Global Bioeconomy Summit
Conference Proceedings

For a Global Sustainable Bioeconomy

25.–26. November 2015, Berlin, Germany

Bioökonomierat

SUPPORTED BY:
Federal Ministry of Education and Research

UNDER THE PATRONAGE OF:
The Federal Chancellor

Welcome Addresses on the Occasion of the Global Bioeconomy Summit 2015

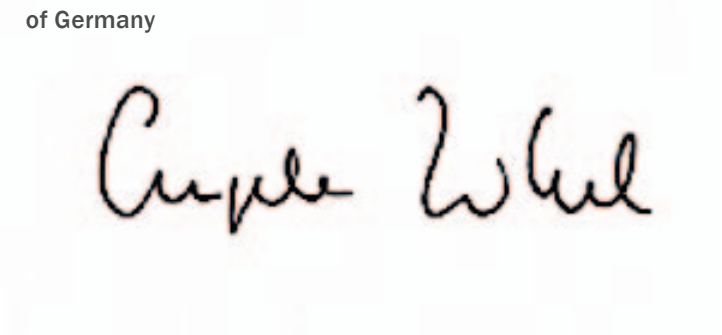
The number of people in the world is growing, whereas the earth's natural resources are limited. This simple fact poses one of the greatest challenges we face today: how can we succeed in meeting the needs of present and future generations alike?

A biobased economy offers a promising prospect. It relies on renewable resources and scientific findings. This means that renewable resources and biotechnological processes primarily help to safeguard food security and are also used to generate sustainable energy and in industrial manufacturing.

Several years ago, the Federal Government launched the National Research Strategy BioEconomy 2030 and the National Policy Strategy on Bioeconomy. Essentially, these two strategies will strengthen the bioeconomy as the driving force of innovation and the key to sustainable growth. To this end, we are promoting interdisciplinarity and collaboration between science and industry, as well as international cooperation. In addition, we want to engage in an intensive dialogue with society. After all, the duty to ensure responsible use of the world's finite natural resources concerns every one of us.

The first Global Bioeconomy Summit held by the German Bioeconomy Council provides an excellent forum for exchanging views on different approaches and experiences across national borders. In view of the important decisions on climate and sustainability policy that will be made this year, global collaboration on the bioeconomy has particular precedence. As patron, I thus hope for a successful outcome of the conference and I wish all participants and guests interesting meetings and stimulating discussions.

Angela Merkel
Federal Chancellor of the Federal Republic of Germany

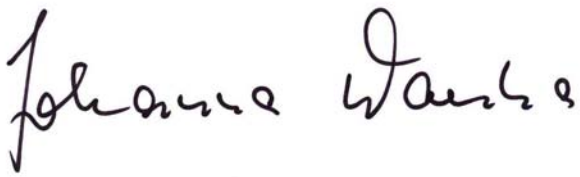


How can the world economy grow sustainably without threatening our natural resources? How can we feed billions of people under these circumstances? How can we wisely reconcile economic and ecological concerns while ensuring that the opportunities and challenges of globalization are shared fairly? The bioeconomy can provide valuable answers to these questions. Research, development and innovation are the keys to a sustainable future. The Federal Government therefore decided at an early stage to adopt a research policy and strategy which promotes the transformation towards a sustainable bio-based economy.

The bioeconomy is becoming an increasingly important concept. Governments all over the world are focusing on green innovations, resource efficiency and sustainable life cycle management. But a truly sustainable bioeconomy can only be achieved if stakeholders on all continents cooperate with one another. This is why we need to follow a global approach: The regional or national objectives which have been defined and the measures which have already been launched must be integrated into a common global bioeconomy agenda.

The Global Bioeconomy Summit provides an opportunity to make further progress with international cooperation. The German Bioeconomy Council has organized this first international bioeconomy meeting as a forum for exchange and networking. I am convinced that this global dialogue on a sustainable bioeconomy will provide many new ideas for shaping our future.

Johanna Wanka
Federal Minister of Education and Research of Germany



Welcome Address Conference Committee

Daniel Barben
Head of Conference Committee

Christine Lang
Chair, German Bioeconomy Council

Joachim v. Braun
Chair, German Bioeconomy Council

Bioeconomy having evolved as a concept in the 1990's has developed into a strategic option in solving the global challenges of food security and climate change. Despite its relative novelty, notions of bioeconomy have gained significant importance especially during the past five years. According to research carried out by the German Bioeconomy Council in preparation for the Global Bioeconomy Summit, 45 countries around the world have adopted bioeconomy strategies as part of their economic innovation agendas. Now it is time to provide a forum for exploring and debating issues pertaining to the challenges and opportunities in the development of a global bioeconomy. We warmly welcome you to this first Global Bioeconomy Summit!

As Bioeconomy combines far-reaching ambition with regional adaptation, there will be no such thing as a singular bioeconomy but rather a plurality varieties. Realizing the rich potentials of bioeconomy requires a common understanding of its foundations and perspectives. International dialogue is needed to define and guide bioeconomy in the context of related or competing notions and interests, for instance with regard to holistic concepts of biological resources or unique features such as carbon neutrality, renewability, re-usability and multi-functionality.

Therefore, the Global Bioeconomy Summit aspires to serve as a starting point for a coordinated and collaborative approach to assessing and advancing the sustainable bioeconomy. We hope that this may help create a true level playing field for bioeconomy strategies as regards global policy-making, mitigating climate change, ensuring food security, and achieving sustainable development in environmental, economic as well as social terms. We are meeting in Berlin to give a future-oriented bioeconomy, including its base in science and society, a strong voice – and develop plans that may be for the benefit of many!

Members of the German Bioeconomy Council

Georg Backhaus

President, Julius Kühn-Institute, Quedlinburg

Reinhard F. J. Hüttl

Scientific Director and Board Spokesperson, German Research Centre for Geosciences (GFZ)

Bioökonomierat

Daniel Barben

Director, Institute for Technology and Knowledge Research, University of Klagenfurt

Folkhard Isermeyer

President, Johann Heinrich von Thünen Institute, Braunschweig

Daniela Thrän

Head of Chair Bioenergy, UFZ Leipzig

Regina Birner

Head of Chair Social and Institutional Change in Agricultural Development, University of Hohenheim

Ingrid Kögel-Knabner

Head of Chair of Soil Science, TU München

Wiltrud Treffenfeldt

Chief Technology Officer Europe, DOW Europe GmbH

Léon Broers

Deputy Chairman of the Executive Board, KWS SAAT AG

Christine Lang (Chair)

Managing Director, ORGANOBALANCE GmbH

Johannes Vogel

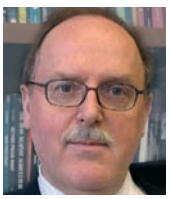
General Director, Museum of Natural History & Professor of Biodiversity and Public Science, HU Berlin

Hannelore Daniel

Director, Central Institute for Nutrition and Food Research, TU München

Lucia Reisch

Professor for Consumer Behaviour and Consumer Policy, Copenhagen Business School



Joachim von Braun (Chair)

Director, Center for Development Research (ZEF), University of Bonn

Ulrich Hamm

Head of Chair Agricultural and Food Marketing, University of Kassel

Manfred Schwerin

Director, Leibniz-Institute for Animal Breeding, University of Rostock

Holger Zinke

Member of the Board, BRAIN AG

In 2009, the German Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) established the Bioeconomy Council as an independent advisory committee to the German Federal Government. In 2012, the Council has been newly nominated for a second four-year term. The 17 members represent industry, society and science and their expertise covers the full spectrum of the bioeconomy value chain. The Council is mainly tasked with providing advice on how to foster the development of a sustainable bioeconomy in Germany and in a global context. For this purpose it engages in political and scientific dialogue, publishes position statements and promotes the future vision of the bioeconomy to broader society. The activities of the council are oriented both towards long-term objectives as well as day-to-day policy requirements.

See also www.bioekonomierat.de/en

International Advisory Committee

The Global Bioeconomy Summit is a community-building platform for policy makers and renowned experts in bioeconomy. With a view to the sustainable development goals adopted in 2015, the Summit aims to start a multilateral agenda setting process to ensure the bioeconomy contributes to sustainable development and green growth. One of the main outcomes of the Summit will be a communiqué defining a global policy agenda for a sustainable bioeconomy. This document has been developed involving international experts in bioeconomy-related policy areas in a process lasting more than six months.

The International Advisory Committee members were selected to represent the diversity in global bioeconomy development. In a first step, fifteen international experts involved in bioeconomy strategy formulation and policy advice were invited to participate in the drafting of a communiqué which will be discussed and finalized by the International Advisory Committee of the Summit. The 15 experts involved in drafting the communiqué have bioeconomy-related expertise in developing, emerging and industrialized economies as well as in different geographies, countries and continents. The drafting group was asked to make first suggestions for guiding principles defining the cornerstones of a global policy agenda for a sustainable bioeconomy. Based on these inputs, the document was refined in several consecutive feedback rounds to integrate suggestions and to reflect comments from the group.

In preparation of the Summit, the draft of the communiqué was shared among the 37 members of the International Advisory Committee (IAC). The Advisory Committee members were invited to provide feedback and suggest changes and additions to the communiqué prior to the Summit. The communiqué was finalized in a special working meeting of the International Advisory Committee in Berlin.

Members of the International Advisory Committee

Country	First Name	Last Name	Biography/Position
Argentina	Eduardo	Trigo	Director, Grupo CEO
Austria	Josef	Glössl	Vice Rector for Research and International Research Collaboration, University of Natural Resources and Life Sciences Vienna
Benin	Sèhounkpindo Gaston	Akouehou	Director, Center for Forest Research and Education, Ministry of Environment
Brasil	Mauricio	Lopes	President, Brazilian Agricultural Research Corporation (Embrapa)
Cambodia	Prum	Somany	Deputy Director, Department of International Cooperation, Ministry of Agriculture Forestry and Fisheries
Canada	Murray	McLaughlin	Executive Director, Bioindustrial Innovation Cannada, Sustainable Chemistry Alliance
China	Chunyi	Zhang	Professor for Architecture, Tsinghua University
Denmark	Jette	Petersen	Director, Danish AgriFish Agency
EU	John	Bell	Director Bioeconomy, DG Research & Innovation
FAO	Olivier	Dubois	Senior Officer, Energy Program/Climate, Energy and Tenure Division
Finland	Sirpa	Kurppa	Professor, Natural Resources Institute
France	Michel	Beckert	Bioeconomy Advisor, Ministry for Higher Education & Research
Germany	Christine	Lang	Chair, German Bioeconomy Council
Germany	Joachim	von Braun	Chair, German Bioeconomy Council
Germany	Daniel	Barben	Head, GBS Conference Committee
Great Britain	Jackie	Hunter	CEO, Biotechnology and Biological Sciences Research Council
Iceland	Sigrun Elsa	Smaradottir	Research Group Leader, Matís
India	Renu	Swarup	Managing Director, Biotechnology Industry Research Assistance Council
Italy	Fabio	Fava	Professor for Industrial and Environmental Biotechnology, University of Bologna
Kenya	Nicholas	Ozor	Executive Director, African Technology Policy Studies Network
Laos	Inthavy	Akkharath	Deputy Director, Department of Forest Resources Management, Ministry of Natural Resources and Environment
Malaysia	Mohd Nazlee	Kamal	CEO, Malaysian Biotechnology Corporation
Morocco	Mohamed	Ait Kadi	President, General Council of Agricultural Development
Netherlands	Jan	van Esch	Directorate-General for Agro, Knowledge and Innovation Department, Ministry of Economic Affairs
New Zealand	Elspeth	MacRae	General Manager Manufacturing and Bioproducts, SCION
NGO international	Ashok	Khosla	Chair, Development Alternatives
Nordic Union	Geir	Oddson	Senior Advisor, Nordic Council of Ministers
Norway	Alvhild	Hedstein	Director General, Norwegian Institute of Bioeconomy Research
OECD	James	Philp	Policy Analyst - Industrial and Environmental Biotechnology
Poland	Andrzej	Siemaszko	Director, National Contact Point for EU Research Programs
Russia	Vladimir	Popov	Director, A.N. Bach Institute of Biochemistry of the Russian Academy of Sciences
South Africa	Ben	Durham	Chief Director Bio-innovation, National Department of Science and Technology
Spain	Manuel	Lainez	Director, National Institute for Agricultural and Food Research and Technology
Sweden	Stefan	Källman	Director, Division for Forestry & Climate, Ministry for Rural Affairs
Thailand	Sopida	Tongsopit	Senior Policy Researcher, National Science Technology and Innovation Policy Office
Turkey	Masum	Burak	General Directorate, Ministry of Food, Agriculture and Livestock
USA	David	Zilberman	Chair, Department of Agricultural and Resource Economics, UC Berkeley

Program 25.11.2015

Berlin Congress Center (bcc)

09:00	**Welcome Address** Chairs: **Joachim v. Braun** & **Christine Lang**, German Bioeconomy Council	Room C 01
09:10	**Keynote Speeches and Strategic Debate I** **How can Bioeconomy Best Contribute to Innovativeness, Economic Growth, and Sustainable Development?** Chairs: **Dilek Bil**, Partner, Sustineo Istanbul & **Joachim v. Braun**, Chair, German Bioeconomy Council **Janez Potocnik**, Co-Chair, International Resource Panel & former EU Commissioner **Marcelo Sanchez Sorondo**, Chancellor, Pontificial Academy of Science **Ashok Khosla**, Chairman, Development Alternatives **Neway Gebre-ab**, Executive Director, Ethiopian Development Research Institute **Murray McLaughlin**, Executive Director, Bioindustrial Innovation & President, Sustainable Chemistry Alliance	Room C 01
10:40	**Coffee Break**	Foyer B 01/2
11:00	**Innovation Policy Fostering Bioeconomy Development** **Georg Schütte**, State Secretary, German Federal Ministry of Education and Research	Room C 01
11:15	**Bioeconomy World Tour: Bioeconomy Innovations – Challenges and Opportunities** Chairs: **Eduardo Trigo**, Scientific Adviser, Ministry of Science, Technology and Innovation of Argentina & **Hannelore Daniel**, Member, German Bioeconomy Council **Glaucia Mendes Souza**, Chair, SCOPE Program for Bioenergy & Sustainability **Ning Li**, Executive Director, Beijing Genomics Institute **Jack Bobo**, Senior Vice President, Intrexon **Ben Durham**, Chief Director BioInnovation, South African Department of Science & Technology **Marc Palahí**, Director, European Forest Institute	Room C 01
12:30	**Political Agenda: Bioeconomy and the Grand Challenges** Chair: **Regina Birner**, Member, German Bioeconomy Council **Helge Braun**, Minister of State to the German Chancellor **Jeffrey Sachs**, Director, The Earth Institute – Columbia University	Room C 01
13:15	**Lunch**	Foyer B 01/2
14:30	**Global Visions for Bioeconomy – an International Delphi-Study** **Ulrich Hamm**, Member, German Bioeconomy Council	Room C 01
15:00	**Introduction to Interactive Sessions** **Keynote: Future-oriented Bioeconomy Policy Making** **John Bell**, Director Bioeconomy, DG R&I – European Commission	Room C 01

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	Interactive Sessions	
15:30 – 18:30	**Poster Session (Refreshments will be served)** Track 1: Bottom-up and Regional Approaches Track 2: Policy Monitoring and Impact Assessment Track 3: Marine, Forest and Agricultural Innovations Track 4: Industrial Innovations and Value-Chains Chairs: **Ingrid Kögel-Knabner/Daniela Thrän/Georg Backhaus/Holger Zinke,** Members, German Bioeconomy Council (See Page 48)	Foyer C 02
16:30 – 18:30	**Parallel Roundtables**	
	RT 1 **Sustainable Development of the Bioeconomy from a Civil Society Perspective** Chair: **Marion Aberle** (Welthungerhilfe) (See Page 21)	Room B 05/06
	RT 2 **Challenge-oriented Bioeconomy Research** Chairs: **Harald Grethe** (University of Hohenheim) & **Léon Broers** (German Bioeconomy Council) (See Page 26)	Room A 03/04
	RT 3 **Developing Business Models and Innovation Networks** Chairs: **Gunter Pauli** (ZERI) & **Dirk Pilat** (OECD) (See Page 31)	Room B 09
	RT 4 **Policy Approaches Fostering Bioeconomy Development** Chairs: **Jackie Hunter** (BBSRC) & **Andrea Noske** (BMBF) (See Page 36)	Room B 07/08
18:30	**Evening Reception (bcc)** Dinner Speech: **Bioprincipled Cities** **Li Zhang,** Prof. for Architecture, Tsinghua University	Room C 01

Program 26.11.2015

Berlin Congress Center (bcc)

09:00	**Welcome Address** Chair: **Folkhard Isermeyer,** Member, German Bioeconomy Council **Peter Bleser,** State Secretary, German Federal Ministry of Food and Agriculture **Maria Helena Semedo,** Deputy Director General, Food and Agriculture Organization	Room C 01
09:10	**Keynote Speeches and Strategic Debate II** **Defining the Transition to a Sustainable Bioeconomy** Chairs: **Franz Fischler,** President, European Forum Alpbach & **Inge Paulini,** Secretary-General, German Advisory Council on Global Change **Gunter Pauli,** Founder, ZERI Initiative & Chairman of the Board, Novamont **Francois Houllier,** General Director, French National Institute for Agricultural Research **Maximo Torero,** Director, International Food Policy Research Institute **Adrián G. Rodríguez, Chief, Agricultural Development Unit, UN ECLAC**	Room C 01
11:00	**Coffee Break**	Foyer B 01/02
11:30	**Parallel Workshops** (in Cooperation) **The Future Role of Biorefining** Partner: **IEA Bioenergy Task 42 Biorefining** Chairs: **Rene van Ree** (Wageningen UR) & **Gerfried Jungmeier** (Joanneum Research) (See Page 43)	Room A 03/04
	Food Security and Small-scale Producers Partner: **UN FAO** Chair: **Olivier Dubois** (FAO) (See Page 44)	Room B 05/06
	Global Investment in the Bioeonomy Partner: **European Commission** Chairs: **Szilvia Nemeth & Lino Paula** (European Commission) (See Page 45)	Room B 07/08
	Bioeconomy & Biodiversity Partner: **Global Natural History Museums & Botanic Gardens** **Conservation International** Chairs: **Johannes Vogel** (German Bioeconomy Council) & **Stephan Blackmore** (BGCI) (See Page 46)	Room A 05/06
	Bioeconomy Policy Analysis Partner: **OECD** Chair: **Peter Schintlmeister** (OECD) (See Page 47)	Room B 09
13:00	**Lunch**	Foyer B 01/02

GLOBAL BIOECONOMY SUMMIT 2015

14:00	**Report and Wrap-up of Interactive Sessions and Workshops** **Christian Patermann,** International Bioeconomy Expert **Lucia Reisch,** Member, German Bioeconomy Council	Room C 01
14:20	**Presentation of the Communiqué - Towards a Global Bioeconomy** **Christine Lang,** Chair, German Bioeconomy Council **Mauricio Antonio Lopes,** President, Embrapa	Room C 01
14:40	**Strategic Debate III** **Towards a Global Dialogue on Bioeconomy Policy** Chairs: **Joachim von Braun,** Chair, German Bioeconomy Council **Luis Almagro,** Secretary General, OAS Organization of American States **Mohd Nazlee Kamal,** CEO, Malaysian Biotechnology Corporation **Alice Kaudia,** Environment Secretary, Kenyan Ministry of Environment and Natural Resources **Frank Rijsberman,** CEO, CGIAR Consortium **Klaus Töpfer,** Executive Director, IASS Potsdam - Institute for Advanced Sustainability Studies	Room C 01
16:00	**Closing Ceremony & Farewell** Chairs: **Christine Lang & Daniel Barben,** German Bioeconomy Council **Short Conference Summary (Video)**	Room C 01
16:15	**Farewell Coffee**	Foyer B 01/02
18:00	**End**	

Panel Speakers

Global Bioceconomy Summit 2015
25.-26. November 2015
Berlin Congress Center (bcc)

Luis Almagro | Secretary General, Organization of American States
Speaker Strategic Debate III
Luis Almagro Lemes was elected Secretary General of the Organization of American States in 2015. Before that Mr. Almagro was Foreign Minister of Uruguay from 2010 to 2015. In addition he was appointed Senator in the national elections in Uruguay in October 2014. Mr. Almagro, a career diplomat, was also Ambassador to China for five years, after occupying senior diplomatic posts in the Foreign Ministry of his country, and in the Embassies of Uruguay in Germany and Iran. In 2014 Foreign Policy magazine named him a Leading Global Thinker, one of ten decision-makers in the region granted this international distinction.

Daniel Barben | Member, German Bioeconomy Council
Conference Committee
Daniel Barben is director of the Institute of Science, Technology and Society Studies at Alpen-Adria-Universität Klagenfurt, Austria. Prior to this he served as Chair of Futures Studies at the Institute of Political Science, RWTH Aachen University. Mr. Barben also taught at the University of Wisconsin-Madison and the Arizona State University. Since 2012, Mr. Barben has been a member of the German Bioeconomy Council and is head of the GBS2015 Conference Committee. In adition he holds memberships in several professional associations such as the European Association for the Study of Science and Technology and the German Political Science Association.

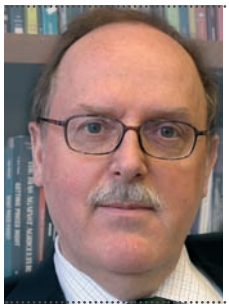
John Bell | Director Bioeconomy, DG Research & Innovation - EU Commission
Keynote Speaker
John Bell is Director Bioeconomy, DG Research & Innovation. He has been a European Commission official since 1993. During his career he has worked on financial aid assistance programmes in the former Yugoslavia and in Albania, as well as public administration reform programmes in Central and Eastern Europe. Mr. Bell was also a member of the Cabinet of Commissioner David Byrne with responsibility for enlargement, public health and global health security issues, including bioterrorism, and Head of Cabinet for European Commissioner Meglena Kuneva on Consumer Affairs. He completed his Doctorate at St John's College, Oxford University in 1993.

Peter Bleser | State Secretary, German Federal Ministry of Food and Agriculture
Welcome Address Day 2
Peter Bleser has been Parliamentary State Secretary at the German Federal Ministry of Food and Agriculture (BMEL) since February 2011. A master farmer by trade, Peter Bleser has been committed to agricultural policy and consumer protection for twenty-five years. Over the years, he has been actively involved in several bioeconomy-related parliamentary groups. Since 2004, he has been the Chair of the CDU Federal Committee on Food and Agriculture in the German Bundestag. From 2007 to 2011 Mr. Bleser has further been a member of the Executive Board of the German Agency for Renewable Resources (FNR).

Jack Bobo | Senior Vice President, Intrexon
Speaker Bioeconomy World Tour
Jack Bobo serves as the Senior Vice President for Intrexon, a synthetic biology company developing solutions to the great challenges in food, energy and health. He joins Intrexon from the U.S. Department of State where he has worked for the past thirteen years, most recently as Senior Advisor for Food Policy following his positions as Senior Advisor for Biotechnology as well as Chief of the Biotechnology and Textile Trade Division. Through these key roles Mr. Bobo was responsible for global outreach to foreign audiences and senior foreign officials across a variety of issues and led or participated in bilateral trade discussions and negotiations. Prior to his position at the U.S. Department of State, he was an attorney at Crowell & Moring LLP.

Panel Speakers

Helge Braun | Minister of State to the German Chancellor
Speaker Bioeconomy and the Grand Challenges
Helge Braun has been Minister of State to the Federal Chancellor since December 2013. Four years before he held the position of the Parliamentary State Secretary to the Federal Minister of Education and Research. Since 2009, Mr. Braun has been a member of the German Bundestag (also from 2002 to 2005: Committee on Education, Research and Technology Assessment and Committee on the Environment, Nature Conservation and Nuclear Safety). Before starting his political career, Mr. Braun worked as a doctor.



Joachim v. Braun | Chair, German Bioeconomy Council
Conference Committee
Joachim von Braun is a Director of the Center for Development Research (ZEF) and Professor for Economic and Technological Change at University of Bonn, Germany. Since 2012 he has been the Chair of the German Bioeconomy Council and also Vice-President of the NGO "Welthungerhilfe". From 2002 to 2009 he has been Director General of the International Food Policy Research Institute (IFPRI) based in Washington DC, the world's premier research institute addressing food, agriculture, nutrition and related development policies. Before these positions, von Braun was professor of Food Economics and Food Policy at Kiel University, Germany. He received his doctoral degree in agricultural economics from the University of Goettingen, Germany in 1978.

Ben Durham | Chief Director BioInnovation, DST South Africa
Speaker Bioeconomy World Tour
Ben Durham is currently Chief Director BioInnovation at the National Department of Science and Technology in South Africa. His responsibilities included the finalization of the South African Bio-economy Strategy, launched in January 2014, and he now is overseeing implemention of the three themes of Agricultural, Health, and Industrial sectors. Ultimately the purpose is to develop and improve the efficiencies of the National System of Innovation, ensuring socio-economic benefits to the broader society. Mr. Durham has previously been a Programme Manager for two Research Support programs at the National Research Foundation, before he joined the Department of Science and Technology in 2003 as Director Biotechnology.

Neway Gebre-ab | Executive Director, Ethiopian Development Research Institute
Speaker Strategic Debate I
Newai Gebre-ab is the Executive Director of the Ethiopian Development Research Institute and the Chief Economic Advisor to the Prime Minister. Mr. Gebre-ab has extensive experience not only in formulating green growth and development strategies but also in macro-economic policy and international finance. He chairs the Ethiopian Government/Donors Committee on Governance and is the Chairman of the board of directors of the National Bank of Ethiopia. In the course of his career, Mr. Gebre-ab has been involved in many multi-lateral policy forums and negotiations, such as the World Bank, the IMF, the United Nations and the New Partnership for Africa's Development.

Ulrich Hamm | Member, German Bioeconomy Council
Speaker Global Visions for the Bioeconomy
Ulrich Hamm is professor for agricultural and food marketing at the University of Kassel, Germany. He has more than twenty years of experience in consumer research and agricultural/food marketing. In recent years, he has specialized in organic food and ethically motivated consumption. In 2012, Mr. Hamm has been appointed to the German Bioeconomy Council. For five years, he has also been a member of the German Scientific Advisory Board for Biodiversity and Genetic Resources. Mr. Hamm serves on the world board of the International Society of Organic Agriculture Research (ISOFAR) and is an editor of the Organic Agriculture journal.

Francois Houllier | General Director, French National Institute for Agricultural Research
Speaker Strategic Debate II
Francois Houllier is the Chair and CEO of the French National Institute for Agricultural Research (INRA), one of the key players in the French bioeconomy. Mr. Houllier has extensive experience in multidisciplinary bioeconomy research. Prior to his current role, Mr. Houllier has held several management positions at INRA. During his early career he was Professor at the National College of Forestry in Nancy and Director of the French Institute of Pondicherry in India. For several years, he was a board member of the European Forest Institute (EFI) and Chairperson of the board, when EFI developed into an international organization in 2005.

Mohd Nazlee Kamal | CEO, Malaysian Biotechnology Corporation
Speaker Strategic Debate III
Mohd Nazlee Kamal is the CEO of the Malaysian Biotechnology Corporation, a government agency responsible for implementing the national bioeconomy strategy. Mr. Kamal has a proven track record as an innovator and manager in the biotechnology sector. He was the founding CEO of Inno Biologics and the Group Managing Director of Inno Bio Ventures. He also has six years of business development experience with multinational companies, for example Amersham Biosciences and Sartorius. Mr. Kamal invented the 'External Spinfilter', which has been marketed by Sartorius BBI Systems. Mr. Kamal is a member of several associations, for instance the Malaysian Molecular Biology Society.

Alice Kaudia | Environ. Secretary, Kenyan Ministry of Environment & Natural Resources
Speaker Strategic Debate III
Alice Kaudia is Kenya's Environment Secretary at the Ministry of Environment and Natural Resources. She has extensive experience in the field of institutional capacity building, community-driven natural resources management and conservation, spanning close to three decades. She has coordinated Kenya's National Climate Change Response Strategy, the Master Plan for Conservation and Sustainable Management of Water Catchment Areas and the National Environment Policy, among others. She is a founding member of the Kenya Professional Association of Women in Agriculture and Environment. Ms. Kaudia has published numerous papers on poverty, community participation and gender in relation to agriculture and forestry.

Ashok Khosla | Chairman, Development Alternatives
Speaker Strategic Debate I
Ashok Khosla is the founder and Chairman of the Development Alternatives Group, a consortium of social enterprises based in India. The group's mission is to create technologies, businesses and markets for large scale generation of sustainable livelihoods. Mr. Khosla is an inspiring leader in sustainable development. He has been President of the Club of Rome, a Member of the Governing Bodies of the World Economic Forum in Davos, IUCN, WWF, IISD, the Stockholm Environment Institute and WETV, among others. He was Special Advisor to the Brundtland Commission and Chairman of the NGO Forum at the '92 Earth Summit in Rio.

Christine Lang | Chair, German Bioeconomy Council
Conference Committee
Christine Lang is one of the founders and the Managing Director of ORGANOBALANCE GmbH. As a Doctor of Biology, she spent 10 years working in industrial research at Hüls Chemie Forschungsgesellschaft where, amongst other things, she established and ran the working group on genetics and molecular biology. Since 2012, she has been the Chairwoman of the German Bioeconomy Council. In 1993 she moved to the Technische Universität Berlin and was promoted to Professor of Microbiology and Molecular Genetics. At the TU Berlin she lectures on genetics in biotechnology. Mrs. Lang is active in various biotechnology associations. She is a member of the Management Board of the DECHEMA and member of the Management Board of the VCI/DIB.

Panel Speakers

Mauricio Antonio Lopes | President, Embrapa

Presentation of the Communiqué

Mauricio Lopes is President of the Agricultural Research Corporation (Embrapa), a leader in bioeconomy research and innovation in Brazil. Mr. Lopes has held different research and management positions at Embrapa since 1989. He was the deputy head for R&D at Embrapa Maize and Sorghum and at Genetic Resources and Biotechnology. More recently, he was a member of the Scientific Council of the Agropolis Foundation (Montpellier, France), the coordinator of Embrapa's Labex in South Korea, and Embrapa's Executive Director for R&D. Mr. Lopes is an agronomist with a MSc in plant genetics, a PhD in molecular biology and a post-doc in sustainable genetic resources use.

Murray Mc Laughlin | Executive Director, BIC & President, SCA

Speaker Strategic Debate I

Murray McLaughlin is the Executive Director of Bioindustrial Innovation Canada in Sarnia, Ontario. Since 2013, he has been responsible for generating business opportunities and building clusters for biobased products across Canada. In the course of his career, Mr. McLaughlin has held several high-level private and public sector positions in agriculture as well as the biobased industry. He was President of the Sustainable Chemistry Alliance, President of Ontario Agri-Food Technologies, Deputy Minister of Saskatchewan Agriculture and Food, and President of Ag-West Biotech. Mr. McLaughlin is an expert in biobased and sustainable chemistry-based technologies, with a focus on advanced biofuels, biochemicals, biomaterials and bio-ingredients.

Ning Li | Executive Director, Beijing Genome Institute

Speaker Bioeconomy World Tour

Ning Li is the Chief Business Officer of Beijing Genome Institute and Executive Director of BGI-Hongkong, BGI-Europe and BGI-America. Mr. Li has led his group to successfully establish lots of forward NGS-based epigenomic platforms in BGI-Shenzhen, and also to develop the bioinformatics analysis tools specifically for the epigenome data analysis. Ning Li has published in most reputable international journals, Nature Genetics, Journal of Autoimmunity, PNAS, PLoS Biology, Plant Cell, Methods, PLoS ONE among others. Li is member of the Steering Committee of Genome Denmark and of the executive committee of International Rare Disease Research Consortium (IRDiRC) on behalf of BGI.

Glaucia Mendes Souza | Chair, SCOPE Program for Bioenergy & Sustainability

Speaker Bioeconomy World Tour

Glaucia Mendes Souza is the Chairperson of the SCOPE Bioenergy & Sustainability project. The SCOPE, published in 2015, details policy recommendations for the sustainable expansion of bioenergy in the world. The project involves contributions from 137 experts in 24 countries. Furthermore, Ms. Souza is the President of the FAPESP Bioenergy Program in Brazil (BIOEN). She is active in several scientific organizations, for example as the Vice- Coordinator of the National Institute of Science and Technology of Bioethanol, as leader of the Biomass Systems and Synthetic Biology Center São Paulo and as member of the Bioenergy and Sustainability Research Nuclei Council.

Marc Palahí | Director, European Forest Institute

Speaker Bioeconomy World Tour

Marc Palahí is the director of the European Forest Institute. Since 2013 in his post as a deputy director of EFI, he has been responsible for the overall coordination and integration of EFI's strategic activities related to research and policy support. Previously he led EFI's policy support activities and during this time was instrumental in launching ThinkForest, a European high-level science forum on the future of forests. He has also worked as head of EFI's Mediterranean Regional Office, EFIMED. Mr. Palahí holds a PhD in forestry and economics and an MSc in forestry engineering.

Christian Patermann | Former Director Biotechnology DG R & I

Report and Wrap-up of Interactive Sessions and Workshops

Christian Patermann is a former member of the German Bioeconomy Council. Over the years, he has held numerous top positions in the international science and technology policy world. He was the Director of Biotechnology, Agriculture and Food Research and the Director for Environment and Sustainable Development at the European Commission's Research Directorate-General and he was Deputy Director-General at the German Federal Ministry for Research and Education. Earlier, he worked at the European Space Agency and the European Molecular Biology Laboratory. Since his retirement in 2007, Mr. Patermann has been an independent consultant for public and private institutions and companies.

Gunter Pauli | Founder, ZERI Initiative & Chairman of the Board, Novamont

Speaker Strategic Debate II

Gunter Pauli is a Belgian entrepreneur, activist, author and lecturer. He made Ecover a pioneering company in sustainable detergents. Over the years, he has promoted sustainable approaches in business, culture, science, politics and the environment. He contributed to the development of the Kyoto Protocol and founded the Zero Emissions Research Initiative (ZERI) and the Global ZERI Network, which uses science and publicly available information to find and develop sustainable business solutions. Mr. Pauli has been visiting lecturer and professor at universities around the world, and a board member of NGOs and private companies in Asia, USA and Latin America.

Janez Potocnik | Co-Chair, International Resource Panel & former EU Commissioner

Speaker Strategic Debate I

Janez Potocnik has been nominated Co-Chair of the UNEP International Resource Panel in 2014. Before, Mr. Potocnik was European Commissioner for ten years. Already a senior politician in Slovenia, he joined the European Commission first as Commissioner for Science and Research and than for Environment. In his earlier career, he was Director of the Institute of Macroeconomic Analysis and Development in Slovenia. He was appointed Head of the negotiating team for accession of Slovenia to the EU, Director of the Government Office for European Affairs, Minister Counsellor at the Office of the Prime Minister and Slovenian Minister responsible for European Affairs.

Lucia A. Reisch | Member, German Bioeconomy Council

Report and Wrap-up of Interactive Sessions and Workshops

Lucia Reisch is a professor for consumer behaviour and consumer policy at Copenhagen Business School, Department of Intercultural Communication and Management. Since 2011 she also hold a permanent guest professorship at the Zeppelin University of Friedrichshafen (Germany). Her main research focus is on behavioural economics and sustainable consumption. She is a member of the German Bioeconomy Council and since 2015 head of the new Advisory Council on Consumer Policy in Germany. Furthermore she has a membership of the German Council for Sustainable Development and the Ethics Commission for Safe Energy Supply. In 2012 she was elected to become one of the 400 lifelong members of Germany's Academy of Technical Sciences.

Frank Rijsberman | CEO, CGIAR Consortium

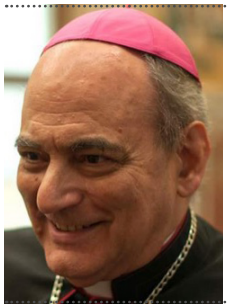
Speaker Strategic Debate III

Frank Rijsberman was appointed CEO of the Consultative Group on International Agricultural Research in 2012, having previously held the position of Director General at the International Water Management Institute. He has also worked as the Director of the Water, Sanitation, & Hygiene Initiative at the Bill and Melinda Gates Foundation as well as Program Director at Google.org, Google's philanthropic sector. Thirty years of experience as a researcher and consultant in natural resources management have helped him drive CGIAR's focus towards improving food security, nutrition and health, reducing rural poverty and protecting the environment. Mr. Rijsberman has worked in Africa, Asia and Europe, and has authored over 60 scientific articles and book chapters.

Panel Speakers

Adrián G. Rodríguez | Chief, Agricultural Development Unit, UN ECLAC
Speaker Strategic Debate II
Mr. Rodriguez is currently Chief of the Agricultural Development Unit at the UN Economic Commission for Latin America and the Caribbean in Chile. He has recently organized the Latin America and the Caribbean Bioeconomy 2015 conference in Chile. Mr. Rodriguez has further been involved in the bioeconomy-related activities in the interregional ALCUE NET. Before moving to ECLAC, he was a Rural Development Specialist at the Inter American Institute for Cooperation on Agriculture in Costa Rica. In the course of his career, Mr. Rodriguez has advised numerous projects and international organizations throughout Latin America.

Jeffrey Sachs | Director, The Earth Institute - Columbia University
Speaker Bioeconomy and the Grand Challenges
Jeffrey Sachs is the Director of The Earth Institute, Quetelet Professor of Sustainable Development, and Professor of Health Policy and Management at Columbia University. He is Special Advisor to United Nations Secretary-General Ban Ki-moon on the Millennium Development Goals, having held the same position under former UN Secretary-General Kofi Annan. He is Director of the UN Sustainable Development Solutions Network and also co-founder and Chief Strategist of Millennium Promise Alliance and Director of the Millennium Villages Project. Furthermore Mr. Sachs is one of the Secretary-General's MDG Advocates, and a Commissioner of the ITU/UNESCO Broadband Commission for Development.



Marcelo Sánchez Sorondo | Chancellor, Pontifical Academy of Sciences
Speaker Strategic Debate I
Marcelo Sánchez Sorondo is an Argentinean Bishop and the Chancellor of the Pontifical Academy of Sciences and the Pontifical Academy of Social Sciences, based at the Vatican. He has intimate knowledge of the pontifical encyclical Laudato Si, which he presents worldwide. Mr. Sánchez has held positions as Lecturer at the Lateran University Rome and as full Professor at the Libera Università Maria SS. Assunta. He received several honors for his work, including the Legion d'Honneur of France. In 2001, His Holiness John Paul II consecrated him titular Bishop of Vescovìo.

Georg Schütte | State Secretary, German Ministry of Education and Research
Innovation Policy Fostering Bioeconomy Development
Georg Schütte has been State Secretary at the Federal Ministry of Education and Research since December 2009. Prior to this, he was Secretary General of the Alexander von Humboldt Foundation in Bonn. Mr. Schütte worked as Executive Director of the German-American Fulbright Commission in Berlin. During this period, he was also a member of the EU Commission's expert group on 'Benchmarking Human Resources'. Among other things he is a member of the Founding Supervisory Board of the Berlin Institute of Health and the Supervisory Board of the GSI Helmholtz Centre for Heavy Ion Research.

Maria Helena Semedo | Deputy-Director General, Natural Resources, FAO
Welcome Address Day 2
Ms. Semedo is Deputy-Director General, Natural Resources of the FAO UN and has been working for it in various positions since 2003. She coordinates the work of the 3 departments Agriculture, Fisheries and Forestry and two natural resources divisions. Ms. Semedo former positions have included Minister for Fisheries, Agriculture and Rural Affairs, Minister for Marine Affairs, Minister for Tourism, Transportation and Marine Affairs. Furthermore she has served as Coordinator of the Permanent Interstate Committee for Drought Control in Sahel (CILSS), as Chairperson of the Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean and as Chairperson of the Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean.

Klaus Töpfer | Executive Director, IASS Potsdam

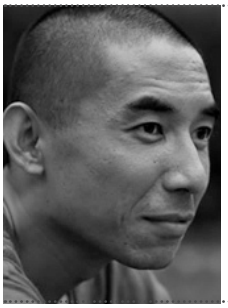
Speaker Strategic Debate III

Klaus Töpfer is the founding Director and current Executive Director of the Institute for Advanced Sustainability Studies (IASS) in Potsdam. Over the years, Mr. Töpfer has held several high-level positions in national and international environmental policy. He was Executive Director of the United Nations Environment Programme (UNEP) and the Under-Secretary-General of the United Nations. He was appointed German Minister for the Environment, Nature Conservation and Nuclear Safety from 1987 to 1994 and subsequently Minister for Regional Planning, Housing and Urban Development. Since 2007, Mr. Töpfer has also been Professor of Environment and Sustainable Development at Tongji University in Shanghai.

Maximo Torero | Director, International Food Policy Research Institute

Speaker Strategic Debate II

Maximo Torero is currently the Division Director of the Market, Trade and Institutions Division at International Food Policy Research Institute, IFPRI Coordinator for Latin America, and also a leader of the Global Research Program on Institutions and Infrastructure for Market Development. In addition he is a professor on leave at the University of Pacific, Lima. Mr. Torero's major research work lies particularly in analyzing poverty, inequality, importance of geography and assets (private or public) in explaining poverty, and in policies oriented towards poverty alleviation based on the role played by infrastructure, institutions, and on how technological breakthroughs (or discontinuities) can improve the welfare of households.



Li Zhang | Professor for Architecture, Tsinghua University

Dinner Speech

Li Brian Zhang is Founding Partner of Atelier TeamMinus in Bejing, which envisages to developping an alternative modernity in Chinese architecture. TeamMinus has earned international recognition, e.g. for the China Pavilion roof gardens at the Expo in Shanghai. Mr. Zhang is also Chair and Professor of Architecture at Tsinghua University. He is Board member of the Society of Chinese Architects and Editor-in-chief of the World Architecture Magazine. Mr. Zhang has taught in a number of reputable international institutions, including Syracuse University, National University of Singapore, Harvard Graduate School of Design and Barcelona School of Architecture.

Roundtables

Global Bioceconomy Summit 2015
25. November 2015
bcc Berlin Congress Center

Roundtable 1: Sustainable Bioeconomy Development from Civil Society Perspective

Chair: **Marion Aberle** (Welthungerhilfe)

Key Topics

This roundtable will provide a platform for NGO representatives from around the world to discuss experiences, activities and positions regarding the development of a sustainable bioeconomy. What can be learnt from experiences in the past? What are the key issues in the present and the future? What are common or diverging viewpoints among NGOs and civil society organizations? Is there a shared vision of a sustainable bioeconomy? What are opportunities for future collaboration? What is the significance of regulatory frameworks and how should they be developed further?

25. November 2015 | 16:30 – 18:30 | Room B 05/06

16:30–16:35 Welcome and short introduction
16:35–18:05 Impulse presentations and Q&A

Conflicting goals between conservation of nature and resources use
C. Heinrich, WWF, Germany

Bioeconomy and food security
J. Rahall, Green Scenery, Sierra Leone

Bioeconomy policy approaches fostering rural development
U. Muoedu, I&U Resources Ltd., Nigeria

Criteria to ensure the primacy of food security
R. Schneider, Welthungerhilfe, Germany

Building people's capacities in agricultural and rural development
A. Padilla, IBON International, The Philippines

Cooperation between governments and NGOs in the fight against hunger
S. Schmitz, Federal Ministry for Economic Cooperation and Development (BMZ), Germany

Bioeconomy within planetary boundaries
S. Ober, Civil Society Platform "Forschungswende", Germany

Communication and engaging civil society in the bioeconomy
K. Sheridan, Sustainability Consult, Belgium

The employment potential of the rollout of the bioeconomy
J. Lund-Larsen, Danish Trade Union, Denmark

Bioeconomy and civil society
W. Oluoch-Kosura, University of Nairobi, Kenya

18:05–18:30 Moderated discussion among roundtable participants

Bioeconomy policy approaches fostering rural development

U. Muoedu, I&U Resources Ltd., Nigeria

Bioeconomy policy approaches for rural development stand in these four approaches:

A. Innovation
B. Stakeholder Participation (Local and Foreign Organization)
C. Collaborative Research, and D. Other development activities.

These four approaches are called for discussion in the following points:

- Lack of information amongst rural people.
- Lack of implementation of policy already created.
- No/poor legislative backup of the policy in developing countries.
- How could land be made available for the bioproduction in areas of high population density?
- How could rural and interested organizations be adequately financed to join in the bioeconomy value-webs?
- Change in government/unstabilized democracy in poor countries.
- Unpredicted crises in Africa which affect the rural development.
- Bribery and corruption - government may set out fund and policy to strengthen agriculture, but the people at the fore-front misuse the fund and policy.
- Is there any way research institution can be established in these rural areas?
- The need for the world to strengthen Research-Extension-Farmers-Input Linkage System and Value-webs programs in rural areas as the government has failed in this aspect.
- The need for the foreign companies/organization/institution to collaborate with the indigenous companies to establish a consolidated bioproduction in many fields - like agriculture, pharmacy, environment, etc. than dealing with government directly.
- The importance of NGOs to assist in rural development, like what welthungerhilfe is doing in poor countries.
- International assistance in production of some nutritious local crops/plant from rural areas that are not internationally recognized etc.

Criteria to ensure the primacy of food security

R. Schneider, Welthungerhilfe, Germany

With the shift from petroleum-based to biomass-based economies, global biomass demand and trade is growing. This trend could become a threat to food security-especially in food insecure regions. Though rising concerns about sustainability aspects have led to the development of voluntary certification standards to ensure that biomass is sustainably produced, food security aspects are hardly addressed as practical criteria and indicators lack. The Center for Development Research (ZEF) and Welthungerhilfe have developed a “Rights-based food security principle for biomass sustainability standards and certification systems”. This tool provides practicable criteria to identify if the Human Right to adequate Food (RtaF) is respected in local biomass production. The conceptual framework of the principle is based on the UN “Voluntary Guidelines to Support the Progressive Realization of the RtaF in the Context of National Food Security” and the four dimensions of food security (availability, stability, utilization, access). Based on this framework, 45 criteria that ensure that the RtaF is not adversely affected by certified biomass production and trade were identified. The suggested criteria are applicable to all biomass types and uses and serve as a best-practice set to complement existing sustainability standards for biomass.

Building people's capacities in agriculture and rural development

A. Padilla, IBON International, The Philippines

Rural peoples in the global south are among the most impoverished and marginalised. There is rising hunger and poverty among the people who produce most of the food for the world's population small-scale farmers, coastal fisherfolk, pastoralists, agricultural workers and landless people. These stem from lack of ownership, control and access to land and other productive resources.

Going beyond simply putting food on the table, the challenge has been on the kind of food production will be genuinely sustainable and beneficial especially for the world's poor. People's organisations and civil society organisations have been working for the attainment of food sovereignty at the policy, advocacy and campaign levels. A number of governments have enshrined this in their Constitutions. Food sovereignty is centered on ensuring that local food production is geared towards local food needs using local varieties, self-reliance (not dependent on commodified inputs), ecological sensitivity, and that communities have the right to determine the food and agricultural policies that affect their lives and livelihoods. Policies and discussions on bioeconomy, therefore, need to be guided by this both at the conceptual and practical/operational levels.

For IBON International, building people's capacities entails education, information and training on food sovereignty. This is done in close partnership with the People's Coalition on Food Sovereignty (PCFS), a global network of organisations of small-scale food producers in Asia, Africa and Latin America. Besides policy and research products on food and agriculture, we have a Food Sovereignty module which is useful for grassroots organisations, advocates and policymakers.

Cooperation between governments and NGOs in the fight against hunger

S. Schmitz, Federal Ministry for Economic Cooperation and Development (BMZ), Germany

Non-Governmental Organizations – national and international, from the North and from the South – play many different roles in the fight against hunger. Some of them act as campaigners and watchdogs which monitor, scrutinize and criticize governments and the private sector. Others are typical stakeholders which advocate for the interests of specific groups of people or for the environment. Many of them implement food security projects in partner countries, often well rooted in local communities and able to operate even under difficult conditions including crises and conflict. These different roles often overlap. It is particularly this diversity of roles that offers great opportunity for the fight against hunger – and interesting entry points for dialogue and cooperation.

German development policy offers some remarkable examples of cooperation between government and NGOs in the field of food security. A national Working Group on Food Security ("Arbeitskreis Welternährung") is a national multi-stakeholder platform that regularly brings together about 20 civil society actors to discuss food security issues. A recently established group of about 30 representatives from civil society, private sector and academia gives strategic orientation and serves as a discussion platform for the "One World – No Hunger" initiative of the BMZ. Finally, German development policy is currently exploring new forms of direct partnership with NGOs in the implementation of larger projects (set-up of "innovation centers") to strengthen innovation in the agriculture and food sector in partner countries.

Bioeconomy within planetary boundaries

S. Ober, Civil Society Platform “Forschungswende”, Germany

Bioeconomy as a social transformation requires a consistent strategy as well as research on new efficiency technologies and efforts toward sufficiency. Civil society is called upon to participate in the prioritization of research questions in the face of finite resources, to accompany the compromises that are reached, to evaluate the approaches, and to assume responsibility for their implementation. Enabling and supporting this process places new demands on politics. Gaps in research and weaknesses in the concept of bioeconomy can be addressed through a deliberative approach.

Forschungswende proposes to encourage the transdisciplinary integration of knowledge for Bioeconomy through a cooperative interface, which is:

“A place where the innovation process is a professional discipline and not a rare, singular event, and where people can meet, interact, experiment, ideate, and prototype new solutions.” (Bason, 2012)
The Research & Innovation Co-Lab for Bioeconomy offers a structure in which processes are developed together with civil society organizations from the very beginning and accompanied by regular evaluation. For a societal development towards Bioeconomy, an intensive exchange with the private sector must be maintained, as they are important actors in the transformation of a petroleum-based economy. The aim is to systematically include CSOs as relevant partners and build on their expertise in order to enhance the R&I governance.

An effective exchange and the definition of common goals for a Bioeconomy within planetary boundaries requires a cultural shift on all sides, which we aim to shape and to further develop.

The employment potential of the rollout of the bioeconomy

J. Lund-Larsen, Danish Trade Union, Denmark

A Danish study made for the Danish trade union, from June 2015 show that there are great opportunities to create job in rural area if we rollout the bioeconomy. Especially if there are an urgent focus on 2 Generation bioethanol, heat and electricity production.

And later on at bio chemicals, bio plastic and medicine.

The study shows that the biggest employment effect will be close to where refineries and biogas plants established, up to 1,000 in the nearest municipalities. Totally it will about 23,700 jobs in 2050. The study show the impact on employment by sector and rural / urban dimension. And also show the impact on employment by level of education.

Conclusion: Bioeconomy creates lots of jobs in rural area. Jobs that cannot be moved to other areas or countries, it gives rural development for the benefit of growth and the social economy.

That bioenergy also can deliver significant CO_2 reductions to socio-economic viable cost for both transport and supply sector.

Bioeconomy and civil society

W. Oluoch-Kosura, University of Nairobi, Kenya

Bioeconomy comprises processes and initiatives that seek to promote human wellbeing through advances in science and technology, biotechnology, biosciences, bio-innovation and community development, among others. These initiatives have potential for increasing food production; utilizing marginal lands; contributing to 'green', clean, healthy and safe environment. Potential also exists to increase efficiency of value chain activities, to achieve food and nutrition security as well as prosperity in a sustainable way. However, being a complex phenomenon, with many actors and outcomes, some of them harmful to society, all categories of stakeholders should play their respective roles in shaping the desirable outcomes for the emerging bioeconomy since the eventual outcome of relevance is sustainable improvement of human wellbeing. For example, genetic engineering/genetic modification of plant and animal germplasm is thought to have negative effects on human health. Similarly, the quest for land to grow biofuel crops often leads to conflicts on land ownership and use due to inadequate consultations or understanding on land tenure rights. Moreover, the sharing of bioeconomy proceeds needs to be done in a fair manner. Due to failure by governments (public sector) and other institutions (private sector) to ensure sustainable bioeconomy processes and outcomes, the civil society must play an important role in the bioeconomy debate. For instance, the civil society should create awareness among producers (farmers) governments and other actors in the bioeconomy processes along the value chain on the potential benefits, challenges, expectations and ethical aspects of bioeconomy. The civil society also has an important role in helping to organize or mobilize the community, including farmers, the processors, traders and the consumers so that they can effectively demand their rightful share of the gains from bioeconomy. In addition, the civil society must play the watchdog role to safeguard the public from negative effects of bioeconomy policies. Given Bioeconomy is a concept associated with many "Rs", calling for actions to: "Reduce", "Reuse", "Recycle", "Replace", "Redesign", "Rebuild", "Redefine", "Revive", Regenerate", "Reform", "Reorganize", "Reimagine", "Rethink" and to attain "Resilience", it is instructive to embrace the Civil Society to engage actively with the other stakeholders to develop consensus on the way forward for a smooth and positive transformation to achieve sustainable wellbeing of mankind.

Roundtable 2: Challenge-oriented Bioeconomy Research - Solving Trade-offs

Chairs: **Harald Grethe** (University of Hohenheim),
Léon Broers (German Bioeconomy Council)


Key Topics

This roundtable will provide a platform for discussing key issues in science-based policy advice. What experiences have been made in different countries? In what form and to what end has policy advice been provided? What role does science or, respectively, do scientists play? Are there tensions between challenge and excellence-oriented research strategies? What is the significance of regulatory frameworks, how should they be developed further? What are options for future collaboration among those concerned with soliciting or offering policy advice on bioeconomy-related research and innovation strategies?

25. November 2015 | 16:30 – 18:30 | Room A 03/04

16:30–16:35 Welcome and short introduction
16:35–18:15 Impulse presentations and Q&A

One bioeconomy...or many? How to make bioeconomy solve real problems
U. Schurr, BioSC Jülich, Germany

The role of industry as an important partner and driver of the bioeconomy
L. Broers, Bioeconomy Council, Germany

The 4th SCAR foresight exercise - the first in the bioeconomy
E. Saggau, SCAR Foresight Group, Germany

Role of biotechnology in sustainable development of agriculture
C. Zhang, Academy of Agricultural Sciences, China

Land and agricultural policy needed towards a sustainable bioeconomy in Germany
K. Hennenberg, Ökoinstitut, Germany

Sustainable bioconomy development and policy monitoring in the Middle East/Iraq
A. Al-Lami, Chief Scientist, Iraq

Impacts of increasing bioenergy demand on global food markets
H. Lotze-Campen, Potsdam Institute for Climate Impact Research, Germany

How does SCAR support the policy advice in the bioeconomy: Member State viewpoint
J. van Esch, SCAR Foresight Group, The Netherlands

Design of a systems analysis tools framework for the EU bio-based economy strategy (SAT-BBE)
H. van Meijl, Wageningen UR, The Netherlands

Modeling the bioeconomy: regional approaches
H. Grethe, Scientific Council for Agriculture, Nutrition and Consumer Protection, Germany

18:15–18:30 Moderated discussion among roundtable participants

One bioeconomy ... or many? How to make bioeconomy solve real problems

U. Schurr, BioSC Jülich, Germany

Bioeconomy offers a wide range of solutions depending on regional drivers, natural resources, research capabilities and required technologies, economies and policies. They all vary regionally. Therefore, bioeconomy framework conditions and – even more important questions and solutions vary significantly between regions. We thus propose systematic approaches to analyse regional opportunities to support decision and implementation. Regionalization could become one of the central principles of the implementation of the bioeconomy. It will be key to develop systemic approaches to identify regional or global questions that can be addressed by a region based on its bioeconomy potential. The opportunities are defined e.g. by natural resources, human and research capacities, available technologies, economic and political framework conditions etc. While, up to now, most of the existing research and/or policy strategies are developed and implemented on the country level, utilization of regional potentials for regional or global contributions would foster the implementation of a sustainable bioeconomy. Today, only a few regional bioeconomy strategies are existing. Systematic approaches and tools to analyse the potential routes of regions for implementation of bioeconomy-based solutions would help to close this important gap.

The role of industry as an important partner and driver of the bioeconomy

L. Broers, Bioeconomy Coucnil, Germany

A large amount of Innovations is required to achieve a sustained conversion from the current oil-based economy towards a knowledge-based bioeconomy. These innovations start with excellent research which produces significant inventions followed by an efficient process along the value chain to develop them in innovations and final products.

The field of bioeconomy encompasses many actors, from a broad range of professions and sectors. A close cooperation between these actors will serve market and thus consumer needs. However, this requires interdisciplinary discourse and interaction of public and private actors within the framework of Public Private Partnerships.In order to transform basic research to marketable products a rapid, effective and continuous knowledge and technology transfer from academia to the private sector is essential. With regard to applied research it would also be important if we can manage besides supply-driven (“push”) also more demand-oriented (“pull”) approaches. Finally, this requires an involvement of industry during all phases of Public Private Partnerships.

The 4th SCAR foresight exercise – the first in the bioeconomy

E. Saggau, SCAR Foresight Group, Germany

Foresight is an important instrument for strategic planning and public policy building. The SCAR has always used Foresight and related processes as a core instrument to inform, to advice and to facilitate policy decision makers on EU and Member State level. The newest published 4th SCAR Foresight is the first in the bioeconomy and covers all aspects of the bioeconomy including agriculture, fisheries and forestry and explores the complexity of systems and their interactions. The exercise opens multiple windows on possible future scenarios, provides food for thought in policy development and offers framework for planning research and innovation in a longer term perspective.

Land and agricultural policy needed towards a sustainable bioeconomy in Germany

K. Hennenberg, Ökoinstitut, Germany

About 10 years ago, there were about 4 mio ha of abandoned cropland in Germany. Today, abandoned cropland has become rare in Germany. Land prices have been risen steadily and German farmers are facing a steadily increasing economic pressure resulting in optimization and intensification of agricultural production, and enlargement and concentration of farms (cultivation area and animal production). Therefore almost all cropland is cultivated today. Moreover, permanent grasslands, that are considered economically less valuable, have been converted (about 4% between 2003 and 2013) or are under conversion pressure. Main drivers for this development are increasing global demand for agricultural products (food and feed) and politically triggered increase in bioenergy production in Germany. Future needs for biomass for material use as aimed at in the national bioeconomy concept will increase the pressure.

Agricultural land use is responsible for several environmental problems in Germany: (1) Large amounts of greenhouse gases are emitted each year due to the cultivation of drained peatlands (600.000 ha of cropland and 620.000 of grassland), application of N-fertilizer (N20 emissions) and meat production (CH4-emissions from livestock); (2) loss of biodiversity due to conversion of permanent grassland and intensification of agricultural practices; (3) pollution of water bodies due to over-fertilization. The new EU Common Agricultural Policy only partly addresses these problems.

In Germany, agricultural land use is strongly related with livestock production. For example, about 50% of Germany's cropland (about 7 Mio ha) is used for the cultivation of feed. Areas for bioenergy production covering about 2 Mio ha are also of importance. We show, based on modelling results and analysis of different scenarios that the amount of cropland and grassland in Germany will have to decline if existing national policy goals on climate and environmental protection and conservation of biodiversity are taken seriously. In case that consumption patterns on animal products remain at current levels, no further agricultural land would be available for growing crops for an increased material use as required by the future bioeconomy.

The authors conclude that a structural change towards a comprehensive and sustainable bioeconomy in Germany can only succeed if a fundamental change in land utilization took place. This means, that efforts of climate, biodiversity, soil and water protection need to be combined with an increase in land use efficiency, but more importantly, with demand side measures, such as policies aiming at a reduction of meat and milk production and consumption.

Sustainable bioeconomy development and policy monitoring in the Middle East/Iraq

A. Al-Lami, Chief Scientist, Iraq

Bioeconomy development is still in its infancy in Iraq, however there seems to be economic potential. Iraq is a rich country in wild sugar cane, corn and other agricultural crops. Regarding the importance of bioeconomy for sustainable development, it is crucial to look at the all its components. The Bioeconomy offers the world a unique opportunity to address complex inter-connected challenges, while achieving economic growth. It can assist the world in making the transition to a more resource efficient society that relies more strongly on renewable biological resources to satisfy consumers' needs, industry demand and tackle climate change. However, there are also great challenges and dangers linked to bioeconomy development, for example with regard to wild life conservation and biodiversity. There is an urgent need to discuss the monitoring side of the bio economy in the world and the Middle East in order to build the appropriate monitoring and assessment systems, which will lead us to find the appropriate policies.

Impacts of increasing bioenergy demand on global food markets

H. Lotze-Campen, Potsdam Institute for Climate Impact Research, Germany

Future scenarios from Integrated Assessment show that meeting ambitious greenhouse gas mitigation targets requires substantial amounts of bioenergy as part of the future energy mix. Currently, bioenergy production worldwide is dominated by first-generation biofuels, directly competing with food crops. Current demand is mainly induced by policy mandates for blending with fossil fuels. However, over the next decades the role of second-generation ligno-cellulosic bioenergy is expected to grow. Between 100 and 300 ExaJoule of bioenergy may be needed in the second half of the 21st century, in order to limit global warming at 2 degrees, compared to pre-industrial levels. Using a global agriculture and land-use allocation model, we have shown in a number of scenario studies how increasing bioenergy demand may affect future land use, water use, agricultural trade, and food prices. Important trade-offs have been analyzed. Increased openness to agricultural trade may reduce food prices and improve food security, but may also lead to increased tropical deforestation, in the absence of forest protection policies. Large-scale bioenergy production may strongly increase water use for irrigation. However, if irrigated bioenergy production is prohibited by specific policies, this may lead to increasing agricultural expansion into other valuable ecosystems. Pricing greenhouse gas emissions from all sectors is a key element of a future climate policy mix. Moreover, providing the right incentives for increasing agricultural productivity and sustainable intensification in crop, livestock and bioenergy production is another prerequisite for managing a growing bioeconomy within limited availability of land, water and other natural resources.

How does SCAR support the policy advice in the bioeconomy: Member State viewpoint

J. van Esch, SCAR, The Netherlands

The SCAR established its Strategic Working Group Sustainable Bio-resources for a Growing Bioeconomy (SWG SBGB) in 2012. The SWG SBGB is exploring the field of the bioeconomy: identifying its scope, Member States' strategies, research needs, barriers and perspectives. This is done through regular workshops, contacts with the different stakeholders, visits to relevant facilities and strategic surveys.

The main deliverables, that might be interesting for the global bioeconomy forum participants, are the knowledge and innovation agenda, the discussion paper on sustainability and the inventory of Member State needs. The SWG wants to play a role as a network partner between Member States, Commission and bioeconomy stakeholders, this summit is a good opportunity to make some new contacts!

Design of a systems analysis tools framework for the EU bio-based economy strategy (SAT-BBE)

H. van Meijl, Wageningen UR, The Netherlands

Background

One of the biggest challenges facing global society today is the provision of food, water, energy, healthcare and other resources and services to a world that will see its population increase by a third in the face of mounting environmental stresses over the next 20 years. SAT-BBE (Sustainable Assessment Tool for the BioBased Economy), an FP7 project, brought together a consortium of internationally recognised and respected researchers who work on the bioeconomy and the topic of sustainability at both European and international levels.

Objective

The objective of SAT-BBE is to design a systems analysis tools framework, which must be useful to a) monitor the evolution of the bioeconomy in the EU, and b) to analyse the socio-economic and environmental impacts of the bioeconomy and its relevant policies.

Activity (this can relate to research methods, policy measures, business activities, etc.)

SAT-BBE explored the data, indicators and models that help to assess the contribution of a bioeconomy in many of these areas to ensure long term economic and environmental sustainability. Given that the lead time for arriving at the solution to some key social and technological challenges is long, there is a need for a framework to structure long-term analytical capacity. This framework should provide guidance to the analysts and researchers studying the issues and problems. Such an analytical framework can also help in providing guidance and decision-support to the policy-makers responsible for the execution of consistent, coherent, and long-term strategies with desirable consequences, and on the bioeconomy as an increasingly leading part of the economic system.

Results

A conceptual system analyses framework for the bioeconomy has been developed based on a supply-demand framework that connects the building blocks (drivers, impacts, responses) for analysing impacts, trade-off and synergy effects that go along with a transition to a biobased economy. The SAT-BBE consortium identified and analysed the most important interactions and feedback effects between the bioeconomy and other parts of the economy (e.g. fossil and energy based industries), taking into account developments in system drivers (e.g. economic development, innovation and technical change) and constraints (e.g. land, water, non-renewable natural resources, labour). Impacts are measured in relation to the five societal challenges of the EC Bioeconomy Strategy.

Lessons-learned and recommendations

Gaps exist especially for ‘new’ and innovative sectors of the bioeconomy regarding the availability of socio-economic indicators. Existing models cover already many aspects of the bioeconomy and are strong in the field of agriculture, forestry, energy or economy wide coverage. New biobased sectors are currently built in but data are limited available and weak.

Improved collaboration between model types is essential to evaluate the evolution and impacts of the bioeconomy across different levels of aggregation. The selected models for collaboration depend on the research question, which means that linking of models through ‘loose coupling’, instead of integration of modules, is a suitable.

On top of private and scientific research initiatives, the development of coherent and integrated policies are needed to set incentives for the most efficient use of biomass, to strengthen the use of organic waste, to improve primary production practices, to mobilize domestic resources, and to support innovation to enable cost-effective deployment of biomass conversion technologies.

Roundtable 3: Sustainable Business Models and Innovation Networks

Chairs: **Gunter Pauli** (ZERI), **Dirk Pilat** (OECD)


Key Topics

This roundtable will provide a platform for discussing the future development of a bioeconomy through creating new biobased value-chains as well as business models and innovation networks. What achievements have been made in advancing business opportunities and industry foundations for bioeconomy-related growth? What may be promising avenues to pursue in the future? What are the challenges to and opportunities for developing the bioeconomy across sectors? What role do regulatory frameworks play, how should they be developed further?

25. November 2015 | 16:30 – 18:30 | Room B 09

16:30–16:35 Welcome and short introduction
16:35–18:15 Impulse presentations and Q&A

The bioeconomy: Shifting from a drive to cut costs to a commitment to generate value
G. Pauli, ZERI, International

Enabling new business models for the bioeconomy
D. Pilat, OECD

Out with old and in with the new: What transformative changes are needed in how agricultural research institutions work to deliver innovation to businesses in the bioeconomy?
A. Dobermann, Rothamsted Research, UK

Knowledge transfer between research and SMEs: Barriers, solutions and examples
S. Braun, University of Hohenheim, Germany

Innovative business model of biomass aggregation, processing and supply for sustainability of biomass based power plants and process plants
M. Ahuja, Bermaco Energy Ltd., India

Circular economy projects realized in Latin America (Ecuador)
C. Springer, Organization of American States, Americas

Clean-up the ocean using RONE – mixed-plastic recycling
G. Yu, Taiwan Hsinchu Green Industry Association, Taiwan

Circular approaches in the bioeconomy
D. Frank, German Phosphorus Platform, Germany

European blue bioeconomy projects initiated by the SUBMARINER Network
A. Schultz-Zehden, SUBMARINER Network for Blue Growth EEIG, Europe

Public private partnerships as business model for bioeconomy development
N. Moll, EuropaBio, Europe

18:15–18:30 Moderated discussion among roundtable participants

The bioeconomy: Shifting from a drive to cut costs to a commitment to generate value

G. Pauli (ZERI)

The past decades industry has pursued a strategy based on economies of scale, cost cutting and a drive to compete globally. This has required standardization and a consolidation of key players on the market. Its success required free trade and investment guarantees and a management characterized by core business based on a core competence. This has led to high unemployment and a dramatic loss of the most innovative and flexible tissue of the economy: SMEs and family controlled enterprises.

A new dynamic impulse must come of the next generation of entrepreneurs and after decades of a synthetic economy, driven by fossil fuels and petrochemicals, a new vertical integration of agriculture and industry will permit the design of a product, process and patent portfolio that will change the rules of the game. The production of biochemicals from thistles (in Sardinia, Italia) and the emerging coffee chemistry (with 8 chemicals from waste) offer an insight in the potential that is already converted into industrial initiatives.

Enabling new business models for the bioeconomy

D. Pilat, OECD

New business models are important to make the transition to the bioeconomy. While some new business models involve large firms, most involve small start-up firms that seek to exploit technological or commercial opportunities that have been neglected or not yet explored by more established firms. New firms tend to engage in more radical innovation than existing firms, and scaling up new business models can therefore help reduce environmental pollution, optimise the use of natural resources, increase productivity and energy efficiency, and provide a new source of economic growth. Although the market for green goods and services is growing, the development of new business models is affected by a range of barriers, many of which can be addressed by well-designed policies. Existing policies also often unduly favour incumbents, limiting the growth of new ideas and business models. This presentation will draw on recent OECD work on innovation and the bioeconomy to address some of the key areas for policy action, such as: 1) how to strengthen market demand for bioeconomy products; 2) removing perverse subsidies that support existing business models and incumbent firms, such as energy subsidies; 3) reducing barriers to entry, exit and growth of new firms and business models; 4) improving governance, to ensure that national and regional policies for the bioeconomy are well aligned.

Out with old and in with the new: What transformative changes are needed in how agricultural research institutions work to deliver innovation to businesses in the bioeconomy?

A. Doberman, Rothamsted Research, UK

Sufficient, healthy, safe food and sustainable agricultural production systems rank high in the development agendas of all national bioeconomy strategies. Despite this, to date, the most substantive growth in the bioeconomy, as evident from investment, new businesses and jobs, can be seen in the pharmaceutical and biomedical sectors, as well as the chemical and biomaterial industries.

World leading agricultural research institutions across the globe could play major roles in growing the bioeconomy but to do so they face challenges in terms of changing their often traditional and deeply entrenched ways of working towards adopting new practises and structures that enable more flexible, entrepreneurial cultures.

As one of the oldest agricultural research institutes, Rothamsted Research, which receives strategic funding from the UK Biotechnological and Biological Research Council (BBSRC), could be considered as such an example. We have been looking into the transformational changes that will be necessary to be competitive in the agricultural-based bioeconomy. Our conclusion is that the changes needed are quite profound and require us to question deeply how we wish to work in the future, what sort of institution we wish to be and how we should develop an open innovation campus recently opened at Rothamsted.

We offer these findings for discussion and experience-sharing.

It is clear to us that the bioeconomy cannot be pursued by simply "re-badging" existing work. Although our science has significant impact in multiple ways (e.g. influencing policy, changing agricultural practises and underpinning crop breeding), for economic impact to be clearly attributable to innovations arising from Rothamsted, the institute will need to work in a more problem-solving and product-oriented manner. In particular, we will need to identify projects on the merits of their market opportunities and co-develop these closely with industry, sharing both the benefits and risks. We will also need to establish new alliances from a wider and less traditional agricultural industrial base and retrain scientists to be more entrepreneurial.

Like many other leading research organisations worldwide, Rothamsted will need to balance market-oriented and ideas-led bioeconomy research with its more traditional hypothesis-driven science and identify the organisational structure, reward systems and leadership to take the newer bioeconomy research forward.

Knowledge transfer between research and SMEs: Barriers, solutions and examples

S. Braun, University of Hohenheim, Germany

Knowledge transfer, defined as the means by which expertise, knowledge, skills, and capabilities are transferred from the knowledge-base (donating entities) to those in need of that knowledge (receiving entities), is a highly relevant topic on the European research agenda. The importance of knowledge transfer in the European food industry is obvious, especially in the case of Small and Medium Sized Enterprises (SMEs) in the food producing sector. These SMEs are increasingly under pressure due to the opening of new markets, an increasing demand of standardized and price competitive food products by the consumers, the rising importance of large retailers, and the need to conform to governmental regulations. To deal with this complex situation, the transfer of new technology and knowledge is essential, becoming an important subject of scientific research, as well as in economic and public policy. The background, the barriers, the solutions, and the practical experiences of scientific knowledge transfer to SMEs in European will be discussed during this presentation. While scientists often are suspected to be in their 'ivory tower', enterprises often lack access to sources of innovation which they so urgently need in order to stay competitive. The central obstacles that hamper the transfer of new scientific insights to SMEs will be outlined, with trust and language being the most important ones. Suggestions to overcome these barriers will be given with reference to the practical experiences gained in previous and ongoing European projects (e.g. TRAFOON (www.trafoon.eu), EuFooD-STA (www.food-sta.eu).

Innovative business model of biomass aggregation, processing and supply for sustainability of biomass based power plants and process plants

M. Ahuja, Bermaco Energy Ltd., India

Background

Biomass based power generation is renewable, widely available, carbon-neutral technology and has the potential to provide significant employment and income generation in the rural community particularly farmers and villagers. The cumulative capacity of biomass power generation in the country is about 1263.80 MW out of which only about 50% is operating and rest is either shut down or operating at low PLF. One of the major reasons for non-performance of installed biomass power plants is unavailability of required quantity of biomass at reasonable cost. The fuel security can be achieved by establishing a fuel supply chain starting from fields to the boiler inlet. M/s. Punjab Renewable Energy Systems Pvt. Ltd. (PRESPL) was established in March, 2011 with a view point of addressing this principal issue of biomass fuel supply management and looks into aggregation, processing, transportation, and supply to biomass based power plants and process plants having boilers. PRESPL is the largest player in organized biomass fuel supply business in the country and handling more than 1000 tons per day of various biomasses.

Business Model

In order to develop biomass supply chain to power plants, identification and training of rural youth is done to develop them as “Village Level Entrepreneurs” (VLEs). VLEs are provided with necessary machinery such as shredder, balers etc. and are given responsibility of collecting biomass from individual farmers, processing and transporting to power plant. VLEs are paid at pre determined rates for biomass supplied to the plant. This biomass model is unique, innovative on following account:

- PRESPL enters into long term fuel supply agreement with clients with pre-decided price and schedule of supply and guarantying quantity and quality of fuel supply. PRESPL acts as single point solution for all fuel needs of the client.
- PRESPL is providing additional source of revenue to the farmers through sale of the feedstock which otherwise used to be burnt/ left in open fields leading to deadly particulate and methane emissions. Burning of biomass in boilers with necessary pollution control equipments not only prevents pollution also leads to clean and renewable power generation.
- In the short span of about 4 years, PRESPL has served more than 20 Nos. of biomass power and process plants and has supplied more than 3, 00, 000 MT of various biomasses which has offset about 17, 20, 000 of CO_2 generation.
- Rural income and employment generation to whole rural chain involving VLEs, farmers and rural youth. For collection, storage and supply of biomass, many tractors, trolleys and other farming equipment are also involved by the local farmers which results in additional use and source of income to more than 20000 nos. of local Farmers. Biomass power plant requiring 450 MT/Day delivers an estimated 1421 “green jobs” within the rural community through the collection of biomass waste, transportation and collection operations.
- Biomass residues such as cotton stalk, Juliflora, maize cob etc. has multiple end uses such as power generation, generation of bio-fuels and bio-chemicals, biogas and bio-CNG production which have immense economic value.

Conclusions

PRESPL’s biomass aggregation and supply business model is need of hour of biomass power industry, environmental-friendly, and has immense positive contribution to rural economy & growth of India.

Clean-up the ocean using RONE - mixed-plastic recycling

G. Yu, Taiwan Hsinchu Green Industry Association, Taiwan

The Ocean Garbage Patches including the Great Pacific Garbage Patch, which are estimated to be the size of Texas (700,000 square Km) or up to "twice the size of the continental USA", the North Atlantic Garbage Patch, and others; which are still growing (double the size in 10 years), and are composed of mainly plastic debris. Although such plastic waste has posed a great danger to the ocean wildlife as well as human beings, we don't have an effective method to clean our oceans as of today.

RONE is a state-of-the-art Pyrolysis technology capable of producing clean and low sulfur content fuel which meets the most stringent international standard (Sulfur content 10ppm) from processing a variety of plastic waste in a low cost manner.

Diesel produced from RONE technology has very high combustion efficiency (Cetane Number ~60) which is 10~15% higher than its petrochemical-based counterpart. The high heat value Diesel and the very high throughput make RONE diesel pricing can be cheaper than any bio-diesel and no higher than petrochemical-based diesel.

RONE can be deployed to effectively clean the Ocean Garbage Patches AND provide clean recycled or re-generated fuel, which not only greatly reduce the greenhouse gas emission, but also economically sound or profitable which makes sustainability come true.

European blue bioeconomy projects initiated by the SUBMARINER Network

A. Schultz-Zehden, SUBMARINER Network for Blue Growth EEIG, Europe

The presentation will provide an overview on European blue bioeconomy projects recently initiated under the umbrella of the SUBMARINER Network:

- Blue growth and smart specialisation of regions: Lead by the Ministry of Economic Affairs, Employment, Transport and Technology Schleswig-Holstein (DE), the Network has developed two projects seeking to enhance blue growth opportunities based on increased capacity of regions to implement their research and innovation strategies for smart specialisation (RIS3) in the field of the blue bioeconomy;
- Baltic Blue Biotechnology Alliance: Lead by GEOMAR (DE), this project will bring together blue biotechnology actors from the Baltic Sea Region to develop innovative marine bio-based products. By systematically pooling national capabilities for joint product development and marketing the participating research institutes and business clusters will be able to reach the critical mass for action;
- Initiation of large-scale mussel farming in the Baltic Sea Region: Lead by Region Östergötland (SE), the project will initiate large-scale, business-based feed-mussel farming to harvest nutrients from the Baltic Sea. The project focuses on four main cases in Sweden, Åland, Denmark and Germany.

The development of the above-mentioned projects has been supported by the Nordic Council of Ministers in its role as Policy Area Coordinator "Bioeconomy" of the EU Strategy for the Baltic Sea Region.

Furthermore, the presentation will provide insights to current project developments within the Network on the following topics:

- Development and transfer of innovative and sustainable aquaculture technologies in the South Baltic area;
- Remediation of enclosed marine waters as a driver for sustainable blue growth.

Roundtable 4: Bioeconomy Policy and Trade Strategies

Chairs: **Jackie Hunter** (BBSRC), **Andrea Noske** (BMBF)


Key Topics

This roundtable will provide a platform for policy makers and promotion organizations from around the world to discuss experiences, activities and positions regarding suitable policy and trade strategies fostering sustainable bioeconomy development. What can be learnt from experiences in the past? What are the key issues in the present and the future? What are opportunities for future collaborations? What is the significance of regulatory frameworks, e.g. in the area of international trade, how should they be developed further?

25. November 2015 | 16:30 – 18:30 | Room B 07/08

16:30–16:35 Welcome and short introduction

16:35–18:15 Impulse presentations and Q&A

Fostering systemic approaches in research and education
A. Noske, Federal Ministry of Education and Research (BMBF), Germany

Building a collaborative IB ecosystem for driving the UK bioeconomy
J. Hunter, BBSRC, UK

Thailand and the transition from conventional bioresource-deployment economy to the sustainable bioeconomy
S. Tongsopit, National Science Technology and Innovation Policy Office, Thailand

Value-added networks for the successful international implementation of bioeconomy
R. Kindervater, BIOPRO Baden-Württemberg GmbH, Germany

Bioeconomy policies and policy coherence in the Baltic Sea Region
G. Oddson, Nordic Council of Ministers

Reviving the fortunes of traditional grains in East Africa
J. Gatune, African Centre for Economic Transformation, Ghana

Bioeconomy policy approaches in Central Denmark Region – an EU frontrunner
H. Brask Pedersen, Central Denmark Region, Denmark

Trade strategies and bioeconomy
H. Hetmeier, Ministry for Economic Affairs and Energy (BMWi), Germany

Boosting SME engagement in the bioeconomy
L.H. Jensen, Agro Business Park A/S, Denmark

Realizing bioplastics potential in Europe – creating a favourable landscape
H. von Pogrell, European Bioplastics, Europe

18:15–18:30 Moderated discussion among roundtable participants

Building a collaborative IB ecosystem for driving the UK bioeconomy

J. Hunter, BBSRC, UK

BBSRC is the key investor and shaper of research underpinning the UK bioeconomy, which directly provides £36.1bn GVA to the UK. The UK's world leading academic bioscience research base has key strengths in molecular and cell biology that supports the emerging industrial biotechnology and bioenergy (IBBE) sector directly providing £1bn GVA to the UK.

In 2012 BBSRC recognised the value of joining up the research base, building links into industry and the need for new innovative funding mechanisms to support IBBE research.

These needs have been addressed through a new strategy supporting 13 unique collaborative Networks and establishment of the IB Catalyst enabling translation of IBBE research by supporting CR&D at different stages of the translation pipeline.

The Networks have established high quality cross-disciplinary nuclei for interactions between academia, industry, policy makers and NGOs to tackle new research challenges, translate research and deliver key benefits in IBBE. Memberships have grown from 1913 to 3625 in 15 months (25% from industry, 160 international members).

Key attractions of the Networks:

1. Autonomy of financial support delivered by each Network to initiate academic business interactions covering all aspects of the relevant supply chains;
2. Responsive funding for activities needed in their particular area of focus;
3. Availability of considerable funding for academic-business consortia through the IB Catalyst and ERA-IB programmes.

This strategy enables the UK to harness the potential of biological resources for producing and processing materials, biopharmaceuticals, chemicals and energy with an increasing focus on the use of waste residues.

Thailand and the transforming of conventional bioresource-deployment economy to the sustainable bioeconomy

S. Tongsopit, National Science Technology and Innovation Policy Office, Thailand

Though bioeconomy is a new concept of utilizing bioresource to achieve sustainable development, deployment of bioresource is not new for Thai economy. Since Thailand is in a hotspot of biodiversity, bioresource has been used in various purposes for a long time, especially food and traditional medicine etc. Thailand economy has been based on agriculture and food industry that shares the main global's market of food products.

In the case of food and agriculture, however, with the conventional agriculture and food manufacturing process as well as the agricultural waste, there are big challenges for Thailand to head to sustainable development, both in terms of creating the high value products and having energy efficiency and environmental friendliness.

Thailand has not gotten a policy focus directly on bioeconomy in the past few years. Instead, it only has 'the environmental friendly 'Green and Clean Manufacturing'. Heading toward the Green growth industry is taken into account in the 20-year National Industrial Development Master Plan 2012-2031. Apart from agriculture and food industry, the renewable bioenergy industry and biomaterials is emerging. These sectors of bio-based industry are expected to switch the petrochemical-based industry to be environmental friendly while it could achieve the global competitiveness.

However, as Thailand is in a process of national reform, shifting Thailand from being a commodity-based economy to be a knowledge-based economy to escape the middle-income trap is pivotal needed. The knowledge-based Bioeconomy is concerned in terms of bio-based and biopharmaceuticals industry. Therefore, the efficiently deployment of genetic resources would contribute the high-value economy and the sustainable development.

In parallel, the private sector is working proactively to develop Thailand Bio Hub in order to integrate the value chain from the feedstock, e.g. sugar cane and cassava, to produce high values bio-products.

It is likely that Thailand is heading toward bioeconomy. However, a need of synchronizing between related ministries is challenging for Thailand's administration structure. Apart from the synergy of the feedstock production and the industrial structural changes which require an enormous attempt of adjustment in every related sectors, the strategic investment, the novel norm and regulations and the readiness of technology and novel character and qualification of human resource are of particular concern.

From point of view of the national policy of bioeconomy in Thailand is still in the early stage, the pace of switching the industrial structure to the novel bioeconomy would take time and critical high effort. The clear holistic landscape of key actors of the country's bioeconomy system as well as the country's position in the global's context must be taken into account.

The bottom-up approach taken by private sectors and decentralized local actors or intermediary organisations would be beneficial to provide incremental change of the system. Both networking within the country and the international collaboration in terms of business partnership, capacity building would accelerate bioeconomy activities and the knowledge flow practically. The setting up of regional bioparks is expected to gain foundation and build up the national's capability of bioeconomy in a long run.

Value-added networks for the successful international implementation of bioeconomy

R. Kindervater, BIOPRO Baden-Württemberg GmbH, Germany

Baden-Württemberg is one of the economically high performing states in Germany. One of the state's specificities is the high density of small and medium sized companies in many high tech fields like automotive parts production, machine building, automation products, plastic products, medical technology, aerospace components, fine mechanic and microsystem technology components. The classical chemical industry in Baden-Württemberg is structured in the medium sized range, oriented towards the final product levels in the value chain. Due to this structures a dedicated bioeconomy reseach strategy has been developed by the state ministry of science, research and the arts together with scientific specialists from all state universities. The scope of the strategy fills the whole range of the bioeconomic value network plus a variety of thematic fields like simulation and modelling, ethical issues, social and economical research. Being divided in three main areas of application (Biomethane applications, Lignocellulose feedstocks for material use and algal applications for protein based food production) plus projects in the accompanying research fields, a systemic research programme has been started, to induce the development of a bioeconomy in the state. In the field of the corresponding economic development, the state owned non-for- profit organization BIOPRO Baden-Württemberg is responsible for network building, innovation support and the corresponding technology transfer into the above mentioned industry structure of Baden-Württemberg. This approach is accompanied by the implementation of different value chains into a value added network on an international level to develop new business cases between raw material producers, converting industries and final product manufacturers.

Bioeconomy policies and policy coherence in the Baltic Sea Region

G. Oddson, Nordic Council of Ministers

As a macro-regional organisation – and in its capacity of leading bioeconomy cooperation efforts within the EU Strategy for the Baltic Sea Region – the Nordic Council of Ministers has together with a large number of public and private partners identified a number of bottlenecks slowing the transition towards the bioeconomy. One of them is bioeconomy policies and policy coherence.

The bioeconomy cuts across sectors. Therefore the bioeconomy does not fit in neatly into one specific policy area but must rather be addressed through a number of efforts in different policy areas. Currently some countries in the Baltic Sea Region have rather holistic bioeconomy policies in place. In other countries the bioeconomy is being pursued through cross-cutting, but specialized, efforts such as in research policy – and yet others pursue the bioeconomy as components of broader sector policies for e.g. agriculture, fishery, forestry, regional development, environment and innovation.

Realising the bioeconomy calls for countries to move beyond silos and sector policies and towards integrated policies and incentives across these "traditional" sectors.

To support countries to actually and practically go about realising the bioeconomy, the Nordic Council of Ministers has now taken the initiative to facilitate a macro-regional cooperation platform: "The Baltic Sea Region Bioeconomy Policy Dialogue Forum".

This forum aims to facilitate sharing of bioeconomy policy practices for purposes of inspiration and policy learning. In doing so the policy forum will support efforts to multiply current good policy practices as well as efforts among policy makers to co-create next best bioeconomy policy practices.

Reviving the fortunes of traditional grains in East Africa

J. Gatune, African Centre for Economic Transformation, Ghana

Traditional Grains of millet and sorghum have been losing market share.to maize and more recently to wheat and rice in East Africa This trend does not node well for the region. Maize is very vulnerable to water shortage while wheat and rice are largely imported. The loss of traditional gains can be attributed to poor image (as they are seen as food for the poor) and low productivity (due to neglect by researchers). However the crops have superior nutritional profiles and more importantly uniquely suited to East Africa's agro-ecological conditions. They require very low levels of water and can thrive in heat and poor soils. They are thus key to securing food security of the region especially in face of climate change. Also given their superior malting quality they have the potential to support a significant food manufacturing sector. Beyond food the crops they can also serve as important feedstock for animal feeds, brewery and biofuel industries. Indeed sweet sorghum is also being touted as having potential to replace sugar as a feedstock for sugar and alcohol production and also provide food. However the traditional grains value chains remain largely informal and fragmented. Policy option for unlocking potential for this crops include mandates e.g. 10% inclusion of sorghum flour in bread, incentives e.g. removal of import duties on food processing equipment and Public Private Partnerships (PPPs) to upgrade the value chains. ACET has done a number of studies that have illuminated policy approaches that governments in the region can adopt.

Bioeconomy policy approaches in Central Denmark Region – an EU frontrunner

H. Brask Pedersen, Denmark

As one of eight European regions, Central Denmark Region has been selected as European Bio economy Frontrunner by the EU Bioeconomy Observatory. Central Denmark Region is the largest agricultural region in Denmark. It includes one third of the Danish livestock and one third of the total agricultural land. It is the centre of Danish wind power and biogas production from manure. The region has the highest share of renewable energy in Denmark, with 33% of the total energy consumption. The Regional Council has set a target of 5 % for the share of renewable energy by 2025. The Regional Council has during the last decade initiated and supported initiatives promoting renewable energy and the use of biomass for bioenergy. The initiatives include different kinds of support to innovation and demonstration projects, capacity building, market development, and long term policy conditions. More recently, the Regional Council has supported projects utilizing waste and biomass for more high-value product, and several companies in the region already have new products on the marked. A national bioeconomy cluster, including companies, universities and organisations, has also been supported to promote collaboration and innovation projects across value chains. Mapping projects have been initiated to identify demonstration projects and other activities within the areas of transport fuels, feed protein production, new food ingredients from by-products, marine biomass, and food waste. Based on the results from these, the Regional Council will initiate a new bioeconomy programme in 2016 to further develop bioeconomy in the region.

Boosting SME engagement in the bioeconomy

L.H. Jensen, Agro Business Park A/S, Denmark

A core challenge for translating the potential of the biobased economy into growth and jobs in Europe is the issue of engaging the European SME community. On a European level 66% of employment is in SMEs and 99% of all registered companies are SMEs. But more importantly: SMEs create more jobs than large enterprises. Between 2002 and 2010, 85% of total employment growth was attributable to SMEs, and SMEs have a much higher employment growth rate (1% annually) than large enterprises (0.5% a year). Yet so far, the push for the bioeconomy in Europe seems to some extent to be dominated by larger industrial players.

The roundtable presentation will spark a discussion on the role of cluster organisations, innovation networks and similar organisations as enablers of SME engagement in the bioeconomy and the measures, challenges and barriers that are connected to this ambition.

The lead presenter has many years of experience in facilitating business development through clusters, networks and partnerships – especially targeting SMEs. He represents Biocluster.dk and the national innovation network for biomass in Denmark (INBIOM), which has 10 years track record in the bioeconomy. INBIOM has more than 700 members, which are active in the entire value chain of the bioeconomy.

The presentation will build on the experiences in engaging industry, academia and especially SMEs in the bioeconomy. But mostly, these experiences will be used to frame a discussion on, which specific measures are required to further engage the SME community in the creation of a biobased economy.

Realising bioplastics potential in Europe – creating a favourable landscape

H. von Pogrell, European Bioplastics, Europe

The global bioplastics industry is growing at a rate well above average with production capacities of plastics that are biobased, biodegradable or both increasing by 20 to 100 percent each year. Europe is leading in R&D and provides a huge potential market, yet is lacking the necessary legislative framework to attract and ensure investments into production and conversion as well as to support a full-scale market penetration of bioplastic products. Europe is in danger of missing out on the benefits of the bioplastics industry – from reduced environmental impact (renewable resources, resource efficiency, greenhouse gas emissions reduction, etc.) to creation of high-skilled jobs. First member states such as Italy and France have taken initial important steps by acknowledging the advantages of the large family of bioplastic products in relevant fields such as resource efficiency and waste management.

Workshops

Global Bioceconomy Summit 2015
26. November 2015
bcc Berlin Congress Center

The Future Role of Biorefining in the Bioeconomy - a Stakeholder Dialogue

Chairs: **Rene van Ree** (Wageningen UR) **& Gerfried Jungmeier** (Joanneum Research)

26. November 2015 | 11:30 – 13:00 | Room A 03/04

To present and discuss the potential role of biorefining and its stakeholders in the transition to a future bioeconomy in which biomass will be sustainably used for the synergistic co-production of food, feed, biobased products and bioenergy.

Key topics:

- Views and roles of different stakeholders on the transition towards a bioeconomy and/or a Circular Economy; who will take the lead?
- Role of biorefining within this transition process
- Main drivers that support this transition process
- Main technical AND non-technical barriers that hinder this transition process
- Role of national and international governments
- Supporting policies & instruments.

Agenda:

11:30 – 11:35
Welcome and Introduction, R. van Ree, Coordinator IEA Bioenergy Task42/Wageningen UR

11:35 – 11:45
Novamont: An Integrated Approach to Bioeconomy and Biochemicals, G. Gregori, Novamont

11:45 – 11:55
Pulp & Paper Industry's Role in the Bioeconomy – the Austrian Case, N.N., Austropapier

11:55 – 12:05
"Integrated Biorefineries" – Recommendations from the SCAR[1] Collaborative Working Group, S. Rauschen, Juelich Division Bioeconomy

12:05 – 12:15
Results Survey of Major Bio(based) Economy Strategies in the 22 member countries of IEA Bioenergy, M. Beermann, Joanneum Research

12:15 – 12:25
Results Survey on the Role of Industry in a Transition Towards the Bioeconomy in Relation to Biorefinery, H. Jorgensen, Technical University of Denmark

12:25 – 13:00
Panel Discussion

1 Standing Committee on Agricultural Research

Bioeconomy, Food Security and Small-scale Producers

Chair: **Olivier Dubois** (FAO)

26. November 2015 | 11:30 – 13:00 | Room B 05/06

With a view to achieving the Sustainable Development Goals, bioeconomy development needs to be guided in order to not harm but rather enhance food security, climate-smart agriculture and family farming.

Key topics:

- Challenges and opportunities for innovative low-carbon technologies to "green" small-scale producers' agrifood chains in the context of "climate-smart" agriculture. Challenges and good practice in resource use in family farming, including: Efficiency (water-energy-land), 'save and grow'; and competition over the use of resources (e.g. use of agricultural residues for soil management and/or animal feed and/or bioenergy).
- Ensuring that bioenergy and biomaterial production do not harm but rather benefit family farming and food security.

Agenda:

11:30 – 11:40
Introduction, O. Dubois, FAO

11:40 – 12:00
Experiences with the Biomass-based Value Web Approach in Africa, D. Virchow, ZEF Bonn

12:00 – 12:20
Agri-Forestry Innovations and Business Models Integrating Small-scale Producers, P. Mishra, Abellon

12:20 – 12:40
Challenges and Opportunties for Small-scale Producers and Enterprises in the Production of Biomaterials, J. Tissari, FAO

12:40 – 13:00
Plenary Discussion on Dealing with Challenges and Opportunities, Possible Next Steps

Global Investment in the Bioeconomy

Chairs: **Szilvia Nemeth & Lino Paula** (European Commission)

26. November 2015 | 11:30 – 13:00 | Room B 07/08

The Bioeconomy can give practical answers to global problems and can contribute substantially to sustainable development. This requires structured international, often multilateral cooperation that can bring synergy into the efforts undertaken by countries and regions. The EU gives key importance for stepping up efforts and working systematically with international partners to scale up the existing innovations in the Bioeconomy. The challenges and opportunities at stake at international level are often similar. For this reason the main part of this EU workshop will be a structured brainstorming discussion with key international and European stakeholders that have an interest in building a stronger international community around the Bioeconomy.

Key topics:

- Introduction: main outcomes of the Bioeconomy Investment Summit (Brussels, 9-10 November 2015) and new priorities of the European Commission
- Interactive, participatory discussion on the EU internationalization agenda of the Bioeconomy
- Building the international dimension of a revised Bioeconomy Strategy

Agenda:

11:30 – 11:40
Introduction by the European Commission

11:40 – 11:50
Keynote Speech on Internationalization of the Bioeconomy, J. Philp, European Commission

11:50 – 12:50
Discussion in Groups on Specific Questions on Internationalization of the Bioeconomy

12:50 – 13:00
Conclusions

Bioeconomy & Biodiversity

Chairs: **Johannes Vogel** (German Bioeconomy Council) **& Stephen Blackmore** (BGCI)

26. November 2015 | 11:30 – 13:00 | Room A 05/06

The biological diversity of planet earth, has always been our life support system: providing the goods and services we depend upon. Now it forms the basis of the Bioeconomy, and will be essential in meeting the global challenges, which the new Sustainable Development Goals (SDGs) set out to address by 2030. At present, however, we make use of only a small proportion of the estimated 10–13 million species, the potential contribution of most species to the Bioeconomy remains unknown. As biodiversity loss continues and a sixth great extinction crisis is in prospect, the threat to our life support system demands urgent responses. This workshop will explore the roles and potential contributions to the bioeconomy of biodiversity research institutes and collections based institutions such as natural history museums and botanic gardens.

Key topics:

- To explore the roles and contributions to the bioeconomy of biodiversity research and biodiversity collections.
- To consider how biodiversity research can help to broaden the biological base of the bioeconomy, which currently rests upon a relatively small subject of the biodiversity of the planet.
- To consider what new partnerships and frameworks might be needed to further a sustainable bioeconomy and the protection of biodiversity.

Agenda:

11:30 – 11:40
Natural History Museums, J. Vogel, German Bioeconomy Council

11:40 – 11:50
Plant Diversity and Botanic Gardens, S. Blackmore, BGCI

11:50 – 12:00
Proposals for a Cost-effective Rational System for Conserving Plant Diversity, P. Smith, BGCI

12:00 – 12:10
Non-plant Diversity, N.N.

12:15 – 13:00
Discussion

Reconciling Food and Industrial Needs

Chair: **Peter Schintlmeister** (OECD)

26. November 2015 | 11:30 – 13:00 | Room B 09

For the bioeconomy to work it needs new supply and value chains that will be more complex and numerous than fossil fuel chains. However, the mantra of the bioeconomy has to be "food first" as there is a natural tension between using biomass for food and industrial usage. Many of the OECD nations are net consumers of biomass, and some of the key developing nations are net suppliers of biomass. However, we know that Malaysia and other emerging countries have ambitious plans to develop a 'bioeconomy industry' around higher value-added products.

Key topics:

- What policies can be put in place to ensure food security first
- How biotechnology can contribute to a bioeconomy
- How food/feed and industrial demands on biomass may be reconciled
- How these policy goals may achieve sustainable value chains and an equitable global bioeconomy.

Agenda:

11:30 – 11:45
Enabling Food Security Policies in Southeast Asia: ASEAN Food Security Initiatives, M. Yoovatana, Ministry of Agriculture, Thailand

11:45 – 12:00
Biotechnology in Brazil for a Global Bioeconomy W. R. Filho, Brazilian Agency for Industrial Development

12:00 – 12:15
An Inclusive Bioeconomy: Potential Benefits for Africa, H. T. Demissie, African Centre for Technology Studies (ACTS)

12:15 – 12:30
Policy Instruments for Sustainability in Bioeconomy Value Chains, S. Ugarte, SQ Consult

12:30 – 13:00
Discussion

Poster Session

Global Bioceconomy Summit 2015
25. November 2015
bcc Berlin Congress Center

In the poster session, experts from all over the world will share information on their activities and lessons learned. Many projects will report results from research groups working across institutions, disciplines and national borders. All contributions refer to innovation in the sense of new ideas, products, methods or social interactions being applied to bioeconomy development.

The session is designed to give participants the opportunity to talk to very experienced researchers, policy advisors and business representatives. It also features posters from junior scientists entering the field with fresh ideas.

The following abstracts provide a first overview of the posters that will be presented during the session. They span the breadth and depth of bioeconomy development. The posters have been grouped into four tracks and were marked by a corresponding color code:

Track 1
Bottom-up and regional approaches

Track 2
Bioeconomy monitoring and policy impact assessment

Track 3
Marine, forest and agricultural innovations

Track 4
Industrial innovation and bioeconomy value-chains

Poster Abstracts

Poster Session – Track 1

Poster Session – Track 2

Poster Session – Track 3

Poster Session – Track 4

Sustainable and flexible value chains of biogas production in Baden-Württemberg

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Background

Due to price increases for biomass and a severely remodeled subsidy system for bioenergy, the biogas sector is currently facing considerable challenges. Because numerous biogas plants already exist, biogas research is working to guarantee even more efficient and sustainable biogas production. In addition, it is anticipated that biogas plants will be profitable in the future without federal subsidies.

The research network "Sustainable and flexible value chains of biogas production in Baden-Württemberg" is integrated into the Bioeconomy Research Program Baden-Württemberg. It focuses on research competence existing in the entire biogas value chain in Baden-Württemberg. The research network started in July 2014.

Objective

Altogether 15 sub-projects are funded to pursue the following objectives:

- Developing new technologies in the biogas value chain in the context of biomass supply, its conversion and processing.
- Evaluation of food- and non-food markets in order to analyse the ecological, economic, socio-technical and ethical advantages or disadvantages of current and future biogas production.

Activities and Results

Outstanding researchers from various institutions in Baden-Württemberg collaborate in four interconnected research areas (RA).

RA1: Substrate production and supply
RA2: Substrate conversion
RA3: Utilization of conversion products
RA4: Economic, ecological, socio-technical and ethical impacts

Sub-projects of the RA2 and RA3 deal with the research of new technologies and build an important keystone of the network. They aim to

(i) analyse the processing techniques for residues and waste materials usable for biogas production;
(ii) develop techniques to feed biogas into the natural gas grid in combination with Power to Gas (PtG) concepts.

These findings serve as a basis for other projects operating on a regional and state level. For bioenergy production, an important research challenge is to detect alternative substrates (waste/sludge) which also help relieve the market of agricultural biomass. All these results will be the basis for the model-based sub-projects which use economic and ecological models on farm, regional, state and EU levels. A close cooperation exists with the Competence Network Modeling the Bioeconomy, which is also a part of the Bioeconomy Research Program Baden-Württemberg. This will allow a realistic definition and calculation of model scenarios in order to evaluate the future of biogas production in Baden-Württemberg, considering especially the intensive competition for the scarce agricultural area.

Lessons learned and Recommendations

As the first year has shown, an interdisciplinary analysis of value chains of biogas production is very important. The collaboration needs a comprehensive platform between the different disciplines. It will lead to an additional value in understanding and results. The results should show how and where to produce comparatively low priced bioenergy from biogas with fewer negative externalities. The outcome of the research network should be useable for scientists, policy makers and also practitioners.

Perspectives of a future-proof logistics applied to the natural raw material supply in the Cluster Region (Plan C)

V. Auer, University of Applied Sciences Rosenheim, Germany and **K. Husmann,** Northwest German Forest Research Station (NW-FVA), Göttingen, Germany

Background

The use of renewable biomass has great opportunities to reduce fossil raw material consumption. The crucial factor is the competitive supply of raw materials. Thereby the major challenges are the consistent quality, season-independent availability and logistics. Thus the availability and supply of raw material are essential factors in the bio-economy.

Objective

The collaborative project "VP 1.6 Perspectives of a future-proof logistics applied to the natural raw material supply in the cluster region – Plan C" wants to contribute establishing the bio-economy:

- creating a raw timber potential analysis based on the National Forest Inventory (NFI 3)
- developing a benchmarking method for the raw material supply
- optimizing the treatment of forest stand and wood logistics

The regional project focuses on beech wood as a lignocellulose containing advanced resource.

Activity

To ensure the *raw material availability* long-period planning is necessary. Sustainable forest management is only possible if the younger age groups are less utilized than their growth. To initiate generation change the utilisation of older age groups has to be greater than the growth. Both growth and utilization were derived by NFI data. Security of *raw material supply* depends on the knowledge and the practical experience to optimize integrated value chains. The consortium explores a method which smartly combines specific forest knowledge and logistics thinking. The aim is to develop a model-based valuation method which enables an optimized raw material supply.

Results

In the project area the annual average of beech wood growth was about 4.8 million cubic meters of standing wood in forests per year from 2002–2012. By contrast the utilisation was approximately 3.3 million m^3/a. Due to bark reduction and inevitable harvest losses, this translates to 3.9 million cubic meters of standing wood. The remaining 20% cannot be interpreted as an available raw timber potential, since it is located in young age-classes. Hence, the results show an utilisation of raw timber that largely exhausts the growth. This situation is expected to be repeated in the following period 2012–2022.

On this basis a comparison of supply and demand for beech raw wood was developed. Wood working companies process the useable raw timber with approximately 2.0 million m^3/a. The stem wood - small wood ratio is approximately 1:3. The balancing of 1.3 million m^3 small wood was completely plausible. The 1.3 million m^3 of smaller diameter assortments were not totally accountable. The results show an almost complete absorption of the growth potential in the past, which is consistent with the analysis of Mantau. Increasing demands lead to an intensification of competition. The supply of individual companies will largely depend on their willingness to pay.

Lessons-learned and Recommendations

The NFI 3 is currently the latest and most accurate data source to estimate the timber potential. The results still are a reliable basis for large-scale planning after the project. The next step is the development of the stand wise planning tool (mapping space-time ratio) and thus giving the possibility of logistics optimization.

Where wood meets chemistry – Central Germany as the model region for a bio-based future

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Background

A "Bio-economy" is defined as "the knowledge based production and use of renewable resources to provide products, processes and services to all sectors of a future sustainable economy". Food security and sustainable production of renewable resources have a high priority in this concept.

A sustainable bio-economy needs the close cooperation between economical areas which usually do not work together: agriculture and forestry, food industry, chemical industry, plastics and plastic processing industry, wood processing industry, construction industry, energy industry and machinery and plant engineering. The Federal State of Saxony-Anhalt in Central Germany can provide this industrial infrastructure and has thus become home of the Leading Edge cluster BioEconomy

Objectives

The Leading Edge cluster BioEconomy was set up primarily for optimizing the material usage of wood with high value creation (wood as a material of construction and as a raw material for the chemical industry), supplemented by the energetic usage of the process residues. It operates with the following goals:

- Sustainably maximize value creation of non-food biomass through coupled production and cascaded utilisation in order to generate chemicals, new materials and energy.
- Speed up innovation through the integrated, temporally and spatially coordinated up scaling of processes and plants from laboratory to demonstration and industrial scale.

Activities

The cluster started up in 2012 as a small group of 33 industrial and research partners. It organized itself as a "Verein" (BioEconomy e.V.) and defined its core competencies as the *development, scale-up and application of innovative technical processes for the sustainable use of renewable non-food resources, primarily beech wood*. The cluster's technical centres, where the majority of the research and development projects is carried out, are located in Rottleberode in the Harz, at the Fraunhofer Chemical & Biotechnological Process Centre (CBP) in Leuna and at the Deutsches Biomasseforschungszentrum in Leipzig.

Results

From October to August 2015, the cluster has grown to more than 100 partners. These work together closely in almost 50 joint R&D projects in the areas of wood logistics, wood construction, biorefining of wood, new chemicals, polymers and materials on the basis of wood and on the energetic use of lignicellulosic re

Multidisciplinary transition to a sustainable bioeconomy – the case of the Paper Province 2.0

M. Dahlström and M. Lestelius, Karlstad University, Sweden

Background

Karlstad University, in Värmland county (Sweden) with 270 000 inhabitants and an area of 17 000 km2 dominated by forests, has been engaged in the field of bioeconomy for decades. In the Engineering sciences this has spanned national and international projects, including projects of EU FP6-FP7, COST and Marie Curie. In the Social sciences the university has a long-standing track of research in regional development. The university has a reputed strength in multidisciplinary research including activities involving non-academic partners such as regional authorities, industry and organizations. Together with the cluster organization, The Paper Province, the current activities started in the ERDF-project Future Factory 2011-2013. The project showed how both engineering and social sciences could contribute to innovation and growth in the forest industry sector. This lead to the ambition to extend the scope to include a transition of the region to a sustainable bioeconomy. VINNOVA, Sweden's governmental innovation agency, supported The Paper Province with a 10 years initiative for 2013-2022 of SEK 130 M (ca €15M). The initiative is co-funded (50%) through a triple helix partnership engaging Paper Province (LP) and its member companies (+90), Region Värmland, Local authorities, The Swedish Forest Agency and Karlstad University.

Objective

- A transition to a sustainable bioeconomy of the region, by engaging the whole society.
- Academic objective – how to do that?

Activity

Examples involving Karlstad University:

- Social scientific research (Service management workshops and courses, Developing methods for multidisciplinary research, Researching key academic and policy concepts, Developing doctoral studies in multidisciplinary research environments)
- Engineering research (Innovation driven projects, Industrial PhD student projects, Innovation workshops with entrepreneur, MSc student projects)

For the overall project

Networking, Engaging in policy making, Turning triple helix into quadruple helix activities, Multidisciplinary research projects

Results (after 2 years)

- Researchers contribution to realizing a Smart Specialization strategy of Region Värmland
- New projects: 1. Social sciences research (Developing cross-cutting stakeholder involvement for realizing the bioeconomy; Developing doctoral studies in multidisciplinary research environments; Transition to bio-economy, smart specialization and quadruple helix; Research forum; 2. Engineering research (Research project on fossil free drying papermaking: Two new innovation projects together with SMEs; One InterReg project on the use of wood materials, waste, energy handling and sustainability in pulp and paper industry; Nordic Rheology Conference 2015; Four collaborative project applications within the bioeconomy field (forest industry and pharmaceuticals) to a national research foundation.

Lessons learned and Recommendations

- Yet no multidisciplinary projects including both Social scientific and Engineering research, but progress is made.
- Stamina, an open mind and tolerance is required to achieve multidisciplinary and cross-sector collaborations. The 10-year project is an advantage.
- Policy interaction is needed, since true societal transition to a sustainable bioeconomy requires this.
- Assess strengths and weaknesses and prioritize, which will give payback in future collaborations

“Smart specialization Weser-Ems 2020” in the Bioeconomy Cluster

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Background & Objectives

Economic Potential in the Bioeconomy Cluster in Weser-Ems

The economic potential in the Bioeconomy in the Weser-Ems Region is very high. You find many SME (often Hidden Champions) and more than 115.000 employees. But this line of business is challenged by several aspects such as: Globalization, ecological challenge, limitation of resources, decreasing consumer acceptance or skills shortage.

The 17 counties and urban municipalities in the Weser-Ems Region started a process of knowledge transfer in order to boost regional innovation and to achieve economic growth and prosperity. This strategy was based on a strong partnership between businesses, public entities and knowledge institutions.

Activities

- Network of Knowledge
- Masterplan Bioeconomy 2020
  - Challenges
    - Structural Change in Bioeconomy
    - Natural Resources (Ground/ Water)
    - Communication
    - Change of nutrition
    - Use of renewable resources
    - Management of liquid manure surpluses
    - Technical innovations for agriculture
    - Skills Shortage
  - Projects

Results

- Projects
  - Development of new courses of studies
  - Development of out-of-school courses
  - Smart farming/ precision farming
  - Technical solutions for management of liquid-manure surpluses
  - Cadastral with information on soil fertility
  - Food 2020
  - Open-engineering platform
  - Biomass utilisation of alga

www.weser-ems.eu

Lessons-learned & Recommendations

- The Weser-Ems Region consist 17 counties and urban municipalities. Overall it´s a rural area. In order to compete economically with other metropolises all over the globe it´s reasonable to work together as a region. Besides the EU commission demands regional cooperation and smart specialization for the actual Funding Period 2014–2020.
- Knowledge is one of the most important resources at the beginning of the 21st century. SME often possess special knowledge but mostly do not have an own research and development department. So it´s helpful to bring these companies together with universities and institutes in order to gain innovation.
- It was very fertile to work in interdisciplinary groups of experts from business, science, administration and local politics.
- Some challenges were identified for the Bioeconomy cluster in the Weser-Ems region. The Masterplan focuses on the year 2020 – it´s recommendable to think strategic for a process lasting a least several years.

Life in the midst of changes in climate conditions: Adoption of sustainable land management practices in the Niger basin of Benin

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Background

Climate change constitutes a serious challenge for the world, especially for developing countries. For the structural transformation of African agriculture, African farmers have to adopt relevant strategies to mitigate the adverse impacts of climate change on their activities such as declining agricultural productivity. However, all these adaptation strategies are not appropriate because leading to environmental degradation. Therefore, greater attention is thus being given to alternative models of intensification, in particular through sustainable land management technologies. Most of the recent papers have focused on either perceptions or adaption or have linked farmers' adaptation strategies to climate change perception. The difference between these two categories of papers is that the first category ignores the two-stage process of adaptation. Indeed, adaptation process involves firstly perception stage and secondly adaptation decision. However, there is also a body of literature on adoption of sustainable land management practices.

The previous papers concluded that farmers are most of the time aware about climate change, even though their awareness is not always consistent with historical climate records. Many factors such as gender and the education level of the household head, access to extension services and the number of relatives in a village are found to play an important role in the adaptation process. However, the findings of these studies are relatively local-specific and it is hard to find studies that analyze the determinants of perception and sustainable land management practices in the context of Benin.

Objective

This research analyzed the determinants of farmers' perception and farm-level sustainable land management practices (planting trees, stone bunds, less fertilizer application, crop rotations and intercropping with nitrogen-fixing crops such as beans, groundnut and soybeans) in the context of the Niger basin of Benin.

Methods

A variant of the Heckman two-step procedure, which is composed of a univariate probit at the first stage, and a multivariate probit at the second stage was used. This modeling procedure allowed to take into account the two-stage process of adaptation by accounting for the selection bias. Moreover, it allowed to simultaneously model the determinants of all the five sustainable land management practices and to explore the complementarities and substitutabilities among them.

Results

The results of the correlation coefficients of the error terms indicate that there are complementarities (positive correlation) between different sustainable land management practices being used by farmers. Results confirm that secure land tenure, distance to nearest market, tractor use, plow use, have heard about climate change and membership of farmers' organizations are some of the important determinants of perception of climate change and of adoption of farm-level sustainable land management practices.

Recommendations

Policies aimed at easing the structural transformation of agriculture, have to provide basic services to farmers such as better access to market, to appropriate roads, to education, to relevant extension services and to climate information.

Key words: Adaptation strategies, Climate change, Heckman two-step, Multivariate Probit, Perception, Sustainable land management practices.

Master‘s program in bioeconomy

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Background

The three faculties (Agricultural Sciences; Natural Sciences; Business, Economics and Social Sciences) of the University of Hohenheim together have a strong bioeconomic profile and decided to join efforts in a Master’s program in Bioeconomy starting in the winter semester 2014/15.

Objective

The objective of the Master’s program in Bioeconomy is to offer a comprehensive and systematic overview of all aspects of the production of (new) biobased products and services. Our students examine all aspects of renewable resources in a systematic analysis of the biobased value chain:

- their production and utilization in agricultural ecosystems in diverse climatic regions,
- their ecological performance,
- their properties,
- methods of conservation,
- biotechnological and sustainable industrial processes to convert these resources into (new) biobased products,
- the potential market launch of biobased innovations on an individual and societal basis.

Consequently, students acquire the expertise necessary to consider a range of issues in this complex field from diverse perspectives: producers of new resources, manufacturers of biobased products and consumers.

Activity

During the first year of the program students acquire fundamental knowledge of all aspects of the bioeconomy including its interconnections and interdependencies. Three bridge modules are offered in the first semester, which introduce the basic concepts of the agricultural, natural or economic sciences. This allows students with various disciplinary backgrounds to acquire the qualifications necessary to successfully complete the program. In addition, students acquire the skills necessary for a systematic analysis of biobased economies.

The second year of studies allows students to design their own curriculum by choosing from a range of elective modules. In a systematic examination of the entire biobased value chain in the module “Projects in Bioeconomic Research”, students put their acquired skills into practice by tracing a specific product from inception to market launch in close cooperation with industry representatives. A research-intensive Master’s thesiscompletes the program.

Results

The Master’s program in Bioeconomy started in the winter semester 2014/15 with 12 students. Only few applications had been submitted due to the novelty of the program. For the winter semester 2015/16 79 offers of admission have been extended. This shows an increasing interest in the program.

Lessons learned and Recommendations

The interdisciplinary approach is challenging for students as well as teachers. A distinctly collaborative learning culture has developed among students with students sharing their individual disciplinary or regional knowledge. Moreover, our students have quickly adopted the team and project-based learning mindset, which is one of the core competencies of the program. Also, teachers have started to more intensely co-operate across disciplinary boundaries regarding the contents and methodologies of their teaching. In workshops experiences were exchanged and it was concluded that didactic support on interdisciplinary educational methods is recommended.

"Bioeconomy Austria": Approach towards a national strategy

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Background

Austria's bioeconomy sectors currently generate approximately 8 per cent of GDP and employ 230,000 people. This share ought to be increased significantly since today's fossil-based world economy poses major challenges to the international community. Biogenic, renewable resources can play a key role in reaching a low-carbon, resource-efficient society and a clean economy. At present, Austria highly depends on fossil fuels, yet is determined to make a sustainable, innovative future reality and has therefore set the course for bioeconomy. Two cornerstones were crucial for starting the Austrian process:

1. In its Strategy for Research, Technology and Innovation (2011) the Austrian Federal Government included the aim to continue developing the potentials of science, research, technology and innovation in order to meet the grand challenges like global scarcities in energy and natural resources or climate change and its threatening consequences.
2. BIOS Science Austria and the Austrian Union for Agricultural Research (ÖVAF) presented a comprehensive Bioeconomy Policy Paper in November 2013 and set the impetus for acknowledgment of bioeconomy in the Work Programme 2013-18 of the Austrian Federal Government.

Objective

Starting from 2014, BIOS Science Austria and ÖVAF established the platform "Bioeconomy Austria". The objective was to initiate a suitable process in the development of an Austrian Bioeconomy Strategy within the context of existing Austrian strategies. To approach a widely accepted Austrian Bioeconomy Strategy, it is critical to involve all stakeholders and Federal Ministries relevant for the development and implementation. A comprehensive approach is key to meet the existing and upcoming challenges at national level and to unite goals and strategies of bioeconomy, in particular with those of energy transition, sustainability and industry 4.0.

Current Activities & Results

1. Elaboration of a RTI-Strategy for the sub-area of biobased industries in Austria in 2014.
2. In 2015, an inter-ministerial RTI-status-quo-report on bioeconomy-related activities was formulated and is currently subject to an open consultation.
3. For strong political support and societal acceptance of the development and implementation of a bioeconomy strategy, further steps remain to be taken. Three months before the Global Bioeconomy Summit, various national bioeconomy approaches (from Finland, Germany, India, Italy and USA) will be discussed at the Technology Symposium of European Forum Alpbach 2015. Furthermore, those international experts will provide feedback on the Austrian process and discussion on bioeconomy. As a follow-up of the current activities, a comprehensive stakeholder dialogue for Austria is scheduled starting in autumn 2015.
4. At the Global Bioeconomy Summit, we intend to present the results of the above mentioned consultation process and of the international feedback mechanism at the Technology Symposium of European Forum Alpbach 2015, together with potential impacts for the Austrian approach.

Lessons learned and Recommendations

The preparatory work for the bioeconomy stakeholder dialogue in Austria showed that – among others - in particular the following topics require further attention and debate:

- Definition(s) of "bioeconomy";
- Differentiation of priorities at regional, national, macro-regional (e.g. Danube Region) and European level;
- Consideration of socio-economic and environmental dimensions, in addition to technological innovations;
- and integrated sustainability assessments.

Skills and competencies for a sustainable bioeconomy

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Background

Against the background of the grand challenges, the development of a sustainable bioeconomy is essential. A comprehensive understanding of bioeconomy is an important prerequisite for a future workforce and thus for the development and implementation of sustainable bioeconomy routes. However, today still disciplinary academic and vocational training dominate our education systems. The demand of interdisciplinary-trained young people with excellent basic knowledge and additional bioeconomy competences and skills, be it in the academia, industry or primary production sector, will increase in the future. Therefore, a special education portfolio is needed, but not available yet. The Bioeconomy Science Center (BioSC) is an innovative competence center where the scientific expertise and modern infrastructure within important bioeconomy topics of the Universities of Bonn and Düsseldorf, the RWTH Aachen as well as the Forschungszentrum Jülich are clustered. BioSC is spearheading innovative and systematic approaches in teaching and training in the different focus areas of the bioeconomy, which are core elements of the BioSC education program.

Objective

For an integrated bioeconomy, regional training and education programs linked to global networks are an efficient way forward. Ideally, they should already start at school level and continue through university and the entire working life (lifelong learning). The BioSC aims for an inter- and transdisciplinary education of young people at a top quality involving research, economy, industry and society. The BioSC education approach provides a wide range of tailor-made modules and additional certificates addressing people at various education levels and with different scientific backgrounds – with the aim to combine excellent disciplinary capabilities with integrating and team skills.

Activity

Besides providing interdisciplinary competences and basic skills in bioeconomy the graduate education program aims also to implement opportunities to interface with scientists with diverse scientific backgrounds and industry by offering networking events, discussion platforms, excursions and lab exchanges. To bridge the gap between experts from science, industry and society, the BioSC implemented a public lecture series, which creates open space for discussion. For rising awareness and enthusiasm of teenagers for the bioeconomy a holiday academy for pupils is established.

Results

- A structured education program was developed, which offers graduates additional inter- and transdisciplinary skills as well as basic knowledge about the bioeconomy.
- In the frame of the BioSC education program, training and e-learning materials were generated and will be the basis for future education activities.
- A dialogue between society and scientists or experts was stimulated and is on-going.

Lessons-learned and Recommendations

International integration of education activities is needed and presently developed in BioSC since the value chains of a bio-based economy are transboundary. Therefore, additional skills as cross-disciplinary thinking and the holistic understanding of the bioeconomy concept are required by the future workforce. The intensification of collaborative cooperation in bioeconomy education is an essential prerequisite for the successful implementation of a global bioeconomy. Thus, the experience and knowledge gained during the establishment of the BioSC education program provides an excellent foundation for international cooperation.

Bioeconomy Council Bavaria

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The bioeconomy concept aims at a transition towards a biobased economy and implies the use of sustainably-sourced, renewable resources. Besides increasing innovation capacities, bioeconomy can contribute to integrating ecology and economic growth. It is thereby perceived as a solution for overcoming the 21st century's key challenges such as climate change, preservation of biodiversity, global food security and resource efficiency. Yet, to be able to solve these challenges, a comprehensive approach for implementing the concept is required.

Therefore, in March 2015, the Bavarian State Ministry for Food, Agriculture and Forestry appointed an independent advisory council to develop a Bavarian bioeconomy strategy: the Bioeconomy Council Bavaria. The council members equally represent industry and science by covering a broad field of expertise (e.g. forestry and agriculture, chemistry, food and nutrition, material use of renewable resources, environmental and social ethics). An office located at the Competence Centre for Renewable Resources (Straubing) represents the council's operative and coordinative unit.

Based on the EU bioeconomy strategy, the development of a Bavarian strategy will help to support the success of transnational or national bioeconomy concepts by tailoring them more specifically to regional circumstances. Hence, the council's task is to develop recommendations for designing and implementing a bioeconomy concept meeting economic, social and ecologic challenges. This requires, among others, consideration of regionally available resources as well as economic structures and potentials. For this purpose the council conducts a status quo analysis of the Bavarian bioeconomy which provides a profound basis for deriving a region-specific competence matrix. The matrix illustrates the material flows of renewable resources as well as research projects, actors and networks that are shaping the Bavarian bioeconomy. By means of a subsequent SWOT-analysis the council derives recommendations for the development of an appropriate governance framework. Throughout these steps a continuous stakeholder dialogue ensures the consideration of civil society's bioeconomy-related ideas and concerns.

First results of the council's analyses show that the Bavarian bioeconomy is based on a bottom-up approach mainly driven by individual economic actors. The broad spectrum of regionally produced renewable resources is primarily processed in the traditional food sector and the energy industry. By contrast, the material use of renewable resources is limited to few industrial applications. Since value chains within and between these sectors tend to be isolated from each other, strengthening the interrelations between them and applying a holistic perspective could contribute to exploiting the bioeconomy's full potential. From the council's point of view this holistic perspective includes the top priority of food supply and cascading use of renewable resources. Expected benefits range from the creation of new revenue streams and impulses for the rural development to the expansion of Bavaria's long-term international competitiveness and the establishment of sustainable economic structures.

Sustainable bioeconomy regions – getting the balance right?

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Background

Large globalised fossil configurations are shifting towards relatively smaller regionalised biomass-based configurations. This transformation towards a biobased economy will induce effects on the environment and communities across and within different regions. Therefore, how can we balance the tradeoffs of decentralized biomass processing for a region while nurturing environmental and socio-economic conditions?

Objective

Work conducted at the Bioenergy Department (UFZ), encompasses several facets of life cycle thinking with regards to biomass production and conversion. The aim of this work is to adapt and expand traditional life cycle approaches to integrate more sustainability considerations in the evaluation of bioeconomy systems, with a particular focus on the regional foreground.

Activity

We develop life cycle approaches for assessing regional sustainability options for a regional biobased economy in two lines of investigation.

Environmental sustainability is assessed using "RELCA" – a REgional Life Cycle inventory Assessment. This is the first approach which combines both the distribution of regional bioenergy technologies and biomass, enabling the exploration of how regional bioenergy configurations influence the direct regional environmental burdens and indirect non-regional burdens associated with the production of a regional bioenergy product. It is therefore, a powerful scoping approach which can provide valuable insight into the environmental performance of regional biomass based configurations.

The second line is the measurement and evaluation of the social performance of regional bioeconomy chains. This is carried out using the newly developed model "RESPONSA" – a REgional SPecific cONtextualised Social life cycle Assessment. By using this tool it is possible to identify potential social benefits and risks for stakeholders (e.g. workers, local communities and national society) associated with the business activities in a biobased chain. It is a powerful tool to analyse specific social effects including the regional context.

Results

The application of RELCA to a regional biodiesel conversion system in Central Germany indicates that the environmental performance is heavily dependent on the distribution and spatial patterns relating to biomass yields and applied nitrogen fertiliser.

The RESPONSA tool has been established to be used in a case study. Therefore, a relevant context-specific set of social indices have been developed to assess wood-based value chains in bioeconomy regions in Germany and performance reference points have been defined on regional and sectoral basis from statistical data for characterisation purposes.

Together both assessment approaches provide valuable insight into the environmental and social performance, as well as potential tradeoffs of such biobased chains in a regional context.

Lessons-learned and Recommendations

Assessing the sustainability of biomass chains in a regional context should be done with a life cycle perspective encompassing both direct regional burdens and indirect non-regional burdens.

In addition life cycle thinking and approaches need to be designed to address more than one sustainability dimension (e.g. social and environmental). The development of such decision tools to assess the sustainability options of a regional biobased economy from a social and environmental perspective therefore enables the identification of potential tradeoffs between the different dimensions.

The BBW ForWerts Graduate Program: Moving bioeconomy research forward

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Background

The BBW ForWerts Graduate Program is part of the "Bioeconomy Research Program Baden-Württemberg", which aims to establish a research strategy along value chains by integrating the different bioeconomy research groups within the German federal state of Baden-Württemberg into an active network. The graduate program receives funding from the Ministry of Science, Research and Arts of Baden-Württemberg (MWK-BW) and started operating in July, 2014. To date, more than 40 graduate students have been admitted into BBW ForWerts and are conducting their thesis research activities at one of nine participating research institutions in Baden-Württemberg. The graduate program has also been able to successfully attract international students, thereby strengthening the international collaboration about bioeconomic issues.

Objective

The BBW ForWerts Graduate Program aims to educate excellent young academics who will take on the task of connecting the natural sciences to current economic demands and solving global problems. The program offers a three-year curriculum during which the graduate students have the opportunity to participate in a structured educational program in order to gain not only in-depth insight into their own research fields, but also obtain an overview of the other bioeconomy research areas. This interdisciplinary approach is supposed to enable the students to gain extensive knowledge about a variety of bioeconomic issues. Networking with fellow students, industrial partners and research institutions is also a crucial part of the BBW ForWerts Graduate Program. Another focus of the program is to support the students in learning to communicate effectively about their research to fellow researchers as well as to the broader public.

Activity

The BBW ForWerts Graduate Program organizes summer schools, workshops, method courses, and excursions for its graduate students. In addition to the scientific content, networking and communication are important goals of these activities.

Results

Since July 2014, BBW ForWerts has admitted 43 graduate students into the program, 13 of which come from outside of Germany. The graduate program has organized one summer school and two workshops; one additional workshop was organized by the Bioeconomy Research Program and three method courses and three excursions have been offered by BBW ForWerts project leaders. In addition to the 35 graduate students who are funded by the MWK-BW, BBW ForWerts has also succeeded in receiving funding from the "China Scholarship Council" for eight additional Chinese graduate students who were admitted to the program in spring 2015 and will begin their research in fall 2015.

Lessons-Learned and Recommendations

The biggest challenge for the graduate program has been the distribution of the graduate students across multiple institutions making the supervision and monitoring of the students difficult. However, due to the high level of support from both project leaders and graduate students, this challenge could be overcome.

Next to the professional education the young researchers are receiving, the provided networking opportunities offered by the graduate program are widely appreciated by the graduate students. In general, efficient communication and the strong support of its participants is key for a graduate program with graduate students distributed across multiple locations.

Bioeconomy Science Center – a regional research cluster for an integrated bioeconomy in NRW, Europe and beyond

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Background

The integration of knowledge about biological systems for the sustainable production of renewables and their use for food, feed, materials and energy is an essential and emerging field of research for an integrated and circular bioeconomy. Based excellent competencies in bioeconomy related research fields, the RWTH Aachen University, the Universities of Bonn and Duesseldorf and the Forschungszentrum Juelich, a national research institution of the Helmholtz Association, have established in 2010 a competence center for bioeconomy research, the Bioeconomy Science Center (BioSC). At time more than 60 institutes with more than 1400 co-worker are working together along an integrated concept and a common long term strategy.

Objective

The aim of the BioSC is to synergistically align and develop scientific and technological expertise and infrastructures in the fields of biotechnology, bio- and chemo sciences, plant and agro sciences, engineering science, and socio-economics. The expertise ranges from the sustainable production of plant biomass for food/feed and as renewable feedstock, the molecular and microbial transformation of renewables (e.g. to fine chemicals, biomaterials, pharmaceuticals, enzymes, proteins, biofuels) in innovative processes (e.g. biorefinery concepts, cascade use) under consideration of the economic impact and social implication for and of the bioeconomy. In addition state to the art infrastructures and enabling technologies from lab to pilot and field scale are jointly developed and used. Education and training within the different disciplines and research areas of the BioSC and their interdisciplinary interaction within the systemic approach of an integrated bioeconomy are additional core elements of the BioSC.

Activity and results

The development of innovative concepts and research topics in the four research areas and their interaction is supported by several structural and research measures. The BioSC researchers cooperate in more than 35 research projects of different scales focusing on topics of an integrated bioeconomy which are supported by the NRW-Strategy Project BioSC, a long-term funding project by the federal state of North-Rhine Westphalia. The BioSC is also designed as a regional hub for national and international cooperation with e.g. European Technology Platforms and network projects with industry to strengthen the transfer of knowledge to the market and the dialogue with society. The BioSC is actively involved in discussions with different bioeconomy stakeholders from academia, industry, society and politics on national, European and international level. We will discuss a portfolio of instruments, practicable examples and experiences about how to develop integrated bioeconomy approaches.

Lessons-learned and Recommendations

The implementation of this large and transdisciplinary research cluster between three universities and one national lab and bringing the broad range of scientific disciplines and researchers together was a large effort. Within the last five years after the establishment of the BioSC lessons have been learned in terms of instruments, measures and time scales needed for the scientific and structural implementation of the cluster within the framework of national and regional bioeconomy research strategies in Germany and NRW, respectively. The presentation will share the experiences and lessons-learned and will point out some recommendations which could maybe be useful discussion points for the establishment of future bioeconomy research clusters.

The Baden-Württemberg Research Strategy – shaping the future with bioeconomy

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Background

The development of new bioeconomic strategies which use biomass instead of fossil resources and at the same time ensure global food security is an important issue globally and for Baden-Württemberg. The country is characterized by an excellent research environment in life sciences, agriculture, forestry and technology and therefore can play an important role in future developments.

Objective

In 2013 the government decided to strengthen local bioeconomy research and the interactions between the various players in Baden-Württemberg. The general objective was also to enhance the national and international visibility of Baden-Württembergs' bioeconomy research and to strengthen participation in national and international networks.

Activity

A strategy circle of experienced scientists from all relevant disciplines developed the concept for the bioeconomy strategy in Baden-Württemberg. The program was then launched in summer 2013 with a call for proposals in dedicated research areas. 50 projects were selected for funding based on a peer review process and started in 2014.

Results

The strategy circle concluded that an interdisciplinary systemic approach is necessary to analyze entire value chains and furthermore develop sustainable products and processes. Therefore it was necessary to establish new networks between disciplines and institutions.

Three focus areas with different timely horizons were selected based on their excellence and future potential:

- Biogas – Sustainable and flexible value chains in Baden-Württemberg (short term)
- Lignocellulose – Alternative resource platform for new materials and products (intermediate term)
- Microalgae – Integrated use for food and feed (long term)

As a general principle these research areas integrate biomass production and conversion, product development as well as economic, ecologic, ethic and societal aspects.

As overarching research activities it was decided to establish:

- The Competence Network Modeling the Bioeconomy
- Accompanying research activities in social sciences and ecology

An integrated graduate program (BBW ForWerts) ensures interdisciplinary training of future bioeconomy experts and supports regional interactions and networking among young scientists.

The bioeconomy research program Baden-Württemberg is coordinated by a steering committee that consists of the chairs and scientists of the different research areas, the competence network and BBW ForWerts and representatives from the ministry and the local service agency for the biosciences, BIOPRO Baden-Württemberg GmbH. A central coordination office was established to support with project management as well as internal and external communication.

Lessons-learned and recommendations

- Interdisciplinary collaboration and coordination needs time and effort but raises the most innovative questions.
- The concentration on certain value chains as focus areas supports interdisciplinary interactions between scientists since their projects are focused on a common goal.
- The bottom up approach ensured high quality of research.

Global land use: Assessing GHG impacts of alternative EU bioenergy policy scenarios

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Background

The world is facing an unprecedented demand for biomass. All existing studies on pro-jections of the future demand of biomass as energy carrier or material for EU countries but also the rest of the world show increasing trends, often with rapidly increasing rates. The increased use of bio-mass will impact the environment in the EU but also abroad because more and more biomass is imported. Single process chains and options have been analyzed in the recent literature regarding their environmental performance and scenario analysis of certain indicators, such as net GHG emissions, exist. But integrated studies looking at all relevant environmental indicators at once are missing. Global trade of biomass goods, indirect effects caused by a high degree of substitutability of feedstocks, branched process chains and the competition for land make an estimation of net impacts a challenge.

Objective and Activity

We use a partial equilibrium land use model and a forest sector simulation model to assess the environmental impacts of alternative scenarios of EU bioenergy policies. A set of more than 50 indicators is analyzed including general land use, GHG emission, biodiversity, soil and water related variables. The scenarios describe – besides a baseline scenario of current policies – various alternative developments until 2050 (i.e. bioenergy demand in EU stagnates, bioenergy demand in EU is largely met by imports and bioenergy demand in the rest of the world increases more strongly). The development over time of all indicators in the baseline is followed and then deviations of the alternative bioenergy demand scenarios are evaluated.

Results

Preliminary results show that differences between scenarios in 2050 can be as large as differences observed over time in the baseline until 2050. This indicates that the policy scenarios – all based on realistic assumptions – have a significant influence on the environment. Different assumptions of biomass produced in EU affect the intensity of land management, especially forest management. Also in the rest of the word increasing biomass imports to EU might lead to more forest taken into production. This has implications for net GHG emissions and biodiversity in those forests. Water impacts are limited due to the fact that more and more biomass will come from forests instead of cropland. At global level impacts might be limited but there can be strong implications at regional and national level.

Lessons-learned and Recommendations

Only an integrated view (i.e. considering different sectors, ecosystem services and technologies) enables to explore sustainable pathways of biomass use that is needed to establish the bio-economy in a sustainable manner. Computer models cannot take the burden from decision makers to set priorities and design policies. However, they can assist to find and sketch robust pathways and to point to important feedbacks that need to be considered.

Food security impacts of rural households' employment at a large-scale biofuel project in Madagascar

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Background

After the initial hype in 2007/08 and the subsequent downfall of Jatropha production, it is currently still promoted and new Jatropha projects are started. Besides economic, agronomic and environmental questions, doubts exist on the social dimension of sustainability like household food security, welfare and labor conditions. There is little evidence quantifying the socio-economic impacts of large-scale production of Jatropha on smallholders mainly due to a lack of baseline studies and thorough data collection.

Objective

The objective of this study is to provide insights into relationships between employment on the plantation and household food security and innovation performance in agriculture.

Activity

This paper seeks to make a contribution to addressing this knowledge gap by making use of panel data collected between 2008 and 2014 for 390 randomly selected households in three villages in the vicinity of a large-scale Jatropha plantation in Madagascar. Additionally, information from focus group discussions and personal interviews with relevant stakeholders is used. As indicators of food security, we use diet diversity for a recall period of seven days, as well as more mid- and long-term indicators like the length of the food gap in the previous year. Impacts on food security are estimated with the help of a fixed effects model. Besides these direct impacts more indirect effects on access to inputs and markets and innovation performance of households will be analyzed by applying matching procedures and regression models.

Results

Former studies showed that wage employment by smallholder farmers on the Jatropha plantation has significantly contributed to income poverty reduction and reduced income inequality. Focus group discussions revealed that wage income derived from daily labor on the plantation, in particular during the off-season and droughts, helps to increase households' resilience against climate variability. Nevertheless, as the labor demand by the plantation declined substantially after the build-up phase in 2010, very few regular jobs have been created. Plantation incomes are mostly used for food and other necessities and only a small percentage is invested in agriculture or business. Results from the fixed effects models show that the number of days as well as the number of household members working on the plantation contribute significantly to an improved food security. Expected results regarding innovation performance are that households working for the plantation did not report more innovations than comparable households not offering labor to the plantation.

Lessons-learned and Recommendations

Results show that in a region where land is abundant, agricultural production is limited and unemployment exists, large-scale biofuel production can reduce poverty and improve food security of households. To increase these impacts and allow spillovers on agriculture, we recommend putting in place an outgrower system. As wages were still pre-financed by the German investor, we recommend marketing Jatropha oil locally and exploiting additional income possibilities like intercropping Jatropha or Jatropha by-products.

Key influence factors of the transition towards a wood-based bioeconomy in Germany

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Background

Increasing the sustainability of economic processes and products and the use of sustainable resource inputs require a transition from the hitherto predominant fossil-based "throughput economy" towards a circular flow economy based on renewable resources, the so-called bioeconomy. However, these complex economic and societal transition processes face significant uncertainties such as climate change, technological and economic development, sustainability risks, dynamic consumption patterns and policies and governance structures.

Objective

Based on a three-step analysis of the legal and socio-economic challenges of a wood-based bioeconomy in Germany, we present recommendations for the design of future policies.

Activity

In a scenario analysis key influencing factors are identified and their systemic roles for the future development of the wood-based bioeconomy in Germany are specified. In a second step, the legal framework is analysed as a basis for discussing governance structures (third step), particularly "bioeconomy policies" that are needed to initiate a transition pathway.

Results

The key influencing factors differ in terms of their systemic role, e.g. if they are actively driving other influencing factors, such as globalisation or if they are driven such as innovations along the value chain. Based on these, four scenarios were set-up to describe possible futures of the wood-based bioeconomy in Germany in 2050, allowing to adjust business strategies and policy instruments. The legal framework has to progressively support the advantages of the bioeconomy and simultaneously it has to avoid sustainability risks. At present, some regulations, such as the German Waste Management Act, affect all parts of the bioeconomy value chain, but so far it does not offer relevant incentives for the bioeconomy to grow. The wood production is affected by German forestry law, the chemical regulation REACH impacts on processes, and products have to comply with certain standards to be eligible for certification and labelling. The competition between renewable resources and fossil fuels is distorted because of the limited internalisation of environmental costs. This is not addressed effectively by existing policies such as climate policies. This analysis shows the range of existing policies for the bioeconomy and concludes that the overall effect is insufficient to initiate a path transition.

However, politicians are presently not inclined to initiate real path changes due to high political costs. Rather they provide symbolic policy answers or limit themselves to support policies for research and development. A significant "demand" for a strong bioeconomy-oriented policy by consumers, producers or the electorate is also missing due to competing interests. Thus, a successful transition requires a twofold equilibrium: the economic sustainability equilibrium and a corresponding political equilibrium providing the corresponding transition policies.

Recommendations

To overcome potential lock-in effects a critical threshold towards the bioeconomy needs to be crossed; afterwards, the transition process might be self-sustaining. Based on the positive analysis of both current bioeconomy policies and policy demand by bioeconomy actors in Germany, we elaborate recommendations how to develop appropriate transition policies. For instance, it is advisable to combine a gradual development of existing policies with efforts to identify and support innovative niche products and processes.

Integrating environmental concerns in the bioeconomy discourse: A cross-country comparison

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Background

Sustainable development (SD) is highlighted in different national strategies as the overarching goal of the shift towards bioeconomy. It promises to address major societal and economic challenges and at the same time to create a more favourable environment. The bioeconomy in itself however cannot be considered as self-evidently sustainable as visions about the relationship between bioeconomy and sustainability differ substantially. The integration of environmental policy into other policies is recognized an operational principle to implement SD. How SD is approached and ensured in bioeconomy strategies remains therefore an empirical question.

Objectives

Studying the integration of environmental concerns into bioeconomy strategies and related policies is of outmost importance in order to understand whether and how SD plays a role. This research aims to identify whether and how the promoted goal of SD has been integrated in the political bioeconomy discourse by answering the following research questions: 1. Does the political discourse on bioeconomy integrate environmental concerns and if so how? 2. Does the forest sector discourse on bioeconomy integrate environmental concerns and if so in which way? 3. Are there differences in integrating environmental concerns between different countries and between different political levels?

Description of Activity

Theoretically, we build on the approach of environmental policy integration (EPI). The integration of environmental concerns in sector policies is at the heart of EPI. Empirically, the research is based on a comparative country study applying qualitative document analysis. The documents cover national and EU political strategies concerned with bioeconomy as well as political programmes of the forest sector dealing with bioeconomy. Additional to EU policies, following countries are covered in this study: Germany, Sweden, Finland, the Netherlands, and France.

Provisory Results

- There is an ambiguous relationship between SD and EPI prevailing in most countries' discourse on bioeconomy.
- Although national strategies are similar with the EU strategy, there are clear differences and priorities between the different national goals, strategies and perceived problems for realising the bioeconomy.
- The linkages between forests and bioeconomy are differently highlighted in the national strategies and policy documents. While some countries give the forest sector a central role, crucial for the development of national bioeconomy, other countries focus less on this sector. However, forests are primarily seen as a source of raw material.
- Promoted values generally favour economic aspects while environmental concerns are secondary, and seen as directly dependent on economic growth.

Lessons learned (Provisory)

- Indeed, the European understanding of SD is generally associated with ecological modernisation, characterised as a combination between economic growth and ecological concerns. However, quite often there is a blurry line between the promoted values. Economic growth prevails over environmental concerns.
- The complexity of the forest and related issues such as multifunctionality, different ecosystem goods and services, and social aspects require more attention.
- Given the fragmentation of the different policy domains (forestry, agriculture, climate and energy), multi-level policy coordination and integration becomes important.
- In a multidisciplinary, cross-sectorial bioeconomy, intersectoral policy coordination will be core for achieving sustainability goals.

Competence network “Modeling the Bioeconomy” Baden-Württemberg

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Background

The transformation to a bioeconomy requires an integrated analysis because of (i) competing uses of different biomass materials, the supply of which is limited by the scarce production factor land, and (ii) the diverse interrelationships of the involved sectors within the economy and the natural environment. Such an analysis must also confront the challenge of rapid economic and technological development in the supply and use of biomass. Simulation modeling is a widely used methodological approach for an integrated ex-ante analysis of market and technological developments and their impacts.

Objective

The set-up of the competence network “Modeling the Bioeconomy” aims to focus expertise in modeling, which enables the analysis of the transformation of the economy from one based on fossil fuels to a bio-based economy. This allows for the evaluation of transformation pathways regarding their economic and environmental impacts.

Activity

Researchers from four institutions in Baden-Württemberg, leading in the field of model-based economic and ecological analysis, established the competence network “Modeling the Bioeconomy” within the bioeconomy research program Baden-Württemberg. This program is funded by the Ministry of Science, Research and Arts of Baden-Württemberg.

Results

The competence network “Modeling the Bioeconomy” started its research activities in 2014. It analyses the production and use of biomass from agriculture at different scales, from the farm level via the agricultural and energy sector level to the national economy level. To this end, the bioeconomic farm model EFEM, the agricultural partial equilibrium model ESIM, the energy system model TIMES PanEU and the general equilibrium model PACE are combined. The techno-economic site model BIOLOCATE identifies optimal biomass conversion technologies and sites for conversion plants. Effects on the environment are estimated in a life cycle analysis at the product level, after which the results are scaled up with the material flow model CarboMoG at the regional and national levels. This evaluation framework identifies costs and externalities of transformation pathways to the bioeconomy.

Being integrated in the bioeconomy research program Baden-Württemberg, the competence network “Modeling the Bioeconomy” cooperates with the research areas of biogas, lignocellulose, microalgae and accompanying research activities in social sciences and ecology.

A coordination office was established to coordinate the projects within the competence network “Modeling the Bioeconomy” and to enhance cooperation with the other research activities within the bioeconomy research program Baden-Württemberg.

Large-scale bioenergy production: Can adjustment policies neutralize negative side effects?

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Background

Bioenergy use in the energy sector, particularly in combination with carbon capture and storage (BECCS), is projected to play a key role in the coming decades for climate change mitigation[1]. However, the production of bioenergy for use with CCS in the energy sector might come along with various negative side effects in the land-use sector. For instance, conversion of forests to arable land for bioenergy production might cause CO_2 emissions that would not occur in the absence of bioenergy (additional emissions). To avoid such negative side effects, bioenergy deployment could be accompanied by an adjustment policy that aims at forest protection. If this adjustment policy is effective, land productivity would need to increase at higher pace to keep food and bioenergy production constant, which could result in increasing food prices[2,3]. Thus, bioenergy production combined with a forest protection policy might have positive environmental (biodiversity, carbon stocks) but negative socio-economic effects (food security).

Objective

In this study, we investigate the effectiveness of several adjustment policies related to large-scale bioenergy production for the following sustainability indicators: land-use change and associated CO_2 emissions, nitrogen fertilizer use, agricultural water withdrawals, and development of food prices. Moreover, we identify potential trade-offs between the different sustainability dimensions. Finally, we explore an integrated policy, which consists of the most effective adjustment policies.

Activity

We use the recursive dynamic land-use optimization model MAgPIE (Model of Agricultural Production and its Impacts on the Environment)[4,5] for simulating the global effects of large-scale bioenergy production throughout the 21st century under different adjustment policies. MAgPIE integrates various spatially explicit biophysical constraints such as land, yields and available water into an economic decision-making process. The objective function of the model is the fulfillment of given food, feed and bioenergy demand at minimum global costs. Global demand for dedicated bioenergy increases linearly from 0 EJ in 2010 to 300 EJ in 2100, which reflects the upper end of bioenergy potential estimates[6].

Results

Without specific adjustment policy, the production of 300 EJ bioenergy in 2100 causes substantial additional CO_2 emissions from land-use change (LUC). An adjustment policy that prices CO_2 emissions from LUC neutralizes this adverse side effect of bioenergy production – at the cost of rising food prices. The production of bioenergy also increases fertilizer use. The use of grassy instead of woody bioenergy feedstock and more efficient fertilization substantially reduce nitrogen fertilizer use. Furthermore, large-scale bioenergy production increases agricultural water withdrawals. An adjustment policy that restricts irrigation of bioenergy crops neutralizes this impact – at the cost of increased LUC and associated CO_2 emissions. After 2050, bioenergy production also has negative effects on global food prices. Reducing trade barriers for agricultural goods helps to mitigate these effects. Under the integrated adjustment policy, bioenergy production has no adverse side effects on the sustainability indicators considered here.

Lessons-learned

Our results indicate that large-scale bioenergy production might come along with adverse side effects for environment and food security. An integrated adjustment policy that addresses multiple sustainability dimensions could help to alleviate or even neutralize adverse side effects of bioenergy production.

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A measure of the Forest Protected Areas benefits for the surrounding population: A case study of the Bouaflé protected forest (Côte d'Ivoire)

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Côte d'Ivoire, in West Africa, has a high level of biodiversity with around 1,200 animal species and 4,700 plant species. This diversity occurs mainly on forest land. The country has suffered severe deforestation and has lost 90% of its primary forest since 1960. In order to address the deforestation, many actions are taken, one of which is the implementation of protected areas within countries. These measures put restrictions on the access of local communities to forest services. However, local communities, especially poor people supplement their daily livelihood from forests, especially from timber and Non-Timber Forest Products (NTFP). Most of the protected forests in the country suffer from population infiltration. Local people farm inside forests for feeding. What are the direct benefits of the Bouaflé protected forest for surrounding population?

This study focuses on the Bouaflé protected forest (forêt classée de Bouaflé, 20 350 ha) in the western part of Côte d'Ivoire. Made a protected forest since 1974, it is one of the most deforested. We proceed by a questionnaire. Firstly, we described the perception of forest benefits by the population. Secondly, we estimated the benefits of forest conservation using a contingent valuation approach, particularly the Willingness to Pay (WTP) methodology. Thirdly, we recommend innovative measures for protected forests governance.

From our sample size of 156 households, it appears that most of the individuals are aware of the importance of the forest (94% against 6%). They agree that forest provides food (95%), medicines (97%). Most of the individuals who recognise the importance of the forest also think that the forest is a place for farming and hunting, 95% and 62% respectively. Most recognise the role of forests related to climate issues and agree that the forest provide rainfall (94%) and reduces heat (83%). 78% also believe that the forest provide fertile soil. According to the estimate of the benefits, it results on average people are willing to pay 1658.491F CFA (2.53 Euros). The median WTP is 1000 FCFA (1.52 Euros).

The current study is helpful to induce innovation in protected forest governance in Cote d'Ivoire. Since, banning, main focus of conservation measures has shown some limitation, we should encourage local people appropriation of forest conservation strategies. In fact, local people commitment could be effective through a win-win partnership with the development of projects related to ecotourism.

Since local people are aware of forest conservation benefits to them but continue to infiltrate that forests to supplement their daily needs, it is important to couple conservation measures with development of local economic activities, especially ecological tourism. Moreover, surrounding population could be trained to develop and take advantage of some NTFP-related activities (vegetable oil process, artisanal manufacture).

The Protected forests have a great potential for the country commitment in bioeconomy implementation. This study focuses on innovations in protected forests governance so that they could guarantee inputs for a forest-based bioeconomy implementation in Cote d'Ivoire.

Making bioeconomy measurable

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Background

Due to the intensified material and energetic use of renewable resources in the last years, social controversies and acceptance issues have emerged around biomass production for Bioeconomy purposes. Since biomass is a limited raw material with significant different potentials in the diverse regions of the world, the future biomass utilization pathways, have to be carefully assessed in order to establish sustainable regional and global Bioeconomies. Monitoring instruments making Bioeconomy measurable are needed. This will ensure that the implementation and development of this emerging economical field actually will achieve the ambitious strategical targets several governments have set (European Commission 2005; The White House 2012; OECD 2009; Bundesministerium für Bildung und Forschung (BMBF) 2010; The White House 2012; Department of Science and Technology, South Africa 2013).

Objective

The aim of our work is to identify economically, ecologically and ethical-socially oriented key indicators for biomass utilization pathways and to apply them in the frame of an integrated assessment. The key indicators will be determined along the whole product life cycle especially considering competing and cascading utilization of biomass. In a final step they will be integrated specially under the approach of sufficiency into a Bioeconomy-Index for biomass utilization pathways.

Activity

Since so far there is no widely consensus of the definition of Bioeconomy (McCormick, Kautto 2013; Golembiewski et al. 2015), we started by settling the concept for our project[1]. We understand Bioeconomy as the economic activity based on the production, conditioning, trade and use of biogenic resources. From a normative perspective, these activities should be conducted in a way that increases the ecological and social resilience of the systems they take place in. In order to monitor the performance of biomass utilization pathways, we select the economically, ecologically and ethical-socially oriented key indicators under the light of the sustainability strategies efficiency, consistency and sufficiency.

Results

A preliminary list of key indicators for measuring bioeconomy by assessing biomass utilization pathways was established.

Outlook

The preliminary key indicators will be tested on pilot value chains based on winter wheat. This crop, i.e. its grains, silage and straw, offers a variety of utilization pathways e.g. bread wheat, fodder, bioethanol and insulant, among others. The key indicators will be evaluated on the suitability for utilization pathways from other raw materials and adapted or complemented as necessary. According to their impact, the indicators will be allocated in a Bioeconomy-Matrix. Results will be integrated with a multiple-criteria decision analysis into a Bioeconomy-Index for biomass utilization pathways.

Impact assessment of policies fostering biogas in Germany toward 2050: biomass potential, land use change and greenhouse gas emissions

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Background

As part of the national bioeconomy strategy and in pursuit of sustainable and diversified energy supply, the German government is encouraging the generation of biogas and biomethane with the Renewable Energy Source Act (EEG, in German) of 2014, and the Gas Network Access Ordinance (GasNZV, in German). With the EEG 2014 production costs are compensated and the technology remains economically competitive versus non-renewables. Higher incentives are given to low sized plants (<75 kW_{el}) and substrate classes are abolished. On the other side, the GasNZV sets a target of 6 billion normal cubic meters (Nm^3)/year biomethane by 2020, equivalent to 60 terawatt-hours (TWh) and 10 billion Nm^3/year biomethane (100 TWh) to be fed into the natural gas grid by 2030, substituting 10% of natural gas demand.

Since these policies aim at expanding net biogas and biomethane generation, demand on biomass for this purpose is expected to upturn. Bioenergy crops currently represent more than 70% of the total feedstock used for biogas generation, due to their high energy content, nevertheless, under the EEG 2014 rather more incentives are given to alternative, lower energetic feedstock, such as manure and waste. This circumstance makes it relevant to analyze inherent impacts these policies could have, especially on the environment in a context of specific climate and energy political targets, and appraise technical feasibility, while identifying options to avoid adverse environmental impacts upfront.

Objective

The purpose of this study is to estimate the potential impacts of the EEG 2014 and the GasNZV 2010/12 on land use and induced GHG until 2030, biomass market and energy sector's inflicted adjustments, and identify pathways to minimize negative environmental effects.

Methodology

These objectives are pursued by the further development of the European Simulation Model (ESIM), a global partial equilibrium model of the agricultural sector, with a special emphasis on Member States of the European Union (EU). Attainable feedstock for biogas will be depicted with ESIM, in order to examine interactions between biogas generation and provided biomass supply and demand. Emission coefficients to simulate GHG outflows from land use changes due to biomass demand (in Germany, and plausibly from the EU and the rest of the world) will be introduced into the model, thus, enabling climate and energy policy evaluations in bioeconomy scenarios.

Expected results

In order to feature the specific impact of the EEG 2014 and the GasNZV 2010/12, several scenarios will be elaborated based on the various "feed-in tariffs", biogas plant sizes, geographical distribution, and feedstock mixture. Finally, request for biogas will be portrayed until 2030, having 2012 as base year.

As a result of the analysis, a comparison between politically demanded biogas generation and sustainably feasible biogas upsurge will be outlined.

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Insight into the EU bioeconomy and biomass use

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The European Commission has set a long-term goal to develop a competitive, resource efficient and low carbon economy by 2050. As part of a green economy, the bioeconomy plays a key role, being able to replace fossil fuels on a large scale, not only for energy applications, but also for chemicals and materials. This paper presents an analysis of the current status of bioeconomy and biomass use in different sectors in the EU until 2020 and beyond.

The EU has a number of well-established traditional bio-based industries (agriculture, food, feed, fibre, pulp and paper and wood products, biofuels and bioenergy) and new ones are emerging (biochemicals, biomaterials, biopharmaceuticals). From the 2000 Mt biomass used in the EU in 2012, including agriculture, forestry, animal products and aquatic biomass, 21% was used for food, 44% for feed, 19% for processing and 12% for energy production. Bio-based materials and biochemicals do not account yet for a high share of biomass use. For example, the chemical industry used about 8.6 Mt of renewable raw materials in 2011 in comparison with 90 Mt tonnes of feedstock used for various chemicals. We estimate that about 240 Mt biomass was used for heating and electricity production, and about 40 Mt for biofuels.

The switch toward bioeconomy will entail high demand for biomass not only for bioenergy, but also for bio-materials such as plastics that are presently derived from fossil sources. Therefore, the paper will look into the different present and future components of the bioeconomy in terms of biomass demand in relation with existing resources. New bio-materials (bio-plastics, enzymes, biopharmaceuticals, etc.), which are now produced at reduced amounts, could have a significant share in the materials demand in the future. Bioenergy is the most important renewable energy source nowadays with more than 60% and will continue to play a major role in energy supply, as part of the EU energy and climate policies. Biomass demand for energy purposes could increase to about 420 (378–439) Mt in 2030 and 432 (562–702) Mt in 2050, in the reference scenarios.

The conversion of a fossil fuel-based economy into a bio-based economy will probably be constrained by the overall limited availability of sustainable biomass in the EU. An increase in the bio-based economy is expected to be a worldwide development; therefore, only a part of the global biomass potential would be available for the EU. In comparison with current potential of 438–728 Mt biomass in the EU, the biomass potential was estimated at 530–890 Mt for 2020 and 514–990 Mt in 2030. The increasing biomass demand is possible to be covered in the EU, but biomass mobilisation and competition between different uses (food, feed, fibre, bio-based materials and bioenergy) are key issues, depending on the costs.

The bioeconomy brings the opportunity to develop new biobased industries, open new markets for bio-based products and using resources more efficient and environmentally friendly. Shifting towards a bio-economy creates new business and innovation opportunities, in areas such as agriculture, forestry and industry.

Synergies and tradeoffs of biofuel production: An integrated assessment of economic and environmental policy impacts in Malawi

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Development policies often have conflicting effects on economic growth, food security, and natural resources. While the expansion of biofuels is promoted to boost economic development and enhance energy security, tradeoffs with regard to food security through land displacement, to water resources via irrigation and emissions from land clearing could outweigh the benefits. These conflicting impacts make it imperative to analyze interventions in the bioeconomy from both an economic and environmental perspective to ensure socially and ecologically sustainable policy making.

This paper is the first to simultaneously assess the effects of biofuel production on economic development, food, energy, and water security as well as on emissions through the implementation of a comprehensive modeling framework. Sugarcane and ethanol sectors are integrated into a recursive-dynamic computable general equilibrium (CGE) model of Malawi. Different sugarcane-ethanol production technologies concerning farm size and irrigation intensity are simulated to measure changes in energy and food security. To evaluate effects on water and the water embodied within biofuels, the CGE model is linked to a crop model that calculates water requirements of crops based on historic climate data. Changes in emissions are assessed for different land clearing and crop displacement scenarios by linking the CGE model to greenhouse gas inventory models.

Our results indicate that biofuel production is a viable development policy for Malawi, as it can generate economic growth, rural development and poverty reduction. Contrary to many other studies at the global level, we find that energy security must not come at the cost of food security. Since Malawi has a well-established export sector, sugarcane production rather displaces traditional export crops but not food crops. Yet, in a land constrained country like Malawi, food security can only be attained under irrigated production. This however puts pressure on water resources, as irrigation water is exclusively taken from surface water in Malawi. Rainfed sugarcane production would be preferable from a natural resource perspective as water needs and GHG emissions are considerably lower than for irrigated production, but requires too much agricultural land to ensure food security. If new land is cleared for sugarcane production, Malawi is unlikely to fulfil the EU restrictions on GHG emissions and so would lose an important export market. While plantation production exhibits the largest economic growth potential and the lowest land requirements, benefits for rural development and poverty are only attained under smallholder sugarcane production.

These complex effects emphasize that sector-specific policy analysis is inadequate to assess interventions that are likely to evoke competition over scarce resources. Sustainable development is dependent on policy makers' awareness and understanding of the different tradeoffs that can be caused by their actions. Our findings thus stress that only a holistic assessment of economic and environmental impacts is able to identify both synergies and tradeoffs of development policies and foster sustainable policy making in the bioeconomy.

An evaluation of the macro-economic impacts of biobased technologies in the EU

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Background

A potentially limiting factor for achieving the objectives of the EU Renewable Energy Directive (RED) and the EU Bioeconomy Strategy is the availability of sustainably produced biomass at attractive prices. This raises the question which biomass applications generated the largest macro-economic benefits. It can be expected that the macro-economic impacts of using the same quantity of biomass for various biobased applications results in different impacts, due to changes in the use of production factors (labour and capital) and intermediate inputs for bio-based production and from changes in prices, production, consumption and trade.

Objective

The objective of this study is to gain insight into the factors and mechanisms that determine the macro-economic effects of different biobased technologies in the EU.

Activity

Three bio-based applications are considered in the global recursive computable general equilibrium (CGE) model MAGNET (Modular Applied GeNeral Equilibrium Tool): bioelectricity, biofuel (second generation) and biochemical. This is done assuming the use of 1 EJ biomass for all three applications. To evaluate the importance of the indirect economic effects two methods are compared to calculate the net GDP effect. First, the expected change in production value is calculated based on the conversion efficiency and costs of bio-based and conventional technologies, these results are reached without the use of a CGE model. The second method calculates the net GDP effect using MAGNET.

Results

The MAGNET results show that the GDP effect of biofuels is 5.1 billion US$, which is 1.7 times the GDP effect calculated based on the difference in production costs. This multiplier factor 1.7 shows the impact of indirect economic effects on the GDP effect compared to the direct effects. A substantial part of these indirect effects comes from higher wages, which are the result of the labour intensive collection, pre-treatment and transport of biomass. The increase in wages is transmitted to other sectors in the economy, hence production and consumption increases. Another important effect comes from the lower oil price due to the substitution of oil based fuel production by biobased fuel production. The lower oil price is beneficial for the EU economy and improves the terms of trade effect, as the EU is a net oil importer.

The same mechanisms apply to the calculation of macro-economic impacts of the production of biobased chemicals and electricity. The production of chemicals results in the highest net GDP effect compared to the other biobased applications, namely 6 billion US$. The GDP calculated from the change in value of production costs is however 10.6 billion US$. The lower multiplier (0.6) is mainly the result of reduced competitiveness of the services sector and the other industries sector. These sectors are relatively labour intensive and compete for labour with the domestic chemical industry.

Lessons-learned and Recommendations

The macro-economic effects of competitive biobased technologies are larger than the direct reduction in production costs, but the effects differ per technology. Especially the labour intensive collection, pre-treatment and transport of biomass has a large economy wide effect.

Evaluating the land use change and food security effects of the use of residues and waste for bioenergy production

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Background

The use of residues and waste is frequently suggested as a way to avoid undesirable land use change and food security effects arising from the use of crops for energy production. Also the EC Renewable Energy Directive (RED) stimulates the use of wastes, residues and (ligno)cellulose material for bioenergy. However, the use of the sustainable potential of residues and waste for bioenergy generates increases the profitability of the sector(s) that produces the biomass. The increase in profitability (i.e. profits, defined as the rent) depends on the price and costs of collecting the biomass. This extra rent is an incentive for these sector(s) to expand production, which has an effect on both land use and food security.

Objective

The objective is to evaluate the land use and food security effects of the use of the sustainable potential wheat straw in the EU for bioenergy production in 2030.

Activity

A conceptual framework for analysing the land use and food security effects of residues is designed and implemented in the Modular Applied GeNeral Equilibrium Tool (MAGNET), which is a global computable general equilibrium (CGE) model. A baseline scenario for 2030 is assumed in which the use of wheat straw is limited to conventional applications, such as animal bedding and mushroom production. The sustainable potential of wheat straw in the EU in 2030 is estimated at 0.57 EJ (based on results from the EC Biomass Futures project). Two scenarios are evaluated that assume that the total sustainable potential is used for bioenergy generation. The scenarios differ with respect to the price of wheat straw and thereby the rent obtained by the collection of wheat straw.

Results

Results show that the use of wheat straw in the EU decreases the price of wheat in the EU and increases the production and consumption of wheat in this region. The use of land for wheat production in the EU also increases, which is partially compensated by a lower use of pasture land and a reduction in land used to produce other grains. Agricultural land use in the rest of the world decreases due to increased exports of wheat and other agricultural commodities from the EU and a reduction in imports to the EU. The shift of agricultural production from the rest of the world to the EU and the high(er) yields per hectare in the EU, result in higher world average yields and lower agricultural land use globally. Furthermore, the consumption of wheat and other food increases in the rest of the world, which means that the use of wheat straw for bioenergy contributes to an improvement of food security.

Lessons-learned and Recommendations

Consideration of the land use change and food security effects is crucial for a truly sustainable use of residues and waste for bioenergy and therefore also for the effectiveness and efficiency of bioenergy policies. More complex and detailed analyses are needed to evaluate the impact on soil quality, crop production technology and especially the crop harvest index.

The impact of the rebound effect of first generation biofuels use in the EU 27 on greenhouse gas emissions

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Background

An important objective of the mandated blending of biofuel in conventional gasoline and diesel in the EU is reducing greenhouse gas (GHG) emissions. An important assumption thereby is that biofuels replace the production and consumption of oil. However, recent literature challenges this assumption, because an increased use of biofuels will lower oil prices and therefore results in increase crude oil consumption. The net effect is that the consumption of oil and conventional gasoline and diesel do not decrease as much as the increase in biofuel use.

Objective

The objective of this study is to evaluate the impact of the rebound effect of biofuels use in the EU on greenhouse gas (GHG) emissions.

Activity

Eight studies are reviewed (Hochman, Rajagopal et al. 2010; Stoft 2010; Drabik and De Gorter 2011; Laborde 2011; Rajagopal, Hochman et al. 2011; Thompson, Whistance et al. 2011; Chen, Huang et al. 2012; Taheipour and Tyner 2012) and also the MAGNET global economic model is used to estimate the rebound effects of biofuel use in the EU.

Results

Generally, estimated rebound effects are negative in the country where biofuel use is being promoted (i.e. the use of 1 unit of biofuel reduces oil consumption by less than 1 unit; units on energy basis). The rebound effects in other countries are always positive (biofuel use reduces oil consumption by less than 1 unit so the total fuel consumption is increasing). The net global rebound effect is usually positive, which means that GHG emissions savings are not achieved as much as usually is assumed, or emissions may even increase. Own estimations with the global MAGNET computable general equilibrium model indicate a global rebound effect of the 10% biofuel blend mandate in the EU in the year 2020 of 22% to 30% (i.e. the use of 1 unit of biofuel reduces global oil consumption by 0.78 to 0.70 units). This means that GHG emissions will not be reduced as much as usually is assumed, or may even increase. These results show that rebound effects can significantly lower the effectiveness of biofuel policies in reducing GHG emissions.

Lessons-learned and Recommendations

We conclude that the review and analyses presented in this paper clearly show that the rebound effects of biofuel use can greatly decrease the GHG saving potential of biofuels, even more than ILUC, and point at the need for detailed economic modelling when evaluating the environmental sustainability, the effectiveness of biofuel promoting policies, but also the economic impacts. Especially the role of the Organization of the Petroleum Exporting Countries (OPEC) cartel of oil producers is deserves further attention, considering the current high level of oil production and low oil price.

Greenhouse gas emission mitigation & agriculture, trade-off or win-win situation: Bioeconomic farm modelling in the Sudanian area of Burkina Faso

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Will developing countries' farmers benefit from the mitigation policies proposed by the Kyoto protocol? Climate changes talks regularly underline that developing countries' agriculture could play a stronger role in GHGs mitigation strategies and benefit from the Kyoto Protocol program of subsidies. Scientists explain that agriculture can contribute to carbon mitigation by storing more carbon in the soil through greener cropping systems and by planting perennials, by adapting the traditional rice production systems and by raising livestock differently. In this context, a growing number of research project have started to investigate how developing countries agriculture can contribute to these objectives. The clean development mechanism (CDM) proposed in the Kyoto protocol is one particular policy instrument that can incite farmers to mitigate the GHG balance towards more sequestration and less emission.

Through CDM, industrialized countries are ready to finance project in developing countries. If farmers reduce their GHG emission and increase their carbon sequestration will it be a win-outcome where the new techniques will finally improve farmers' income? Some economists such as Michael Porter think that environmental regulation lead to a win-win outcome, in which case subsidies are not necessary. If it is a trade-off between incomes and the environment, subsidies are required. CDM can be mobilized to support the mitigation strategy.

Agriculture implies the use of inputs such as inorganic fertilizers and manure which in turn influence soil organic matter contents. Also the use of pesticides, herbicides and insecticides to cope with the insects, pests and crops diseases influences GHG emissions. Reducing the emission implies the reduction of those inputs which will in turn imply a yield decrease. As the reduction of GHG emission would generate costs and/or revenues, the study aims to assess whether this measure will imply a trade-off between environmental and economic objectives or a win-win situation. I apply this study to the case of small farmers in Burkina Faso through environmental instruments such as the taxation and the emissions limits/standard, and agroforestry. A bioeconomic model is used for this study, in which the farmers maximize their utility (net cash income) subject to constraints as emission limitation, food consumption and resources boundary. Two scenarios have been simulated and compared to the baseline scenario. The results show that the scenario of emission limitation in the annual crops production system involves a trade-off for the small farmers. Their utility from this scenario is lesser than the utility in the baseline scenario. It means that when the farmers produce only the annual crops, integrating the emission reduction in their system impacts negatively their net cash come, compared to the baseline scenario in which they use to produce without an emission constraint. The second simulation scenario is the integration of perennial crops in the farming system as a mitigation strategy. On the planning horizon, the farmers' utility is high than their utility when their produce only annual crops. Also, the net carbon balance is positive. Around 6,118 kg (carbon equivalent) are sequestrated individually. By computing the value on this carbon balance in the farmers' net cash incomes, their utility is better, then practicing agroforestry is a win-win situation for the small farmers, because they reach a higher level of income, and reduce by the same way, the emission from their activities.

The policymakers must encourage the small farmers to adopt the agroforestry, or to integrate the perennial crops in their annual crops system. If not, to reach the emission reduction objective in the annual crops system, subsidies are needed in order to compensate the income lost through the CDM.

Gender effects on adoption of climate smart agriculture (CSA) practices in Burkina Faso

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West African Sahel rural communities, are among the most exposed to the effect of climate change and climate variability due to various factors namely: the low adaptive capacity, and the overdependence on rainfed agriculture and climate hazards. In Burkina Faso, since the prolonged droughts in the 1970s, farmers have been facing recurrent climate hazards. High climatic variability, extreme events, land degradation, and desertification are important challenges faced by farmers in Burkina Faso. These factors combined to climate change related effects require a significant revolution of farmers in their farming systems and methods, such as Climate Smart Agriculture (CSA), to face climate change defies. Climate-smart agriculture includes practices and technologies that sustainably increase productivity, support farmers' adaptation to climate change, and reduce levels of greenhouse gases. This paper examines the adoption across gender of CSA practices in response to climate change in Burkina Faso. Although, Climate change is gender neutral, its impacts and responses, acutely influenced by various factors, may be different across gender. Data used in this study were derived from a survey done in 2013, in which 450 households were randomly from three rural communities of Burkina Faso (Dano, Koumbia and Gourcy) and sampled out through a multi-stage sampling procedure. A Heckman sample selection model was employed to avoid sample selection bias, since not every farmer who may perceive climate change would respond to changes through adaptation. The analyses of determinants of perception to climate change revealed that farmers' perception of climate change is gender neutral but on the other hand was significantly related to the age of the head of household, the level of education, households' head experience of extreme events (drought and flood) and agro-ecological settings. The adoption model indicated that farmers in female-headed households were less likely to adopt than male farmers. However, the associated positive and significant interaction effect of the age of the households head and his/her gender suggested that this effect may be different regarding to the age of female-headed households. The study also showed that farmers socio-economic characteristics, institutional factors (access to credit, access to extension services, and distance to market), farmlands characteristics, households' head experience of extreme events (drought and flood) Significantly influence farmers' choice of CSA practices.

Estimating the opportunity cost of conservation tillage adoption as climate change mitigation option in Tandjoare-Togo

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Conservation tillage has been declared as a win-win-win strategy because it mitigates climate change, improves productivity and enhances ecosystems services while creating green jobs. Adopting conservation tillage consists of minimizing soil disturbance while increasing the use of organic manure, bio-fertilizer (grazing livestock and paraquat) and improved seeds. Thus it contributes to promotion and adoption of green economy cropping system which promotes the use of bio-energy and Bio-economy. The purpose of this study is to estimate the opportunity cost of conservation tillage adoption in Tandjoare-Togo and determine its explanatory factors particularly factors that minimises the cost of its adoption since green economy means the adoption of environmental friendly methods efficiently. This means the use of sustainable practices with less cost. A survey was conducted in Tandjoare-Togo in northern Togo where lands are really degraded and where the main economic activity is agriculture. We found that the total cost of conservation tillage adoption in Tandjoare-Togo is about 125,854.00 USD per year per hectare. Using the Heckman two steps model to assess factors that determine this opportunity cost, we found that farmer's age and ethnicity, awareness of climate change, and revenue positively affect farmers opportunity cost. Furthermore, we found that education and awareness of not-tilling benefits could substantially contribute to the acceptance of conservation tillage at lower costs. These results show that training and advocacy may reduce the opportunity costs of protecting the environment and creating green jobs in agriculture.

Climate change and sustainable economic development: A case study of the horticultural conventional and organic farming systems in Senegal

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Climate change is one of the most important issues that the world is currently facing. The concept of "bioeconomy" or "green economy" has recently emerged is considered as one of the solution as it is considered to be essential to the future of the world economy.

Horticulture production in Senegal is an important agricultural and economic activity that is mainly located in the Niayes zone. However, the increasing use of fertilizers and pesticides to boost the production in order to meet a growing demand has many implications for the environment. The recognition of the problems this system of production has on the health of the soil and farmers but also on the atmosphere with the emission of GHGs, some leading NGOs have started to promote farming systems based on sustainability. Therefore, the rising level of environmental hazards from conventional farming system made it attractive to farmers in the Niayes to adopt sustainable agriculture based on organic farming. The development of organic farming in the area will not only help producer to get more profit with a sustainable way of production but it will give new business opportunities to livestock farmers through the sale of organic manures and to some industries who are madding irrigation engines base on renewable energy such as wind and solar. The promotion of this farming system in Niayes region can contribute to the emergence of bioeconomy in Senegal in the sense that it supports the development of production systems with reduced greenhouse gases (GHG) emissions, adapted to and mitigating the adverse effect of climate change.

The main objective of the study is to investigate the present production and marketing systems of off-season vegetables in the Niayes so as to analyze the potential of organic farming to enhance framers' productivity and to mitigate climate change. A whole farm model is used to study the economic and environmental performances of the organic farming system compare to the conventional farming system in the horticultural production system in the rural community of Diender in the Niayes region in Senegal. The analysis is undertaken in two representative farms (conventional and organic). Gross margin is regarded as economic indicator while carbon emissions are regarded as environmental indicators.

The findings of the study reveal that vegetable production and marketing is a very attractive enterprise for farmers and marketers. Simulation results indicate that the conventional farming system is still more attractive to farmers in the Niayes compare to the organic farming system. This is mainly due to the fact that there is no local market for organic crops. But, environmental results in terms of carbon emissions reduction and carbon sequestration reveal that the organic system is found to be more effective in mitigating climate change. In addition, simulation results show that there is a "win-win" situation for conventional farmers when they partially adopt organic farming system.

Our study suggests that, through appropriate investment in agro-ecological research to improve organic management and the establishment of a local market for organic crops, organic farming can become a competitive alternative to conventional farming, when it comes to healthy food production with less environmental impact in the horticultural sector. In addition, specific actions are needed to promote bioeconomy research and innovation to help the country to move toward a better and more sustainable economic development. However, further studies are needed on components of sustainable intensification to see which system of production is more profitable for farmers of the Niayes region, but also beneficial for the environment, and at regional and even national levels.

Substituting some technological links of the wheat classic yielding system with bioeconomic technological models

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Starting from the wheat crop technological links, it has been found that simply by changing/substituting certain managerial actions the crop can be directed toward a version which corresponds, as faithfully, to a bioeconomic model for the future. Additionally, this system would have a triple positive effect reflected in: increasing the company profits, ensuring population food security (high yields, with high quality, for long periods), protecting the environment and the natural resources involved. Long-term research conducted in an area from southern Romania with classic and conservation agriculture systems aimed to demonstrate that crop rotation, tillage, nutrition and maintenance systems (diseases, pests, weeds control) can bring, by substitution, significant benefits in favour of the biological agricultural economy.

The study began 11 years ago in a farm with a surface of 1200 ha. In order to avoid monoculture, it has been proposed a rotation of four crops that succeed: rape – peas – wheat – corn (sunflower). Effects of avoiding monoculture have immediately appeared, especially in diminishing the diseases, pests and weeds percentage with about 38.4%.

Continuing, conventional tillage system has been substituted by a new, conservative one – plowing and disking removal, replaced by a scarification work at every 3 years, followed by grubber works in vertical plan. These measures have brought savings of time and money for the society and they helped in a significant degree to the soil ecological restoration. Data regarding the economic differences emphasize the advantages of a system compared to the other one.

An essential part of the whole algorithm is represented by the crop nutrition, mainly by the nitrogen one for wheat, since it directly affects the quantity and the quality of the yields. Thereby, a part of the nitrogen currently applied from bag (synthesis nitrogen) has been replaced with biological nitrogen, obtained from the input provided by using peas as preceding plant (130 kg N/ha, which means an average of 32.5 kg N/ha/year) and by the association made by wheat with the *Azospirillum brasilense* bacteria (90 kg N/ha, namely an average of 22.5 kg N/ha/year). In total, the amount of nitrogen substituted is 55 kg N/ha/year.

Achieving a ratio between the biological and the synthesis nitrogen, it will appear that 58% of the nitrogen required by the plants for the whole crop rotation system can be supplied at no cost and without causing damages to the environment.

The entire study aims to demonstrate that the transition to the conservation agriculture is a necessary step on the way to the bioeconomic agriculture and that, in order to achieve this objective, using natural patterns is crucial.

Factors explaining land allocation decisions of Jatropha curcas by smallholder farmers in Northern Ghana

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Background

The Jatropha projects started in Ghana from 2005-2006 and there are about seventeen commercial biofuel developments (Schoneveld et al. 2007). Over twenty foreign companies acquired land to cultivate non-food crops and other crops for ethanol and biodiesel production in Ghana mainly for exports (Dogbevi, 2009). This new source of demand for agricultural commodities creates not only opportunities but also challenges for the food and agriculture sectors (FAO, 2008; Tomomatsu et al., 2007). In developing countries, the consequences of Jatropha development raises the issue of the negative impact of high food prices due to the increased competition from biofuels for agricultural output and resources on income poverty and food security (FAO, 2008). If energy crops are located on marginal land, they can integrate and complement conventional food crops cultivation rather than conflicting with them (Caracciolo and Lombardi 2012). The use of marginal lands could also avoid the displacement of food crops from fertile agricultural land and hence reduce associated negative impacts of land use change (FAO, 2008). The cultivation of Jatropha on marginal lands could so avoid the stress on food availability.

Objective

The main objective is to assess the factors explaining land allocation decisions of Jatropha Curcas depending of the type of land (fertile and marginal land) in Northern Ghana.

Description of Activity

There are three variables of interest. The first one is the total amount of land farmers decided to allocate to Jatropha. The two other variables are dummies corresponding to farmers' decision to grow Jatropha on fertile and marginal lands. We assume that the two decisions (cultivate Jatropha on fertile or marginal lands) are taken jointly, and thus that some unobserved factors may influence both decisions. A bivariate probit model will be used.

Results (Expected)

We expect off farm income and livestock to be significant and negatively influence Jatropha adoption on marginal and fertile land in the sense that getting off farm income and having livestock lead to not view Jatropha production as an attractive activity because their marginal land is already used for fodder. Farm experience is expected to be significant and to have negative effect on Jatropha land decision making on fertile lands. The more the experience farmers' have in agriculture, the less they allocate fertile land to non food bioenergy crops such as Jatropha.

Group membership is expected to influence positively marginal land allocated to Jatropha and negatively fertile land allocated to Jatropha.

Lessons-learned and Recommendations:

Understanding drivers of and barriers to perennial bioenergy crop adoption would be highly relevant for food security. We recommend that policymaker promote bioenergy crops adoption on marginal land rather than fertile land to avoid food security issues. Policy has to focus on enhancing household's capital because a farmer who do not get off farm income or livestock will nned capital to start Jatropha activity whatever the type of land. This could be done by facilitating the access to credit.

Diversifying food systems – horticultural innovations and learning for improved nutrition and livelihood in East Africa

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Background

Regardless of considerable efforts in the past, the reduction of poverty and hunger especially in sub-Saharan Africa has not made adequate progress. The development of the horticultural production sector in East African countries, especially the promotion of african indigenous vegetables (AIVs) shows an opportunity to make substantial contributions toward the alleviation of poverty, hunger and malnutrition. Workplaces and income opportunities originate from labour-intensive production systems and logistic and processing processes. Vegetables deliver vital minerals and vitamins in food. The variety, particularly of indigenous vegetables, contributes to a raised diversity of agricultural production systems.

Although there is growing demand, no suitable expansion of the AIV supply is taking place. This is primarily due to a lack of infrastructure and supportive regulations. Unpredictable precipitation, insufficient plant nutrition, soil degradation and plant diseases show room for improvement. In addition, the post-harvest losses of crops reach upwards of 50%. The weak organisation of local and regional marketing processes lead to considerable transaction costs with the result of lower incomes for small farmers and higher prices for consumers.

Objective and activities

Within the scope of project HORTINLEA, funded by BMBF and BMZ, knowledge should be elaborated on by the investigations and be made readily available to relevant decision makers in order to develop strategies to improve the value chain of African indigenous vegetables. Investigations of six technical subprojects will accumulate knowledge of how to increase productivity. Another group of sub projects focuses strongly on postharvest treatment, product quality, processing, logistics and marketing processes. With the help of value chain analysis, special problems of rural and urban value chains will be examined. A central subproject will regularly collect data from 1500 Kenyan households and analyse how different value chains can contribute to the reduction of poverty and improved food security.

Derived from the experience that research often only marginally contributes to the improvement of the livelihood situation of the poor, special transfer activities will be carried out in subproject “Dissemination”. Another special concern of the project is to promote the ability of young African researchers to plan and to carry out interdisciplinary projects oriented on solving complex real world problems.

Curret results

The international research project HORTINLEA is currently in its third year out of five. Most activites are on track and some first results have been achieved. For example, a baseline panel socio-economic household survey has been carried out in 1,500 households in southwerst Kenya. Many technical and socioeconomic projects depart from this baseline innoviating in specific stages of the value chain of AIVs. The final purpose level result of the project will be the devising of value chain strategies for policy makers who will be thereby enabled to design and carry out measures to tackle poverty, malnutrition and food security challenges of the target region.

A policy for an organic agriculture bioeconomy

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Background

Organic farming serves as a frontrunner for sustainable agriculture and food production. However currently we do not command of a policy for the application of Bioeconomy under organic production conditions.

Objective

To identify a research program and policy for an organic agriculture Bioeconomy, excluding target conflicts e.g., between human nutrition and energy production.

Activity

The German government's National Research strategy for Bioeconomy 2030 identified five activity fields (AF): (1) worldwide food security, (2) sustainable agriculture, (3) healthy and safe food, (4) industrial use of renewable raw resources (4) and (5) energy sources based on biomass production. In this paper we ask how organic agriculture is contributing to these AFs?

Results

Well known are contributions to AF (1): e.g. through regionalising food security and diverse food; AF (2): increased sustainability by e.g. energy efficiency through the exclusion of nitrogen fertilizers and instead production of legume based nitrogen fixation; AF (3): health impacts e.g. by the production of pesticide free food. In contrast, organic farming linkage with AF (4) is at the very beginning and AF (5) does not allow many opportunities, except that of biogas production, while Agroforestry and Alley Farming that might offer a potential, are currently not established on a broader scale.

Lessons-learned and Recommendations

For further conceptualization of an organic based Bioeconomy a research program and policy has to reflect and prove the following issues:

1. Development of an organic Bioeconomy concept that is in line with the ethical foundation of organic agriculture described in the IFOAM (International Federation of Organic Agriculture Movements) principles;
2. Development of organic guidelines for an organic Bioeconomy specifically for the production of non-food products along the whole process chain;
3. Development of techniques and technologies e.g. of renewable raw resources under organic conditions;
4. Assessment of renewable raw resources with regard of their systemic impacts on other organic product sectors / within the whole value chain of organic production, e.g. via LCA;
5. Development of an optimized organic farming system with an increasing productivity that integrates renewable raw resources and energy production in a broader context;
6. An extensive discussion process with stakeholders along the whole organic value chain about a organic agriculture Bioeconomy;
7. Establishment of new partnerships between public and private sectors, serving for the discourse, development and assessment of an organic Bioeconomy.

Aquatic agricultural systems – the key for a sustainable agriculture

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Background

Feeding a growing population without destroying the environment is perhaps the greatest challenge for this century. Achieving this goal will require a major transformation of agriculture to make it a sustainable, resources saving system. To reach this ambitious goal will require saving limited resources such as phosphorous and opening new areas for biomass production. Aquatic ecosystems cover more than 2/3 of the earth's surface but this resource is not yet efficiently used for biomass production. Aquatic agricultural systems (i) enable nutrient recycling, (ii) provide new areas for biomass production that do not compete with terrestrial ones, (iii) produce biomass with less lignin that is easier to process, and (iv) produce biomass for production of bioenergy or chemical intermediates thereby reducing the need for terrestrial energy crops.

Objectives

The project aims at improving the knowledge on suitable organisms, optimizing culture conditions, harvesting and processing of species and developing a nutrient recycling system, with the final goal of a new and sustainable agricultural systems, combining aquatic and terrestrial agricultural systems. To this end, four major research topics have been identified: i) linking aquatic and terrestrial agriculture to improve the biomass production; ii) identifying and isolating high value products, material processing and energetic utilization of aquatic biomass; iii) optimizing cultivation systems of algae, bacteria and vascular plants; iv) recycling of limited resources, such as phosphorous, by using innovative cascades of utilization for high nutrient recycling

Activities

We will develop a multi dimensional aquatic system for the cultivation of various aquatic phototrophic organisms, including phototrophic bacteria, cyanobacteria, algae and aquatic vascular plants. We will establish new methods for fast screening and characterization of small volumes of single-cell organisms, followed by a step by step upscaling to >10m^3. Innovative cascades from bacteria, micro- and macro algae and aquatic vascular plants will provide a high valuable tool for nutrient recycling. This system will be closely linked to existing wastewater treatment plants to get a high efficient nutrient recycling. The economic success of such an integrated agriculture system (terrestrial and aquatic) is based on the simultaneous co-production of food, bio fuels, high valuable chemicals and pharmaceutical products. Protein-engineering and forward evolution will develop new products and improve the quality of existing products, such as vitamins, antioxidants or omega-3 fatty acids. Innovative separating processes will be used to reach a selective, energy efficient cutting off of high value products with a high purity out of these highly diluted aquatic systems.

Results

Aquatic agricultural systems will provide new and valuable additions to its terrestrial counterparts. Combining terrestrial food production and aquatic biomass production leads to a closed and highly efficient agricultural system for production of bio fuels, high valuable chemicals and pharmaceutical products based on a nutrient recycling.

Lessons learned and recommendations

The increasing demand for food crops and the nutrient limitation cause the need for a sustainable agriculture. Linking aquatic agricultural systems with their terrestrial counterparts will increase the production of food crops, high valuable chemicals and pharmaceuticals and result in a sustainable, nutrient recycling and thus self-sustaining agricultural system in the future.

Exploiting the microbial resources on our doorstep: What lessons are still to learn from environmental microbial systems for bioeconomy?

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Background

Besides procedural and chemical processing, nearly all *bioeconomic concepts include at least one biological, microbial-mediated conversion step*. It is a well-known fact that microorganisms are able to conduct a virtually unlimited number of enzymatic reactions within their (extra-) cellular metabolism. Despite more than hundred years of microbiological research, *the vast majority of the microbial biodiversity is still remaining unknown and hence unexploited*. This is especially true for the microcosm right on our doorstep.

Objective

With an increasing demand on new bioeconomic concepts and new conversion pathways, there is a *raising interest in microorganisms and microbial systems with distinct and well-defined metabolic capacities*. This include (i) the exploration of microbial diversity and the microbial tree-of-life, (ii) the characterization of hitherto unknown microbial species with respect to their genetic potential and the corresponding metabolic properties, (iii) the understanding of microbial growth and inter-species interactions, and (iv) the utilization and transfer of microbial ecosystem services to biotechnological solutions for bioeconomy.

Activities

Our recent research activities supported by the German Federal Ministry of Agriculture and Consumer Protection (BMEL) and the German Federal Ministry of Education and Research (BMBF) focus on the *implementation of a well-balanced Microbial Resource Management* (MRM) as proposed by Verstraete et al. in bioeconomy strategies. As model system, the anaerobic digestion (AD) of biomass to precursors for energy production and carbon-chemistry is investigated.

In particular, research projects were conducted on

- the microbial systems ecology of biogas plants (e.g. BMEL 22013913),
- the isolation and characterization of new and hitherto unknown microorganism from AD environments (e.g. BMEL 22017111),
- the characterization and modelling of metabolic pathways in AD (e.g. DFG KL2069/3-1), and
- the development of diagnostic methods for process control in AD (e.g. BMBF 03SF0440A, VDI 16KN017629).

Results

Even though AD is a microbial process studied since Pasteur, our research revealed that more than *70% of the microbial genetic material present in AD is still unknown*. A number of new microbial species and genera were isolated, and genetically and physiologically characterized. Besides the metabolic profiling of microbial trophic networks/levels, also the discrimination of metabolically active and inactive microorganisms is crucial for understanding their functional role in AD.

Lessons-learned and Recommendations

Microbial Resource Management is indispensable for bioeconomy. The natural microbial resources need to be explored and characterized in detail. The knowledge of microbial inter-species interactions is crucial for utilizing defined microbial consortia in biotechnology. Understanding the natural microbial ecosystems services will open the door for new and innovative concepts in bioeconomy. With respect to the widely unknown microbial microcosm it is highly recommended to increase the efforts in microbiological basic and applied research. Therefore, existing networks such as the *Leibniz Network on Biodiversity* and the *Biogas Competence Network* need to be strengthened.

Not only the biodiversity of animals and plants is an indispensable resource for the human future. Also the often neglected and ignored microbial world offers a broad range of unexplored and, hence, unexploited opportunities.

Photosystems and other pigment-protein complexes from extremophilic photosynthetic organisms for biotechnological applications

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Background

Photosystems, in particular Photosystem I (PSI) from the thermophilic cyanobacterium Thermosynechococcus elongatus are exceptionally stable and retain high rates of light-induced electron transfer under a variety of conditions over extended periods of time.

Objective

These traits render PSI highly suitable as a model system for artificial photosynthesis as well as for incorporation into bio-hybrid (nano)devices for the production of solar fuels and other high-value products (HVPs) as well as other biotechnological applications.

Activity

PSI was coupled, e.g., via cytochrome c, to a variety of surfaces/electrodes. These assemblies show unidirectional light-induced photocurrents. Moreover, PSI was attached to a variety of plasmonic metallic nanostructures (which can act as additional antennae to PSI as well as electrode materials) resulting in strong fluorescence enhancements.

Results

The hybrid assemblies show promising light-induced photocurrents [1,2]. Moreover, the exceptionally high plasmonic fluorescence enhancements of ~ 300 fold [3] can potentially be translated into further enhanced electron transfer/photocurrents.

Lessons-learned and Recommendations: PSI and other pigment-protein complexes from phototrophic organisms are promising for biotechnological applications with the prospect of coupling to (redox) enzymes for direct light-powered HVP production.

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The increase of the crop yield by electromagnetic influence and agrolandscape productivity

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Background

The introduction of biotechnology in economy allows much more efficient using of natural resources and diminishes the human influence on the environment. The solution of the food problem of humanity and development and use of new biotechnologies can be carried out most efficiently by increasing the yield of crops and agricultural landscapes productivity. Seeds of crops are one of the main components of a bioeconomy development. The increasing of reproductive capability of seed crops after their preplant electrostimulation leading to a significant increasing of their productivity (up to 35%) was established.

Based on the new knowledge technology the preparation of seed crops by corona discharge increases their yield and thus reduces the costs for storing seed grain, improves land use, saves energy for growing and harvesting. This makes possible essentially increase the productivity of plants that are used in biotechnology.

Objective

The goal is to apply the knowledge and experience of using guided electromagnetic spectrum for

- presowing electrostimulation of seed grain
- optimizing technologic electrostimulation processes for various seed grain
- simplifying the economic, environmental and social problems of land use by virtue of increasing the yield

Activity

The influence of electrostimulation by corona discharge on different types of plants and the separation possibility of seeds unable for germinating and weed was investigated. The experiments were conducted on the same land in two soil-climatic zones (forest-steppe and subcarpathian) of Ukraine.

Declaration of Scientific Discovery:

Reproduction of agrolandscapes productivity by electromagnetic action on seeds of cultivated plants. https://www.infona.pl/resource/bwmeta1.element.agro-71163a23-ec46-4035-a209-f42818456baa?locale=en

Results

The electrostimulation of selected seeds of forage grasses (legumes and cereals) was conducted. The innovative technology for preparing of plant seed was developed, which includes electric separator and devices for testing seeds by mode selection of production line. The resulting seeds represent set of seeds of the cultivated plant genotype with increased yield. An additional increase of forage and seed yields (green mass, hay, seed yield), and the root system, which updates soil biomass was received. In all cases, the effect of seed treatment is between 15 and 35% in comparison to the control variant, which allows reducing the use of crop areas and energy resources for growing and harvesting to appropriate percentage.

Lessons-learned and Recommendations

The methods of experiments with electric separating and electrostimulation of seeds in research seed farms were developed. The material base in the form of scientific-training laboratory was initialized. The design methods of devices for seed electrotreatment in the primary seed production were assimilated.

It is proposed

- to use certified seed grain by farmers in order to increase the efficiency of crops growing;
- to conduct further joint research with scientists for the implementation of innovative technologies for increasing the yield of crops;
- to create a network of research institutions and universities, public structures for dissemination and implementation of the results in bioeconomy.

Technology for mitigation and adaptation to climate change: The use of bio-digesters on farms of small farmers in Canton Turrubares, Costa Rica

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So far in Costa Rica it has led to the use of bio-digesters as a technology to reduce the negative environmental impact of livestock activities. The adoption of these technologies by small producers has been limited because there are few studies that show the economic feasibility of this investment That means the studies show the environmental benefits but not the socio-economics as well. Additionally, it is important to note that today the second most expensive production factor is electricity. This cost affects directly the competitiveness of family agribusiness. The core question is how to improve the competitiveness of the small farmers and at the same time to contribute to avoid the negative impact to the environment and the climate change.

Based on the WOCAT[1] methodological approach and a participatory workshop a small famer was choosen as a study case. The WOCAT- Technology questionnaire was adapted to this case to pick up the core information. The main results of this first study case were divided in two dimensions: environmental and financial. From the environmental dimension the benefits can be summarized as follows: a- reduction of the negative externalities (organic waste, diminishing of gases emission, reduction in the use of firewood); b- source of renewable energy (biogas); c- source of organic fertilizer. From the financial dimension is necessary to consider the following assumptions: a- the biogas is used in the household for cooking in order to reduce the costs of the energy (electricity and firewood); b- this reduction costs was introduced as a income in the financial analysis. Using the traditional financial indicators the results have showed Internal Rate of Return (IRR) was 11% (two points better than the opportunity cost of the capital which was 9,25%) and the Net Present Value (NPV) was ₡ 142.409,12 (1 US$ = ₡530,00).

The study shows the economic benefits through saved costs by the use of biogas. As a concluding remarks of this study case are: a- new communication strategies to encourage families in the use of biogas in the household are needed; b- rural extension programs can be very important in achieving this goal; c- the social dimensión is not taking in account until today. Its approach is necessary to achieve a greater acceptance from family farmers. Small farmers could get additional benefits from the incentive programs that exist in Costa Rica like the “Payment for environmental services” due the reducing the emission of greenhouse gases.

References

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Bioresource insects

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Background

Due to the growing world population there is an increasing demand in alternative protein sources whereas the available land for the production of plant and animal protein decreases owing to desertification and urbanization. Furthermore, the rapidly decreasing resources of fossil fuels necessitate a more sustainable land use. This includes the establishment of novel utilization pathways of hitherto not or not optimally used biomass. Here insects offer prospective alternatives. With almost 1 million described species, insects are a vastly underutilized bioresource and can be utilized for the bioconversion and valorization also of hitherto not usable organic residues to food, feed, protein, lipids, chemicals, enzymes, and bioactive substances. In comparison to conventional livestock, insects have higher feed conversion efficiencies, lower water and land requirements, and lower greenhouse gas emissions.

Objective

The objective is the sustainable valorization of organic residues by suitable insect species into safe, high quality insect-based products such as food, feed, protein, functional biopolymers, and enzymes using a holistic approach. This encompasses a screening for to date unexploited suitable insect species for a bioconversion, the optimization of the value chain biomass-insect-product, the development of appropriate process technology for an industrial production, and the establishment of safe and resource-efficient production concepts. Furthermore, the environmental and economic impact of the utilization of insects is investigated.

Activity (this can relate to research methods, policy measures, business activities, etc.)

Policy measures include collaboration on a study on the regulatory frameworks influencing insects for food and feed by the FAO and participation in the writing of an opinion paper on safety aspects concerning the production of food and food ingredients from insects by the Permanent Senate Commission on Food Safety of the German Research Foundation (DFG).Vast research is and will be performed concerning insect processing, insect fractionation, microbial safety and life cycle and technical assessment. Exemplary insects investigated so far include larvae of the Black Soldier fly *Hermetia illucens* and the Mealworm beetle *Tenebrio molitor*.

Results

There is immense potential in insect biodiversity and the use of to date unexploited insect species. Consequently, there is still a large amount of research required regarding identification, composition [1] and application of known and to date unknown insect species appropriate for respective bioconversion processes in order to extensively exploit the potential of insects as a bioresource. In order to produce insects sustainably on an industrial scale, technological improvement of rearing facilities for automated, cost-effective production processes and the development of resource-efficient and safe processing steps are required [2].

Lessons-learned and Recommendations

There are numerous regulation gaps and knowledge gaps as well as emotional concerns regarding the production and use of insects as food, feed and other applications. Additional comprehensive applied and fundamental research is recommended in order to contribute to closing those gaps.

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Mangroves defoliation effects on the productivity and rural economy, in Tabasco Mexico

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Tabasco Mexico in the presence of an overpopulation of caterpillars of the genus Anacamptodes sp in 2010, caused a strong environmental impact in 3835.7 hectares of black mangrove (Avicennia germinans L.). The caterpillar population was so high that the mangroves disappeared entirely in much of the affected area. In order to assess the damage and propose recovery measures mangrove project "Ecological restoration of 50 hectares of mangrove black caterpillars affected by Anacamptodes sp in the Ejido (Public lands) Las Coloradas, Cardenas Tabasco" was proposed. The funding source was the National Forestry Commission el project was formed in 4 stages.

1) Assessment of damage, this included a detailed diagnosis of the damage caused by caterpillars and possible temporary adaptation measures at the level of ecosystems, economic and social.
2) Establishment of a nursery, this stage included the creation of the nursery, staff training in the production and maintenance of mangrove nursery.
3) Reforestation, which included field training, planting mangrove trees
4) Monitoring

The field work consisted of making an inventory of live and dead trees in the affected area, to do 10 units of sampling of 1000 m^2 each were established, were measured variables dasometric (diameter and height) and seedlings were counted in units 9 m^2. Sampling Questionnaires were applied to community personnel, institutions, professionals and producers who depend on the mangrove as a productive activity.

As a result, the damage to the mangroves was level II and III; it means that required external support for the ecosystem started the recovery process of the initial environmental conditions. 49,000 black mangrove plants were produced and planted. Also, the diagnosis indicated the complete disappearance of the blue crab, drastically reducing the volume scale fishing, shrimp and oysters. In addition to, the siltation of the communication channel between the community and the lagoon.

Three years after black mangroves have been planted , population of blue crab and crab has been stabilizing. With the dredging, volumes shrimp and fishes are almost regular. In the economic and social part, the diagnosis expressed despair at the fishing community and the general population. Loss strongly impact ecosystem. The population was left without money and without work source. Today the mood is perceptible and saving conditions are present. CONAFOR consider successful this project, because of the survival rate (98%) and because people were trained to manage the ecosystem. Similarly four students of postgraduate were graduated, and researches in succession mangroves impacted by Anacamptodes continue. Finally, the community received the State Prize of Ecology José Narciso Rovirosa 2014, for the sustainable management of mangrove resources.

Plant breeding in the European Union: A study of the economic, social and environmental benefits

S. Travella, **Coordinator of the European Technology Platform 'Plants for the Future', a stakeholder forum for the plant sector with members from industry, academia and the farming community (http://www.plantetp.org/)**

Background

Sustainable supply of biomass is one of the cornerstones of the Bioeconomy. The increasing demand for food, feed, fibre, industrial products and energy requires a multidisciplinary approach driven by science, technology and innovation. The prime drivers for success – sufficient biomass of the right quality and at the right time - are breeding and breeding innovation. The contribution of these drivers are recognized by many, yet so far a proper qualification and quantification of the benefits of plant breeding has not been carried out. This is why the European Technology Platform 'Plants for the Future', which represents industrial, academic and farming communities, decided to commission a study on the economic, social and environmental benefits of plant breeding in the EU.

Objective

The study aims to provide reliable, science-based and well-understandable quantitative and qualitative insight on the benefits that plant breeding offers to societies and to the Bioeconomy. In particular, the socio-economic and environmental value of plant breeding in the EU becomes quantifiable and, thus, apparent.

Activity

A meta-analysis on the impact of plant breeding in the EU is providing reliable data on the effect of breeding on European crop production. The breeding effect – primarily a yield impact – will be calculated using the total factor productivity (TFP) approach. The concept basically allows yield improvements to be related to innovation; and with the planned meta-analysis, the impact of plant breeding on yield improvements can be separated from other innovations (e.g. from better machinery, new plant protection products, etc.).

Results

The study is ongoing and will be finalised by the end of October 2015. The following impact areas of modern plant breeding in the EU are addressed:

a) Contribution to social welfare by generating additional farmer income and by providing more affordable food to meet rapidly growing world needs
b) Stabilisation of agricultural commodity markets
c) Generation of additional income throughout the agricultural value chain
d) Added value to rural areas of the EU
e) Reduction of greenhouse gas emissions by reducing the expansion of the global agricultural acreage
f) Preservation of valuable natural habitats, including protection of biodiversity

Lessons-learned and Recommendations

The Bioeconomy aims at producing more with less resources. The sustainable supply of biomass faces several challenges including changing climatic and environmental conditions. Plant breeding is the first and fundamental element in the Bioeconomy value chain. The European plant breeding industry is constantly adapting to new demands and cultivation challenges. Its R&D delivers plant varieties destined for specific end-uses as to add value to all biobased products and processes to follow. To ensure that plant breeding industry has the confidence to innovate, a policy framework that supports innovation in agriculture and that encourages the uptake of agricultural technologies on the farm, is crucial.

Beekeeping in the tropics: The case of honey Tabasco

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Beekeeping in Mexico is an activity of great economic importance, because 45 000 producer are dedicated to this activity distributed in all states of the country, who work with 1.9 million of hives.

Mexico was the 5th world's producer with 57,200 tons in 2014 and was the 4th exporter of honey in the world.

Germany tops the list of buyers of Mexican honey, because it acquires 43 per cent of production exported; USA, 25 percent, followed by Belgium, with 12 percent.

Tabasco State stands out for its biodiversity and is suitable for development of beekeeping area, although its production was low about 272 tons in 2014.

Beekeeping in the state has made progress, They have been characterized by the type of pollen and have been classified as flower honeys (guava, coconut, bush) and multi floral honey, which has added value, improving prices and producers' incomes.

Also, honeys have been characterized by their antioxidant profile and color. Moreover, beekeepers are getting hive products as medicinal syrups, sweets, pollen, royal jelly, propolis, shampoos, body lotions, soaps and others. This allows an integrated management of beekeeping. This production system can be transferred to other areas of apiculture

The beekeeping chain in Tabasco State needs to be organized and increase the number of hives differentiated to produce honey; in addition to have honey collection centers and produces organic honey. On the other hand, Also needs to be implemented strategies to mitigate the effects of climate change, as phenomena such as flooding and prolonged drought in Tabasco State have a negative impact on honey production and quality.

Integrating food security aspects in biomass sustainability standards and certifications through rights based indicators

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Background

Worldwide, governments start to shift from petroleum-based to biomass-based economies. Consequently, global biomass demand, trade and production is increasing particularly for non-food uses. Sustainability concerns regarding biomass production are growing and led, for example, to the development of environmental regulations for bioenergy in the EU. Private certification standards for biomass such as REDcert, ISCC, RSB or Bonsucro are a response to these sustainability concerns though their performance levels regarding environmental and social criteria vary. Food security aspects are hardly addressed in these standards and practical indicators, verifiers and hence measurability lack. This becomes especially alarming when the non-food biomass demand continues to increase, involving the potential trade-offs with food security at local, national or global level.

Objective

The objective of this research is to identify how the Human Right to adequate Food (RtaF), which is applicable in over 100 countries, can be ensured in local biomass production and through certification systems in food insecure regions. We aim to first develop a suitable conceptual framework to integrate the Right to adequate Food in biomass production, processing and trade and derive guidance for the choice the indicators. Second, we identify appropriate indicators to ensure that the Right to Food is not violated by certified biomass operators.

Activity

Having started with a comprehensive literature review and a screening of the ten major biomass standards and certification systems, we then conducted over 15 expert interviews and three multi-stakeholder workshops with certification bodies, standard initiatives, NGOs, ministries, researchers and UN organizations (FAO, WFP). The workshops helped to discuss and revise the developed food security indicators.

Results

We base the conceptual framework on the four dimensions of food security (access, availability, utilization, stability) and the “Voluntary Guidelines to support the progressive realization of the RtaF in the context of national food security” of the FAO. The framework led to the selection of 14 out of the 19 voluntary guidelines which fall within the responsibility of an enterprise. For each selected guideline at least one indicator is developed resulting in a total of 45 rights based food security indicators. Wherever possible, existing indicators are used to ensure a smooth integration in commonly used sustainability standards.

Lessons-learned and Recommendations

The indicator set is applicable to all biomass types and uses, for different biomass sustainability standards, farm sizes and business types. They represent a best-practice set to ensure that the RtaF is not violated at local level when producing and trading biomass and hence protect the food security of the people involved at local level. The multi-stakeholder process ensured that the indicators are feasible and measurable. Thus, they can and should be included as a whole set in existing sustainability standards and certifications. Furthermore, we propose a field testing phase of the set of indicators and the development of a handbook for users. We recommend integrating the rights based food security indicators in all biomass sustainability standards as well as in the European Renewable Energy Directive to foster local food security in food insecure regions.

BiomassWeb: Improving food security in Africa through increased system productivity of biomass-based value webs

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Background

Global demand for biomass as food, feed, source of energy and industrial raw materials is putting increasing pressure on the agricultural sector and food production worldwide. Concepts to ensure food security while attending growing demands for non-food biomass are still in their infant stages. BiomassWeb is part of "Securing the Global Food Supply" (GlobE)", an initiative in the context of the German National Research Strategy BioEconomy 2030 and funded by the Federal Ministries of Education and Research (BMBF) and for Economic Cooperation and Development (BMZ).

Objective

BiomassWeb aims at contributing to food security in Sub-Saharan Africa by focusing on innovations in the value webs of the food and non-food biomass sector. Biomass-based value webs are complex systems of interlinked value chains in which food and non-food biomass is produced, processed and traded.

Activities

BiomassWeb addresses all determinants of food security: (i) food availability through enhanced productivity; (ii) food access through income generation with non-food biomass; (iii) utilization of food through increased nutritional quality; and (iv) food stability through more efficient land-use systems. BiomassWeb research identifies potential productivity and efficiency gains in the biomass-producing, processing and trading system through increased integration of all value-web components. Based on participatory system studies, selected value webs are described, including the value chains of maize, cassava, plantain, enset and bamboo. Furthermore, BiomassWeb comprises a portfolio of exemplary studies such as land-use planning, sustainable intensification of biomass production, innovation opportunities in pre- and post-harvest production technologies, institutional settings and governance structures.

BiomassWeb builds on a network of German and African universities, research institutions, international agricultural research organizations and the Forum for Agricultural Research in Africa (FARA) as a pan-African network with strong expertise in transforming research into action. Geographically, the project focuses on the Sudanian savanna belt (Ghana, Nigeria) and the East African highlands (Ethiopia).

Project sustainability will be achieved through the establishment of a network ("BiomassNet") of biomass researchers and actors in Sub-Saharan Africa's biomass sector as a stakeholder platform for biomass-related discussions and activities in the coming decades.

Lessons learned and recommendations (preliminary)

Capacity development, especially at academic levels, is essential and plays a leading part in BiomassWeb. Important are, however, investments not only in capacity development and research but also in start-up activities to generate jobs and income, thus ensuring food security in rural and urban areas of Sub-Saharan Africa. Also, strengthening the African producing, processing and trading sector for biomass products will need the political commitment of governments as well as international support.

In the long run, BiomassWeb expects to contribute to enhancing the capacity of Sub-Saharan Africa to not only meet its own future demand for food and non-food biomass but also to provide industrial countries with biomass products, and in this way participate in the emerging regional and international bio-economy.

Lignocellulose Baden-Württemberg – resources and technology connected with innovative methodologies and networking strategies

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Background

The bioeconomy Baden Württemberg program comprises among others a research network for lignocellulose. The lignocellulose network connects 23 research teams and is divided into four value chains, which are

- Upgrading of lignin,
- Fermentation of lignocellulosic hydrolysates,
- Fermentation of pyrolysis products and
- Lignocellulosic NanocompoSit materials.

The research projects along these value chains include biomass production, separation technologies and biomass conversion. Furthermore the network comprises projects which address the agricultural, forestall, economic and societal evaluation of new technologies and products.

Objective

Not only for Baden-Württemberg bioeconomy among others means developing innovative products and technologies which are based on renewable bio-resources instead of fossil resources. Lignocellulose is one of the most abundant renewable biomass worldwide. It will play an important role in the economic, ecologic and societal shift from fossil to renewable resources. A main goal of the lignocellulose research network is to establish a strong network of researchers who address to obtain platform chemicals based on renewable lignocellulosic biomass and development activities on exemplary, innovative products and technologies for industry and consumers.

Activity

Within the network diverse possibilities of connecting the research teams can be found. Together with bio-Pro Baden-Württemberg the coordination group takes the challenge to determine the most promising value chains and products and deliver this information to the network and the research teams within. We develop a strategy for bringing scientists and research teams in Baden-Württemberg closer together as well as for the design of new products from lignocellulosic resources.

Results

The process of developing new products and technologies runs through diverse steps from research and development in laboratory scale towards large scale production until the release of innovative products for the market. Currently most research groups are working in laboratory scale. Our task will be to focus the lab-work in an early stadium to the point of innovation which can be found in different steps within the process of development depending on the product and the technology. This will be achieved in small interdisciplinary groups of research teams. We call this product-clinic.

After having identified the points of innovation and promising target-products in the different value-chains, we will include industry partners in an early state. Later also stakeholders from society like product designer, consumers and NGOs will be included in the process of innovation development and product design. A plan for the strategy can be found in the diagram below. Included in the strategy will be a Design-Thinking workshop. Design-Thinking is a promising tool connecting product design and project management which has been developed and applied in Silicon Valley successfully over the last decades.

Lessons-learned and recommendations

We have already used open-space forum as a networking method in our project in order to detect the points of intersection which link the different research projects in order to guarantee the flow of information and material. The methods turned out to be highly efficient for the relatively large number of research teams in our network.

Fibre crops as bio-refinery sources: Potentials and challenges

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Background

Sustainable and bio-based concepts are increasingly requested within the course of bio-economy development. Meanwhile natural fibres and materials thereof are indispensable in this context. Growing plants like fibre hemp, nettle or oilseed flax, their processing and further application represent examples of sustainable economy due to favourable integration in crop rotations, development of rural based employment as well as coupled and cascade utilization of numerous products for food, feed, materials and energy.

Objective

Few of the most important prerequisites for a successful integration in industrial value added chains are the economic competiveness and the quality of raw materials and intermediates. In regard to the supply of agricultural fibrous raw materials it has to be stated that technological improvements in harvesting, post harvesting and processing procedures still imply huge potentials to fulfil this requirements. At present, the technological status of natural fibre supply chains results in high investment and procedure costs. Most of existing processing lines are not operating reliable and are targeted on only few traditional products.

Activity

A multitude of technological developments was carried out by scientists and technicians of the department of post harvesting at the Leibniz Institute for Agricultural Engineering to improve the given situation.

A new technology system for the processing of bast fibre crop straw integrating innovative modes of action for all process steps was developed and investigated. Subsequently the pilot scaled test equipment was transferred to industrial activities and represent nowadays one the few available multipurpose processing plants for bast fibre crops. Linen, oilseed flax, industrial hemp, fibre nettle or even tropical crops like kenaf can be upvalued to technical or even textile fibre qualities. Specific progress was achieved with a patented technology to enable a considerable improvement of value added from the woody core (shive) of fibre crops. At present a complete new and innovative supply and processing procedure for fibre crops is under investigation at the ATB. Main focuses of research activities are the simplification of the supply steps in agriculture (harvesting and storage), the preferable integrated processing of the whole crop material into high value composites as well the utilization of so far unused components of the plant (e.g. leaves, flowers, sap). A unique pilot scaled processing line is available to carry out fundamental as well applied research on semi-industrial scale.

Results

Value added from bast fibre crops can substantially be improved by means of the new technological developments for their supply and processing. Solutions are provided to match quality as well price demands from industrial application.

Lessons-learned and Recommendations

Remarkable improvements have to be carried in order to enable value added from farm and forest based raw materials. For the successful establishment of the bioeconomy development it is important to utilize natural resources to their optimal extent. Fibre crops and their tissue components represent such a resource with already naturally given specific characteristics. Due to the competition both between crops in rotations as well semi and final products in industrial applications it is important to improve the exploitation of their relative exquisiteness.

The BIOVALUE innovation project

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Results from the +10 miil. ton plan (Gylling et.al 2012) show that it is possible to expand the resource base for the Danish Bioeconomy with an additional 10 million ton biomass for biorefining without compromising the existing food and feed production. It is also realized that expanding the traditional Bioeconomy of today to a competitive Bioeconomy that can compete with the Fossil economy take serious resources and a concerted action from many diverse stakeholders.

Expanding the Bioeconomy will take a vast number of innovations and inventions and it will be necessary to assess and connect these in a systemwide bioeconomy value chain context.

The BIOVALUE innovation project is a Strategic Platform for Innovation and Research on Value-added products from Biomass (www. biovalue.dk) with the objective to target the entire value chain from sustainable biomass production to separation and conversion of all components of biomass into value-added products

As part of the project a platform for Socio-economics, Sustainability and Ethics is established with the aim to link the results from the biological/technical projects into a production/value chain context in order to assess system-wide sustainability of biomass production and biobased products.

The economic analyses will be conducted at three levels of aggregation: primary production/supply chain level, the agricultural sector (with a fairly detailed representation of agricultural biomass production and the interaction between different agricultural activities and farm types), and the national economy (with description of the interactions between agriculture, biorefineries and the rest of the economy), and with the largest possible consistency between the results from the three model tools. Environmental impact assessment in a life cycle perspective will also be conducted across the whole value value chain, by splitting the chain in two manageable sub-chains : i) the agricultural system (assessment of the sub-chain will assess and quantify the environmental impacts from agricultural biomass production, taking into account the interactions between different agricultural activities, and including effects from defined prechain activities as for instance production of imported fodder), and ii) a non-agricultural sub-chain (assessment of the sub-chain will assess and quantify environmental impacts related to the production of the bio-products from agricultural raw materials taking into account energy consumption, transportation, waste and avoided productions (i.e. avoided production of conventional products to be substituted by the bio-products)).

This uniqe integrated economic/environmental assessment tool can as an example be used to assess value chains for production of grass based “green” protein as substitute for soy meal. The assessment will cover all value chain aspects from biomass production to end use products.

Such holistic bioeconomy value chain assessments are used in the Danish Bioeconomy panel as part of the basis for further recommendations.

Assessment tools for sustainability monitoring of added-value networks in the bioeconomy

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Background

The recent strategies for developing a bioeconomy support the material use of biomass by bio-based industries such as the chemical industry, the wood industry, the pulp and paper industry. The transition from linear added-value chains of individual companies towards circular added-value networks by means of cross-sectoral joint production and cascade use demands for the establishment of common resource management systems and assessment tools at different scales (e.g. the plant scale, product scale and cluster scale) to monitor, assess and optimize the implementation of innovative conversion processes and supply chains between the different industries.

Objective

The application of lignin-based resins from biorefineries e.g for production of fibre-reinforced foams and laminates in bio-based composites or for modification of engineered wood products for improved durability of load-bearing structures represents an excellent example for bioeconomy research on joint production between different wood-based industries thoroughly investigated by various researchers and practitioners in the “Leading-Edge Cluster Bioeconomy”.

Activities

Starting point for adopted monitoring approaches of those future added value networks is the assessment of processes and products as the above mentioned with regard to the minimization of environmental impacts, the minimization of resource competition and waste production-with Life Cycle Assessment tools regarding the associated material and energy flows and environmental impacts. Furthermore for assessing the cross-sectoral added-value networks from cluster scale perspective a sustainability monitoring tool was developed. The methodology for the tool integrates established Life Cycle Assessment methods (such as Life Cycle Assessment and Life Cycle Costing) and extended them with a recently developed methodology for social Life Cycle Assessment, Eco-Efficiency Assessment and with End-of-Life Management scenarios in order to assess different production and recycling options according to their potential economic, social or environmental effects. Finally by aggregating the data from these assessment a sustainability index is derived, which can monitor established and emerging process chain designs of industrial networks in wood-based bioeconomy according to their sustainability performance.

Results

Thereby a broad range of sustainable options for coupled production and cascade use between future biorefineries and established wood-based industries within bioeconomy regions can be evaluated. The analytical results generated from these analysis help to identify sustainable wood resource conversion and utilization pathways for a bioeconomy.

Lessons-learned

As important results the most relevant monitoring parameters for the wood-based industries were identified for the different scales (e.g. efficiency of energy use at plant and industry level and the added value of by-product utilization for individual companies) and a web-based sustainability monitoring tool for assessing coupled productions options against business-as-usual references was established. From our analysis we can draw the conclusion that assessing the sustainability of biomass chains should be done with a regional life cycle perspective encompassing.

Reducing fossil peat in growing media by biochars

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Background

Efficient agriculture and horticulture are highly dependent on fertile soils and suitable growing media. In Europe the horticultural production is mainly based on growing media, which are dominated by peat deriving from large reservoirs of peatlands primarily in Baltic and Skandinavian countries. In 1999, nearly 40 million m3 of peat were used across the world in horticulture. Since peat can not be considered as a renewable but as a fossil source the sustainability of its use on the long-term has to be questioned. A negative side-effect of agricultural plantations on peatlands, peat mining and the horticultural use of peat dominated growing media is the increase of greenhouse gas emissions.

Objective

Although growers are interested in new compounds for growing media, it is not easy for them to find those organic materials, similar to peat, which may fulfil not only the demand of hobby gardeners but also the demand of the professional market. As one innovative material biochar is discussed. It derives from thermal carbonization of biomass and organic waste materials, obtaining a new value-added step. The key questions are whether biochar can be combined with other non-peat materials, and to which extent biochar may work in growing media.

Network activity

Since peat resources are limited and the supply of new substrates is urgently needed for the production of growing media, a workshop of the EU COST Action TD1107 *Biochar as option for sustainable resource management* was held at the Estonian University of Tartu in May 2015. This workshop aimed to discuss about *opportunities for using biochar in synergy with peat as constituents of growing media*. The view of stakeholders on new biochar based growing media has been involved in order to consider their business interests and to facilitate the introduction of new compounds in growing media.

Results

Growing media must ensure basic physical and chemical constituents. In today's sophisticated nurseries, tailor-made fertilizers and crop-specific growing media are essential for both yield and quality. First results on a lab scale have been reported with a range of biochar content in growing media of up to 50 and 80%. On large scales, companies in Estonia and Finland have started to use biochar as absorbing agent in their growing media products. Lessons-learned and Recommendations The question how much of peat might be replaced in growing media depends on functional aspects, which comprise physical, chemical and biological (e.g. pathogen interaction) properties. It can be expected that also in Germany biochar, coming from local or regional sources, will be used increasingly in growing media as long as availability and quality standards are guaranteed, environmental impact reduced and their economic feasibility and competitiveness is given.

OrCaCel – OrganoCat plant and pulping combinations for the full valorization of lignocellulose from marginal land grown perennial plants

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Background

For a reliable and sustainable production of bio-based chemicals and fuels, the development and enhancement of next generation bio-refineries is of great importance. Avoiding the competition with food and feed, alternative cultivation strategies such as usage of marginal lands is essential for a sustainable biomass valorisation. An important aspect is the effect of cultivation and harvesting conditions of the biomass, as it affects the composition of the produced biomass and thus the subsequent disintegration and fractionation.

Objectives & Activities

The OrCaCel project addresses the optimization of valorisation of lignocellulosic biomass by an integrated approach combining plant management and the disintegration *via* the OrganoCat process. Correlation of the data generated by characterizing the OrganoCat product streams with the data provided by the analysis and characterization of the original biomass creates new conversion chains for biomass determined for defined chemicals and energy storage.

Results

The preliminary research focuses on perennial plants like *Sida hermaphrodita*, which can be cultivated on marginal lands, generate high amounts of biomass and can produce diverse biomass compositions when managed differently. To choose a harvest time point, best suited for a subsequent pre-treatment process, field plots of Sida hermaphrodita and specific plant parts were analysed for their biomass composition. In parallel, the feedstock qualities were determined by the ratios of the main cell wall components (e.g. pentose-hexose ratio, cellulose-hemicellulose–lignin ratio) in a particular harvest, i.e. plant development stage. Furthermore, the OrganoCat process was further developed raising the biomass-to-solvent and –catalyst ratio, which leads to higher product concentrations in the effluents.

Lessons-learned & Recommendations

The OrCaCel project is an innovative project, which integrates cultivating of biomass and disintegrating lignocellulosic biomass to achieve an overall improved production-utilisation system. To understand the influence of different periods of growth on the perennial plants, compositional analyses were conducted. This facilitates the selection of the appropriate harvest time point to obtain the most suitable biomass composition to be applied to the OrganoCat process. Vice versa, the OrganoCat process was improved to raise efficiency of the pre-treatment and fractionation.

Shaping the future bioeconomy

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Background

The bioplastics industry is growing at a rate well above average with production capacities of plastics that are biobased, biodegradable, or both increasing by 20 to 100 percent each year. Europe is leading in R&D and provides a huge potential market for bioplastics, yet, is lacking the necessary legislative framework to ensure and attract investments into production and conversion as well as to support a full-scale market penetration of bioplastic products. Europe is in danger of missing out on the benefits of the bioplastics industry – from reduced environmental impact to creation of high-skilled jobs.

Objective

Create a favourable legislative landscape across the EU for the European bioplastics industry to flourish in.

Activity

- Representation of the interests our industry at EU level, mostly with regards to the issues of resource efficiency, use cascades, biorefineries, green public procurement and efficient waste management
- Promote standardisation of biobased products and biodegradable/compostable products
- Publication of an increasing set of market data and comprehensive consumer information
- Connecting different research efforts EU-wide/international
- Cooperation-building within the European bioeconomy, e.g. as member of the European Bioeconomy Alliance
- Creating of networking platforms such as the annual European Bioplastics Conference

Results

- EUBP is a respected knowledge partner for policy makers and institutions in Brussels on the important issues of the Circular Economy Package, biobased feedstock availability, use cascades, waste targets, etc.
- Standardisation relevant to bioplastics is progressing; market introduction and communications around the standards are being facilitated
- An ever-growing network comprising of relevant stakeholders from the agro-sector to waste management.

Lessons-learned and Recommendations

- The EU needs to focus on measures close to market introduction
- Bioplastics are a relatively small industry that is meet with a lot of interest but also partly misguided/exaggerated expectations (time-wise)
- Many measures are falling short of truly considering a life cycle approach
- Emotional debates such as the „food vs. fuel debate“ need to be “reset” to fact-based discussions, otherwise we are torpedoing our innovative potential.

Review of the environmental sustainability of bioeconomy value chains

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The bioeconomy concept refers to the sustainable exploitation of renewable biological resources for the production of energy, food&feed and bio-based products. It is a cross-sectorial concept which offers opportunities for investment in several sectors, including: agriculture, forestry, fisheries and biochemical industries. The European Commission announced its strategic interest on bioeconomy through the communication: "Innovating for Sustainable Growth: A Bioeconomy for Europe" COM(2012) 60, highlighting the unique opportunity to accomplish economic growth while guarantying resource security and efficiency through strategic and sustainable use of renewable biological resources.

The growing interest in bioeconomy has boosted the development of new value chains and technologies for the conversion of biomass into food, feed, energy and bio-based products, as well as increased the efficiency of well-established conventional value chains. A comprehensive sustainability assessment of bioeconomy is a key issue to direct investments towards the most sustainable value chains and to determine the impacts of shifting from the current petrol-based economy to a more bio-based one. Life Cycle Assessment (LCA) is a broadly accepted method that can be used to quantify the impacts along bioeconomy value chains (i.e. from cradle to grave) [2].

The objective of this work was to perform a review analysis of publicly available LCA studies for the three pillars of bioeconomy: food, bioenergy and bio-based products. This analysis encompassed 7 bioenergy value chains, 10 bio-based products and 6 food products. A gap analysis of the published data revealed that apart from few products (such as liquid biofuels, some biopolymers and food crops) the environmental assessment of bioeconomy value chains is still in its infancy and its scope is often limited to very few impact indicators (i.e. GWP and energy efficiency). The analysis also showed that uncertainty over LCA results is significant. Among the several factors that contribute to this uncertainty, perhaps the most important ones are those related to energy efficiency, system boundaries and allocation. Comparisons with the fossil-based alternative value chains were performed for the bioenergy and bio-based products, which revealed benefits and tradeoffs of the bio-based value chains considered.

[2] EC – JRC – IES, 2014. Methodology for environmental sustainability assessment in the framework of bioeconomy observatory.

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The efficient use of wood as regional resource – an ecological assessment of common and new technologies for material wood processing

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Background

Global challenges such as climate change, financial crisis or decreasing fossil resources have major influence on many organizations when it comes to resource-related issues and, therefore, call for a changed behavior based on well thought-out decisions from where to take future resources. With the development of innovative manufacturing technologies for the material use of the regenerative resource “wood”, new areas of application e.g. in construction and furnishing can be exploited. Furthermore, the wood-inherent properties can be enhanced making it more resistant towards environmental impacts and, thus, making it more economically competitive. But only when bioeconomy goes hand in hand with sustainable forest management, regions can benefit from the entire spectrum of forest ecosystem services in the long run.

Objective

This research intends to systematically investigate the environmental assets and drawbacks of different wood processing technologies (naturally impregnated tropical timber, chemical impregnation, thermal treatment, thermal-mechanical treatment = moulded wood) under consideration of the full life-cycle.

Activity

With the help of a literature research, appropriate indicators have been identified which are particularly suitable for an integrated evaluation of wood as regional resource. They have been classified according to ISO 14031 as Environmental Condition Indicator (ECI) or Environmental Performance Indicator (EPI). The assessment and ranking of the different cases is based on quantitative and qualitative data from literature research or own calculations.

Results

In the upstream chains the regional aspects, namely the origin of the wood, play the major role for the ecological assessment. As ecosystems show different levels of sensitivity and trade-offs exist between ecosystem services (biodiversity, carbon storage, air cleaning, value creation), the use of primary forest has to be seen as least sustainable. Wood treatment technologies can take pressure from such fragile ecosystems by utilizing less critical wood species. During the manufacturing of wood products the high material efficiency of moulded wood reduces the cumulated energy demand likewise the environmental impacts coupled to energy generation. The environmental advantage during use depends on the lifetime and whether the properties of the wood product are adequate to substitute other materials. Different LCA studies show here a general advantage to common materials such as steal or concrete. The emission of toxins from chemical impregnation poses a problem not only during the use phase of wood products. Also the end-of-life phase is affected since toxic ingredients from weather coatings prevent the application of cascading use concepts.

Lessons-learned and Recommendations

A next step should be a comparative life-cycle assessment of all described wood processing technologies within a common scope. Moreover, the weighting factors should be developed within a group of stakeholders. Especially, as the use of long-term products in furnishing gets in conflict with the short period of trends, further socio-economic research about acceptance and preferences has to be conducted. From the technical point of view thermal mechanical treatment has to be improved so that coatings can be minimized as far as possible.

A methodological approach for the assessment and optimization of wood based biorefinery concepts

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Background and purpose of the work

The strong global dependence on fossil fuels results from the intensive use and consumption of petroleum based derivatives. With regard to the risks of diminishing petroleum reserves and growing climate change, there is need for an ecological and political acting. One promising approach is the change-over from a fossil-based chemistry to a bio-based in order to ensure the long-term supply with basic chemicals and energy. The utilization of biorefineries is thereby seen as a path with great prospects. Due to the multitude of possible raw materials, products, conversion pathways and combinations of technologies, the development and/or optimization of sustainable biorefineryconcepts, based on economic and ecological criteria, turns out to be a major challenge. For this reason it is necessary to provide the process engineers with a robust assessment methodology which already starts at the conceptual work.

The purpose of this study, which takes place in the scope of the joint project “Spitzencluster BioEconomy” and is funded by the German Federal Ministry of Education and Research, is to develop a robust methodology for the assessment and optimization of biorefineries on the basis of economic and environmental parameters as well as an eco-efficiency analysis.

Approach

For this purpose an exemplary wood based biorefinery concept with the main products ethylene and lignin and the by-products biomethane and hydrolysis lignin was simulated with the process simulation software Aspen Plus®. For the economic assessment a dynamic investment calculation is performed. The environmental assessment is conducted by life cycle assessment using the impact assessment method ReCiPe 1.08. Based on the results of these calculations key parameters of the biorefinery concept can be identified and optimization approaches are developed. For a concluding and comparative evaluation of the original biorefinery concept and its optimizations alternatives a new ecoefficiency analysis is applied. By means of this analysis, the following questions can be discussed:

- Is the construction and operation of the biorefinery profitable?
- Do the products of the biorefinery lead to less environmental impacts compared to fossil based reference products?

Results

By means of the created assessment methodology it is shown that the highest potential for an economic and environmental improvement of the exemplary biorefinery-concept is the reduction of process steam and other process energy as well as the utilization of further by-products. Therefore various optimization approaches were used, e.g. mechanical vapor compression and thermal coupling of separation columns, heat integration by pinch analysis and recovery and liquefaction of fermentation CO_2. Furthermore, it is shown that the eco-efficiency of the original biorefinery-concept was increased by the implementation of the optimization approaches.

Conclusions

The assessment methodology allows a distinct identification of economic and environmental key parameters and the elaboration of promising optimization approaches for biorefineries. The newly developed eco-efficiency approach enables a fair economic and environmental comparison between different biorefinery-concepts and already existing technologies. Finally the assessment indicates the possibility to design profitable biorefinery concepts causing less environmental impacts compared to corresponding fossil reference systems.

Market acceptance of bio-based products: Factors in business-to-business and public procurement

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Background

The authors will present an overview of the results of two expert surveys on the acceptance of bio-based products in the B2B market and in public procurement, conducted in the context of the EU-financed project "Open-Bio: Opening bio-based markets via standards, labelling and procurement".

Objective

The B2B survey provides an overview of key market drivers and barriers as well as perceptions on the role of product labeling and standardization for enhancing the uptake of bio-based products. The procurement survey focused on possible measures and informational needs of public procurement officers for enhancing the uptake of bio-based products in (green) public procurement.

Activity

The survey was administered as a two-stage Delphi survey with over 320 respondents from 17 EU member states on the B2B market and 171 respondents on the procurement sector from 12 different EU member states.

Results

According to the business experts, the B2B market uptake of bio-based products will be mainly driven by their positive public image and certain environmental benefits. High and volatile production costs are important market barriers, the more so as the prospects for receiving a green premium are rather low. Furthermore, an unsupportive regulatory environment and uncertainty about future regulation seem to hinder a stronger market uptake, whereas concerns about social and environmental impacts and the use of GMOs in feedstock production are not considered important market barriers. Regarding the development of a European label for bio-based products, business experts support the introduction of a bio-based label, which addresses additional environmental criteria and feedstock-sustainability-related issues.

Key findings of the procurement sector survey include that bio-based products are not yet considered a relevant category in green public procurement and that bio-based content on its own is typically not viewed as a relevant justification for inclusion in green public procurement schemes. The lack of practical guidance and information on bio-based products creates uncertainty regarding the use of specifications on bio-based content in public procurement. Moreover, eco-labeling schemes are important points of references for green public procurement, suggesting that the incorporation of bio-based content as criteria in relevant labeling schemes could also promote their uptake in green public procurement.

Lessons-learned and Recommendations

Both business and procurement experts await a clear political signal for a stable and long-term regulatory support of bio-based products as significant contributions to a transition towards a circular economy. The further development of the market also depends on the establishment of competitive prices vis-á-vis conventional fossil-based products. An important result is that significant differences exist regarding the market drivers for bio-based products across different EU countries, a point to be taken into account when developing harmonized approaches for the EU.

FISCH, the cluster for sustainable chemistry in Flanders, as a catalyst for building new bio-based value chains

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Background

FISCH, Flanders Innovation Hub for Sustainable Chemistry, is a public-private partnership between the Flemish government and the chemical industry.

Objective

The mission of FISCH is to identify, stimulate and catalyse innovations for sustainable chemistry in Flanders. In order to reach its goals, FISCH controls an innovation budget of circa 5M € per year.

Activities

The innovation agenda of FISCH consists of four programs: Renewable Chemicals, Sidestream Valorisation, Process Intensification and Advanced Sustainable Products. Within these four programs, FISCH develops strategic roadmaps and sets up innovation projects with its member companies and research institutes. The main focus is on collaborative research and development projects covering new value chains with short to midterm valorization by companies active in Flanders. In addition, FISCH supports strategic basic research with longer term valorization, infrastructure- and incubator-related activities and pilot- and demonstration-scale projects. For setting up pilot projects in the domain of bio-economy, FISCH collaborates with the regions of North-Rhine Westphalia and the Netherlands within the BIG-C consortium.

Examples of collaborative projects within the Renewable Chemicals Program:

OMEGA-EXTRACT: Downstream processing of photoautotrophic micro-algae for high added value omega-3 rich algae oils at pilot scale. Partner companies Proviron, Ecotreasures and Gova. Partner research institutes KULeuven, Ghent University and VITO.

CARBOLEUM: Catalytic conversion of carbohydrate side streams to develop new, innovative chemical applications. Partner companies Cargill, Taminco and EcoVer. Partner research institutes KULeuven, Ghent University and VITO.

AMBER: Valorization of protein-rich sides streams from biofuel production for applications in the feed and chemical industry. Partner companies Aveve Group, Lawter, Nuplex and Boss Paints. Partner research institutes VITO, KULeuven and Antwerp University.

Results

In a time frame of 3 years, FISCH started up 20 collaborative projects between 36 companies of which 15 SMEs and supported 16 collective projects. All together, these FISCH projects will deliver 211 new jobs and an economic leverage factor of 28 on the spend subsidies.

Lessons-learned and recommendations

A public-private partnership between industry and government, and with an important role for the research institutes, is an effective way to support the larger scale collaboration projects that are necessary for the transition towards a bio-based economy.

Feedstocks for the industrial biotechnology

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Background

Renewable resources can be utilized directly, e.g. as energy carriers, as packaging materials, as fibres, for the production of colouring agents or as lubricants. However, they can also be converted biotechnologically by enzymes and microorganisms, giving us access to a multitude of biocompatible products and possible uses. The industrial application of renewable resources is one of the five priority fields of action, which were identified in the "National Research Strategy BioEconomy 2030" to address a cascading and coupling use of biomass. In this context of application paths (biomass for food & feed, as industrial raw materials, energetic use) the food security always takes the highest priority followed by higher added value products like chemicals and materials.

Objective

Besides increasingly important issues with regard to quantity and availability of raw materials together with their properties and quality the feedstock costs are very important for the production of bulk chemicals. Especially for biotechnological processes, in which the carbon of various substrates should be converted into microbial products, there is an increasing interest in the use of cheap raw materials, biogenic residues and wastes.

Renewable feedstocks (e.g. lignocellulosics, green biomass, agro-residues, and food waste) are being used as raw materials for the production of microbial lactic acid (LA). Lactic acid, its salts and esters have a wide range of potential uses and are extensively used in diverse fields, e.g. bioplastics (PLA).

Research Activities & Results

There have been various attempts to provide bulk chemicals like lactic acid from inexpensive raw materials also at low costs. The value of (agri/food) residues as carbon and/or nutrient source depends on their specific contents of cellulose, hemicellulose, lignin, starch, protein and minerals. The different materials have to undergo a pre-treatment and hydrolysis to release the fermentable sugar components. Various methods for the pre-treatment are available and widely used. Possible disturbing impurities and inhibitors (e.g. phenolic components from lignocellulosics, heavy metals in municipal waste or recycled paper), difficult to use components (e.g. pen-toses) and partly fluctuating or relatively low concentrations of bioavailable carbon sources in these materials should be considered. Special detoxification steps can help to improve the fermentability and conversion efficiency of such lignocellulosic hydrolysates.

Lessons-learned and Recommendations

Because of the relatively low price of LA, one of the major challenges in its large-scale fermentative production is the cost of the raw material. Together with the need of low-cost carbon, coming more and more from food and agro-industrial residues and by-products there is an additional demand of suitable supplements, which should not cause additional costs and problems in view of impurities. Therefore an optimization is necessary to find a balance between the substitution of expensive nutrients and the limitation of interfering or undesirable components of natural raw materials, respectively. Exploitation of high quality L(+)- and D(-) lactic acid for the production of biopolymers is one of the recent applications.

FPC – a bio-composite from agricultural waste to replace/reduce plastics

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Background

Forest or agricultural waste such as wood chips, bamboo chips, rice husks, wheat husks, corn stalks, cotton stalks, sugarcane bagasse, Palm or coconut shells, coffee residues, etc. are very often burned away especially in the rural area of countries such as China, India and Southeast Asia. The air quality in the atmosphere is severely impacted by such out-of-control burning due to the huge volume of such agricultural waste generated each year.

Objectives

The ubiquitous use of plastics nowadays in our society and the consequences of the garbage problems have prompted most governments and organizations to urge citizens to reuse, reduce and recycle. Nevertheless, the sheer volume of today's plastic garbage remains a consistent headache for urban authorities and environmental protectionists.

Activities

FPC (Fiber Particulate Composite), a new bio-composite from wood chips or agricultural waste to replace or reduce the use of plastics, is the effective way to solve the above problems. FPC is made of 100% natural ingredients from any agricultural waste which contains fiber, and our proprietary natural compatibilizer which is mainly from starch, that enables FPC to be used like a "plastic" with all of plastic molding methods existed today.

Recommendations

FPC can be used by itself (in this case, 100% replace of plastic use), products such as golf-tee or planting pots made of 100% FPC are categorized as bio-degradable and compostable; and also can be mixed with other petrochemical plastics (such as PP, PE, PVC, EVA, natural rubber or synthetic rubber etc.) or bio-plastic (such as PLA, etc.) to create Bio-Hybrid Products (in this case, the reduce of plastic use, typically in the range of 30~60%) which is not only eco-friendly, but also healthier since it will reduce the pungent smell typically associated with plastics and cost no higher than it's petrochemical counterparts.

FPC uses ZERO (0) carbon footage garbage as it's main material, can reduce the growing size of forest or agricultural waste, and potentially can reduce the air pollution due to the burning of such waste, and reduce the use of plastic, significantly decrease the greenhouse gas emission while creating a new generation of bio material which is sustainable, healthy, eco-friendly and at no higher cost.

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Regular updates, as well as videos, presentations and reports can be found following the Global Bioeconomy Summit on the website
www.gbs2015.com/resources.

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