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Forestry and Forest Streams

Few surface water sources are as pure as a freely-flowing stream in an undisturbed forest.

Commercial timber production and harvesting, however, can affect stream quality by increasing sediment, nutrients, organics, chemicals, and temperature. Forest streams which could be affected flow through 43 East Texas counties and into seven of Texas' major river basins.

To minimize such impacts, a federal law now requires that potential water pollution sources such as forestry activities be included in a statewide water quality management plan. In fulfilling part of the requirements set out in Section 208 of the Federal Water Pollution Control Act Amendments, the Texas Department of Water Resources developed a plan for water quality management for the 23 million forested acres in East Texas.

RESEARCH EFFORTS

Researchers associated with the Texas Water Resources Institute contributed to the development of this plan by identifying possible controls to lessen the impact of forest practices on water quality and by analyzing the economic implications of such controls. Two professors at Texas A&M University, Wilbert Blackburn in Range Science and Clifford Hickman in Forest Science, directed the studies.

When attempting to identify forest practices affecting water quality, they found that nearly all prior research on the subject applied to forests in northern climates or mountainous regions. Because geology, soils, topography, and climate are rather unique in Texas, according to the researchers, data from other areas cannot be used to establish Texas guidelines.

Several important characteristics in which Texas forests differ from those in other regions include:

1. Runoff is minimal because of the flat or gently sloping terrain.
2. Reforestation rates are rapid compared to colder climates.
3. Stream temperatures are naturally warmer, and Texas fish are less affected by changes in temperature or quality of streams than are salmon or trout in northern forest streams.
4. Sediment and nutrients delivered by East Texas rivers are important to the productivity of Gulf Coast bays and estuaries.
5. Road systems in East Texas forests are well established because of previous timber harvests and because of other uses of roads such as hunting or oil and gas activity.

POTENTIAL POLLUTION

Sediment is generally considered the primary water pollutant from Texas forest practices. Even though sediment occurs naturally in many Texas streams, sediment carried by runoff from forest lands is a potentially serious problem because it can:

- Carry plant nutrients and forestry chemicals such as herbicides, insecticides, and fertilizers into streams.
- Adversely affect aquatic environments.
- Reduce the recreational value of streams.
- Increase water treatment costs downstream.

The amount of sediment produced by forest practices is determined by many interacting factors such as geology and land use practices. Some forest sites can undergo severe treatments with little increase in sediment production while other sites produce large amounts of sediment after only slight disturbance.

Forest practices most likely to increase sediment production are poor road construction and site preparation activities. Bare soil exposed by road building has long been recognized as a major source of sediment production in timber harvesting. In some forests, a permanent road system is installed and maintained, but in others, temporary roads are constructed with minimum specifications for drainage and surfacing and with little or no provisions for maintenance.

Mechanical site preparation before tree planting can cause major sediment loss because it increases surface erosion by removing forest litter and increases volume and intensity of surface runoff by compacting soil. Site preparation processes include shearing, windrowing, disking, and other heavy equipment activity.

HARVESTING IMPACTS

Careless harvesting can also result in large quantities of sediment loss to streams.

The most common harvesting procedure in East Texas is called clearcutting, which–as the name implies–means harvesting every tree in a certain area. The clearcutting process

is similar to steps taken in agricultural production: (1) crop harvest, (2) debris removal, (3) mechanical site preparation, (4) planting, and (5) cultural practices such as fertilization and pesticide application.

A major difference in crop acres and clearcut acres, however, is that within a one-year period, the ground cover on the forest land will be substantially regenerated and may not be disturbed again for 30 years or longer. Agricultural cropland generally receives the same steps each year.

The harvesting operations most likely to affect stream quality are skidding (dragging) trees to the loading area and harvesting along stream banks. Skidding causes soil compaction and removes protective cover from the forest floor. Debris from skidding and hauling activities can wash into streams and have a significant impact in terms of clogging channels and possibly altering oxygen levels.

Harvesting along streams can cause erosion of banks and allow sediment normally filtered by the ground cover to enter the stream. Removing shading vegetation can affect stream temperatures because of increased exposure to the sun.

CONTROL STRATEGIES

One purpose of the study led by Blackburn was to determine the best forestry strategies to control sediment production. These strategies generally mean performing forest practices in a manner that will decrease onsite soil disturbance and stream channel damage. The 54 control strategies identified by Blackburn include:

1. Streamside buffer strips with trees and ground cover left intact.
2. Rapid revegetation of exposed areas.
3. Design and maintenance of roads to diminish impact.

Blackburn's team of researchers also surveyed the forest industry in Texas to find out the cost of various forest activities and how controls to diminish the potential impact on water quality would affect these costs. He found that most of the recommended practices are now common procedures in public forests and many have been adopted on land owned and managed by the forest industry.

Forest land in East Texas is owned and managed by one of three types of owners–public, industry, or private (nonindustry)–each with a different set of objectives. Ownership objectives such as recreation, conservation, or investment determine to a large extent what type of forest management practices a landowner adopts.

Public forest ownership in Texas includes four state forests managed by the Texas Forest Service and four national forests managed by the U.S. Forest Service. The Texas agency owns 7,512 acres and leases another 1,927 acres–a small amount compared to the 661,512 acres owned by the U.S. Forest Service. The major objective of these agencies is

for multiple use of forest resources, so protection of water quality is a management objective.

Forest industry lands–lands owned by lumber and pulpwood processing companies–comprise nearly 35 percent of the total commercial forest land in East Texas. This amounts to well over three million acres. Additional acreage is controlled by the large companies under long-term lease agreements and through cooperative management agreements with nonindustrial private forest landowners. These lands are typically subject to intensive forest management practices to assure the maximum timber yield per acre. The industry has adopted many management practices designed to increase land value which also protect stream quality.

The largest single ownership class is the small private landowner group which represents more than 60 percent of the total forest area. Landowners in this category number over 400,000 and own an average of 100 acres or less. Many of these owners live in Texas cities far away from their forested property, and less than 20 percent of them practice some form of continuous forest management. Even fewer have adopted measures which would decrease harvesting impacts on stream quality.

COSTS OF CONTROLS

Hickman looked at potential economic implications associated with government-imposed controls to minimize sediment loss. From an economic standpoint, according to him, it is important to recognize that pollution control measures result in both benefits and costs. Benefits of measures to reduce sediment include longer-lasting reservoirs and reduced water treatment costs downstream. Costs include higher production costs resulting in increased prices for wood products.

Appropriate measures to control pollution, Hickman feels, depend on a careful assessment of the benefits to be achieved in relation to costs associated with the,, use. Data to make such an assessment is presently unavailable, and Hickman cautions against the adoption of overly-stringent restrictions by the state or federal government because potential costs could be great.

Two current studies, when complete, should furnish the data needed to evaluate the necessity of controls. Blackburn plans to measure the quality and intensity of runoff from small watersheds as they are subjected to specific timber harvesting practices. He hopes the results will help guide future forest management decisions as well as determine the impact of forest practices on water quality.

In addition to Blackburn's current study, a project is now underway at Stephen F. Austin State University in Nacogdoches which will give scientists a baseline quality for undisturbed forested watersheds in East Texas. Researchers there are collecting data on precipitation, soil, vegetation, topography, sedimentation, stream flow, nutrients, pesticides, and biological properties of water in East Texas.

Management to protect water quality, according to both Blackburn and Hickman, is synonymous with good forest management. Whatever measures are taken to protect forest streams will also benefit the forest industry by reducing soil and nutrient loss, minimizing erosion problems, encouraging fish and wildlife, and increasing the land value.

As research results emphasize these benefits, and as landowners become increasingly aware of them, the forest industry in East Texas will continue to adopt management practices to protect the quality of forest streams.