POSTER ABSTRACTS:Atlantic White-cedar Symposium 2006

Effect Of Water Levels, Temperature, And Precipitation On The Growth Rates Of Atlantic White Cedar In An Intermediate-Aged Stand Within Alligator River National Wildlife Refuge

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Studies of cedar in Alligator River National Wildlife Refuge (AR) have reported higher water tables, higher stem densities of cedar, and higher carbon sequestration rates than found in other cedar stands in the region. However, the annual response of cedar to climate is poorly understood. The purpose of this study was to compare cedar ring widths in an intermediate-aged stand at AR to climate data and to other cedar stands in AR and in Dismal Swamp National Wildlife Refuge (DS). Cedar cores were collected in summer 2003 from a near monoculture intermediate-aged stand in AR in two subplots within nine plots along a previously established transect. Two cores were taken from three randomly selected trees in each subplot (n=54). Ring widths were measured and recorded using a Velmex TA sliding stage interfaced with image analysis and Measure J2X software. Average age of cedars at AR was 15.3 +/- 1.41 years and average ring width was 1.64 +/- 0.39mm, which was similar to ring widths for trees from an adjacent mature stand in AR (1.68 +/- 0.59mm), and smaller than ring widths in a similar-aged stand at DS (2.2 +/- 0.432mm, $p < 0.00001$). When compared to DS stands, smaller ring widths at AR may reflect greater stress associated with the higher water table at AR. Stem density at AR was 31,563 stems/ha, compared to 1,361 stems/ha for the similar aged stand at DS. We could find no evidence that cedar stress associated with high water tables limited stand primary productivity.

Response Of Atlantic White Cedar To Water Level, Temperature And Precipitation In An Intermediate-Aged Stand In The Great Dismal Swamp National Wildlife Refuge

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Atlantic white cedar (*Chamaecyparis thyoides*) (cedar) is a globally-threatened wetland ecosystem that was a major component of the Great Dismal Swamp National Wildlife Refuge (GDSNWR). Cedar stands in GDSNWR were severely impacted by Hurricane Isabel in 2003 and reestablishment requires appropriate hydrologic conditions. Tree rings of many species respond to climatic factors including precipitation and temperature, which are significant factors in hydrologic models. The purpose of this experiment was to determine effect of climate on growth rate for an intermediate-aged cedar stand in GDSNWR to aid reestablishment of the species. Two transects with a total of nine plots, each with two subplots, were established in a mixed cedar and red maple (*Acer rubrum*) stand. In each subplot, three trees were selected, cored, aged and ring widths were determined using Measure J2X software (n = 51). Data were compared with climate data and other cedar stands in GDSNWR and Alligator River National Wildlife Refuge. Trees averaged 26.6 +/- 1.12 years old and mean annual growth rate of cedar was 2.2 +/- 0.432 mm, which was less than growth rates for the first 27 years in an adjacent, mature stand in GDSNWR (2.94 +/-0.467 mm). Study site stem density for cedar was 1,361 stems/ha and 1,278 for red maple. Though climate effects appear complex, differences among sites could be due to water tables. While lower water tables enhance cedar growth rates, these levels may lower stem density and favor red maple invasion.

A Baseline Data Study Of The Hydrologic Regime And Wetland Plant Communities At Hackett Hill, Manchester, New Hampshire

Kimberly Hall, Sierra Club

The primary objective of the study was to document the hydrologic regime for selected Atlantic white cedar, Atlantic white cedar/giant rhododendron, black gum, and red maple swamps and to document dominant species within these plant communities on the Hackett Hill property in Manchester, New Hampshire. The intent of this research was to provide baseline data documenting existing hydrologic conditions and plant community composition within these wetland basins prior to potential development of the surrounding uplands. To record the existing hydrologic regime for each of the four plant communities, 23 piezometers were installed in seven transects located throughout each of the four wetland basins. The water level at each piezometer was measured once every two weeks for one year to obtain data for one complete hydroperiod. The results of water table monitoring were analyzed according to mean water level, water table fluctuation, and inundation/hydroperiod. A one-time vegetation sampling event of three vegetative strata (ground cover, shrubs, and trees) at each of the 23 piezometers was conducted. The ground cover and shrub strata were sampled using one and three meter box plots, respectively. The tree stratum was sampled using a five-factor prism. Species dominance was determined based upon percent areal coverage, basal area, and density. Dominant species were then assessed and analyzed with respect to mean water level using R2 regression analysis to observe trends in species occurrence and "wetlandness." Long-term (several years or more) hydrologic and ecological monitoring is recommended to obtain data representative of the average hydroperiod.

Microbiota of Atlantic White Cedar Forests: an interim report

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This is a progress report on a census of the microscopic life in the surface water and adjacent moist substrate of Atlantic white cedar [*Chamaecyparis thyoides* L. (BSP)] bogs, including phytoplankton (floating algae), periphyton (attached algae), protozoa and micrometazoa (multi-celled microscopic animals). One objective is to define a suite of indicator species as a key to the status of the system. The survey continues the all-taxon biodiversity census for this unique coastally restricted forested freshwater wetland ecosystem type. Specimens are collected from all parts of the cedar's native range. The Atlantic White Cedar Network (AWCnet), including dozens of professionals in diverse disciplines, collect samples of submerged, emergent and saturated mosses, plant parts, detritus and bog water. Samples are maintained in natural day-night light conditions at 10-20 C. Living material is examined with phase-contrast microscopy at 40x-400x magnification. Observations are recorded via digital color photomicrography and filed in a Filemaker Pro database. Data and images are incorporated in the global "micro*scope" website, part of the Universal Biological (UBio) database housed at the Marine Biological Laboratory, Woods Hole, MA. Each sample is also preserved by 1)drying, and immersion in 2)70% EtOH and 3)Lugol's Solution. Dried material are prepared for storage in 4 national herbaria. Digital images of living material are being incorporated in the Digital Herbarium of the MBL-WHOI-NOAA Library, Woods Hole.

Defense of the Manchester Cedar Swamp Preserve by the NH Sierra Club

Priscilla Mattson
NH Sierra Club

The NH Sierra Club is seeking to assure the integrity of an Atlantic white cedar swamp complex in the Hackett Hill area of northwest Manchester, NH. A 1998 Compliance Order required Manchester to protect the swampland in exchange for leniency in an EPA-mandated clean-up of the Merrimack River. The swamp complex and certain adjacent lands now comprise the 602-acre Manchester Cedar Swamp Preserve, which is owned and managed by The Nature Conservancy. Recently, residential development has occurred directly adjacent to the Preserve, within the watershed of certain swamps. There are also plans for an additional residential project, as well as the construction of an industrial/business park at the Preserve's periphery. Sierra Club volunteers have informed City officials and the public that the planned undertakings may have serious environmental consequences. The proposed development may: (1) disturb the hydrology of the swamps and encourage growth of invasive wetlands plants; (2) eliminate an animal corridor between the Preserve and undeveloped land in an adjacent town; and (3) extirpate certain animal species that inhabit the swamps and uplands. The Sierra Club has suggested that the properties eyed for development instead serve to buffer the Preserve and be used for environmental education and passive recreation. Recently, these suggestions have drawn attention, since Manchester's northwest corner is showing signs of "urban sprawl" andthere is some interest in curtailing this trend. The Sierra Club should continue its Hackett Hill conservation efforts, aided by the newly emerging support.

Overview of Atlantic White-Cedar Restoration Program by the New Jersey Forest Service

New Jersey Forest Service

In 1998 enabled through cooperative agreement between NJ Department of Environmental Protection and NJ Pinelands Commission, the NJ Forest Service began an Atlantic White Cedar (AWC) Restoration Initiative in order to demonstrate techniques and methods of regenerating this resource. Since the agreement’s inception the project has established AWC restoration sites across a variety of site conditions ranging from abandoned cranberry bogs to hardwood swamps. Site preparation, natural and artificial regeneration, deer fencing and competition control techniques are adapted to fit particular restoration circumstances and needs. Specialized equipment utilized on many sites such as Gyro Trac 18XP biomass shredder has enabled access and site preparation in areas which have otherwise been unavailable. This poster will provide an overview of New Jersey Forest Services’ AWC restoration project including site description, practices and process implemented and results acheived. Several restoration projects conducted prior to 1998 will also be highlighted. These particular projects dating back several decades have provided longer term success results and provide the basis for our current AWC restoration initiative.

The Effects of Planting Density on the Growth and Yield of AWC -Third Year Results

Bill Pickens
NC Division Forest Resources

This study examines the influence planting density has on the growth and subsequent yield of Atlantic White Cedar plantations. How does planting density effect growth rate? Would higher planting densities produce greater yield and a better rate of return? The conical shape and small bole of Atlantic white cedar (2-16 inch diameter at breast height inches) allow it to regenerate and maintain dense stands (250 to 300 ft2 basal area per acre). Artificial regeneration of Atlantic White Cedar is costly. Resource managers often recommend planting densities common to loblolly pine (600-800 seedlings per acre) to keep establishment costs low. The study is located on Pantego soil series (black fine sandy loam) that is drained. Prior to planting the site was clearcut, root-raked, and burned. Bareroot seedlings were planted at three planting densities; 6 x 12 (605 seedlings/acre), 6 x 6 (1210 seedlings/acre), and 4 x 6 (1815 seedlings/acre). After three growing seasons the height across all treatments averaged 6.4 feet. Height differences for each treatment are not significant. Overall survival across all densities is 85 %. Survival by treatment is 91% (6x12) 86% (6x6), and 83%(4x6). Lower survival of the 4x6 treatment is likely due to planting seedlings on unsuitable micro sites. Early growth is not effected by density.

Atlantic White-Cedar Swamps: Disappearing Blackwater Treasures

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Scattered across the Sandhills of the Carolinas are remnants of a unique, valuable, and imperiled wetlands ecosystem -- Atlantic white-cedar (*Chamaecyparis thyoides:* AWC) swamps. Atlantic white-cedar -- colloquially-known as "juniper" -- was one of the most commercially-important trees in its range from Colonial times to the early 19th century, because of its naturally rot-resistant wood, which is also strong, lightweight, straight-grained, and easily-worked. Many geographic place-names in the Carolinas reflect the cultural and economic importance of AWC.

Atlantic white-cedar occupies only a small fraction of its former extent, mostly because of overharvesting, lack of regeneration, drainage and filling of wetlands, and alterations in fire regimes. Juniper communities are classified by the US F&WS as critically endangered, and by The Nature Conservancy as globally threatened (G2). Juniper tends to occur in blackwater swamps, most often along streams, but also in isolated swamps such as Carolina Bays. In the Carolinas, it typically grows in frequently-saturated peat soils atop sand, or in wet sandy soils near streamheads. Factors such as soil and other seedbed requirements, hydrologic dynamics, competing vegetation and past fire history of the site all play critical roles in regeneration of AWC. Pure AWC stands can maintain up to twice as many healthy trees per acre as other forest tree species. Juniper wood has always commanded a premium price relative to pine and many other species. Notable wildlife species associated with AWC include black bear, white-tailed deer, wild turkey (roost sites), Wayne's black-throated green warbler, and the rare pine barrens tree frog and AWC-endemic Hessell's hairstreak butterfly.

On 28-30 October 2002, we hand-planted about 6,000 AWC seedlings in a recently-drained, 10-acre man-made impoundment along Spring Branch, a first-order blackwater stream on Aiken Gopher Tortoise Heritage Preserve and Wildlife Management Area in Aiken County, SC. Seedlings had been grown for 1 year in Ropak Multi-Pots (6 inch^3 cell), and a second year in Anderson bands (3 x 3 x 9 inches). This partnership project sought to restore ecosystem integrity by restoring "natural" (1) processes (e.g. streamflow), (2) species composition (AWC plus other native wetland species), and (3) structure (AWC and pocosin and bog vegetation grading upslope to frequently-burned, longleaf pine-wiregrass ecotype). To determine if temporal variation in planting date affected seedling survival and growth, we conducted a replicated experiment by planting 120 AWC seedlings in mid-September, -October, -November, and –December. Thirty seedlings were planted on each date. After 1 year in the field, survival was 100% on these 120 seedlings, and those seedlings planted earlier in the fall were slightly taller than those planted later. All planting dates yielded good results, possibly because the site was constantly wet and rainfall was abundant. Differences in height were judged to result from a longer period of root confinement in containers during the fall of 2002 for seedlings outplanted in November and December. Overall survival after 2 years in the field was near 100%, with almost all trees healthy and some trees 5-6 ft. tall. Fall planting of containerized AWC appears feasible when moisture is adequate.

The Effect Of Climate On The Growth Of Red Maple (*Acer rubrum* L.) And Atlantic White Cedar (*Chamaecyparis thyoides* (L.) B.S.P.) In The Great Dismal Swamp National **Wildlife Refuge**

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Red maple, *Acer rubrum* L., is an opportunistic species that becomes established following a variety of disturbances such as logging, land clearing, agricultural abandonment, wind throw, and insect and disease outbreaks. One of the communities red maple invades is Atlantic white cedar, *Chamaecyparis thyoides* (L.) B.S. P., swamps. Congress created the Great Dismal Swamp National Wildlife Refuge in 1974 and mandated the restoration of cedar and bald cypress, *Taxodium distichum* (L.) L.C. Rich.

The purpose of this study was to determine the response of red maple and cedar to climate through the use of tree-ring data. Tree growth is frequently affected by variations in climate and these variations are recorded in the sequence of wide and narrow rings in many species of trees, including cedar and red maple. Mean annual tree-ring widths were measured for 52 red maple tree cores and 231 cedar tree cores. Correlations were performed between standardized tree-ring widths and growing period precipitation and temperature data. The results indicate that water level management has not been adequate to eliminate mature red maple trees and further hydroperiod increases may be warranted.

Relationships among predawn leaf water potential, soil moisture and water table for four indicator shrub species in New Jersey Pinelands

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In the New Jersey Pinelands, the presence and relative abundance of many understory shrub species is highly correlated with mean water-table level and soil moisture in association with positions along complex upland to wetland gradients. The aim of this study is to determine the potential impact of water levels on plant species composition by evaluating short-term response to water stress. To what extent do spatial and temporal differences in water availability influence leaf water potential of shrub species? We measured predawn leaf water potential in *Galusaccia frondosa*, *Eubotrys racemosa*, *Vaccinium corymbosum*, and *Clethra alnifolia* along four transects that spanned gradients associated with pitch-pine lowland to cedar swamp community types during two growing seasons. The study was conducted at the Brendan Byrne State Forest in the McDonalds Branch basin, an undisturbed watershed that drains into the Rancocas River. Time domain reflectometry was used to estimate volumetric soil moisture content at the time leaf water potential was measured. Partial-record water level observation wells in each study site were monitored bimonthly for the same period of record. Water table data collected from two continuous-record wells installed nearby were used to predict water levels for the specific sample locations and dates ($r^2 = 0.82 – 1.00$). Our preliminary results suggest that leaf water potential can respond to spatial and temporal decreases in water level and soil moisture, although the significance of the response varies between species and transect location.