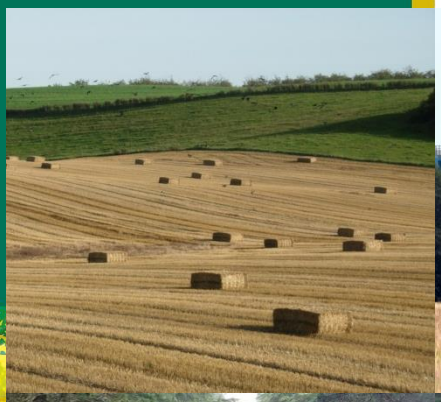
Sustainability of bioenergy supply chains

Book of abstracts from an inter-Task workshop 18-19 May 2017, Gothenburg, Sweden

Inter-Task project "Measuring, governing and gaining support for sustainable bioenergy supply chains"





IEA Bioenergy

IEA Bioenergy: ExCo: 2017: 06

Sustainability of bioenergy supply chains

Book of abstracts, workshop 18-19 May 2017, Gothenburg, Sweden

Inter-Task project: "Measuring, governing and gaining support for sustainable bioenergy supply chains"

Edited by Inge Stupak, Thuy Mai-Moulin, Martin Junginger

Front page photo acknowledgement: Johannes Ravn Jørgensen, Aarhus University, Inge Stupak, University of Copenhagen

Published by IEA Bioenergy

PREFACE

Sustainability of liquid and solid biofuels production continues to be under scrutiny, including complex topics such as indirect land-use change, competition for land with food production, forest carbon accounting and sustainable forest management principles. Sustainability criteria and metrics differ between feedstock and final end-use, for example road transport vs. heat and power, scale of the end-use, and there are yet no criteria for aviation, shipping and materials. At the same time, the public debate on sustainability of bioenergy is heated, with opinions about sustainability often being based on mix of science, emotions and political agendas. Part of the controversy is different approaches to governance and the partial or perceived failure of these systems to ensure the sustainability of bioenergy supply chains. Obviously, definitions of 'sustainable bioenergy' also depend on different views and priorities among different stakeholder groups, both within and outside the value chains. To address these challenges, the IEA Bioenergy inter-Task project on "Measuring, governing and gaining support for sustainable bioenergy supply chains" is pursuing three main objectives:

1. To provide an overview and examples of calculation methods & tools to assess the sustainability of various biomass and bioenergy supply chains and discuss needs, possibilities and limitations of global, uniform/harmonized framework.
2. To compare and assess the legitimacy, including effectiveness and efficiency of a variety of approaches on how to govern and verify sustainability of biomass and bioenergy supply chains in different conditions.
3. To understand the positions and underlying motivations of stakeholder groups relative to their perceptions of bioenergy and inform dialogues/discussions to avoid misconceptions and gain trust in bioenergy.

The project was started in 2016, and a multitude of studies have been initiated, focusing largely on the agricultural, forestry and biogas sectors. The aims of this workshop are two-fold:

1. To share preliminary project results from the work carried out under the three objectives to an audience of both IEA Bioenergy members and informed stakeholders from industry, policy, the NGO community etc.

2. To obtain feedback from these stakeholders on the results and approaches, identify possible knowledge gaps to properly address the overall project aim, which should additionally be addressed in the remainder of the project.

There will be ample opportunity to discuss with the project participants and other stakeholders

during the workshop, but we also encourage that you use this book of abstracts to write down feedback during the presentations, so that it can be communicated to the authors later, in person or in writing.

Thank you for any feedback to help us improve our work!

On behalf of the project participants,

Martin Junginger

Leader, IEA Bioenergy inter-Task Sustainability project team

CONTENTS

Preface 3

Contents 5

Programme 7

P1. Comparison of tools for assessing greenhouse gas emissions savings of biofuels (O1) – Helena Chum 9

P2. How to analyse ecosystem services in landscapes (O1) – Oskar Englund 10

P3. Relating ecosystem Services to indicators of progress toward a sustainable bioeconomy Presenters (O1) - Virginia Dale 11

P4. Delphi survey approach for the identification of sustainability indicators and environmental impacts of forest biomass harvesting for a biorefinery: Case study in Québec (O1) - Ichrak Lakhdhar 12

P5. Assessing the climate effects of forest bioenergy systems: Swedish case study (O1) – Olivia Cintas 13

P6. Assessing the climate effects of forest bioenergy systems: A Canadian case study of unloved wood (O1) – Evelyne Thiffault 14

P7. Trust and legitimacy in governance of sustainability of bioenergy supply chains (O2) – Maha Mansoor 15

P8. Drivers and effectiveness of sustainability governance of agricultural crop production in Denmark and at EU level (O2) – Niclas Scott Bentsen 16

P9. Sustainability governance of agriculture-based bioeconomy in Canada (O2) – Charles Lalonde, presented by Tat Smith 17

P10. Integrating policy, market and technology in sustainability governance of agriculture-based biofuel and bioeconomic development in the us (O2) – Jianbang Gan 18

P11. Bridging ecosystem services and sustainable bioenergy indicators on agricultural landscapes with stakeholders (O2/O3) - Keith Kline 19

P12. Modeling improvements in sustainability of corn stove removal and through energy crop integration into agricultural landscapes (O2) – Shyam Nair 20

P13-A. The German Biogas Case – Sustainability Governance and Stakeholders (O2/O3) – Daniela Thrän 21

P13-B. The impact of governance on the deployment and the environmental sustainability of manure based centralised biogas production in Denmark (O2) – Teodorita Al Seadi, presented by Daniela Thrän 22

P14. Role of stakeholders' perceptions for bioenergy sustainability: Case of forest biorefinery in La Tuque, Quebec (O3) – Leonard Nkunzimana 23

P15. Linking measurement and governance: wood pellets from the southeastern United States (O2/O3) – Virginia Dale 24

P16. Measuring, Documenting, and Communicating the Sustainability of Supply Chains within the Wood Pellet Industry of the Southeast U.S. (O2) – Brian Kittler 25

P17. Governance of sustainable forest management and bioenergy in Ontario (O2) – Quentin Cheung, presented by Tat Smith 26

P18. Position, perceptions, and visions of stakeholders on bioenergy sustainability: methodology and preliminary results (O3) – Thuy Mai Moulin 27

PROGRAMME

Thursday 18 May 2017		
09.00-09.15	General workshop & project introduction. Presenter: Martin Junginger	
09.15-09.30	Introduction to Objective 1. Presenter: Annette Cowie	
09.30-09.45	Introduction to Objective 2. Presenter: Inge Stupak	
09.45-10.00	Introduction to Objective 3. Presenter: Uwe Fritsche	
10.00-10.30	General discussion on approaches	
10.30-11.00	Coffee	
	Objective 1 **Measuring sustainability**	**Objective 2 and 3** **Governance and stakeholder involvement**
11.00-11.30	P1. Comparison of tools for assessing greenhouse gas emissions savings of biofuels. Presenter: Helena Chum (confirmed)	P7. Trust and legitimacy in sustainability governance of bioenergy supply chains. Presenter: Maha Mansoor
11.30-11.55	P2. How to analyse ecosystem services in landscapes. Presenter: Oskar Englund	P8. Drivers and effectiveness of sustainability governance of agricultural crop production at EU level. Presenter: Niclas Scott Bentsen
11.55-12.20	P3. Relating ecosystem Services to indicators of progress toward a sustainable bioeconomy Presenters: Virginia Dale and Keith Kline	P9. Sustainability governance of agriculture-based bioeconomy in Canada. Presenter: Tat Smith for Charles Lalonde and Maria Wellisch
12.20-12.45	P4. Delphi survey approach for the identification of sustainability indicators and environmental impacts of forest biomass harvesting for a biorefinery: Case study in Québec. Presenter: Ichrak Lakhdhar	P10. Incorporating policy, market and technology in sustainability governance of agriculture-based biofuel and bioeconomic development in the US. Presenter: Jianbang Gan
12.45-13.45	Lunch	
13.45-14.45	Discussion: possibilities and limitations of a global harmonized framework to assess sustainability of biobased production	Discussion: governance of sustainability of agri-based bioenergy and the bioeconomy
14.45-15.15	P5. Assessing the climate effects of forest bioenergy systems: Swedish case study. Presenter: Olivia Cintas	P11. Bridging ecosystem services and sustainable bioenergy indicators in agricultural landscape with stakeholders Presenters: Keith Kline and Virginia Dale
15.15-15.45	P6. Assessing climate effects of forest bioenergy systems: A Canadian case study of unloved wood. Presenter: Evelyne Thiffault	P12. Modeling improvements in sustainability of corn stove removal and through energy crop integration into agricultural landscapes. Presenter: Shyam Nair
15.45-16.15	Coffee	
16.15-17.00	Discussion: Results and methodology approaches in the Swedish and Canadian case studies	Discussion on documentation and perceptions of sustainability of agri-based bioenergy in the US
17.00-18.00	Report back from sessions and discussion of findings	
19:00	Dinner (at own expense)	

Friday 19 May 2017			
	Objective 1 **Measuring sustainability**	**Objective 2 and 3** **Governance and stakeholder involvement**	
08.15-09.00	General discussion on methodologies to assess the climate effects of bioenergy systems	P13 (A&B). Sustainability governance and role of stakeholders in the different market phases of biogas development in Germany with a view to other countries. Presenters: Kay Schaubach and Daniela Thrän	P14. Role of stakeholders' perceptions for bioenergy sustainability: Case of forest biorefinery in La Tuque, Quebec. Presenters: Evelyne Thiffault, Léonard Nkunzimana, Biljana Kulišić and Patrice Mangin.
09.00-09.30		Discussion of governance and perceptions of sustainability of biogas	
09.30-10.00	Coffee		
10.00-10.30	P15. Linking measurement and governance: wood pellets from the southeastern United States. Presenters: Virginia Dale, Keith Kline, Don Hodges, & Neelam Poudyal		
10.30-11.00	P16. Measuring, Documenting, and Communicating the Sustainability of Supply Chains within the Wood Pellet Industry of the Southeast U.S. Presenter: Brian Kittler		
11.00-11.30	P17. Governance of sustainable forest management and bioenergy in Ontario. Presenter: Tat Smith, for Quentin Cheung		
11.30-11.45	Coffee		
11.45-12.30	Discussion of governance and perceptions of sustainability of forest-based bioenergy		
12.30-13.30	Lunch		
13.30-14.30	P18. Position, perceptions, and visions of stakeholders on bioenergy sustainability: methodology and preliminary results (O3). Presenters: Thuy Mai Moulin, Uwe Fritsche and Martin Junginger		
14.30-16.00	Roundtable with various stakeholders & common conclusions		

P1. COMPARISON OF TOOLS FOR ASSESSING GREENHOUSE GAS EMISSIONS SAVINGS OF BIOFUELS (O1) – HELENA CHUM

Presenter	Helena L. Chum[1,a]
Co-authors	E. Warner[1], Y. Zhang[1], L. G. Pereira[2], O. Cavalett[2], A, M. Bonomi[2]
Collaborators	T38: A. Cowie, M. Brandão, K. Johnson; T39: J. McMillan, J. Saddler; T40: M. Junginger and collaborators. Model developers: IFEU, Germany, RVO, The Netherland, ANL, US, (S&T)[2] Consultants, Canada
Address	[1]National Renewable Energy Laboratory, Golden, CO, USA, [2]Brazilian Bioethanol Science and Technology Laboratory (CTBE), Campinas, São Paulo, Brazil
E-mail	[a]Helena.Chum@nrel.gov

Abstract

Many life cycle assessment (LCA) tools and analyses calculate the greenhouse gas (GHG) emissions of biofuel supply chains, each has differing purposes, use various methods and data sources thus providing different emissions reductions relative to equivalent petroleum fuels.

In this study we assessed three LCA models used in the regulatory context: (1) the GHGenius (version 4.03a), a well-to-wheel tool, used by Natural Resources Canada for policy guidance and in Canadian provinces; (2) the public EU calculator BioGrace I 4d, a well-to-tank tool, designed for regulatory compliance of emissions reductions of commercial biofuels and other requirements of the EU-Renewable Energy Directive/Fuels Quality Directive; (3) the public U.S. Greenhouse gases, Regulated Emissions, and Energy use in Transportation Model GREET (version 2015 used), for LCA analyses is part of a consequential framework of multiple U.S. and global models. As an additional analysis, the Virtual Sugarcane Biorefinery (VSB) model (4), developed by CTBE, enabled to compare the treatment of models #1-3 for sugarcane ethanol produced in Brazil. VSB includes updated inventory based on recent agronomic practices and conversion process plants, utilizing the public database Ecoinvent version 2.2 for background processes (e.g. diesel and fertilizer production).

U.S. collaborators compared models #1-3 that calculate GHG emissions of corn (maize) ethanol from commercial dry milling processes. CTBE compared models #1-4 for the production of sugarcane ethanol in Brazil. In an attemp to achieve similar GHG emissions figures, model data and methods were harmonized, arriving at 52-54 g CO_2eq/MJ of corn ethanol for plants using U.S. natural gas and 16-17.5 g CO_2eq/MJ of sugarcane ethanol for a Brazilian system. Co-product allocation, land and soil use modeling approach, agronomic operations, feedstock productivity, ethanol production technology maturity are some of the major differences for corn ethanol. Ethanol overseas shipping, nitrogen, limestone, assumed percentage of straw field-burned and fossil energy use in agronomic operations are the major sources of differences for sugarcane ethanol. Under harmonized conditions the models produce the same results within the uncertainties of the analyses.

Two models are systems' tools for R&D across the transport sector while BioGrace I is a specific calculator for commercial biofuels within the EU regulatory framework. The equivalent EU JEC model to GREET and GHGenius is not available publicly, but results from commercial and developing technologies are published. We emphasize the need for continual model updates. Best practice in LCA publications specify model versions used and detail data as supplements.

Inter-Task collaborators recently published results from prospective well-to-wake LCAs of renewable jet fuels (de Jong et al 2017) employing best practices of sensitivity analyses to explore plausible ranges of expected GHG emissions and suggested a possible global allocation strategy. ICAO and the global aviation are expanding assessments to include more dimensions of sustainability as addressed in this workshop.

de Jong, S., Antonissen, K., Hoefnagels, R., Lonza, L., Wang, M., Faaij, A., & Junginger, M. (2017). Life-cycle analysis of greenhouse gas emissions from renewable jet fuel production. Biotechnology for Biofuels, 10(1), 64.

Notes:

P2. HOW TO ANALYSE ECOSYSTEM SERVICES IN LANDSCAPES (O1) – OSKAR ENGLUND

First author*	Oskar Englund
Co-authors	Göran Berndes, Christel Cederberg
*Organization	Chalmers University of Technology
*Address	Div. of Physical Resource Theory, Chalmers, 412 58 Göteborg
*E-mail	oskar.englund@chalmers.se

Abstract

Ecosystems provide goods and services to society, contributing to our survival and well-being. From a sustainability perspective, maintaining — or increasing — the supply of such ecosystem services (ES) is important. With increasing demand for land, often with competing interests, there is a need for improved understanding, and promotion, of biomass production in landscapes that generate multiple ES and support biodiversity. A variety of multifunctional biomass production systems — where biomass feedstocks are produced along with other ES — have been analysed with the intention to support the development of attractive feedstock supply options for the emerging bioeconomy.

The effects on biodiversity and ES of introducing new biomass production systems in the landscape depend on landscape characteristics, including existing land use, and on the localization, design (including plant choice) and management of the biomass production system.

A multitude of approaches exist that address biodiversity and ES on different spatial and temporal scales. The variety of approaches — along with an inconsistent terminology — can create difficulties in situations where governance agreements are to be made. This is particularly complex in a context where multiple goals need to be considered, e.g., mitigation of climate impacts from land use, promotion of renewable energy, increased food production, and more sustainable resource management in general.

This paper identifies and qualitatively assesses methods for mapping ES in terrestrial landscapes, based on a systematic review of the scientific literature. It further aims to clarify the associated terminology, in particular the concept of landscape and landscape scale. The objective is to contribute to the knowledge base required for sustainable expansion of biomass production systems that also contribute positively to biodiversity and the generation of other ES than biomass harvest.

In total, 347 cases of ES mapping were identified in the reviewed papers. Regulating and maintenance services were most commonly mapped (165), followed by cultural (85), and provisioning services (73). For individual ES, a large variation in number of mapping cases was found. This variation may either reflect the perceived importance of the ES, or that different ES can be more or less easily mapped. Overall, Logical models and Empirical models were most commonly used, followed by Extrapolation, Simulation/Process models, Data integration, and Direct mapping.

Only twelve percent of all ES mapping cases were validated with empirical data. The review revealed highly diverging views on the spatial extent of landscapes in studies of ES, and that the term landscape is sometimes used rather arbitrarily.

Notes:

P3. RELATING ECOSYSTEM SERVICES TO INDICATORS OF PROGRESS TOWARD A SUSTAINABLE BIOECONOMY PRESENTERS (O1) - VIRGINIA DALE

First author*	Virginia H. Dale
Co-authors	Keith L. Kline
*Organization	Oak Ridge National Laboratory
*Address	PO Box 1, Oak Ridge, TN 37831-6036
*E-mail	dalevh@ornl.gov

Abstract

International growth of bioenergy industries has led to scientific and public interest in determining how production and use of bioenergy feedstocks affect ecosystem services. Several countries require assessments of the effects of bioenergy production and use to verify that targets for greenhouse gas emission reductions and other goals are met. At the same time nongovernmental organizations and other groups are concerned about compromising biodiversity, air quality, and jobs via production of bioenergy. Assessing effects of bioenergy on ecosystem services offers a useful viewpoint from which to consider associated trade-offs. Bioenergy systems can enhance a variety of ecosystem services such as fuel and climate regulation but can also impact other services in negative ways. Effects of bioenergy feedstock production and use are context-specific, and therefore general statements regarding costs or benefits of cellulosic-based biofuels on ecosystem services may omit or misrepresent important local effects. Documenting progress toward sustainability and improvements in ecosystem services calls for meaningful indicators and their effective use to support informed decisions. This presentation discusses indicators that should be considered when attempting to quantify changes in ecosystem services associated with bioenergy.

We apply the first three steps of the ecosystems services approach set forth by The Economics of Ecosystems and Biodiversity (TEEB) for Local and Regional Policy Makers. The example system discussed is the use of cellulosic biomass for ethanol in the US state of Iowa. We find that bioenergy feedstock sustainability can be quantified using eleven indicator groups. The social aspects of concern include perceptions such as risks (floods, droughts, investment, market failure), effective stakeholder participation, transparency, and public opinion, as well as social well-being (e.g., household income, food security, employment, and work days lost to injury). Primary environmental concerns are productivity, greenhouse gases, water quantity and quality, and soil quality. Top issues among the economic indicators are profit and energy security. Provisioning, cultural, regulating, and supporting ecosystem services are affected by cellulosic biofuels in the midwestern US.

Building on a multiple indicator framework, this project provides an example of how a landscape design approach can have immediate benefits not only for bioenergy feedstock production but also for regional ecosystem services. By taking a holistic view of potential changes in services and metrics that measure those changes, this analysis is more comprehensive than analyses that focus on only one metric.

Notes:

P4. DELPHI SURVEY APPROACH FOR THE IDENTIFICATION OF SUSTAINABILITY INDICATORS AND ENVIRONMENTAL IMPACTS OF FOREST BIOMASS HARVESTING FOR A BIOREFINERY: CASE STUDY IN QUÉBEC (O1) - ICHRAK LAKHDHAR

First author*	Ichrak Lakhdhar
Co-author	Evelyne Thiffault
*Organization	University Laval
*Address	Pavillon Abitibi-Price, 2405, rue de la Terrasse, Local 2145E, Québec (Québec) G1V 0A6, Canada
*E-mail	Ichrak.lakhdhar@gmail.com; Ichrak.lakhdhar.1@ulaval.ca

Abstract

In the context of the implementation of a large scale biorefinery for the exploitation of forest residues in Québec, a feasibility study was crucial to evaluate the environmental aspects of biomass procurement for such a project.

The aim of this study is to determine the major environmental issues raised by forest biomass harvesting, best practices to be adopted and finally the best indicators that would allow to assess a site sensitivity for forest biomass supply.

For this purpose, "Delphi" is an iterative technique that has been proven as an effective experimental tool for identifying the main issues for decision making by allowing a group of experts, to deal with complex problems through a structured communication. It employs a series of linked questionnaires through successive rounds, followed by detailed feedbacks and summary reports, until a reasonable level of compromise is reached.

In our work, the Delphi method is adopted to find a consensus between selected experts mainly on the environmental impacts of biomass procurement on different types of ecosystems, and on sustainability indicators and on how to operationalize them.

The importance of Delphi survey for a valid study as well as a detailed description of the methodology will be also presented.

In the next steps, the indicators and best practices that will have emerged from the Delphi will be mapped to identify environmentally sustainable biomass procurement areas and feedstock availability.

Notes:

P5. ASSESSING THE CLIMATE EFFECTS OF FOREST BIOENERGY SYSTEMS: SWEDISH CASE STUDY (O1) – OLIVIA CINTAS

First author*	Olivia Cintas
Co-authors	Göran Berndes, Julia Hansson, Bishnu Chandra Poudel, Johan Bergh, Pål Börjesson, Gustaf Egnell, Tomas Lundmark, Annika Nordin
*Organization	Chalmers University of Technology
*Address	Div. of Energy Technology, Chalmers, 412 58 Göteborg
*E-mail	Olivia.cintas@chalmers.se

Abstract

Bioenergy is unique among renewable energy sources in that it is a part of the terrestrial carbon cycle. The CO2 emitted due to bioenergy use was earlier sequestered from the atmosphere and will be sequestered again if the bioenergy system is managed sustainably, although there may be a significant temporal imbalance between carbon emissions and sequestration. Over the years, many concepts and indicators have been developed to account for biogenic carbon flows and there is still debate on how carbon accounting should be made in evaluations of bioenergy systems.

In this paper, we present an approach to evaluate the potential role of forest management in Swedish scenarios towards climate neutrality by mid-century. Swedish climate policy targets net zero greenhouse gases (GHG) by mid-century, with road transport independent of fossil fuels by 2030, requiring far-reaching changes in the way energy is used. Forest management is expected to support carbon sequestration and provide biomass for various uses, including energy.

We combine two energy scenarios with four forest scenarios and quantify GHG balances associated with energy-use for heat, electricity, and road transport, and with forest management and production, use, and end-of-life management of various forest products, including products for export. The aggregated GHG balances are evaluated in relation to the 2-degree target and an allocated Swedish CO2 budget. The production of biofuels in the agriculture sector is considered but not analysed in detail.

The results suggest that Swedish forestry can make an important contribution by supplying forest fuels and other products while maintaining or enhancing carbon storage in vegetation, soils, and forest products. The GHG neutrality goal is not met in any of the scenarios without factoring in carbon sequestration. Measures to enhance forest productivity can increase output of forest products (including biofuels for export) and also enhance carbon sequestration. The Swedish forest sector can let Sweden reach net negative emissions, and avoid ‘‘using up” its allocated CO2 budget, thereby increasing the associated emissions space for the rest of the world.

The CO2 budget approach represents a complementary perspective to that derived from life cycle assessment (LCA) and carbon accounting studies, which sometimes (depending on methodology choices) have associated forest bioenergy systems with initial net GHG emissions. This has been used as an argument against incentivizing forest bioenergy, especially when near term GHG targets are in focus. Leaving aside the ongoing debate about methodological approaches in LCA and carbon accounting, and trade-offs between short term GHG targets and longer term temperature goals, the contrasting conclusions derived from the two perspectives illustrate the need for several points of view and information and knowledge from many scientific disciplines, applying a range of different methodologies.

Notes:

P6. ASSESSING THE CLIMATE EFFECTS OF FOREST BIOENERGY SYSTEMS: A CANADIAN CASE STUDY OF UNLOVED WOOD (O1) – EVELYNE THIFFAULT

First author	Evelyne Thiffault[1,a]
Co-authors	Ichrak Lakhdhar[1], Rut Serra[2], Julie Barrette[3], Claude Durocher[1], Mathieu Béland[1], Alexis Achim[1]
Organization	[1]Centre de recherche sur les matériaux renouvelables, [2]Fédération québécoise des coopératives forestières, [3]Natural Resources Canada
Address	[1]Département des sciences du bois et de la forêt, Université Laval, 2405 rue de la Terrasse, Pavillon Abitibi-Price, Université Laval, Québec (QC), G1V 0A6 Canada
E-mail	[a]Evelyne.thiffault@sbf.ulaval.ca

Abstract

Surplus forest growth can be an abundant but yet untapped and poorly unaccounted for source of forest biomass. A special case of this category is low-quality, degraded, damaged, or dead trees, together referred here as "unloved woods". In Canada, a substantial volume of unloved woods goes unutilized despite being part of the forest annual allowable cut (AAC). These unloved woods represent an attractive source of biomass for bioenergy, and an interesting case for evaluating the carbon balance of bioenergy, since the reference scenario (i.e. no-bioenergy), and outcomes of biomass procurement in the bioenergy scenario on the forest value chain are closely dependent on dynamics and economics of the conventional forest product industries and forest management systems.

Factors explaining the abundance of unloved woods include a combination of: forest product market pricing and broader economic performance; operational difficulties; regulatory framework and restriction; regional structure of the wood processing industrial network; and wood properties and tree/stand characteristics. The harvested proportion of the AAC is particularly low for boreal hardwood species. As an example, calculations of carbon balance of procurement of biomass from degraded boreal hardwood stands as a substitution to petroleum coke provide GHG mitigation benefits after 12 years or less after implementation of the bioenergy system, with cumulative GHG savings of 5.6-8.5 tonnes of CO2 eq per gigajoule of bioenergy produced over a 100-year period. Current common practice for those unloved stands is to cut down and bulldoze the trees into large windrows and replant the cleared block. Another alternative reference scenario for those hardwood stands is to leave them standing (when the governmental financial incentives for clearing and replanting run low). With this reference, a bioenergy scenario in which those stands would be cut and replanted and the trees used as biomass feedstock would provide GHG mitigation benefits within 23 years. Harvesting these unloved stands for bioenergy therefore provides an incentive to replant areas that are otherwise stagnant and prevents the creation of heaps of slowly-decomposing discarded trees, which also eat on productive forest areas.

Preliminary results from a parallel study estimated the cost savings for silviculture created by the removal of forest biomass for bioenergy. It was found that by reducing the amount of coarse residues on site, biomass procurement saves around about 54% of total site preparation costs, thereby possibly creating positive incentives for site regeneration after harvest, with further effects on carbon balance.

Further analyses including both GHG savings associated with bioenergy, but also the positive effects of procurement of forest residues and unloved woods on further forest productivity, management activities and consequent flow of forest products will be performed for the case study of the forest biorefinery of La Tuque (QC).

Notes:

P7. TRUST AND LEGITIMACY IN GOVERNANCE OF SUSTAINABILITY OF BIOENERGY SUPPLY CHAINS (O2) – MAHA MANSOOR

First author*	Maha Mansoor
Co-authors	Inge Stupak, Tat Smith, Rocio Diaz-Chavez et al.
*Organization	Osgoode Hall Law School & Faculty of Environmental Studies, York University
*Address	4700 Keele St, North York, ON M3J 1P3, Canada
*E-mail	maha.mansoor@mail.utoronto.ca

Abstract

Public and private regulatory initiatives for the sustainability of bioenergy have emerged and take variety of forms, including public regulation, international processes, certification systems, best management practices and company policies. These systems aim at alleviating sustainability concerns, but despite high ambitions, recent discourse amongst civil society and academia questions if they can be authoritative and effective regulators of sustainability. Concerns are, for example, if the EU Renewable Energy Directive is adequately democratic, as third party countries are impacted by these regulations, but do not have access to influencing them.

Debate also persists if standards are adequately comprehensive, if systems are effective and if they lack mechanisms for control and accountability. This creates uncertainty if both private and public institutions can be trusted as legitimate and effective regulators of sustainability of bioenergy, and, consequently, in the bioenergy sector. This paper proposes frameworks to describe, classify, and analyse sustainability governance systems, with a special focus to those developed for bioenergy and the bio-economy. It is the intent that such analyses of concrete supply chains can form a basis for discussions on how systems emerge and develop, and how they can develop in the future, for increased trust in their legitimacy and effectiveness. For this purpose, we define governance comprehensively to include public and private, mandatory and voluntary regulation. We first provide definitions of sustainability governance and input and output legitimacy, and, in relation to this, outline our conception of trust. Based on Bernstein and Cashore (2007), we propose how sustainability governance can be analysed as a multi-phase process, with phases separated by changes in drivers involving and granting of trust and legitimacy by actors through time. We suggest that in order to reach the final phase, there must be an increase in input and output legitimacy, and that description, classification, and analysis of their design is useful for moving forward. We offer an analysis framework for this purpose, which is based on McDermott et al. (2009). Finally, we consider how analysis of sustainability governance of bioenergy and the bio-economy can help improve the legitimacy of these systems, and which the challenges are in a broader and global context.

Notes:

P8. DRIVERS AND EFFECTIVENESS OF SUSTAINABILITY GOVERNANCE OF AGRICULTURAL CROP PRODUCTION IN DENMARK AND AT EU LEVEL (O2) – NICLAS SCOTT BENTSEN

First author*	Niclas Scott Bentsen
Co-authors	Inge Stupak
*Organization	University of Copenhagen, Department of Geosciences and Natural Resource Management
*Address	Rolighedsvej 23, 1958 Frederiksberg C, Denmark
*E-mail	nb@ign.ku.dk

Abstract

Most of the land area in Denmark is intensively managed for agriculture. About 60% of the land is under agriculture, while forests occupy around 15%, urban areas 10% and open nature types 5%. After World War II, new opportunities had a large impact on the development of agriculture in Denmark. Tractors replaced horses, herbicides replaced soil scarification, and commercial mineral fertilizer replaced manure. This laid the ground for specialized farms, where animal husbandry and milk production moved to the west, to the less fertile soils, while grain and vegetable production moved to the east, to the more fertile soils. It created new environmental challenges, especially in relation nutrient management, that these two productions no longer depended on each other.

This study reviews the development of environmental sustainability governance for crop agriculture in Denmark and the EU, as much national regulation in EU member states stems from EU regulation. We defined governance comprehensively to include governmental regulation, international agreements and conventions, public or private certification systems, standardization, best management practices, education programs etc. Danish agriculture is heavily regulated with regard to environmental issues. EU legislations such as the common CAP and its cross compliance principles, the Water Framework Directive, the Habitat Directive are some of the most important EU regulations with implications for Danish farmers and their management. Additionally, national legislation such as the Planning Act and the The Nature Conservation Act are important. This study examines the requirements of these regulations and the rigor of the associated enforcement and control systems, and review the extent to which these legislations have led to measurable changes in environmental impacts of agriculture over time. The study will discuss the results in the context of the bioeconomy and the need to develop sustainability governance that targets the bioeconomy as a whole.

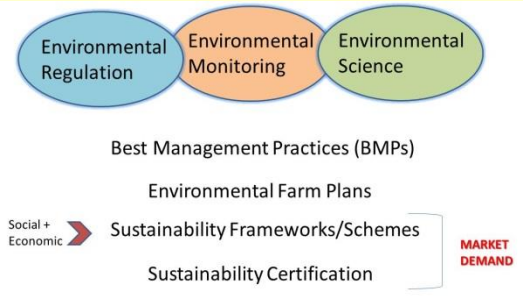
Notes:

P9. SUSTAINABILITY GOVERNANCE OF AGRICULTURE-BASED BIOECONOMY IN CANADA (O2) – CHARLES LALONDE, PRESENTED BY TAT SMITH

First author	Charles Lalonde[1] (presented by Tat Smith)
Co-authors	Maria Wellisch[2]
Organization	[1]Agren Consulting, [2]Agriculture and Agri-Food Canada
Address	[1]Guelph, Ontario; [2]Ottawa, Ontario CANADA
E-mail	[1]charles.lalonde73@gmail.com, [2]maria.wellisch@agr.gc.ca

Abstract

An increasing number of requests by large food retailers for sustainable meat, grain and oilseed products serves as the dominant driver for the Canadian agriculture sector's current sustainability work. Numerous initiatives, such as the Canadian Roundtable for Sustainable Beef, Canadian Roundtable for Sustainable Crops, Sustainable Farm and Food Initiative, Provision Coalition, National Environmental Farm Plan, are under development to address these information requests in a coordinated and cost-effective way. The Canadian agriculture and agri-food sector supplies safe food and feed products, and, to a small extent, feedstocks for the bioeconomy. This report describes the evolving approach to defining sustainable agriculture and the implications on the supply of sustainable biomass feedstocks for the emerging bioeconomy. It begins by describing the Canadian agriculture system, and environmental management of agricultural production through a combination of environmental regulation, science and best management practices. The current and potential agriculture-based bioeconomy is then presented as a subset of the broader agricultural system. Several sustainability initiatives are underway in Canada, including public sector environmental indicator work and private sector initiatives, to provide a single source of information for sustainable agriculture. As the timelines of these initiatives extend beyond the timelines of this IEA report, only work in progress can be described. The report will discuss additional sustainability considerations that bioproducts end-users are asked to address, including carbon intensity as part of new clean fuel legislation.



The emerging Canadian system of sustainability governance will be compared with that of the EU (Denmark) and the US in a separate report.

Notes:

P10. INTEGRATING POLICY, MARKET AND TECHNOLOGY IN SUSTAINABILITY GOVERNANCE OF AGRICULTURE-BASED BIOFUEL AND BIOECONOMIC DEVELOPMENT IN THE US (O2) – JIANBANG GAN

First author*	Jianbang Gan
Co-authors	Inge Stupak, C.T. Smith
*Organization	Texas A&M University
*Address	Department of Ecosystem Science and Management, 2138 TAMU, College Station, TX 77843, USA
*E-mail	j-gan@tamu.edu

Abstract

The United States is a major producer and consumer country of agricultural products and biofuels in the world. U.S. biofuel policy can be dated back to 1970s, providing tax exemptions to biofuel (corn ethanol in particular) producers. Recent renewable fuel standards (e.g. the Energy Independence and Security Act of 2007) have set up an ambitious national goal for biofuel production. With the scaling-up of biofuel production come concerns about sustainability, particularly environmental sustainability such as land-use expansion (including indirect land-use change) and intensification and associated soil, water and biodiversity issues as well as greenhouse gas emissions. This study aims to review historical bioenergy policy, assess sustainability concerns and governing elements, and develop mechanisms for sustainability governance of the emerging biofuel and bioeconomic sector.

We'll start with a comprehensive review of the evolution of U.S. biofuel policy and policy drivers. Because biomass and biofuel production are closely related to crop and livestock production at local, national and international levels, we'll also examine interactions among biomass/biofuel (fuel), crop (food) and livestock (feed) markets and the role of markets in sustainability governance. Additionally, technology related to biomass/bioenergy production, conservation practices (e.g. non-tillage), and precision agriculture has interacted with agricultural sustainability and can play a role in future sustainability governance in a context of a bioeconomy. We'll examine the interrelationships among policy, market and technology along with sustainability certification systems and supply chain control systems. Based on the systematic assessment, we expect to propose sustainability governance mechanisms for biofuel and bioeconomic development in the United States.

Notes:

P11. BRIDGING ECOSYSTEM SERVICES AND SUSTAINABLE BIOENERGY INDICATORS ON AGRICULTURAL LANDSCAPES WITH STAKEHOLDERS (O2/O3) - KEITH KLINE

First author*	Keith L. Kline
Co-author	Virginia H. Dale
*Organization	Oak Ridge National Laboratory
*Address	1 Bethel Valley Road, Oak Ridge, TN 37831-6038
*E-mail	klinekl@ornl.gov

Abstract

Increasing the production and use of cellulosic biomass feedstocks for biofuels potentially affects provisioning, cultural, regulating, and supporting ecosystem services. Effects include changes to disease and pest control, water and soil quality management, and risk management. Systematic monitoring and ongoing stakeholder engagement are necessary to support continual improvement. Stakeholders are anyone positively or negatively affected by changes in ecosystem services associated with a project. Stakeholders across the bioenergy supply chain are diverse and range from rural suppliers and producers to final consumers of renewable energy. We review stakeholder engagement and implications of production of the native perennial switchgrass (*Panicum virgatum*) as a biomass crop in the southeast United States (US). From that analysis, we developed an approach for prioritizing indicators to assess progress toward defined social, economic and environmental goals. That approach is being applied to production of cellulosic feedstocks in the US Midwestern state of Iowa.

Many rural communities in the US are characterized by declining populations, incomes, and jobs. Market-based strategies are needed to improve soil health and water quality while supplying increasing volumes of biomass for food, feed, fiber, and energy. We describe two strategies being pursued to help achieve these goals in Iowa: (i) variable rate collection of residue (stover) from the predominant crop in the region, maize (*Zea mays L.*), and (ii) planting perennial grasses as stream buffers or on less-productive areas within current agricultural fields. This case illustrates how priority issues can be identified by building on stakeholder input collected from prior surveys and meetings. Eleven relevant indicator categories were identified for biomass production in Iowa including water quality in streams for wildlife, recreational use and municipal supplies. The stakeholder groups in Iowa are informed about interactions among land-management practices, soil erosion, and water quality. Some stakeholders need additional information to compare a specific site's cellulose-based biofuel strategy to alternatives and to differentiate the effects of cellulosic fuels from those associated with conventional practices and grain-based ethanol production.

Effects of bioenergy systems are context-specific. Stakeholder values must be considered to define indicators, baseline conditions, targets, and opportunities for improved resource management. Integrating social, economic and environmental considerations in a landscape design illustrates where and how bioenergy production can contribute to natural resource management goals. By engaging stakeholders in the process, more effective and efficient practices and more useful indicators of progress toward a sustainable bioeconomy can be developed over time.

Notes:

P12. MODELING IMPROVEMENTS IN SUSTAINABILITY OF CORN STOVE REMOVAL AND THROUGH ENERGY CROP INTEGRATION INTO AGRICULTURAL LANDSCAPES (O2) – SHYAM NAIR

First author*	Shyam Nair
Co-authors	Michael Griffel, Damon S. Hartley, Tessica A. Gardner, Jason Hansen, and Gabe McNunn
*Organization	Idaho National Laboratory, Idaho Falls, ID 83406
*Address	P.O. Box 1625, MS 3570, Idaho Falls, ID 83415-3570
*E-mail	Shyam.nair@inl.gov

Abstract

For U.S. Department of Energy's Bioenergy Technology Office, researchers at Idaho National Laboratory (INL) are applying and further developing the Landscape Environmental Assessment Framework (LEAF) to assess (1) the potential to increase total biomass production in corn-dominated agricultural fields in the US and (2) the potential to limit losses of soil, soil carbon, and nutrients to the environment. After corn stover harvest, exposure of topsoil to the elements leads to emission of soil carbon, erosion of soil by wind and precipitation, and leaching of nutrients. To achieve increases in biomass production, corn stover removal can be offset by integrating energy crops such as miscanthus and switchgrass into non-profitable corn subfield areas. Basic and rigorous stover-removal criteria were considered, based on previous INL research, to limit these post-harvest environmental releases. Perennial energy crops capture nutrients and carbon from the soils as they grow, effectively limiting the release of nutrients into the environment while increasing biomass production. Another model, AGricultural Non-Point Source Pollution (AGNPS), developed by U.S. Department of Agriculture, Agricultural Research Service, is being incorporated into LEAF to assess the impacts of wash-off of nutrients from agricultural watersheds into surface water bodies and the potential effectiveness of energy crop integration in reducing them. An initial study of four U.S. counties, submitted for publication in a refereed journal article, indicated (1) potential to considerably increase biomass production sustainably over the long-term, and (2) potential to manage the balance between food and biomass production through selective harvesting of corn stover together with selective integration of energy crops into row-crop subfields. Current work is focused on extending the study to include most corn-producing fields in Iowa and Kansas (99 counties in Iowa and 105 counties in Kansas) and to assess the impacts on two watersheds in Iowa. Input datasets for 36 counties have been completed as of this writing and they are being analyzed by AgSolver using LEAF to generate estimates of total biomass production, soil, soil carbon, and nutrient releases. Initial analysis of an agricultural subfield in a watershed in Iowa is ongoing concurrently. Preliminary results from the current work, as available, and details of past work will be presented at the workshop, followed by more detailed reports and publications later in the year.

Notes:

P13-A. THE GERMAN BIOGAS CASE – SUSTAINABILITY GOVERNANCE AND STAKEHOLDERS (O2/O3) – DANIELA THRÄN

First author*	Daniela Thrän
Co-authors	Kay Schaubach
*Organization	DBFZ gGmbH
*Address	Torgauer Str. 116; 04347 Leipzig; Germany
*E-mail	daniela.thraen@dbfz.de

Abstract

Over the last two decades, Germany has supported the implementation of renewable energy, resulting in shares of 32% in the electricity sector, 13% for heating and cooling and 5% in the transport sector (2016). With 17% of the renewable electricity generation, biogas is the third pillar after wind (41%) and solar power (PV, 20%). In renewable heating, heat from biogas CHP take second place (10%), dominated by solid fuels (65%). Biomethane (upgraded biogas) plays only a marginal role in the transport sector.

The main driver for renewable energies in Germany was the reduction of GHG emissions, of which the energy system is one of the main contributors. Other drivers are the increase of energy system resilience by using domestic resources and the support of technical innovation. For biogas, a range of additional benefits occur, such as treatment and valorising of manure and other organic residues. This is reflected in the sectoral structure: The majority of the more than 8,000 biogas plants in Germany are installed at farms, using maize and manure as dominating substrates. The main output is power, fed into the national grid, and heat, consumed on site or through district heating. The digestate is used as bio-fertilizer on fields. Flexible, demand driven power provision from biogas became a major issue during the last five years.

The main instrument to facilitate this development is the Renewable Energy Act (Erneuerbare-Energien-Gesetz, EEG), which came into force in 2000. It opens up the grid and market access, sets Feed-in-Tariffs (FIT) for 20 years (ensuring investment security) and sets boundaries for feddstocks and technologies (partially based on sustainability criteria). To ensure the (environmental) sustainability, additional legal framework directly or indirectly complement the EEG, e.g. organic waste regulation (BioAbfV), biofuel sustainability regulation (Biokraft-NachV), biomass order (BiomasseV), Federal Immission Control Act (BImSchG) or the Act on fertilizers (DüngG).

The EEG has been adapted regularly based on a monitoring considering implementation status, prices, reaching of set goals (including sustainability) and impact on various sectors such as agriculture. Driven by the EEG, three market phases can be discerned so far: 1. Start-up (protected niche), 2. market saturation (major build-up done, exposure to market) and 3. market integration (switch from FIT to auctions, full competition).

According to the described market structure, the most relevant stakeholders are farmers (as substrate suppliers, investors and plant operators), politicians (setting the framework) and the energy sector as offtaker of the final products.

Notes:

P13-B. THE IMPACT OF GOVERNANCE ON THE DEPLOYMENT AND THE ENVIRONMENTAL SUSTAINABILITY OF MANURE BASED CENTRALISED BIOGAS PRODUCTION IN DENMARK (O2) – TEODORITA AL SEADI, PRESENTED BY DANIELA THRÄN

First author*	Teodorita Al Seadi (integrated presented by Daniela Thrän)
Co-authors	Inge Stupak, Tat Smith
*Organization	Biosantech
*Address	Lerhøjs Alle 14, 6700 Esbjerg, Denmark
*E-mail	teodorita.alseadi@biosantech.com

Abstract

Centralized biogas production based on co-digestion of animal dejections (slurries and manures) with other biomass is an original Danish concept of sustainable biogas production, which is well known today around the world. The biogas technology was introduced in Denmark as an experiment, back in the 1970s, during the oil crisis, aiming to increase security of the energy supply through utilisation of national, renewable resources. The technology is nowadays mature and well-established, and includes a variety of technical solutions and a broad range of co-substrates aiming to enhance methane yield of manure digestion. A number of specific factors and beneficial pre-conditions have influenced the development of the Danish manure based biogas production. Among these are the governmental bottom-up development strategy, the existence of the district heating system, the policies for de-centralised CHP production, energy and environmental protection policies, energy taxes, waste treatment strategies, a long-term support for biogas development, stimulation of cooperation, learning and knowledge sharing between different categories of stakeholders, to mention only some of them. The first biogas plants were designed only for energy generation. Later, it became clear, that biogas can make a significant contribution to solving some important environmental problems of the conventional, intensive agriculture, and of the energy and the waste management sectors. Consequently, centralised biogas plants were considered as integrated solutions for energy production, manure and organic waste treatment and manure/nutrient redistribution. Regulatory initiatives, policies and strategic planning, promoting sustainability of biogas production and use emerged with time, including national and international/EU legislation, regulations, positive lists, best practices, certification systems etc. It is known that the deployment and spreading of a specific technology not only depends on its technological maturity and the economic conditions, but to a very large extent also on public support and awareness about the respective technology. In the case of biogas, sustainability governance should not only ensure that the development is on a sustainable path, but also enhance public trust in biogas from manure co-digestion and improve the public perception of biogas as renewable fuel in general. This paper reviews the development of the governance frameworks to ensure environmental sustainability of manure based centralized biogas production in Denmark, with a special focus on how the governance systems emerged and developed over time, which were the drivers, and how it impacted the further development of the biogas sector. We analyze and discuss how sustainability governance can develop in the future, for increased trust in its legitimacy and effectiveness.

Notes:

P14. ROLE OF STAKEHOLDERS' PERCEPTIONS FOR BIOENERGY SUSTAINABILITY: CASE OF FOREST BIOREFINERY IN LA TUQUE, QUEBEC (O3) – LEONARD NKUNZIMANA

First author	Leonard Nkunzimana[1,a]
Co-authors	Evelyne Thiffault[1], Biljana Kulišic[2], William White[3], Luc Bouthillier[4], Simon Barnabé[1], Christophe Krolik[5]
Organization	[1]Centre de Recherche sur les Matériaux Renouvelables, Université Laval et Université du Québec à Trois-Rivières, [2]Energy Institute Hrvoje Pozar, [3]Kingsmere Economics Consulting, [4]Centre de recherche sur les innovations sociales, Université Laval, [5]Chaire de recherche et d'innovation Goldcorp en droit des ressources naturelles et de l'énergie, Université Laval
Address	[1]Département des sciences du bois et de la forêt, Université Laval, 2405 rue de la Terrasse, Pavillon Abitibi-Price,Université Laval, Québec (QC), G1V 0A6 Canada
E-mail	[a]leonard.nkunzimana.1@ulaval.ca

Abstract

Investments in the forest bioenergy sector remain timid in Canada despite the abundance of its forest resources. Scientists agree that the lack of reliable and relevant information on social acceptability and associated benefits in communities is a barrier to decision-making for development. This work highlights the role of stakeholders' perceptions on the expectations associated with the development of a forest biorefinery in La Tuque, Quebec. Semi-structured interviews, surveys, and the fuzzy Analytical Hierarchical Approach (f-AHP) are used to collect and analyze the information related to these expectations. The study involves representatives of public and private organizations, local leaders, First Nations and businesses operating in La Tuque. The semi-structured interviews revealed that expectations (both negative and positive) associated with the biorefinery project are mostly linked to socio-economic aspects, for example the impact of adding a new player in the forest value chain on the regional economy, and on the organization of forestry activities (access to the forest resources, cost sharing of road building and maintenance, etc.). Evidence from the f-AHP shows that creation of new business opportunities and additional revenues to local enterprises and communities rank high among expectations. Also, retaining youth in the communities and creating occasions for the use and valorization of forest residues are among the prominent expectations of stakeholders. As a whole, environmental concerns related to biomass procurement and carbon balance of bioenergy do not appear as important to stakeholders. A better understanding of stakeholders' expectations is important to better design and implement bioenergy policies. In this process, a synergy with stakeholders that have an influence in the forestry sector and in the supply and use of biomass, the mobilization of researchers and public incentives seem to be important avenues to ensure the success of such a project in La Tuque.

Notes:

P15. LINKING MEASUREMENT AND GOVERNANCE: WOOD PELLETS FROM THE SOUTHEASTERN UNITED STATES (O2/O3) – VIRGINIA DALE

First author*	Virginia Dale
Co-authors	Keith Kline, Don Hodges, and Neelam Poudyal
*Organization	Oak Ridge National Laboratory and University of Tennessee Institute of Agriculture
*Address	1 Bethel Valley Road, Oak Ridge, TN 37831-6036
*E-mail	dalevh@ornl.gov

Abstract

Production of pellets in the southeastern United States (SE US) has grown from negligible amounts over past decades to 4.6 million metric tonnes in 2015 with 98% of the wood pellets shipped to Europe to displace coal in power plants. Wood pellets in the US are a fraction of total forestry operations and can be produced while maintaining or improving forest ecosystem services as well as supplementing incomes to private rural landholders.

The ongoing debate about costs and benefits of wood-pellet bioenergy production in the SE US requires an understanding of the science and context influencing decisions associated with its production. Dramatic changes have occurred in the SE US landscape since large-scale settlement began in the 18th century accompanied by row crop cultivation and almost complete forest conversion that resulted in high soil erosion rates.

US federal policy instruments safeguarding all forests include protection of rare species and ecosystem services. State agencies, land trusts, nongovernmental organizations (NGOs), and citizen alliances safeguard state and private forests. Depending on the forest type and condition, that protection may involve active management.

Feedstock for wood pellets produced in the SE US comes from private forest land – most of which is family owned. Hence understanding the goals, constraints and perspectives of these family forest owners is essential. Family forest owners are motivated by diverse interests including asset preservation, profit generation, aesthetics, wildlife, recreation, and inheritance for heirs. Harvesting decisions by family forest owners are frequently triggered by life events, such as the need to raise money for medical treatment, education, or retirement, or by a change in ownership. Although SE US family forest owners often lack the resources or incentives to engage in certification schemes, all pellet mills that export require that logging contractors follow Best Management Practices (BMPs).

Ecosystem services in the SE US are protected by this requirement to utilize loggers trained to apply scientifically-based BMPs in planning and implementing harvest for the export market. Bioenergy markets supplement incomes to private rural landholders and provide an incentive for forest management practices that simultaneously benefit water quality and wildlife and reduce risk of fire and insect outbreaks. Bioenergy may also increase the value of forest land to landowners, thereby decreasing likelihood of conversion to non-forest uses. The balance of evidence to date suggests that current levels of wood pellet production in the SE US have had a benign effect on forest ecosystem services.

Notes:

P16. MEASURING, DOCUMENTING, AND COMMUNICATING THE SUSTAINABILITY OF SUPPLY CHAINS WITHIN THE WOOD PELLET INDUSTRY OF THE SOUTHEAST U.S. (O2) – BRIAN KITTLER

First author	Brian Kittler
Co-authors	
Organization	Pinchot Institute
Address	1400 16th St NW #350, Washington, DC 20036, USA
E-mail	bkittler@pinchot.org

Abstract

This study aims at making recommendations for improving the legitimacy and effectiveness of governance and certification systems to benefit sustainable deployment the wood pellet potential in the Southeast U.S. By interviewing personnel with operational experiences among wood pellet producers in the region, this study investigates how environmental sustainability of bioenergy supply chains in the Southeast U.S. wood pellet industry is documented and measured. Through these interviews we are seeking to understand:

A. What is driving companies' engagement with sustainability initiatives?
B. Which sustainability initiatives are most common for demonstrating compliance with sustainability criteria?
C. Where are the largest challenges to documentation of compliance with sustainability criteria, and where is the largest potential for improving the documentation?
D. Where are the largest challenges to tracking documentation, and where is the largest potential for improving the tracking?
E. What are the largest challenges to managing communication about sustainability with stakeholders?

Eight interviews have currently been carried out representing 6 companies and nearly 75% of the export capacity. Preliminary results show the feedstocks, sourcing strategies, and supply chains for the pellet mills varied considerably, e.g. procuring 100% of fiber from certified industrial forestland, to procuring only approximately 5% of fiber from certified forests, to a vertically integrated company certified by FSC, SFI, and SBP possessing a pellet mill in conjunction with a sawmill, both supported largely by their land. The up-stream supply chains of the pellet mills include multiple and varied raw material suppliers, typically loggers, wood dealers, and sawmills.

Pellet mills have adopted various forms of sustainability governance, including SFI Forest Management and Fiber Sourcing certification, FSC Controlled Wood certification, and SBP certification. The drivers to use sustainability governance vary and typically include regulations, customer demands, and corporate policy. Evidence used to prove compliance with sustainability governance varies but typically includes third party risk assessments, largely focused on risks to being unable to establish a chain of custody back to fiber origin, and risks to biodiversity. For all pellet mills significant challenges include documenting chain of custody and/or risks from secondary and tertiary suppliers—i.e. sawmills and wood manufacturing facilities supplying residues. Sustainability performance of the mill was typically communicated through the company's website, third-party audits, and through trade associations.

Notes:

P17. GOVERNANCE OF SUSTAINABLE FOREST MANAGEMENT AND BIOENERGY IN ONTARIO (O2) – QUENTIN CHEUNG, PRESENTED BY TAT SMITH

First author	Quentin Cheung
Co-author*	Tat Smith
*Organization	University of Toronto
*Address	33 Willcocks Street, Toronto, ON M5S 3B3 Canada
*E-mail	tat.smith@utoronto.ca

Abstract

Biomass harvest is an emergent and marginal activity taking place within Ontario and Canada's greater forest products sector. Driven by European carbon abatement policies and rising bioenergy demand in South East Asia, there has been renewed interest in the use of Ontario's abundant residue supplies for the purposes of wood pellet and feedstock export. However, such interest calls into question the ability of the existing regulatory complex to curtail and identify potentially negative effects, accommodate for environmental and social change, and ensure downstream sustainability within the supply chain. This paper aims to follow through the current regulatory and supply chain regimes for biomass harvest in Ontario to identify policy designs, institutional configurations, and evidence to support sustainable results. Our study identifies a bulk biomass source within the Boreal Forest Region, where the combination of full tree harvest and mixed species composition has resulted in a biomass source from unmerchantable species for which no market currently exists. In addition to harvesting residues, mill residues may provide a minor contribution owing to low supply and competing end-use. Existing policies were assessed through application of the policy analysis framework developed by McDermott et al. (2008 & 2009) based on comparison of policy type and threshold values to determine prescriptiveness. Requirements for four criteria sensitive to biomass- riparian buffers, residual retention, skidding, and high value conservation forest were analyzed in relation to existing provincial guidelines and the forest management guidelines for Ontario's three most common certification programs- the SFI, FSC, and PEFC/CSA. In general, the Ontario Stand and Site guide provided the most frequent and restrictive use of quantitative (substantive) thresholds, whereas the CSA and SFI were primarily systems based. Of the three certification systems, the FSC standards were the most prescriptive and yielded the most substantive requirements, and all three systems stipulate compliance with provincial rules and regulations. Our analysis also identified similar policy approaches and threshold values across international government regulations and forest certification standards. Chain of custody requirements between the three systems also demonstrated near identical performance and policy type. Mechanisms and methods for monitoring and policy revision, which are elements of Ontario's adaptive management framework were also discussed. The use of iterative policy setting may reduce policy uncertainty, alleviate negative outcomes and improve effectiveness. We present recommendations for a continued adaptive and precautionary approach, but also for expanded monitoring to establish direct impacts of long-term biomass removal and sustainability goals. Increasingly complex governance under new policy and existing provincial regulation may also restrain biomass harvest through limitations and increased costs for assessment of areas surrounding endangered species habitat.

Notes:

P18. POSITION, PERCEPTIONS, AND VISIONS OF STAKEHOLDERS ON BIOENERGY SUSTAINABILITY: METHODOLOGY AND PRELIMINARY RESULTS (O3) – THUY MAI MOULIN

First author*	Thuy Mai Moulin
Co-authors	Uwe Fritsche, Martin Junginger
*Organization	Utrecht University; International Institute for Sustainability Analysis & Strategy
*Address	Van Unnik – Room 912, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands
*E-mail	t.p.t.mai-moulin@uu.nl

Abstract

Bioenergy has an important role in the energy landscape in the short, medium and long term future. Many member states of the European Union and numerous other countries have recognized the potential role of bioenergy in reducing greenhouse gas (GHG) emissions and in helping countries to become less dependent on fossil fuel supply. However, there are still concerns and misconceptions about the impacts of bioenergy such as competition with food production, impact on forest carbon stock, limited and/or delayed GHG savings compared to fossil fuels and competition between energy and material use. Also, lack of unbiased information and involvements of local community in bioenergy projects may hinder the sector development.

As part of the *Measuring, governing and gaining support for sustainable bioenergy supply chains* project, a methodology was developed to identify the positions of stakeholders directly and indirectly involved in existing and future bioenergy value chains. The methodology has been used to map relevant stakeholders for different national case studies and at supra-national level. Four steps are being carried out:

1) **Identify** relevant stakeholders in different bioenergy value chains
2) **Communicate** with stakeholders via a general questionnaire (see http://ieabioenergysustainability.questionpro.com), interviews and workshops to understand their viewpoints, decisions and influences to the bioenergy value chains
3) **Compare** stakeholders' positions, viewpoints and influence in different bioenergy value chains and identify both the main points of diverging views and possible areas of common ground
4) **Provide recommendations** on how to gain (further) support from stakeholders for sustainable bioenergy value chains management

During the workshop in Gothenburg, preliminary results will be presented, based on responses received so far from the questionnaire, and a limited number of individual interviews with various supranational stakeholders. At the same time, this workshop will also provide the opportunity for participating stakeholders to give further input to the project during the discussion.

Notes:

Further Information

IEA Bioenergy Website
www.ieabioenergy.com

Contact us:
www.ieabioenergy.com/contact-us/