they arise in order to be able to constructively handle these situations.

Learning Objectives:

- Students will identify specific constructive and destructive behavioral responses to conflict.
- Students will understand the difference between active and passive responses to conflict.
- Students will become more aware of conflict styles and recognize the best uses of each style.
- Students will gain insight about their own response to conflict and apply new strategies for resolving conflict.

Presentation Outline:

1. Viewing Conflict
   A. Dealing with Conflict
   B. Working in Groups
   C. Type of leadership
2. Understanding Conflict
   A. What is it / what causes it?
   B. Positive and negative effects of conflict
   C. Your approach to conflict
   D. Healthy and Unhealthy responses
3. Conflict resolution theory
   A. Competing
   B. Collaborating
   C. Compromising
   D. Avoiding
   E. Accommodating
4. Self-Assessment
   A. How do you approach conflict

   B. Case Scenarios
5. Key steps to resolving conflict
   A. Setting the scene
   B. Gathering information
   C. Agreeing on the problem
   D. Brainstorming possible solutions
   E. Negotiating a solution
6. Stress and Emotions
   A. Role of stress in inhibiting conflict resolution
   B. How to identify if you are stressed
   C. Emotional awareness
7. Conflict resolution tips and advice
   A. Keeping Calm
   B. Top 5 Tips

Methods for Water Quality Sampling

Topic Statement: Rivers, streams and bodies of water throughout the state of New Jersey are the lifeblood of a thriving ecosystem**.** Clean healthy water is essential to the survival of all forms of life on the planet and it is continuously threatened by land use decisions that we as a society make every day. Understanding the methodology and tools that are used by field professionals to collect stream data, and the ability to interpret that data, is one of the first steps in becoming a concerned citizen scientist and an informed member of society. This lecture aims to inform stewards how the Department of Environmental Protection collects field data, analyzes it, and makes informed policy decisions based on the findings. Stewards will also gain an understanding of where they can access this data online and how to interpret the data in order to make well informed decisions for themselves.

Learning Objectives:

- Students will learn about the tools and methodology that are used by NJDEP professionals to gather and interpret data from the field
- Students will learn which parameters NJDEP staff assess in order to determine the relative health of the water bodies throughout the state.
- Students will learn why these parameters are important measures of stream health and how they can affect aquatic communities
- Students will learn where they can access and analyze data online that has been collected by the NJDEP and by citizen scientists.

Presentation Outline:

1. Introduction to water quality sampling
    A. Why do we sample?
    B. How do we use the data we collect?
    C. Reporting and Data Entry
    D. Policy Decisions
    E. How you can help by volunteering

2. Parameters of water quality sampling
    A. Temperature
    B. Dissolved Oxygen
    C. Turbidity
    D. Nitrates
    E. Phosphates
    F. pH
    G. Conductivity

3. Threats to clean water ways
   A. Land use decisions
   B. Point and non-point pollution
   C. Erosion
   D. Chlorides
   E. Thermal Pollution
   F. Optical Brighteners

4. Field Sampling
   A. Tools of the trade
   B. Calibration of tools
   C. Safety
   D. Sampling techniques and procedures
   E. Importance of established QA/QP

Rutgers Environmental Steward Program

Field Trips

Volume 4 Issue 2 **Green Knight newsletter** May 2013

Environmental Stewards Trip to Bowman's Hill Wildflower Preserve

Pat Rector, Environmental and Resource Management Agent, Morris and Somerset Counties

The Environmental Stewards Class of 2013 had their class field trip on Wednesday April 24, 2013 to Bowman's Hill Wildflower Preserve (BHWP) in New Hope, PA.

The BHWP was set aside in October 1934 under a gift from the Washington Crossing Park Commission as 100 acres (currently totals 134 acres). Through the years the Preserve has become "acknowledged as the State Wildflower Preserve of Pennsylvania" (http://www.bhwp.org/about/Mission-and-History.htm).

Fig. 1. The Plant Stewardship Index was explained by Jared Rosenbaum (not seen in photo). Bruce Barbour, Rutgers Cooperative Extension and Environmental Steward Coordinator is seen speaking to Irene Sabin, Environmental Steward Alumi and Coordinator of the Alumi website. Photo Pat Rector, 2013

The Preserve is home to approximately 800 species of native plants and during the course of a year over 100 species of birds can be seen.

A two hour lecture was provided (Fig. 1) by Jared Rosenbaum on the Plant Stewardship Index (PSI), a quantitative measure to assist in comparing sites for restoration based on native plants and invasive species on the site. The index is available on-line and Jared Rosenbaum can assist with specific questions regarding setting up a design for using the program. According to the Floristic Quality Assessment Program:

> The Index is based on two tenets:
>
> 1) Plants differ in their tolerance to disturbance and disturbance types.
>
> 2) Native plant species exhibit varying degrees of fidelity to particular native habitats. Further information about the Plant Stewardship Index can be found at http://www.bhwp.org/psi/PSI-User-s-Guide-and-References.htm .

Fig. 2. MaryAnnn, one of the two volunteer naturalists who led the guided walking tours stops to show and explain botany, ecology and native plant lore along the way. Photo Pat Rector, 2013

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Environmental Stewards... continued

(Continued from page 6)

Following a BYO lunch outside on a beautiful day the class was led on a two hour tour on a guided wildflower walk (Fig. 2). While allowing the area to grow naturally, the area has also been planted with native plant species for 70 years, and due to the accurate record keeping the area is considered a botanical institution. The area has been fenced to keep it deer-free (although there may be a few that have managed to get in recently) and this has been critical in maintaining the native species. Virginia bluebells abounded in meadows (Fig. 3, 4) and a bloodroot was still in bloom (Fig. 5) along with spring beauties (Fig. 6). Along the Marigold Trail skunk cabbages had lost their flowers but were in the apparent "cabbage" look, and marigolds bloomed beautifully along the stream (Fig. 7).

The annual Bowman's Native Plant sale begins Sunday May 5th at 11am – 4pm. http://www.bhwp.org/calendar.htm , with a selection of over 200 species of native plants, trees, and shrubs.

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Fig. 4. Virginia bluebell bloom in wooded meadow at Bowman's Hill Wildflower Preserve. Photo Pat Rector, 2013.

Fig. 3. Virginia bluebell.

Fig. 5. Last bloodroot of the season. The diagnostic leaves of the bloodroot plant are visible. Photo Pat Rector, 2013.

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Environmental Stewards... continued

Fig. 6. Spring beauty, a delicate native plant are often only visible to the observant hiker or pollinators. Photo Pat Rector, 2013.

Fig. 7. Skunk cabbage and marsh marigolds. Photo Pat Rector, 2013.

Fig. 8. Environmental Stewards Class of 2013, Dukes Farm and Atlantic County Utilities Authority Students. Photo Pat Rector, 2013.

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Volume 5 Issue 2 **Green Knight newsletter** May 2014

If We Can Save the Pine Snake We Can Save the Pinelands

Pat Rector, Rutgers Environmental and Resource Management Agent, Rutgers Cooperative Extension

Emile DeVito, Ph.D. Manager of Science & Stewardship at New Jersey Conservation Foundation graciously gave of his time on Sunday April 27th to give the Rutgers Environmental Stewards from all five classes an educational tour of the Franklin Parker Preserve in the heart of the Pinelands. His knowledge of the area and its history provided a lesson that managed to be both vast and intimate.

Franklin Parker Preserve is 9,770 acres in Woodland Township, Burlington County and is New Jersey Conservation Foundation's largest property. The property was formerly a cranberry farm and has since been restored to be a wetland. (http://www.njconservation.org/franklinparkerpreserv.htm). The wetland restoration was extensive and won the Governor's Environmental Excellence Award.

The Franklin Parker Preserve is home to threatened and rare species including the bobcat, bald eagle, Barred Owl, Pine Barrens Tree Frog and the Northern Pine Snake. Emile said "If we can long-term save the Northern Pine Snake, we can save the Pinelands." The Northern Pine Snake is threatened by habitat loss in other areas and by poaching. Poaching because it is a docile snake that makes a great pet, and is often sold as a pet in places as close as Pennsylvania. Although we were able to see a Northern

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Emile (center with cap) talks to the Rutgers Environmental Stewards Class of 2014.

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Pinelands... continued

(Continued from page 9)

Pine Snake (*Pituophis melanoleucus*) we were asked not to post our picture anywhere that it might be seen because poachers can use that picture to find, trap and remove the snakes. Emile feels if we can maintain habitat for the pine snake and protect them, then we will have done what was necessary to save the Pinelands.

Emile explains the purchase of the Franklin Parker Preserve to the Rutgers Environmental Stewards. Photo Courtesy Pat Rector.

RUTGERS New Jersey Agricultural Experiment Station

Rutgers Environmental Steward Program

Internship

RUTGERS
New Jersey Agricultural Experiment Station

Bruce Barbour
Cooperative Extension of Warren County
Administration Building
165 County Route 519 South
Belvidere, NJ 07823-1949

908-475-6505
Fax: 908-475-6514

Rutgers Environmental Steward Intern Project Proposal Form

Project Criteria:

1. Must be environmentally related
2. Should require approximately 60 hours to complete with more optional upon mutual assent of volunteer, host and RCE.
3. Task should match volunteer's skill and ability and personal interests to assure satisfaction and effectiveness.
4. Outcome must be measurable and quantifiable.
5. Outcome must produce benefits beyond personal well being.
6. Beneficiary (host) must agree to provide appropriate support, guidance and written evaluation in a timely fashion

Volunteer Info (Leave blank unless this position is being proposed by an Environmental Steward Intern):

Name: _____

Address: _____

_____

Phone: _____ E-mail: _____

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Host Agency Info:

Name:

Address:

Phone:

Supervisor Name:

E-mail of supervisor:

Nature of Host Agency (circle): Private Enterprise, Non-profit, Government

Add more pages as necessary for the items that follow:

Project Description: Please include anticipated outcomes or accomplishments and who benefits.

Nature of anticipated impact (circle all that apply): Social, Economic, Environmental

Evaluation Plan:

Learning Objectives in plan (If any):