

Impacts of Fertilization on Water Quality in a Coastal Pine Plantation

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Approximately 1 million hectares of plantation pine in the coastal plain region of the United States are drained to improve soil trafficability for harvesting and planting operations and to improve soil moisture growth conditions throughout the year. These poorly drained lands are being intensively managed with pine forests for maximum timber production. Intensive forest management activities include drainage, harvesting, thinning, site preparation, fertilization, herbicides, and artificial regeneration. Forest harvesting and site preparation, and especially fertilization, may affect concentrations of important plant and aquatic ecosystem nutrients. In the southeastern United States, about 528,000 ha of pine plantations are fertilized annually, mainly with nitrogen (N) and phosphorus (P). Cultural eutrophication from excessive nutrients is a leading cause of water quality impairment in southern waters. Phosphorus is the most serious problem in freshwater and nitrogen in estuarine waters. Although the overall quality of water drained from these forested lands has generally been reported to be higher than the agricultural lands, hydrologic and water quality impacts of these intensive management practices on receiving water bodies continue to be important environmental issues, but poorly understood.

A study is being conducted to examine the effects of fertilization of two managed pine forests of varying stand ages on the Weyerhaeuser's lands in Carteret County, North Carolina, U.S.A. The main objective of this research is to evaluate the impacts of fertilization of a young regenerated (watershed D2) and a mature, but recently thinned (watershed D3) coastal pine plantation on the downstream quality of waters drained from these stands. A paired watershed approach with the adjacent undisturbed watershed (D1) on a mature pine forest as a control will be used to examine the fertilization effects primarily on drainage water nutrients of each of these two watersheds. These three experimental watersheds are fully instrumented and have a substantial baseline of hydrology and water quality data beginning in 1988. The treatment watersheds (D2 and D3) were fertilized using aerial application in September of 2005. Hydrology and water quality data both from the pre-treatment (1988-90) calibration and fertilization treatment (2005-2007) periods are being analyzed using graphical, analytical, and statistical procedures to evaluate the effects of fertilization on nutrient (nitrogen and phosphorus components) concentrations as well as loading rates. This information will be helpful for forestry agencies and land managers to understand the effects of fertilization on water quality drained from pine forests of various stand ages on poorly drained soils. This will also provide information needed to design and implement BMPs for fertilization application and for regulatory agencies in evaluating forestry's relative contribution to eutrophication.