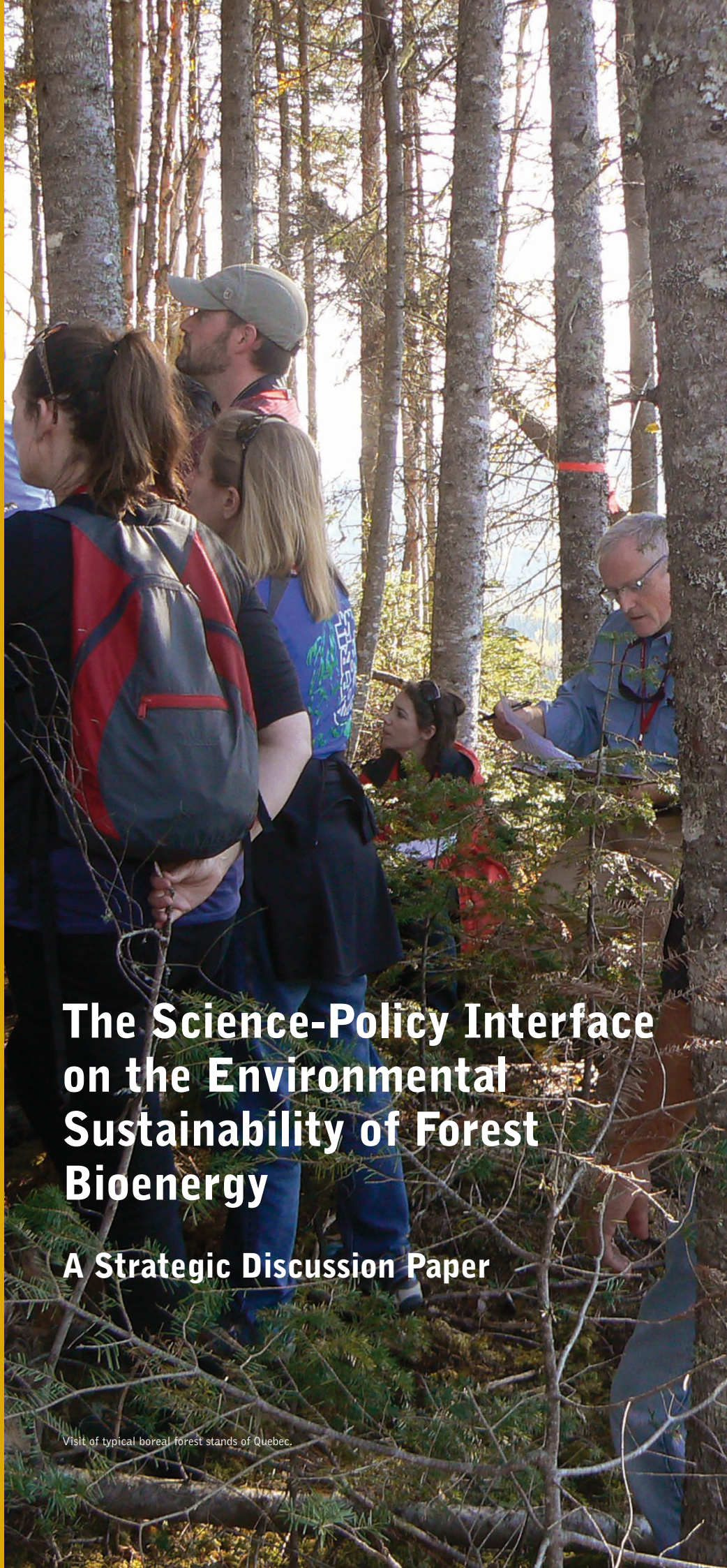
This publication reports on the discussions and opinions expressed during an expert workshop on the environmental sustainability of forest bioenergy in Canada, held in Quebec on the 3-5 October 2012.

The workshop was organised by the International Energy Agency Bioenergy Task 40 (International Sustainable Bioenergy Trade) and Task 43 (Biomass Feedstocks for Energy Markets), the IEA Bioenergy Executive Committee, the Faculty of Forestry, Geomatics and Geography of Laval University (Quebec, Canada), and Natural Resources Canada, with collaboration from the Global Bioenergy Partnership and the Canadian Council of Forest Ministers. Participants engaged in dialogue critical for the formulation of rational policy to achieve sustainable forest bioenergy production systems.

The Science-Policy Interface on the Environmental Sustainability of Forest Bioenergy

A Strategic Discussion Paper



Visit of typical boreal forest stands of Quebec.

IEA Bioenergy

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INTRODUCTION

Key European, Canadian and American experts involved in bioenergy research, industry and policy development met in Quebec City on 3-5 October 2012, to discuss the sustainability of forest bioenergy in Canada through field visits, scientific presentations and moderated discussions. This two-day event engaged participants in dialogue critical for the formulation of rational policy to achieve sustainable forest bioenergy production systems.

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BACKGROUND

As countries seek ways to reduce GHG emissions, forest-based bioenergy is seen as an appealing alternative to fossil fuels. Increasing demand has created growing interest in sourcing biomass from traditional as well as non-traditional forest feedstocks. This has led to concerns over potential environmental impacts, stimulating discussions at the local and global levels about the sustainability of forest biomass production for bioenergy. Multiple levels of governance for sustainable forest management are already in place, while new standards, criteria and indicators targeting bioenergy products are being developed.

The European Union (EU), one of the most important global markets for wood pellets, has outlined mandatory sustainability criteria for biofuels in its *Renewable Energy Directive 2009/28/EC* (EU RED). It has also put forth recommended sustainability criteria for solid and gaseous biomass for electricity, heating and cooling, in the *Report COM(2010)11 (Box 1)*. The discussion on sustainability requirements for this type of biomass, which includes wood pellets and wood chips, is ongoing in the EU, and decisions on the need for binding sustainability criteria of this material for use within the EU are anticipated. Two key areas of concern that have been identified are biodiversity and GHG balance.

Policies such as the EU RED and additional sustainability requirements need to take into account the scientific knowledge underpinning sustainability principles, and the variety of contexts and ecological circumstances of countries, as well as the economic operators that the policy will affect. Otherwise, such policies may create barriers to the successful mobilisation of sustainable biomass supply chains and possible conflicts for trade flows of bioenergy products.

With its large forest resources and associated industry, Canada should have an increasing role to play in the international trade of solid biomass. The EU already represents a major market for Canadian biomass (*Box 2*). The abundance of extensively managed and naturally regenerated forests and the importance of natural disturbances are key features of the Canadian forest landscapes that set it apart from other regions of the world with respect to the type of potentially available bioenergy feedstocks.

BOX 1

Excerpts from the recommended sustainability criteria for solid and gaseous biomass (from Report COM(2010)11):

- GHG emission saving shall be at least 35% until Jan 2017, when it must be 50%, and then 60% in Jan 2018;
- Biomass shall not be produced from land with high biodiversity value, namely land that was one of the following in 2008:
  - primary forest or wooded land, with native species and no visible indication of human activity, with functioning ecological processes;
  - designated protection areas, reserves or rare or endangered species habitats as designated by IUCN, unless there is proof that production does not interfere with those protection purposes;
  - highly biodiverse grassland that is natural or non-natural but species-rich unless harvest can be shown to preserve its grassland status.
- Biomass shall not be produced from the conversion of lands with high carbon stock, namely land that was one of the following in 2008:
  - wetlands;
  - peatlands (unless it can be proven that harvesting did not involve drainage of previously undrained soils);
  - continuously forested areas (> one ha) with a canopy cover of more than 30% and trees higher than five meters;
  - land spanning more than one ha with trees over five meters and a canopy cover between 10 and 30% unless the biofuels can be produced in such a way as to still offer 35% GHG reduction benefits.

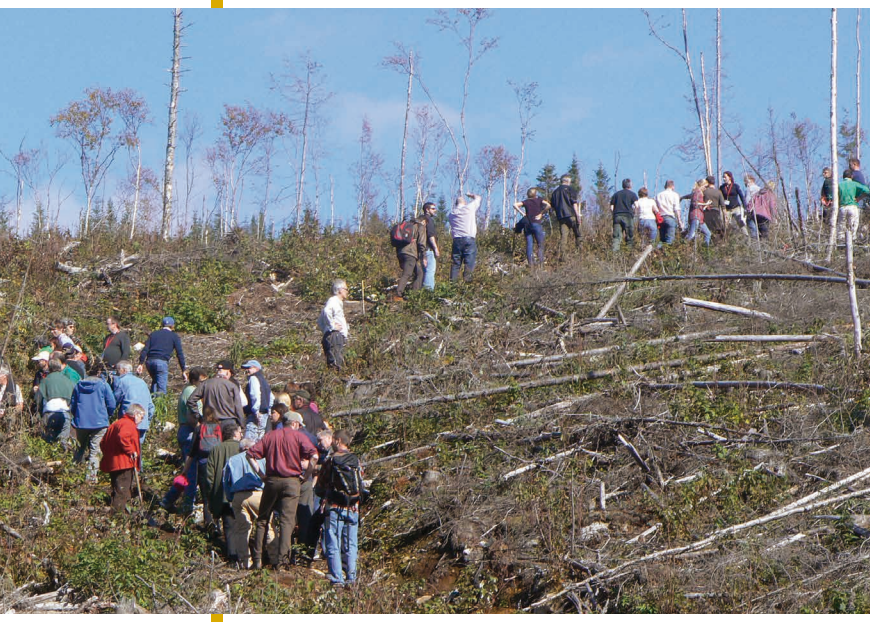
(Note that wastes and certain residues would not be required to comply with the criteria.)

BOX 2

Snapshot of Canada's forest & bioenergy industry

- With its 397 million hectares (ha) of forests and other wooded lands, Canada has 10% of the world's forest cover and 30% of the world's boreal forest.
- 77% of forests are provincially owned, 16% are federal, and 7% are privately owned.
- 150 million ha (of 229m ha of managed forests) are certified by one or more globally recognised certification schemes.
- In 2010, roughly 15 million ha of forest were affected by natural disturbances, an area equivalent to more than three times the area of the Netherlands. By comparison, 0.68 million ha of forests were harvested, mainly by clearcutting.
- Canada has historically been one of the world's largest exporters of wood products, and, unlike many Western countries, is a net exporter of energy.
- About 84% of Canada's pellet production capacity is based on mill residues as feedstock.
- 90% of Canada's pellet production is exported overseas, mainly to the United Kingdom and the Netherlands.
- In 2010, wood pellets from Canada represented about a third of EU pellet imports.

Statistics are from the State of Canada's Forests Annual Report 2012 (Natural Resources Canada), from Lamers *et al*. 2012. *Renew. Sustain. Energy Rev.* 16:3176-3199, and from the Wood Pellet Association of Canada.



Workshop participants visited field trials on the ecological sustainability of forest biomass harvesting.

For historical and geographical reasons, the bulk of forest management activities in Canada takes place in forest landscapes inherited from nature, or that have been only lightly influenced by direct human interventions, contrary to most forest areas in Europe. Canada has an ambitious research programme, both in universities and in governmental research institutions, on the ecological impacts of forest management and the sustainability of forest biomass harvesting. This programme has provided a valuable body of information for the development of forest management guidelines in Canadian provinces and for various certification systems for forest management in Canada. Forestry practices have thus been developed that aim to preserve features of natural forests and to emulate natural disturbances. This approach to sustainable forest management applies to forest biomass procurement practices in Canada through federal and provincial regulations and forest management certification systems.

However, the Canadian approach may not easily align with overarching sustainability standards such as the EU RED. The EU RED aims to apply globally to all biomes, including tropical and subtropical forests, whose management raises issues that are different from those found in Canada. The workshop therefore presented a timely occasion for increased understanding of issues related to the environmental sustainability of biomass feedstocks from the Canadian forest sector and the policy developments taking place on both sides of the Atlantic. It provided a venue for thoughtful, progressive discussion and interaction among stakeholders of different jurisdictions so that further development of policy mechanisms takes into account both higher concerns for sustainability, and specific local conditions and scientific knowledge.

WORKSHOP OVERVIEW

Participants from 11 countries in North America and Europe were present at the workshop, and included policymakers, industry, academia and civil society, representing a variety of organisations from local groups and governmental agencies to international bodies. The event was held at the Forêt Montmorency research station, 100 km north of Quebec City in the Laurentides wildlife reserve. The setting of the event, in the heart of the boreal forest, allowed for access to sites showcasing research trials, forest management activities and unique features of Canada's forests.

A mix of field visits and roundtables were used to address the following questions:

- What mix of governance mechanisms (e.g. mandatory regulations, voluntary certification, local and national best-management practices) will satisfy public demand for sustainable bioenergy?
- Will markets requiring sustainability certification be attractive to energy producers, or will red tape and certification costs cause producers to choose other markets with less stringent requirements?
- Will the scientific rigor underpinning the sustainable forest management systems in Canada, the United States and Europe, including regulations and voluntary certification, satisfy international policy intent? Is harmonisation needed?
- Will bilateral trade and sustainability standards negotiations be required to achieve fair and productive solid bioenergy feedstock trade between North America and Europe?

DISCUSSION HIGHLIGHTS

Sustained vs. slow development of the bioenergy industry in the face of uncertainty

Participants agreed that the world is in a transition period from the dominance of fossil-fuel use to increased reliance on renewable energy, and that climate change makes this transition all the more necessary. During the transition period, there is a need to be pragmatic, and use all available tools to decrease CO2 emissions. Participants agreed that bioenergy can be associated with negative impacts, but stressed that the same applies to the development of other renewable energy options. Some participants felt that lack of complete understanding of impacts should not be a cause to stop or delay deployment of the industry, and they insisted that rapid developments are needed. However, others challenged the assumptions that justify the use of forest biomass for bioenergy production (such as the presumed carbon neutrality of bioenergy and the ecological sustainability of forest biomass harvesting practices); they suggested that these assumptions be carefully studied before the bioenergy industry be further deployed.

Concluding thoughts: It is important to make use of available biomass resources. However, as much as possible, new scientific knowledge and technologies must be incorporated in policy and industry, to secure significant GHG reduction and high standards of ecosystem management and protection.

Learning from the past

Participants discussed how we should learn from the development of biofuels in the past. Some 15 to 20 years ago, many in the environmental community believed that all biofuels were a great idea; there was limited reflection on the widely varying performance concerning environmental and socioeconomic aspects. Because of increased demand, subsequent market shifts and research findings, some 'first generation' biofuels have since fallen out of favour. Reflecting on past experiences can help us to anticipate the issues and pitfalls that might be associated with second-generation biofuels, and to avoid repeating the same mistakes.

Concluding thoughts: It is important to learn from past experiences in the bioenergy sector so as to anticipate issues with solid biofuels. This will help to facilitate sustainable deployment of new technologies.

Participants discussed and compared forest biomass harvesting practices in Quebec and in Europe.

'No-go' areas and primary forests

Participants were divided on the merits of the EU RED defining 'primary forests' as a no-go area for biomass procurement. The EU RED bases its definition of 'primary forest' on the Food and Agriculture Organisation (FAO) definition: *"forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed"*. The rationale for excluding primary forests is protection of biodiversity through protection of 'biodiverse land', which is seen as valuable to all humankind.

In Canada, 'primary forest' is not used as a category in forest and land-use inventories. For the (sole) purpose of carbon accounting and reporting, Canadian forests are categorised into 'managed' and 'unmanaged'; however, these categories are socio-political constructs and are not meant to reflect a 'virgin' or protection status. In Canada, those areas that correspond to the 'primary forest' definition are either conserved in protected areas or are part of the commercial forestry landbase. In the latter, biodiversity is protected through sustainable forest management regulations and certification. Forest management in previously un-accessible areas typically involves conversion of primary forest to modified natural or semi-natural forest, and more rarely to plantation forest (and even more rarely to exotic species plantation), which is different from typical forestry practices in most of Europe. Additionally, the prevalence of natural disturbances in the Canadian forest landscapes blurs the boundaries between 'primary' and other forest types.

Many felt that 'primary forest' is too simplistic a term, and does not properly apply to different regions of the world, such as Canada. The use of primary forests as a sustainability criterion originates from biofuels and is meant to prevent land-use change. It does not properly apply as a sustainability criterion for forest bioenergy. Some participants advocated the use of sustainable forest management principles (SFM) and measures of biodiversity and ecosystem functioning within the sustainability regulations that would apply to the full forest landbase, rather than absolute protection of certain ecosystem types and areas defined as 'no-go' for biomass procurement. Participants accepted that SFM is a challenge but also highlighted as excellent the approach applied in Quebec.

Concluding thoughts: Definitions of sustainability criteria must be commonly agreed, and well understood by all affected parties. The effects of those definitions must be understood in the varied contexts found across the global bioenergy industry. This requires a process for operationalising sustainability criteria so as to ensure validity and relevance in a specific context.

Experts from academia and government explained the main features of forest management in Quebec and Canada.

Harmonisation of sustainability criteria

The concern was raised that overarching policies such as the EU RED might take precedent over what Canadians have defined as SFM. Some participants were of the opinion that forest bioenergy policies should build on existing SFM standards. Others were reluctant to suggest changing the sustainability framework of the EU RED, unless it is proven that alternatives can provide a similar guarantee of environmental protection; for example, for biodiversity and primary forests. It was agreed that some harmonisation of criteria is needed, coupled with a review of existing sustainable forestry policies, standards and agreements that apply to forests involved in bioenergy markets (e.g. Montreal Process).

Participants agreed that consensus among stakeholders on policy development is needed, and that public expectations and perceptions about sustainability should also be taken into account. The interface between science, policy and public demand must be smooth and well-functioning in order to best support sustainable bioenergy development.

Concluding thoughts: Harmonisation or standardisation of sustainability criteria for bioenergy products is required for effective international bioenergy trade. However, national laws, regulations and best-management practices are needed as a complement, to ensure sustainable biomass production in a context where international markets express varying degree of concern about sustainability.

Biomass production and GHG balance

Participants discussed the fact that, due to the longer rotations of forests compared to annual crops, the GHG accounting for forest bioenergy requires other principles. While project (or forest stand) level accounting is appropriate for quantifying GHG balances associated with forest operations, such as GHG emissions from forest machinery and trucks, proper GHG accounting also requires consideration of carbon balances at the landscape level. Debate in recent years on the climate-change mitigation benefits of forest bioenergy has to a large extent involved varying perspectives and disagreements on the applicability of different GHG accounting principles.

The carbon sequestered during forest growth is released when the biomass is used (burned or gasified) and subsequently sequestered again during forest regrowth. Some analysts have proposed that the temporal imbalance between sequestration and emissions causes a 'carbon debt', which needs to be paid back before the forest bioenergy system contributes to climate-change mitigation. Others reject the carbon-debt concept as an outcome of a misleading analytical construct that does not correctly represent the forest bioenergy system and associated carbon balances.

Despite this disagreement, it can be concluded that whether incentives to promote forest bioenergy contribute to near- and/or long-term climate targets depends on a range of environmental and socio-economic factors: the change in forest management and harvesting regimes due to bioenergy demand depends on forest ownership and the structure of the associated forest industry; the carbon stock response to changes in forest management and harvesting depends on the characteristics of the forest ecosystem (soil and climate conditions, historical and current management regimes, and natural disturbance regimes); and the characteristics of both existing energy systems that will be substituted and of the bioenergy system (type of feedstock, pathway of bioenergy production) determine the GHG savings achieved from bioenergy use.

Accounting for the timing of GHG mitigation benefits is a matter of much concern in the scientific sphere, and options to introduce GHG accounting into policy measures are being explored. Some participants saw an urgent need to propose a methodology, however imperfect it might be, and to

incorporate it into certification systems. Some respondents were of the opinion that reduction of GHG emissions in the *short* term is important in the context of climate change. However, others believed that policies should not be focused exclusively on the short term; long-term implications must be considered as well.

Some voiced concerns that, since biomass production is so sparsely distributed across the landscape and has a relatively low energy density, building a global biomass market with intercontinental trade is not a step in the right direction. Supporting local use and minimising transportation requirements (and associated GHG emissions), may be better than large-scale forest harvest and international biomass trade for bioenergy purposes.

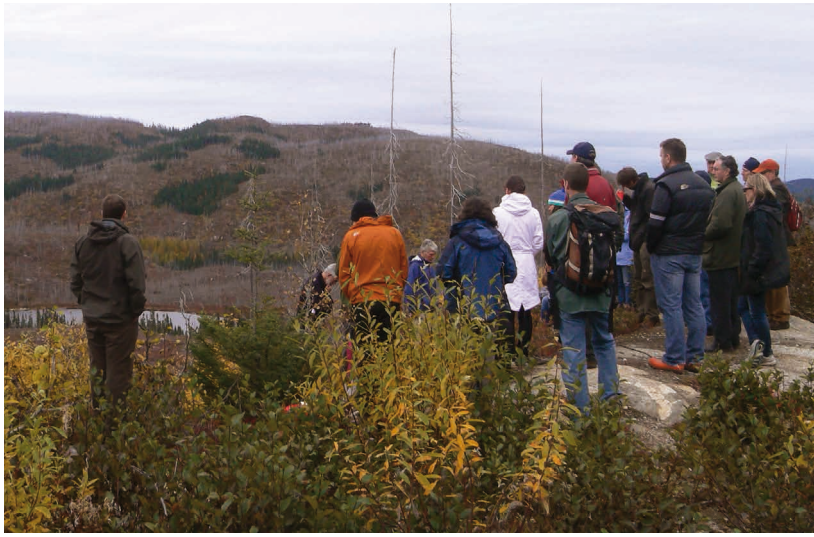
Concluding thoughts: The GHG balance of forest bioenergy must be accounted for, both in policy and in certification systems. More research is needed to clarify and understand the nuances, such as timing of mitigation benefits, but incentives are needed that ensure short- and long-term benefits to the atmosphere. Proper GHG accounting requires that both the landscape and project (or stand) levels be considered.

Inclusivity of impacts and the double standard

On the other hand, participants discussed the fact that it is economic operators (i.e., actors along the biomass supply and value chain) that need to show compliance with the requirements of the EU RED, in contrast to government-to-government trade agreements. It may be challenging for operators from non-EU states to get access to European markets, but some participants indicated that suppliers could always opt for other, potentially less stringent, markets and possibly cause 'leakage' problems.

One important aspect that was mentioned was that, if the direct and indirect effects of biomass production and use are taken into account, then the same must be accounted for in non-renewable and other energy sources, as well in other products such as food, to avoid a double standard.

Concluding thoughts: It is important to ensure that sustainability regulations really meet their intended goals, and at the same time don't create unnecessary complications for economic operators in different countries. It is equally important that sustainability requirements that are relevant for other energy options be applied in such cases, and that agriculture and forestry in general are subject to requirements ensuring sustainable land use. This would ensure that bioenergy products are not unduly hampered by excessive restrictions compared to other energy options, and that leakage does not flood markets with unsustainably produced bioenergy products.



Visit of naturally disturbed stands in the Grands-Jardins national park.

FINAL REMARKS

According to the organising committee, there was a general understanding that:

- The format of the workshop was successful in addressing science, policy, NGO and industry concerns, with an open dialogue among participants.
- Overall sustainability governance and certification will be widely implemented only if there is a sound business case underpinning forest bioenergy supply chains.
- Certification might be a valuable tool for client acceptance of bioenergy.
- There is a need to address GHG emissions and to establish proper carbon accounting principles.
- The framework of sustainable forest management should include bioenergy, with the addition of GHG accounting in certification systems.
- Although most discussions focused on the boreal forest, it was agreed that the results were applicable to all forest types, with some differentiation.
- In the case of Canada, sustainability of forest management should be understood in the context of natural disturbances (e.g. fire, insect epidemics).
- There was recognition that there will be additional international processes addressing forests, and there is a need for coordination of these processes.
- The future role of bioenergy must be placed in the context of the overall bio-economy.

This event allowed participants to obtain a first-hand view of Canadian forest management as carried out in Quebec, and most were impressed with what they saw. Moreover, it allowed European regulators to understand the Canadian situation better than they could through correspondence or holding meetings in Europe. A similar event is currently being planned in the United States, further demonstrating the success of this innovative and exciting workshop.

The workshop brought together participants from 11 countries of North America and Europe.

COMMENTS FROM PARTICIPANTS

Giulio Volpi, Directorate-General for Energy, European Commission (Belgium)

"The Quebec workshop on forest bioenergy has been useful for increasing our understanding of Canada's forest ecology, management and governance. It was based on a balanced and open dialogue between stakeholders from various countries and backgrounds. The knowledge and understanding acquired during the event will help inform our policy analysis of issues related to forest biomass for energy."

Brian A. Kittler, Pinchot Institute for Conservation (United States)

"The Quebec workshop on biomass export sustainability was by all marks a successful event. Bringing together market stakeholders on both sides of the Atlantic at a key moment in the evolution of international trade in wood biomass is critical and the Quebec event set a high bar. Due in large part to the example provided by this event we are now in the planning stages of a similar event in the US. Both the attendees and the format of the event itself will likely mirror the good work of those in Natural Resources Canada and the other institutions who planned the event in Quebec's southern tier of the boreal."

Jörgen Ransmark, E.ON (Sweden)

"At the workshop, I got a deeper understanding of the Canadian methods that enable a large-scale, scientifically based, productive forestry based on ecological principles. I will use this knowledge to influence future legislation, the development of sustainability criteria in the EU, and in the work on our biomass policy in E.ON. Locating the workshop in a research station was very successful; we got an immediate contact with the magnificent Canadian forests. The remoteness and the dedication of the organisers created an open and constructive atmosphere that promoted discussions and enabled us to establish many valuable contacts for the future."

Amélie St-Laurent Samuel, Nature Québec (Canada)

"The success of the workshop was due to the high diversity of stakeholders that attended the event. Care has been taken to ensure that a range of geographical and political contexts was represented. This event is an important first step towards a better integration of environmental aspects in the planning of biomass supply chains, and sets the course for better communication and outreach between actors to ensure a sustainable future for forest bioenergy."

Gordon Murray, Wood Pellet Association of Canada (Canada)

"The main benefit of this workshop was getting international regulators, scientists, power utilities and ENGOs all together for healthy and respectful exchanges of viewpoints. It also provided an opportunity to showcase Canadian practices. In my view, this was the most worthwhile event of the year for me."

Jonathan Kierstead, Nova Scotia Department of Natural Resources (Canada)

"As a small province in Canada with limited available biomass for export, we have begun to follow with interest import requirements of the European Union. The Quebec workshop nicely combined field excursions with excellent indoor presentations from a variety of sector perspectives worldwide. This workshop worked because participants were able to engage in thoughtful discussions in the woods regarding biomass and ecosystem management and carry these to indoor policy discussions with clearer understanding of the whole biomass supply chain. The location provided an excellent opportunity to showcase biomass removal field trials to help international participants understand the extent of Canadian forestry standards and, frankly, the best discussions about forest practices and resulting policy happen when all perspectives gather in the woods!"

Roundtables addressed questions of sustainability and governance of forest bioenergy.

Graham Stinson, Canadian Forest Service (Canada)

"The workshop was an excellent venue for frank and open exchange of ideas and perspectives between experts from forestry, forest science, and renewable energy policy disciplines from UK, EU and North America. The setting provided outstanding opportunity for all to see examples of Canadian SFM first-hand, and the retreat atmosphere stimulated very open discussion among participants. It seemed to me that most if not all participants were returning home with a broader perspective of the issues at hand and a better appreciation for the diversity of considerations."

Marco Colangeli, Global Bioenergy Partnership (Italy)

"The workshop represented a unique occasion for multiple stakeholders to discuss scientific and policy implications of sustainable forest bioenergy. The outstanding location chosen by the organisers allowed the participants to immerse themselves into the topic and better understand the dynamics of boreal ecosystems, and the perfect organisation of the event is worth my most sincere congratulations. During this highly informative meeting, several fundamental notions of forestry sustainability were discussed in the field, majestically explained by top researchers and scientists from both sides of the Atlantic. Following the workshop, the Global Bioenergy Partnership has initiated internal discussions that will lead to the establishment of an Activity Group focused on Sustainable Modern Wood Energy Development. The workshop gave the opportunity to many Global Bioenergy Partnership (GBEP) partners to meet experts and other stakeholders in the field of wood energy in person and to establish valuable connections and collaborations. The engagement of the Global Bioenergy Partnership in wood energy-related discussions and actions was certainly strengthened by the participation in this event."

Ralph Brieskorn, Ministry of Infrastructure and the Environment Sustainability Directorate (The Netherlands)

"The Quebec Workshop focused on the necessity to use more biomass from forests for energy in order to combat climate change, and on ways to source this biomass in a sustainable way. Especially the EU will source more and more biomass from outside Europe and this could be a risk of unsustainable forest management. The workshop provided a platform to exchange views on the growing use of biomass for energy, the sourcing and harvesting, definitions on primary forests, nature protection measures and how sustainable management practices, especially in Canada, are applied and can be used for the development of policies in Europe. It also created an opportunity to explain what the concerns of the EU are and how, due to the growing export from (developing) countries, safeguards for sustainability, comparable to biofuels, have to be developed. The workshop was well organised, had a good atmosphere, with a nice balance of policy discussions combined with field visits."

The Forêt Montmorency research station is nested in the Laurentides wildlife reserve.

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DISCLAIMER

In this publication the authors report the discussions and opinions that were expressed by the participants during the workshop on sustainability of forest bioenergy in Canada. The 'final remarks' are reflections by individuals in the Organising Committee.

The views expressed in this publication do not necessarily represent the views or policies of the IEA Bioenergy Secretariat or of its individual Member countries.

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