NCASI Fact Sheet

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NCASI's Long-Term Receiving Water Study

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Background

The Long-Term Receiving Water Study (LTRWS) is an ongoing integrated NCASI study of the physical, chemical, and biological characteristics of US pulp and paper receiving streams. Initiated in 1998 in response to proposed EPA revisions to existing Effluent Guidelines and Standards, the aim of the LTRWS is to fill important information gaps regarding the effects of pulp and paper mill effluent (PPME) on receiving water biota and place the industry's manufacturing, wastewater treatment processes, and effluent characteristics into the appropriate environmental context of their receiving waters. Specific objectives are to determine whether there are detectable differences in water quality and stream biota upstream and downstream of effluent discharges and the significance of any observed differences to the ecological functions of the river. The four LTRWS receiving waters are Codorus Creek (PA), the Leaf River (MS), and the McKenzie and Willamette Rivers (OR). These streams differ in terms of ecoregion, receiving water type (warm- or coldwater) and size (wadeable and non-wadeable), in-stream effluent concentration, and mill process type (bleached vs unbleached kraft) and were selected so study results would be broadly applicable to US pulp and paper facilities.

Photo: Bill Arthurs boat electrofishing

Approach

States assess instream environmental effects by evaluating water quality, determining the presence and absence of biological organisms, and assessing habitat characteristics. The LTRWS approach is a comprehensive assessment of stream conditions through measurements of water quality parameters; community structure and biomass of fish, benthic macroinvertebrates, and periphyton; and habitat such as substrate and streamside characteristics. Measurements taken multiple times per year at multiple sites upstream and downstream of PPME discharges allow seasonal and annual variability to be determined and enable possible effluent-related effects to be distinguished from naturally-occurring differences across sites. In addition to in-stream assessment, effluent chemistry and toxicity are evaluated during short-term whole effluent toxicity (WET) tests in conjunction with field sampling, while effluent-exposure effects at different fish life stages and through the subsequent generation are evaluated during laboratory-based fish life cycle studies. The dataset generated from the ongoing LTRWS is unique from other studies because it comprises fine-scale replicate measurements, multiple biotic assemblage types with associated water and habitat quality data, and seasonal collections from multiple sites over many years. To that end, findings provide a robust and unparalleled assessment of PPME effects on receiving water ecology.

Findings and Value

Results from the LTRWS show that treated effluents typically have no effect on biota during laboratory WET tests; even in 100% effluent exposures. Findings from longer-term effluent exposure during fish life cycle studies show no effects on egg development, hatch-ability, fish growth and survival, and most reproductive measurements. When effluent-related effects are seen in these studies, it is at effluent concentrations substantially greater than those in the receiving stream. Most water quality measures are unchanged at sites downstream of the effluent discharge relative to upstream sites, although inputs from tributary streams significantly affect water quality characteristics in the main channel of

Photo: Joan Ikoma periphyton sampling

all four streams. In Codorus Creek, where effluent can make up a significant percentage of stream flow (30 to 50%), increases in color, conductivity, chemical oxygen demand, ammonia, and some metals are observed downstream of effluent discharges. However, such increases are rarely observed in streams where effluent is only a small portion of stream flow. In all four study streams, effluent-related changes in biota are rare. Patterns in periphyton, macroinvertebrates, and fish, especially in the larger rivers, are driven mainly by naturally occurring differences across seasons and years. Upstream to downstream changes in biota across sites are mostly seen in the smaller, wadeable Codorus Creek, and are related to differences in temperature and other environmental characteristics rather than effluent.

In addition to providing strong evidence that mill effluents are compatible with receiving stream integrity and maintenance of designated uses, an important finding from the LTRWS is that medium- to long-term studies are imperative to accurately assess and interpret biota and water quality patterns. The robust LTRWS dataset forms the basis of studies to develop, evaluate, and interpret new and subtle measures of aquatic ecosystem health. Further, increased understanding of spatial and temporal variability in receiving waters informs the interpretation of the significance of any biological, physical, or chemical changes that may occur. Results from the LTRWS have been shared with stakeholders, researchers, and regulators through meetings and peer-reviewed publications, and NCASI members have used LTRWS data to support discharge permit changes, re-evaluation of mill in-stream benchmarks, and development of site-specific criteria. Continued study of the effects of effluent on receiving water quality and communities is valuable in demonstrating the sustainability of the pulp and paper industry and provides important context for addressing the effects of emerging issues and contaminants of concern.

For More Information Contact

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