Workshop on

THE SCIENTIFIC FOUNDATION FOR SUSTAINABLE FOREST BIOMASS HARVESTING GUIDELINES AND POLICIES

Toronto, Ontario, 18-21 Feb. 2008

NOTES FROM FACILITATED DISCUSSIONS

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Disclaimer

The contents of this report are a compilation of un-attributed notes that summarize discussions that took place at the workshop, and therefore do not necessarily reflect the views of the Workshop Organizing Committee, sponsors, or all participants.

1. Introduction

1.1 Workshop goals

The forest bioproducts and bioenergy sectors are developing rapidly across Canada. Thus far, these sectors have depended largely on waste wood left over from industrial processing; however, slash is an emerging and potentially important source of industrial feedstock. In Canada, relevant research on the impacts of removing slash on ecosystem processes has been conducted for over 30 years. Industrial and regulatory agencies across the country are now developing science-based guidelines and regulations for sustainable biomass removal. This scientific knowledge can also be used to develop criteria and indicators to assure markets that increased biomass harvesting will not compromise the integrity of our forest ecosystems in the future.

Sharing what is known about the impacts of biomass removal in different Canadian forests will create synergies and reduce duplication among different agencies across the country as they conduct work relevant to their own ecosystems and circumstances. By working together, experts with diverse backgrounds and interests can develop answers to key questions, such as:

- What do we know about biomass removal impacts on different Canadian ecosystems?
- What are the most important gaps in our knowledge, and how can they best be filled?
- What research approaches are most appropriate for answering key questions?
- What synergies and efficiencies can be achieved through networking?
- What approaches would allow direct comparisons among different regions, while still addressing local research priorities?
- What tools would facilitate rapid uptake and efficient transfer of new and existing knowledge across Canada?
- What lessons can we learn from experience in other countries?

Sharing scientific knowledge about the impacts of biomass removal in different Canadian forests also creates synergies and reduces duplication among different agencies across the country as they conduct work relevant to their own ecosystems and circumstances.

To foster sharing and discussion of current environmental sustainability issues, a three-day workshop was held in Toronto, in February 2008. This workshop brought together scientists, government regulators, industry, environmental non-government organizations, and others with an interest in forest bioenergy, with the following objective: *Identify what is known, and what needs to be known, to develop sustainable biomass removal guidelines and policies in different jurisdictions across Canada.*

To achieve this objective, the Workshop Organizing Committee identified the following goals for the workshop:

- Participants will share updates on the state of forest biomass removal knowledge across Canada;
- Gaps related to development of sustainable biomass removal guidelines, policies, criteria and indicators, and certification systems will be identified;
- Priorities for research will be debated and collated so that they can feed into strategic planning by agencies across Canada;
- Common approaches to research methodologies will be determined to maximize synergy and increase application and comparability of results across Canada;
- Tools that will facilitate storage, access, and use of knowledge will be identified and prioritized, and agencies will be identified to develop and/or maintain them;

- Ways in which knowledge can be generated, synthesized, made more useful, and applied will be identified, including: adaptive management frameworks, development of generic guideline systems, meta-analysis, approaches for synthesizing information for land managers;
- Long-term research networks will be formed that increase synergy and cooperation in research, field trials, and monitoring of operational biomass removal;
- Long-term inter-agency networks will be formed that will increase transfer of ideas, experience, and knowledge in research and in guideline and policy development.

Some of the above goals were achieved at the workshop itself, while fulfilment of others will depend on the commitment of participants and agencies over the coming months, as they apply lessons learned from the workshop and carry ideas and initiatives forward. The workshop is therefore part of a continuum in the learning and application of environmental sustainability principles, and not an end in itself.

Furthermore, the workshop could not address the economic and social issues that are also part of the three-component approach to sustainability, as popularized by the Bruntland Report. These are equally important considerations in the evolution of forest bioenergy policy and application in Canada, but were beyond the scope of the workshop because of time and space constraints. A full discussion amongst the three sustainability components is highly desirable, and it is hoped that the current workshop impacts and outputs will help feed environmental knowledge into a wider national discussion of sustainable forest bioenergy. Workshop outputs will therefore compliment those of other national initiatives (e.g., BIOCAP Canada Foundation and EnergyINet. 2006. Strategies for Strengthening the Bioenergy Sector in Canada. Final Report of the Canadian Bioenergy Challenge Dialogue, July 17, 2006. BIOCAP Canada report, Kingston, ON; http://www.biocap.ca/images/BioenergyChallengeDialogue.pdf)

1.2. Workshop participation

The 131 workshop participants came from across Canada (108), the USA (12), Europe (10) and New Zealand (1). Over half of the Canadian participants came from Ontario. Participation by country, province and state is broken down further in Table 1.

Of the 131 participants, 42% worked for governments, 40% worked in a university (as either a researcher or as a graduate student), and 11% worked in industry or as a consultant; the proportions were similar for the 108 Canadian participants: 44% from government, 38% from universities, and 11% from industry + consultants. (See Table 2 for more detailed statistics.)

Workshop participation was open, and no restrictions were placed on attendance. The emphasis of the workshop on scientific knowledge and its application to policy and guidelines, not surprisingly, drew a high proportion of participants from research (universities and government) and from government agencies. The workshop also provided a good opportunity for graduate students and young scientists and professionals to network with the wider science, industry and administrative community.

Participants were self-selecting, and it was beyond the scope of a specialized workshop such as this to ensure equal representation from all agencies with a general interest in environmental sustainability; while desirable, disseminating information to or eliciting input from a wider audience would require a different objective, venue and format. Nonetheless,

Table 1. Participation at workshop, by country, province and state.

Canada		**108**
USA		**12**
Europe		**10**
New Zealand		**1**
Total participants		**131**

Canada	Yukon	1
	British Columbia	7
	Alberta	8
	Saskatchewan	2
	Ontario	66
	Quebec	12
	New Brunswick	4
	Prince Edward Island	2
	Nova Scotia	4
	Newfoundland & Labrador	2
Total from Canada		**108**

USA	Arizona	1
	Louisiana	1
	Massachusetts	1
	Maine	1
	Michigan	3
	Minnesota	2
	Texas	1
	Virginia	1
	Vermont	1
Total from USA		**12**

Europe	Sweden	4
	Germany	1
	Denmark	1
	Finland	1
	Netherlands	1
	Norway	1
	UK	1
Total from Europe		**10**

Table 2. Participation at workshop, by employer.

Employer	Participation			
	Total		Canadian	
	No.	%	No.	%
Government	55	42	47	44
University researcher	36	27	24	22
University graduate student	17	13	17	16
Forest industry	7	5	7	6
Environmental non-government organization (ENGO)	4	3	4	4
Consultant	3	2	2	2
Biomass industry	3	2	2	2
Non-government organization (NGO)	2	2	1	1
Forestry association	2	2	2	2
Energy industry	1	1	1	1
First Nations	1	1	1	1
Total participants	131	100	108	100

the small group discussion format at the workshop was designed so that all voices present could be heard.

The representation by province generally reflects the relative regional strengths of sustainability research across Canada, and regional interests and the state of the forest bioenergy sector in different provinces; holding the workshop in Toronto presumably made it relatively easier for participants from Ontario to attend.

A dozen US participants added valuable cross-border perspectives, and many worked in ecosystems similar to those found in Canada. Of the four Swedish participants, three were invited speakers; regrettably, time constraints restricted the option of having more speakers from other Nordic countries and from Europe. Finally, a meeting of national representatives of the International Energy Agency Task 31 (Biomass for Energy from Sustainable Forestry) was held immediately after the workshop and many representatives were able to attend the workshop as well; this brought a wealth of European experience to discussions. The active participation of so many international participants greatly enhanced the value of the workshop for Canadian participants.

1.3 Workshop structure

The workshop was structured to inform participants about the context for forest bioenergy and the current state of knowledge in Canada and elsewhere, and to provide opportunities for facilitated[1], interactive small group discussions at key points in the program. Questions for these facilitated discussion sessions were designed to help build participants' awareness of sustainability issues over the course of the workshop, culminating with the key topics that were discussed on the final day.

The general outline of the workshop was:

- Day 1
  - Context
  - Site productivity and biodiversity research in Canada
- Day 2
  - Site productivity and biodiversity research in other jurisdictions
  - Development of guidelines
- Day 3
  - Identification of research gaps
  - Identification of next steps to be taken

More details on the workshop program and agenda are presented in Appendix A; the full program and speaker details can be found elsewhere in the *Program and Abstracts*, which was revised after the workshop to include details and abstracts that were not available before the workshop.

Participants were pre-assigned to tables so that a range of knowledge, expertise and experience could be brought to bear on discussions. There were 8 to 12 people at each table, and the composition of people was changed each day to maximize opportunities for

[1] Three different facilitation processes were used so that participants could discuss, critique and consolidate viewpoints around key questions that logically followed-on from topics addressed by invited speakers and panelists; in each case, questions were first addressed in small groups, which then shared salient points in a plenary discussion session with all participants. The three processes were small group discussion, world café, and round-robin facilitation.

participants to meet, network and consider divergent views on the sustainability of forest biomass harvesting. (There is therefore not necessarily any correlation between Group 1 on one day and Group 1 on another day in the notes in the Appendices.)

Note-takers, drawn from graduate students[2] who previously received an afternoon's training on note-taking techniques and a briefing on the format for the facilitated discussions, were pre-assigned to each small group discussion table and recorded points raised at each table. Participants volunteered to moderate discussions at each table and, at the end of each session, a representative from each table reported key points back to the full plenary session. Three note-takers recorded the main points discussed at the plenary summary discussions.

Through this approach, the scope of any individual participant's ideas are broadened as different points of views are brought forward in small group table discussions; the small group then consolidates these to main points that are reported back to plenary discussion sessions; finally, the consistent (or main) points emerge through discussion as successive groups report back to the plenary session. A natural expansion of ideas therefore takes places at small table discussions, and a consolidating and filtering process then takes place in plenary sessions. Finally, at the close of the workshop, participants were asked to commit to initiatives arising from the workshop discussions; if actions speak louder than words, then these commitments reflect perhaps the highest level of consolidation of ideas, based on the discussions over the preceding two-and-a-half days.

It is important to note, however, that none of the facilitated processes included consensus building, or voting for priorities; summary notes from plenary discussion sessions simply report back on the main points that emerged. A concept, idea, or point of view that is (in an objective sense) important – but not recognized as such within a small group – may therefore not emerge at a plenary session, but may still be worthy of further consideration. All of the notes recorded from the small groups and from the plenary sessions are therefore reproduced below, so that no points are overlooked; while emphasis can be placed on the notes from plenary sessions, the knowledge and opinions represented in notes from small group discussions should also be considered on the basis of their own merit.

Points recorded in summary notes have not been prioritized, although similar points have sometimes been grouped successively within the notes; notes have also not been edited for content, although obvious grammatical and spelling errors have been corrected. The notes therefore serve as "raw data", expressing the viewpoints of individuals and, through the consolidation processes of facilitated discussion, small groups and all participants as a whole.

Finally, it must be borne in mind that the discussion notes reflect the views of participants from the regions and the sectors outlined in Tables 1 and 2 above; while there are many important and helpful points contained in the notes, and while these are hopefully reflective of especially the scientific research community in Canada (which was well represented at the workshop), there are other sectors and regions who were not as well represented. These notes are therefore not so much an end in themselves as they are a beginning of a national discussion on environmental sustainability of forest biomass harvesting. However, given the participation, they are reflective enough of knowledge and opinions across the

[2] Adit Sharma, Aneeka Malik, Anne Koven, Bei Wang, Cassia Sanzida Baten, Fraser Smith, Jess Kaknevicius, Jieming Chen, Jon McKechnie, Joshua Jacobs, Sedric Pankras, Smith Sundar, Xiaoli Tang, Yong Zhao, Ziya He

country to give initial guidance to agencies and industry, but further work would be required to focus future discussions on issues most relevant to particular provinces or regions.

1.4 Document outline

This document contains three levels of notes of discussions at the workshop. The notes from discussions with the highest levels of integration and consolidation are presented first, although these actually took place later in the workshop (see Appendix A for program agenda):

1. Highest level of integration and summary, from plenary sessions (Section 2): summary outcomes and research priorities
   - Achieving workshop outcomes: immediate next steps that participants were willing to take to continue the momentum of the workshop
   - Identification of research needs: Research priorities
   - Canada as a leader in environmentally sustainable forest bioenergy research
   - Is there a place for sustainable forest biomass harvesting in Canada?

2. Intermediate level of integration and summary, from plenary sessions (Section 3):
   - Supporting workshop conclusions: summaries of discussions of research needs

3. Most detailed level of integration and summary, from small group discussions (Appendices B-G):
   - Notes from small group discussion sessions

4. Workshop evaluation (Appendix H):
   - Appreciations, regrets, and next steps

2. Summary outcomes and research priorities

On the morning of the third day, workshop participants considered information from the previous two days, and from this determined research gaps, the next steps that need to be taken, and the next steps that individuals were willing to take[3]. Questions were:

- *What 1-2 research priorities have emerged?*
- *What have you learned from your work?*
- *How can we make Canada a leader in research about forest bioenergy? (experimental designs/ research approaches; sampling protocols; international collaboration)*
- *What scientific gaps in Canada may hinder the development of guidelines for biomass harvesting?*
- *What are 1-2 immediate next steps that you (and your organization) are willing to take?*
- *Is there a place for sustainable forest biomass harvesting? Why? Why not?*

2.1 Achieving workshop outcomes: immediate next steps that participants were willing to take

Acknowledging that some could be constrained by the priorities of their employers, participants were nonetheless asked if there were tasks that they would be willing to undertake, based on what they learned at the workshop:

- *What are 1-2 immediate next steps that you (and your organization) are willing to take?*

Outreach, Advocacy and Networking

- Organize more workshops of this kind, including a follow up
- Make scientists and organizations work together
- Write a draft of conclusion from this meeting
- Coordinate research efforts, including forming a scientific network
- Communicate the results

Guidelines and research

- Conduct provincial wide assessment of opportunities of biomass harvesting and risk to ensure balanced approach
- Ensure compatibility of biomass harvesting with existing commitment within approved forest management plans and overall provincial policy
- Assess opportunities to mitigate ecological risk
- Assess opportunities and risk to harvesting on the passive land base
- Identify research priority in international level
- Improve mapping methods to get sensitive zones
- Write a paper for a meeting in September on bioenergy nutrient amelioration
- Revise and redefine the guidelines
- Develop standards and ground rules
- Calculate availability of biomass

[3] This session used a round-robin format of facilitated discussion (sometimes known as a “spider-web”, or an “interview matrix”) in which each person at a table of six took responsibility for one of the six questions and then interviewed each other person at the table; the group then reviewed the answers and identified the most commons answers. Each interviewer then went to a table with people who asked the same question at different tables, and repeated the process of reporting back and identifying the most common answers; these consolidated answers were then reported back to the plenary session.

Since the end of the workshop, other initiatives that the Organizing Committee are aware of include:

- Develop protocol for establishing statistically valid “legacy trials” as part of routine forest operations
- Cooperation between different agencies to identify and translate key foreign papers into English
- Consider NSERC funding opportunities for synthesizing environmental knowledge that feeds into policy
- Consider cross-border funding opportunities to share information and collaborate with US researchers
- Carry out meta-analysis to relate tree growth response after slash removals to site and soil conditions, using data from the Nordic countries and Canada; after successful analysis, expand meta-analysis to include US and other relevant countries
- Review base cation conundrum

2.2 Research priorities

Participants collectively identified research priorities as listed below, including research gaps to be filled in the development of guidelines.

- *What 1-2 research priorities have emerged?*
- *What scientific gaps in Canada may hinder the development of guidelines for biomass harvesting?*

General

- Develop thresholds so we can determine what we can get away with
- Identify the functional relationships
- Develop sensitivity indicators
- Create new mapping and inventory tools
- Consider how will biomass harvesting impact the overall forest industry
- Explore ammelioration issues: alternatives to ash?
- Will short-term issues have a greater long-term impact
- Provide long-term research support
- Conduct operational scale research
- Conduct industrial research

Synthesis of current knowledge

- Synthesize existing research - reanalyze the available data
- Share cross-disciplinary, cross-jurisdictional knowledge for creation of state-of-the-art benchmarks

Nutrients

- Conduct long-term studies retrospective analyses of legacy forests on the effects of nutrient cycling and site productivity
- Investigate relation of fine woody debris with nutrient cycle
- Look at potential for soil amelioration with fertilization
- Examine species-specific responses to soil nutrient conditions
- Investigate site-specific responses to nutrient fluxes
- Examine the relation between nutrient cycling and biodiversity
- Examine temporal impacts on site productivity – short-term *vs.* long-term

Biodiversity

- Link site productivity and nutrient cycling with biodiversity
- Determine the impact of fine woody debris / coarse woody debris removal on biodiversity
- Link forest management practices, harvesting techniques and biodiversity impacts
- Incorporate biodiversity aspects in existing long-term studies
- Look at how, of if, biomass fits within natural disturbance regimes
- Improve our understanding of ecological significance of downed wood

Economics

- Conduct studies on market supply and demand economics
- macro and micro economics research
- availability of resource (supply)
- impact on existing forest industries
- optimal placing of infrastructure for biomass collection, conversion and distribution
- Optimize returns from biomass from different product streams: energy, biocomposites, *etc*.
- Conduct life cycle analysis of systems → land use implications from interaction of biomass retrieval, traditional forestry, and agriculture in market

Technology

- Examine conversion technologies for energy retrieval from biomass
- Examine engineering aspects of conversion technologies

Policy and guidelines

- Develop and use communication tools between sectors and knowledge
  - Make what we learn understandable through all sectors so that it acts more effectively
- Conduct governance research for who owns the material
- Monitor existing guidelines and standards
- Develop national framework
- Investigate environmental impact of forest bioenergy – carbon storage and GHG emissions reductions, integration with other climate change mitigation policies

Gaps hindering the development of guidelines

- International forest process
- Long-term: don't need to fill gaps 1st
- Lack of soil information (*i.e*., pH), similar to agricultural systems
- Definition of biodiversity (Functional importance) (we need to define what we are talking about when we use "biomass")
- Definition of biomass (Interactive + timely)
- Gap of science: management (transfer of new info)
- Lack of what policy should look like
- Importance of cation depletion
- Strategic policy to make framework
- Define thresholds
- Climate change - physical social climate
- Disperse research: Universal protocols between provinces
- Connections between the science and guidelines - "scientific interpreter" - translate the science to policy
- Goals that will help form guidelines and policies
- Regional guidelines

2.3 Canada as a leader in forest bioenergy research

Research gaps were looked at in another way by examining the activities that would need to be undertaken for Canada to become a leader in research on sustainable biomass harvesting.

- *How can we make Canada a leader in research about forest bioenergy?*

- Goals should be defined by government and industry
- Funding, build on current research, collaboration and networks
- Improve the research being conducted:
  - Long-term trials, standardized measurements and protocols that have common language so that knowledge is transferable between provinces
- Define thresholds / critical levels
- Physical examples: from forest to end use
- Build on the current structures in place
- Take an integrative approach that involves a social element
- Use what we know and have and try to build on that

2.4 A place for sustainable forest biomass harvesting: Why? Why not?

Finally, participants considered why there is or is not a place for forest biomass harvesting in Canada.

- *Is there a place for sustainable forest biomass harvesting? Why? Why not?*

Both ***drivers*** (factors that are supporting biomass harvesting) and ***barriers*** (factors that are hindering biomass harvesting) were identified. From a show of hands, all but one participant agreed that there is a place for sustainable forest biomass harvesting in Canda, but this virtual unanimity was based on the inclusion of ***qualifiers*** (cautions to be adhered to as biomass harvesting takes place) on what is meant by “sustainable”.

Drivers

- Climate change will be a driver as we need to substitute fuel sources
- Make use of silvicultural wastes burnt road side
- Rural economic opportunities
- Accessibility of resources
- World economic development
- Biorefinery
- Fuel substitution
- Tradition to innovation
- Fiber is available,
- Expectation from the forest
- Energy demand
- Industry demand for raw materials
- Transformation of industry from traditional to innovation to diversify the forest products
- Availability of the resources
- Improper utilization of harvested material for its maximum outcome

Barriers

- Lack of communication
- Lack of adaptive management
- No comprehensive approach
- No coordination in a national perspective
- No effective monitoring; long-term monitoring is lacking
- No target for decreasing carbon emission
- No set goals for maximizing the utilization of natural resource
- Lack of capital support to initiate biomass based industry
- Definition of “biomass” is not well defined, fitting with the sustainability framework
- Economic
- Framework - technical support along with financial initiatives

Qualifiers

- Sustainability
- Long-term goals
- Adaptive management

3. Supporting workshop conclusions: summaries of plenary discussions of research needs

The next steps and research gaps identified on the third day and summarized above in Section 2 were informed by and built upon a previous series of similar discussions held throughout the first two days of the workshop. The main points from all the plenary sessions at the workshop, which fed into the summaries above, are listed below.

3.1 Context and planning frameworks

The first interactive discussion session followed directly after four presentations in the first session of the workshop, *The Canadian context for forest bioenergy – where, when and how does science fit in?*, which focused on the policy, industrial and environmental non-governmental contexts for forest bioenergy, and on sustainable forest management frameworks. Small groups started their conversations with the following two questions:

- *What is the most surprising idea or information you heard about how, when and where science fits into the (i) policy context, (ii) industry context, and (iii) ENGO context?*
- *What did you notice about the planning frameworks as you think about forest bioenergy?*

Some table groups specifically addressed the questions, while others used the questions as a springboard into more general discussions about the context in which forest biomass harvesting might take place. The following main points emerged from the plenary session at which all small groups reported back on their findings.

Energy sector

- Are we suggesting that we replace the forest industry with the energy sector?
- Are we looking at this as an economic opportunity or in a climate change perspective? What is driving the industry?
- Link up with other ministries to form a cohesive policy approach: do we have the right representation at this conference? Where is the energy sector?
  - The difficulty of pulling the different groups involved (producers, users)
- Where does bioenergy fit in the broader energy context? Are we capturing the best value for this product? How does it compare with other energy sources?
- Using tax incentives to deliver bioenergy? Are we developing markets?
- How do we include more bioenergy in the north and include more aboriginal involvement to create sustainable communities?

Current science

- Are current experimental designs capable of long space and time scales given the short-term nature of funding? - we do require long-term funding at ecosystem or landscape scales?
- Why aren't we learning more about the application of studies?
- We need to be specific about what we are talking about when we talk about biomass (stumps, residues)
  - Are we talking about more intensive industries? Fertilization?

Current policy

- Is Industry moving ahead while environmental policy is lagging behind?
- Why don't the current guidelines apply and how would they look different?
- Policy gaps: what are exactly the indicators that need to be measured?
- How do we prioritize all the indicators?
  - Site specific threshold values to guide indicators
- Difference between public and private landowners: they have different considerations and objectives; and how do guidelines influence them?

3.2 Site Productivity

Site productivity was discussed twice in small groups after two different speaker sessions. On the first day, after a review of the literature relevant to site productivity issues in Canada and a panel review of current research initiative across Canada in the second speaker session *Canadian science: what do we know, and what are the key issues?*, small groups started conversations on what we know and do not know from site productivity research in Canada with the following two questions:

- *What additional issues are there regarding site productivity?*
- *What stood out for you in the presentation? What new perspectives do you have?*

On the second day, after reviews of site productivity research in the USA and the Nordic countries in the speaker session *International science: what do we know, and what are the key issues?*, small groups used the following questions to take discussions on this topic further:

- *What else can you share that's happening in jurisdictions besides the USA and Nordic countries?*
- *What have you heard (concepts, approaches, scientific practices) that applies to Canada? Doesn't apply to Canada?*
- *What additional issues are there related to site productivity?*
- *What interaction/linkages do you see between site productivity and biodiversity?*

The following main points emerged from both discussion sessions as small groups reported back during subsequent plenary discussion sessions:

Site productivity

- Should we be looking at a TRIAD approach: intensive management for bioenergy with protected areas
  - Using a landscape level approach to meet multiple objectives
- What sort of intensity of biomass removal are we talking about in Canada?
- Is bioenergy within the range of natural disturbance, and are we using natural disturbance as a control?

Research gaps

- We already have the long-term research on site productivity, can we use the studies that already exist
- Are long-term studies enough? Do we need to be looking at bigger scales of research?
- What about non-clear cut systems?
- Coordination of research efforts - identify the priorities and important aspects

- Are we including ecosystem resilience (disease, dieback, decline syndromes)? Where are they represented in the productivity models?

Additional considerations

- Do you incur future costs in the things you lost (*i.e.*, fertilization to combat a decrease in site productivity)?
- Do we want to create more productive forests now so that we have more biomass in the future *vs*. losing productivity now and trying to repair
- Need to focus more on monitoring and to see if ideas are working after they are implemented?
- Are our assumptions in terms of species responses take into account climate change and change in species composition? And are we preparing for the forest of tomorrow?
- Develop markets close to the source: regionalization of markets

Scientific research outside of Canada

- Difficult to access some sites for experiments on fertilization and ash addition; also question about carbon neutrality if we have to use helicopters to do it
- Shortage of long-term studies in Canada to understand nutrient budgets — at least 25 years needed — retrospective studies and studies building on the LTFP sites
- In much of Ontario, lack of soil maps and GIS maps, what's the basis of assessment?

Soil processes – Lessons outside of Canada

- Interesting point on forest productivity *vs*. carrying capacity: by improving genotypes and other things we can still maintain productivity even though soil capacity could be drawn down
- The mechanisms of cation and base saturation processes (*e.g.*, soil cation content in general, cation removal, and what anions are involved *etc*.), for understanding the implications of the long-term effects and for risk assessment
    - Inputs of strong acids in the Appalachian region in the past 50-70 years, exacerbated by the fact that many sites in the Northeast are nitrogen/sulfur saturated, in turn exacerbated by harvesting; natural proton production as organics decompose; because of the huge amount of calcium in the biomass, no matter what kind of harvest methods we use, we are going to be removing calcium; no way weathering is going to keep up with the export, particularly on nitrogen/sulphur saturated sites
    - In whole tree harvesting, calcium is the major depleted nutrient, and liming doesn't seem to always produce responses — are we applying it at the wrong time?
    - How much does a tree need in terms of nutrient budgets compared to the total amount in the soil; what is the optimal level; in the very young sites in Nordic countries, calcium deficiency in the soil is one of the biggest issues
- Calcium: evidence of forest decline (*e.g.*, in Virginia) loss of vigour correlated with Ca loss, and Ca may be a surrogate of some other factors/a combination of them, so maybe a good indicator? *e.g.*, nitrogen saturation, micro-flora and -fauna/mycorrizae; lots of potential decline mechanisms related to Ca depletion; if good indicator then we don't need to try to understand all these mechanisms?

Forest management

- From a regional context in BC and ON, we tend to be on the left side of the gradient in terms of natural forests *vs*. intensive management; intensive management zonation to meet additional biomass demands
- Shortfall in intensity gradients: where do afforestation *vs*. reforestation fit in?
- The framework of sustainability in Jim's slides is a good framework to adopt
- Public interests not on soil productivity — a big challenge

- Spatial distribution is important but temporal scale also — where is the society going: within the timeline of this rotation, would we still be using biomass given opportunities and development of other renewable energy sources?
- Should we focus on high-priority sites, instead of just on sensitive sites: focus on ones that we are really having an impact

Lessons from other countries

- Differences from Canada: Nordic countries have longer-rotation forests, so lots of uncertainty
- New Zealand
  - Low Ca/P naturally — Ca trace element, little response when adding Ca, but adding P with Ca has effects
  - A risk of the eucalyptus taking too much calcium from the sites
- In Brazil, Ca accumulates in the biomass; with eucalyptus, where soils naturally contain high calcium

3.3 Biodiversity

As with site productivity, biodiversity and landscape issues were discussed twice in small groups after two different speaker sessions. On the first day, after a review of the literature relevant to biodiversity issues in Canada and a panel review of current research initiative across Canada in the second speaker session *Canadian science: what do we know, and what are the key issues?*, small groups started conversations with the following two questions:

- *What additional issues are there regarding biodiversity?*
- *What stood out for you in the presentation? What new perspectives do you have?*

On the second day, after reviews of biodiversity research in the USA and the Nordic countries in the speaker session *International science: what do we know, and what are the key issues?*, small groups used the following questions to take discussions on this topic further:

- *What else can you share that's happening in jurisdictions besides the USA and Nordic countries?*
- *What have you heard (concepts, approaches, scientific practices) that applies to Canada? Doesn't apply to Canada?*
- *What additional issues are there related to biodiversity?*
- *What interaction/linkages do you see between site productivity and biodiversity?*

The following main points emerged from both discussion sessions as small groups reported back during subsequent plenary discussion sessions:

Linkages between productivity and biodiversity

- Linkage between productivity and biodiversity: measurements now need to incorporate the interactions between different nutrients — the black box — interactions with other aspects
  - By identifying and focusing on rich sites, we may also benefit biodiversity
  - Across nutrient gradients — shifts of species, *e.g.*, edibility of plant foliage across the gradient

- Do sites benefit biodiversity or biodiversity functions in maintaining productivity, *e.g.,* colonization of logs
- Harvesting fine slash may have little impact on biodiversity but what about on site productivity
- Biodiversity in the soil (below ground) also important — connection with productivity

Forest management

- Broader context: in Canada, haven't gone down the intensive management road, so less need for rehabilitation
- Do we want to walk down the intensive path and repair/remediate later or we can prevent that
- Spatial distribution of the materials of both sizes — coarse and fine woody debris — "the middle size"?

Context and lessons from other countries

- Difficult to apply the lessons from Nordic countries with our large extent of natural forests
- Is increased diversity always good?
- Population growth: food stock being used as biodiesel now; *vs*. forest products as energy source
- With climate change, do we open productive lands for agriculture or stay with low-grade forestry, *e.g.*, pulp?
- Agriculture expansion onto inferior soils or moving to forest lands, with urbanization taking over agricultural lands
- Fine woody debris small impact — maybe the landscape is already heavily impacted in Nordic countries?
- Slash is not a common feature? In ON, it is in many places
- Are there any potential policy mechanisms to put in place to stop stump removal

Appendix A. Workshop program (with facilitated interactive discussion sessions indicated with asterix and bold font)

MONDAY 18 FEBRUARY (DAY 1)

The Canadian context for forest bioenergy: where, when and how does science fit in?

	8:50 AM	-	9:15 AM	Policy drivers – where, when and how does science fit in? *Bill Thornton*
	9:15 AM	-	9:40 AM	Opportunities and challenges to biomass harvesting in Canada: an operational perspective. *Mark Ryans*
	9:40 AM	-	10:05 AM	Biofibre utilization: a conservation context. *Trevor Hesselink*
	10:05 AM	-	10:30 AM	*Refreshment break*

Expanding our understanding of where science fits into the big picture

	10:30 AM	-	10:55 AM	Linking science, policy and operations through sustainable forest management frameworks. *Brenna Lattimore, Jim Richardson & Tat Smith*
*	10:55 AM	-	11:40 AM	**Interactive discussion: Context for bioenergy (Appendix B)**
	11:40 AM	-	12:25 PM	*Lunch*

Canadian science: what do we know, and what are the key issues?

	12:25 PM	-	12:50 PM	A review of research on biomass removals and site productivity relevant to the Canadian context. *Evelyne Thiffault, David Paré, Brian Titus & Doug Maynard*
	12:50 PM	-	1:30 PM	Panel presentation: Current site productivity research in Canada. *Shannon Berch, Dave Morris, David Paré & Paul Arp*
	1:30 PM	-	1:40 PM	Q&A for clarification
*	1:40 PM	-	2:25 PM	**Interactive discussion: Site productivity (Appendix C)**
	2:25 PM	-	2:55 PM	*Refreshment break*
	2:55 PM	-	3:20 PM	An overview of Canadian research on biomass removals and biodiversity. *Jay Malcolm, Wayne Bell, Shannon Berch, Bill Chapman, Dave Morris, Steve Newmaster, Dan Puddister & Ian Thompson*
	3:20 PM	-	4:00 PM	Panel presentation: Current biodiversity research in Canada. *Bill Chapman, Steve Newmaster & Tim Work*
	4:00 PM	-	4:10 PM	Q&A for clarification
*	4:10 PM	-	4:55 PM	**Interactive discussion: Biodiversity (Appendix D)**
	4:55 PM	-	5:05 PM	Closing comments

WEDNESDAY 20 FEBRUARY (DAY 2)

International science: what do we know, and what are the key issues?

	8:30 AM	-	8:40 AM	Review of Day 1
	8:40 AM	-	9:05 AM	Site productivity lessons from the USA. *Jim Burger & Andy Scott*
	9:05 AM	-	9:30 AM	Site productivity lessons from the Nordic countries. *Bengt Olsson*
	9:30 AM	-	10:15 AM	**Interactive discussion: Site productivity (Appendix E)**
	10:15 AM	-	10:45 AM	*Refreshment break*
	10:45 AM	-	11:10 AM	Biodiversity lessons from the USA. *Brenda McComb*
	11:10 AM	-	11:35 AM	Biodiversity lessons from the Nordic countries. *Anders Dahlberg*
*	11:35 AM	-	12:20 PM	**Interactive discussion: Biodiversity and landscape issues (Appendix F)**
	12:20 PM	-	1:20 PM	*Lunch*

Moving science into guidelines and policy

	1:20 PM	-	1:40 PM	Woody biomass harvesting guideline development: the Minnesota experience. *Dick Rossman & Kurt Rusterholz*
	1:40 PM	-	2:00 PM	The development of regulations and good-practice guidelines for whole-tree harvesting in Sweden. *Hillevi Eriksson, Karin Hjerpe, Hans Samuelsson & Heléne Lundkvist*
	2:00 PM	-	2:40 PM	Panel presentation: Moving science into guidelines and policy - Canadian experience. *Nancy Densmore, Larry Skinkle, Michel Campagna & Shawn Morehouse*
	2:40 PM	-	2:50 PM	Q&A for clarification
	2:50 PM	-	3:20 PM	*Refreshment break*

Taking stock: Where to next?

*	3:20 PM	-	4:40 PM	**Interactive discussion: Guidelines and policy (Appendix G)**
	4:40 PM	-	5:00 PM	Summary of Day 2 & preview of Day 3

THURSDAY 21 FEBRUARY (DAY 3)

Workshop sessions

	8:30 AM	-	8:50 AM	Review of Day 2
*	8:50 AM	-	10:20 AM	**Pairs interviewing**
	10:20 AM	-	10:40 AM	Refreshment break
*	10:40 AM	-	11:10 AM	**Small group synthesis**
*	11:10 AM	-	11:55 AM	**Large group report back**
	11:55 AM	-	12:15 PM	Lunch pick up
*	12:15 PM	-	12:30 PM	**Future steps**
*	12:30 PM	-	12:50 PM	**Meeting evaluation**
	12:50 PM	-	1:00 PM	Wrap-up and adjourn

Appendix B. Canadian context for forest bioenergy: where, when and how does science fit? (*Small group discussion notes*)

Small groups started their conversations with the following questions:

- *What is the most surprising idea or information you heard about how, when and where science fits into the (i) policy context, (ii) industry context, and (iii) ENGO context?*
- *What did you notice about the planning frameworks as you think about forest bioenergy?*

Group 1

- It is necessary to clarify all the questions we may come across and people should find where and to which level the researches move forward, and establish confidence to do so
- We should take the cost and money into careful consideration; all the money should be used in the best ways
- Be aware of public concerns and the market
- Criteria and indicators are also very important
- All the variables of the forests should be taken into account for future predication
- Link energy to environment
- The whole manufacture process for the bioenergy
- Evaluation of the products value
- Long-term impacts it will bring
- Biomass will convert to cheap energy; Should take into account: CO_2 taxes, space

Group 2

- There is an information gap regarding how much we can harvest from the forest, in a way the figures necessary to define the “ecosystem threshold”
- In the bio-fiber policy not much emphasis for “sustainability”
- Sustainability can costly with the existing information regarding forest management practices when we look at intense forest management
- “Bio-refinery” concept is an innovative step for the diversification of products from renewable natural resources like biomass
- We are missing or not compiled information from the past forest management practices (literature), that may be helpful to take a better decision
- It is clear interest difference between industry and environmentalist; industry is looking for using the available resources from the forest (how much is available has to be decided by the environmentalist to guard the sustainability); in a way, industry is looking forward for an “action”; environmentalists are lagging behind to make a good decision, because of the information gap

Group 3

Context

- Ecological and Social Context: To harvest biological resources sustainably, it is first necessary to understand what “sustainability” means in an ecological context
- Harvesting of biomass has a unique socio-ecological context

- Consistency: it will help to sensitize industry, governments and NGOs to the critical policy issues that surround industrial raw material sources and sustainable uses of forest resources
- Bioenergy stretch - new action: should have draft strategy which presents sector-based action plans; Continue to promote and encourage bioenergy in the wood processing
- Integrate regulations by law: Integration of field level harvesting (operation), ecology, and economics
- Huge gaps between the policy and the public views
- Guideline for the biomass context: don't integrate biomass into the field level

Planning frameworks

- Legislation - bioenergy
- Integration: adopt the old regulations into the new bioterms
- Public has different views and perspectives (eco-perspective and social perspective) Public concerns: slow process, expensive (should do the case study)
- Biomass will convert to cheap energy; should take into account: CO_2 taxes, space, landownership, transportation cost, markets
- Competition between each country - concern about sharing information

Group 4[4]

- Pre thinning is practiced more lately; In Finland subsidy is given for doing pre-thinning operation
- Feasibility and economics of pre-thinning should be studied further
- Certification sometimes causes not enough room for flexible operations

Group 5

- Transportation subsidy? Surprised
- Amount of slash left 30-50/ha
- Bioenergy is OK, but in the range of bioproducts (biodiversity, long-term economic feasibility)
- Long-term impacts - policy now, science to follow
- Site types - how fine to "aid" not handle FMP
- Climate change
- We are talking about manageable systems
- Change is not necessarily negative,
- How do we get functional changes?
- Specialists *vs*. generalists: is there redundant functionality?
- Forest biomaterial is a small part of bioenergy (10%)
- Biofiber policy is not just for promoting the production of biorefinery
- Long-term impact on our ecosystem

Group 6

- Crown *vs.* private ownership – different scales, different potential for influence
  - In New Brunswick, Irving actively involved in whole tree chipping for energy for cogeneration at mills

[4] Conversation digressed, as this was the first discussion session of the workshop, and participants were not yet familiar with the format.

  - Policy developed in New Brunswick has no influence on Irving operations
- In US, different regional, state, and private landholders
  - Few states have biomass policies and guidelines
- In general, a policy vacuum exists – no harvesting guidelines, incentives, *etc*., although there exists a smattering of small initiatives
  - Maritime Bioenergy Working Group developed their own guidelines for small holders
- Currently driven by Europe rather than domestic guidelines and markets
- Discussing Adaptive Forest Management, was mentioned that science has a role in initial inputs to planning, but must be followed ecosystem-specific monitoring and evaluations at the landscape level
  - Current assumption that stand-level plans will achieve landscape goals

Group 7

Context

- While demand for bioenergy will rapidly rise, there is no mention as yet of scale and cost/volume
  - *E.g*., no talk as yet of hard figures for cost of CO_2 and/or carbon tax
- Looking at fuel costs alone, coal is the best option; yet as social and environmental pressures increase, bioenergy will likely rise in importance, but hard costs need to be evaluated
- Bioenergy touches on so may different disciplines that it may be too complicated to approach through just one framework
  - *E.g*., are the limits to the success of bioenergy political, economic, environmental, or are we proceeding down a path with no sustainable end and no means by which to evaluate that choice of path?
- Is biomass harvesting going to compete with forestry resources due to an increased demand as bioenergy plants come on line in Canada? If so, what is the best course of action for the sustainable use of this resource?
- Logistically, where are we talking about locating the plants for manufacturing bioenergy? Transportation is a huge cost in the system and some report that after 82 km, the economic benefits of bioenergy disappear

Planning frameworks

- A cap and trade system will be a major player in defining the course of bioenergy development
- Economics taking over silviculture flies directly in the face of ecosystem management
  - *I.e*., what you leave is as important as what you take from a system
- Need for clarification on definition of ‘sustainable’
  - Ethanol from corn with subsidies in US seen as economically sustainable yet without subsidies, not economically sustainable, and looking at it ecologically also not sustainable

Group 8

Policy context

- Alberta reliance on coal, compared to Ontario moving away from coal
- Policies need to be developed right now as technologies are developed
- Lack of mention of geothermal
- Things are developed ad hoc, but is it the most practical (lack of talk about feasibility)
- Science takes a long time, and need for built-in communication loop for continuing to upgrade policies as new science comes up

- The rush into this — need for precaution
- Context in relation to other forms of energy alternatives
- What indicators for sustainability — lessons from agriculture/from nordic countries

Industry context
- Where does geothermal fit in?
- New technologies move fast ahead of regulation, as proponents push things forward... but there needs to be a research focus, more knowledge
- There are biorefineries built already in the US, but not much broad discussions prior, so good to have this discussion right now
- Rush — rejected 30 years ago for stump harvesting

ENGO context
- Issues about site productivity of full tree harvesting and stump harvesting
- Lack of talk about dead wood and its management
- Current levels of harvesting devastating to biodiversity already, so additional pressure from biomass harvesting; slash is not completely waste, burning mimics natural processes of nutrient release
- Lessons from nordic countries from species loss as a result of long-term biomass harvesting
- Nutrient budget?

About the planning frameworks and other points
- Progress of regional development
- Sharing of information? *e.g.*, encyclopedia of southern bioenergy
- Knowledge exchange between all involved parties, not just technology transfers

Group 9

- More policy framework needed in ON
  - Energy policy needs to look at the opportunities and consider alternative energy sources
- Could a bioenergy system be built around the Great Lakes - creates shipping opportunities that would be cheaper than road transportation
  - Is there a way to achieve this sustainably?
- Some industries (steel, cement) have already considered bioenergy
- Scandinavia started their energy supply in the forest industry and then shifted to district heating sources; this forced the industries to be more efficient and then sell electricity to the grid
- Ownership of the residue: who has it?
  - We need policy, but will this cause us to revisit the tenure system?
- Is it possible for us to hook up to the grid? Is it economically viable?
  - If this is too difficult is there a role that policy could play
- The closest to the biomass are already those who have a surplus of energy
- Is government set up in a way to make a decision across the sectors?
- Should we be hearing from the energy sector rather than the forestry sector?
- Separate sectors within the government need to work together
- What is the best optimum use of biomass?
  - Heat and power? Multiple use?
- ON Power Generation: needs to consider a broader suite for energy
- Jointed teamwork and representation going to power generators
  - Is the right representation at the conference?

- Policy will impact multiple jurisdictions and we need to have the representation
- Climate impacts on forest ecosystems?
  - How will this impact the energy sector?
- Bioenergy *vs*. climate change
- Root systems are being included in the estimates?
- Removing stumps
  - Perforates the forest floor
  - How does this impact soil C?
  - Disturbances increases mineralization
  - More research is needed before decisions are made
  - In any way is this emulating a natural disturbance that it could be compared with?

Group 10

Policy context

- Right now in Canada the technologies have been developed but there is a capital deficit with which to start up experimental plants

Industry context

- What is the bioenergy return?
  - Difficult to quantify as it depends on the fuel type and the technology used (cellulosic ethanol, gasifiers, *etc*.)
  - Power plants are beginning to run on bioenergy, so we will know the answer in one or two years
  - It's a 10:1 return for fuel oil in Finland
- Determining plant location is a big issue as we can not transport biomass far
- How do you select items to monitor? There is not enough money to monitor everything, everywhere. Monitoring is a hidden cost. As an industry it is a tough decision – do you satisfy environmental/social concerns or focus on the operational/management side with your limited funds?

Environment and ENGO context

- We have only addresses one side of the coin and neglected discussion on the consequences
- We must engage the public to identiy their concerns
- The ENGO presentation consisted of a large number of questions; ENGOs represent stakeholders so this must reflect the public's stance on this subject – they have many questions!
- Previous energy sources such as coal and ethanol did not produce negative consequences until it was used on a larger scale; we must consider the consequences of 'scaling-up' bioenergy use

Other Questions

- What is the push for bioenergy? Is it a societal push (ENGOs), an economic push (the material is on the ground anyways lets use it) or an energy crunch push (we need alternate fuel sources)?
  - In the EU it is an economic push as there is a tax on fossil fuels but none on bioenergy
  - In America it is the energy crunch driving it as they are determined to decrease oil consumption

Group 11

Context

Wood for energy

- Life cycle of biomass should be handled and analyzed carefully
- Some concerns about ecological security for biomass harvesting
- Need integrated planning

From the monitoring point of view

- How much do we need,
- What kind of monitoring is needed most
- The guideline should be practical

Where does bioenergy fit in the whole energy pool

- Not sure if biomass is the best for energy production
- Currently the harvesting system seems feasible for energy deficit province, like Ontario; for energy rich province like Saskatchewan, biofuel is just a small component
- However, there are lots of interest from biorefinery development in Saskatchewan
- Besides economic perspectives, concerns on climate change greatly encourage the use of biofuel

From evaluation perspectives

- Best end use of wood
- Allocate to optimize economic values of wood
- With the bottom line of social, economical and environmental sustainability
- Hope there would be more aboriginal involvement in the biomass harvesting system

Appendix C. Site Productivity in Canada (*Small group discussion notes*)

Small groups started their conversations on what we know and do not know from site productivity research in Canada with the following two questions:

- *What additional issues are there regarding site productivity?*
- *What stood out for you in the presentation? What new perspectives do you have?*

Group 1

- Even aged site management including removing poor quality wood, improved thinning and pre commercial thinning should be practiced
- Thinning should be done when the moisture content is low in trees
- Carbon taxing, look for alternatives like wind /solar
- Make biomass a local energy source
- More research needed on chemistry/cat ion exchange
- New perspective on policy, decision, right practices on system ecology system productivity
- Ash cycling
- Apprehension on adopting Scandinavian systems in Canada because of dissimilarities
- Short distances transportation for bringing down the cost and using the resources locally

Group 2

- Landscape content: landscape scale
- Developing tools to estimate site index and models that predict height growth of site trees
- Full land effective
- Characterizing the different biomass loss% and biomass waste%
- Winter harvesting *vs*. summer harvesting - the effect to the site productivity: keep the nutrient, low ash content, dry field
- Whole tree harvesting - slash: very expensive, should increase the wood value
- Comparison stumpage harvesting: Europe *vs*. North America; residues *vs*. stumpage harvesting
- Study the texture of soils: best is medium texture soils, soil drainage, physical properties of the moisture content of soils, the capacity of holding/keeping the moisture of soil
- Nutrient demand (up to 30 years) - the land demand, put back the nutrient to the land
- Decomposing - long-term experimental design
- Sensitivity-monitoring system
- Predictive ecosystem mapping

Group 3

Additional issues

- Hope there would be more aboriginal involvement in the biomass harvesting system
- Losses of carbon, *etc*., associated with different harvesting regimes besides clear cutting

- Relative changes *vs*. absolute amounts; also relative to what — other elements or the whole picture
- Species compositions
- What about resilience and resistance to diseases/insects — heterotrophic pyramid and its contribution to the energy web
- What's below ground — carbon pathways, *etc*., related to carbon sequestration
- What's the sources of removed biomass
- Losses over multiple rotations will be more severe
- Why is carbon not treated as a nutrient — tied to nitrogen/tractability

What stood out

- Limitations of models — applicability in different locales
- Difficulties in doing the research; specificity/heterogeneity
- Processes of nutrient circulation — natural disturbances
- Faced with urgency, but also need for long-term projects — full-/second-rotations — retrospective analysis important
- Depths of knowledge not adequately addressed
- Interesting and useful models
- What's the acceptable levels of losses

New perspectives

- We need to communicate across different disciplines — what science is being done and the need as other actors see for additional research
- Do sites need to be left alone after a few rotations for recovery?

Group 4

- Other productivity impacts:
  - Fire, conventional harvesting techniques, silviculture: harvesting is only one productivity factor
- Nutrients: liming has not increased productivity, despite Ca and Mg depletion noted in soil studies and models
  - Cannot connect observed effects with nutrient balance; example was given of reforestation on highly degraded soils in Oak Ridges Moraine (Ontario) that nutrient models would not see possible
  - Tree species must be considered as certain trees will have different responses to nutrient levels
  - Fertilization used extensively in Sweden in 1980s, re-emergence at present, ash deposition debated
- Data availability:
  - Nutrient balance data from 1960s and 1970s when whole tree harvesting was debated
  - Focus on yields
  - Potential to mine existing unpublished data from these studies
- Soil criteria (*i.e.*, determining low or high risk for whole tree harvesting): it is difficult to interpret numerical data

Group 5

- What is the specific value for evaluating forest soil?
- Scale of the land nutrient for productivity
- Species, nutrient, water holding capacities, species migrate

- Continue retain the slash
- Long-term experiments
- Deer population going to the north

Group 6

Additional issues regarding site productivity

- Role of fire on landscape and how this might mimic the nutrient pattern seen in research plots
- Soil is a major factor in site productivity, but this should not be exclusively studied to the detriment of research on wildlife, fire, social & economic sustainability, *etc*.
  - Possible role of climate in site productivity & soils
  - Link between disturbance, soils, and growth unknown
  - Link between only disturbance and growth unknown
- Public perception is a major factor that must be considered in this debate
- Diversity of forest uses is perhaps what we should be managing for, since public wants and needs change much faster than stand turnover

Group 7

- Data for the long-term effects of calcium and magnesium (base cations) removal as a result of full tree harvesting should be monitored
- Calcium is an essential part of the middle lamella of the cell in the form of calcium pectate and magnesium is part of the chlorophyll; newly formed tissue will be having more middle lamella; so the depletion of calcium and magnesium from the soil can be reduced by leaving the leaves rather than removing the whole residue
- Soil amelioration using ash to replenish calcium and magnesium should be studied on experimental basis
- Biomass removal should be with within the limits of natural disturbance
- Chemically replenishing the cation removal will be costly and difficult
- Indicators for ecosystem disturbance should be studied, very less information is available

Group 8

- Do we do more damage to the trees and site productivity with these multiple entries? (via compaction, erosion, *etc*., all of which can decrease tree growth)
- The situation is complex – in areas with sandy soil, compaction will increase tree growth, and in other soil types it will decrease tree growth
- We would have liked more talk about hardwoods
- Also missing was discussion over the size of things removed; we spoke of stems and other broad categories but there are differences in the size of crowns, stems, *etc*., that should be discussed

Group 9

- Observe the dynamic changes of the whole forests (species, natural disturbance)
- How to characterize the nutrients, carbon, nitrogen as well as fire
- Landscape and land use
- Clarify the structure of the whole forestry
- Model modification

- Criteria for evaluation
- Turn so called waste and damages into value
- Trials: how to design more reasonably, take all the factors into consideration and the responses, multiply indicators?
- Efficiency of the harvesting system
- Shift the application of biomass
- Full-tree application
- Funding for long-term researches

Group 10

- Little work but we are fortunate to have some long-term study sites
  - we still don't have all the information on what the findings are
- Calcium is a limiting nutrient
  - Why is there so much calcium in the trees?
  - How much is available in the soil and how will it impact growth
- We need to understand waht is going on and what the system really needs
  - Should we be measuring what is in the soil?
- We need a guidance document that discusses specific sites and the amount that could be removed
- Should work just be built on work in the past?
- Can we use agricultural models for nutrient cycling?
  - Differences with forest land
  - But do we have the opportunity to still get some answers from this sector?
- What are the rules for fertilization in Canada? ON?
- There is a need to collaborate within the nation and coordinate
  - Measuring things in different ways with different protocols
  - Where is the consistency?
- Should we be considering the changes in the micorrhizal community and how they are impacted?
- Are we focusing too much on studying the amounts without knowing the roles?
- Are we going to lose focus by avoiding certain sites?
- Where are the markets?
- Economics may end up dictating where harvesting takes place not necessarily productivity

Group 11

- Managed forest disturbances: is there any research on the impact of biodiversity removal on carbon in soils? For example, the soil capacity for carbon sequestration seems increased after forest fire
- C&I: is it possible to integrate the current FSC system into the monitoring of nutrition cycle? Since many forests in Canada are already certified under FSC system
- Many factors affects the biomass productivity (*e.g.*, species, site issues)
- Sensitivity maps:
  - What are the criteria?
  - Implications
- Also talk about the Nordic experience: commercial plantation of willow for energy use, but seems this experience is not very successful, since willow contains too much silicon.

Appendix D. Biodiversity Lessons from Canada (*Small group discussion notes*)

Small groups started their conversations on what we know and do not know from biodiversity research in Canada with the following questions:

- *What additional issues are there regarding site productivity?*
- *What stood out for you in the presentation? What new perspectives do you have?*

Group 1

- How does fine woody debris contribute to biodiversity?
- How do we take this information and translate it to guidelines
  - Especially given that there will always be gaps in knowledge
  - Will findings help to drive the policy process?
- Is leaving the forest floor intact good enough for the guidelines?
- There is longer term research for site productivity
- Is there a potential linkage between biodiversity and site productivity? Should we be treating them as separate entities?
- Is it necessary to form a gap analysis to see where research is needed in terms of productivity and biodiversity?
- When will the guidelines be developed? Only after all the research has been done?
- Do we have the right people who can come together and come up with the guidelines?
- How can we use the information to decide what to extract and what needs to remain?
- Do we just focus on plantations for energy?
- If we choose to subsidize the industry here how will it impact energy sources and demand in other countries?
- Can we just separate biodiversity
  - A need to integrate and approach
- If the current guidelines are not adequate, then how can we make new ones?

Group 2

Additional issues regarding biodiversity

- Zoning land is tricky. For example Quebec wants to use fertile plots for intensive forestry yet these areas are rich with biodiversity. So how do you decide on zoning land uses?
- What can we do with unfertile lands? Local communities in Quebec were surveyed and asked if they wanted a plantation on their degraded land and the overwhelming answer was no due to the majority being against chemical use of any kind.
- We can never do industrial forest extensively
- 40% of biomass is below ground but we do not want to harvest it as it will be too ecologically damaging
- Are people looking at the present guidelines?
- Upfront differences in biodiversity, soil chemistry, *etc*., disappear over longer time scales. Are we considering the scale of one harvest rotation in all these studies?
- We might need to incorporate larger riparian buffers and other such measures if we chose to take more material from the forest

What stood out for you in the presentation?

- Too many ‘unknowns’ regarding biodiversity
- There was nothing positive about biodiversity in connection with bioenergy

Group 3

- Species before and after harvest
- Relationships between the impacts and species
- Major land biodiversity, other parts conservation management
- Ecosystem management
- Standards (different places, different conditions)
- Long-term soil productivity - Agricultural soil mapping
- Create a baseline - unmanaged forest/unmanaged wood (choose the species)
- Soil biodiversity - always changing - difficult to set up a baseline

Group 4

- Long-term studies required
- In Nordic countries the practices were continued for 30 years and the real results are coming out recently
- Should the policy making driven by industrialists or scientists
- Refocus to biomass farming
- Accurate definition for biomass
- Accurately defined guidelines
- Some times guidelines should be representing local requirements needed
- Operational level on harvesting biomass can be depend on resources and geographic location and need for the energy locally
- We should focus on areas where data and facts are missing than formulating more policies

Group 5

- Landscape content
- Special distribution of biodiversity
- Gaps between the biodiversity and site productivity
- For case study, should create a baseline - unmanaged forest/unmanaged wood (choose the species)
- Soil biodiversity - always changing-difficult to set up a baseline
- Long-term soil productivity - Agricultural soil mapping
- No research funding - getting very expensive
- Biomass - forestry management (biodiversity (low risks))

Group 6

- Ecosystem disturbance as a result of harvesting should be studied on a space and time scale rather than looking at small scale, most of the data we have is based on site or local scale not on landscape basis
- There is always going to be an effect on biodiversity as a result of intensive forest management; so the key is to going for the harvest with the demand (to start with removing the residues) as well as to account the expected biodiversity in the management strategies; in another way there should be a “balance”
- The caution we have to address is not doing a mistake out of “ignorance”

- Adaptive management should be a way to go for intense forest management situation

Group 7

Additional issues regarding biodiversity

- No mention of climate change
- Biodiversity section had no mention of aquatic/terrestrial interaction zones (shorelines, riparian areas, *etc*.)

What stood out for you in the presentation? What new perspectives do you have?

- Studies in Quebec appear to be more comprehensive and collaborative than those in other provinces

Group 8

- Data availability:
  - Previously gathered, unpublished data potentially available for data mining
- Relation between residue collection and impact on biodiversity
  - Biofuel harvest to remove fuels for forest fire, seen as waste material, harvest of unmerchantable species
  - All harvesting methods have biodiversity impacts, societal choice as to what will be allowed
  - Forest management planning to ensure certain forest structure to support biodiversity
    - Deviation increases risk of reducing biodiversity, again is a societal choice how far one wants to deviate from ecosystem optimal

Group 9

- How much function of biodiversity is on whole ecosystem
- Can not prove it
- Not necessarily negative
- Functional group balancing, removable and non removable
- More DNA gene, more species, more flexibility
- Biodiversity *vs*. productivity

Group 10

- Can we use existing research to get some measures to help us understand biodiversity under biomass harvesting?
- However, in this session, no point on the impact of biomass removal to biodiversity
- Impacts on humans, especially the aboriginal people's life, seems to be ignored among those researches
- No research to compare the natural disturbance and man-made invasions
- Researchers should also think more about markets
- Research networks are important for
  - Baseline data
  - Sources of information

Appendix E. Site productivity lessons from elsewhere (*Small group discussion notes*)

Small groups started their conversations on what we can learn from other countries with the following questions:

- *What else can you share that's happening in jurisdictions besides the USA and Nordic countries?*
- *What have you heard (concepts, approaches, scientific practices) that applies to Canada, and that doesn't apply to Canada?*
- *What additional issues are there related to site productivity?*
- *What interaction/linkages do you see between site productivity and biodiversity?*

Group 1

- Questioned cost-effectiveness of ash spreading in Canadian context
- Response to nutrient conditions or soil indicators is highly site-specific
  - Must separate sustainable soils and sustainable forest production to see what is actually occurring in forests
- Complexity of plant nutrition
  - Interaction of nutrients?
  - Limiting nutrient situation or stoichiometric ratio balance?
  - Short-term or long-term impact time-line
- Influence of biodiversity
  - Role of species in nutrient cycle
  - Impact on those species creates impact on site productivity, feedback between the two
  - Rock-eating fungi are a great example of where input/output nutrient analysis has shortcomings
- In general, studies are unable to definitively link soil quality and site productivity

Group 2

- Biodiversity related research
- Short-term measurement, get short-term effect, may not reliable
  - It can not predict long-term result
  - Later maybe a disaster
- Rotation age, what the effect of rotation
- Nutrients
  - Magnesium degree not mentioned
  - Soil chemistry a lot attention, bio and micro organisms less attention
- Impact is a time factor
- Soil temperature another factor

Group 3

Applications in Canada

- Wood ash to the forest is a huge cost due to transportation, yet the use of palletized or granulated ash for fertilizer is quite effective

- Why not re-introduce fire at the stand itself through prescribed burns of whatever slash is left after biomass harvesting?

Group 4

- Ashing is a good soil amelioration technique but dispersion in the field is going to be difficult as it is light; but pelletising ash along with other fertilizer can make the job easy
- Site productivity is an issue, so we shouldn't push to a situation were we have to replenish
- In boreal forest the ashing may not be a good practice compared with the Nordic country practices
- Most of the Swedish forest is certified and most of the companies doing harvesting have their own guidelines

Group 5

Applications in Canada

- Research on nutrient budgets for forests
- Some data on nutrient budgets already but now used for different purposes
- Experiments on liming and ashes

Additional issues

- Spatially explicit information needed on nutrient budgets
- Changes over time
- Forest managers want/need to get information at a finer scale, while experiments might be occurring at a larger scale, less location specific

Interaction/linkages between site productivity and biodiversity

- Invasive species — fertilizers effects or whole-tree harvesting, *e.g.*, trees, shrubs in regeneration
- But are there seed banks for invasive species and other species, especially in the boreal forests?

Group 6

Lessons beyond thee USA and Nordic countries

- New Zealand: 95% wood harvesting in plantation forests, Utilisation of the plantation forests began in the 1940s and began making a significant contribution to New Zealand's timber needs; Renewable, cheap forests, market (economic issue)

Applications in Canada

- Certification system: Certified soils, adaptation Nova Scotia acid soil certification system;
- Putting wood ash doesn't apply to Canada and putting ash is not economic
- Putting paper mill slash into soils?
- Energy crops: in New Zealand, Sweden, in Ontario and Saskatchewan (small portion)
- Old tree harvesting: Stumpage, full tree (cheapest in NS; for the mills in QC), stem cut
- Natural forest field: Young plantation *vs.* 20-30 years plantation

Additional issues

- Site compaction: compaction of soils

Interaction/linkages between site productivity and biodiversity

- Biodiversity *vs*. Site productivity: What do to and how to do it?

Group 7

- Forest gradient
- The cycle of dead wood
- How to find a shrift
- Slash removal
- Special distribution of biodiversity
- Soil maps
- Energy crops: in New Zealand, Sweden, in Ontario and Saskatchewan (small portion)
- Old tree harvesting: Stumpage, full tree (cheapest in NS; for the mills in QC), stem cut

Group 8

- Certification soil system
- Increasing diversity is not always good
- Single tree selection
- Patterns and criteria
- Understand of changing energy market
- Key drivers, how the system works
- Dynamic characterization of ecosystems
- Interaction of nutrients and other factors
- Balance of biodiversity and site productivity
- Transportation is a big issue in North America

Group 9

- No nitrogen in fertilizer but then add along with it a fertilizer
- How does nitrogen fertilizer impact or hamper micorrhizal
- Need ash to counter the acidifying effect of forest harvesting
- Forestry should not acidify: this is a measure of sustainability
- Nitrogen needed on poor sites but ash is not needed
- Will we start to see the responses of site productivity with time?
- Guidelines are present in Sweden for nitrogen input
  - US does not have guidelines because federal legislation will not impact states because of states rights
  - There are volunteer guidelines and best management practices
- Recycle ash for biodiversity and water quality issues
- What is the nature of the stands that are harvested?
  - Is there an opportunity to use multiple species as a way to combat productivity losses?
- Sweden uses planting as a method of regeneration bu also use natural regeneration
- US bioenergy:
  - High hardwood components in forests mixed with unmerchantable wood, therefore have the opportunity to use residual hardwood, but because hardwoods are so nutrient rich when they are removed a large portion of the nutrients are removed along with them, a significant loss of phosphorous; the portion of nutrients removed is greater

Group 10

Site Productivity and Biodiversity Lessons from Elsewhere

Applications in Canada

- Will Canada go in the direction of the Nordic countries? We should not in terms of biodiversity and the amount of available CWD in forests
- Site productivity is not static; it changes over time. For example, we know in Sweden that the climate will get wetter and this will change the productivity of our sites. This type of long-term thinking must be applied to Canada as well.
- We need long-term study sites (20, 30, 40 years) because we only have around 15 year sites
- We would like to replicate the Nordic studies which look at the latitudinal gradient of site characteristics within a country
- In Sweden the application of wood ash is the responsibility of the woodlot owner; the ash is primarily returned to sites from where it came but it can also be taken to apply on watersheds suffering from acidification, as this is more important
- Regarding ash, there will be an EU handbook coming out with much relevant information; see website http://www.recash.info/events.asp?lang=en or Google "Recash"
- Whole tree harvesting is often encouraged on sites that are acidified as this removes nitrates from the system
- Can we increase productivity of trees for energy instead of resorting to stump removal? Also consider that if we do things correctly now we will not have to waste money on fertilizer and other inputs to sites in the future
- Within sites can we grow different trees for different purposes, *i.e.*, some for pulp and paper and others for biomass?

Guideline Development

- Protected areas in Canada unlike in several other countries are not established based on biodiversity needs in the landscape level. In British Columbia, landscape level management is in the hands of the industry. What guidelines and incentives can we provide industry?
- We need different guidelines beyond forest management and harvesting – we need ones specific to biomass harvesting

Additional Issues

- There are many links between site productivity and biodiversity: make sure not to consider all biomass (*i.e.*, snags and stumps and branches) as the same. For example, a tree that dies of lightning will have different insect and fungus species on it than one that dies from harvesting procedure.
- Does the unseen biodiversity have unseen consequences at the landscape level? So even when we can not document stuff (like the effect of salamanders) they have an effect.
- Quebec: we moved towards Ecosystem Management and we have zonation for more intensive use but we focus on keeping CWD
- If we start using helicopters to supply ash or other nutrients to wooded sites, we are no longer being carbon neutral
- We are content with what was said this morning
- Does it make sense in the long run to use biomass? Many people are unsure about biomass as a fuel source

Group 11

Questions on C&I

- Is it reasonable to use productivity as an indicator, since productivity is sensitive to species
- Species conversion can make production loss
- Soils are different in North and South Ontario, and forest in South are more productive
- Therefore, mapping site species should consider both site specific and species specific

Soil nutrition mechanism

- Need some clarifications about chemistry dynamics in the soil
- Base situation need to be considerate, for example, can we identify the gradients of soil in Ontario
- Chemicals in soil is highly responsible to management impact, make sure we understand what is important for the whole system
- A problem: lack of soil maps in Ontario, since currently most of the maps are for agricultural use

Appendix F: Biodiversity Lessons from Elsewhere (*Small group discussion notes*)

Small groups started their conversations on what we can learn from other countries with the following questions:

- *What else can you share that's happening in jurisdictions besides the USA and Nordic countries?*
- *What have you heard (concepts, approaches, scientific practices) that applies to Canada, and that doesn't apply to Canada?*
- *What additional issues are there related to biodiversity?*
- *What interaction/linkages do you see between site productivity and biodiversity?*

Group 1

- Stumps harvested in the US and used for kindling because of they are highly resinous
- Slash isn't a part of the natural forest?
  - Natural: it contributes to development of the forest floor
  - Should we be looking in the slash for organisms or focusing on the forest floor?
- Need to look at this throughout the whole rotation because one large pulse may not make a difference
- Reduction in the number of species overall with biomass removal
- Too much slash= not suitable for planting sites or may hinder reproductive forest land, therefore it is advantageous to remove some
- Slash is useful in helping to protect some regenerating plants because it provides a natural barrier for browsers
- Slash piles hold a host of unique organisms: not a lot of light or nutrients, a place for nitrification; too strong to prevent anything from growing
- Are the controls accurate?
  - Materials are actually redistributed so this does not mimic an operational study
  - How would comparing it with an operational study change the results?
- In Sweden is there a normal or historical forest that we are comparing with? What organisms are represented here and how do they differ from second growth forests?
- Sweden overall has less diversity because of the ice age
- Should we be focusing on patchiness of tree slash rather than having a fixed percentage of slash retained across the whole landscape?
- Will intensification of biomass removal impact the forest floor?
- Need to start thinking across the gradient of management intensity, and not just the removal of this material from a natural forest setting

Group 2

- Get rid of roots
- Transportation is a big issue in North America; in northern Ontario, roads are frozen in the winter
- In Nordic countries: good transportation system, between sites to the road is less than 1 km, good road distribution, good networking
- Development of technology applies to the small scale
- Should copy from Nordic countries for geothermal energy
- Need to define biomass: biofibre, herbs, branches, the whole tree? - definition

- Biodiversity: species, habituating, impact…Researchers are doing their own things, more from the observation side, we need to know causing effect

Applications in Canada and Additional Issues

- Biomass harvesting has a huge impact on biodiversity; what should we be doing?
- Should study harvesting for the bioenergy alone in NS
- Convert land - agriculture crops (urbanization) to forest; moving agriculture land to forest land and back forth
- Guidelines: trails forest management intensity - critical issue: to get government researcher's commitment

Interaction/linkages between site productivity and biodiversity

- Policy development: pre-harvesting issue; regulation to protect the harvesting (no clean cut)
- SK is similar like ON, review other province's regulation
- Bio-harvesting: Carbon

Group 3

- Time-line of impact: short-term or long-term?
- Swedish experience may be specific for their situation
  - Historically, higher level of disturbance in forests
  - This has selected hardy species that can rejuvenate after disturbance
  - In Canada, this may not be the case for many species
- Must consider different types of biomass: *i.e.*, slash *vs*. stumps *vs*. deadwood
- Different forest structures will elicit different biodiversity responses
  - Limited coarse woody debris in Sweden, substantial volume in Canadian boreal stands
- Biomass retrieval is a question of how to do so sustainably
  - Is impact as big as scale of harvesting?
  - Harvest of non-merchantable species creates pressures on policies requiring living trees to be left after harvest
  - Frequency of disturbance with shorter rotation to meet energy needs
  - Harvest methods and changes in economics may have significant biodiversity impacts

Group 4

Applications in Canada

- Scandinavia is in its third and fourth rotation of operational harvesting on many sites, therefore whatever damage might be caused by clear cutting & biomass harvesting has probably already occurred long ago and does not show up in current studies
- Biomass harvesting opens the opportunity for better silvicultural practices such as OSB, veneer logs, and now slash all has a value; this further opens the door to a range of silvicultural opportunities at a given site and eliminates the need for high-grading

Additional Issues

- Guidelines for biodiversity and CWD have changed substantially as they are largely driven by policy decisions
- Regarding effects on biodiversity, removal of biomass as slash is of minimal impact compared to the damage already incurred through clearcutting

- Efficacy of certification schemes for bioenergy and biodiversity, while checklists work well for those in the field, difficulties exist for applying biodiversity indicators across a wide range of forest types

Group 5

- Disturbance to biodiversity
- Energy plant
- Guidelines for fuel wood reduction
  - Reduce the density of certain areas
  - Average 6m3 targeted wood debris (Sweden) is too low
  - 40% biomass after harvesting, vary upon species
- No guidelines on how much should maintain for landscape and species
- Ecological reaction - guideline for wood debris and biodiversity, nutrient perspective
- Put more emphasis on energy wood debris
- Insects transfer in a few ways
- Guidelines for private and crown land in Canada available
- Monitor in cut unit level
- Multi-layer monitor
  - Objectives of certain amount of habitats (than population)
  - Work with research project; make sure the result of treatments is related to animals studies
- Management plan creation

Group 6

Other jurisdictions

- NZ: plantations in many places and a small trunk of natural forests; just a small patch of natural forests managed with strict guidelines; compared to canada, where plantations are just coming on line now as we are just going into the second rotation; gradient important? - *e.g.*, from urban to agriculture to plantation to natural forests

What applies in Canada

- Scale is important
- Economics: money driver
- Needs to catch up on basic biology/ecology — knowledge about species, *etc*.

What doesn't apply to Canada

- Deforestation from a long time ago, little natural/old forest, so context is very different and the lessons must be viewed with this in mind
- Depends on the land management regimes in different locations
- Does Anders Dahlgren mean that biodiversity or slash removal was a minor conservation issue?

Additional issues

- Does reforestation from agriculture always benefit biodiversity? Context-dependent and species-specific
- Different policies and institutions across jurisdictions even within a country — connectivity

- Lack of communications in terms of goals in biomass harvesting, *e.g.*, the source — from slash/waste or other sources, and the intensity of the harvesting; or the scope of the practice
- To make it economically viable, the amount may need to be high
- We know some things very well (*e.g.*, retention level needed to maintain biodiversity) but how feasible is this given political and economic considerations
- Connectivity between protected zones and surrounding areas
- We are undergoing continuous paradigm shifts
- Integrated policy is important in terms of biodiversity

Group 7

- The driving force in other countries (Sweden) is the economics; but in Canada it may not be the same
- CWD is necessary for biodiversity and FWD is necessary for site productivity, so need to keep the required in the floor even if we are going for residue removal
- Stump removal is still not a wide practice in Nordic countries except in Finland
- There is going to be an effect in diversity so we should prioritise accordance with current knowledge rather than saying “No” to the harvest

Group 8

- Do not assume unseen changes have no effect on diversity
- In Canada nothing have changed much, it conflicts with biomass removal and bio diversity
- Specific crops like mono culture or fuel crops can affect biodiversity worse
- Should think in the direction of how increased productivity affect biodiversity
- Policy makers should give higher priority to biodiversity than productivity
- CWD(Coarse wood debris) should be left behind to support biodiversity and FWD should be taken away
- Afforestation and reforestation to support biodiversity of degraded lands
- Mixed species for biodiversity and biomass according to requirement

Group 9

Some confusion regarding Bengt Olsson’s presentation:

- Are they (Swedish) using low-value wood for energy? If they do, then there is not much impact on biodiversity since in the managed forest system, not much decayed wood, fungi, *etc*., exist
- If not, how could they achieve the environmental target?
- Need to categorize the managed forest system and natural system
- Management techniques are critical for biodiversity issue: case in Finland

Also some questions on energy plantation raised by Suzanne Wetzel; Tat Smith said that in North America most energy plantations are on agricultural land.

Canada *vs.* Nordic

- Forest management is more extensively in Canada
- Bio-system in even-aged and uneven-aged forest react differently to biomass removal, therefore should be differentiated
- In Sweden, more specific targets regarding management

Landscape issues

- Firstly should consider preference between habitat use or energy use
- Conservation values should also be evaluated beforehand
- Need guidelines for species-site matching

Appendix G. Guideline development (*Small group discussion notes*)

Participants answered three questions[5]:

- *What contextual factors are you noticing that influence the development of guidelines? (e.g., political, roles of players, land tenure, state of bioenergy use, scale (spatial, temporal))*
- *What can we learn from the policy frameworks we've heard from elsewhere and apply them to Canada?*
- *What recommendations would you offer for the development of guidelines?*

Group 1

Guideline Development

- Some similarity to Europe
- Policy different in different country
- Canada did not sign Kyoto protocol
- Increasing dollar, economy is losing
- Policy developed from tradition, suite for each steps of development, good for Canada
- European country policy develop from facts
- 35 policies in 3 themes
- Result based guideline
- Political and market based system change to tenure system
- Look from the forestry perspective, access bioenergy
- Opportunities for more value added products
- Value added process, market decide
- Other industry is booming, forestry industry are dying out
- Look into long-term tenure
- Different model, new kind of system
  - Tenure, *etc.*, integrated
  - A deal between government and land owner
  - Temporary license, *e.g.*, non-renewable forest licence
  - Go to nontimber forest product
  - Some flexible way

Group 2

Guideline Development

Contextual factors that influence guideline development

- Industry consensus difficult
  - Minnesota experience: compromise with industry along way proved futile when industry removed support for guidelines in the end
  - Industry conflicted over biomass energy - see as competition

[5] World café facilitated process: Participants started in a given group, with a single question to discuss. At a designated time, all but the moderator and note-taker moved to another group to discuss another question. The moderator who remained briefed the new set of participants on what was discussed previously, and then asked for more points, or elaboration on previous points. In this way, participants contributed to the built up the knowledge-base relevant to each question as they moved from group to group. (For more information, see: http://www.theworldcafe.com/what.htm.)

    - Fear protective guidelines may spread into existing timber harvest guidelines, limiting available harvest
    - What is role of bioenergy within traditional forest industries
- What can we learn from policy frameworks from elsewhere?
    - Policy provides justification for bioenergy
- Resource availability
    - Limited by harvesting guidelines
    - Provincial jurisdiction over land tender, resources so expect individual guidelines to be developed
    - Possible benefits from networking between provinces in policy development
    - Policy requires longevity and stability, consistency with other objectives (1st Nations, community economic development, *etc*.)
    - CCFM may act as umbrella organization to bring together jurisdictions

Recommendations for guideline development

- Place in context of sustainable forestry, considered as part of an integrated operation
- Science based, consensus based policy development
- Flexibly policy as science knowledge grows
- Stakeholder involvement is necessary, but ultimate role of decision maker is government
- Develop common guidelines and principles between jurisdictions to ensure ease of meeting guidelines for inter-jurisdictional operations

Group 3

Guideline Development

Contextual factors that influence guideline development

- All examples listed!
- While these contextual factors definitely influence the development of guidelines, these factors still need to be demonstrated as being useful to the development of biomass as a sustainable energy source
- The money needs to be in place

Applications of policy frameworks from elsewhere

- We are currently at the coarse-filter stage of development and we need to proceed as planned with diverse approaches to find optimal solutions in the future

Recommendations for guideline development

- Think hard about how fast these projects are put in place:
    - Before subsidizing new projects, think it through, including other options such as ethanol
    - Be careful what you wish for…
- BC shows complex results from relatively simple guidelines and prescriptions
    - Practitioners must be involved in policy development if there is any hope for implementation
    - Guidelines should be short and simple, if only to get them established
- Examine all options including peat, grass, marginal lands, areas not included in current FMP's, *etc*.

Group 4

Guideline Development

- Definition of the biomass, biofibre should be clarified
- Normalized forest concepts
- Permitting regulation systems
- Guidelines, what kind of researches can make policies move forward
- Researches to suitable to policies
- Long-terms decision, not to repeat mistakes before
- Input and output
- Publications to make public aware of the basic conception of biomass
- Organizing this kind of workshop
- Continuing information and continuing learning

Group 5

Guideline Development

- Forest type is a crucial factor
- How terms are defined, changing definition on merchantable material
- Biofiber and biomass policy should be different
- Well defined permits defining what is available and not available
- Minnesota and BC plan can be studied and adopted where ever feasible
- Industry people should not allowed to make decision solely
- Continuous learning and implementation of policies
- Forest communities like fist nation should be included and taken care of

Group 6

Guideline Development

- In North America, the driving force for guidelines is more on “reducing green house gases”; in Scandinavian countries, it is more market-driven
- In Canada we have more private Land (*e.g.*, New Brunswick, Nova Scotia), so those should be address the land ownership when making a guideline
- Maritime certification standards can be are different from others even if the certification agency is same, so even if given a chance to follow guideline from some where else we should be cautious for the fact situation is different from site to site and region to region
- The best way to form a guideline is to form a common frame work of guideline for both crown land and private land and addressing specific guidelines for specific issues

Group 7

Guideline Development

Contextual factors that influence guideline development

- Sweden: carbon tax drives bioenergy, *vs*. Canada with no unified policy on climate change so no strong political driver
- Energy security and self-sufficiency also drive bioenergy
- Industry interests but costs high now
- Voluntary guidelines *vs*. certification
- In some cases guidelines only apply to crown lands
- ENGOs play a major role in ON/Canada in general — questioning of the policy development

    - But different objectives/focus of different NGOs
    - Some NGOs feel that this is an additional stress and the overbearing issues that persist have not even been addressed
- Current state may be that biomass is already harvested (up to 70-80% with WTH), should the focus be what to do with this removal now — is it a resource waiting to be utilized?
- Urban-rural divide — urbanites don't see the clearcutting — public perception
- Who's buying biomass — co-generation in mills

What can we learn and apply to Canada

- Canada? Different provinces, *e.g.*, BC — dead wood left from pine beetle epidemic have a window of 15 years of utility — left for biodiversity purposes *vs*. left on roadside and burned
- Put in appendix or certain chapters in the sustainable forest management framework — only focus on waste on roadsides, but no re-entry or re-evaluation of the additional removal in terms of the sustainable forest management framework
- Because Canada is still mostly on the first rotation/old-growth now, the guidelines we develop now may not be applicable to the second-growth/rotation forests, which will have less dead material than the old-growths

Recommendations for the development of guidelines

- Consensus group of different actors — technical team and stakeholders — need a staged consensus process, so at each stage, consensus on a certain issue is reached and written down
- We have a window of opportunity — how long the process should be to encourage the development instead of discouraging it due to the extended process
- Good consultation is not just asking the question, but listening to and using the feedback for improvement — once a decision is announced, it's delivered
- Science needs to get in before the framework process is already going on because policy makers are reluctant to make changes
- A tight timeline may be a good idea — but needs a built-in revolution process to allow feedbacks to be incorporated and changes be made
- In Ontario, the tenure system doesn't allow biomass guidelines to be developed — crown lands — bigger picture issues need to be dealt with
- Role of technology and infrastructure needed to accompany it

Group 8

Guideline Development

Contextual factors that influence guideline development

- Land tenure: who owns the biomass
- What are the objectives? Economic or climate change?
- Should we focus on setting out targets first before putting forward the guidelines
- Forest companies are already strained financially - is this option economically viable in Canada? How many jobs are formed? Is it profitable?
- Need for a development of domestic markets
- Will policy be directed by our emissions and will this incrase the competition of woodfuel among other energy sources

What can we learn and apply to Canada

- Bioenergy helps with local job creation
- Policies in other countries have helped to push back the dependence of fossil fuels and other nonrenewable fuel sources
- Tax neutrality: implement a carbon tax while decreasing another tax
  - Is this an effective mechanism?
- Alternative energy sources are outcompeting bioenergy
- How do we get past the pilot stage?
  - Is it economically feasible?
  - Need government help here
- Most biomass energy being used in Canada is within industry

Recommendations for the development of guidelines

- Need to define what we mean by woody debris
- Do we remove all the fine woody debris and focus on leaving the coarse for biodiversity value?
- Should not just be focusing on the initial pulse but also a combination with retention
- Need to consider the monitoring and enforcement costs associated with the guidelines
- Educate those that are working in the forest about coarse woody debris identification and importance
- Need better data on productivity in Canada (related with soils) to help determind productive areas
- Can guidelines really be developed without the available data?
- Need to have flexibility in the guidelines so that as more is known then guidelines can be adjusted accordingly
- Is our definition of biomass too limited: boundaires of biomass may actually change with time
- We need a better concept of what is available before developing the infrastructure
- TRIAD approach?
- Build the energy plants closer to the resources to save on costs, and to help with fuel load management near communities that want to avoid high fuel loads
- Will the value of biomass become high enough so that all of the tree is used for bioenergy?
  - Will international competition help play a role in this?
- If biomass prices are higher than pulp and paper then materials will be redirected and may not need to address removing additional biomass from the forest
- Guidelines should be inclusive of other sustainable forest management
- Guidelines should not depend on economic pressures

Group 9

Guideline Development

Contextual factors that influence guideline development

- Political drive for practical: economical interest, bioenergy (price of oil); public expects Federal government do everything, small political scale, economical circumstance, employment, Provincial Jurisdictions (localized)
- Context - critical
- In Maritime, 98% trees clean cutting regardless the tree species - no regulation prevent
- Need Guidelines for biomass and diversity
- Land tenure: private land *vs*. Crown land

What can we learn and apply to Canada

- Corn ethanol - before the government subsidizes something, need to be careful
- BC has simple rules to get better results; we don't need very complex jurisdictions; keep it simple, start up simple, something is measurable
- Need forest practition: how do you make sure practition? Protective research - combine wood science

What recommendations would you offer for the development of guidelines?

- Increase pressure for the future
- Need to be evaluated/monitoring/general knowledge gain: such as Carbon taxes
- Need some target: policy target related to the missions
- Primarily - maintain site productivity/diversity - most strict regulations
- From Canadian perspective: quantity the results (exercise going through), missing experience (hasn't started yet), quality control/ quality assure
- Policy: change and adopt it

Group 10

Guideline Development

- Keep it simple, easy to understand, explain the choices made
- Draw a line in the middle of the grey and progress from there, using adaptive management
- Go through the 'lessons learnt', 'best practices', *etc.*, from other places and take the best and the most applicable ones
- Nova Scotia: 75% of land is private and this poses a challenge; consider making laws, not just guidelines
- Scientists always say 'it's really complicated', instead can they say 'it's really complicated, however… we can make solutions…"
- It is too early to use certification for energy because the energy sector is already tight for money and at the edge
- We are using forests in new way and we must consider how broad the scope and impacts are
- Policies on tenure should also be developed (*i.e.*, who owns the biomass?)
- Always communicate

Contextual factors that influence guideline development

- The whole process is driven by industry and even policy and science has to play 'catch-up'
- Bioenergy is occurring in a policy vacuum and science must now dictate what guidelines should be, or communicate existing guidelines, so that we can proceed
- We can use some of the existing data on this topic from New Brunswick
- In BC the policy is to leave four logs per hectare when harvesting – there is obviously no science to this policy; this reflects the urgent need for policy
- We are operating with many different definitions of terms; we require standardization/simplification of terminology

Application to the Canadian context

- Studies from New Brunswick
- Some of the bio-indicators used for site monitoring in the U.S. may be applied; for example, the thickness of the humus layer

- We must make our adaptive management framework explicit to the public to make the public amenable to it; too many policies have implied outcomes; we need to make explicit statements
- Can we figure out ways to intensively manage without depleting sites?

Appendix H. Workshop evaluation

Participants were asked to fill in an evaluation form at the end of the workshop. Written comments were:

Appreciations?

- Food, catering (3)
- Well structured - especially the third day
- Influential
- Interaction
- Good sign-up list for further contacts
- We need another one soon!!
- Overall good design and format for conference, positive meeting of minds. Overall good work on:
  - Synthesis
  - Conversations
  - Interviews
  - Small groups
- Diversity of opinions at conference very positive.
  - People who were present was a good representation
  - Representation was good because we were able to get an idea of what is going on within our own country
  - Richness of discussion
- Reassured: work has been done, we have the minimum knowledge and could potentially develop guidelines from this
- We have the resources in Canada and are not at the point of restoration international perspective was nice; but also the national
- Structure was refreshing because it forced participants to interact - representation from academics, economists and governance groups

Regrets?

- Room is small
- Would have been nice to have the management context on the first day, before we ge to know about all the research efforts
- Other aspects of biomass need to be mentioned
  - Social aspect
  - Silviculture aspect
  - Are there any positive aspects, e.g. removing slash and creating space for replanting on roadsides
  - Carbon dimension
- Unsure about format of final roll-up. Summarizing findings of 6 individuals in 2 minutes means that a lot is lost that is important. However, a lot was gained by doing the summarizing that would not have come out otherwise and no-one knows how else this could have been structured any better.
- Where do we go from here?
- Could have been more representation from the industry sector -- this also could be a second step in the path for bioenergy

What's next?

- More stakeholders participation: use effective ways to piece the puzzle of bioenergy together