Silviculture in Forested Wetlands of the Southeastern and Gulf Coastal Plains: Exploring Wetland Impacts, Communication Hurdles, Best Practices, and Future Directions

A Full Day Symposium to be Held at the 2016 Society of Wetland Scientists Annual Meeting
Thursday, June 2, 9:20 a.m. – 4:40 p.m.
Corpus Christie, Texas

SYMPOSIUM ABSTRACT
The coastal watersheds of the southeast United States contain an estimated 20,000 to 30,000 square miles of forested wetlands. These forested wetlands provide important ecological services such as flood control, habitat for ducks and recreational fish species, and many others. A significant proportion of these forested wetlands is intensely managed for silviculture and is therefore important economically to the communities where they occur.

Remote sensing studies indicate that in coastal watersheds wetlands are being lost to non-wetlands at a much higher rate than they are being lost in inland watersheds. A large portion of this loss is correlated with forested wetlands in areas of active silviculture. When forested wetlands become non-wetland areas they are more likely to be developed, resulting in a loss of not only wetlands, but also forest land. The forestry and wetland conservation communities have a shared interest in understanding and reversing the trend of forested wetland loss to non-wetland areas.

This symposium will bring together experts in wetland science, silviculture, and remote sensing to address outstanding questions about what may be causing forested wetland loss, including: the effect of different types of ditches on wetland hydrology over the short and long term; the effectiveness of silviculture best management practices in sustaining forested wetlands; and how forested wetlands are affected by changes in soil and hydrology across landscapes, temporal changes in the hydrology, climate change, and evapotranspiration rates. Panel discussions and Question and Answer sessions will allow participants to identify areas for further research and future action.

AGENDA
Session 1 (Session Purpose: Provide information about the importance of forested wetlands in the Southeast to federal policy makers and the silviculture industry, recent trends in forested wetlands associated with silviculture, and how to talk about these issues in ways that facilitate understanding.)

1) Managing Forested Wetlands of the Southeastern and Gulf Coastal Plains: What the heck is silviculture anyway? (Presenter: Jim Shepard, Auburn University)
   Abstract: Forested wetlands are common in the South, especially in the Atlantic and Gulf coastal plains. Forested wetlands have long been an important source of many ecosystem services important to humans, including biogeochemical cycling, wildlife habitat, flood storage, and biological productivity that yields marketable goods like timber. Silviculture is forest
management practices that meets the needs and values of landowners and society. Characteristics of wetland forests: trees, soils, and hydrology sometime necessitate special silvicultural practices. This presentation will provide an overview of the kinds of special practices used in various kinds of forested wetlands. Silvicultural practices in forest wetlands types differ, for example between bottomland hardwood forests and non-riverine swamps and both may be different than in uplands. A challenge for foresters is that there are different federal and state systems for the identification and delineation of wetlands. For example, the National Wetlands Inventory has mapped most of the wetlands in the U.S. and conducts a periodic assessment of changes in wetlands extent and type. NWI uses a different definition and procedure for identifying wetlands than the system used by the Clean Water Act to regulate the discharge of dredged and fill material in wetlands. Such discrepancies leave foresters confused about whether a particular kind of forest is a wetland or not. For example, are coastal pine flatwoods wetlands? Other questions center around effects that various silvicultural practices have on wetlands. This presentation will provide an overview of terminology used in forestry and will also identify potential sources of confusion and misunderstanding.

2) **Forested Wetlands and the Forest Products Economy in the South** (Presenter: Fred Cubbage, North Carolina State University)

**Abstract:** This paper will examine forested wetlands area in the South and its share of total forest area and harvests, and the contribution of wetlands harvests to the total forestry sector economy. As of 2004, the 13 southern states ranging from Texas to Virginia currently has 535 million acres of land; 215 million acres of forest land; and 203 acres of timberland that could provide commercial timber harvests. Of the timberland, 152 million acres (75%) are owned by other private 36 million acres (18%) by forest industry owners. The South has 268 billion cubic feet of timber inventory; with 108 billion cubic feet of softwoods and 168 billion of hardwoods. Annual timber harvests and removals in the South consist of 10.1 billion cubic feet, with 6.5 billion in softwoods and 3.6 billion in hardwoods. As of 2009, the forest products industry in the South—including forest, timber production, and processing of solid wood, wood furniture, and paper products—employed 470,000 persons. It generated $133 billion in gross output; $26 billion in in wages and salaries; and $43 billion in total value added. Based on these aggregate forest inventory and harvest and forest industry contributions, we will assess the share that come from forest management and harvests in wetland forests. Given that the definition of wetlands itself is fluid, we will use proxies for wetland type forests such as bottomland hardwoods, hydric soils, or other criteria that are available and collected by the USDA Forest Service Forest Inventory and Analysis data. We will make specific data queries form the FIA data base; update the 2004 data summarized here; and estimate the share of the South’s forest economy that could be linked to wetlands silviculture and management.

3) **Status and Trends of Forested Wetlands in the Coastal Watersheds of the U.S.** (Presenter: Mitch Bergeson, U.S. Fish & Wildlife Service)

**Abstract:** The US Fish and Wildlife Service (USFWS) is the principle Federal agency that provides information to the public on the extent and status of the Nations wetlands. The latest report, co-authored by the USFWS and the National Oceanic and Atmospheric Administration (NOAA), titled ‘Status and Trends of Wetlands in Coastal Watersheds of the Conterminous U.S. – 2004 to
2009’ shows that 40% of the Nation’s 20.8 million acres of freshwater forested wetlands occur in coastal watersheds. The report also finds that most of the freshwater forested wetland loss occurs in these coastal watersheds. The loss of this wetland habitat type is mainly contributed to silviculture and development activities. This presentation will cover the study design, methods and discussion of results as they pertain to the loss of freshwater forested wetland habitats in the coastal watersheds of the U.S, and include results from local wetland inventories of change studies.

4) **Questions and Answers** (Jim Shepard, Auburn University, Fred Cubbage, North Carolina State University, Mitch Bergeson, U.S. Fish & Wildlife Service) The audience will have an opportunity to ask questions about the previous three talks and share experiences and insights.

5) **Panel Discussion: How do we communicate better? What are the common interests/themes?** (Panelists: Susan-Marie Stedman, National Oceanic & Atmospheric Administration; Jennifer Linn, U.S. Environmental Protection Agency) Panelists will reflect on the three presentations and explore opportunities to improve communication and collaboration between wetland and silviculture practitioners.

**Session 2** (Session Purpose: Explore what we know about how silviculture practices, past and present, affect forested wetland hydrology.)

1) **Hydrology and Water Balance of Forested Wetlands in the Southeastern United States** (Presenter: John Stanturf, USDA Forest Service)

   **Abstract:** Forested wetlands encompass broad areas of the southeastern US, providing important ecosystem services including wood products, recreation, quality water, and biodiversity. From the barrier islands along the Atlantic Ocean and the Gulf of Mexico, across the Coastal Plain and Piedmont to the Appalachian Mountains, and up the Mississippi and other rivers; forested wetlands present a myriad of vegetation types, associated landforms, and hydrologic settings. Levees, artificial drainage, and dams and diversions have altered the natural hydrologic characteristics of most forested wetlands in the South to some extent, ranging from minor changes in flow paths during the wettest seasons to permanent changes in water table levels or inundation regimes. This presentation will provide an overview of forested wetland types and generalized hydrological characteristics, specifically estuarine, riverine, and basin wetland types. Particular attention will be paid to forested wetlands that are managed for industrial wood products (e.g., pine flatwoods, bottomland hardwoods, and cypress-tupelo swamps).

2) **Silvicultural Operations in Forested Wetlands: Effects on Soils and Hydrology** (Presenter: Mike Aust, Virginia Tech)

   **Abstract:** Silvicultural operations are common in both riparian (e.g., bottomland hardwoods) and nonalluvial wetlands (e.g., wet mineral flats). Common operations in bottomland hardwoods that have the potential to influence soil and hydrologic properties include harvest trafficking effects on soil physical properties and reduction of evapotranspiration. Long-term research indicates that such changes may be short-term in bottomland hardwoods due to the ameliorative effects of sediment deposition, shrink-swell soils, rapid revegetation of the site, and soil carbon inputs. Wet mineral flats are more commonly managed for pine plantations, yet these sites may also be affected by harvest trafficking and transpirational reductions.
Silvicultural manipulations of these sites are used to minimize and/or ameliorate harvest effects. Common silvicultural operations include maintenance of road ditches for minor surface drainage and bedding. Bedding, combined with fertilization, has been shown to be an effective mechanism for restoration of soil physical properties, subsurface water movement, and site productivity. Riparian wetlands are potentially less sensitive to harvest disturbances than non-alluvial forested wetlands due to the beneficial effects of sediment deposition. Long-term research generally indicates that silvicultural operations are compatible with maintenance of both pine and hardwood forested wetlands.

3) Longterm Water table, Water balance, and Evapotranspiration of Drained Pine Plantation Forests on Southeastern Atlantic Coastal Plain (Presenter: Devendra Amatya, USDA Forest Service)

Abstract: Managing drained pine plantation forests to sustain water quality/quantity, and site and ecosystem productivity requires a detailed understanding of eco-hydrologic processes and water balances, as well as their interaction with management practices. Intensive silvicultural operations (harvesting, thinning, and site preparation) can affect the hydrologic balance of these watersheds. Timber harvesting has been shown to reduce evapotranspiration (ET), elevate ground water level and increase water yield, stormflow, and peak flow rate until the canopy is regenerated. While these managed forests are highly productive, changes in land use and climate, could alter hydrology, degrade water quality, and result in the loss of other ecological functions. This paper summarizes long-term studies on drained loblolly pine (Pinus taeda L.) forests of varying soil types and management practices on managed forests in coastal North Carolina (NC). More than 25-years of data from an intensive field study were used to describe the long-term water balances of three 25 ha watersheds in Carteret County, NC. The hydrology of mineral soil drained by parallel ditches at this site was characterized by highly dynamic outflow driven by water table position, as affected by rainfall and ET. Managed forests on these watersheds underwent various silvicultural and water management treatments during the study period. Hydrologic effects of similar treatments on managed forests at another NC coastal plain site with organic soils were used for comparison. Long-term water table, outflow, and ET dynamics of the managed forests are presented in context with data from long-term natural pine mixed hardwood stands at Santee Experimental Forest in coastal South Carolina. On these energy-limited (PET/P < 1) coastal sites, 70-80% of the precipitation (P) is lost to ET, which is close to potential ET (PET), with the remainder to drainage outflow.

4) Questions and Answers (John Stanturf, USDA Forest Service Mike Aust, Virginia Tech, Devendra Amatya, USDA Forest Service) The audience will have an opportunity to ask questions about the previous three talks and share experiences and insights.

5) Panel Discussion: What research needs are there to better understand what is happening? What actions can we take to collaborate better? (Panelists: Bryan Hulka, Weyerhauser; Sammy King, Louisiana State University) Panelists will reflect on the three presentations and highlight potential research needs that will enhance our understanding of how silviculture practices do or do not effect forested wetlands as well as opportunities to collaborate between wetland and silviculture practitioners.
Session 3 (Session Purpose: To examine tools and best practices to evaluate and improve silviculture practices particularly those that support both forest productivity and wetland hydrology)

1) Section 404 and the Silviculture Exemption (Presenter: Mike Wylie, U.S. Environmental Protection Agency)

Abstract: Section 404(f) of the Clean Water Act (CWA) exempts from US Army Corps of Engineer (Corps) permitting certain silviculture, agriculture and ranching practices. Section 404(f) exempts discharges of dredged and or fill material that are defined as normal, ongoing activities that do not change a waters use and impair its flow or circulation or reduce its reach. Congress enacted the Section 404(f) exemptions in the 1975 CWA amendments. The US Environmental Protection Agency (EPA) and the Corps determine if a certain silviculture activity is exempt under the CWA. However, landowners do not require federal approval under the statute and are free to proceed if they feel their activities fit within the exemptions. The vast majority of southeastern silviculture tracts are rarely investigated by EPA or the Corps unless an alleged violation is raised to staff’s attention or the landowner is requesting a wetlands jurisdictional determination. Section 404(f) forestry enforcement and compliance cases generally involve: improperly constructed ditches, conversations from silviculture to agriculture or development, improperly built forestry roads and conversions of certain forested wetland tracts to pine plantations. Generally, EPA is the federal agency that undertakes difficult forestry enforcement and 404(f) exemption requests. The recurring federal issues on non-compliant forestry sites are: wetland drainage, date of discharges, property ownership changes, statute of limitations, statute and regulation interpretation, and agency resources. In most cases, EPA seeks landowner compliance through voluntary measures, uses its administrative authority to seek compliance through compliance orders and/or issues penalties, or seeks DOJ assistance in civil proceedings as a last result in difficult or novel cases. EPA and the Corps are frequently working with our state and federal partners to provide appropriate guidance and direction to landowners to ensure the growth and protection of our environmentally and economically vital southern forests.


Abstract: Development and implementation of forestry best management practices (BMPs) to minimize harvesting effects on wetland soils and hydrology represents one of the great successes of the Clean Water Act (CWA). Forestry BMPs include a practice or combination of practices that are determined by a state or a designated planning agency to be the most effective and practicable means (including technological, economic, and institutional considerations) of controlling nonpoint sources of pollution at levels compatible with environmental goals. Development and implementation of BMPs for forested wetland management has resulted from the efforts of diverse stakeholders, including industrial and non-industrial private forestland owners, wood procurement entities, state and federal agencies, forest certification entities, universities and research organizations. The “Silvicultural Exemption” allows management activities within jurisdictional forest wetlands without obtaining a permit, so long as management is part of “normal” and “on-going” operations, and all states in the Atlantic and Gulf coastal plains recommend the use of BMPs during wetland
forest management. Furthermore, managers constructing roads and stream crossings within jurisdictional wetlands and other waters of the U.S. are required to adhere to 15 U.S. Army Corps of Engineers baseline BMPs. Therefore, BMPs in forested wetlands encompass a suite of recommended and/or required prescriptions that are intended to reduce disturbance to soils and site hydrology and encourage successful stand establishment through natural and/or artificial regeneration. For more than 25 years, the National Council for Air and Stream Improvement (NCASI) has worked with universities, state and federal agencies, and the forest products industry on research projects focused on the sustainable management of forested wetlands. This presentation will provide an overview of BMP prescriptions commonly used during wetland forest management and review findings from NCASI sponsored research that has tested BMP effectiveness.

3) **Application of Hydrologic Models & Tools for Managing Silviculture Systems in Forested Wetlands** (Presenter: Ge Sun, USDA Forest Service)

**Abstract:** Forested wetlands in the coastal watersheds of the southeastern U.S. provide important ecosystem services including timber supply, groundwater recharge and purification, carbon sequestration, wildlife habitat, and climate moderation. Managing these ecosystems are changing given the increasing pressure from changes in land use and climate, urbanization, and multiple management objectives (e.g., augment of water yield, increase in forest productivity, reducing wildfire risk). Various hydrological models (conceptual or mathematical) and tools have been developed in the past three decades to aid the understanding of wetland hydrological and biogeochemical processes and assessing forest management impacts. A preliminary survey of existing modeling tools suggests that these models vary greatly in complexity (from multivariate statistical models to watershed-scale models) and applicability in silviculture practices (from data-driven risk assessment models to decision support systems). Upland hydrological models that do not explicitly tract the water table dynamics do not apply to wetlands. Accurately predicting the response of wetland hydrology and water quality in wetlands to forest management and climate variability across space and time is challenging because wetlands are ‘hot spots’ in a heterogeneous landscape and detailed information of physical and (i.e., topography) biological (i.e., ecosystem structure) properties, and management practices (i.e., ditches) are often lacking. Different types of wetlands (i.e., isolated vs. floodplains wetlands) have different groundwater-surface water interaction processes thus different type of models are needed. Wetland hydrological models have been linked to large scale models to study the unique role of wetlands on a large spatial context. Existing wetland hydrological models have been mostly used for research purposes and have been limited in guiding wetland forest management. Future studies should incorporate disturbance hydrology and biogeochemical processes in exiting models to full account for the influences of different type of silviculture practices.

4) **Modeling Effects of Silviculture Drainage on Wetland Hydrology-DRAINMOD, Field Data, and Results** (Presenter: Wayne Skaggs, North Carolina State University)

**Abstract:** The criterion for wetland hydrology is defined such that a site must satisfy minimum conditions for water table depth or inundation for a minimum continuous period during the growing season in half of the years, on average. Because of temporal variability in precipitation,
long continuous monitoring periods may be required to determine the wetland hydrologic status of a given site. Hydrologic models can be used with long term weather records to reliably predict daily water table depths on wetland or poorly drained upland sites over many years, and thereby provide a much less expensive alternative to long term monitoring. This paper reports the results of a simulation study to determine the impacts of drainage for silviculture on wetland hydrology. DRAINMOD simulations were used to determine the threshold drainage intensity (ditch depth and spacing) that removes wetland hydrology from forested wetlands. Results of field studies to test the reliability of the model for predicting the hydrology of wetland sites are presented. Analyses were conducted for 13 soil series and profile combinations at ten locations in the Atlantic and Gulf coastal states. A threshold ditch spacing was obtained for each combination of soil profile, ditch depth, and location. The threshold spacings can be used as benchmarks to directly evaluate the impact of drainage alternatives on wetland hydrology. Lateral impact of a drainage ditch on wetland hydrology was determined for a 0.9 m (3 ft) deep drainage ditch for all soils and locations considered. Results of simulations and field data are used to discuss effects of ditch depth and hydraulic conductivity on wetland hydrology and the lateral impact of the ditch.

5) Questions and Answers (Mike Wylie, U.S. Environmental Protection Agency, Erik Schilling, National Council for Air and Stream Improvement, Inc., Ge Sun, USDA Forest Service, Wayne Skaggs, North Carolina State University) The audience will have an opportunity to ask questions about the previous four talks and share experiences and insights.