WOODY BIOMASS 101

General Harvesting Issues, Concerns, and Recommendations for Alabama Forest Owners

By Jim Jeter
Statewide BMP Coordinator/Hardwood Specialist, Alabama Forestry Commission

It is important for Alabama forest owners to understand what is going on with woody biomass harvesting in Alabama, and how the issues involved will affect some of their forest management strategies.

Issues and Concerns

While definitions of woody biomass are usually similar, there can be surprising differences. These differences in definitions are at the center of a national debate as Congress considers a new energy policy as well as a cap and trade bill involving carbon sequestration. There are some factions that want a very narrow definition allowing only a small portion of usable woody biomass to meet the standards within these two bills; then there is the other side that prefers a broader definition that would be advantageous to most woodland landowners.

Technically, the term *woody biomass* includes all the trees and woody plants in the forest, woodlands, or rangelands. This biomass includes limbs, tops, needles, leaves, and other woody parts. In practice, woody biomass usually refers to material that has historically had a low value or no economic value and cannot be sold as timber or pulpwood. At present this is the case in Alabama and most of the southeastern states. In the South, woody biomass that has been harvested thus far includes logging slash, small diameter trees, tops, limbs, and/or trees that cannot be sold as a higher-value product. Markets will determine which trees are considered acceptable for each individual product and which are relegated to the low-value biomass category. As markets change over time and from region to region, different kinds of materials may be considered woody biomass. So far in Alabama, short-rotation woody biomass plantations have not been implemented as a silvicultural system. However, as more government incentives are brought forth, these plantations will be a part of the woody biomass market.

While the debate lingers, there have been concerns by different groups as to what effects the removal of woody biomass may have on the environment. As natural resource managers, there is great concern that we adopt practices and develop products that are not only environmentally, socially, and economically sound, but also meet present needs without compromising the ability of future generations to meet their needs. To address these concerns, most groups are looking at criteria and indicators for nine principles: soil productivity, biological diversity, water quality, climate change, socio-economic well-being, legality, transparency, continuous improvement, and integrated resources management planning.

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Soil Productivity: The maintenance of site productivity is perhaps the key non-water quality issue when anticipating the expansion of the use of woody biomass. Many soils in the South are still recovering from agricultural practices of a century ago. This improvement in soil quality is largely due to the extensive reforestation efforts undertaken in the 1930s. With the addition of key nutrients through fertilization "boost," the options are to either improve or maintain existing site productivity of most forest soils. If it is proven that the harvesting of woody biomass actually depletes the nutrients in certain soils, fertilization may become a standard management tool. Studies have shown that most soils recover any nutrient loss within three to six years after a harvest.

It is unlikely that any damage from forestry operations other than road construction would prevent establishment of vegetative cover. If so, measures suggested by Best Management

Practices (BMPs) to establish vegetative cover following harvesting would prevent soil erosion and restore some of the soil's productive capacity. Additional measures (fertilization and tillage) to restore or increase site fertility beyond that needed to establish vegetative cover would be justified by economic analysis of tree growth. Studies over time have shown that individual case/site analysis is needed to determine whether avoidance of soil damage is more cost effective than rehabilitation.

There is great diversity in soils across the South, from droughty sands to sandy loams to sandy-loam-clays to clays. Due to this diversity and its corresponding productivity, each soil has its own specific recommendations dealing with nutrient depletion or addition. However, those of biggest concern should be the droughty deep sands. In the case where a tract contains mostly sandy soils, it would be recommended that less woody biomass be harvested. There are numerous ongoing soil studies dealing with nutrient depletion and nutrient translocation that should give us a better handle on this in the future. Until then, special steps may be taken to mitigate nutrient loss on sites identified as vulnerable to nutrient depletion. Examples of such steps may include altering the harvest plan, redistributing a portion of the logging slash, or supplementing the native nutrient level through fertilization.

Use the web soil survey at **http://websoilsurvey.nrcs.usda.gov** to view the soils on a given tract, or contact your local county USDA Natural Resources Conservation Service (NRCS) office. This survey provides a simple yet powerful way to analyze soil data in three basic steps.

Soil compaction and excessive rutting can also impact site productivity. This is usually the result of logging or performing equipment operations during wet or saturated soil conditions. Although site productivity can be restored in these cases, the necessary mechanical site preparation practices are very expensive. Timing harvest operations to avoid wet soil conditions or minimizing equipment travel patterns can prevent such impacts.

Biological Diversity: As biomass utilization expands there will be growing pressure to maximize the efficiency at which these raw materials are harvested. There is a major concern that this pressure could result in increased intensification of natural forest management as well as conversion of native forest to plantations or short-rotation dedicated energy crops. Intensive forest management has been a well-accepted silvicultural practice among forest managers in the southern states, thus presenting less concern in this region. However, the concern is greatest in the northern-most states where intensive management is presently not the norm. Recommendations regarding plantation establishment and management, and situations where biomass is the primary product being grown and harvested will be addressed as biomass utilization intensifies and specifications for particular products are established, i.e., species, rotation length, and product size.

One of the central concerns in woody biomass removals is the reduction of the quantity of dead wood left on site. Dead wood plays an important role in the ecosystem, from wildlife habitat and nutrient cycling to carbon storage. Coarse woody material (CWM) provides habitat for mammals, amphibians, reptiles, and beetles. Birds use snags to build nests, search for insects, and as hunting perches. Woody material on the ground decreases water run-off and erosion. If woody biomass harvesting gets to the point where biodiversity and the lack of dead wood on a tract is an issue, specific recommendations will be made to leave a certain amount/number of the desired material on-site. Again this would be site-specific and based on what is present before the harvest.

Intensive management of pine plantations in the South has been a major concern for years; however, Alabama remains fifth in the nation in biodiversity. There is a major push by most groups to take anything dealing with genetically modified organisms (GMO) off the table as allowable biomass. There is also great concern dealing with species being introduced that will later be deemed as an invasive species. Even though most intensive management practices are geared toward a specific stand, if short-rotation woody biomass plantations become a reality the public may become more aware of the landscape management approach to support the full range of biodiversity we presently enjoy. As biomass markets expand, more emphasis and attention may be placed on watershed management.

We need to remember that these issues are distinctly related to scale. At the landscape scale, concerns for habitat diversity and fragmentation are high and there is little guidance on how it could be affected. Major unknowns create great uncertainty in determining whether a fully developed, widespread bioenergy market would significantly affect landscape scale attributes. Will

demand be high enough to have significant broad impacts on landowner behavior? Is demand high enough to significantly change logging opportunities? On the landowner scale, there is much that can be considered in a management plan to maintain habitat complexity and diversity in the framework of intensive management for any product type. Some of these guidelines are listed in this document in the "Recommendations" section.

Water Quality: In general, water quality and riparian concerns should not change with the addition of woody biomass removals to a harvest plan. Streams and wetlands should be protected by existing Best Management Practices (BMPs) for Forestry. Southern states have an excellent track record in the development, implementation, and monitoring of forestry BMPs related to water quality. Using the Clean Water Act as a fundamental base, each state in the South has a BMP manual and program to address water quality issues.

Climate Change: One of the reasons biomass harvesting is so appealing is that the resulting fuel, energy, and chemicals provide an alternative to fossil fuel-derived products, thereby offering the possibility of dramatic reductions in carbon dioxide emissions and other greenhouse gases. The opportunity for forest-derived biomass to be part of the carbon solution is an important consideration in the planning and development of biomass projects. Without careful planning, projects may include inefficiencies that greatly undermine opportunities to replace fossil fuels and minimize greenhouse gas emissions. Ideally, biomass development will occur in a manner that maximizes efficiencies in energy production and minimizes energy consumption associated with transportation, storage, and raw material processing, while maintaining biodiversity and improving the environment.

Socio-Economic Well-Being: Despite general enthusiasm for the prospects of bio-energy production, there are significant concerns about the potential role of forests in bio-energy production. Some see great opportunity, viewing new markets for forest biomass as a source of income to more effectively respond to ecological challenges including insect and disease threats, wildfire and fuel loading concerns, storm events, and natural disasters. There are, in addition, perceived benefits of achieving more effective management of young forests to support longer-lived species and higher-valued products. Biomass harvesting and resulting energy, fuel, and chemical products are also widely viewed as offering significant opportunities for economic development, fossil fuel independence, community self-reliance, and job creation. Some of the challenges facing woody biomass include the cost of technology in the facility for bio-energy production and developing a market for biomass as competition grows in the energy markets. Additional factors include competition for use in other wood products, environmental concerns with sustainability of our forests, and community acceptance as an alternative energy source.

Finally, there should be economic considerations when examining ways to increase woody biomass production while meeting the standards that are expected from the general populous. Intensively managed plantations are enterprises for which landowners will expect some level of economic return. There are various costs associated with managing for increased biodiversity which create trade-offs between biodiversity and economic returns. If management practices are too costly, they are unlikely to be implemented on private lands.

The Biomass Crop Assistance Program (BCAP) is one such program that responds to the added cost of transporting woody biomass to a certified facility. BCAP is part of the Farm Bill and Recovery Act. In Phase 1, which is active, it provides financial assistance to producers that deliver eligible biomass material to designated biomass conversion facilities for use as heat, power, bio-based products, etc. Initial assistance is for the collection, harvest, storage, and transportation costs associated with the delivery of eligible materials through a direct matching of dollar for dollar of dry ton delivered to qualified facilities, up to $45 maximum over the next two years. Phase 2 should be activated by this spring and will pay biomass growers. The details of Phase 2 have not been made public. At the time of this writing, Alabama has 13 Qualified Biomass Conversion Facilities.

This program is administered by the USDA Farm Service Agency (FSA). To view details and updates, go to ***www.fsa.usda.gov/FSA/webapp?area=home&subject=ener&topic=bcap*** or the Alabama Forestry Commission website, **www.forestry.alabama.gov.** Click on the Market and Information Resources tab on the left, and then Biomass at the top.

Transparency: The success or failure of biomass projects may hinge upon public trust of forest managers and biomass project developers. Mistrust of forest managers is strong among people who hold an ecocentric perspective of the environment, while only weak levels of trust tend to exist in other segments of the population. Environmental groups in the early stages of learning about biomass utilization may tend to react negatively to proposed projects until trust is established. Acceptable forest management prescriptions vary geographically and depend upon individual experience and beliefs. What is good for the northern states may not be good for Alabama.

The diversity of existing perceptions on forest management and public agency trust can challenge projects that may create biomass feedstock on public lands and projects developed through public-private partnerships. We as landowners and natural resource managers must gain this trust by using sound, proven silvicultural practices in our prescriptions to others. There is already a fear from environmental group representatives that large-scale biomass utilization will allow demand for biomass to control forest management decision making, rather than forest management leading the decision making, resulting in the production of woody biomass as a byproduct of forest restoration. We must calm those fears and prove them wrong.

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Legislation: Renewable Portfolio Standards (RPS) or Renewable Electricity Standards (RES) are regulations placed on providers of electricity to produce certain percentages of their energy from renewable resources. Although Alabama has not enacted such regulation, over 25 states have done so. New policies being discussed at the national level will, in all probability, set Alabama's percentages. The bill to watch is The Renewable Energy Standard (RES), which will not only define these percentages, but also provide the accepted definition of what will be eligible as woody biomass. This will be pivotal for Alabama's forest owners.

Continuous Improvements: Since there is no "legally-approved" definition of woody biomass, what type of forest it can be removed from, or how much we will need to harvest, we must work with our present knowledge, making assumptions until these issues are solidified. Presently there are a lot of questions to be answered. Universities will have to answer most of the questions with studies and models. Then the practices will have to be put in place on the ground to verify the projected results.

One such study has already been announced. Auburn University, the recipient of a grant worth up to $4.9 million from the US Department of Energy, will design and demonstrate a high productivity system to harvest, process, and transport woody biomass from southern pine plantations. Specific project objectives are to develop design improvements in tree length harvesting machines for energy plantations; configure and assemble a high-productivity, lowest-cost harvesting and transportation system for biomass and demonstrate at full industrial scale; and document performance of the systems.

There have been and will be more demonstrations of woody biomass harvesting equipment such as the "Biobaler." Visit **www.supertrak.com/video/BIOBALER.wmv** to view how it works.

As with any new endeavor, policies change, techniques change, and practices on the ground change. We must look ahead and try to address the issues until there is a defined policy and market. One thing we cannot do is become complacent in our thinking or silvicultural practices; we must be willing to accept and embrace change if we are to succeed.

Integrated Resource Management Planning: Woody biomass harvesting and associated energy, fuel, and chemical producers offer significant opportunities for economic development, fossil fuel independence, community self-reliance, and job creation. Again, woody biomass harvesting could also help in responding to ecological challenges including insect and disease threats, storm events and natural disasters, wildfire and fuel loading concerns, and goals of achieving more effective management of young forests to support longer-lived species and higher-valued products. However, as stated before, biomass harvesting raises significant social concerns about aesthetics and political conflicts with other forest values and benefits. Careful monitoring and precautionary guidelines, as well as other policy and planning actions, are needed to ensure that biomass investments do not negatively impact biodiversity, soil productivity, and ecosystem health in Alabama or any other state. It will take a collaborative effort through a multidisciplinary team at the state level to address all the issues. The team should consist of a broad and diverse group of stakeholders that are professionals in their field and science-based.

Precautionary Woody Biomass Harvesting Recommendations for Alabama's Forest Owners

General

- If you do not have a written management plan, obtain one by hiring a consultant forester or by contacting your local AFC county office. Service providers and AFC contacts can be found by going to **www.forestry.alabama.gov**.
- At the very minimum, utilize a written woody biomass harvesting/timber sale contract. Examples of what a landowner should consider when selling forest products are located on the AFC website listed above.
- Develop and implement a reforestation plan.
- Follow Alabama's Best Management Practices for Forestry manual.

Soil Productivity

- Woody biomass harvesting operations should be completed in conjunction with a normal harvest or other management activity when possible. Avoid re-entry into a site for biomass harvest, if possible. Concentrated slash piles can be collected in a second pass if needed. Do not harvest/log when sites are extremely wet or soils are saturated.
- Enough logging slash should be left and scattered across the area to maintain site productivity. Minimize the extent of forest tillage.
- Protect sensitive sites and steep slopes by leaving slash and understory vegetation. The litter layer should be protected and the soil undisturbed.
- Select sites with deep soils and low erosive potential for short rotation woody crops.
- Evaluate site productivity to determine frequency of biomass harvesting and removals, especially on deep sandy sites.
- Use fertilizer if desired at recommended rates.

Biological Diversity

- Plant seedlings at a rate conducive to slow crown closure.
- Thin the stand if the rotation cycle will allow it.
- Maintain sensitive areas, streamside management zones, and other areas that will create stand diversity.
- Use frequent low-intensity prescribed burns if the rotation cycle will allow.
- Non-pine woody vegetation can be controlled by using a selective herbicide that is also conducive to growing wildlife-beneficial plants.
- Utilize intensive site preparation to enhance grass and forbs on soils that will allow.
- Retain key structural features such as snags, coarse woody debris, and mature live trees.

- In intensive management regimes, avoid large regularly shaped stands that do not conform to changes in habitat characteristics, soil type, or hydrology.

Water Quality

- Have a pre-harvest plan.
- Maintain streamside management zones, riparian buffers, and other sensitive sites.
- Apply all erosion control BMPs where needed.
- Maintain vegetation and litter cover on steep slopes or highly erodible soils.
- Do not apply fertilizer or herbicides directly into water bodies unless they have an aquatic label.
- Avoid harvesting stumps and root systems in areas where it will cause excessive erosion.
- Any chip piles should be located at landings and away from water bodies.
- Any stabilization where slash and litter were utilized, alternative techniques such as mulch and seeding will be needed.
- Promptly reforest the site.

Note: It is generally agreed that current forestry BMPs are adequate at this time to protect water quality during woody biomass harvesting.

Forest Health

- Reduce risks of escape of known and existing invasive species by identification and control of such on site.
- Prevent dispersal of invasive species by not harvesting biomass prior to seed maturity, cleaning equipment, and minimizing propagule dispersal throughout the rotation cycle.
- Minimize soil disturbance by rapidly replanting the site.

Conclusion

High energy prices in the global market and a strong reaction from federal and state governments in the form of new legislation are promoting the use of locally available feedstocks to reduce both the country's dependence on foreign sources of energy and greenhouse gas emissions, while igniting new forms of economic opportunities. Forests are poised to be a major source of biomass to supply some of the energy in various sections of the economy, especially in the southern states.

Availability of woody biomass can be severely affected by resource owner's willingness to adopt biomass treatments, particularly in areas like Alabama that are dominated by private lands. In summary, "one size does not fit all" should be the correct approach to promote the use of woody biomass. Future efforts should continue monitoring evolving challenges and opportunities as technology and market conditions change and new policies are adopted at the federal and state levels. Natural resource managers and private landowners must be flexible and protective of our existing forest acres if we are going to be successful in the endeavor.

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