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The Potential for Sustainable Wood-Based Bioenergy in Maryland: Summary and Conclusions

Background and context

Emerging markets for woody biomass may contribute to the sustainable management and conservation of Maryland's forests by expanding the range of forest management opportunities available to landowners. However, these same markets raise concerns about the potential for negative impacts to the state's natural resources and existing industry. This study evaluates a number of social, economic, and environmental sustainability concerns regarding the development of wood-based bioenergy markets in Maryland. As such, this report explores biomass supply, utilization technologies, energy and natural resource policies, and the science behind biomass harvesting, in an integrated manner.

This report also serves as the foundation for *A Guide to Forest Biomass Harvesting and Retention in Maryland*, a set of voluntary guidelines developed to build upon the state's existing natural resource management policies and promote sustainable forest management should demand for woody biomass increase.

Finding a balance point that maximizes the opportunities of emerging bioenergy markets, while limiting the potential for unintended and negative consequences presents a significant challenge. While this report explores several questions related to the sustainability of bioenergy markets, others (e.g., lifecycle GHG balance) are touched upon only briefly, and warrant further discussion and analysis. Even among some issues addressed in detail, there remains considerable uncertainty that only long-term research could adequately tackle.

Report structure

In this report, the concept of sustainability is addressed in an integrative fashion. Thus, the first three chapters are intended to help clarify who the actors are likely to be in bioenergy markets, how these actors may respond to price signals, and how and why their actions may be constrained. Other issues explored in this report include the potential feedstock demands of various energy technologies, the energy outputs of these technologies, and the policies that influence their development. The last two chapters evaluate the ability of Maryland's system of voluntary and regulatory forest management programs to safeguard forest productivity, soil and water quality, wildlife habitat and biodiversity, and other natural resource values during biomass harvest regimes.

Findings and conclusions

Sustainability and market expansion

Wood biomass markets have existed in Maryland for more than twenty years, yet this experience is largely limited to the wood products industry and one small facility with modest feedstock requirements. Landowners supplying this facility report expanded management options and incentive to reinvest in their forests. In recent years, energy policy has stimulated increased investment to expand bioenergy markets across the country. In Maryland, although significant speculation has occurred, such investments have yet to be made.

> **<u>Key Finding</u> – For bioenergy projects to be sustainable, site-level due diligence must consider: constraints on biomass supply including competition, social preferences, energy demand, and environmental impacts.**
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> – State environmental review and forest product licensing processes, and supply analyses that are prerequisite for financial backing, may address much of this need for due diligence.
> – Individual energy facilities can adopt sustainable sourcing policies to help ensure sustainability.

Safeguards for biomass harvests

A number of existing programs governing forest management in Maryland address concerns related to soil health, water quality, wildlife habitat, biodiversity, and other ecosystem services. The integration of biomass harvesting guidelines with current outreach, education, and extension programs, such as the Maryland Master Logger Program, may offer assurances that sustainability is considered when such harvests are

carried out in the field. Monitoring of the impacts of biomass harvests and the effectiveness of biomass harvesting guidelines is essential.

<u>Key Finding</u> – If biomass harvests are to contribute to sustainable management, biomass harvesting guidelines and forest management plans must be followed.

Assessing regional biomass supply

Analyzing regional wood supply dynamics is a complex, but critical process when assessing potential for bioenergy development. There is tension between producing energy in facilities that are large enough to achieve economies of scale and supplying these facilities with a sustained fuel supply from across the landscape.

<u>Key Finding</u> – When social, economic, ecological, technological, and other logistical constraints to biomass supply are considered, Maryland's available and sustainable supply is considerably reduced from estimates that consider physical inventory alone.

- While Maryland's forests are extensive, their ability to support bioenergy development is significantly reduced (up to 80.5%) due to a number of social and economic constraints.
- If cultivated on Maryland's idle lands, more than 600,000 green tons of wood biomass could be available from dedicated wood energy crops each year. However, this supply is not economically feasible without subsidy, an increase in the price of energy alternatives (e.g. coal and natural gas), and/or valuing the ecological services provided by energy crops in ecosystem service markets.
- Over half of Maryland's total biomass supply comes from urban areas; however, just how much of this material is recoverable and usable as feedstock remains unclear.

Evaluating bioenergy options

Bioenergy projects are more likely to be sustainable if scaled appropriately to the economically, ecologically, and socially available supply of biomass. The optimal site, size, and type of bioenergy facility depends on the distribution of biomass resources, transportation costs, economies of scale, and energy demand.

<u>Key Finding</u> – Large-scale options with high fuel demands (e.g., electricity-only biopower plants, co-firing at coal-fired plants, and commercial-scale biorefineries) are likely to be less viable in Maryland.

- Only central Maryland has enough feedstock to potentially supply a biopower facility capable of producing electricity at competitive prices. Relying greatly on urban wood waste, such a facility would only produce enough electricity to power 4% of Maryland's detached single-family homes.
- Co-firing biomass in existing power plants is one of the least capital-intensive and most easily implemented options to mitigate fossil fuel consumption. However, the relative inefficiency of co-firing, coupled with the fuel demands of utility-scale coal boilers, would likely prove taxing on biomass supplies in Maryland.
- Commercial-scale production of wood-based cellulosic ethanol is not presently feasible in Maryland when supply constraints are considered. Commercial-scale ethanol production is only economical in large facilities (at least 50 million gallons per year) that consume considerable volumes of biomass. If cellulosic ethanol could be produced at competitive prices in facilities producing 30 million gallons per year, it is technically possible for Maryland to support up to three cellulosic ethanol facilities of this scale with the state's current supply of woody biomass, but only if 100% of forest landowners participate, and 100% of the maximum potential supply of urban wood waste is used. These facilities would produce enough ethanol to equal just over 2% of Maryland's annual consumption of gasoline.

<u>Key Finding</u> – Small to moderate-scale bioenergy options (e.g., residential and institutional thermal energy projects, combined heat and power, and densification facilities) are more likely to be sustainable in Maryland.

- District thermal and "Fuels for Schools" type projects hold significant promise to use Maryland's limited biomass supply efficiently while keeping energy dollars local. A number of financial mechanisms that could support this type of venture are already in place within the state.
- Maryland has up to 3,000 opportunities to produce both usable heat and electricity in the most fuel-efficient manner available, and biomass may be an ideal fuel for a number of these combined heat and power (CHP) facilities. Maryland's net metering and interconnection policies

may provide impetus for such projects, but additional support for CHP may be necessary.

- Converting to wood pellet appliances may offer homeowners substantial savings over the long-run as pellet fuels cost 20 – 70% less than traditional home heating fuels. Such a strategy also reduces the state's consumption of fossil fuels, as 33% and 16% of Maryland homes are heated by electricity and home heating oil respectively.

Implications for policy

Careful review of renewable energy policy proposals is needed given concerns related to the sustainability of biomass supplies and market competition with existing wood-users.

<u>Key Finding</u> – Existing bioenergy policies focus primarily on electricity and transportation fuels, but Maryland has limited potential to sustainably develop these market areas.

- Evaluate state policy goals for bioenergy to identify areas of synergy, incongruence, and infeasibility.
- Different policies will result in different outcomes for the energy and forest sectors. If carefully crafted, there is potential for energy policy to strengthen the forest sector, by capitalizing upon synergies between the energy and forest products sectors.
- Maryland's biomass resource has potential to support renewable energy goals for the 40% of Maryland's total energy demand that comes as thermal energy. Few existing renewable energy policies address this sector, yet thermal, CHP, and small-scale biomass densification offer the most potential for sustainable bioenergy development in Maryland.
- Renewable thermal energy from CHP and thermal technologies does not currently qualify for renewable energy credits (RECs) under Maryland's renewable portfolio standard. The state may wish to reevaluate this ruling, particularly if black liquor is excluded as a Tier 1 resource.
- If Maryland's renewable energy future is to include biomass, policies supporting development of sustainable supply chains may be needed. It is imperative that any such policies be very carefully crafted to avoid unintended market distortions and unsustainable outcomes for forest resources.