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Sustainable Biomass Retention and Harvesting Guidelines

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Using the Forest Guild Sustainable Retention and Biomass Harvesting Guidelines

On a Whole-Tree Biomass Harvesting Project in Vermont

by Jeff Smith

As a founding member of the Forest Guild, I embrace the Guild's concept of "excellent forestry" that forest management both in planning and implementation should strive to be ecologically, economically, and socially responsible. I believe these three important components have to be in balance when considering natural processes and landowner objectives. The forest does not need humans, but humans need the forest in many ways. So when we take products from the forest, we need to do so in a holistic way. How each individual forester achieves this balance varies by his or her insight and knowledge of a particular region, its markets, its work force, and local forest ecology. There is no one right path to success when implementing excellent forestry, but it is pretty easy to tell when the line has been crossed.

As a "dirt forester" with over 25 years of field experience, I have been involved in several hundred timber sales in Vermont and New Hampshire. The size and scale of these operations are highly variable – from a few acres logged with a horse (my most recent job) to much larger projects including whole-tree harvests using mechanized logging equipment. In each instance, I try to balance the needs and goals of the landowners with the capacity of the forest in meeting those goals. To do this, I use both the latest science and my own intuition and experience.

Whole-tree harvesting has always been a conundrum for me. On the one hand, this is a tool that has allowed me to employ silvicultural prescriptions in forests with a lot of low-grade trees, i.e. forests that have challenging logistics such as long skidding distances in difficult terrain as well as in areas where landowners did not want a lot of "brush" left. On the other hand, I have wrestled with the wisdom of removing whole trees from the forest. Historically, there has not been a lot of local scientific literature on the subject - at least articles that I could read, understand, and apply easily.

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Dear Forest Guild members and friends,

2011 has been witness to New Mexico's most severe fire season in recorded history. Hundreds of thousands of acres of forest burned leading to unprecedented loss of community, ecological, and cultural resources. While there is no silver bullet solution to prevent these kinds of large-scale fires, biomass utilization, as a by-product of forest restoration, that supports community social and ecological goals is a step in the right direction for many forest-based rural communities.

For biomass to be a part of our nation's renewable energy future, issues of ecological sustainability and carbon impacts need to be understood and accounted for. While the national biomass dialogue often focuses on these issues, it is important to also recognize other factors that should be considered when evaluating biomass potential.

Woody biomass is a finite resource that must be used efficiently to maximize renewable energy outcomes. Overall, woody biomass is most efficiently used to produce thermal energy (heat). Many rural communities across the West rely on fossil fuels for heat. Rising costs of petroleum-based energy have significant economic impacts in small, rural communities. Utilizing woody biomass as an alternative to produce thermal energy is a commercially viable, cost-efficient means to reduce dependence on foreign oil and produce energy savings in rural economies.

As an example, by using woody biomass instead of heating oil to create thermal energy, one school in Enterprise, Oregon (in the eastern part of the state) is projected to save $125,000 annually on heating costs. Over time, this additional money can be reallocated to improving the quality of education via staff increases and/or curriculum additions.

As this edition of *Forest Wisdom* demonstrates, using biomass for energy presents a suite of complex technical and social issues. Sound science and public policy is needed to both protect natural resources and make informed renewable energy decisions. The Forest Guild recognizes these complexities and is a leader in addressing the ecological sustainability of biomass harvesting and utilization. At the same time, we understand that there are valid ecological and economic reasons to use biomass for energy and that these benefits need to be considered in the broader biomass dialogue.

Michael DeBonis, Executive Director

So, as in other parts of my life when there is no clear path, I have developed my own "seat of the pants" approach. My "guidelines" for whole-tree harvests have been to employ this method only on relatively fertile sites, in partial cuts or small patch cuts, and to not use whole-tree harvesting on the same acres in successive cuttings. I have always left snags and legacy trees because intuitively it never made sense to me to remove this valuable forest component. Also when employing mechanized logging, I have matched the equipment to the type of silviculture I was attempting to implement. I think this type of equipment is best suited to creating larger openings and gaps; although skilled, careful loggers can do amazing work in tight stands as well. Utilizing these standards, I have had (in my biased opinion) successful outcomes including work on my own property.

Above, a stand of very large pine on the Tucker Mountain Forest. This photo and the cover photos courtesy of Jeff Smith.

In May 2010, the Forest Guild published *Forest Biomass Retention and Harvesting Guidelines for the Northeast*. As a member of the working group that authored the report, I am familiar with the document and the research behind it. Realizing that the science is young and that there is a lot more to learn, I also recognize that the publication is just a first stab at developing targets for maintaining forest structure following timber harvests. What it does that other research has failed to do is actually set numbers and sizes that a forester can shoot for when implementing a timber sale. It is not meant to be the final work on the subject; rather it takes an early look at answering questions about the sustainability and ecological integrity of the forest by considering what is left behind following timber harvesting.

With a whole-tree harvesting project on my schedule this summer, I have decided to use this opportunity to implement the Forest Guild's new guidelines to see if they were practical and achievable. The first step was getting the landowners to allow me to experiment a little bit. It seemed to me that the divergence from the "typical job" that I would do was minimal.

In this case, the landowners (five siblings) were agreeable to try and implement the guidelines as long as they did not negatively impact revenues in a substantial way. One of the owners had concerns over the aesthetics of the job, wanting a neat, clean result. After reading the guidelines, she had a better understanding of why forest structure is important, which in turn helped her to see slash and downed wood in a different context. The next step was finding a logger open to trying something different who could do this work while still making a profit.

Tucker Mountain Forest, their 493-acre property, had a new forest management plan written in 2010. The Vermont Land Trust holds a conservation easement on the property. One of the ownership objectives is to be responsible stewards of the property. Another is to be able to generate periodic income so that it makes financial sense for the owners to hold on to the land. There are a number of management activities planned over the next 10 years, and it was decided to start with the most difficult and challenging area first.

The goals of this harvest are as follows:
1. Cut back trees on a field edge to create a "soft ecotone" for wildlife habitat diversity and keep open a fabulous long-range view;
2. Cut trees that are encroaching into a meadow that the owners want to maintain as open land both for wildlife habitat and recreational pursuits;
3. Implement silvicultural prescriptions that will release advanced regeneration created

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Jeff Smith
A founding member of the Forest Guild, Jeff runs a small forestry consulting business in Thetford, VT where he specializes in helping small landowners with all aspects of sustainable land management.

At right, Jim leans against a tree in his forest.

Unless otherwise indicated, all photos in this issue of Forest Wisdom are courtesy of Marcia J. Summers.

A Landowner's Experience with Biomass Harvesting

by Marcia J. Summers

Marcia J. Summers
Marcia has worked as the Forest Guild's director of development and communications since October 2006. She is also serves as the editor of ***Forest Wisdom*** and A***cross the Landscape***.

On a brisk and partly sunny Saturday morning last April, I joined about 45 other foresters, forestry students, faculty members, and landowners on a tour of James Dumont's and Karen Leuders' forest in Lincoln County, Vermont. As we approached the property, I couldn't help but notice the scenic sloping woodlands that neatly framed the house and barn. Our group gathered in a nearby field, then crossed a wooden bridge, and trekked up the hillside with the owners to visit a two-year-old biomass harvesting site and discuss what we saw in the context of the Forest Guild's sustainable biomass retention and harvesting guidelines.

Once our group had reached the biomass harvesting site, a random area was selected as a sample plot, and we examined it for lying dead wood, snags, coarse woody debris, dominant tree species and density, and proximity of any erosion to a nearby stream. A lively discussion about the forest's current state produced a consensus that, conducted today, this harvest would successfully conform to the Guild biomass retention and harvesting guidelines.

In particular, group members noted that sufficient lying dead wood, snags, and coarse woody debris were retained; that care was taken in a riparian zone to build culverts; and that the logger was highly skilled in leaving minimal skidding damage marks when removing logs to the landing area.

The landowners had worked with Vermont Family Forests to conduct their biomass harvest on 25 acres of his 150-acre private, non-industrial forest. Jim describes it as "mostly sugarbush with some red pine and spruce plantations and mixed growth." While not intending to subdivide the forestland, he admits that their major challenge to keeping the parcel

intact is the taxes on the land. Accordingly, their primary objective for the 2009 harvest was producing income to pay those taxes.

Their forest management plan outlined several additional objectives including protecting water quality; maintaining biological diversity; sustainably producing saw timber while maintaining site productivity; providing numerous recreational opportunities on well-designed and maintained trails, and conserving the scenic beauty of their woodlands.

In addition to low-to-moderate graded hardwood saw timber , the harvest resulted in 106 cords of firewood with details as follows:

- With the logger working for the landowner, the timber was sold using a lump sum plus timber sale method. The net profit after logging and excavation expenses was approximately $26 per green ton in stumpage for the timber.
- The landowner netted $5 per green ton for the firewood and an additional $10 (per cord) fee for on-site storage to enable future processing of the firewood at the landing site.
- The use of a forwarding trailer to transport firewood from the harvesting site to the landing area was the key to minimizing skidding damage. It also allowed for a smaller than usual landing site, better sorting, and improved aesthetics, all of which supported the landowners' forest management plan objectives.

Although the biomass harvest resulted in a lower net profit than they desired, Jim nonetheless stated that they would continue to include sustainability objectives in future harvests on their forestland.

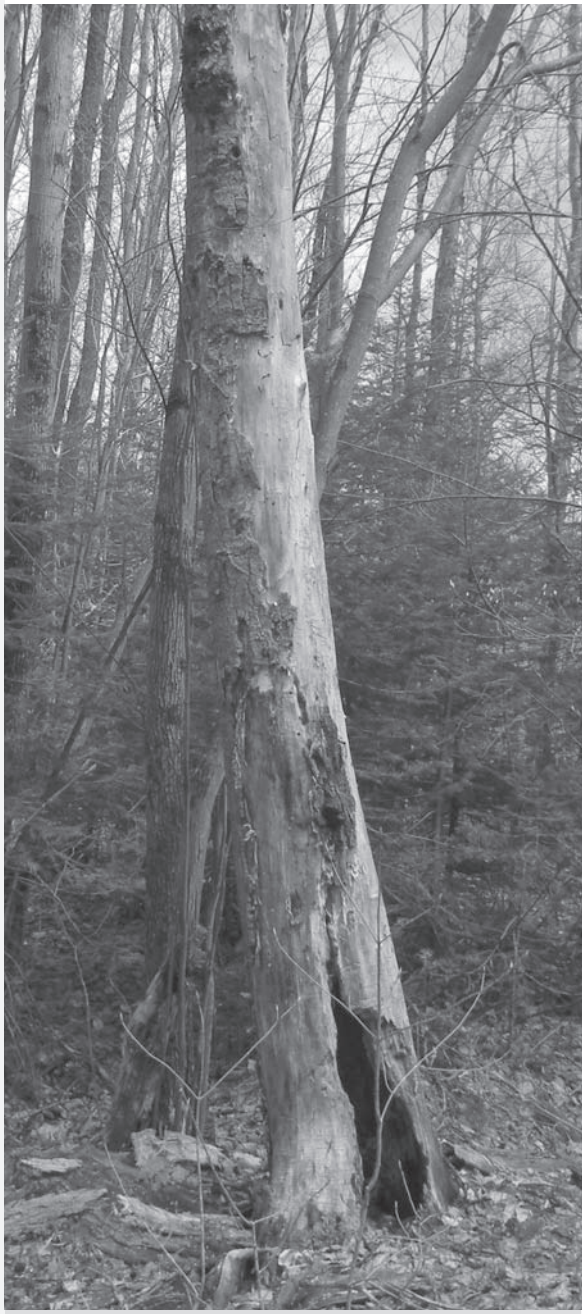
At the end of the day, what is most important for Jim Dumont about owning and living in their own forest in Lincoln County is conserving what he loves most. That means "lots of things... privacy, a place to walk and snowshoe, my own firewood supply, and knowing where the fishers live..." ■

Editor's note: Neighborwood Project Findings, Vermont Family Forests, Bristol, VT (4-28-2011) was the source of technical information and data for this article, and Jim Dumont replied to a survey.

Photos from top to bottom:

One of the culverts built on the harvesting site.
A bridge built to protect the main stream from erosion.
A view of the woodlands from the field near their home.

> *"Their major challenge to keeping the parcel intact is the taxes on the land. Accordingly, their primary objective for the 2009 harvest was producing income to pay those taxes."*



Harvesting and Retention Guidelines for Forest Biomass

by Dr. Zander Evans

The Forest Guild has embarked on a project to create and disseminate forest biomass harvesting and retention guidelines across the U.S. A center piece of that effort to date is a 2010 Conservation Innovation Grant (CIG) to the Forest Guild from the USDA Natural Resource Conservation Service to promote adoption of sustainable forest biomass harvesting guidelines in the Northeast. The Guild is partnering on the project with the Nature Conservancy, the Pinchot Institute for Conservation, and the University of Maine. A number of Forest Guild members are also involved in outreach activities.

The Guild is using CIG funding to share the guidelines through workshops and field meetings with forest landowners and the foresters who work with them. For example, we have introduced the guidelines to Green Mountain College in Vermont and landowners in the Mahoosuc region of Maine and New Hampshire. A regional meeting September 22 and 23 in Fairlee, Vermont provides another opportunity to learn about the guidelines in the field (www.forestguild.org).

To draft guidelines in the Northeast, we convened a regionally based team of 23 Forest Guild members, both foresters and researchers. The team relied on two foundational documents to guide their work. *An Assessment of Biomass Harvesting Guidelines* detailed biomass harvesting and retention guidelines already in use by states and other organizations. The second document, *Ecology of Dead Wood in the Northeast*, provided an in-depth synthesis of current science so that recommendations would be based on the best available research.

Where the research was either inadequate to connect practices, stand-level outcomes, and ecological goals, or the science was inconclusive, the guidelines relied on field observation and professional experience. The guidelines provide general guidance such as avoiding intensive biomass removal on low-nutrient sites. A key piece of the Guild's guidelines is the use of specific targets for retention of downed woody material, snags, and live decaying trees, as shown in Table 1 on retaining forest structures .

The guidelines were designed to be flexible and easy to follow while still protecting key

"Where the research was either inadequate to connect practices, stand-level outcomes, and ecological goals, or the science was inconclusive, the guidelines relied on field observation and professional experience."

Table 1. General Guidelines for Retaining Forest Structure

Structure	Minimum Target (per acre)		Considerations
	Number	Basal Area (ft^2)	
Live decaying trees 12-18 inches DBH	4	3-7	Where suitable trees for retention in these size classes are not present or may not reach these targets due to species or site conditions, leave the largest trees possible that will contribute toward these targets.
Live decaying trees >18 inches DBH	1	2	
Snags>10 inches DBH	5	3	Worker safety is top priority. Retain as many standing snags as possible; but if individual snags must be felled for safety reasons, leave them in the forest.

ecological values. For example, a central piece of the guidelines is the retention of tops and branches after harvest. This recommendation as explained in the guidelines can be adapted to a range of stand conditions and harvest intensities:

"In areas that do not qualify as low-nutrient sites, where 1/3 of the basal area is being removed on a 15- to 20-year cutting cycle, it is our professional judgment that retaining 1/4 to 1/3 of tops and limbs will limit the risk of nutrient depletion and other negative impacts in most forest and soil types. Additional retention of tops and limbs may be necessary when harvests remove more trees or harvests are more frequent. Similarly, where the nutrient capital is deficient or the nutrient status is unknown, increased retention of tops, branches, needles, and leaves is recommended. Conversely, if harvests remove a lower percent of basal area, entries are less frequent, or the site is nutrient-rich, then fewer tops and limbs need to be retained on-site."

The guidelines can be used to augment and enhance existing Best Management Practices (BMPs) or help auditors assess compliance with third-party certification standards that address forest structure and maintenance of downed woody material. In addition, the Northeast guidelines provide suggestions for forest harvest operations, silvicultural practice, and carbon management. Because harvests provide practical lessons and the effect of intensive biomass removals is an area of active research, the Guild's biomass retention and harvesting guidelines should be revisited every few years.

The Forest Guild has embarked on a similar effort in the Southeast to develop and promote biomass retention and harvesting guidelines for Southeast forest types. As Forest Guild member Dr. Josh Dickinson pointed out three years ago in a *Forest Wisdom 11* interview (www.forestguild.org/publications/forest_wisdom/Wisdom11.pdf),

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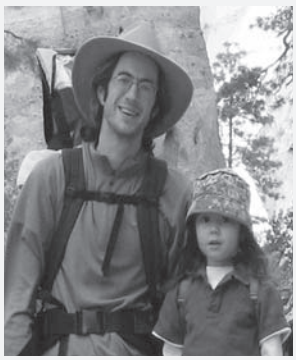

Dr. Zander Evans
A Forest Guild professional member since 2006, Zander is the research director for the Forest Guild. He is currently working on studies of sustainable biomass removal and the carbon impacts of forest management.

A Principled Approach to Biomass

by Robert Turner

Robert Turner

A consulting forester and Guild professional member since 2001, Robert Turner serves clients across the Northern Forest states from his perch on the western flanks of the Green Mountains in Vermont

Last week, a woman (we'll call her Mary) approached me at a small outdoor concert and said she recognized me from a local conservation event I had helped to organize. I didn't recognize her face or name (after the passage of four years); yet it didn't take me long to recall the conversation we'd had. It wasn't the specifics I remembered—it was her passion. I had led a panel discussion on the pros and cons of using biomass for energy, and she had felt strongly that it was a fool's bargain to burn our forests as a substitute for fossil fuels. While I've had many similar conversations with other individuals over the last few years, I was struck by two observations as we briefly revisited the topic. First, neither the issues nor our opinions had changed much over the intervening period. Second, in spite of my involvement in these issues over the last four years, I wasn't feeling particularly confident that I could any better defend my "reasoned and informed" position on biomass use in the face of this woman's equally impassioned opinions and emotions.

Mary is a member of her local planning commission. She speaks knowledgeably about the challenges of balancing development with the working landscape. She lives in a wooden house and burns wood for heat throughout the long Vermont winter. She is clearly engaged in the discussion about global warming and alternative energy. I could have tried to "educate" her about my personal and professional reasons for supporting community-scale biomass, but instead I chose to listen to and explore her concerns. Towards the end of our second conversation, she offered what she'd remembered most about our first—that I was willing to listen. I told Mary that I shared many of her concerns and that my point of view was also influenced by my professional experience.

I am a consulting forester who has spent a good bit of time working on various aspects of biomass energy. I have landowner clients selling low-grade wood for the generation of heat and electricity. I am a member of a biomass energy study group that is preparing policy recommendations for legislative consideration. I am working to develop a decision support tool to build the capacity among state forestry staff in the Northern Forest states to answer questions about biomass supply, demand, and sustainability. And, I have worked at the community level with schools and local groups interested in finding alternatives to using heating oil for local buildings.

Most of us would readily admit the topic is complicated, not just technically, but also culturally and morally. And while I make a living dealing with the technical issues to help me pay the bills, the cultural and moral dimensions raise questions that are both important and fascinating to me:

- How defensible are the various estimates of "sustainable" supply?
- Do we have confidence in our ability to effectively monitor the impact of increased biomass use?
- Is it somehow morally tenuous to promote the increased use of wood for heating and electricity before we seriously invest in conservation and reduce consumption?
- Assuming we, as professional foresters, can reasonably mitigate long-term damage to forest ecosystems (an assumption that challenges the humility part of the Forest Guild's 4th principle), how much control do our systems really have over the power of markets to drive harvest intensity?
- Why are policy makers able to promote 30-year plants as though our forests were so much ore up for grabs to the first person who is able to stake a claim?
- Jobs are as important in my state as in most others, but given the incredible range of information and opinions in the public debate on biomass, why wouldn't public caution and suspicion be justified?

I feel an obligation to think about these questions deeply. Many of us have spent a career feeling as though society misunderstands (or ignores) our role as professionals in favor of louder and better funded voices. As Guild members, we espouse fairly severe principles, the first being to practice "responsible forest management that places the highest priority on the maintenance and enhancement of the entire forest ecosystem." (The Forest Guild principles may be found in their entirety on page 13.)

The questions that I posed can offer an opportunity to bring our Forest Guild principles to the fore: the forest first, an ecosystem perspective, humility and continuously learning, and knowledge sharing. These principles form the basis of a moral position. We don't all have to believe the same thing, but our organization and profession are strengthened when our opinions are well grounded in our principles. Sure, the public would love definitive answers to difficult questions, but I believe they also crave the confidence that the forest's care has been entrusted to professionals who are responsible and ethical.

For example, Principle 5 requires grounding "in field observation and experience," but also obliges us to share this experience with our society. "Excellent forestry" is defined as the blending of ecological practice with community benefit. My experience suggests that scale is a key consideration in the fossil fuel versus biomass debate. If we cannot answer the above concerns with confidence, then prudence suggests that we proceed cautiously. That much seems obvious.

I also believe there are many community-scale benefits that cannot be reduced to jobs or investment or localized spending—all of which are important. Locally, I can have a conversation with an individual or group about the impacts that local sourcing has on individual landowners. I can shift the debate from one that leans heavy on the economics of switching fuels, to one that focuses on the sustainability of a culture that produces many tangible and intangible products besides fuel.

The intangibles that we Guild foresters offer to our communities will, I believe, foster increased respect for our profession now and in the future as my son and his will hopefully continue to be foresters. ■

> *"I believe [the public] also crave the confidence that the forest's care has been entrusted to professionals who are responsible and ethical."*

Forest Carbon and Biomass: A Question of Neutrality?

by Bob Perschel

Bob Perschel
A founding member, Bob is the Forest Guild's Eastern forests director. He leads the Guild's national effort to develop sustainable retention and biomass harvesting guidelines and is working on policy and management issues related to climate change and forest carbon.

Forests are one of the earth's great biological ecosystems. When utilized and managed within their ecological constraints, they offer human beings many of the goods and services that make a sustainable existence possible. Biomass energy derived from intact, well-managed forests could be part of a long-term solution. Yet uncertainty about biomass sustainability has led some states to question if and how biomass fits within their renewable energy goals. This article approaches the debate about utilizing biomass for energy from my perspective as a forester.

Forest Guild foresters strive to use natural models to manage complex biological systems based partly on a commitment to continuous learning. That's why the Forest Guild was involved in the *Biomass Sustainability and Carbon Policy Study* (June 2010) commonly referred to as the Manomet study regarding the use of biomass in Massachusetts to help mitigate climate change.

One of the basic tenets of sustainable forestry is that the products we reap are more ecologically sound than those either created from fossil fuels, e.g. plastic, or those whose manufacture is dependent on the use of fossil fuels, e.g. steel.

So it was disconcerting that the June 10, 2010 Associated Press headline, "Mass. Study: Wood Power Worse Polluter than Coal," indicated that producing energy from coal is better than producing it from biomass. Such misleading conclusions challenge the entire ecological foundation of all our forestry, not just the production of biomass for energy.

Forests are a biogenic source of carbon and, if managed sustainably, recapture the carbon released through combustion. In contrast, as geologic sources of carbon, any combustion of fossil fuels adds new carbon to the biosphere. Therefore, if we simply ask whether sustainably managed forests can produce biomass and recapture the carbon released over time, the answer is yes.

However, that wasn't the question being asked of the Manomet team. Our task was to help the Massachusetts Department of Energy Resources (Mass DOER) determine how to best spend a limited pool of money on Renewable Energy Credits to gain the maximum mitigation of atmospheric carbon and climate change. Massachusetts is bound by law to reduce emissions by 80 percent by 2050. So both the timing and the amount of the mitigation were important to Mass DOER. They needed to know not only how biomass stacked up against fossil fuels by 2050, but also if the Renewable Energy Credits might be better spent if applied to solar, wind, or geothermal within that time frame.

The Issue of Carbon Neutrality

The term "carbon neutrality" continues to cloud the issue. We know that the carbon released from forest biomass harvested in sustainably managed forests is eventually re-sequestered and over time reaches a neutral position - i.e. there is the same amount of carbon in the atmosphere as before the harvest. However, if we consider

the carbon released from harvesting, transportation, or manufacturing, then no alternative energy source – biomass, solar, wind, geothermal- is completely carbon neutral when first implemented. The disadvantage for the combustion of forest biomass is that when we harvest live trees it can take decades to recapture the emitted carbon, and it puts more carbon into the atmosphere initially than fossil fuels per unit of energy derived. The advantage for forest biomass is that, if managed sustainably, the carbon is eventually recaptured.

So the issue becomes one not of carbon neutrality but of the comparative effects on atmospheric carbon and climate change between different energy options. The fundamental policy question for Massachusetts, or any political entity, should be: Is the climate change effect caused by biomass better or worse than fossil fuels it would replace, and how does it stack up against the other renewables over time?

The controversy over the comparative ability of biomass to mitigate climate change started in the mid-1990s when researchers (e.g., Marland and Schlamadinger 1995) began exploring a more complex understanding of biomass combustion and life-cycle carbon accounting. In October 2009, the controversy was ignited with the publication of *Fixing a Critical Climate Accounting Error* (Timothy Searchinger 2009, www.sciencemag.org), an influential paper more commonly known as the Searchinger report.

International accounting rules generally consider biomass as carbon neutral, but the Searchinger report noted flaws in the accounting. Since not all biomass is derived from well-managed forests, there are different carbon recovery rates depending on the forest and the type of management, and the burning of biomass actually puts more carbon in the air initially than burning fossil fuels. Although these accounting flaws could be rectified, the Searchinger report concluded that biomass should not be granted a blanket status of carbon neutrality in climate change mitigation programs.

Carbon Debt and Carbon Dividend

In 2009, Massachusetts was emerging from a divisive debate over the management of public forestlands, and a grass roots citizen outcry to consider the Searchinger findings prompted the Manomet study. The Manomet team steered clear of the carbon neutrality issue by offering the concept of "carbon debt," forwarded by Fargione et al. (2008) and by adding the concept of "carbon dividend." This "carbon debt and dividend" thesis allows a comparison of biomass to fossil fuels. Biomass initially releases more carbon into the atmosphere when burned than fossil fuels, creating a "debt" in the overall

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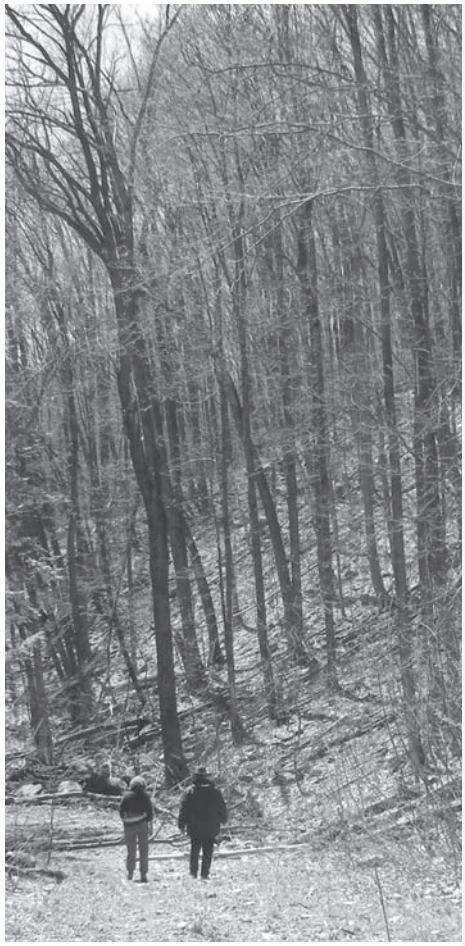

"As geologic sources of carbon, any combustion of fossil fuels adds new carbon to the biosphere."

Forest Guild Guidelines from page 7

the Southeast is a major producer of wood for the bioenergy market. Most recently, on May 12, 2011, Georgia Biomass opened a wood pellet plant in Waycross, Georgia capable of producing 750,000 tons of pellets per year for export to Europe. Large-scale projects like this have the potential to generate intensive biomass harvesting over extended areas and negative ecological impacts that biomass retention guidelines can help mitigate.

As we did with the development of the Northeast guidelines, the Guild has been collaborating in the Southeast with various regional partners. We collaborated with the Environmental Defense Fund and scientific experts to produce a science synthesis, *Ecology of Dead Wood in the Southeast.* A team of Guild members is currently completing guidelines that will help stewards working with Southeast forest types such as Appalachian hardwoods or coastal plain pinelands. In conjunction with the Guild's work on biomass harvest and retention guidelines, Guild staff members have also been contributing to an effort to model the carbon impact of using biomass for energy in the Southeast. This carbon study will help identify which combinations of forest management regimes and combustion technologies can make forest biomass a climate-friendly energy option.

Harvesting and retention guidelines for forest biomass are also needed in the Western U.S. where biomass harvests are often linked to fuel reduction and other wildfire threat reduction efforts. These regional concerns add other elements to ecological considerations for biomass retention. Two Guild recent reports, *Carbon Accounting and Management of Lying Dead Wood* and *Fuels Treatment Practices for Mixed Conifer Forests* provide a good starting point for the Guild to engage in the conversation taking shape around bioenergy, fuel reduction, and forests from Washington State to California to New Mexico.

The Forest Guild is dedicated to responsible forest management that places the highest priority on the maintenance and enhancement of the entire forest ecosystem. Our work on biomass harvesting and retention guidelines will help landowners and foresters to remove traditionally low-value wood in a sound ecological manner. Guidelines will encourage landowners and foresters to use new bioenergy markets as a tool for good silviculture to maintain and enhance forest ecosystem health over the long term. ■

The term biomass refers to vegetation removed from the forest, usually logging slash, small-diameter trees, tops, limbs, or trees not considered merchantable in traditional markets. Similarly we use the phrase biomass harvesting to refer to the removal of logging slash, small-diameter trees, tops, or limbs.

Forest Biomass Retention and Harvesting Guidelines for the Northeast. Forest Guild, May 2010

This issue of ***Forest Wisdom*** was made possible in part by a USDA Natural Resources Conservation Service 2010 Conservation Innovation Grant, ***Promoting Adoption of Innovative Conservation Practices for Sustainable Forest Biomass Harvesting.***

MEMBERSHIP

Professional Membership in the Forest Guild is open to all forest professionals whose work is directly related to the stewardship and protection of forests, whether that work occurs through on-the-ground management, policy, advocacy, or research.

Other individuals who share a concern for forests and forestry are invited to participate as **Supporting** or **Sustaining Members**.

Students are also encouraged to join and become involved.

JOIN TODAY
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Forest Carbon and Biomass from page 11

carbon balance. As forests pull carbon from the atmosphere and store it, there is less carbon in the atmosphere than if using fossil fuels, i.e. a "dividend" is accumulated.) Recovering the carbon debt by sequestration takes time —decades in many cases—for trees to regrow, recapture the carbon, and produce a dividend. Once the carbon debt is paid off, biomass (unlike fossil fuels) begins yielding carbon dividends and continues to do so as trees grow and sequester additional carbon.

Although there has been considerable criticism of the Manomet study, it is proving to be a viable way to answer the relevant policy question for Massachusetts and has been replicated in biomass carbon studies elsewhere. The U.S. Environmental Protection Agency (EPA) took up the debate when considering if and how to regulate biomass facilities under its Final Rule: Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule. It considered both the blanket "carbon neutral" approach and the "biomass is worse than fossil fuels" approach to be too simplistic for a complex issue and asked for more input. Subsequently, on January 12, 2011, the EPA announced that it would defer greenhouse gas permitting requirements for carbon dioxide emissions from biomass-fired and other biogenic sources for three years.

As policy makers continue to weigh renewable energy options, it will be important to frame the analysis so that data is used to accurately gauge the full potential of biomass to mitigate climate change.

The Role of Sustainable Forestry

The need to mitigate climate change broadens the meaning of sustainable forestry to include maintaining forest carbon supplies while we continue to produce forest products and protect ecological values. The Guild has been a leader in this area through our work developing and implementing biomass retention and harvesting guidelines.

For foresters, the upshot of the growing interest to use forest biomass to help mitigate climate change is that it is both a challenge to the notion of the benefits of well-managed ecological systems and an opportunity to engage with both the public and policy makers regarding how sustainable forestry can play a signature role in this critical inter-generational challenge. The Forest Guild intends to stay actively involved as the discussion continues. ■

Forest Guild Principles

1. The well-being of human society is dependent on responsible forest management that places the highest priority on the maintenance and enhancement of the entire forest ecosystem.

2. The natural forest provides a model for sustainable resource management; therefore, responsible forest management imitates nature's dynamic processes and minimizes impacts when harvesting trees and other products.

3. The forest has value in its own right, independent of human intentions and needs.

4. Human knowledge of forest ecosystems is limited. Responsible management that sustains the forest requires a humble approach and continuous learning.

5. The practice of forestry must be grounded in field observation and experience as well as in the biological sciences. This practical knowledge should be developed and shared with both traditional and non-traditional educational institutions and programs.

6. A forester's or natural resource professional's first duty is to the forest and its future. When the management directives of clients or supervisors conflict with the Mission and Principles of the Guild, and cannot be modified through dialogue and education, a forester or natural resource professional should disassociate.

MISSION

The Forest Guild promotes ecologically, economically, and socially responsible forestry as a means of sustaining the integrity of forest ecosystems and the welfare of human communities dependent upon them. The Guild provides training, policy analysis, and research to foster excellence in stewardship, to support practicing foresters and allied professionals, and to engage a broader community in the challenges of forest conservation and management.

in a cutting about 18 years ago and capture the value in some of the trees that are declining or those that are competing with good-quality crop trees ;
4. Create opportunities for the establishment of new age-classes of trees.

These objectives are multi-faceted with no one objective taking priority over another except that the job has to generate a positive cash flow. For this particular treatment area, I decided that whole-tree harvesting was the method that would accomplish most of the objectives in a cost-effective way.

Why whole-tree harvesting in this situation? I made this decision based on what we are trying to accomplish from a management perspective. It is not just a matter of convenience. Both the trees growing up into the fields and those on the field edge are generally too small to harvest profitably using conventional logging methods. The work could be accomplished using various forestry mowers or a brontosaurus; but it would be quite costly. Whole-tree logging methods can remove small-diameter trees in a cost-effective and aesthetically pleasing manner in this location.

Mechanized logging equipment (To me, this generally means cutting the trees with a feller-buncher and skidding whole trees with grapple skidders) is also appropriate and, in my opinion, is required to produce a positive cash flow in this case. One 50-acre stand has prolific advanced softwood regeneration. Feller-bunchers have the ability to cut trees, pick them up, and set them down while minimizing damage to the existing regeneration. A highly skilled timber faller can cut trees and drop them accurately; but the trees still have to be pulled out, often causing a lot of damage to small, young trees. Also, about half of the treatment area is downhill from the log landing area, meaning all of the wood needs to be dragged uphill to the landing which generally requires more powerful skidders.

Finally, about 75 percent of the volume to be removed is low quality. In today's market place, the only way to generate a positive cash flow under these conditions is to be efficient and productive. In northern New England, this generally means leaning towards mechanized logging. In the past 10 years or so, the number of loggers in this area who continue to cut trees with a chain saw and pull the trees with cable skidders has declined, which further adds to the challenges of getting such a job done efficiently and profitably.

By the middle of summer, much of the tree marking and job layout is completed, a logger has been chosen, and the job has yet to be started. The logger I hired is willing to see if he can operate the job while considering the Forest Guild guidelines. While he has relatively large equipment, it certainly is not the largest that is being used in this region, and I feel comfortable that it is appropriate for the job at hand. Some of the general guidelines developed in the Guild guidelines (such as protecting rare forests and species and determining low-nutrient sites and residual stocking and harvest intervals) are addressed ahead of time during the planning process. Other non-measurable suggestions in the guidelines such as retaining existing forest structure, buffering wetlands and other sensitive sites, and the general harvesting practices are not unique considerations for this forester or many others and are thus easy to meet.

For the suggestions that can be measured, it seems that the most straightforward to measure and the easiest guidelines to meet are those for retaining forest structure. Snags can be left or created during harvests, and legacy trees can be identified and retained as well. Also downed woody debris (DWD) can be created and when already present during harvesting, it can be avoided and left intact in most cases. The volume of DWD is not that easy to measure with a high degree of statistical accuracy. It does seem that the science for what is typical in certain forest types is incomplete because the ranges found in the research vary widely.

So, in my mind, measuring the current volume is less important than attempting to accumulate DWD over time. It is possible to leave a good amount of DWD in the woods following a harvest. From an economic and operational perspective, it seems like the hardest metric

> "It is not meant to be the final work on the subject; rather it takes an early look at answering questions about the sustainability and ecological integrity of the forest by considering what is left behind following timber harvesting."

to meet will be to leave 25 to 30 percent of the tops and limbs from a whole-tree harvest. This will also be difficult if not nearly impossible to measure because usually whole-tree chips contain both bole wood and top wood.

From top to bottom:
Beech tree to be released.
Field edge to be cut back.
Snag and DWD flagged for retention.
Photos courtesy of Jeff Smith.

My goal for addressing the retention of forest structure on this particular job is to try and strike a balance between leaving adequate material behind and not burdening the job too much financially. On most of the property (although not on every acre), I will use my "seat of the pants" guidelines to see how close the work comes to meeting the Forest Guild biomass harvesting guidelines.

On one 3- to 5-acre part of the job, I intend on strictly following the guidelines. Here, I will instruct the logger to leave about 1/3 of the tops and leave DWD as recommended. With the logger keeping good track his time and production, I will be able to understand the cost of strict adherence to the guidelines. Further benefit and cost analyses could also be done to see what the measurable differences are between strict adherence and a slightly looser approach that makes adjustments in the field as experience and ground conditions dictate.

I am interested to see how the project turns out. I intend to do some follow-up measurements in both areas to see if I can pick up any differences. In September, the forest is scheduled to be a field tour site for landowners and foresters to see first-hand how the Guild guidelines can be applied on the ground. Also, in the next few years, I will be implementing jobs that are done with smaller, conventional logging equipment on the same property. This will allow me to make further comparisons with the whole-tree logged sites.

As mentioned above, one of my personal goals on all of the properties I manage is to increase the forest structure and the amount of DWD over time; the exact amount left following any one harvest or on any particular acre being less important to me than continuing to accumulate it over time. My current inventory methods include collecting the baseline data necessary to measure this. So I will know the trend when I re-inventory.

I believe the Forest Guild biomass harvesting guidelines will be both practical and effective for whole-tree logging projects. I look forward to combining the Guild guidelines with my pretty extensive "seat-of-the-pants" experience to help landowners meet their objectives and steward their forests for the future. ■

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