Water Quality and Quantity

Environmental Effects of Woody Biomass

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Background

Water is a universal resource that sustains life and is integral to maintaining productivity of the land. Biomass harvesting and utilization for energy can affect water quality and quantity. Water quantity is the timing and total yield of water from a watershed, and is measured by total yield and peak flow over a specified period of time. Water quality is the suitability of water for drinking, recreational uses, and as habitat for aquatic organisms and other wildlife (Neary 2002). It is measured by the amount of sediment, water temperature, and concentration of chemical compounds, including nitrate-nitrogen and other nutrients in the water.

Concerns

Harvesting wood and development and use of infrastructure (roads, skid trails, and landings) can expose soil, leading to soil erosion and runoff that can affect water quality and hydrological processes. Removing vegetation and litter during biomass harvesting for bioenergy can increase the risk of higher peak flows. It also allows more water to fall directly on the soil surface and infiltrate to groundwater, resulting in a higher water table that could lead to soil saturation and a loss of productivity (Eigenbrod and Kaluza 1999). Removing trees canopy adjacent to streams can result in temperature increases in summer which are lethal to some aquatic organisms (Holopainen and Huttunen 1992).

High concentrations of nitrate-nitrogen in drinking water are a concern for human health, and are related to algal growth in surface water bodies, which can lead to eutrophication and the death of aquatic fauna. Such problems are associated with the intensive and heavy use of chemical fertilizers and of herbicides.

Road construction is often the major source of sediment movement to streams. Risks rise with an increase in road networks to access previously unmerchantable fiber and leaving roads open longer to harvest energy feedstocks in addition to conventional harvesting. Biomass harvesting and site preparation operations also increase the risk of erosion and movement of sediment to surface waters (Moore 1999; Rice et al., 2001).

Plantations of short-rotation woody crops (e.g., willow, poplar) can deplete groundwater resources, especially if irrigation is required (Van der Salm et al., 2006). On the conversion side, most power plants require water for steam production and cooling. If water used in the conversion process is released untreated into lakes or rivers, it can negatively affect water quality because of the chemical used during the conversion process.

Mitigation strategies

All states have published water quality best management practices (BMPs) and some have woody biomass harvesting guidelines which are intended to mitigate a variety of impacts. They can serve as an excellent source of strategies to consider. Selected strategies are presented below. When working with a third-party contractor, consider including relevant mitigation strategies in a written, signed contract.

- Minimize the amount of infrastructure (skid trails, landings and roads) on a site, and close areas to further trafficking once the harvesting activities are completed;
- Practice one-pass harvesting and make the best use of already existing roads.

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- Apply best management practices during road construction, site preparation operations and other silvicultural and stand management activities to mitigate the potential for sediment movement and reductions in water quality.
- Maintain a filter strip between the water body and the forest disturbance to protect surface water. Seed exposed surfaces with native materials.
- Install and maintain water diversion devices to slow and redirect the overland flow of water (Shepard 2006).
- Monitor carefully the use of herbicides and fertilizers in biomass production (including recycled wood ash) and adhere to prescribed guidelines of the use of these herbicides and fertilizers. In addition to the current BMPs, special considerations may be needed when harvesting biomass (Shepard 2006). For example, increased utilization through the removal of all above-ground biomass and conceivably stumps and tap roots may require more frequent fertilization. Care should be exercised to ensure that fertilizer materials are not transported into streams, wetlands and lakes at levels that could impair water quality.
- Avoid establishments of short rotation woody crop plantations for energy in areas where long-term regional groundwater availability could be a concern.
- Do not harvest biomass on sites where nutrients are the primary limitation to tree growth. Biomass harvesting on drought-stressed sites should be avoided or limited to once per rotation (Hall 2002).
- Follow conventional forestry BMPs to avoid impacts on water quality and quantity.
- Power plants are encouraged to re-use water during energy conversion. If water is to be released to lakes or rivers, plants should secure and comply with permits from the appropriate regulatory agency.

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