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Developing Forest Resource and Biomass Markets in the South

Volume III: Biomass Designation and Tracking for Renewable Biofuels Production

March 2012

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Completed under contract for the Georgia Forestry Commission by:

BioResource Management, Inc.

Dougherty & Dougherty Forestry Services, Inc.

Preface

In many ways, the quality of life in America depends upon reliable and affordable energy. This is most evident in our need and desire for people and goods to be mobile; to fly to business meetings, to depend on quick delivery of our online orders, to drive across three states to visit relatives, or to expect fresh fruit at our grocer in January. Today, warning signs show that traditional petroleum fuel sources are vulnerable because of unstable governments and limited crude oil supplies. America has an opportunity to develop alternative fuel sources to allay these concerns of instability in petroleum fuel sources. The U. S. Congress has established guidance and support in the development of renewable fuels. Unfortunately, existing federal law also places constraints on the use of forestry biomass for the production of liquid renewable fuels. The Energy Independence and Security Act of 2007 included a new Renewable Fuels Standards (RFS2), which established a new definition of *renewable biomass* and instituted documentation requirements to ensure that qualifying *renewable biomass* is used by biorefineries that produce renewable fuels. This report provides a description of these constraints and recommends methods to manage them within a biomass procurement system.

Many in the renewable energy industry feel that the production of transportation fuels will be the best utilization of biomass in the future. This vision will require successful development of economically viable biomass conversion technologies. A few companies are aggressively pursuing this vision in the South, such as Kior, Dupont Danisco, and LanzaTech. Range Fuels was the original pioneer of pine-produced biofuel, but failed in its pursuit of an economically viable conversion technology. While this was a setback, Range's experience was a learning tool that provides a base for continued work by LanzaTech and others.

As renewable fuel production technologies develop, the forest biomass supply chain should also develop to meet the needed demand. The traditional wood product supply chain from forest regeneration to finished wood product is understood by those in the forest product industry. Companies within the bioenergy sector are new to using forest resources and must apply RFS2 requirements to a feedstock supply chain with which they may be unfamiliar. Alternatively, forest product companies may venture into biofuels production and will need to adapt their feedstock procurement to RFS2 requirements. This report should be of value to all those pursuing the use of forestry biomass in the production of liquid fuels.

Since this industry is just emerging, I recommend that you read the entire report. However, the "Operationalizing Biomass Recordkeeping" and "Examples" sections may provide the most value for your developing project. As always, we encourage feedback to guide our future services to the forest industry and landowners in Georgia.

Nathan McClure
Utilization Department, Georgia Forestry Commission

Notice

This volume is part of a series of technical reports designed to assist with the development of forest resource and biomass markets in the southern United States. The volumes and their intended purposes are as follows:

Volume I: An Overview of the Timber and Biomass Supply Chain
Volume I describes the general organization and operation of the typical forest resource supply chain for those with limited knowledge of forest-based industries.

Volume II: Mechanisms for Securing Long-term Forest Biomass Supply
Volume II explores alternative methods to providing long-term assurance of forest resource feedstock deliveries to a mill.

Volume III: Biomass Designation and Tracking for Renewable Biofuels Production
Volume III suggests methods that lead to compliance with the Renewable Fuels Standard established by the Energy Independence and Security Act of 2007. It is also useful to those establishing procurement systems that document sustainability of the forest resource.

Disclaimer

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This report is not intended to provide constraints, agreements, or encourage concerted actions that may restrain competition, set prices, or any way violate antitrust laws. The Georgia Forestry Commission and the federal government do not recommend the use of any specific form of biomass procurement or transaction. The information provided herein present a partial list of the various alternatives to meeting individual company goals and RFS2 requirements.

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Contents

1. Introduction

The Renewable Fuel Standard (RFS) program was created by the Energy Policy Act of 2005 as the first renewable fuel volume mandate in the U.S. The Energy Independence and Security Act (EISA) was enacted in 2007 and significantly modified the RFS program to its current structure known as RFS2. RFS2 included a variety of changes, including updating annual volume standards for renewable and advanced biofuels and establishing greenhouse gas (GHG) reduction thresholds, among others.

A key EISA provision for the Georgia forest products industry and wood-consuming biorefineries is the act's definition of "renewable biomass." The definition specifies the biomass resources that qualify as raw material for production of renewable fuels, as well as the attendant feedstock source documentation measures that indicate compliance with the definition[1]. The purpose of this report is to review the RFS2 definition of renewable biomass, outline recordkeeping requirements, and examine the most feasible alternatives for ensuring compliance with the regulation.

2. Renewable Biomass Defined

With respect to biomass sourced from Georgia's forests[2], EISA considers four elements in determining whether the material qualifies as renewable:

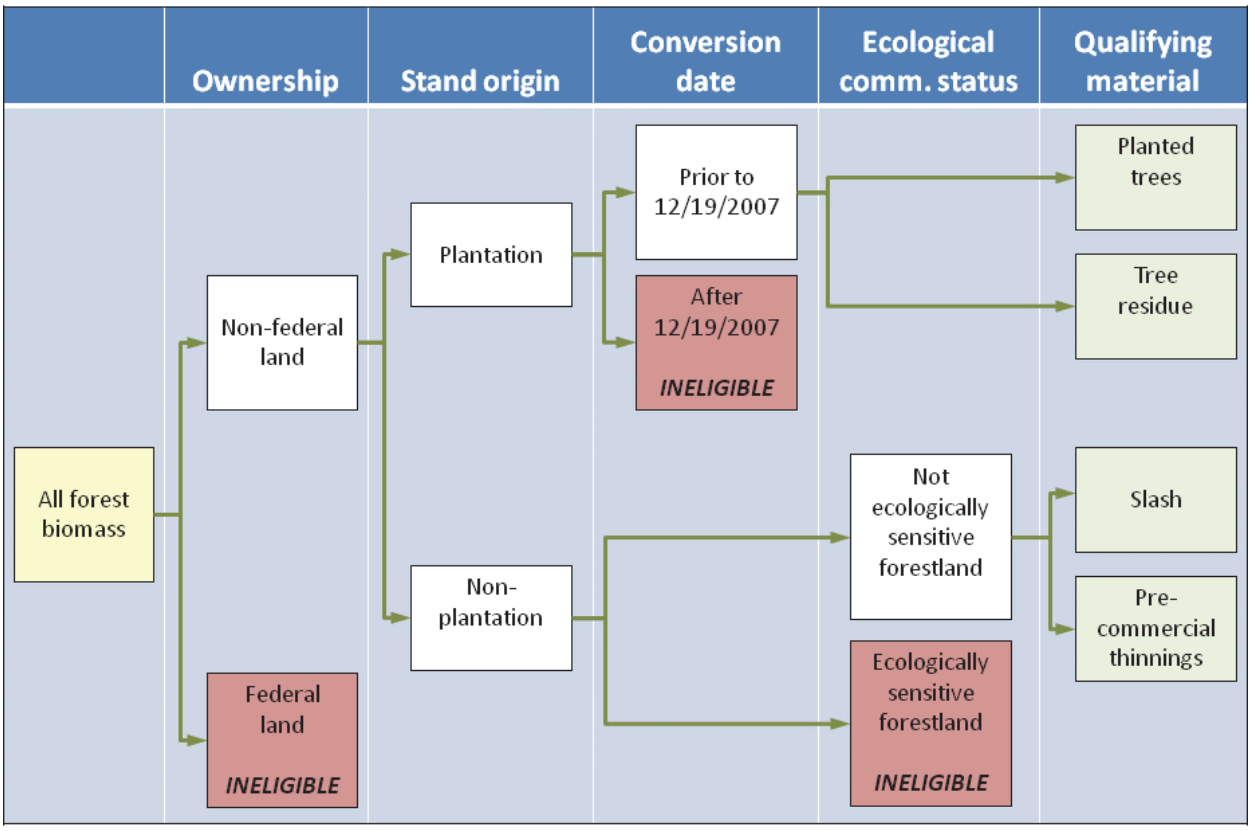
1. *Ownership*. Biomass originating from federal land is not eligible.
2. *Stand origin*. Renewable biomass can be sourced from plantation or non-plantation forests. However, biomass from non-plantation sources is limited to slash and pre-commercial thinnings, while planted trees and tree residue are eligible when sourced from plantations.
3. *Conversion date*. In the case of plantation-grown biomass, the conversion of the stand from non-plantation to plantation must have occurred prior to EISA's enactment on December 19, 2007.
4. *Ecologically sensitive forestlands*. Non-plantation biomass cannot be sourced from ecological communities considered critically imperiled, imperiled, rare, old growth or late successional forests.

The sum of all Georgia's forest biomass resources can thus be filtered through a series of steps that progressively eliminates material not qualifying as renewable biomass. The framework is graphically represented in Figure 1.

[1] See 40 CFR 80.1401 for renewable biomass and other EISA definitions, relevant definitions are included in the Appendix; 40 CFR 80.1454 addresses RFS2 recordkeeping.

[2] EISA qualifying renewable biomass includes other categories such as algae and agricultural crops and residues, among other materials. Only forest-sourced renewable biomass is considered in this report.

Figure 1. Categories of renewable biomass.



In summary, effectively all material sourced from plantations established on non-federal land prior to EISA's enactment qualifies as renewable biomass. This is because non-planted trees are, in most cases, ultimately converted to tree residue, which is a qualifying material. Slash and pre-commercial thinnings are eligible when sourced from non-federal, naturally regenerated forests, provided that the tract of origin is not considered an ecologically sensitive forestland. Slash includes tops, limbs, and bark resulting from logging activity; pre-commercial thinnings include cull trees and any trees or other vegetation removed to promote the growth of the remaining forest stand.

3. Recordkeeping Requirements for Renewable Biomass

Renewable fuel producers are obliged to comply with recordkeeping and reporting requirements for their biorefineries by collecting and maintaining appropriate records from their feedstock suppliers proving their feedstocks satisfy the renewable biomass definition. EPA has identified

records relating to the (a) biomass production location, (b) biomass transfer, and (c) verification of plantation conversion date[3].

1. In order to document the production location and transfer of forest-sourced biomass, EPA requires *all* of the following records:
    a. Maps or electronic data identifying the tract of land where feedstock was produced, and
    b. Bills of lading, product transfer documents, or other commercial documents demonstrating the quantity of feedstock purchased from each production tract.
2. In order to demonstrate that tree plantations were converted prior to the EISA enactment date, EPA requires *at least one* of the following:
    a. Sales records for planted trees or tree residue from past harvest activity,
    b. Purchase records for seedlings or inputs such as fertilizer,
    c. Written silvicultural management plan or agreement for land management consultation from a professional forester,
    d. Documents indicating participation in a government-sponsored silvicultural program,
    e. Documents indicating land management in accordance with a silvicultural product certification program, or
    f. Evidence of existence and ongoing maintenance of physical logging infrastructure, *together with one of the aforementioned documents*.

As summarized in Figure 1, a total of four criteria determine the renewable status of forest-sourced biomass. In principle, a biorefinery's RFS2 recordkeeping system should thus go beyond the location, transfer, and plantation conversion date in order for its biomass to fully qualify as renewable. At this stage, EPA has yet to indicate any specific recordkeeping requirements related to a non-plantation tract's "ecologically sensitive forestland" status. Likewise, EPA has not specified whether any documentation of the material type is needed, for example, to determine whether a given volume from non-plantation forest qualifies as pre-commercial thinning.

While the EPA definition of "old growth or late successional" identifies a tract age of 200 years or more and is thus relatively straightforward, the identification of imperiled or rare ecological communities is more challenging. NatureServe is a non-government organization that works with state natural heritage programs to maintain a database containing the status of individual species and ecological assemblages around the U.S.[4] The ranking of communities reported by NatureServe is identified in the EPA definition: ecological communities with either a local ranking (S1, S2, or S3) or global ranking (G1 or G2) indicating critically imperiled, imperiled, or rare. Individual non-plantation tract characteristics could thus be evaluated according to this

[3] See 40 CFR 80.1454(d)(1) and (2).

[4] The NatureServe Explorer is a searchable database of ecological units (in increasing hierarchical order: alliances, associations, systems, communities) that can be filtered by location, and can be found on the NatureServe website: www.natureserve.org.

system by qualified professionals. As a practical matter, this determination may be difficult in some cases, as Georgia does not currently rank ecological units on a state level. Furthermore, special skills may be needed to make the designation of ecological community membership of any given tract of timber. Some suggestions for ensuring compliance with this consideration are included in Section 6.

4. Alternative Biomass Recordkeeping Systems for RFS2

Rather than maintain sourcing documentation for each load of biomass received by a facility, renewable fuel producers have the option to pursue an alternative biomass tracking system under RFS2[5]. The alternative approach effectively passes some of the responsibility for maintaining documentation from the biorefinery to other participants in the biomass supply chain. The approach requires the biorefinery to participate in "a comprehensive program of annual compliance surveys," that is, annual third party audits of the record-keeping system. The attributes of the alternative biomass tracking system include:

1. Annual compliance surveys must be planned and conducted by an *independent surveyor*,
2. Surveys must be *conducted on-site* at biorefineries and feedstock supplier locations,
3. Surveys must be *representative* of the supply area and feedstock suppliers,
4. Surveys must be designed to achieve *at least the same level of quality assurance* as outlined in Section 3 above.

A detailed annual compliance survey plan must be submitted to and approved by EPA in the year preceding the calendar year in which the surveys will be conducted, and a detailed report must also be submitted to EPA by the independent surveyor within 30 days of completion of the annual survey. Independent surveyors must maintain all records relating to the annual compliance audit for a period of five years, and must permit EPA to monitor the conduct of the audits, the records reviewed, and the surveyor's analysis of audit results.

Under this alternative renewable biomass tracking system, renewable fuel producers must take "all reasonable steps" to ensure that the entities within their biomass supply chain cooperate with the independent surveyor and/or EPA. At a minimum, this means that biomass supply contracts must contain provisions that require supply chain members to provide documentation enabling confirmation of the renewable status of delivered biomass to independent surveyors or EPA.

This may provide a window enabling the proposing facility some flexibility in documentation requirements. While not specified by EPA, a number of other items could potentially verify the conversion date of tree plantations. For example, an increment core indicating a planting date prior to 2007 from a tract where even-aged trees occur in straight lines is clear confirmation of a

[5] See 40 CFR 80.1454(h).

conversion date prior to EISA enactment. Aerial photographs are widely available in digital format, and photos indicating past tract conditions could also presumably serve to confirm conversion dates.

Another form of digital media that may prove useful under an alternative tracking system is remotely sensed satellite imagery. The Landsat program provides a nearly 40-year time series of satellite imagery at relatively high resolution (0.22 acre pixel size). Landsat records a sort of specialized digital photograph, measuring the spectral signature of the landscape across seven bands of the electromagnetic spectrum. Landsat data is not useful to a biorefinery in its raw form, but image processing can be contracted to a firm with the appropriate skill set and knowledge of the biorefinery's objectives to generate a useful product.

Landsat-generated products can include supply shed level mapping of a variety of forest attributes useful to biomass procurement and management. For example, Landsat data is commonly used to detect vegetation change, such as that resulting from land clearing or timber harvesting. Change detection can determine the year any given stand was harvested and replanted, and additional refinement of the analysis can indicate such silvicultural interventions as thinning events. When applied to an entire supply shed, a tract age map can be generated that allows the biorefinery to match a harvested tract to a specific mapped location for delivered biomass, thus verifying its date of conversion to a tree plantation. Beyond the RFS2 application, supply shed level tract mapping provides other useful information to procurement staff, such as identifying potential future supply bottlenecks due to reduced tree planting for a period of years or identification of areas within the supply shed of high or low procurement potential.

Furthermore, a supply shed level forest cover mapping system may prove useful in documenting a biorefinery's potential influence on forest cover. The impacts of biofuels on land cover is an ongoing contentious topic and one that hasn't been ignored by EISA. The requirement that renewable biomass be sourced from tracts converted to plantations prior to enactment of EISA is a direct response to concerns that biofuels might result in widespread conversion of natural landscapes to biomass plantations. Landscape scale considerations also factor into renewable biomass sourced from planted crops or crop residues that are subject to "aggregate compliance," whereby conversion date documentation requirements are relaxed unless EPA finds that agricultural land in the U.S. has expanded beyond the level present at enactment of EISA[6].

What can emerge from an alternative recordkeeping system is a "top-down" approach to documenting the source of biomass material. Such a system is top-down inasmuch as its perspective begins at the level of the shed as a whole and progresses down to the level of individual tracts. This approach could provide value to the biorefinery beyond RFS2 documentation, and this may make it attractive to many facilities. Nevertheless, since these alternatives have not yet been codified by EPA it is not clear whether they would prove

[6] See 40 CFR 80.1454(g).

acceptable to the agency, either alone or in combination for the purpose of validating the status of biomass from a given tract. Until presented with an ordered structure for the implementation of a documentation verification system in the form of a compliance survey plan, EPA may not be in a position to fully evaluate the proposed alternative methods, and as a result, it is difficult to say with certainty where they will land in their evaluation.

In large part, the advantage afforded by an alternative recordkeeping system for renewable biomass is that it passes some of the document review and archive responsibility to another party, the contracted supplier. While this eases some of the biorefinery's documentation and archival burden, in the end it may expose the facility to shortcomings on the part of the supplier that may prove problematic to the biorefinery. Specifically, under the alternative system, the supplier is making a decision about the renewable status of biomass being delivered to the biorefinery, and any errors in the supplier's decision that are detected in an annual audit are by extension the biorefinery's errors. The contract supplier may also be lax in archival practices, which may generate similar problems during annual audits. Biorefineries can to some extent control for these issues by conducting regular "internal" audits of suppliers, but this also takes procurement staff effort that could be utilized for implementing a conventional RFS2 documentation system. Ultimately, biorefineries will need to work closely with EPA to determine whether a system suitable to the facility's biomass procurement and management structure is acceptable to the agency.

5. Georgia's Timber Supply Chain and Document Generation

Chain-of-custody

When considering how to integrate an RFS2 recordkeeping system into a facility's biomass procurement and management structure, it's helpful to consider the components of the forest-to-facility wood supply chain. In general terms, the timber supply chain in the Southeast begins with the forest landowner and ends with the wood-using facility, in this case a biorefinery. Between the landowner and biorefinery, the actors involved and flow of material may vary, but at its core, the supply chain consists of:

a. Transfer of title to the material from the forestland owner to a buyer,
b. Harvest and landing of the purchased timber,
c. Processing of the woody material to meet biorefinery specifications, either at the point of generation, an intermediate site, or at the facility itself,
d. Transport of the biomass from its point of origin to the biorefinery gate.

Landowners may conduct timber sales or enter into multi-year supply agreements; the latter are generally only a feasible option for large landowners. Timber sales can result from an announcement by a landowner to potential buyers followed by a bidding process or other

negotiation, or from direct contact of the landowner initiated by a potential buyer. In either case, compensation for the timber purchase is made in the form of a lump sum or a per-unit payment. A lump sum simply values the entire stand of timber on offer in a single dollar value that reflects the composition of the stand and off-take market conditions. Per-unit sales compensate the landowner a given value for each unit, usually tons, of product delivered to one or more mills.

Timber buyers may be dealers, loggers, or wood-using facilities. Under the most common arrangement, dealers purchase timber from landowners and sell to different wood-using mills with whom they have a relationship. The arrangement may include a wood supply quota. Dealers contract with logging crews to harvest timber, and may engage an additional party to transport timber to mills. Alternatively, loggers may purchase and directly market timber, acting as dealers themselves, and again may contract the trucking of harvested wood to market. Finally, wood-using facilities may purchase timber directly from landowners. In this case, the facility likely has logging crews and truckers under contract to complete the in-woods work and transport.

Regardless of the counterparty of a timber sale, landowners frequently employ *timber sale contracts* to formally delineate the terms of the sale[7]. Common components of timber sale contracts include pricing for the various forest products or cutting unit, performance bond requirements, contract duration, Best Management Plan compliance, damage penalties, and harvesting restrictions.

Georgia Code requires that wood *load tickets* be furnished to landowners for each load of timber removed from their property as part of a per-unit timber sale[8]. Load tickets are generated by the receiving mill and are required to include:

1. Ticket number,
2. Name and location of receiving facility,
3. Date received at facility,
4. Tract name,
5. County and state of origin,
6. Dealer name (if any),
7. Producer or logging company name,
8. Tree species,
9. Weight (tons) or scale (cords or other) information, including net weight or total scale volume,

[7] *Timber sale contracts* are distinct from *biomass supply contracts*. Timber sale contracts are specific to a single tract or tracts and are executed between a single landowner and a buyer who could be a dealer, logger, or biorefinery. Biomass supply contracts are executed between a biorefinery and a biomass supplier who could be a dealer, logger, or landowner and define a given volume of biomass deliveries sourced from many individual tracts over a specified time period.

[8] See O.C.G.A. § 12-6-23.

10. Volume deducted as a result of defects or other classification deduction,
11. Name of person receiving, weighing, or scaling wood.

This load ticketing system currently in place goes a long way towards RFS2 recordkeeping needs by satisfying the chain-of-custody requirements between timber tract and receiving facility. The tract name can correspond to the identification number assigned it by a harvest authorization or similar form (see discussion in Section 6 and examples below), thereby linking it directly to supporting documentation. While not required by law to be provided as part of lump sum timber sales, by obliging suppliers to provide ticket content relating to biomass origin and production (items 4-8 above), the facility could satisfy the chain-of-custody demands of RFS2 for all forest-sourced material using a system already familiar to supply chain participants.

Depending on a biorefinery's fuel specification, harvested material may need to undergo size reduction prior to delivery to the facility. This can take place in the woods if the logger has chipping or grinding equipment, or could happen in a satellite location where unprocessed wood is received - potentially from many suppliers - and processed prior to delivery to the biorefinery gate. Recordkeeping requirements for the latter alternative would require an additional step, as material is commingled from many sources prior to delivery to the facility.

Biomass Eligibility

With respect to documentation of conversion to tree plantations prior to enactment of EISA, a number of documents suffice. Because expenses for reforestation and afforestation are eligible for tax credits, landowners will generally maintain *records relating to site preparation, seedling purchase, and tree planting expenses*. This is also true for post-establishment management activities such as understory competition control or prescribed burns. However, some landowners may not have maintained these types of records for the decade or more between tree plantation establishment and harvest activities, and as a result, other documents may be needed.

Silvicultural management plans can also verify plantation conversion dates. Silvicultural management plans can be very detailed documents, providing an overview of the forest and land resource as well as indicating to landowners the means and methods to achieve their individual management goals. At a minimum, any management plan would contain tract boundaries and at least a general description of tract conditions that would include mention of whether the tract was planted or naturally regenerated, as well as the tract age.

Landowners participating in Georgia's Forest Stewardship Program receive *Forest Stewardship Plans* completed by an independent consultant or Georgia Forestry Commission personnel that can verify plantation conversion dates. Likewise, *management documents related to participation in Sustainable Forestry Initiative, Forest Stewardship Council, or American Tree Farm* third-party certification programs contemplate sufficient detail to verify plantation conversion dates.

In summary, most of the documentation required by RFS2 is already generated by the supply chain or can be easily adapted from current practices. Tract location maps - if not already included as part of timber sale documents - are easily prepared by biomass sellers, given the ready availability of such sources as digital aerial photography and property appraiser records. Chain of custody documents are already generated in the form of truck load tickets required by law. Confirmation of tree plantation conversion dates can be verified by a number of documents that landowners likely maintain in their records.

6. Operationalizing Biomass Recordkeeping

The task confronting the biorefinery is to adapt and maintain those records already generated by the timber supply chain, inserting any additional documents where necessary. For example, timber sale contracts are a part of many transactions, and can form the starting point of documenting material origin if it contains maps of the timber tract being sold. Beyond that, load tickets suffice to demonstrate chain-of-custody, and a variety of documents are likely available to verify tree plantation establishment dates.

Timber sale contracts

Timber sale contracts are not universally executed between landowners and timber buyers, and when executed will often be considered confidential by the landowner and buyer. Furthermore, timber sale contracts often do not address the transfer of residual woody biomass material such as logging slash, since at present it is often left behind following harvest of the tract. In any case, the biorefinery does need some verification that the supplier delivering the material is in fact the owner of that renewable biomass. One way a biorefinery could satisfy this need is to introduce a document indicating that the landowner has formally transferred title of the renewable biomass to the biorefinery supplier. Such a document could be as simple as a one-page form signed by landowner and supplier confirming the sale or transfer of the renewable biomass, and specifying the type of material being transferred, perhaps formatted as a checklist.

Ecologically sensitive forestland

Biorefineries must also make a determination that material sourced from non-plantation forests is not derived from ecologically sensitive forestland. Although it may require an inventory or stand characterization generated as part of a forest management plan or similar document, the late successional/old growth forest criterion is unlikely to affect much forestland, and can be evaluated by practicing foresters. The imperiled or rare community consideration however, will require some attention from the biorefinery. Determining a given tract's ecological community membership, and the corresponding determination of whether it is an imperiled or rare

community, may be beyond the skill set of many professional foresters engaged by landowners or biomass suppliers.

In order to ensure compliance with the imperiled or rare ecological community sourcing restriction, a biorefinery could take the extreme position of avoiding biomass from non-plantation stands altogether, or alternatively require a survey of all non-plantation stands to ensure all tracts comply with the restriction. Neither is likely to be an attractive option, since the former may eliminate an important volume of the supply shed's biomass from the biorefinery's fuel supply, while the latter would represent an excessive cost to procuring biomass from non-plantation forests.

A more reasoned approach would be for the biorefinery to identify those general types of non-plantation forests in the facility's supply shed that could be considered imperiled or rare. In the case of Georgia facilities, longleaf pine (*Pinus palustris*) forests are primarily a forest type of which biorefineries should be aware. Naturally regenerated longleaf pine stands can be common in some areas, but because the current extent of longleaf pine forests has declined to less than 5% of their original range, many longleaf pine forest communities are considered rare or imperiled. That's not to say that a biorefinery could not source any biomass from non-plantation longleaf pine stands, but rather that any material identified by a supplier as originating from such a stand will need further scrutiny to ensure that the tract in question is not part of an imperiled or rare community. Furthermore, a common problem with maintaining the longleaf pine forest is contending with intrusive, low-value hardwoods, where fire has been excluded for a number of years. In such cases, biomass harvesting in the form of hardwood thinning would be an effective aid to natural longleaf pine management, and the biorefinery, suppliers, and conservationists all have an incentive to keep this silvicultural tool in place, despite current ambiguity relating to rare or imperiled community designations.

In summary, as the types of non-plantation forests that may be considered imperiled or rare will vary around the state, biorefinery procurement staff will need to be become familiar with those forest types occurring within their facility's supply shed. Staff will also need to affirm that they have determined the material originating from non-plantation stands as compliant with this criterion, perhaps as part of a harvest authorization described below.

Document review and acceptance

The biorefinery needs to demonstrate that it has evaluated documents allowing for a decision on whether a given volume of forest-sourced material satisfies the definition of renewable biomass. This step in the process can be documented, for example, by an authorization form developed by the biorefinery. The form would simply indicate that a member of the procurement staff has evaluated the tract documents, found that the material qualifies as renewable biomass, confirmed transfer of title from landowner to supplier, and has authorized delivery of the material. Such a

system would prevent the delivery of any noncompliant loads, thus avoiding any potential violations related to feedstock sourcing.

Digital recordkeeping and data systems

Collecting and maintaining the documents required by RFS2 is not a trivial task. If a biorefinery's annual demand for raw material is 500,000 green tons, and the average tract on which renewable biomass is harvested generates 100 truckloads, then the biorefinery will need to maintain sufficient documentation on 180-200 tracts each year. Clearly, digital records and software systems are an essential part of efficiently handling a task of this scale. Most records can be generated and maintained in digital format, or original hard copies converted to digital, when necessary.

There are a number of software packages that have been developed to track wood transactions and forest product inventories for wood using mills. A few examples of such software include SMSTurbo from Creative Info Systems, Yard Boss software from Aldata, Cutting Edge software from Caribou, and WeighWiz software from 3Log Systems. These software products typically incorporate digital weights of arriving loads, a process that is often automated by having arriving truckers scan bar coded cards issued by the facility. The scanned card contains information linking the load back to the seller, and the software package then sends weight information to the accounting system, where it is merged with contract and payment information, and generates such documents as truck load tickets. When coupled with facility consumption information, the system can maintain a running inventory of wood products on hand and, depending on the needs of the mill, this inventory can be maintained on a basis as detailed as individual logs.

Any system that has the ability to scan a load card and link it to a seller can also be used to identify the tract of origin. Once the tract of origin is identified, all other information about the arriving load, such as that related to RFS2, can be assembled. The software packages described above are typically tailored to some degree to reflect the preferences and needs of the user. As a result, biorefineries have a range of options to identify particular attributes of any given system according to the facility’s procurement staff needs and the facility's accounting systems and software.

The basis of all scale/inventory software products is a database system that can be integrated with other software systems, such as the facility's accounting software. Databases can also provide linkage with other non-numeric digital content such as contract documents, tract maps, and the like. For example, a supplier profile database form can contain the supplier's contract volume and price for biomass material and freight, all of which factor into the supplier's periodic payment generated by accounting staff, as well as contract volume oversight. The profile may

also contain links to a digital copy of the supply contract, truck load tickets or harvest authorizations issued to the supplier, as well as other documents such as digital maps.

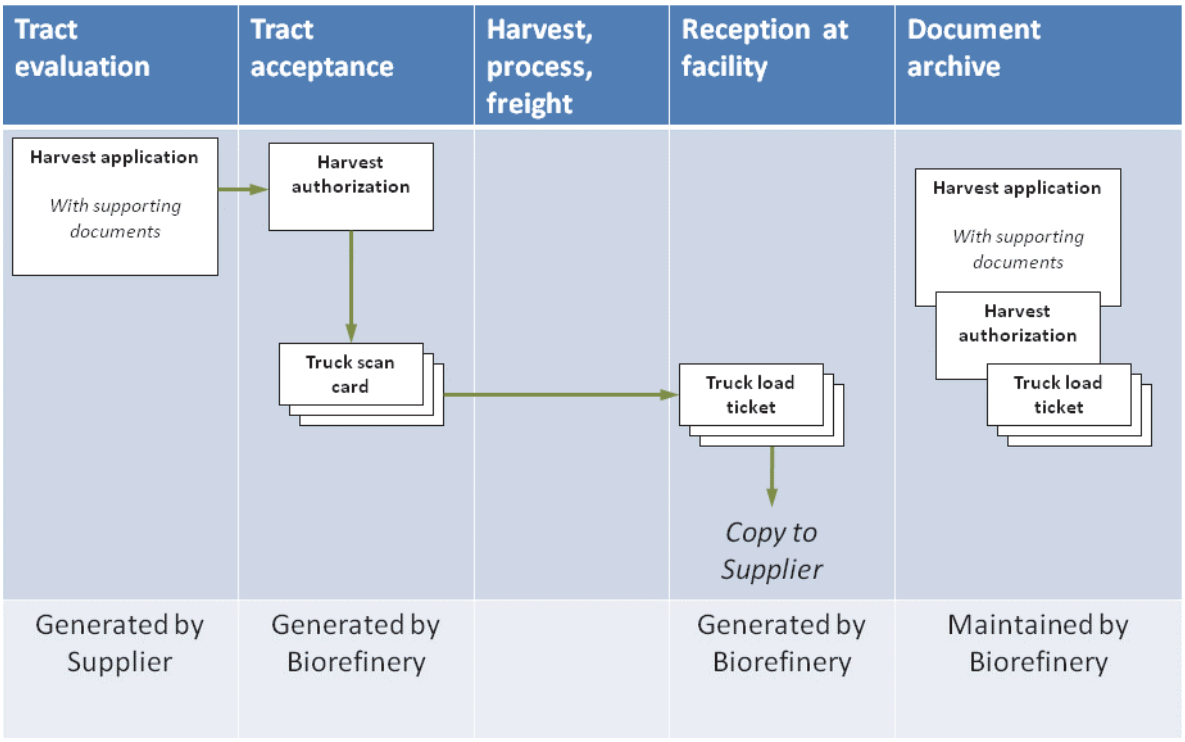
GIS (geographic information system) software and procurement staff trained in its application make a useful complement to recordkeeping software products. GIS software allows a wide range of tasks and analyses to be conducted by staff, from simple tasks such as determining the freight distance from the facility to a harvested tract to more complex analyses that evaluate the impact of competitors within the supply shed. Many suppliers may not be in a position to submit digital maps, but hard copies of maps can readily be converted to GIS shapefile format, combined with other data layers such as digital aerial photos, and archived for longer-term analysis and recordkeeping purposes.

7. Examples

A few examples are outlined below to help illustrate the actual tasks and documents associated with some potential recordkeeping structures. While there is more than one method to manage documentation, and indeed there are too many potential ways of organizing a biomass fuel procurement system to identify a single one-size-fits-all method, an example structure that satisfies RFS2 requirements is summarized in Figure 2.

Example 1. Planted trees and tree residue sourced from a tree plantation. A per-unit timber sale was executed under a timber sale contract in a planted pine stand. Larger diameter roundwood will be sorted into various higher-value products while small diameter planted trees, tops, limbs, and other unmarketable woody biomass is to be chipped and delivered to the biorefinery.

Figure 2. Document generation and retention for example biomass purchase.



The supplier completes a *Harvest Application*, a form developed by the biorefinery that establishes the foundation of the recordkeeping system for each individual tract. The Harvest Application identifies the location of the tract, estimates the volume of tree residue to be delivered to the biorefinery, identifies the species mix, and the logging and freight contractors responsible for harvest and delivery of the material. At a minimum, the Harvest Application requires three supporting documents: a map identifying the location of the tract, the *Biomass Title Transfer* form, and one of several potential documents indicating the date of the tract's conversion to a plantation. The Biomass Title Transfer format is generated by the biorefinery and completed and signed by the landowner and supplier, confirming that the landowner has transferred title of the planted trees and residual material to the supplier delivering the material to the facility. Suppose that in this case, the supplier provides an acceptable hard copy map and a management plan completed by a professional forester that the current timber harvest is contemplated in that management plan, and the supplier provides a hard copy of a valid Biomass Title Transfer form.

The Harvest Application enables the biorefinery to assess the eligibility of the biomass prior to its harvest and delivery to the facility, thus allowing the refinery to avoid reception of any material not meeting the renewable biomass definition. The biorefinery evaluates the documentation regarding tract conversion date, location, and transfer of title from landowner to supplier. While not applicable in this case, the Harvest Application would also allow the

biorefinery to confirm that a non-plantation stand was not designated an imperiled or rare ecological community, or whether it needed further evaluation to determine eligibility. Once the biorefinery determines that the biomass from the tract is acceptable, it issues a *Harvest Authorization* to the seller, a document that formally gives the go-ahead to deliver biomass to the facility. At the same time, the biorefinery issues *Truck Scan Cards* to the supplier. These cards identify each load of material by its tract of origin numbered according to the Harvest Authorization, and are kept by truckers and scanned at the scale house upon arrival.

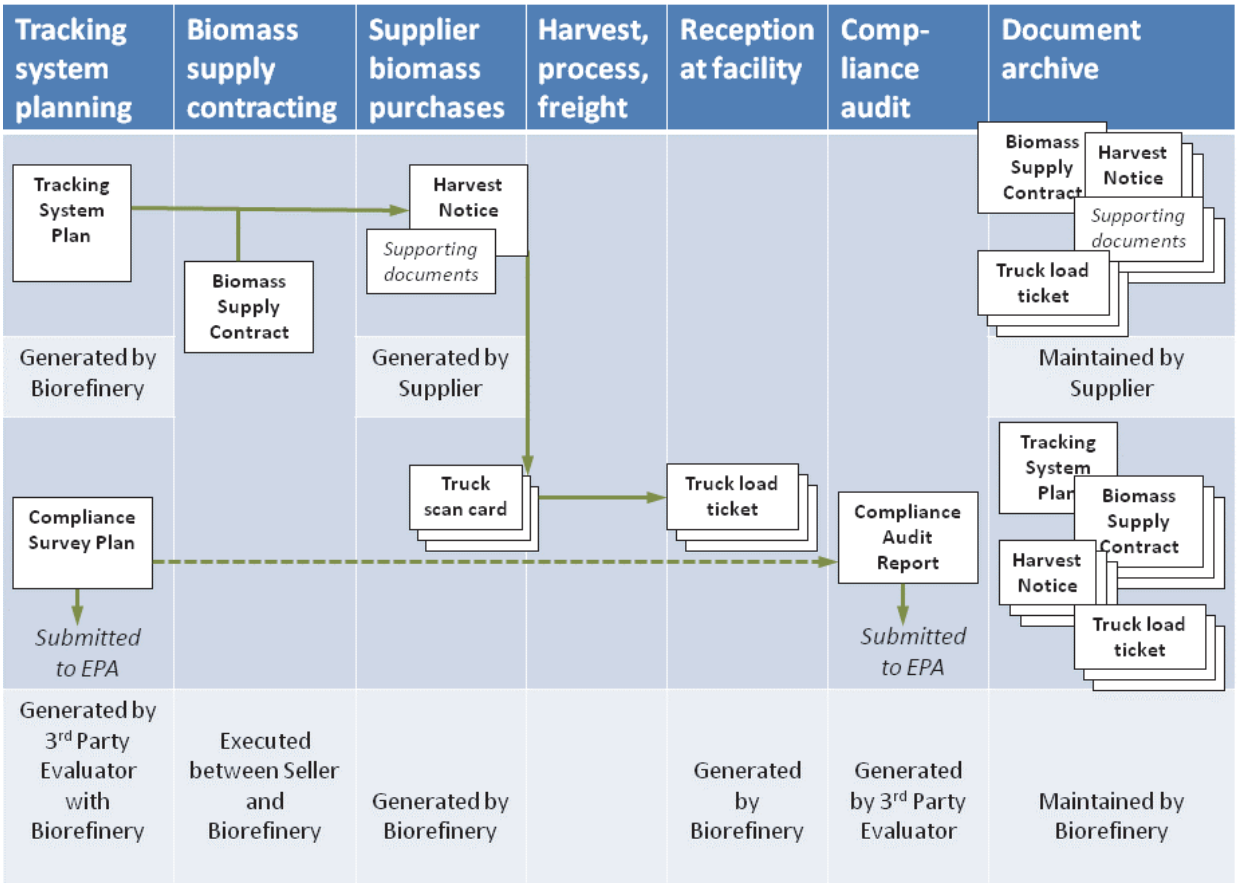
The truck weights, along with the Harvest Application and supporting documents, provide all the necessary information to complete the *Truck Load Ticket* that identifies the load according to its tract of origin number assigned by the Harvest Authorization. Recall that according to Georgia law, the supplier must be provided a copy of the Truck Load Ticket for submission to the landowner, since this is a per-unit sale. Truck Load Tickets can be generated in both digital and paper format, since the facility does not need a hard copy, but the trucker and supplier will likely require one. Finally, since the biorefinery in this example has not pursued the "alternative" recordkeeping system described above, the facility converts to digital format and archives the (1) Harvest Application and supporting documents, (2) Harvest Authorization, and (3) all Truck Load Tickets for the tract.

Example 2. Planted trees and tree residue from tree plantation under "alternative" recordkeeping system. Assume all the same tract attributes in the first example (tree plantation, small diameter planted trees and all biomass not suitable for other markets harvested and delivered to biorefinery). The generation and retention of records for this example is summarized in Figure 3. While the figure may make this example appear more complex than the previous one that is not necessarily the case, as entire alternative recordkeeping system is portrayed for additional clarity.

The alternative system begins with the development of a *Tracking System Plan* by the biorefinery that indicates the specific steps biomass suppliers must pursue to contract and deliver biomass to the facility and the oversight provided by the biorefinery. The Tracking System Plan forms the basis for the development of an annual *Compliance Survey Plan* by a third party evaluator with collaboration from the biorefinery. The Compliance Survey Plan must be submitted to EPA in advance of the calendar year in which it will be applied.

Because of the alternative recordkeeping system requirements, all biomass delivered to the facility under this system must be under a supply contract. During or following compliance planning, the biorefinery executes *Biomass Supply Contracts* with individual suppliers. These contracts bind the supplier to deliver only compliant material, require the supplier to maintain supporting documents verifying renewable biomass status for biomass under contract, and furthermore allow for audit of these records by the biorefinery, third party compliance inspector, and EPA.

Figure 3. Document generation and retention for alternative recordkeeping example.



Once a Biomass Supply Contract is in place, it is the obligation of the contracted supplier to evaluate the eligibility of the biomass from any individual timber tract. In order to do so, the supplier must obtain and maintain tract maps and any documents available to establish the tract's date of conversion to a tree plantation. If conversion date documentation is unavailable from the landowner, the biorefinery may be able to provide the supplier with verification if it maintains a tract age mapping system. In any case, it is the obligation of the supplier to archive these documents and make them available for audit.

Once the supplier determines the tract complies with renewable biomass requirements and completes a Biomass Title Transfer form, he submits a *Harvest Notice* to the facility, at which point the facility issues *Truck Scan Cards* as in the previous example. The Harvest Notice assigns a track number and identifies the tract location, and provides the information necessary for the facility to issue *Truck Load Tickets* for arriving loads, as in the previous example.

Documents archived by the supplier include the executed Biomass Supply Contract, Harvest Notices with supporting documents associated with each timber tract harvested, and Truck Load Tickets linked to each timber tract. Unless specified by the biorefinery, the supplier may either

maintain these as hard copies or in digital format. Unlike the previous example, the biorefinery need not maintain documentation confirming renewable biomass status of individual tracts, but rather converts to digital format and maintains records relating to oversight of the system (Tracking System Plan), the supplier (Biomass Supply Contract), biomass point of origin (Harvest Notice), and chain of custody (Truck Load Tickets).

At some point during the calendar year, the third party evaluator will conduct its annual compliance survey, as laid out in the Compliance Survey Plan, which evaluates documentation and oversight, and submit its *Compliance Audit Report* to EPA.

8. Appendix

Listed below are verbatim definitions relevant to forest-sourced biomass from 40 CFR 80.1454.
Ecologically sensitive forestland means forestland that meets either of the following criteria:

1) An ecological community with a global or state ranking of critically imperiled, imperiled or rare pursuant to a State Natural Heritage Program. For examples of such ecological communities, see ``Listing of Forest Ecological Communities Pursuant to 40 CFR 80.1401; S1-S3 communities," which is number EPA-HQ-OAR-2005-0161-1034.1 in the public docket, and ``Listing of Forest Ecological Communities Pursuant to 40 CFR 80.1401; G1-G2 communities," which is number EPA-HQ-OAR-2005-0161-2906.1 in the public docket. This material is available for inspection at the EPA Docket Center, EPA/DC, EPA West, Room 3334, 1301 Constitution Avenue, NW., Washington DC. The telephone number for the Air Docket is (202) 566-1742.
2) Old growth or late successional, characterized by trees at least 200 years in age.

Forestland is generally undeveloped land covering a minimum area of 1 acre upon which the primary vegetative species are trees, including land that formerly had such tree cover and that will be regenerated and tree plantations. Tree-covered areas in intensive agricultural crop production settings, such as fruit orchards, or tree-covered areas in urban settings, such as city parks, are not considered forestland.

Planted trees are trees harvested from a tree plantation.

Pre-commercial thinnings are trees, including unhealthy or diseased trees, removed to reduce stocking to concentrate growth on more desirable, healthy trees, or other vegetative material that is removed to promote tree growth.

Renewable biomass means each of the following (including any incidental, de minimis contaminants that are impractical to remove and are related to customary feedstock production and transport):

1) Planted crops and crop residue harvested from existing agricultural land cleared or cultivated prior to December 19, 2007 and that was nonforested and either actively managed or fallow on December 19, 2007.
2) Planted trees and tree residue from a tree plantation located on non-federal land (including land belonging to an Indian tribe or an Indian individual that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that was cleared at any time prior to December 19, 2007 and actively managed on December 19, 2007.
3) Animal waste material and animal byproducts.

4) Slash and pre-commercial thinnings from non-federal forestland (including forestland belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the United States) that is not ecologically sensitive forestland.
5) Biomass (organic matter that is available on a renewable or recurring basis) obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire.
6) Algae.
7) Separated yard waste or food waste, including recycled cooking and trap grease, and materials described in Sec. 80.1426(f)(5)(i).

Slash is the residue, including treetops, branches, and bark, left on the ground after logging or accumulating as a result of a storm, fire, delimbing, or other similar disturbance.

Tree plantation is a stand of no less than 1 acre composed primarily of trees established by hand- or machine-planting of a seed or sapling, or by coppice growth from the stump or root of a tree that was hand- or machine-planted. Tree plantations must have been cleared prior to December 19, 2007 and must have been actively managed on December 19, 2007, as evidenced by records which must be traceable to the land in question, which must include:

1) Sales records for planted trees or tree residue together with other written documentation connecting the land in question to these purchases;
2) Purchasing records for seeds, seedlings, or other nursery stock together with other written documentation connecting the land in question to these purchases;
3) A written management plan for silvicultural purposes;
4) Documentation of participation in a silvicultural program sponsored by a Federal, state or local government agency;
5) Documentation of land management in accordance with an agricultural or silvicultural product certification program;
6) An agreement for land management consultation with a professional forester that identifies the land in question; or
7) Evidence of the existence and ongoing maintenance of a road system or other physical infrastructure designed and maintained for logging use, together with one of the above-mentioned documents.

Tree residue is slash and any woody residue generated during the processing of planted trees from tree plantations for use in lumber, paper, furniture or other applications, provided that such woody residue is not mixed with similar residue from trees that do not originate in tree plantations.

About the Authors

BioResource Management, Inc. is based in Gainesville, Florida and provides a range of services related to project development and facility operations for biomass industry developers, investors, and landowners. BioResource has over thirty years of experience in forestry, agricultural and urban biomass projects, including site identification and assessment, biomass production, logistics, procurement and management for both the biofuels and bioenergy industry.

Dougherty & Dougherty Forestry Services, Inc. is a full-service forest management consulting firm serving forest landowners, investors, and industry with offices in Wake Forest, North Carolina, Athens and Waycross, Georgia and Daphne, Alabama. Services include: forest management, forest inventory and appraisal, investment analysis, due diligence, feasibility, and research.

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