INTEGRATING MODELS OF CITIZENS PERCEPTIONS, METAL CONTAMINANTS, AND WETLANDS RESTORATION IN AN URBANIZING WATERSHED

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Our research, funded by the USEPA through a STAR (Science to Achieve Results) grant, combines metal uptake in wetland plants, education of citizens and public officials in wetland values and function, with measurement of the education's effectiveness. The research has begun to provide information of substantial value in protecting wetlands in central New Jersey. That part of the research carried out by Dr. Jaffé and his students at Princeton aims to obtain a mechanistically-based understanding of the dynamics of trace metals in wetland sediments. Mobility of trace metals in wetland sediment is controlled by the vertical redox profile that develops in these sediments. This profiles determined by the transport of different electron acceptors into the sediments via diffusion and advection and for oxygen also the transport through the roots of wetland plants. Our overall goal is to use the scientific information from our research to increase public understanding and support for the vital role wetlands play in the integrity of watersheds, and to use scientific insights from the modeling and research in education of local officials whose decisions impact protection of wetlands. Characterization of Beden Brook and Rocky Brook sub-watersheds has provided valuable information to citizen groups in efforts to oppose wetlands loss from development. For example, citizens in Montgomery Township were able to persuade their Planning Commission to require a reevaluation of a major roadway extension through wetlands of exceptional quality. The Stony Brook-Millstone Watershed Association has been instrumental in the formation of two organizations that are additional vehicles for dissemination of information from our research. One, the Natural Lands Network includes municipal officials, citizens' groups and non-profit representatives from our region, and the other, The Watershed Institute, community-based watershed associations throughout the State, many who have been recently organized and thus can profit from the experience and resources of our Association. Evidence of increased environmental consciousness of citizens and public officials in our area include the results our social science surveys, conducted as part of the research, which show an overwhelming support for wetlands protection.

AN NGO AND THE USDA- NRCS WETLAND RESERVE PROGRAM COLLABORATE TO ESTABLISH AN ENVIRONMENTAL EDUCATION FACILITY IN RURAL SOUTHWESTERN NEW YORK

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Take a derelict 1200 home site, 1100-acre resort with 25 years of health issues, poaching, timber theft, and environmental abuses. Utilize new: leadership, volunteers, vision and stewardship, the permanent protection and funding offered by the USDA-NRCS Wetland Reserve Program and you have a national model for education, conservation, economic development and preservation. By employing a conservation easement under the Wetland Reserve Program (WRP) the emergent wetlands, upland habitat and the over 200 varieties of birds that call this area home will be protected in perpetuity. This stewardship, restoration and conservation program created the framework for a wide range of programs that lead to the establishment the James A. Zaepfel Nature Sanctuary and Research Center. We will discuss how the project came to fruition, the hurtles and problems encountered as well as the steps required for other NGOs to replicate our program.

550 acres of the original 1,100 acres have been placed in the USDA-NRCS Wetland Reserve program. This site will forever be preserved as a wetland ecosystem. As a direct result of this strategy, several volunteer field biologists and ornithologists have committed their professional time and expertise to the facility. The Center is in the process of developing wetland ecology education programs for students of all ages, an 80 acre wetland enhancement project is underway, there are several active scientific research projects ongoing on the property and wildlife habitat improvement activities have been implemented and more are planned for the future. Cornell University Agro-forestry School has established a test site for a new variety of Sugar Maples. A portion of the property has been accepted into the Wildlife Habitat Improvement Program (WHIP) and will be seeded in the spring of 2003. The first hiking and biking trails have been established with a 5 mile system to be completed in 2002. This system will tie into the Bicentennial Bike Trail, New York State Snowmobile Corridor #3, the new 12 mile Rails-to-Trails, the North Country Scenic Trail and the Finger Lakes Trail. In addition the first year of the Monitoring Avian Productivity Survivability (MAPS) Program has been conducted. This has been coupled with training programs for Graduate Students from SUNY @ Fredonia.

EDUCATING THE PUBLIC ABOUT WETLANDS

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Scientists often overlook one of the most practical steps of a research project; how to convey the information gathered through the project to the public. Being successful at educating the public about your research is not difficult, but requires foresight and planning on the researchers' part. Some practical guidelines to accomplishing this are: choosing your target audience, finding out what they already know about the issue, creating an outreach program that speaks to them on their level of comprehension, and evaluating your efforts. With our project, our intention is to educate three groups of people: municipal politicians, teachers and the general public. We conducted a survey of the governing bodies of26 municipalities as well as a sample of the general public within the same municipalities. We then used the data gathered from the survey to identify gaps in local knowledge of wetlands. Our Education program was cultivated from that knowledge; filling in the gaps and clearing up the major misconceptions that we identified. An evaluation of our efforts will be conducted in the coming year.

THE LILLY ARBOR PROJECT: AN EXPERIMENT IN URBAN RIPARIAN RESTORATION

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The Lilly ARBOR Project is an experimental riparian restoration project along the White River in downtown Indianapolis, IN. The site was created to be both a research and education site a) for long-term study of floodplain and riparian restoration strategies, b) to evaluate restoration procedures currently utilized by restoration managers, and c) to monitor the long-term growth and development of an urban riparian forest and its function.

The site is undergoing ecological restoration through the reforestation of 8 acres of the riparian corridor along a 1 km river reach utilizing 12 species of native trees. This ecological reforestation project completes a key component of a conservation corridor through Marion County, Indiana.

The experiment in riparian restoration is designed to test the relative success of three different reforestation strategies: a) containerized stock; b) bare root whips; and c) bare root whips with some weed control strategies. 1330 trees have been planted with 2 acres planted in each style. 2 additional acres were not planted and serve as control plots. After 1 year of growth, there is no statistical difference in tree survival based on planting style. Important differences in survivorship are apparent between different species with Black Willow, Cottonwood, Sycamore, and Ohio Buckeye suffering significantly higher mortality than all other trees regardless of planting style. Species specific differences in growth rate are evident for all three planting styles.

Monitoring is ongoing for ecosystem function including population and site usage studies for reptiles, amphibians, butterflies, dragonflies, and birds. Vegetation monitoring includes seed bank studies, the relationship between native and exotic herbaceous vegetation, and natural recruitment, among others. October 2002 will mark the second year of growth and monitoring at the site and will provide important comparative data.

LANDOWNER FRIENDLY HABITAT RESTORATION- BUILD IT AND THEY WILL COME

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The U.S. Fish and Wildlife Service's *Coastal* and *Partners for Fish and Wildlife* (PFW) Programs and the Natural Resource Conservation Service's Wildlife Habitat Incentive Program (WHIP), Wetland Reserve Program (WRP), and Conservation Reserve Program (CRP) provide pro-active, voluntary habitat restoration programs that brings numerous partners and cooperators together to share and accomplish a common goal of improved fish and wildlife habitat in the most densely populated State in the Nation.

These programs working individually or together restore and enhance estuarine and palustrine wetlands throughout New Jersey. In addition, a variety of riparian habitat is restored through streambank revegetation and fencing. These programs while administratively different share a common goal of delivering cost-effective, on-the-ground, proactive, partner-building results that benefit a variety of fish and wildlife resources including federally listed species. In addition these programs are widely supported by a variety of constituent groups.

Since 1991, the *Coastal* and PFW Programs have implemented restoration on approximately 4,634 acres of wetlands, 560 acres of uplands, 18.3 miles of riparian habitat, and restored 20 miles of fish passage. In addition the Coastal Program provides technical assistance to improve acquisition of lands at targeted ecosystems and watersheds. The programs work in concert with, but do not duplicate, existing habitat restoration programs by other federal and State agencies and non-governmental organizations. The programs currently restore approximately 550 acres of wetlands, 200 acres of uplands, 6 miles of riparian, and 5 miles of fish passage or instream habitat annually. In 2001, these programs leveraged a 90 percent cost-share for the projects accomplished making the program very cost-effective.

Since 1995 WRP has been used to restore wetlands on about 500 acres of former agricultural land in New Jersey. Restoration sites include estuarine wetlands on former salt hay farms, and palustrine emergent, scrub/shrub and forested wetlands on blueberry farms, grain farms, vegetable farms and pasture and hay operations throughout New Jersey. Permanent easements have been purchased on about 350 acres with the remaining acreage in 10-year agreements.
The WHIP program, begun in 1998, focuses on several upland and wetland priority species or habitats. Over 175 agreements with landowners are in place for 5-10 year plans to create, enhance and maintain targeted wildlife habitats, mainly on private lands. Wetland habitats include those for the federally threatened bog turtle (*Clemmys muhlenbergii*). About 20 bog turtle sites have received funding for control of woody vegetation, livestock fencing, prescribed grazing, invasive exotic vegetation management (including biological control of purple loosestrife) and water quality protection. The CRP program has been implemented in New Jersey since 1985 and began mainly as an erosion control program but has evolved into a valuable wildlife habitat and wetland protection program.

BOTTOMLAND HARDWOOD WETLAND/STREAM RESTORATION – 2 CASE STUDIES IN NORTH CAROLINA

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In Spring 2002, Marsh Resources Inc. (MRI) completed construction on two bottomland hardwood restoration sites in North Carolina to be used for mitigation for the NC Department of Transportation (NCDOT). These sites were the Pott Creek Mitigation Bank in Lincoln County, a 74 acre forested wetland and stream restoration mitigation bank, and the White Oak Creek Mitigation Project in Johnston County, a 52 acre forested wetland mitigation project. While both sites have been developed for the NCDOT, the nature of the two projects, with respect to the design and construction, was very different. The Pott Creek site was a forested floodplain wetland restoration project with a significant stream restoration component (over 4,000 linear feet). The White Oak Creek site was a forested wetland restoration project designed to capture storm water runoff and intermittent stream flows to reestablish hydrology. Each project had its own design, construction and regulatory challenges, which will be discussed. The costs of developing both banks and the overall economics of mitigation in North Carolina will also be discussed.

WETLAND RESTORATION IN MARGINAL AGRICULTURAL FIELD

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The Division of Soil & Water Conservation, Drainage section is responsible for assisting landowners in the formation, construction, and maintenance of Group Drainage Associations' tax ditches and public ditches. These multi-purpose water management systems provide drainage for uplands while increasing biodiversity through the creation of adjacent wetlands and terrestrial habitat. They also provide filtering and nutrient removal through plant uptake in their associated riparian buffers. Historically, the planning and construction of water management systems has been accomplished with only administrative considerations from governmental agencies. The traditional program was a single purpose program (namely, drainage) with little consideration given to environmental issues such as habitat or wetlands. Various environmental groups and regulatory agencies began to question the potential impacts these projects were having on natural resources. Changes in the water management program were initiated in response to these environmental concerns and issues. Additionally, Governor Castle's Executive Order No. 56 mandated State agencies to achieve projects with a no net loss of wetlands. Rigorous project reviews with agencies became the norm in order to assure the implementation of environmentally sensitive projects. This initiative resulted in the development of a detailed list of proven environmental practices. This list was incorporated into the Delaware's Tax Ditch Best Management Practices (BMPs) which are routinely employed by resource managers and planners on all water management projects. BMP examples include one-sided construction, saving trees within the construction zone, relocating channels around sensitive wetland areas, etc. These BMPs and project reviews ensure that the environmental impacts are minimized. Inevitably, some impacts will be unavoidable, therefore, compensation (voluntary and permitted) is employed.

The Drainage section has become proactively involved in wetland/habitat restoration/creation projects. Through teaming up with U.S. Fish and Wildlife Service, Delaware Fish and Wildlife, the Conservation Districts, EPA and NRCS, the Drainage section has become well known for its ability to put on the ground the most diverse and innovative projects in the region. Significant time has been dedicated to experimenting with construction techniques and ideas to jump-start wetland projects. Employing construction techniques which replicate natural wetland systems has resulted in the establishment of many demonstration/education sites. These wetland projects have been constructed with minimal engineering, and in many cases utilizing "in-field engineering." Emphasis has been placed on irregularly shaped perimeters with micro and macro topography a must. Trees ranging from one to six inches in diameter have been relocated into the wetland with a backhoe or hydraulic excavator. Coarse woody debris has been added to provide habitat structure and long-term carbon source and basking/loafing areas for reptiles and waterfowl. Straw and horse manure have been added to provide organic matter and a substrate for aquatic invertebrates. The surrounding upland areas have been seeded with warm season grasses for buffers, filter strips and to provide additional wildlife habitat. Several systems have been treated to plantings of nursery stock for further diversity and educational experience for many groups of varying ages.

This presentation will focus on sharing many of the most frequently utilized Best Management Practices in Delaware's Water Management projects. Highlighted will be examples of construction techniques used to jump-start wetland restoration projects to promote diversity in plant and animal communities.

STUDYING SUCCESS OF FEDERALLY-REQUIRED WETLAND MITIGATION IN NEW ENGLAND

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The Corps Regulatory Program has long been concerned with the success and effectiveness of compensatory mitigation, but comprehensive studies of this effectiveness have generally not been conducted. The New England District Regulatory Division developed a study to analyze the effectiveness of compensatory mitigation projects (creation and restoration) in New England. The New England District has had staff dedicated to mitigation review and monitoring, which has helped with both collection and consistency of data relating to mitigation, making this type of study possible.

The study, examining 60 compensatory mitigation sites throughout New England, was designed to determine the effectiveness of compensatory mitigation for permitted impacts in New England, develop lessons learned, and make programmatic improvements as warranted. Success of mitigation was assessed in two principal ways. The first measured success against the permit requirements: did the mitigation meet the standards stated in the permit? The second generally proved to be more difficult to assess: was the mitigation functioning as a natural wetland system and did the mitigation compensate for the lost functions from the permitted activities?

Assessing success in terms of whether the compensation wetlands functioned as natural wetlands and replaced the functions lost through permitted impacts required more in-depth study than compliance with permit conditions. Independent function and value assessments were performed. Detailed information on soils, vegetation, hydrology, and wildlife usage was collected for each site.

EVALUATION OF MITIGATION SUCCESS IN NEW JERSEY

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In April of 2002, the New Jersey Department of Environmental Protection released the study entitled: Creating *Indicators of Wetland Status (Quantity and Quality) Freshwater Wetland Mitigation In New Jersey*. The study included a field delineation of 85 freshwater, non-tidal, wetland mitigation projects in New Jersey. The results document that compensatory freshwater wetland mitigation in New Jersey is contributing to the failure of the State's strategic planning goal for wetlands: "*improve wetland quality and function and achieve a net increase by 2005*". This presentation will focus on the results of the study and the steps that the NJDEP Land Use Regulation Program has taken to reverse those trends.

STATUS AND EFFECTIVENESS OF WETLAND MITIGATION BANKING IN TEXAS

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This paper presents an inventory and summarization of current wetland mitigation banks in Texas. There are a total of 14 mitigation banks in Texas. These mitigation banks are located in the Galveston and Fort Worth Districts of the U.S. Army Corps of Engineers (USACE), which cover about 75% of Texas. There are four mitigation banks that are governed by State or County agencies such as The Texas Department of Transportation, and Harris County (Houston) Flood Control District. The remaining 10 mitigation banks are owned and operated by private entities.

Each of the mitigation banks has been permitted through the USACE to compensate for unavoidable impacts to wetlands and waters of the U.S. The mitigation banks can be used as a form of compensatory mitigation in the Section 404 permitting process that allows for off-site mitigation.

The Galveston and Fort Worth Districts of the USACE provided access to their files for each of the permitted mitigation banks in Texas. A review of each bank's status was completed which inventoried the following information:

- Name of the Mitigation Bank - Sponsor;
- Dat of Bank Authorization - Time to Process Bank Application - Credit Approval Rate;
- Size - Acres - Number of Tracts - Service Area;
- Types of Enhancements;
- Success Criteria;
- Status of Success Measurements;
- Efficiency - Effectiveness - Number of Permits Utilizing Bank; and
- Number of credits Sold - Credits Available.

The overall efficiency of processing Section 404 permits will be summarized related to utilizing mitigation banks as an alternative option of providing compensatory mitigation. An opinion from the USACE as to their utilization and usefulness of the mitigation banks is presented.

EXPERIMENTAL DETERMINATION OF EVAPOTRANSPIRATION RATES OF WET WOODLAND HABITAT IN ENGLAND

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Recent wetland creation projects have highlighted the dearth of available information with respect to the water use rates of wet woodland habitat in England. The UK National Biodiversity Action Plan highlights wet woodlands as a habitat for concern and provides targets for the management, restoration and creation of wet woodlands throughout the UK. In addition, recent flooding events have re-fuelled the discussion about the use of our floodplains, and the potential for restoration of wetland habitats to form part of our flood storage mechanisms is currently being considered by government agencies. To address the lack of information regarding wet woodland water use, a technique for determining evapotranspiration (ET) rates from wet woodland based on the principles of lysimetry has been developed. Measurements of willow-dominated riverine wet woodland ET have been collected from two sites in the Midlands region of the UK. Initial monthly ET rates have been determined, and from these monthly crop coefficients (Kc) have been derived. These Kc values can be used with Reference Crop Evapotranspiration to produce site-specific water budgets for target wet woodland habitat.

Initial results are compared with relevant published data and show that wet woodlands are likely to have greater monthly water requirements during the growing season than other wetland habitats (e.g. wet grassland and reedbeds) often found within the same wetland mosaic.

HYDRIC SOILS DERIVED FROM “PROBLEMATIC” RED PARENT MATERIALS

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Most hydric soils show morphological features that can be used to identify and delineate those soils in the field. These “field indicators” of hydric soils are applicable in most situations, but there are special or “problematic” conditions where standard morphological indicators are not adequate. Some soils which have formed from certain red parent materials are considered “problematic” in the sense that hydric soils formed from these materials to not demonstrate the morphological features typically expected of hydric soils. Research has shown that the problematic red parent material soils are inherently resistant to the development of redox depletions of iron. A color change propensity index has been developed to document when such conditions exist in a soil. A test morphological indicator has been proposed which is more subtle than the standard field indicators. The Mid-Atlantic Hydric Soil Committee (MAHSC) has initiated a study to evaluate the proposed test indicator. Study sites have been instrumented in Virginia, Maryland and Pennsylvania. Morphological observations will be compared with water table data collected over several years to evaluate the effectiveness of the proposed test field indicator for accurately delineating hydric soils in these special settings.

ANOMALOUS BRIGHT LOAMY HYDRIC SOILS OF THE MID-ATLANTIC COASTAL PLAIN

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In most settings, standard morphological features can be used to identify and delineate hydric soils. Nevertheless, there are special problem settings where the typical morphological features, or field indicators, do not seem adequate for making these determinations. In certain low lying areas of the Mid-Atlantic coastal plain adjacent to coastal marshes, for example, there are loamy textured soils which seem to be saturated for significant periods of the year, but do not meet any of the approved field indicators of hydric soils. These atypical soils which have a higher chroma matrix color have been termed Anomalous Bright Loamy Soils (ABLS.) Several hypotheses have been posed to explain the persistence of bright (high chroma) colors in these soils. These hypotheses will be explained and preliminary data will be presented which may begin to nullify or validate these hypotheses. Eventually, alternate morphological field indicators may be proposed for recognizing these anomalous hydric soils.

MODIFICATION OF AN HGM LOW GRADIENT, RIVERINE GUIDEBOOK TO FACILITATE RAPID ASSESSMENT OF ROUTINE WETLAND PROJECTS

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The Hydrogeomorphic (HGM) Approach was developed to address the need for a replicable technique to assess wetland functions under the Clean Water Act Section 404 Regulatory Program. During the past several years, considerable time, effort, and expertise have been devoted to the development of regional guidebooks that include models and standardized techniques for conducting scientifically-based functional assessments. The potential utility of the HGM guidebooks for regulatory and non-regulatory activities is promising; however, it will not be realized if regulators and resource managers do not perceive them as effective wetland assessment tools.

The focus of this study was the functional assessment guidebook for low gradient, riverine wetlands in western Kentucky (LGRG), the first of the regional guidebooks to be published. Although the guidebook has been available for nearly two years, it has received little use by either state or federal regulatory or management agencies. Reasons given for the underutilization of the HGM Approach generally, and the LGRG specifically, include: (1) models that are perceived to be complex, (2) field procedures that are perceived to be too rigorous and time-consuming, and (3) uncertainly about the utility of HGM assessments in the day-to-day regulatory process.

The goal of this study was to modify the LGRG to the extent that regulatory personnel or consultants could conduct HGM assessments at the same time that routine wetland delineations were being performed. The first objective was to reduce the number of variables to the minimum possible while still maintaining the ability to distinguish differing degrees of impacts. The LGRG was designed to evaluate eight functions using 27 variables. In the modified HGM procedure, the number of functions evaluated was reduced to three, using seven variables. The field sampling procedures themselves also were simplified. Where appropriate, visual estimates of model variables were used in place of explicitly measured variables. Some highly correlated variables were combined to yield single estimates that could be used in the model computations.

The modified HGM models and procedures currently are being evaluated for ease of use, precision, and expediency. Selected regulatory personnel and consultants have been invited to participate in the evaluation and testing of the modified HGM models. The accuracy of the models and procedures will be evaluated by comparing the modified model scores with those computed using models and procedures from the LGRG.

PHYSICAL AND CHEMICAL PROPERTIES OF SOILS IN MID-ATLANTIC PIEDMONT SLOPE WETLANDS

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The Hydrogeomorphic (HGM) Method for wetland functional analysis relies on rapid assessment techniques to collect data that can be used in a model that establishes how that wetland functions in comparison to reference standards developed using data from the same wetland HGM sub-class. In the Mid-Atlantic Piedmont we will be developing models for wetlands in the slope class. Currently we are proposing two sub-classes, a slope discharge wetland that discharges water throughout most of the year and a toe of slope seep on floodplains that discharges water seasonally. Once long-term data is collected on reference sites, the data will be correlated to characteristics that can be sampled rapidly in a single visit to be inserted in the HGM Model to establish functional indices for the functions of the sub-class. For this study 36 reference sites have been established. A major component of the data collection process includes soils related data. Soils data collected include soil morphology, texture, pH, organic carbon, CEC, soil temperature, and soil N. Common classification of soils in these sub-classes are Aeric Endoaquults, Typic Fluvaquents, and Fluvaquentic Humaquepts. Total C ranged from 80 Mg ha^{-1} to 1934 Mg ha^{-1}. Total N ranged from 4.7 Mg ha^{-1} to 791 Mg ha^{-1}. Sequestration of C and N were variable for both subclasses, but were related to duration of inundation.

SOILS OF DEPRESSIONAL WETLANDS IN THE MID-ATLANTIC REGION

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The 1996 National Food Security Act (FSA) manual, 3rd Edition provides for the granting of exemptions for activities that may have minimal effects (MW) on wetlands. To achieve this determination of MW, Interim procedure of HGM was developed. The procedure will remain in effect until a wetland functional assessment procedure based on Hydrogeomorphic (HGM) principles are developed. Although HGM models are not specifically used, functional assessment concepts are incorporated into this procedure. The interim models should be designed so that when the full HGM model is developed they will be similar conceptual.

The functions of the soils in the depression and the soils adjunct (the side slopes of the depression) are very important to the ecosystem of the wetland.

Water entering the soil is important for maintaining plant growth, preventing erosion, carrying solutes soil biological “filter”, maintaining anaerobic conditions and contributing to groundwater recharge and discharge. In soils with perched water tables, soil layers with low conductivity influence the maintenance of saturated conditions above.

Soil quality is important for the condition of Depressional Wetlands, such as the arrangement of the soil horizons, infiltration, soil texture, continuity, root quantity, and rooting depth. All these properties have a major role in how Depressional Wetlands function.

Depressional Wetlands has the capacity to regulate the outflow and/or the inflow and the ability to provide storage of water. These wetlands contribute to the maintenance of characteristic of soils, vegetation, invertebrate and vertebrate communities.

A combination of the geological material and the regional water balance in the Mid-Atlantic region leads to moderation of ground water flow within the depressions. The principal water sources for this region of depressional wetlands are from the surrounding landscape as surface runoff or interflow, from groundwater and from precipitation. The principal water loss is through evapotranspiration. These hydro-dynamics produce an inter- and intra-annual cycle of ground water exposure and water storage above and below the edge of the temporary wetlands. This cycle supports the diverse plant and animal habitats as well as biogeochemical processes.

These wetlands are oval depressions with poorly to very poorly drained soils in the center of the depression and a distinct rim of well to moderately well drained sandy or loamy soils. The rim may rise 3 to 6 feet or more above the depression center.

HYDRIC SOILS OF FLOOD PLAINS IN THE MID-ATLANTIC PIEDMONT

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The soils on flood plains of the Piedmont province are generally young. The upper portion of the profiles often have formed in materials which have accumulated during the last couple of centuries following colonial settlement and erosion and deposition of materials from agricultural lands within the watersheds. These soils generally are classified as entisols or inceptisols reflecting the youthful nature of the soils. Often there are slope/seep wetland soils at the base of upland slopes just at they enter the flood plain. In these wettest portions of the landscape, typical hydric soil morphology is observed. However, further out into the flood plain, there appear to be soils that are saturated for extended periods which would seem to be hydric soils, but they do not demonstrate the kinds of morphological features generally associated with hydric soils. This may be due in part to the youthful nature of the soil parent materials. Several sites in Maryland and Delaware have been instrumented to document the water table dynamics and the redox conditions of the flood plain soils in question. By comparing the water table and soil chemical properties to the hydric soils "technical standard," we hope to be able to 1) determine how far the hydric soils extend across the flood plain and 2) determine which morphological features can be used to accurately identify and delineate hydric soils in these settings.

CHARACTERIZATION FOR FIVE DIFFERENT HABITATS IN THE SURROUNDINGS OF THE GANDOCA LAGOON AND USE EVALUATION FOR THE ASSOCIATED BIRD COMMUNITIES IN THE WILDLIFE NATIONAL REFUGE GANDOCA MANZANILLO IN COSTA RICA

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The Wildlife National Refuge Gandoca Manzanillo (RNVS-GM) is located in the Limon province, canton Talamanca, Sixaola district, geographically is situated at:
Latitude 9º 35'26'' and longitude 82º 35'46''. Within the Refuge it is found the Gandoca Lagoon, located southeast. The Gandoca Lagoon is a coastal wetland with a mouth to the sea, and the tides and fresh waters of near rivers as Sixaola or Gandoca ones influence it.

The main purpose of this investigation was recompiled information to have a general sight of the wetland and the relationship between wetland-community.

Fieldwork was made between january and April 2001. An avian fauna and vegetation monitoring was made in different habitats that surround the Gandoca Lagoon: (I) Yolillal (*Raphia taedigera*), (II) Mangrove (*Rizophora mangle*), (III) Cativera (*Prioria copaifera*), (IV) Secondary Growth Forest (SGF) and (V) Pastureland.

197 bird species were identified, migratory and resident ones in the outside areas of the Gandoca Lagoon, and 124 bird species inside the sampling parcels. 25 families and 45 tree species were also identified, with average lengths and diameters that go from 17.7 meters and 18.5, respectively.

The higher bird diversity was in January (H' 3.7728), the habitat with higher diversity was the Pastureland habitat, followed by SGF one (H' 3.0949 and 3.0597, respectively). The habitat with higher number of individuals was found in the Pastureland habitat (672), followed by Mangrove, Cativera, SGF and Yolillal, respectively. The higher observations percentage were made in habitats IV and V, 18% and 20% during February and March, respectively.

The higher number of individuals was observed in the middle and under canopy area, with average lengths of 9 and 14 meters. The 49% of the avian fauna have preferences for the wooded areas. There are not significant differences in the number of species according to the habitats sampled and the data collection months (P<003 at 95%); otherwise there are not significant differences between the number of individuals and the habitats (P< to 0096 at 95%).

TESTING PROPOSED CHANGES TO THE NORTHEAST WETLAND PLANT LIST IN THE VIRGINIA COASTAL PLAIN

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A proposed revision to the “National List of Plant Species That Occur in Wetlands: Northeast (Region 1)” was published in 1996. This proposal assigned wetland indicator categories for a number of plant species on a subregional basis (lower coastal plain, seaboard lowland, etc.). These subregional indicator categories were intended to describe the variability in the occurrence of some plant species in wetlands across the Northeast region. I evaluated the proposed subregional changes for 4 species that frequently occur in wetlands in the lower coastal plain of Virginia and that were considered to have the greatest potential to affect the extent of jurisdictional wetlands in Virginia. The species examined were loblolly pine (*Pinus taeda*), American holly (*Ilex opaca*), sourwood (*Oxydendrum arboreum*), and paw paw (*Asimina triloba*). The proposed changes in wetland indicator categories for these species were reviewed using all available computerized data for the lower coastal plain of Virginia from the records of the Norfolk District, Army Corps of Engineers for the period 1992 to 2001. A total of 376 samples containing 1 or more of these 4 species as community dominants were compiled. These samples were drawn from upland and wetland sites in 10 counties and 6 cities in the lower coastal plain of Virginia. The effect of the proposed wetland indicator changes were evaluated by comparing wetland determination data under both the current and proposed wetland indicator classifications. The proposed changes resulted in a 16% increase in the number of samples with hydrophytic vegetation but only a 2 % increase in the number of samples that would be considered jurisdictional wetlands. The proposed changes had a minor effect on wetland hydrology determinations. It appears that the proposed changes to the wetland indicator status for these species would not substantially expand wetland jurisdiction in the lower coastal plain of Virginia.

WOODY PLANT SPECIES IMPORTANT TO WETLAND DELINEATIONS ON THE DELMARVA COASTAL PLAIN

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Anecdotal evidence collected from the Delmarva Coastal Plain indicates that the indicator status of a number of plant species may not be truly reflective of their frequency of occurrence in wetlands. Nine of the species in question (*Fagus grandifolia, Clethra alnifolia, Vaccinum corymbosum, Ilex opaca, Pinus taeda, Quercus alba, Mitchella repens, Asminia trilobia,* and *Liriodendron tulipfera*) were evaluated for their tolerance to saturated soil conditions. Research plots were set up at six locations in Delaware and Maryland. Each location had three plots: a seasonally saturated wetland, an adjacent transition zone, and an upland. The hydroperiod for each plot was evaluated by automated monitoring wells over a two-year period. The frequency of occurrence for each target species was determined for each plot using a point intercept method. Preliminary results indicate that *A. triloba* favors drier areas; *I. opaca* and *V. corymbosum* favor wetter areas, and *C. alnifolia* and *F. grandifolia* tend to favor transition zones.

INTERAGENCY COMMENTS TO THE PROPOSED REVISIONS OF THE NATIONAL WETLAND PLANT LIST THAT OCCUR IN WETLANDS

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In response to the request for comments regarding the proposed indicator status changes to the 1996 National List of Vascular Plant Species That Occur in Wetlands (Northeast-Region I), an Inter-agency Team representing the U.S. Fish and Wildlife Service (FWS), Chesapeake Bay Field Office, U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and U.S. Environmental Protection Agency-Region III (EPA) conducted a two-day field study at ten different locations on the lower Coastal Plain physiographic province (subregion) in Maryland and Delaware. The three species the group focused on were Lobolly Pine, Pinus taeda, Pawpaw, Asminia triloba, and American Holly, Ilex opaca. At each site a characterization of the vegetative communities, hydrology and soil morphology in wetland and associated upland sample points were collected. The results of the study indicate all three species manifest a wide ecological amplitude. The subject species were found on a variety of landscape positions with hydric soils and wetland hydrology (per the 1987 Corps of Engineers Wetland Delineation Manual) as well as non-hydric soils and upland hydrology. Based on this study, as well as observations from the interagency team's combined 33 years of experience working in this physiographic province, the proposed changes of the subject plant indicator statuses to facultative are ecologically sound.

NWI WETLAND INDICATOR STATUS---WHAT ARE THE DIFFERENCES BETWEEN 1988 AND 1997 INDICATORS FOR PLANTS IN THE MID-ATLANTIC STATES?

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Wetland delineations in accordance with the 1987 Corps Manual and the 1989 Joint Federal Manual are based in part on the wetland indicator status assigned to plants by regional interagency panels and published by the National Wetland Inventory (NWI) of the US Fish and Wildlife Service. Indicator statuses for some or all of the plant species observed at a particular location are scored according to the formal rules of the Manuals, and the results are used for recognizing vegetation that satisfies or fails to satisfy the required hydrophytic vegetation parameter at that location.

Nationwide lists of indicator status were made available in 1982, 1986, 1988, and 1996/97, none through formal interagency rulemaking. For five years regulators have been reluctant to authorize use of the 1996/97 version of NWI indicator statuses, despite its obvious advantages over prior versions of this technical tool, including clarifications and corrections as well as revisions. A significant innovation in the 1996/97 list is subregional designations. Only a few subregional statuses are available to date for the plants of NWI Region 1 (Northeast), but they address several widespread species important for wetland delineation in some locales.

This presentation identifies changes of indicator status between 1988 and 1996/97 for plants found in the mid-Atlantic States of NWI Region 1, focusing on substantive (as distinguished from nomenclatural) changes. Just what is the object of the equivocation? The best professional judgment imposed on delineators by the Manuals (not to mention common sense) demands that current technical tools be used in wetland delineation---information regarding plants as well as soils and hydrology. Ongoing changes in soil documentation, however, have been quietly adopted without mention in the technical or regulatory literature, much less through formal rulemaking. This contrasts sharply with the bureaucratic unwillingness to adopt the 1996/97 NWI plant list.

In the absence of federal acceptance of the 1996/97 NWI plant indicator statuses (which are still imperfect and in need of further revision), informal, uncoordinated efforts are underway in several States of Region 1 to revise NWI indicator statuses. The substitution of these informal State-level indicator statuses portends dramatic changes in the extent of vegetation currently recognizable as hydrophytic (both more and less), particularly if they were to be adopted unwittingly by wetland delineators. Hence the efforts in several States deserve widespread critical attention from both delineators and regulators.

SPECTROSCOPIC IDENTIFICATION AND DELINEATION OF WETLANDS

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Recent trends in imaging spectrometry show that end users will soon have access to hyperspectral satellite remote sensing systems to support operational programs. In this context, spectral properties of vegetation will be discussed in connection with spectral and ground resolution. It will be stressed that in nature no homogenous or uniform canopy exists. Therefore,
the mixed pixel problem in the instantaneous field of view (IFOV) has to be considered when high-resolution data are compared with conventional fieldwork or data obtained from orbiting platforms. Based on laboratory research, minor absorption features of vegetated areas have the potential for diagnostic monitoring although the water spectral signatures beyond 1000 nm and the varying cell structure of fresh vegetation tend to mask spectral signatures of biochemical species.

IMAGING SPECTROMETRY OF WETLANDS

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Recent development of hyperspectral scanners allows further detailed mapping of vegetation and related photosynthetic pigments and its relation to the leaf area index (LAI). The inflexion point of the red near infrared slope allows the extraction of further details. The red edge shoulder is defined by the low reflectance due to pigment absorption and the high reflectance at around 800 nm. This feature is spectrally located within a short envelope of approximately 30 nm. Hyperspectral imaging (spectrometry) for deriving vegetation anomalies therefore, requires high spectral resolution in the NIR and in the visible. Examples of spectrometry will be presented and selected spectral bands for identifying diagnostic features will be documented.

APPLICATION OF REMOTE SENSING TO WETLANDS MANAGEMENT

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We have been developing satellite and airborne remote sensing techniques for observing environmental properties of coastal wetlands and estuaries. Wetland losses, biomass changes, invasive species, riparian buffers, suspended sediment and chlorophyll concentrations and other environmental indicators were studied and mapped to provide much needed information to coastal resource managers. A particularly useful result is an improved method for remotely sensing wetland biomass changes which corrects for interannual, atmospheric, and soil reflectance variations without the need for explicit local correction factors. The biomass algorithm, based on vegetation indices, is applied to a time series of Landsat/TM and SPOT imagery and used with selected thresholds to detect significant wetland changes.

Despite these successes, many practical problems remain. For instance, new court decisions have endangered non-tidal, freshwater wetlands which, being small and patchy, are difficult to resolve with the popular medium resolution sensors on Landsat and SPOT. High resolution satellites, like IKONOS, can detect small wetland sites, but are lacking mid-infrared bands needed to discriminate wetland types and woodlands from wooded wetlands. Also high-resolution satellites require many costly images for surveying large coastal regions and have severe location accuracy requirements. Finally, matching seasons and tidal conditions for coastal change detection limits the number of suitable satellite images, which are already curtailed by cloud cover problems.

REMOTE SENSING DATA REQUIREMENTS FOR WETLAND MAPPING ALONG THE SOUTH SHORE ESTUARY, LONG ISLAND

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Wetlands in near-shore regions represent a natural resource and an environment in which water quality and marine processes are important factors to be considered for economic development and recreational activities. The use of multi-spectral data obtained from various space platforms are presented in order to demonstrate the database needed for proper integrated coastal zone management. Coastal wetlands are multi-stage optical systems and therefore, the optical properties of water parameters and vegetation will be discussed. Case studies will be presented to address water quality, vegetation and coastal changes, tidal marshes, mud and sand flats along selected regions of Long Island's South Shore estuary.

VERNAL POOL REGULATION IN MARYLAND

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Vernal pools, important amphibian breeding habitat, by definition are isolated wetlands often overlooked in the regulatory process. In Maryland, a vernal pool is defined as a "…wetland in a confined depression that has surface water for at least two consecutive months during the growing season, and: (a) Is free of adult fish populations; (b) Provides habitat for amphibians; and (c) Lacks abundant herbaceous vegetation." The MD State Nontidal Wetlands Protection Act was passed by the Legislature in 1989 and took effect on January 1, 1991. The regulations provide protection to nontidal wetlands and their buffers, including isolated wetlands. Furthermore, they specifically protect vernal pools as "nontidal wetlands with significant plant and wildlife value". Significant wetlands have extra layers of regulatory protection, including a public notice process. However, vernal pools are often located within upland areas slated for development or are not shown on development plans because they are isolated and not federally regulated. This presentation examines how to recognize vernal pools in the field and the regulatory protection of isolated nontidal wetlands in Maryland.

RESTORATION AND MITIGATION CRITERIA IN WETLANDS ENFORCEMENT

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Region III of the U.S. Environmental Protection Agency (EPA) is responsible for overseeing the implementation of the Clean Water Act in Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia. Wetlands enforcement is one component of that oversight which is covered under Section 404. EPA is not only responsible for oversight of the Section 404 program, but also plays an active role in designated lead areas as a result of Field Level Memorandums of Agreement with several Corps Districts in the Region. These areas include four counties in the eastern panhandle of West Virginia, four counties in western Pennsylvania, several counties in the Poconos and the NE drainage of the Susquehanna, and Sussex County, Delaware.

There are both general and regionally specific requirements for restoration and mitigation of wetlands violations. Restoration is generally the preferred alternative in the enforcement arena since the success rate of restored wetlands is much greater than the success rate of created wetlands. However, mitigation is often necessary when permanent structures have already been established (such as buildings, homes, etc.) or when restoration would cause more harm than good. To paraphrase the “no net loss” policy, whenever a wetland is permanently impacted, replacement wetlands must be created of the same or greater acreage. Additionally, to account for the temporal loss of functionality until the replacement wetland has become established, a 2:1 ratio of created wetlands to impacted wetlands is generally followed.

This presentation will outline the Region III Wetlands Enforcement Program’s role in wetlands restoration and mitigation. It will go through the standard method for restoration and mitigation, case-by-case deviations from the norm, as well as examples of both.

SWANCCS FOR THE MEMORIES: FEDERAL WETLANDS JURISDICTION AFTER SOLID WASTE AGENCY OF NORTHERN COOK COUNTY VS. U.S. ARMY CORPS OF ENGINEERS

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This article will discuss the rulings by federal courts on federal wetlands jurisdiction after the Supreme Court decision Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, 121 S. Ct. 675 (2001) ("SWANCC"). In SWANCC, the Supreme Court ruled that wetlands that were isolated, non-navigable, intrastate used solely by migratory birds as habitat were not subject to federal jurisdiction. The Supreme Court's discussion of the Commerce Clause and navigability raised more questions of the extent of federal wetlands jurisdiction than it answered. Decisions such as Headwaters, Inc. v. Talent Irrigation District, 243 F.3d 526 (9th Cir. 2001) have read SWANCC narrowly, in light of United States v. Riverside Bayview Homes, Inc., 474 U.S. 121 (1985), examining such factors as surface hydrological connections in determining federal jurisdiction. Other decisions, such as United States v. Newdunn Associates, Civil Action No: 2:01cv508 (E.D. Virginia) (April 3, 2002), have read SWANCC more broadly and severely restricted the jurisdiction of the United States. It is clear from these cases that the extent of federal jurisdiction remains a dynamic issue.

GEOGRAPHICAL DISTRIBUTION OF WETLAND CHANGES IN THE U.S., 1992-1997

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Recent wetland area trends were estimated for the U.S. (excluding Alaska) from the National Resources Inventory (NRI). There was an average annual net loss of 32,600 (_ 12,900) wetland acres per year for the period 1992 – 1997. About 31% of the wetlands and 43% of the gross wetland loss occurred in 9 Southeastern states. Development for anthropogenic uses accounted for 49% of the gross wetland loss, conversion for agriculture accounted for 26%, losses on forestland accounted for 12%, while miscellaneous reasons made up the remainder. Development accounted for most of the wetland losses in the southern and eastern portions of the U.S. while agriculture was an important factor for wetland loss in other regions of the country.

Wetland losses were disproportionately high in 253 counties bordering the oceans compared to the 2,843 counties that occur inland. These coastal counties had 28% of the population, 7% of the area, 18% of the developed land, 20% of the wetlands, and 31% of the wetland losses. Sixty-six percent of wetlands lost in coastal counties was the result of development while only 41% of wetlands lost in inland counties was d

TIDAL WETLANDS LOSSES IN NEW YORK STATE

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In order to evaluate the effectiveness of the state's tidal wetlands program in protecting wetlands under the Tidal Wetlands Act (Article 25 of the Environmental Conservation Law), a tidal wetlands trends analysis is being conducted by New York State Department of Environmental Conservation (NYSDEC). To date, the tidal wetlands trends analysis has shown that the regulatory program to protect tidal wetlands from the historic "fill and build" damage is extremely successful. In many areas, such as Shinnecock and Moriches Bay on Long Island, there is no detectable loss due to those activities. In fact, the vegetated wetlands have increased over 300 acres in Shinnecock and Moriches Bay due to the landward migration of high marsh. The NYSDEC has observed, though, significant and accelerating losses of vegetated tidal wetlands, principally Spartina alterniflora in Jamaica Bay and Long Island. In Jamaica Bay between 1974 and 1994, 526 acres of marsh islands were lost at an average rate of 26 acres per year. Between 1994 and 1999, 220 acres were lost at an average rate of 44 acres per year. In addition in selected areas there was a loss of 124 acres of S. alterniflora along the shore of Long Island and a loss of 284 acres of S. alterniflora along the south shore of Long Island. The vegetated intertidal marsh is being converted to nonvegetated underwater lands. A strategy has been devised to address these losses. See: http://www.dec.state.ny.us/website/dfwmr/marine/twloss.html.

USING GIS AS A TOOL TO IMPROVE MUNICIPAL REGULATION OF INLAND WETLANDS AND WATERCOURSES IN GREENWICH, CONNECTICUT

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Municipalities in Connecticut have been regulating inland wetlands and watercourses at the local level since the CT Inland Wetlands and Watercourses Act took effect in the mid 1970's. Since inland wetlands were defined by the presence of "poorly drained, very poorly drained, alluvial and flood plain soils", early municipal regulatory maps were based on the existing US Soil Conservation Service County (now NRCS) soils maps. Watercourses were as identified on USGS topographic quadrangle maps. Because of the level of accuracy of these maps, local regulators were presented with a number of problems in actually locating inland wetlands and watercourses on the ground.

Generally, the available regulatory maps were used as a guide or inventory to the approximate location of inland wetlands and watercourses on a specific property. The regulatory permit process required more detailed information, however. As a result of this need, soil scientists and land surveyors were necessary to locate the inland wetlands and watercourses on each property when a permit application was submitted.

Since the Greenwich Inland Wetlands and Watercourses Agency began regulating wetlands in 1974,it has collected more than 12,000 parcel records with the location of wetlands and watercourses throughout the Town. The initial Greenwich Inland Wetlands and Watercourses Inventory map was based on a combination of SCS soils mapping and aerial photo interpretation of 1970 black and white aerial photography at 1/12000 scale.

In 1998 the Town of Greenwich started to develop a town-wide Geographic Information System. As part of this GIS, information on the location ofwetlands and watercourses was obtained. Data was interpreted from 1997 color aerial photos, the land records of the Town, and 2000 color infra-red aerial photos. The James Sewall Company was hired to delineate and classify (by NWI standards) both wetlands and watercourses in 2001. The subsequent wetland and watercourse GIS layers have been extremely helpful in improving the regulatory process and answering the question "are there wetlands or watercourses" on a specific property in Town.

Future efforts will link the wetland layers to the Agency's extensive application data base. For the first time in almost 30 years the Agency has the ability to not only know where and what type
of wetlands and watercourses are located on a property but also what water resources are located in the affected watershed. Such information would make cumulative impact assessments possible. GIS will play an increasingly important roll in protecting the wetlands and watercourses of Greenwich, CT.

THE MONTGOMERY COUNTY INTERAGENCY WETLANDS COORDINATING COMMITTEE

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In 1996 Montgomery County Departments of Transportation, Environmental Protection, Permitting Services; and Park and Planning, along with the Maryland Department of the Environment (MDE) and the Army Corps of Engineers, met to develop a means to expedite and better coordinate the Wetlands/Waters of the US permitting process. That gathering formed the Interagency Wetlands Coordinating Committee.

The primary goal of the committee is to provide coordinated information, guidance, direction, and assistance to anyone proposing land disturbance within a wetland area in Montgomery County, Maryland. We review new Wetland Permit Applications for work in the County, and welcome meeting with anyone who is proposing to disturb a wetland. Often we save applicants time by spelling out needed information on their application or plans.

In general, we have found putting all of the reviewing agencies together, allows us to discuss the merits or drawbacks of the various projects without the pitfalls of interagency miss-communication. This forum also allows the reviewers the opportunity to discuss the various issues and problems affecting their respective agencies.

Projects are normally referred to us by a reviewing agency. As an open forum anyone with a proposal can be placed on our agenda, (time allowing).

The permanent members of the committee come from Maryland Department of the Environment, U.S. Army Corps of Engineers, Maryland Department of Natural Resources, Maryland National Capital Park and Planning's Environmental Planning Division, and the County's Departments of Transportation, Permitting Services, and Environmental Protection.

WETLAND VEGETATION REFLECTANCE VARIABILITY FOR SPECIES LEVEL CLASSIFICATION OF HYPERSPECTRAL DATA

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A study was conducted to investigate whether reflectance data from *Phragmites australis* and *Spartina alterniflora*. in a New Jersey wetland could be used for species level discrimination using hyperspectral remote sensing images. Fall reflectance spectra for both species were collected in the filed using a field spectroradiometer for high and low elevation marsh and for different vegetation cover types. An analysis of inter and intra species spectral shape was performed to determine the roll of plant structure and percent vegetation cover in the variability of the spectral response. Future work will attempt to determine which filters derived from the
spectral shapes best discriminate *Phragmites sp*. form *Spartina sp*. in a hyperspectral image.

EVALUATING THE INTER-RELATIONSHIPS BETWEEN WETLANDS, STREAM STABILITY, AND STORMWATER MANAGEMENT. DO CURRENT PRACTICES ADEQUATELY ADDRESS THE DIRECT AND INDIRECT EFFECTS OF DEVELOPMENT?

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Current stormwater management and resource protection practices focus largely on direct impacts to wetlands and streams and may fail to address indirect and cumulative effects to interconnected resources. The inter-relationships among water resources, including stream stability, wetlands, water quality, habitat, and floodplains, are sometimes overlooked in project planning, permitting, and design. Stream stability is essential to maintaining water quality, habitat for in-stream resources, and adjacent floodplain wetland systems. If a stream is functioning efficiently, sediment and water are transported in equilibrium, and the habitat and water quality in both the stream and adjacent wetlands are maintained. However, if perturbations occur, such as development in the upper watershed, stream systems may lose equilibrium and become entrenched. One of the consequences of entrenchment is that stream flow during storm events no longer overtops banks to flood floodplain wetlands. The entrenchment can indirectly impact wetland habitat and downstream water quality, and ultimately cause adjacent wetlands to disappear due the lack of surface and groundwater influence.

This study focuses on streams and their unique interaction with wetland resources that often exist in their floodplain riparian zones. This study will determine the need for a more holistic approach to stormwater management by evaluating both the direct and indirect impacts to a stream located down gradient from a recently approved development in Anne Arundel County, Maryland.

NURSERY FISH UTILIZATION OF SEVERAL NATURAL AND RESTORED INTERTIDAL HABITATS IN SARASOTA BAY, FLORIDA.

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The Sarasota Bay region lost approximately thirty-nine percent (39%) of its intertidal habitat to various activities during the 20th century. During the 1990's, the completion of over twenty (20) intertidal habitat restoration projects within the watershed began the attempt to regain some of the lost natural functions of the bay. However, no comprehensive assessment of the value of the created or restored habitat has occurred. Different estuarine habitat types within Sarasota Bay may differ in terms of utilization by early-juvenile, targeted fishery species considered commercially or recreationally important. Densities of early-juvenile fish of targeted species may be greater within some restored habitat sites than others. This project investigated the nursery fish utilization of several restoration sites within the Sarasota Bay watershed and compared them with nearby natural sites. Sampling occurred at approximately twenty (20) sites (restored and natural) during two seasons coinciding with anticipated peak abundance for juvenile fish recruitment within the study area. The comparison of natural and restored sites allows an estimation of the relative value of critical habitat types by reference to abundance and diversity of key "nursery" guild species. The information acquired will be used in concert with newly-created GIS data layers to help identify selected critical habitat types in terms of priority for protection and restoration. This long-term restoration plan will be partly based on considerations of fish community abundance supported by each critical habitat type and the proportion of historic and differential losses of each habitat type revealed through regional studies.

WETLANDS PROTECTION PLAN FOR NAVAL SECURITY GROUP ACTIVITY WINTER HARBOR MAINE

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Naval Security Group Activity Winter Harbor (NSGAWH) is located along the central coast of Maine in the Acadia Physiographic Region. The Operational Area (186 ha) includes Corea Heath, which has been described by the Maine Natural Areas Program (MNAP) as the fifth most significant coastal raised peatland in the United States. The purposes of this project were to obtain baseline digital ortho-photography and planimetric mapping; delineate wetlands; establish permanent vegetation monitoring plots;conduct surveys for rare plants and water birds; conduct breeding and migration bird surveys, and develop an interpretive field guide as components of a long-term wetland management plan that emphasizes the protection and preservation of the unique Corea Heath.

Digital orthophotography provided the basis for spatial analyses using ArcView geographic information systems. Mapping of planimetric features provided a basis to evaluate three land reuse alternatives. A jurisdictional determination for 122 ha provided a basis for determining wetlands protection and restoration efforts. Baseline data were obtained on 44 plots for long-term monitoring of wetlands, plant communities, and species of special concern. There were 28 plant communities classified and sampled according to MNAP's Natural Community Classification System. Eight current or former state-listed plant species have been collected at Corea Heath; four species of rare water birds have potential to occur in the area.Analysis of bird surveys conducted since 1993 indicated that intertidal and near shore habitatsas well as coastal forests are a migration corridor and important areas for feeding, resting, and migration. The interpretive field guide illustrated the presence of rare andpotentially critical habitatson the Operational Area. The primary purpose of the guide was to educate decision-makers for future reuse of the Coreasite about unique and valuable natural resources present.

COASTAL WETLANDS EVOLUTION PATTERNS AND PROCESSES: THEIR IMPLICATIONS FOR COASTAL WETLANDS MANAGEMENT IN DEVELOPED ESTUARIES

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To protect the existing resource base, coastal wetlands are strictly regulated from losses that would otherwise occur from direct human disturbance. However, the coastal wetlands resource base is highly vulnerable to indirect losses in developed estuaries. Indirect losses occur as a consequence of a negative balance between the processes that cause coastal wetlands loss and the processes that would naturally create coastal wetlands. Losses continue to occur from the natural processes of shoreline erosion and drowning in place. The loss of landward migration space to development and restriction of ocean and estuarine shoreline dynamics by engineering measures limit formation of new coastal wetlands. Measures to ensure ongoing creation and maintenance of coastal wetlands need to be incorporated into regional policies if the management objective of maintaining the coastal wetlands resource base is to be achieved. Potential management measures to maintain the resource base should be applied as a function of coastal wetland landscape position, and include ensuring landward migration space, creating new intertidal substrate upon which coastal wetlands can be built, and maintaining existing intertidal substrate upon which coastal wetlands occur. Each measure will invariably produce environmental and social tradeoffs that require consideration in formulating strategies to maintain the coastal wetlands resource base.