

# **Wetlands in Upper Delaware Watershed**

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A Technical Report for the Upper Delaware  
Watershed Management Project  
November 2003



• Restored emergent wetland on former muck cropland in Pequest Watershed, Independence Township, Warren County.



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# **Wetlands in the Upper Delaware Watershed**

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## **Overview**

“Wetland” describes an assortment of areas on the landscape that have unique soils, plants, hydrology and wildlife. Wetlands generally occur between uplands and deepwater areas and occur in many forms from forested “swamps” to emergent “marshes”. Wetlands often include some characteristics of uplands and some characteristics of aquatic areas. Bogs, fens, vernal pools, rivers, lakes and ponds are all considered types of wetlands. Some sites with soils saturated for as little as 2-3 weeks a year are considered wetlands by regulatory agencies as well as wetland scientists. Some wetlands have water year round while other wetlands dry out seasonally. Wetlands are among the most biologically productive ecosystems on earth and they often display great species diversity and richness. Wetlands provide many ecological functions that are valuable to society and therefore have been protected by federal and state statutes for many years. A wetland is defined by the NJ Freshwater Wetlands Protection Act (2001) as “an area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions....”.

Wetlands currently comprise about 10% of the entire Upper Delaware Watershed or about 75 square miles. Historically, the wetlands of the watershed have been viewed as waste lands, best suited to conversion to other uses such as agriculture, residential housing or commercial sites. Statewide, New Jersey has lost about 39% of its original wetlands to agriculture and development. Sussex, Warren, Morris and Hunterdon Counties are thought to have much higher wetland losses than the statewide average. Up to 71% of the original wetlands in Hunterdon County, 57% in Sussex County, 46% in Warren County and 29% in Morris County have been converted (Tiner, 1985). While historically agricultural conversions accounted for most wetland losses, recent wetland losses in the Northeast US are overwhelmingly due to development. USDA reports that development accounted for over 38% of the total wetland loss and agriculture accounted for only about 5% of the total wetland losses between 1992 and 1997. (USDA NRCS 2000).

A recent study by the US Fish & Wildlife Service reported that nationally, wetlands losses are slowing dramatically. The loss of wetlands in the United States from 1986 to 1997 declined by 80% from losses in the previous ten-year period. In the 1990's an average of 58,500 acres of wetlands were lost annually in the United States while losses in the 1980's were 290,000 acres annually (National Wildlife 2001).

Many wetlands in the Upper Delaware Watershed that were never drained or filled were however degraded by human disturbance. These areas are still considered wetlands but their ecological functions are greatly reduced when compared to undisturbed wetlands. Degradation can happen in many ways. Polluted water entering a wetland can reduce plant species health and vigor and thereby reduce wetland plant functions such as supplying wildlife habitat, reducing soil erosion

and increasing nutrient uptake. Other degradations include hydrologic modifications, fill of soil or other material and reduced diversity due to invasive exotic vegetation.

The Upper Delaware Watershed still includes many unique and ecologically valuable wetlands. Many of the watershed's 75 Natural Heritage Priority Sites, identified by the NJ DEP Office of Natural Lands Management, include unique wetland communities (NJ DEP, Office of Natural Lands Management 2001). Over 135 calcareous sinkhole ponds were identified in the Appalachian Valley and Ridge physiographic province (much of which falls in the Upper Delaware Watershed) in a recent report prepared for the US Environmental Protection Agency (Walz, *et al.* 2001). These unique wetland communities support a large number of rare plant species and provide significant habitat for rare invertebrates and amphibians.

## **Wetland Functions**

Wetlands provide many different ecological functions, depending upon where wetlands are located, the type of wetland, the particular season and other factors. During heavy rainfall events, wetlands can store floodwaters for safe, slow release after the storm event ends. Wetlands can trap nutrients and sediment carried by stormwater. Some nutrients are taken up by vegetation in wetlands and some nutrients are processed into different forms in wetlands. Wetlands can help recharge groundwater if situated on permeable soils. Wetlands provide important food, water, cover, nesting sites and space for local native fish and wildlife species. Many wetlands harbor rare species of plants and animals that are found only in association with these unique areas.

Many wetlands have been acquired by federal, state and local governments and are used for environmental education and recreation. More than half of all adults in the United States hunt, fish, bird-watch or photograph wildlife. These activities, which rely on healthy wetlands to a large degree, provided an estimated \$60 billion to the nation's economy in 1991 (USDA 1995). Wetlands provide habitat for about one-half of all the fish, one-third of all the birds and one-fourth of all the plants on the federal threatened or endangered species list.

Wetlands yield commercial fish as well. They are often spawning and nursery areas for commercial finfish and shellfish species. The United States fish processing and sales industry generates about \$27 billion annually and employs hundreds of thousands of people. It is estimated that 71% of this value is derived from fish species that depend upon wetlands during their life cycle (USDA 1995).

The pollution abatement function of wetlands helps keep sediment, nutrients and other materials from entering streams, lakes and reservoirs used for drinking water. The presence of healthy wetlands in a watershed with streams used for drinking water can save millions of dollars in water treatment facilities. Similarly, wetlands stormwater storage functions help to reduce flooding and erosion; protect crops in agricultural areas; as well as protect roads, buildings and human health in developed areas.

For many years wetlands in the Upper Delaware Watershed have received protection from several important laws. At the federal level, the Clean Water Act of 1977, Section 404, required permits for many wetland disturbances from the US Army Corps of Engineers until 1987. With passage of the New Jersey Freshwater Wetlands Act of 1987, the NJ Department of Environmental Protection assumed freshwater wetland regulatory authority. Some forestry and agricultural activities are exempt from these regulations. Certain activities are regulated by "Statewide General Permits" that are more easily obtained than "Individual Permits". The general permits are for activities that have little supposed impact on wetlands individually and when impacts are examined cumulatively over the state.

# Status of Wetlands in the Upper Delaware Watershed

According to the NJ Department of Environmental Protection (DEP) 1995/97 land use/land cover dataset, the Upper Delaware Watershed includes over 49,000 acres of freshwater wetlands (Table 1). This represents just over 10% of the 746 square miles of the Upper Delaware Watershed. The 1986 data for the watershed is also presented below. For this report, wetland types are grouped into the four categories below:

**Table 1. Wetland categories, acreage and changes in the Upper Delaware Watershed**

Wetland Category	1995/97 Acres	1986 Acres	Change in Wetland Area 1986 to 1995/97 (acres)
Forested Wetlands	27,942	28,472	-530
Scrub/Shrub Wetlands	6,332	6,103	+229
Emergent Wetlands	6,982	7,301	-319
Modified/Disturbed Wetlands	7,946	7,559	+387
<b>Total</b>	<b>49,202</b>	<b>49,435</b>	<b>- 233</b>

Cowardin, et al (1979) provide the following definitions for wetland types.

**Forested Wetlands** are characterized by woody vegetation that is 20 feet tall or taller and usually possess an overstory of trees, an understory of young trees or shrubs and a herbaceous layer.

**Scrub/Shrub Wetlands** are dominated by woody vegetation less than 20 feet tall and include true shrubs, young trees and trees and shrubs that are small or stunted due to environmental conditions. Scrub-shrub wetlands may represent a successional stage leading a forested wetland or they may be a relatively stable community.

**Emergent Wetlands** are characterized by erect, rooted herbaceous wetland plants, excluding mosses and lichens. These wetlands are usually dominated by perennial plants.

**Modified/Disturbed Wetlands** - For this report we have grouped the five NJ DEP categories of agricultural wetlands (modified), disturbed wetlands (modified), managed wetland-built up maintained recreation area, managed wetland-maintained lawn greenspace and wetland rights-of-way (modified) into a category we called Modified/Disturbed Wetlands.

Forested wetlands account for over ½ of the wetlands in the Upper Delaware Watershed and these wetlands play a critical ecological role in the watershed. Much of this wetland is located adjacent to streams and rivers. Forested wetlands adjacent to streams provide a filter for surface and subsurface waters and can remove and process nutrients, sediment and other pollutants from surface runoff and subsurface waters. These same forests provide shade to streams and protect cold and cool water fisheries and all other stream life adapted to forested conditions that have been present for most of the last 10,000 years in the Upper Delaware Watershed. The trees from the forests provide major energy inputs such as leaves and woody debris that provide food and cover for stream macroinvertebrates at the bottom of the stream food webs. Much of the forested wetland is important wildlife habitat for rare species such as the barred owl, long-tailed salamander, wood turtle and bobcat. The NJDEP data indicates that 2% (or 530 acres) of the Upper Delaware Watershed's forested wetlands were lost between 1986 and 1997. When considering the important ecological function of forested wetlands, this rate is quite alarming. If

these trends continue, in just 50 years almost 10% of the regions forested wetlands could be gone.

Emergent and scrub/shrub wetlands only constitute 14% and 13% of the Upper Delaware Watershed's wetlands respectively, however these wetlands also have critical ecological functions. Many of these wetland acres are located in large, contiguous wetland tracts that provide valuable water quality functions and rare plant and animal habitat. The NJDEP data show a 4% loss of emergent wetlands and a 4% gain in scrub/shrub wetlands between 1986 and 1997. The gain of scrub/shrub wetlands is probably due to natural succession of emergent wetlands or due to farmed areas that have been abandoned and have reverted to wetlands over the period.

The data indicates an increase in modified/disturbed wetlands of about 5% between 1986 and 1997. Although these areas have hydric soils, these wetlands probably provide fewer ecological functions than all other wetland categories discussed. If this increase is removed from the data, the total wetland acreage actually decreased by about 1%. Some of the changes in wetland acreage over the period may have also been due to "corrections" of the 1986 data reported by DEP in the 1995/97 dataset. In addition, the datasets are not directly comparable due to changes in some wetland categories and codes between the 1986 and 1995/97 datasets.

## **Wetland Status by Sub-watershed**

Wetland maps of the five major sub-watershed groups in the Upper Delaware Watershed are presented in Maps 1-5. The five sub-watersheds have some very different wetland characteristics.

### *Flat Brook Watershed Group*

The **Flat Brook** sub-watershed group has 6,785 acres of wetlands (Map 1). Fifty-eight percent of these wetlands are forested wetlands, 22% are emergent wetlands and 16% are scrub/shrub wetlands. Much of the forested wetland areas are found along the streams in this sub-watershed group, including the Big Flat Brook, Little Flat Brook and many of the smaller tributaries to these two streams. Much of the emergent and scrub/shrub wetlands is also found in association with the major streams in the Delaware Water Gap National Recreation Area and several state Wildlife Management Areas. Only 4% of this sub-watershed group's wetlands are modified/disturbed wetlands.

### *Paulins Kill Watershed Group*

The **Paulins Kill** sub-watershed group has 15,330 acres of wetlands (Map 2). The wetland makeup is similar to the Flat Brook sub-watershed group. Fifty-six percent of this sub-watershed's wetlands are forested wetlands, 16% are emergent wetlands and 13% are scrub/shrub wetlands. Again, forested wetlands are associated with the streams in this sub-watershed group. A large concentration of forested, scrub/shrub and emergent wetlands is found east of the town of Newton and east of Lafayette. This area includes a large area of organic soils. Some of this area has been drained and farmed and are included in modified/disturbed wetlands. Other areas have had the muck mined and are now considered open water wetlands. Fifteen percent of the Paulins Kill sub-watershed group's wetlands are in the modified or disturbed category, a high percentage compared with the Flat Brook watershed.

### *Pequest Watershed Group*

The **Pequest** sub-watershed group (Map 3) has 16,107 acres of wetlands and again a large percentage (50%) of its wetland area is in the forested wetlands category. However, in this sub-watershed group the second largest category is the modified/disturbed wetlands totaling 3,931 acres or 24% of the watershed's wetlands. This area is almost entirely in two organic soil areas with a long history of agricultural drainage – Alphano and Great Meadows. Adjacent to these two large areas of modified/disturbed wetlands are emergent, scrub/shrub and forested wetlands. Much of these wetland areas were also drained at one time, but are reverting back to wetlands after being abandoned by agriculture. Some of the large forested wetlands were always too low for agricultural drainage to be effective and have remained woodlands, although probably timbered during the late 19<sup>th</sup> Century. Other large wetland areas in this sub-watershed group include the Cat Swamp area near Oxford and the Whittingham Wildlife Management Area in Green Township.

### *Pohatcong-Lopatcong Creek Watershed Group*

The **Pohatcong-Lopatcong** sub-watershed group (Map 4) has only 3,500 acres of wetlands - the fewest wetland acres of any of the five sub-watershed groups in the Upper Delaware Watershed. Again, most of the wetlands are forested (63%). These wetlands are mainly along the Pohatcong Creek, especially in the upper reaches between Washington and Hackettstown and along the five smaller streams originating in the Scotts Mountain area of Harmony Township. The downstream areas of the Pohatcong Creek and the Lopatcong Creek have been extensively cleared of woody vegetation and modified for agriculture and development. Nineteen percent of this watershed's wetlands are in the modified/disturbed categories and much is located in the downstream reaches near Phillipsburg. Only 6% of the Pohatcong/Lopatcong wetlands are emergent wetlands and 12% are scrub/shrub wetlands.

### *Musconetcong Watershed*

The **Musconetcong** watershed (Map 5) has 7,482 acres of wetlands and the breakdown of the wetland types is very similar to the Pohatcong/Lopatcong watershed wetlands. Sixty-eight percent of the wetlands are forested wetlands, 7% are emergent wetlands and 14% are scrub/shrub wetlands. Much of the downstream area of the Musconetcong watershed was extensively farmed and cleared of much of the original woody vegetation. Seven percent of this sub-watershed's wetlands are in the modified/disturbed category and are located in the downstream areas.

## **Modified Agricultural Wetlands**

The NJ DEP freshwater wetlands mapping effort in the mid to late 1980's included a category of wetland called "modified agricultural land". This category consisted of drained hydric soils that, at the time of the mapping, were in active agricultural uses such as cropland, hayland or pastureland. Due to agricultural activities, this land usually had lost the native wetland vegetation and the original wetland hydrology. In 1986, the NJ DEP freshwater wetlands dataset included about 6,300 acres of modified agricultural land in the Upper Delaware Watershed. There is some concern that this land is being converted to other uses such as commercial and residential development, illegally because the sites do not possess wetland vegetation and wetland hydrology although they still have hydric soils. Table 2 summarizes the amount of modified agricultural land present in 1986, the change in the 1995/97 NJ DEP dataset and the categories that the modified agricultural land was coded under in 1995/97 dataset.

**Table 2. Modified agricultural (ModAg) wetlands in five sub-watershed groups and changes between 1986 and 1995/1997**

<b>Sub-watershed Group</b>	<b>Acres in the ModAg category 1986</b>	<b>Acres changed from ModAg 1995/97</b>	<b>Former ag, becoming shrubby, not built up</b>	<b>Managed wetland, lawn or rec. area</b>	<b>Rural residential</b>
Flat Brook	179	4	4	0	0
Paulins Kill	1579	199	168	8	7
Pequest	3510	118	93	6	4
Pohatcong-Lopatcong	525	81	60	3	4
Musconetcong	522	57	41	0	9
<b>Total</b>	<b>6315</b>	<b>459</b>	<b>366</b>	<b>17</b>	<b>24</b>

Between 1986 and 1995/97 there were 459 acres of modified agricultural land in the Upper Delaware Watershed converted to other wetland categories. Eighty percent (366 acres) are now in the category “former agricultural wetland – becoming shrubby, not built-up”. Most of this land has been abandoned from agricultural use and is reverting to natural wetland vegetation and presumably some wetland hydrology is returning. Normally, these fields are abandoned when they are no longer productive because excess surface or subsurface water has interrupted agricultural operations. Another 10% has become “managed wetland in lawn or recreational areas” and “rural residential”, indicating a loss of most wetland functions. These areas, if converted without a DEP permit, were converted illegally. The remaining 10% is now in a number of other categories such as: industrial, artificial lakes, disturbed wetlands, commercial/services, transportation/communication/utilities, orchards/vineyards/nurseries and other agriculture. Again, these areas were probably converted illegally.

In the spring of 2002 some limited field investigation was conducted by the Natural Resources Conservation Service (NRCS) personnel to field check some of the 1995/97 modified agricultural wetlands. Most of the sites observed were still in agricultural production and used as cropland, hayland or pastureland. Several fields had been abandoned and were beginning to grow up in woody wetland vegetation. These areas would now fit the “former agricultural wetland – becoming shrubby, not built-up” category that described most changes between 1986 and 1995/97. No other wetland changes were observed during the NRCS field investigation.

# Wetland Restoration Opportunities in the Upper Delaware

Restoring wetland areas that are degraded, drained, filled or otherwise lost is one way to reduce the net loss of wetlands that is occurring in the Upper Delaware Watershed, throughout New Jersey and the United States as well. With assistance from federal agencies that have active wetland restoration programs in New Jersey some wetland acreage in the Upper Delaware Watershed has recently been restored.

## Wetland Reserve Program

The USDA Natural Resources Conservation Service's (NRCS) Wetland Reserve Program (WRP) is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. Landowners have the option of enrolling eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements. The program is offered on a continuous sign-up basis and is available nationwide. This program offers landowners an opportunity to establish, at minimal cost, long-term conservation and wildlife habitat enhancement practices and protection. Land must be former farmland that is restorable and must be suitable for wildlife benefits.

While the primary target of WRP is private land, state and local governmental lands and non-governmental organization lands are eligible. In the Upper Delaware Watershed only about 80 acres are currently enrolled in WRP and permanent easements protect these restored wetlands. Projects include restoring emergent and forested wetlands on former agricultural lands that were at one time extensively drained. Statewide about 500 acres are enrolled in WRP. Over 1 million acres nationwide have been enrolled in WRP, with large acreage in the Southeast and along the Mississippi River drainage. The program was recently reauthorized by Congress and will be available to landowners for at least the next six years.

## Partners for Fish and Wildlife

In New Jersey, the US Fish & Wildlife Service's Partners for Fish and Wildlife program targets habitat restoration and enhancement to benefit federal trust species of fish and wildlife. Wetland restoration and enhancement is a program focus here in New Jersey. In recent years, projects in the Upper Delaware Watershed have been completed to restore, create or enhance emergent wetlands, scrub/shrub wetlands and forested wetlands that provide habitat for waterfowl, wading birds, amphibians, reptiles and mammals.

## Wetland Mitigation

In December 2002, the Bush Administration affirmed its commitment to the national goal of no net loss of wetlands. The *National Wetlands Mitigation Action Plan* was unveiled and it outlined how the overall functions and values of wetlands will be increased through the combined efforts of numerous governmental programs, partnerships and initiatives. The *Action Plan* listed the following action items that would be developed:

- Clarifying Federal Mitigation Guidance
- Integrating Compensatory Mitigation into a Watershed Context
- Improving Compensatory Mitigation Accountability
- Clarifying Performance Standards
- Improving Data Collection and Availability

The NJ Department of Environmental Protection requires compensatory wetland mitigation for unavoidable impacts to wetlands during permitted construction or development activities.

Balzano, et al. (2002) conducted a field evaluation on 90 freshwater wetland mitigation sites in New Jersey. The study concluded that although some 'high quality' wetland mitigation sites were observed, wetland functions and wetland quality overall in these sites is falling far short of meeting NJ DEP goals for wetland mitigation. No wetland mitigation sites in the Upper Delaware Watershed were examined during the study. Sites were examined from 17 of NJ's 20 watershed management areas.

Wetland mitigation banks are a form of regional compensatory mitigation, with the goal of providing greater resource protection and benefit to the public. Wetland mitigation banking promotes the restoration of larger wetlands to provide off-site compensation for multiple small mitigation projects, resulting in economies of scale in planning, implementation and management. Consolidation can result in wetlands of greater value because of their size and the commitment to long-term management. Mitigation banking can also result in wetlands of greater ecological value through the restoration of historic wetland diversity and distribution within a watershed by reducing the effects of habitat fragmentation. Several wetland mitigation banks that have been approved by NJ DEP have been constructed and are functioning in New Jersey. No banks are active in the Upper Delaware Watershed area.

## **Summary**

Wetland resources in the Upper Delaware Watershed are important to the environmental health of the region. Wetlands provide important ecological and economical functions to the area including:

- Water Quality Protection
- Nutrient Storage and Cycling
- Stormwater Retention
- Reduction in Flood Flows and Frequencies
- Provide Wildlife Habitat
- Provide Rare Plant and Animal Diversity
- Recreational Opportunities Such as Hunting, Fishing, Hiking, Birding
- Aesthetic Values

Much of the original wetlands of the area have been lost by filling, draining or other disturbance. Gross wetland acreage has changed little between 1986 and 1997, although there were acreage reductions in some important categories of wetlands. The data suggests that forested wetlands declined by almost 2% and emergent wetlands declined by more than 4% between 1986 and 1997. The two datasets are not directly comparable due to some coding changes and changes in wetland categories. From 1986 and 1995/97 datasets and from 2002 field inspections, it appears that most modified agricultural wetlands are remaining in agricultural use or being abandoned and reverting to fully functioning wetlands. Less than 1% of these modified agricultural wetlands have been converted to residential or other developed land use. There are opportunities for wetland restoration in the region but few landowners, including state and federal landowners (up to 25% of the land), are electing to restore wetlands in the Upper Delaware Watershed.

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