



Loss of White Cedar in New Jersey Pinelands Linked to Stormwater Runoff

One of the impacts of suburban stormwater runoff in the New Jersey Pinelands is the conversion of classic Atlantic white cedar wetlands to swamps dominated by hardwoods. Researchers Ehrenfeld and Schneider (1990, 1991) documented the link between human disturbances and vegetative changes at a series of wetland sites defined by differing levels of suburban intrusion. Importantly, they found that cedar wetlands directly influenced by stormwater runoff were much more strongly altered than all other wetland sites.

The cedar swamp is a unique habitat and serves as home to many rare and endangered plants and animals. In New Jersey and other states in the mid-Atlantic region, this habitat is typified by a nearly monospecific canopy of Atlantic white cedar with perhaps small amounts of several deciduous species including red maple, black gum, and sweetbay magnolia. The understory usually contains a variety of shrub species and the undulating swamp floor is carpeted with *Sphagnum* spp. The cedar swamp is a stressful environment, combining extreme acidity with low nutrient availability. The conditions result in a sensitive plant community with low diversity structure.

Virtually all water entering these wetlands is derived from infiltration in the uplands. This tight hydraulic connection assures that upland development will impact the quantity and quality of the water. Constituents of concern include nutrients, chloride, heavy metals, and organic chemicals from sources such as septic systems, lawns, and road surfaces. In addition, imper-

vious surfaces reduce groundwater recharge and influence the seasonal dynamics of the water table. Drainage ditches, and stream channelization also can act to change wetland hydrology.

Ehrenfeld and Schneider defined four groups of sites within the Pinelands to represent a gradient of suburban impact:

- *Control sites* were located within undisturbed watersheds and completely isolated from engineering features associated with development.
- *Near sites* were proximate to, and upstream of, unpaved roads within undisturbed watersheds.
- *Developed sites* were located within suburban developments with septic systems present along the wetland edge.
- *Runoff sites* were located in developed areas, and had stormwater sewer outfalls directly to the wetland.

Each individual site chosen for the study (four to five sites within each group) had a closed canopy of white cedar and was sampled for hydrologic, water quality, species composition, and community structure. Table 1 presents water quality data from each of the groups.

Species composition in cedar wetlands is highly sensitive to development. As part of the study, the researchers classified all species observed into four habitat categories: *indigenous* to cedar swamps; found in other *Pineland* habitats; found in non-Pineland



Table 1: Mean Water Quality Parameters Measured During the Growing Season at the Four Site Types - Sample Sizes in Parentheses (Ehrenfeld and Schneider, 1991)

Parameter	Control	Near	Developed	Runoff
Ammonia (µg/l)				
Surface water	3.9 (38)	2.2 (46)	141.3 (18)	229.4 (54)
Ground water	42.1 (50)	98.4 (50)	506.2 (48)	583.3 (60)
Orthophosphate (µg/l)				
Surface water	14.4 (64)	12.5 (88)	7.6 (24)	55.0 (92)
Ground water	11.0 (80)	12.7 (100)	30.9 (72)	68.0 (98)
Chloride (mg/l)				
Surface water	4.71 (40)	6.25 (46)	6.93 (18)	12.99 (54)
Ground water	4.93 (50)	7.04 (50)	16.4 (50)	15.4 (60)