IEA Bioenergy

Inter-task project

Measuring, governing and gaining support for sustainable bioenergy supply chains

Objective 1

Annette Cowie, Goran Berndes and intertask project members

18-19 May 2017, Gothenburg, Sweden

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Objective 1

Leaders: Task 38 & 43 (Cowie & Berndes)

Provide an overview of **calculation methods & tools** to assess the sustainability of biomass and bioenergy supply chains and discuss needs, possibilities and limitations of a global, uniform/ harmonized framework

Objective 1

- Includes climate forcers and other environmental, economic and social criteria & indicators for *sustainable biomass feedstock production*
- Critically review tools and calculation methods
- Discuss with respect to specific bioenergy systems

Objective 1

Discuss:

- issues surrounding the application of tools and methods
- possibilities and drawbacks/limitations to develop uniform/harmonized approaches
- Consider applicability to bio-based materials beyond bioenergy.

Structure - Objective 1

Activity	Leader, progress
Comparison of tools for assessing biofuels	• Chum, • Work in progress
Methodological aspects of assessing climate effects of forest bioenergy systems	
Canadian case study	• Thiffault • Work in progress
Swedish case study	• Berndes • Scientific papers published
Challenges for LCA and other assessment tools supporting governance	
Assessments of ecosystem services in landscapes	• Berndes • Scientific paper published • Popular summary underway
Indirect land use change and baselines	• Langeveld / Cowie • Work in progress
Australian case study: use of cleared scrub for bioenergy or biochar compared with in-field burning	• Cowie • Work in progress
Synthesis	• Berndes, Cowie • Not started

IEA Bioenergy
Task 38

Sustainability of bioenergy supply chains

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

Objective 1.
Measuring sustainability
Task 38 Lead: Annette Cowie
Task 39 and Task 40 Contributors

Inter-Task workshop 18-19 May 2017, Gothenburg, Sweden

P1. Comparison of tools for assessing GHG emissions savings of biofuels

NREL NATIONAL RENEWABLE ENERGY LABORATORY

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

H. Chum, E. Warner, Y. Zhang,
National Renewable Energy Laboratory, Golden, CO, USA

L. G. Pereira, O. Cavalett, A. Bonomi
CTBE, Campinas, São Paulo, Brazil

CTBE Laboratório Nacional de Ciência e Tecnologia do Bioetanol

Task 39 IEA Bioenergy

How to Analyse Ecosystem Services in Landscapes

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IEA Bioenergy InterTask Workshop:
Sustainability of Bioenergy Supply Chains

RELATING ECOSYSTEM SERVICES TO INDICATORS OF PROGRESS TOWARD A SUSTAINABLE BIOECONOMY

Gothenburg, Sweden
May 18-19, 2017

Virginia H. Dale and Keith L. Kline
Oak Ridge National Laboratory

http://www.ornl.gov/sci/ees/cbes/

ORNL is managed by UT-Battelle
for the US Department of Energy

This presentation does not contain any proprietary, confidential, or otherwise restricted information.

OAK RIDGE National Laboratory

Delphi survey approach for the identification of sustainability indicators & environmental impacts of biomass harvesting for a Biorefinery: Case study in Québec

Presented by: **Dr. Ichrak Lakhdhar**

Supervisor: **Pr. Évelyne Thiffault**

Co-supervisor: **Pr. Paul Stuart**

Industrial supervisor: **Pr. Patrice Mangin**

IEA Bioenergy inter-task project,
Gothenburg, Sweden
18-19 May 2017

Assessing the climate effects of forest bioenergy systems: Swedish case study

O. Cintas[a], G. Berndes[a], J. Hansson[a,b], B. Poudel[c], J. Bergh[c], P. Börjesson[d], G. Egnell[e], T. Lundmark[e], A. Nordin[e].

Assessing climate effects of forest bioenergy systems: A Canadian case study of unloved wood

Evelyne Thiffault

Progress - Objective 1

Underway: Challenges in LCA: Indirect effects and baselines

Quantifying the climate effects of bioenergy - choice of reference system

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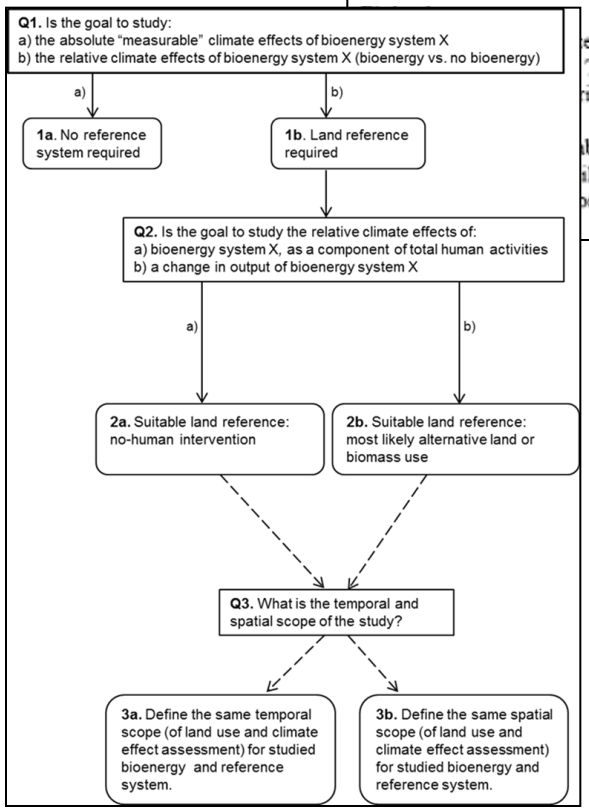
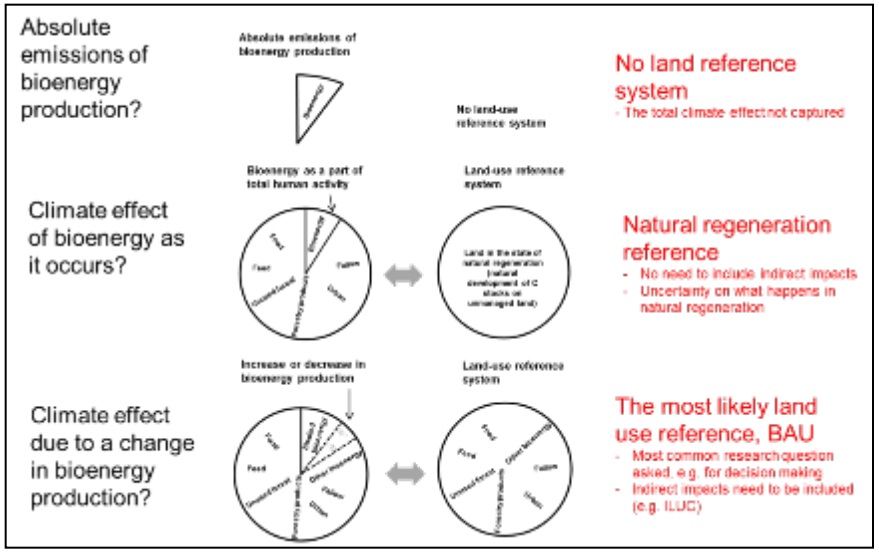
ilt Environment, KTH - Royal Institute of Technology, Stockholm, Sweden
omy and Systems Analysis, Institute of Soil Science and Plant Cultivation,





Alternative management of scrub?

Progress - Objective 1

GLOBAL CHANGE BIOLOGY BIOENERGY
GCB Bioenergy (2017), doi: 10.1111/gcbb.12425

Carbon balances of bioenergy systems using biomass from forests managed with long rotations: bridging the gap between stand an

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Australia, [4]Department of Forest Ecology and M
[5]Department of Forest Resource Management, S
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Ecology, Swedish University of Agricultural Sci

Abstract

Studies report different findings concerni
use of different approaches to define spat
bioenergy systems that use biomass from
and boundary conditions. Two approache
ing vs. constant spatial boundaries – are c
by combining a series of time-shifted for
argue that the approach that uses constar
in the landscape throughout the accounti
to accurately describe the carbon fluxes i
ence of the stand-level dynamics, which i
the stand level. Modelling of profit-driven
implications for carbon balance of manag
expanding system boundaries are used)
expectations of market development for b
forest-based bioenergy in isolation but sh
planning as a whole is affected by bioene
landscapes and forest product pools. Due
products markets. We recommend that fu
as policy options and energy technology p

Keywords: bioenergy, carbon balances, forest, fo

Received 19 September 2016; accepted 5 Novemb

Introduction

Assessing greenhouse gas (GHG) balances
mate effects of bioenergy is essential to in
development and implementation. Studies
GHG balances for bioenergy systems someti
that bioenergy systems are neutral in regard
sphere–atmosphere CO_2 flows, since the bio
tem is integrated in the carbon cycle

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The potential role of forest management in Swedish scenarios towa climate neutrality by mid century ☆

Olivia Cintas [a,*], Göran Berndes [b], Julia Hansson [b,c], Bishnu Chandra Poudel [d], Johan Berg
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ABSTRACT

Swedish climate policy targets net zero greenhouse gases (GHG) by mid-c
independent of fossil fuels by 2030, requiring far-reaching changes in the way
agement is expected to support carbon sequestration and provide biomass
energy. In this paper, we combine two energy scenarios with four forest scen
ances associated with energy-use for heat, electricity, and road transport, a
and production, use, and end-of-life management of various forest produ
export. The aggregated GHG balances are evaluated in relation to the 2-deg
Swedish CO_2 budget. The production of biofuels in the agriculture sector is c
in detail.

The results suggest that Swedish forestry can make an important contributi
and other products while maintaining or enhancing carbon storage in vegeta
ucts. The GHG neutrality goal is not met in any of the scenarios without factor
Measures to enhance forest productivity can increase output of forest prod
export) and also enhance carbon sequestration. The Swedish forest sector ca
also reduce emissions, and avoid "using up" its allocated CO_2 budget, thereby incr
sions space for the rest of the world.

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1. Introduction

In 2015, at COP21 in Paris, world leaders agreed, among other things, to (a) aim for a peaking of global greenhouse gas (GHG) emissions as soon as possible, (b) achieve GHG neutrality ("a balance between anthropogenic emissions and removals by sinks") in the second half of this century, and (c) hold global warming well below 2 °C (UNFCCC, 2015). This will require strong mitigation efforts (IPCC, 2014). Cumulative carbon dioxide (CO_2) emissions and global temperature change are near-linearly related and inde-

pendent of the timing of CO_2 emissic
Matthews et al., 2009; Meinshausen et
2009; Knutti and Rogelj, 2015; MacDoug
cumulative "carbon budget" in line with
been proposed to be more robust and easi
icy target than emissions-rate or concentr
2009). However, difficulties translating ca
thing governments can control, such as sh
gets, have also been pointed out (Victor,

In 2013, the IPCC working group I (W
carbon budgets associated with variou
below a 2-degree limit. For a better than
the increase in global average surface ter
emissions below 2 degrees, the associat
emissions from 1870 and on is no greate
budget drops by about one-fifth if non-CO_2

☆ This article is part of an special issue "Sustainability of increased forest biomass harvest from a Swedish perspective" published in the journal Forest Ecology and Management 383, 2017.

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Review

How to analyse ecosystem services in landscapes—A systematic review

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ABSTRACT

Ecosystem services (ES) is a significant research topic with diverse modelling and mapping approaches. However, the variety of approaches—along with an inconsistent terminology—cause uncertainties concerning the choice of methods. 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*. 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.

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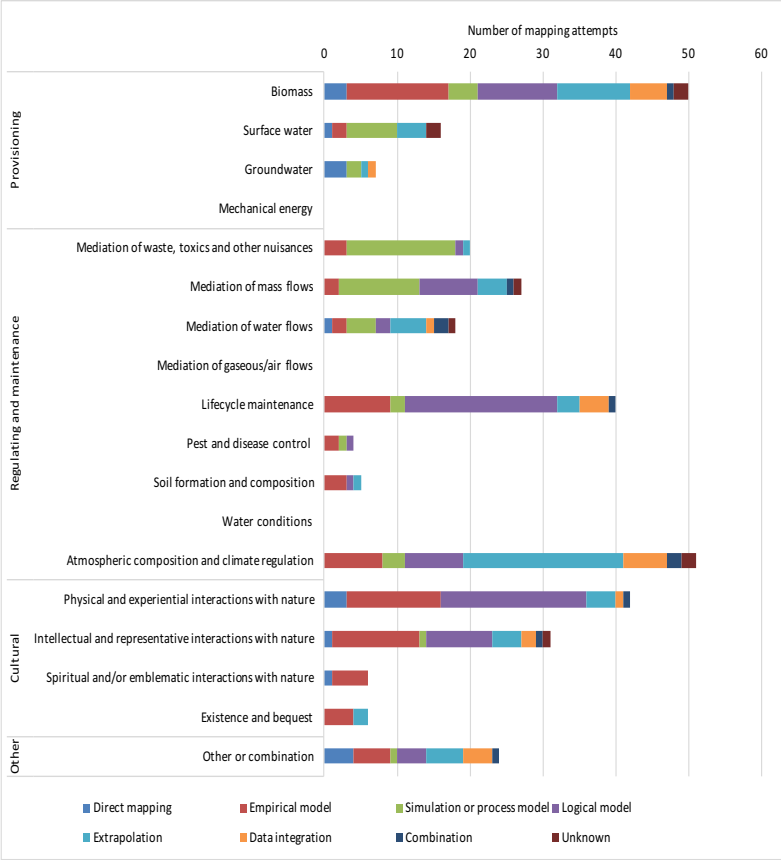
Progress - Objective 1

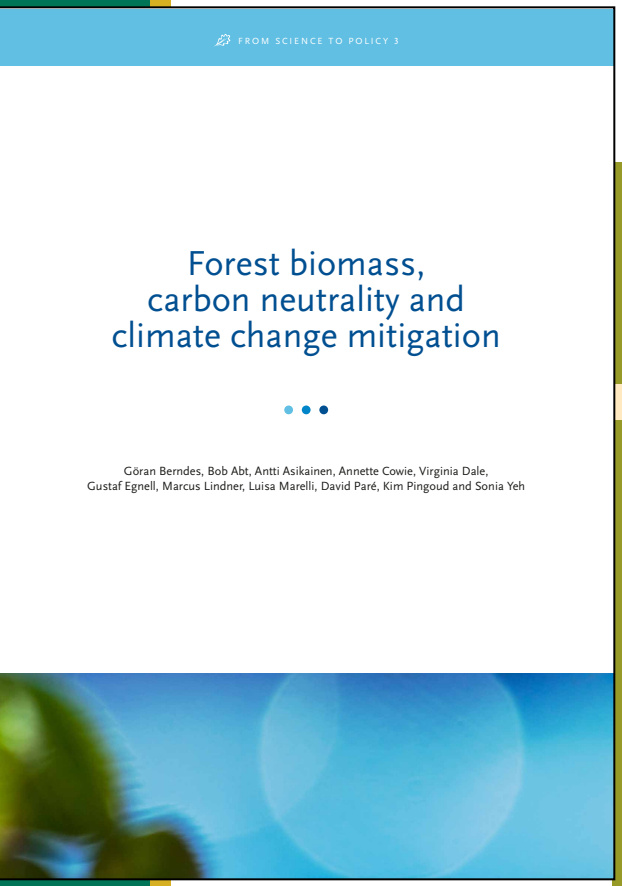
Assessments of ecosystem services in landscapes
Underway: Summary report based on scientific publications

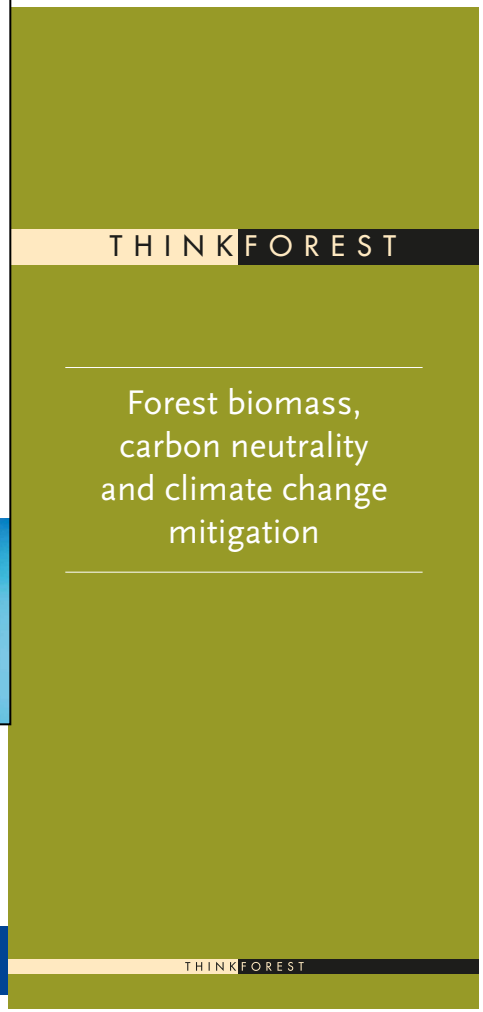


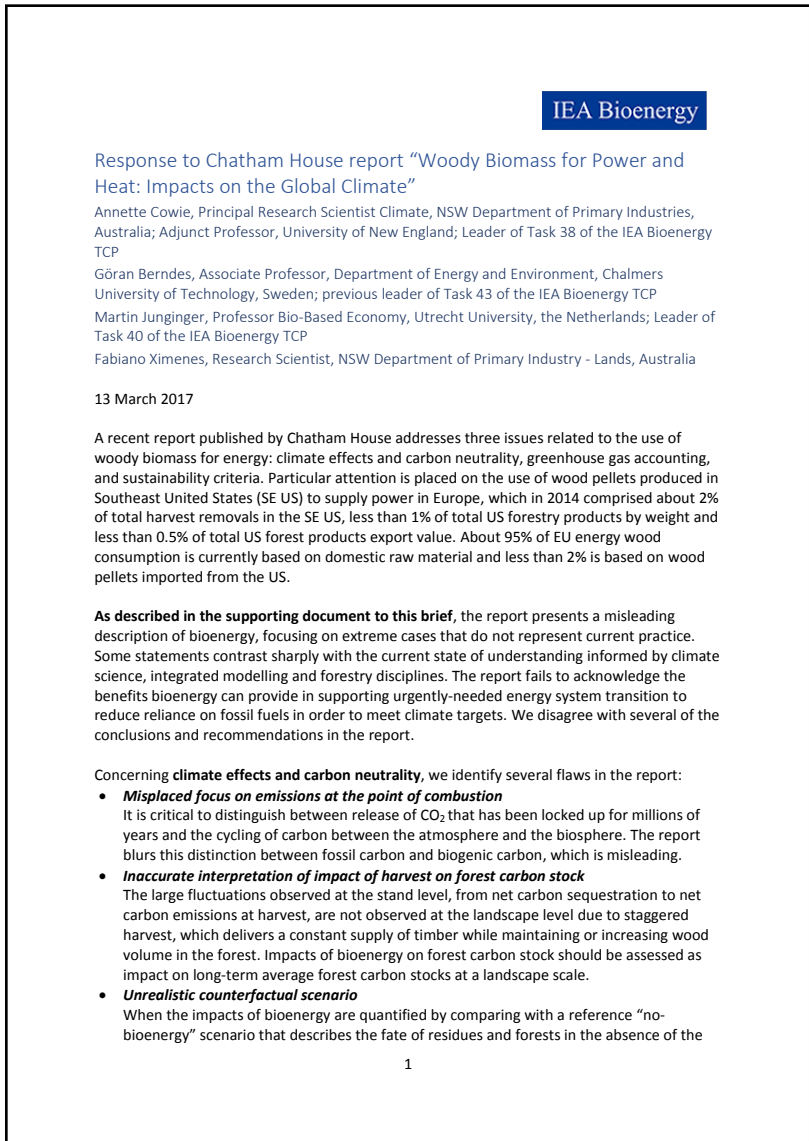
Number of times different ecosystem services have been mapped at a landscape scale in publications included in a systematic literature review. Methods are identified via colors in the diagram.

Progress - Objective 1

Associated output: EFI report & Chatham house response







IEA Bioenergy

Response to Chatham House report "Woody Biomass for Power and Heat: Impacts on the Global Climate"

Annette Cowie, Principal Research Scientist Climate, NSW Department of Primary Industries, Australia; Adjunct Professor, University of New England; Leader of Task 38 of the IEA Bioenergy TCP

Göran Berndes, Associate Professor, Department of Energy and Environment, Chalmers University of Technology, Sweden; previous leader of Task 43 of the IEA Bioenergy TCP

Martin Junginger, Professor Bio-Based Economy, Utrecht University, the Netherlands; Leader of Task 40 of the IEA Bioenergy TCP

Fabiano Ximenes, Research Scientist, NSW Department of Primary Industry - Lands, Australia

13 March 2017

A recent report published by Chatham House addresses three issues related to the use of woody biomass for energy: climate effects and carbon neutrality, greenhouse gas accounting, and sustainability criteria. Particular attention is placed on the use of wood pellets produced in Southeast United States (SE US) to supply power in Europe, which in 2014 comprised about 2% of total harvest removals in the SE US, less than 1% of total US forestry products by weight and less than 0.5% of total US forest products export value. About 95% of EU energy wood consumption is currently based on domestic raw material and less than 2% is based on wood pellets imported from the US.

As described in the supporting document to this brief, the report presents a misleading description of bioenergy, focusing on extreme cases that do not represent current practice. Some statements contrast sharply with the current state of understanding informed by climate science, integrated modelling and forestry disciplines. The report fails to acknowledge the benefits bioenergy can provide in supporting urgently-needed energy system transition to reduce reliance on fossil fuels in order to meet climate targets. We disagree with several of the conclusions and recommendations in the report.

Concerning **climate effects and carbon neutrality**, we identify several flaws in the report:

- ***Misplaced focus on emissions at the point of combustion***
  It is critical to distinguish between release of CO_2 that has been locked up for millions of years and the cycling of carbon between the atmosphere and the biosphere. The report blurs this distinction between fossil carbon and biogenic carbon, which is misleading.
- ***Inaccurate interpretation of impact of harvest on forest carbon stock***
  The large fluctuations observed at the stand level, from net carbon sequestration to net carbon emissions at harvest, are not observed at the landscape level due to staggered harvest, which delivers a constant supply of timber while maintaining or increasing wood volume in the forest. Impacts of bioenergy on forest carbon stock should be assessed as impact on long-term average forest carbon stocks at a landscape scale.
- ***Unrealistic counterfactual scenario***
  When the impacts of bioenergy are quantified by comparing with a reference "no-bioenergy" scenario that describes the fate of residues and forests in the absence of the

1

	Objective 1: Measuring sustainability	
11.00-11.30	Comparison of tools for assessing greenhouse gas emissions savings of biofuels.	Presenter: **Helena Chum**
11.30-11.55	How to analyse ecosystem services in landscapes.	Presenter: **Oskar Englund**
11.55-12.20	Relating ecosystem Services to indicators of progress toward a sustainable bioeconomy	Presenters:**Virginia Dale & Keith Kline**
12.20-12.45	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**
12.45-13.45	Lunch	
13.45-14.45	Discussion: possibilities and limitations of a global harmonized framework to assess sustainability of biobased production	Commenter: **Horst Fehrenbach**
14.45-15.15	Assessing the climate effects of forest bioenergy systems: Swedish case study.	Presenter: **Olivia Cintas**
15.15-15.45	Assessing climate effects of forest bioenergy systems: A Canadian case study of unloved wood.	Presenter: **Evelyne Thiffault**
15.45-16.15		Coffee
16.15-17.00	Discussion: Results and methodology approaches in the Swedish and Canadian case studies	Commenters: **Jeffrey Skeer & Helena Chum**
17.00-18.00	Report back from sessions and discussion of findings	
	Friday 19 May 2017	
	Objective 1: Measuring sustainability	
08.15-09.30	General discussion on methodologies to assess the climate effects of bioenergy systems	Commenter: **Richard Peberdy**