South Carolina's

Best Management Practices

Forest Biomass Harvesting Recommendations:

A Supplement to South Carolina's Best Management Practices for Forestry

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FOREST BIOMASS HARVESTING

Growing interest in renewable energy creates an opportunity for woody biomass to emerge as a potentially significant new market for South Carolina forest landowners. Many forest products companies already use biomass for steam and power generation and could readily transition to increased biomass energy production. Additional opportunities may exist for new facilities engaged in biomass energy production and related markets such as liquid fuel conversion or fuel pellet production.

Although forest industry has experience with biomass energy, use of biomass for large-scale energy production in South Carolina is not widespread. Should demand increase, biomass harvesting could result in greater removal of woody material per acre than conventional harvesting methods. This potential change in harvesting techniques has raised concerns about wildlife and biological diversity, water quality, soil productivity, and interaction with other silvicultural treatments. Harvesting greater volumes of woody material from a site may require additional attention to soil stabilization, site productivity, and related issues.

South Carolina Best Management Practices for Forestry (BMPs) are designed to protect water quality and comply with applicable regulations during

forest operations. BMPs also provide recommendations for good stewardship such as maintaining site productivity and enhancing wildlife habitat. Failure to comply with BMPs may result in a violation of water quality or wetland regulations that is subject to enforcement action by the appropriate regulatory agency. Therefore, recommendations directly related to protection of water quality are considered separately from other practices.

These recommendations were developed to ensure that site-specific concerns related to biomass harvesting are adequately addressed. Larger scale issues such as the end-use of different forest products and overall resource sustainability will be determined by landowner decisions, market factors, and other driving forces. These recommendations are intended to supplement *South Carolina's Best Management Practices for Forestry* in situations where more woody material is removed than during traditional forestry operations.

Defining Biomass

Definitions of biomass used by federal and state programs, renewable energy standards, and certification programs vary widely. Biomass, for purposes of this document, is defined as above-ground woody material removed from forests for energy production. This typically includes logging slash, small diameter trees, tops, limbs, and cull trees.

Woody biomass is often a by-product of forest management, restoration, and fuel reduction treatments, so it will be assumed for these guidelines that biomass harvesting is a part of normal silvicultural activities. These recommendations are not intended to address high intensity management specifically for short rotation woody biomass crops.

Biomass harvesting may range from simple collection of accumulated logging debris to intensive removal of woody material specifically grown for biomass energy production. Biomass harvesting may be conducted at the same time as conventional logging, as an intermediate treatment, or as a stand-alone practice. Biomass may be produced as a by-product of other forest practices or as a primary objective. The degree of management intensity and the frequency and amount of biomass removal can vary widely, so all recommendations should be adjusted according to the operation and specific site conditions.

Harvesting of higher-valued forest products and traditional wood products is addressed through existing BMPs. Should markets divert traditional products such as pulpwood towards bio-energy production, standard BMPs apply. Production of clean chips for fiber is often more similar to conventional logging operations as covered under existing BMPs, but some biomass harvesting recommendations may also be applicable.

Water Quality

South Carolina's Best Management Practices for Forestry provide guidelines for protecting water quality during a wide range of forestry operations including harvesting, site preparation, reforestation, prescribed burning, pesticide and fertilizer application, and minor drainage. Some of these practices, such as disking and bedding, involve intensive site disturbance. BMPs include recommendations for common forestry situations such as riparian protection, stream crossings, and road construction.

Standard BMPs apply to all forest operations. These additional recommendations address potential water quality impacts that may occur with the addition of biomass harvesting:

Streamside Management Zones

- Do not remove understory or other biomass from the primary SMZ on perennial or intermittent streams other than trees, tops, and limbs allowed under existing BMPs. The standard primary SMZ width for perennial and

intermittent streams is 40’ from each side of the bank. Standard BMPs recommend leaving a minimum of 50 square feet of overstory basal area distributed throughout the primary SMZ along perennial streams, and retaining understory vegetation and organic debris to protect the forest floor and stream banks on intermittent streams.

- Avoid piling or placing chips or fine material in SMZs or wetlands, and prevent such material from entering water bodies.

Harvesting

- Use alternate methods of stabilization such as hay bales, silt fence, and erosion control fabric where debris is not sufficient to prevent erosion.
- Avoid removal of stumps, roots, leaf litter, and forest floor for biomass.
- Avoid piles of chips or fine materials in wetlands or near canals and ditches where seasonal flooding may carry material off-site.
- Avoid biomass removal that exposes mineral soil on steep slopes (>30%) or highly erodible sites.
- Limit biomass removal on slopes greater than 20% to reduce the risk of erosion.
- Biomass harvesting activities are subject to all requirements for silvicultural wetland road construction as described in standard BMPs.

Non-Water Quality Issues

South Carolina's Best Management Practices for Forestry are primarily intended to prevent nonpoint source pollution from silvicultural operations. However, SC BMPs also address on-site impacts not directly related to water quality. The BMP manual includes recommendations for issues such as rutting, harvest planning, and additional options for wildlife management. Likewise, biomass harvesting has the potential to impact site productivity and wildlife habitat, especially if carried out more intensively and/or more frequently than conventional harvesting.

Productivity and Soil Nutrients

Biomass harvesting impacts on soils can vary greatly depending on a variety of conditions such as soil type, past land use, and frequency and amount of biomass removal. Intensity of forestry operations should be adjusted to match conditions in a manner that will maintain organic matter, soil nutrients, and site productivity.

Generally, a single biomass harvest may be conducted on most sites in SC without impacting productivity of the next rotation. However, lower fertility sites are more susceptible to nutrient depletion and require greater attention to maintain soil nutrient availability with ***repeated*** biomass harvests. In South Carolina, deep sands and shallow rocky soils have the highest risk for poor nutrient availability.

Although biomass harvesting may result in greater nutrient removal than conventional harvesting, decisions should be based on available soil nutrients rather than removals.

While there is much evidence that responsible biomass

removal can be conducted without soil or site-quality impacts, further knowledge is needed regarding impacts of frequent and long-term biomass harvesting. The following management options should be considered during biomass harvesting operations:

- Conduct biomass harvests in conjunction with normal logging when possible to minimize re-entry and limit the frequency of disturbance.
- Use existing roads, skid trails, and landings where possible to minimize soil compaction.
- Limit biomass removal on sites with shallow soils, very sandy soils, or low soil fertility.
- Avoid leaving piles of residual or fine material that would impede regeneration.
- Retain leaves, needles, and branches to the degree possible because they contain the highest concentration of nutrients. Harvesting in winter after leaf-fall or otherwise leaving leaf material on-site can substantially reduce nutrient losses.
- Consider amelioration with fertilizer, ash, or lime where nutrient depletion is a concern. Fertilization or amelioration should be based on available soil nutrients rather than the amount of nutrient removal.
- Use a soil expert system, available data, or soil testing to identify vulnerable soils and adjust harvesting practices accordingly. The USDA Natural Resources Conservation Service's Internet-based Web Soil Survey is an excellent source of soils data.

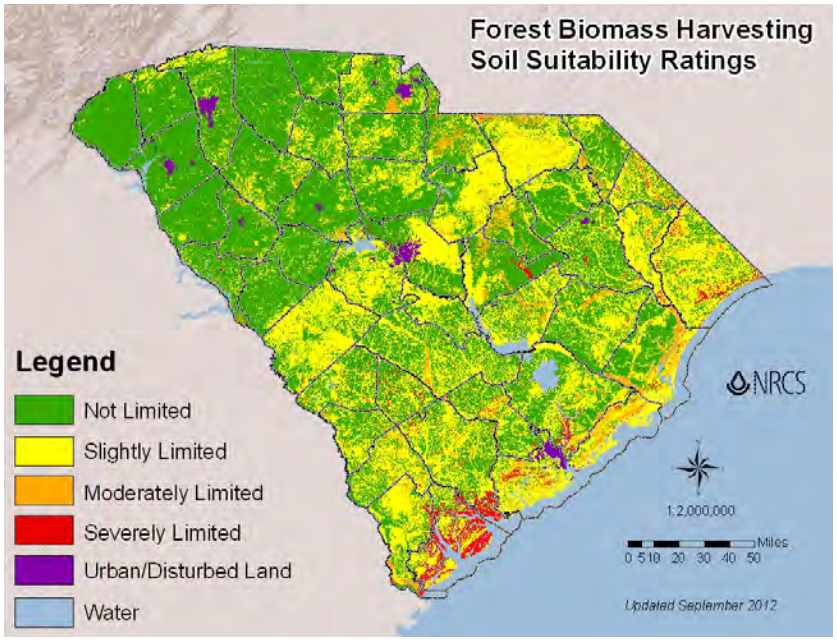
Soil Suitability

The USDA Natural Resources Conservation Service conducted a review of suitability and resilience of South Carolina soils to forest biomass harvesting. A map showing general soil suitability was developed using seven properties that are understood to affect long-term soil productivity. These properties address issues of operability, soil compaction, and erosive potential during forest operations.

Using the criteria shown in Table 1, suitability ratings were generated for the state (Map 1). Limitations included low available water, high water table, restrictive layers, erosive potential, and low or high organic matter. Some of these limitations can be addressed through measures such as using appropriate equipment and seasonal restrictions, but each site and operation should be considered individually. Careful planning and management of biomass harvesting operations should include thorough evaluation of potential site limitations.

Soil/Site Property	Not Limited	Slightly/ Moderately Limited	Very Limited
Water Table Depth (cm)	>60	30-60	<30
Restriction Depth (cm)	>100	50-100	<50
Sand (%)	<80	--	>80
Available Water Capacity (cm)	>18	14-18	<14
Kw Factor	<0.32	--	>0.32
Cation Exchange Capacity (cmol/kg)	5-10	0-5, 10-20	>20
Organic Matter (%)	2-3	2-10	<1 or >10

Table 1. Soil properties and suitability classes for forest biomass harvesting (USDA NRCS).



Map 1. Forest biomass harvesting soil suitability ratings (USDA NRCS).

Dead Wood, Wildlife Habitat, and Biological Diversity

Standing and downed woody material such as snags and coarse woody debris contribute to overall biological diversity by providing an important habitat component and microsites. Downed woody material and snags typically make up about 5 - 6% of the biomass in Southeastern forests, though past land use is an important factor. Generally, larger-sized snags and downed logs tend to be more beneficial for wildlife and last for a longer period of time.

Biomass harvesting may also provide opportunities to promote biological diversity and protect threatened and endangered species, such as mid-story vegetation

control for red-cockaded woodpeckers. Although not directly related to water quality, managers should carefully consider the role of woody biomass in the ecosystem.

- Avoid biomass harvesting in sensitive areas such as springs, seeps, rocky outcrops, and unique habitats such as endangered plant areas.
- Retain sufficient leaves, limbs, and debris to provide organic input. Conventional logging equipment will commonly leave 20-30% of above ground biomass on-site due to harvesting and material handling constraints.
- Where appropriate, use biomass harvesting as a method of vegetation control to enhance habitat for rare, threatened, and endangered species.
- Retain some snags where available and compatible with safety requirements. Leaving three snags/acre is recommended to provide nesting and feeding sources for a wide range of snag-dependent wildlife.
- Leave downed woody debris in a variety of size classes to meet different habitat needs. It is recommended that at least one ton/acre of coarse woody debris be left for biological values. Southeastern forests typically have 0.4 – 2 tons/acre of coarse woody material on the forest floor.
- Plan biomass harvesting in order to maintain a variety of habitat types and age classes on the managed property.

Silvicultural Considerations

Development of markets for woody biomass has the potential to impact silvicultural decision making by presenting new revenue opportunities for previously non-merchantable material. Some lands considered marginal for forest production may become

economically feasible to manage for woody biomass, and unmanaged or under-utilized forest lands may be more actively managed. Markets for small, low-quality trees may encourage pre-commercial thinning and timber stand improvement practices, and reduce site preparation costs. Some forest practices which are normally a cost to the landowner, such as wildfire fuels reduction, may become potential sources of revenue.

Outside of forest management, wood energy production may create value for materials previously burned or landfilled from activities such as land clearing, urban and community forest management, and storm salvage.

Forestry professionals and landowners will be faced with making the best choices to meet their objectives and goals for each site, and determining how biomass harvesting may be incorporated into their ongoing management decisions for long-term forest management.

Additional Resources

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