The Virginia Wetlands Report

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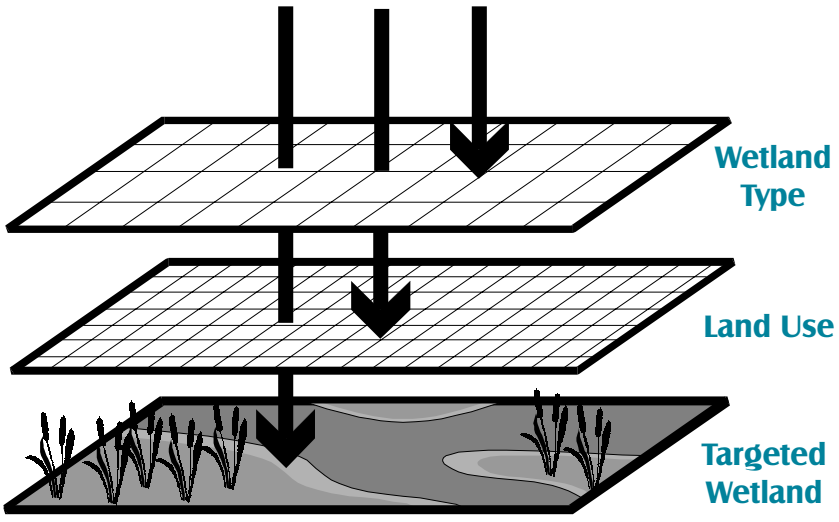
Chesapeake Bay Program Wetlands Initiative—New Approach Allows the Identification of Locally Important Wetlands

Carl H. Hershner

Almost everyone would agree that it is much easier to get people to do something they want to do than it is to force their actions. It is this common sense notion which is motivating a new Wetlands Initiative under the auspices of the Chesapeake Bay Program Wetlands Workgroup. State and federal wetlands program managers are working with local government officials and nongovernmental organizations (NGOs) as members of the Chesapeake Bay Program (CBP) Initiative team. The goal is to make wetlands protection a routine and desirable part of local planning. The workgroup's strategy is to develop a useful and very simple protocol for identifying wetlands in a local watershed which may be providing important services to the local community. By disseminating the protocol, along with guidance on a variety of nonregulatory wetlands protection tools, the Initiative team aims to enable local planners to preserve local wetlands while actually working on issues such as storm water management, open space preservation, and water quality improvement.



New Chesapeake Bay Program Protocol identifies important wetlands by considering wetland type and adjacent land use.

The CBP Initiative team has crafted a very simple wetlands assessment methodology which identifies potentially important wetlands based on the wetland type and surrounding land use. These two pieces of information are widely available. Wetland types are indicated on National Wetland Inventory (NWI) maps generated by the U.S. Fish and Wildlife Service's inventory program. These maps are available for almost the entire Chesapeake Bay drainage basin. Land use information is available in several formats, including local zoning maps and satellite imagery. Again, this information is available for the entire Chesapeake Bay drainage basin.

Editor's note: The Virginia Coastal Resources Management Program stopped funding for advisory activities in the VIMS Wetlands Advisory Program on October 1, 1997. VIMS used these funds for partial support of the permit reviews the Advisory Program conducts for local wetlands boards. We also used the funding for publication of the Wetlands Report, Technical Reports, and the Wetlands Plant series. As a consequence of the discontinuance of these monies, we will cease publication of the Technical Reports and the Wetland Plant series, and scale back other activities until such time as alternative funding can be identified.

Using the consensus of a group of wetlands management experts, the CBP Initiative team developed a series of simple decision rules to guide the assessment. The rules were constructed so that they did not require detailed information. In addition, they were developed with the intention of having the assessment conducted by computer. Since NWI maps and satellite imagery are available in digital format, it is possible to use computerized geographic information systems (GIS) to evaluate the mapped information, apply the assessment rules, and depict the final evaluations. The Initiative team plans to develop this computerized version of the assessment method so that it will operate in ArcView, one of the most popular (common) GIS programs currently available.

The assessment method is constructed so that it evaluates both the capacity and the opportunity of a wetland to perform any one of five general functions. The functions include water quality improvement, provision of habitat, flood buffering, erosion protection, and sediment trapping. Capacity to perform each of these functions is evaluated on the basis of wetland type. For example, the typical mix of vegetation found in most palustrine forested wetlands makes them particularly capable of functioning as habitat for a wide variety of species. In contrast, the soft growth forms of most lacustrine emergent wetlands do not provide particularly effective erosion protection.

The second step in the assessment method is to evaluate the opportunity a wetland has to perform a particular function based on the type of land use occurring next to the wetland. For example a wetland may have a high capacity to provide habitat, but it will probably be more important for that function if it is adjacent to undeveloped lands rather than an urban setting.

The purpose of the assessment method is to identify those wetlands which are probably most important for the performance of each of the particular functions in any given watershed. The Initiative team is quick to point out that the method can not determine if any particular wetland is *unimportant.* This is because the method does not attempt to assess the actual level of performance of any function in the context of the local system. Only the *probability* that a wetland may be important for performance of a function is evaluated.

Because it can provide a simple and early assessment of what wetlands may be doing in a landscape, the method provides useful guidance to local planners interested in preserving the benefits derived from natural systems. This can encourage careful wetlands preservation since they can play important roles in modification of storm water flows, improvement of local water quality, and provision of recreational opportunities, to mention just a few of the typical concerns for local governments.

At the present time, the CBP Initiative team is engaged in testing the draft assessment method. Two small watersheds were selected for the first applications, one in Pennsylvania (Lititz Run near Lancaster) and one in Maryland (Hunting Creek in Calvert

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Wetland Functions

- **Production of plant material**
- **Provision of habitat**
- **Improvement of water quality**
- **Flood buffering**
- **Erosion protection**
- **Sediment accretion**

General Types of Wetlands

- **Estuarine (tidal)**
- **Palustrine (inland nontidal)**
- **Riverine (in and along rivers)**
- **Lacustrine (associated with lakes)**

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GIS Geographic Information System

Targeting for Effective Wetlands Preservation - A GIS Application

Marcia R. Berman
Lynn M. Dancy

In 1995, the Norfolk District of the U.S. Army Corps of Engineers established the Virginia Wetlands Restoration Trust Fund with authorization from the 1991 amendments to the Nationwide Permit Program. The trust fund has been established as an innovative mitigation alternative where property owners contribute to a preservation fund to raise money for the restoration or purchase of wetlands for preservation. In Virginia, the Nature Conservancy serves as the trustee working cooperatively with the U.S. Corps of Engineers.

As trustee, the Nature Conservancy must establish locations where the acquisition of property for restoration or preservation provides for the protection of lands of some significant value to offset the impacts of degraded wetlands or enhance protection of some increasingly threatened sites. At the same time, the purchase is expected to yield the maximum return of expended funds due to tax incentives offered by the Nature Conservancy as a non-profit organization. All acquisitions must be approved by the Corps of Engineers.

The Department of Resource Management and Policy (RMAP) and the Comprehensive Coastal Inventory (CCI) Program at VIMS are designing protocols for the selection of sites using Geographic Information System (GIS) technology (Dancy, in prep). GIS has proven to be effective for the analysis of complex, multi-dimensional landscape questions. This GIS application is being developed as a tool for the selection of priority sites for preservation. Highest priority is given to those wetland sites which can provide five critical functions: habitat, flood buffering, erosion protection, sediment storage, and water quality improvements. A protocol for ranking high priority wetlands is being based on wetland type, landscape position, and the surrounding landscape. These data are currently available in GIS formats for the Commonwealth of Virginia. They are readily available to local, state and federal agencies with an interest in implementing this technical approach.

Digital data collected by the U.S. Fish and Wildlife Service's National Wetlands Inventory Program (NWI) provide the location of tidal and non-tidal wetlands by community type. This data set was reorganized into seven general categories of wetland type.

Land use and land cover data classified from satellite imagery are available from a number of different sources. The RMAP/CCI model uses data from the Multi-resolution Land Characteristics (MRLC) database developed at the EOS data center for region III of the U.S. Environmental Protection Agency (EPA). This data set classifies the landscape into fifteen different components. It has been modified to eight general categories for this study. Other land use data is available from the EPA or NOAA's Coastal Change Analysis Program (CCAP).

Since the criteria for selection includes provisions for threatened habitat, the model incorporates data provided by the Virginia Department of Conservation and Recreation, Division of Natural Heritage. These data are provided in territorial blocks rather than site specific locations. Each block represents approximately 0.65 km^2.

Primarily, the model uses best professional judgement to evaluate wetland functions given the designated wetland type, followed by opportunity to perform those functions based on landscape position. Wetlands, in the form of digital polygon areas, are ranked according to these factors. For example, palustrine forested wetland polygons are not necessarily important for erosion control since erosive forces such as high wave energy are not normally present where these wetland types exist. However, palustrine forested wetlands do act as important water quality filters since they are positioned to receive wastewater, nutrient discharges, and surface runoff. Furthermore, a particular palustrine forested wetland positioned adjacent to a large agricultural area or urban area has a greater opportunity to perform this function than a palustrine forested wetland adjacent to a rural residential area. Here, the land use data are combined with the wetland coverages. The GIS actually makes these wetland assessments through analysis of their position with respect to the neighboring land uses or patterns observed; and later re-codes the various polygons based on these evaluations. Digital records are maintained for the ranked data sets.

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— Feathers & Fins —

Barred Owl

(Strix varia)

Julie G. Bradshaw

The barred owl (*Strix varia*) is a large brown and gray owl with dark eyes and no ear tufts (unlike the yellow eyes and ear tuft "horns" of the great horned owl). Length is 17-24 inches, wingspan is 40-50 inches. It has barring horizontally across the breast, with vertical streaks along the belly. The barred owl is the most commonly seen owl in our area, due in part to its semi-nocturnal hunting habit. It is also generally more vocal than other owls (e.g., great horned and screech owls). Its call is commonly described phonetically as "who cooks for you; who cooks for you-all." It also has a call that has been described as loud, prolonged, raucous outbursts of laughs, cackles, and hoots. Both sexes participate in calling. From a distance, the calls may be mistaken for dogs barking. The owls call throughout the year, with frequency peaking in late winter prior to egg-laying, and in late summer and fall, as the young disperse and try to establish territories.

Barred owls are generally associated with extensive forested wetlands (e.g., bottomlands, swamps, floodplains). However, researchers have found that the owls' attraction is not to the wetness of these areas, but to the extensiveness of old-growth deciduous forest in these areas, with trees of sufficient size to provide the cavities required by the species for nesting and cover. Extensive old-growth forests are often restricted to areas that are too wet to log, farm, or otherwise develop.

Barred owls are found throughout the eastern half of the U.S., and across Canada and the Pacific northwest U.S., where its range is expanding and it appears to be displacing the closely related spotted owl. In most of its range, the barred owl is nonmigratory, often using the same nest site for many years. Estimates of annual home ranges for barred owls vary from 200-900 acres.

Barred owls are opportunistic feeders. In most areas, their diet consists primarily of small rodents such as mice and voles. In bottomland hardwoods of the southern U.S., they may feed extensively on crayfish. In forested habitats near salt and brackish marshes, fiddler crabs provide a portion of the diet. Other prey items include larger mammals

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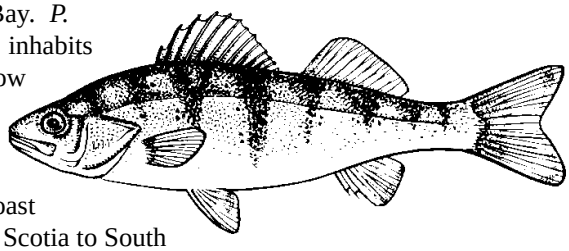
Yellow Perch

(Perca flavescens)

Lyle Varnell

Yellow perch have historically occupied an important niche in the Maryland and Virginia commercial and recreational fisheries; however, there appears to be no recent targeting of this species by Virginia commercial interests. It remains a popular recreational fish within the Bay community, and a brief but significant commercial fishery exists in the upper Bay. *P. Flavescens* inhabits fresh and low salinity waters along the Atlantic Coast from Nova Scotia to South Carolina. Their close relatives include the darters and the walleye.



P. flavescens is characterized by a bright yellow color with five to eight dark vertical bands on each side. The tail is forked and the dorsal fins are separate. It is believed to live up to 12 years of age and may reach lengths of one foot.

One reason for the yellow perch's popularity in the Bay's fisheries is that its spawning migration generally begins several weeks earlier than the run of other exploited finfish species. Yellow perch are semi-anadromous within the Chesapeake Bay, with prespawning inshore or upstream migrations to waters less than 2 parts per thousand (ppt) beginning in February/March. Males typically arrive at the spawning grounds before the females, and do not commence downriver migrations until most of the females have already departed the spawning grounds. Spawning, beginning in February and usually running through April, occurs nocturnally in shallow (1.5-3.0 meters depth) tidal or nontidal waters over rock, sand, gravel, rubble and aquatic vegetation. A typical female produces between 1,000 and 150,000 eggs which are deposited in long flat ribbons or floating bands.

After spawning, adults migrate downriver to waters generally less than 13ppt. Larvae remain nearer to the spawning grounds and school in shallow and open water at, or near, the surface. Yellow perch tend to remain in large schools after growth to the juvenile stage. Juveniles are initially pelagic, but become demersal when total length is approximately 25 millimeters. Inshore movement from deeper waters occurs mid-summer, and above about 50 millimeters total length juveniles are commonly associated with aquatic vegetation. Males mature after approximately one year and

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Chesapeake Executive Council Directive No. 97-2

Wetlands Protection and Restoration Goals

Editor's Note: A little over one month ago, the Chesapeake Bay Executive Committee signed a new directive for the Chesapeake Bay Program. Directive 97-2 addresses the management of wetland resources in the Bay watershed. Directives have considerable importance, in so far as the Executive Committee is composed of the governors of Virginia, Pennsylvania and Maryland, the mayor of Washington D.C., the administrator of the Environmental Protection Agency, and the chairman of the Chesapeake Bay Commission. The composition of the committee means that the new Directive not only provides "marching orders" for the Bay Program staff, but it also represents a commitment on the part of each of the states to achieve specific goals. In the case of Directive 97-2, this means that Virginia and its partners in the Chesapeake Bay Program will be moving aggressively to enhance existing efforts to manage wetland resources.

The text of Directive 97-2 is reprinted below. A quick review will indicate that the governors have committed their respective states to some positive, but very difficult, goals. The time lines established for the development of information, plans, and goals are short, and will require rapid and constructive efforts. The Directive addresses all wetlands, both tidal and nontidal, and commits to genuine progress toward attainment of a "no net loss" goal for the resource.

The next editions of the *Virginia Wetland Report* will review some of the issues raised by the new Directive, and report on the progress of the states toward meeting the goals detailed below.

Wetlands, both tidal and nontidal, play a critical role in the Chesapeake Bay ecosystem, a role that was recognized by the Chesapeake Bay Program in the 1987 Chesapeake Bay Agreement and in the 1989 Chesapeake Bay Wetlands Policy. The maintenance of existing wetlands and restoration of wetland acreage and function are critical to sustaining habitats for breeding, spawning, nesting, and wintering living resources, including those living resources vital to the regional economy. Wetlands also play a valuable role in keeping the Bay healthy by retaining nutrients and minimizing the impacts of flooding.

In 1989, we committed in the Chesapeake Bay Wetlands Policy to a no net loss goal and to take steps to achieve a long-term goal of a net resource gain in acreage and function. We reaffirm the no net loss goal for the watershed, recognizing that the no net loss must be for both acreage and function. We maintain our commitment to protect existing wetlands to the maximum extent practicable. In addition, we reaffirm our commitment to the following ongoing implementation actions:

- To reduce the losses of wetlands from regulated activities by encouraging more preliminary consultations to avoid or reduce wetland impacts early in the planning process.
- To compensate for unavoidable wetland losses from regulated activities by requiring permittees to mitigate for wetland losses in a manner that encourages replacement of both acreage and function.
- To encourage non-regulatory measures to protect and manage wetlands outside of the scope of regulatory programs.

The purpose of this directive is to develop strategies to achieve the protection and restoration of the wetlands resource, to establish a quantifiable wetland restoration and preservation goal and to define methods to measure our success in meeting that goal.

Therefore, we direct that the following specific actions be undertaken by the Chesapeake Bay Program:

- Evaluate and supplement as necessary, current wetland tracking and accounting mechanisms, including the need for the development of new databases or other new information collection techniques to improve our ability to evaluate our progress in protecting and restoring wetlands. That effort shall include the following efforts:
  - By June 1998, identify a strategy to complete wetland status and trends in the Bay watershed wetlands every 5 years. This strategy shall provide the means to obtain measurable data and information that will accommodate the broad-based needs of the Bay Program and the local governments in the Bay watershed. It shall include an evaluation of the validity and reliability of new inventory technologies as assessment tools. Their cost effectiveness, and the util

ity of potential tools and technologies for assessment purposes.

- By January 1999, complete the National Wetlands Inventory Program mapping of the entire watershed to provide a modern benchmark to quantify the nature and extent of wetlands in the Bay drainage basin.
- Complete and publish a wetlands status and trends report for dissemination to the public by January 2000, and every 5 years thereafter.

Based upon our characterization of wetland resources as noted above, the Chesapeake Bay Program, in coordination with other public and private entities, shall:

- By the annual Chesapeake Executive Council meeting in 1998, develop jurisdiction-specific strategies for achieving net gain goals. At a minimum, the strategies should include a plan for restoring every acre of wetland lost each year with an acre of wetland of similar ecological value. Upon development of a quantifiable goal, the jurisdiction-specific strategies will be updated in 2000, and every 5 years thereafter.
- By the annual Chesapeake Executive Council meeting in 1999, establish a quantifiable goal for a net gain in wetlands acreage and function based upon the results of wetlands trends reports, assessment or regulatory and non-regulatory programs, and local interests. This goal will acknowledge and reflect information used to establish Maryland's Wetlands Recovery goal of 60,000 acres and any similar goals which may be set in the interim by the other jurisdictions.

We further commit to assisting local governments and community-based watershed efforts through the development of tools and information. This commitment shall include:

- Augmenting wetlands assessment projects completed in the states of Maryland and Pennsylvania with an additional pilot project in Virginia to be completed by July 1998.
- Drawing upon the lessons from the pilot projects, completing and publishing a community-based approach to wetlands preservation and restoration no later than January 1999.
- Targeting community-based approaches for wetland management to ensure that priority technical-assistance, and assistance in defining measurable preservation and restoration goals, can be provided to interested communities. Priorities for responding to local requests for assistance will be determined by the Bay Program after consultation with local governments and others in order to ensure the most effective use of limited technical assistance resources.

***By this directive,* we reaffirm our commitments made in the 1987 Chesapeake Bay Agreement and the 1989 Chesapeake Bay Wetlands Policy to take steps to achieve a net resource gain as a long-term goal for wetland restoration in the Chesapeake Bay basin, recognizing the role wetlands play in the overall health of the Bay and its living resources. We, the undersigned, agree to further our efforts through this directive.**

Date: October 30, 1997

For the Commonwealth of Virginia
George Allen

For the State of Maryland
Parris N. Glendening

For the Commonwealth of Pennsylvania
Thomas J. Ridge

For the District of Columbia
Marion Barry

For the United States of America
Carol M. Browner

For the Chesapeake Bay Commission
W. Tayloe Murphy, Jr.

Chesapeake Bay Program

Wondering about Wetlands

William Roberts

Q What is marsh toe protection and how does it protect a wetland?

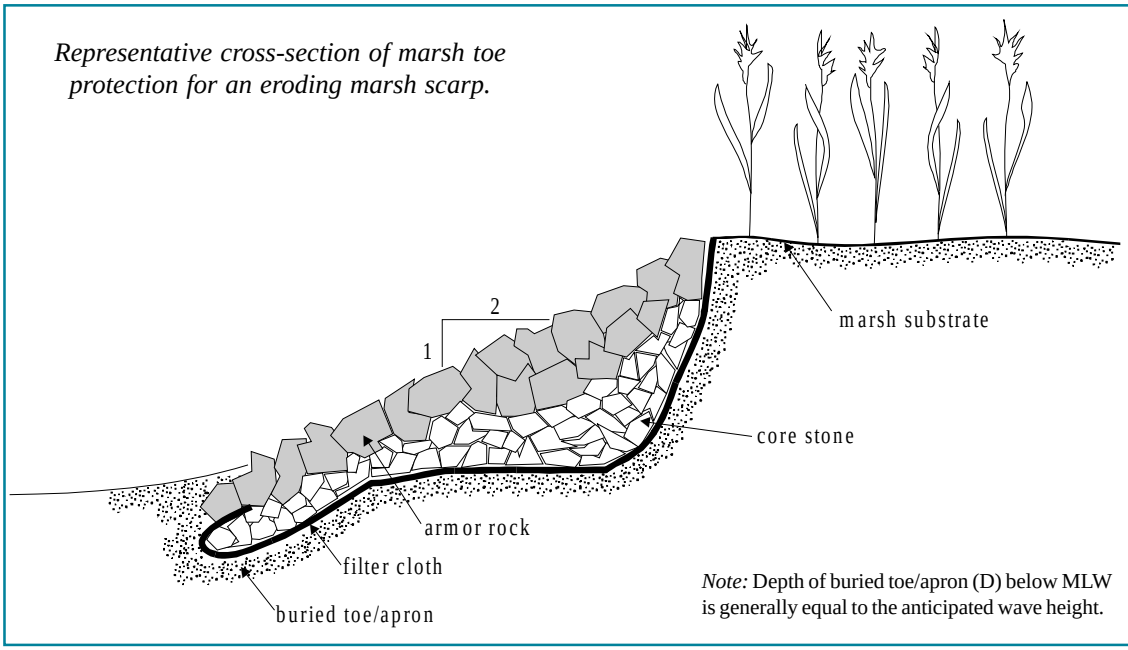
A As sea level rises and soft marsh substrates settle, vegetated wetlands are often subjected to wave driven erosion along their channelward edge. The wave action erodes away the fine clays, silts and organics which, in conjunction with the vegetation root mass, bind the larger sand particles together forming the peat-like marsh substrate. As a result of this process, a vertical scarp of eroding marsh substrate is exposed to erosive wave energies. Eventually, the constantly eroding scarp will move landward, resulting in the loss of the vegetated wetland.

Vegetated wetlands are important because of the valuable functions they perform in the marine environment. The wetland vegetation removes nutrients from the water column during the growing season and then recycles these nutrients during the winter months. In many cases, thickly vegetated stands of wetland plants act as excellent filters for sediments carried into aquatic areas from upland erosion. Most of the important finfish, not to mention blue crabs, grass shrimp and other marine organisms utilize these vegetated wetlands as a source of food and habitat. The important concept to remember is that in every case, whether the function is nutrient recycling, sediment capture or provision of food and habitat, the vegetated wetland must interact, unimpeded with the marine environment. Fish, crabs, plankton, detritus, etc., must be able to enter and exit the wetland with each tidal cycle.

Now we can address the real topic of this column, "How to protect these eroding scarps without interfering with the vegetated wetland's interaction within the marine environment?" Marsh toe protection consists of a layer of properly sized riprap stone placed on filter cloth and aligned along the leading edge of the eroding marsh. The vertical elevation of the marsh toe protection structure should not exceed the height of the vegetated wetland surface it is protecting. This insures that the marsh toe structure is overwashed during each tide cycle and allows marine organisms and detritus to enter and exit the wetland.

On occasion, due to excessive fetch or wave energies, it may be necessary to construct the vertical elevation of the marsh toe protection slightly higher than the surface of the marsh. In these instances, several options exist that can somewhat reduce the resulting isolation of the marsh. Gaps in the uppermost layers of the structure will allow marine organisms greater access to the marsh or, if possible, the ends of the structure can be lowered to improve access. If the shoreline suffers from extreme exposure to wave stress, it may be necessary to place a splash apron just landward of the main structure.

Representative cross-section of marsh toe protection for an eroding marsh scarp.



Note: Depth of buried toe/apron (D) below MLW is generally equal to the anticipated wave height.

Chesapeake Bay Program Wetlands Initiative—New Approach Allows the Identification of Locally Important Wetlands
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County). The Initiative team is also interested in testing the method in Virginia and is awaiting final designation of a watershed for that purpose. In each watershed, the Initiative team has collaborated with local officials and NGOs to apply and evaluate the assessment method.

Preliminary findings in both Pennsylvania and Maryland suggest the approach is sound and useful. The chief limitation planners and regulators have found is the accuracy of the wetlands inventory upon which the assessment protocol is based. While generally very good, NWI maps are not 100% accurate. For example, they tend to miss some smaller nontidal wetlands in forested landscapes, and they can be out of date in rapidly changing areas. For this reason, the assessment method, which assumes the inventory represents actual conditions, can only be as complete as the inventory. This has proven satisfactory for watershed level planning, but specific site planning must still rely on field surveys.

The assessment protocol utilized by the CBP Initiative team is modeled on another planning protocol under development at VIMS. The VIMS protocol has been developed by a graduate student, Lynn Dancy, and her advisors, Carl Hershner and Kirk Havens. The goal of the VIMS protocol is to identify wetlands in large watersheds which might be good targets for acquisition by wetlands preservation programs. The VIMS protocol is also based on an evaluation of probable performance of functions using a variety of information. As with the CBP Initiative team's method, wetland capacity to perform specific functions and the opportunity afforded by landscape setting are both assessed. In addition the VIMS protocol considers "threat" to the wetland in the form of potential for changes in surrounding landuses.

The VIMS protocol has been tested in the York River basin, a much larger area than either of the watersheds used by the CBP Initiative team. The reason for this difference is found in the intended purpose of each method. The CBP method is aimed at local government planners and small watershed associations. The VIMS protocol is being developed for state and regional managers. Nevertheless, the two methods share a common conceptual design and can be used over smaller or larger areas as desired.

Developers of both methods stress the importance of considering wetlands as part of the larger landscape in order to develop appropriate management strategies. In each method, assessment of wetland functions is heavily dependent on surrounding land uses. This reflects current scientific understanding about processes in wetlands. It also reflects an evolving approach in resource management programs. Managers understand that for wetlands, preservation of benefits provided to a local system, often requires management of not just the wetland but the rest of the system as well. The CBP method and the VIMS protocol represent the state of the art in development of guidance for this type of integrated management.

Both methods are intended to undergo further testing and development in the first half of 1998. Subsequently, assuming no unforeseen problems arise, the methods will be prepared for general dissemination to interested parties. Additional information about the CBP Initiative method can be obtained by contacting the Wetlands Workgroup at the Bay Program headquarters in Annapolis, MD. More information about the VIMS protocol can be obtained from the VIMS Wetlands Program office at Gloucester Point, Virginia.

Related Information on the Web

VIMS: http://www.vims.edu
Chesapeake Bay Program: http://www.epa.gov/r3chespk/
National Wetlands Inventory: http://www.nwi.fws.gov/
EPA Surf Your Watershed: http://www.epa.gov/surf/surf_search.html

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Targeting for Effective Wetlands Preservation - A GIS Application
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Finally, the selection of preservation sites must consider the relative threat or ecological importance of an area. Data from the Division of Natural Heritage defining critical habitat areas which may support rare, threatened or endangered species can be used to further prioritize those areas previously ranked for high function, opportunity, and landscape position. Proximity or connectivity to these areas of special management concerns can be identified using GIS techniques to perfect the site selection.

This application of GIS offers another valuable management tool which enhances the effectiveness of current management capabilities. These tools continue to improve the efficiency at which we can make decisions and offer opportunities to expand the level of certainty in our approach to land use problems.

Reference:

Dancy, L.M., 1997. Targeting Wetland Preservation Areas For Compensatory Mitigation Utilizing a GIS Protocol, M.S. thesis in preparation, Dept. of Resource Management and Policy, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Peat: Processing and Potential for Restoration

Pamela Mason

In the previous Virginia Wetlands Report, I discussed the uses of peat and most common methods of harvest. Worldwide, 90% of peat is mined using the milled peat extraction method and the scant research on restoration which has been conducted has focused on this practice. The milled peat extraction process typically begins with the excavation of trenches both around, and through, the peat bog. The trenches serve to remove water from the site, allowing the use of large harvesting machinery. Next the live vegetation is removed and several centimeters of the peat surface is loosened to dry. Once dried, the peat is collected in vacuum harvesters. Generally, this process is repeated until all the peat is mined. Milled peat mining allows for the harvest of the loose surface layer of peat known as the top spit. Loss of this material can have a significant impact on the potential for restoration.

The first step in the restoration process is the assessment of the extent of damage to the hydrology, topography and vegetation of a site. If the damage was not severe (i.e. only a portion of the surface was disturbed, or excavation was fairly shallow), it may be possible to repair the area. If the damage was more severe, it is necessary to rebuild the site.

As with all wetlands, water is critical to the formation and restoration of a peat bog. Water losses occur not just from drainage canals, but from lateral flow to adjacent areas. The water table must be maintained within one-half to one meter of the surface for successful restoration. Water elevation may be reestablished using dams, embankments, or by the provision of supplemental water.

The effects of topography on the potential for restoration are considered on two levels—the surface topography and the underlying stratigraphy. On the macro scale, the surface slope of the site must be essentially flat in order to prevent surface water runoff and loss. On a micro scale, surface topography should mimic the hummocks and hollows of natural bogs. The soil stratigraphy of a bog is composed of the catotelm (lower black peat layer) and the acrotelm (the upper white peat layer). The catotelm is highly decayed, permanently waterlogged material which serves as an impermeable seal for the bottom of the bog. The acrotelm experiences the most biotic activity and the greatest hydrologic flux. For the purposes of restoration, it has been estimated that the water storage function of the catotelm requires a minimum depth of 50 cm, and the acrotelm should be at least 30 cm in depth.

For those sites which are not extensively damaged, revegetation rates can be impressive. However, for large scale mining sites, evidence indicates little natural reestablishment of vegetative species. Mosses of the genus *Sphagnum* are the dominant vegetation. While vegetative parts of *Sphagnum* species appear to be dispersed by both air and water, the most successful efforts of revegetation have required human intervention. The best results come from restoration efforts which preserved the living top spit, or surface layer, of the bog prior to mining, and returned the material to the bog once mining had stopped. The viability of the material as an effective revegetation tool requires constantly moist conditions.

Despite evidence of the possibilities of bog restoration, the reality is that the extremely slow redevelopment of bogs makes evaluation of success difficult. It has been estimated that bogs accumulate peat at a rate of one to two millimeters annually, and living vegetation as rapidly as six inches annually. These fairly large numbers are dwarfed, however, by current mining practices which may harvest peat to depths of ten feet or more.

Reference:

Roos, Steve. 1997. Raised bog restoration to peat producing *Sphagnum* species: an overview of European approaches. URL http://www.soils.umn.edu:8003/h5015/roos.htm.

Fun Fact: *Aside from its use as a fuel or horticultural material, peat is used to fuel fires for the purpose of drying malted barley providing the distinctive flavor of single malt scotch.*

Yellow Perch
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reach total lengths of greater than 100 millimeters. Females do not mature until their third summer. At maturity, females are generally greater than about 140 millimeters total length.

Adults have a distinct daily behavior, with schools moving upward in the water column and inshore at night. Feeding occurs at dusk and dawn (after an inactive nocturnal period) in shallow waters. Yellow perch are carnivores; adults feed on all sizes of prey up to and including crayfish, crabs, minnows and young fish.

Wetlands are exploited by yellow perch for nursery and feeding areas, which make this species an important link in the trophic system of the upper reaches of the Chesapeake Bay's tributaries.

Calendar of Upcoming Events

Jan. 13-15, 1998	**National Conference on Goal Setting: Criteria for Coastal Habitat Restoration.** Charleston, SC. Contact Pace Wilber at (803) 974-6235 or email: pwilber@csc.noaa.gov
March 15-19, 1998	**Fourth Annual Marine Estuarine Shallow Water Science and Management Conference.** Atlantic City, NJ. Contact Ralph Spagnolo at (215) 566-2718 or Ed Ambrogio at (215) 566-2758 or email: ambrogio.edward@epamail.epa.gov.
June 8-12, 1998	**Society of Wetlands Scientists Annual Meeting.** Anchorage, Alaska. Contact Terry Brock: tbrock@ptialaska.net
July 12-15, 1998	**The Coastal Society Biennial Meeting. Minding the Coast: "It's Everybody's Business"** Williamsburg, Virginia. Contact Mo Lynch, Conference Chairman, at (804) 684-7151 or email: tcs16@vims.edu.

Barred Owl
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such as squirrels and rabbits, birds, frogs, snakes, lizards, salamanders, fish, and insects.

Nesting is most common in natural cavities of live and dead trees, but also occurs in old hawk, squirrel, and crow nests. Normally, two eggs are produced and incubated by the female for approximately 1 month. The young fledge at 6 weeks after hatching, but may still be getting some of their food from the parents until about 4 months of age.

Barred owl populations are primarily restricted by availability of extensive forests with large diameter (>20 inches dbh) deciduous nest trees. Carmichael and Guynn (1983) suggest that 1 snag tree per 25 acres is required to support a maximum barred owl population. The owls require a fairly closed canopy (optimum canopy closure was estimated at 60% (Allen, 1987)) at the nest site. More open forest invites intrusion by competing species such as the great horned owl. Opening the canopy can also allow more vegetation growth in the understory, which can make hunting more difficult for the owl. Management for barred owls should include maintaining large contiguous tracts of mature deciduous, or mixed pine and deciduous, forest. Where logging must occur, single tree selection is preferred. Leaving hollow trees and snags standing benefits the owls as well. Current interest in maintaining and expanding forested buffers along streams should serve this species well, ensuring that the night air will continue to be filled with the raucous cackles and “who cooks for you-all” call of the barred owl.

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