Recovery of carbon stocks after wildfires in boreal forests : a synthesis

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Cool forests at risk?

The Critical Role of Boreal and Mountain Ecosystems for People, Bioeconomy, and Climate

#IBFRA18

17–20 September 2018

IIASA, Laxenburg, Austria

Welcoming words

Dear Friends, colleagues, Cool Forest Ambassadors, and honored guests,

It is a great pleasure to welcome all of you to our Cool Forests Conference in Laxenburg. This is the first time we have the honor to host this conference, the 18th IBFRA conference, in Austria.

This Cool Forests event is much more than a usual conference. It is the start of a collective effort to raise awareness about the critical role of boreal and mountain forest ecosystems for a sustainable future.

In 18 scientific sessions, world-leading and early-career scientists will examine the critical ecosystem functions and services of Cool Forests, identify their risks, and propose pathways to protect them. With their knowledge and expertise, we will develop key messages that are relevant for policymakers, the private sector, and civil society as a whole. The moderated science-stakeholder dialogues on the third conference day will stimulate and steer the process on how these key scientific findings can develop strategies and decisions by policy, industry, and civil society organizations.

Our aim is to take these messages forward and identify pathways to integrate them in the discussion at the international arena.

We thank all of you for contributing to this goal, by presenting your abstracts and keynotes, discussing the scientific findings, participating in a panel or by establishing new collaborations to enhance relevant research activities and to spread the insights in resulting publications and policy briefs.

We would also like to express our gratitude to the scientific committee for reviewing the abstracts, to all of our generous sponsors for supporting this event and to everyone else who contributed to making this conference possible. Thank you!

We wish you all a very insightful and stimulating event, encouraging all of us to join our efforts in identifying future pathways for the critical role of Cool Forests!
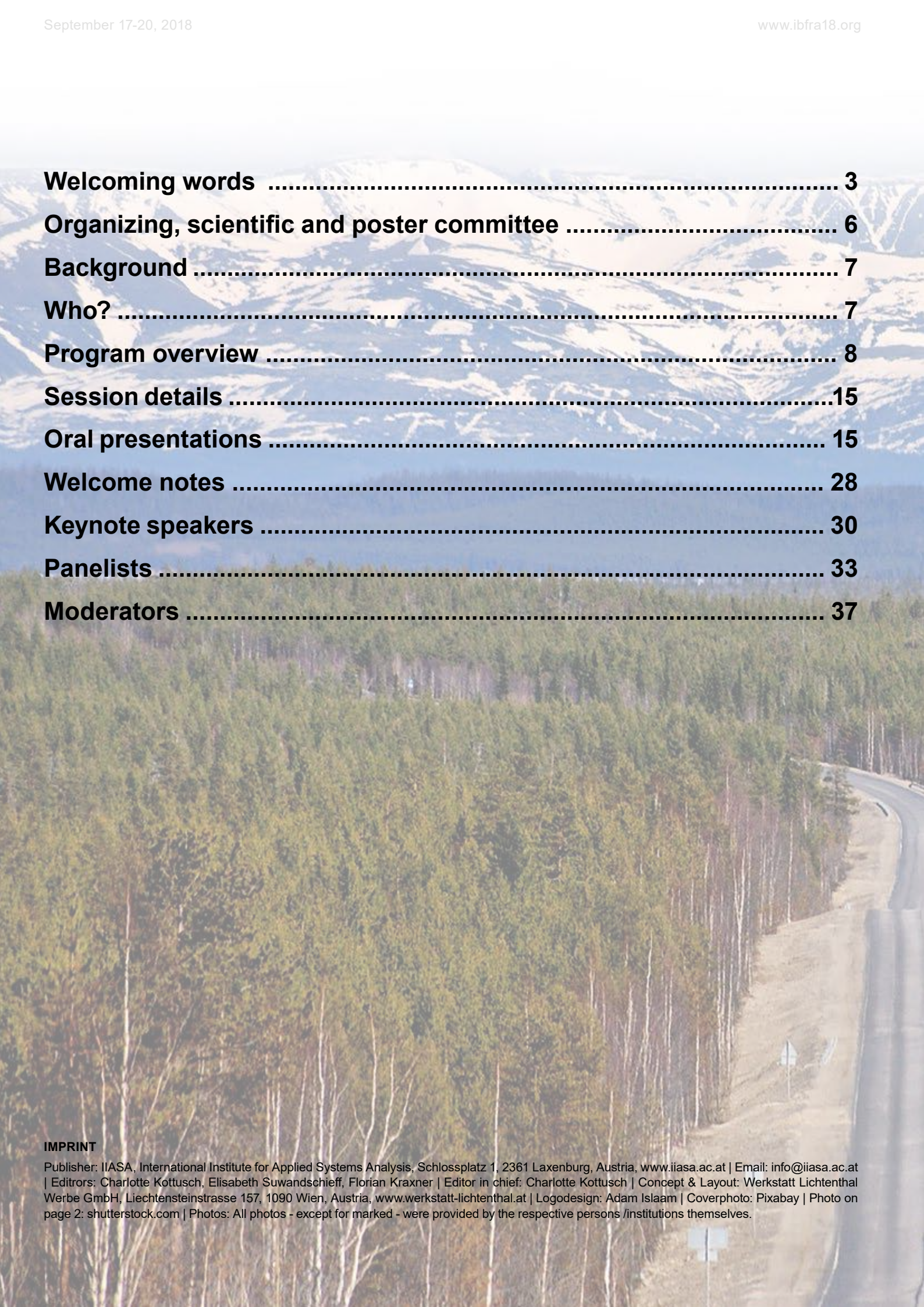
Florian Kraxner (Conference Chair)

Charlotte Kottusch
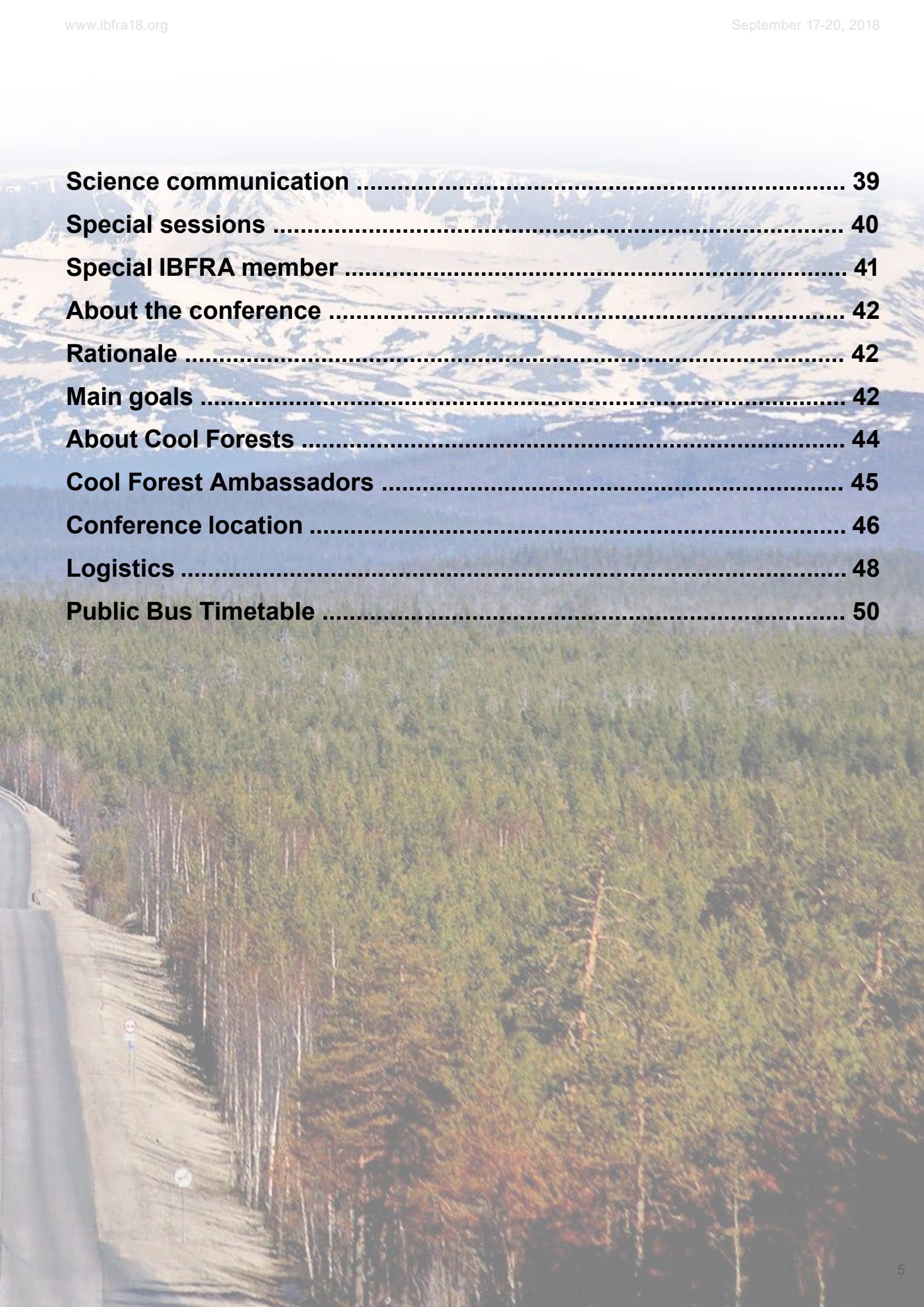
Anni Reissell

Anatoly Shvidenko

The Cool Forests Team

Organizing, scientific and poster committee

LOCAL

Florian Kraxner (Conference Chair)
International Institute for Applied Systems Analysis (IIASA), Austria

Charlotte Kottusch
International Institute for Applied Systems Analysis (IIASA), Austria

Anatoly Shvidenko
International Institute for Applied Systems Analysis (IIASA), Austria

Anni Reissell
International Institute for Applied Systems Analysis (IIASA), Austria and Institute for Atmospheric and Earth System Research (INAR), University of Helsinki, Finland

Gerald Steindlegger
ISS – Integrated Sustainability Solutions, Austria

Katica De Pascale
International Institute for Applied Systems Analysis (IIASA), Austria

Elisabeth Suwandschieff
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International Union of Forest Research Organizations (IUFRO), Austria

INTERNATIONAL

Rasmus Astrup
Norwegian Institute of Bioeconomy Research, Norway

Brian Bonnell
Natural Resources Canada–Canadian Forest Service, Canada

Susan G. Conard
George Mason University, USA

Werner Kurz
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Natural Resources Institute Finland (LUKE), Finland

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Alexander Onuchin
Sukachev Institute of Forest Siberian Branch, Russian Academy of Sciences, Russia

Christiane Schmullius
Department for Earth Observation, Friedrich Schiller University Jena (FSU), Germany

Eugene Vaganov
Siberian Federal University, Russia

STUDENT VOLUNTEERS (IFSA/BOKU)

Alice Cosatti
International Forestry Students' Association (IFSA)

Wolfgang Engl
International Forestry Students' Association (IFSA)

Dylan Goff
International Forestry Students' Association (IFSA)

Amila Meskin
International Forestry Students' Association (IFSA)

Erwin Moldaschl
International Forestry Students' Association (IFSA)

Dunja Sustic
International Forestry Students' Association (IFSA)

Background

The International Boreal Forest Research Association (IBFRA, http://ibfra.org/) is the only international public institution bringing together forest and ecological professionals, policy makers, civil society organizations, and other stakeholders from boreal and, to a significant extent, temperate zones. Established in 1991 by USSR, USA, Canada, and Nordic countries with a mission "… to promote and co-ordinate research to increase the understanding of the role of the circumpolar boreal forests in the global environment and the effects of environmental change on that role" (the White-Sea Declaration, 1991), during its 25-year history IBFRA has become an authoritative international forum on comprehensive studies of boreal and temperate forests and valuating their role in providing stability of the Earth climate system and global economy. IBFRA has organized 17 international conferences with a total of 3,500 participants and a substantial number of international studies, as well as several scientific expeditions in Northern Eurasia and Alaska. About 700 research papers have been published in proceedings and special issues of international peer-reviewed journals.

Who?

Partnering Institutions:

IBFRA: International Boreal Forest Research Association

The International Boreal Forest Research Association (IBFRA) was formed in 1991 with the mission to promote and coordinate research related to boreal forests.

IIASA: International Institute for Applied Systems Analysis

The International Institute for Applied Systems Analysis (IIASA) is an international scientific institute that conducts research into the critical issues of global environmental, economic, technological, and social change that we face in the twenty-first century. ESM (Ecosystems Services and Management), AFI (Arctic Futures Initiative) (and MLR: Mid-Latitude Region – Initiative)

PEEX: Pan-Eurasian Experiment

The Pan-Eurasian Experiment (PEEX) study is a multidisciplinary climate change, air quality, environment and research infrastructure program focused on the Northern Eurasian particularly arctic and boreal regions.

IUFRO: The International Union of Forest Research Organizations

IUFRO is „the" global network for forest science cooperation. It unites more than 15,000 scientists in almost 700 Member Organizations in over 110 countries, and is a member of ICSU. Scientists cooperate in IUFRO on a voluntary basis.

Program overview

DAY 1 Monday 17/09/18		
When	**What**	**Where**
08:00	Pick-up	Central Station, Vienna
08:30	Registration and Coffee	Conference Center Entrance
09:00 – 10:00	**Opening Ceremony** **Welcoming notes by:** ■ Introductory note by **Florian Kraxner**, Conference Chair, IIASA ■ **Nebojsa Nakicenovic**, IIASA Acting Director General/ Chief Executive Officer ■ **Rasmus Astrup**, Norwegian Institute of Bioeconomy Research and IBFRA President ■ **Alexander Buck**, IUFRO Executive Director ■ **Anni Reissell**, Arctic Futures Initiative Coordinator, IIASA, Research Coordinator, INAR, University of Helsinki, Finland; PEEX ■ **Ingwald Gschwandtl**, Director, Head of Forest Policy, Forest Economics and Forest Information in the Federal Ministry for Sustainability and Tourism of Austria	**Oval room**
10:00 – 10:30	Coffee & Posters	Foyer and Kaisergang
10:30 – 12:30	**PARALLEL SESSIONS 1**	
C1	Cool Forests impacts on the global carbon budget	Oval room
B1	Cool Forests as a resource	Marschall-zimmer I
PN1	Sustainable forest management, biodiversity and wildlife management	Marschall-zimmer II
12:30 – 13:30	Lunch	Foyer
13:30 – 15:20	**PARALLEL SESSIONS 2**	
Special Session 1	A strategy for protecting old growth forest in Europe	Oval room
B2	Afforestation, reforestation and plantations	Marschall-zimmer I

PN2	Biogenic disturbances in Cool Forests	Marschall-zimmer II
15:20 – 16:00	Coffee & Posters	Foyer and Kaisergang
16:00 – 18:00	**PARALLEL SESSIONS 3**	
C3	Processes in high latitude and high altitude, mountains and permafrost	Oval room
B3	Economics of ecosystem services, innovation and technological change	Marschall-zimmer I
PN3	Remote sensing and mapping of Cool Forests	Marschall-zimmer II
18:00	**End of day one**	
18:15	Pick up at Conference Center > Vienna	Conference Center

DAY2 Tuesday 18/09/18		
When	**What**	**Where**
08:00	Pick up	Central Station, Vienna
08:45 – 10:30	**PARALLEL SESSIONS 4**	
C4	Cool Forests and major biogeochemical cycles	Oval room
B4	Science-policy interaction	Marschall-zimmer I
PN4	Mid-latitude ecotone	Marschall-zimmer II
10:35 – 11:00	Coffee & Posters	Foyer and Kaisergang
11:00 – 13:00	**PARALLEL SESSIONS 5**	
C5a	Climate Change, negative emissions, and Cool Forests	Oval room
B5	Transition to sustainable forest management in Cool Forests	Marschall-zimmer I

C5b	UN and Paris Agreements and the SDGs (former Climate Session)	Marschall-zimmer II
13:00 – 18:00	**Excursion to alpine uplands (Alpines Vorland) on the critical role of water provisioning by mountain forests** Excursion guides: ■ **OFR DI Peter Lepkowicz** ■ **OF Ing. Emanuel Schlapfer** Snacks are provided in the Bus to the excursion area. An Austrian-style "Jause" (lunch) will be provided in the forest. The excursion will lead us to the Lower Austrian Alps where Vienna's drinking water originates. The guided tour in the alpine spring zone of the first Vienna Spring Water Main comprises of visits to the mountain area of Schneeberg (translated: snowy mountain), and to special forests stands including alpine forest rejuvenation areas, wildlife management and hydrological aspects of this ecosystem.	
	Drop off: Vienna Central Station Vienna – no return to Laxenburg!	

DAY 3 **Wednesday 19/09/18**		
When	**What**	**Where**
08:00	Pick-up	Central Station, Vienna
08:45 – 10:30	**PARALLEL SESSIONS 6**	
C6a	Wildfires in Cool Forests	Oval room
C6b	Current and future research and information needs	Marschall-zimmer I
Special Session 2	Participatory mapping of forest cover changes	Marschall-zimmer II
10:35 – 11:00	Coffee & Posters	Foyer and Kaisergang
11:00 – 13:00	**POSTER SESSION**	Kaisergang
11:00 – 13:00	Scientific keynote speakers meeting for stakeholder dialogue (closed meeting)	Kaminzimmer
13:00 – 14:00	Lunch Panelists lunch (closed meeting, Kaminzimmer)	Foyer

14:00 – 14:30	**Stakeholder Dialogue and Keynotes** (2 talks of 10 min & 5 min Q&A) **Introduction:** ■ **Florian Kraxner**, Conference Chair, IIASA **Stakeholder Keynote Lectures** ■ **Keynote 1: Maria Patek**, Austrian Federal Ministry for Sustainability and Tourism (BMNT): „The significance of mountain forests in Austria ■ **Keynote 2: Hubert Hasenauer**, University of Natural Resources and Life Sciences, Vienna: „The role of research and education to ensure sustainable development"	Oval room
14:30 – 15:30	**Stakeholder Dialogue on Climate** (moderated plenary session with a 10 min science keynote, 15 min panel statements, 15 min panel discussion and 15 min Q&A) ■ M**oderator: Christiane Schmullius**, Friedrich-Schiller-University Jena ■ **Science Keynote: Werner Kurz**, Canadian Forest Service, Natural Resources Canada/ Government of Canada **Panelists:** ■ **Eugene Vaganov**, Siberian Federal University ■ **Markku Kulmala**, INAR, University of Helsinki ■ **Stephan Singer**, Climate Action Network International ■ **Mette Wilkie**, Forestry Policy and Resources Division Forestry Department of FAO	Oval room
15:30 - 16:00	Coffee & Posters	Foyer and Kaisergang
16:00 – 17:00	**Stakeholder Dialogue on Bioeconomy** (moderated plenary session with a 10 min science keynote, 15 min panel statements, 15 min panel discussion and 15 min Q&A) ■ **Moderator: Gerald Steindlegger**, ISS Integrated Sustainability Solutions ■ **Science Keynote: Maartje J. Klapwijk**, Swedish University of Agricultural Sciences **Panelists:** ■ **Markus Lassheikki**, The Central Union of Agricultural Producers and Forest Owners, Finland ■ **Michael Proschek-Hauptmann**, Schweighofer Group ■ **Sten Nilsson**, Forest Sector Insights and Visiting Scholar, IIASA ■ **Jaana Bäck**, Forest Sciences, University of Helsinki ■ **Johann Kottulinsky**, VP Biorefinery and Pulp Trading, Lenzing	Oval room

When	What	Where
17:10 – 18:10	**Stakeholder Dialogue on People and Nature** (moderated plenary session with a 10 min science keynote, 15 min panel statements, 15 min panel discussion and 15 min Q&A) **Moderator: Peter Mayer,** Federal Research and Training Centre for Forests, Natural Hazards and Landscape, Austria **Science Keynote: Dipak Gyawali**, Pragya (Academician), Nepal Academy of Science and Technology (NAST) **Panelists:** ■ **Nikolay Shmatkov**, WWF Russia ■ **Denis Popov**, Mondi Group, Sustainable Development, Austria ■ **Lukas Mandl**, Member of the European Parliament ■ **Dolores Pavlovic**, IFSA President	Oval room
18:15 – 18:30	**Summary of key messages from the stakeholder dialogues** ■ **Florian Kraxner**, Conference Chair, IIASA	Oval room
18:45 – 18:50	**Cool Forests Group Picture** (All conference participants)	In front of the Conference Center
19:00 – 19:30	**Cool Forest Ambassador Signing Ceremony** **Welcoming words by:** ■ **Martin Eichtinger**, Minister of the State Government in representation of Johanna Mikl-Leitner, Governor of Lower Austria ■ **Andreas Januskovecz**, Director, Forestry Office and Urban Agriculture, Vienna	Schloss Restaurant
19:30 – 23:00	**Conference Dinner & Ball** (Reception with champagne, life music, dancing, wine tasting and buffet dinner) **Music:** ■ Vienna Philharmonics ■ IIASA band	
23:00	Pick up at Conference Center > Vienna	Conference Center
DAY 4 **Thursday 20/09/18**		
When	**What**	**Where**
08:00	Pick up	Motel One
08:45 – 08:55	**Opening: Introduction, rationale, aims, outcome** ■ **Moderator of the day:** Anni Reissell, IIASA, INAR, University of Helsinki	Oval room

09:00 – 09:40	**Science Focus – Looking into the Future – Early Career Scientists (ECS)** (Presentations by four ECS in panel 4 x 5 min & 15 min Q&A) **Moderator:** ■ Katharina Albrich, University of Natural Resources and Life Sciences, Vienna **Panelists:** ■ Manuel Rakos, former president of IFSA, BOKU ■ Hélène Genet, University of Alaska Fairbanks ■ Janice Burns, IUFRO ■ Adriana Gomez-Sanabria, IIASA	Oval room
09:45 – 10: 45	**SDG Keynotes** (3 talks of 15 min & 15 min Q&A) ■ **Moderator:** Gerald Steindlegger, ISS – Integrated Sustainability Solutions, Austria ■ **Keynote 1:** Bhaskar Vira, Cambridge University: "Integrating across themes & SDGs. The critical role of forests for the SDGs" ■ **Keynote 2:** Justina Ray, Wildlife Conservation Society Canada: "The exceptional value of intact forests in the boreal realm, with a focus on biodiversity" ■ **Keynote 3:** Mette Wilkie, Forestry Policy and Resources Division Forestry Department of FAO: "Mountain Forests and the SDGs"	Oval room
10:45 – 11:10	Coffee & Posters	Foyer and Kaisergang
11:10 – 13:00	**Science communicates: Who is listening? – Practical Experiences & Successful Communication** **Are you being heard? Find out how to communicate complex issues** **Moderator:** Florian Kraxner, Conference Chair, IIASA **Speakers:** ■ Maria De Cristofaro, Forestry Department, FAO ■ Kai Lintunen, Finnish Forest Association ■ Jennifer Hayes, USDA Forest Service ■ Faheem Chaudhry, M&C Saatchi London, global headquarters of M&C Saatchi Worldwide **Communication pitch presentations: Sell your story!** **Moderator:** Ping Yowargana, IIASA, Ecosystems Services and Management (ESM) Program **Three pitch presentations** **Jury:** ■ Markku Kulmala, INAR, University of Helsinki ■ Maria De Cristofaro, Forestry Department, FAO ■ Kai Lintunen, Finnish Forest Association ■ Denis Popov, Mondi Group, Sustainable Development	Oval room
13:00 – 14:00	Lunch	Foyer

| 14:00 – 15:15 | **Science strives for impact: Action & Collaboration**

■ **Moderator:** Raisa Mäkipää, Natural Resources Institute Finland

Stakeholder perspective (2 talks of 15 min & 5 min Q&A)
■ **Keynote 1 (live video):** Jack A. Kaye, Science Mission Directorate, NASA, USA: "NASA approach to Cool Forests"
■ **Keynote 2:** Frank Martin Seifert, Earth Observation Programme, ESA/ESRIN: „Space for Forests"

Panel introduction:
■ Werner Kurz, Canadian Forest Service, Natural Resources Canada/Government of Canada
This session will introduce the insight process of IBFRA. IBFRA insight is boreal focused research synthesis.

Panelists:
■ Alexander Buck, IUFRO
■ Florian Kraxner, Conference Chair, IIASA
■ Markku Kulmala, INAR, University of Helsinki and PEEX
■ Rasmus Astrup, Norwegian Institute of Bioeconomy Research and IBFRA President
■ Gerald Steindlegger, ISS Integrated Sustainability Solutions
■ Dr. Hillevi Eriksson, the Swedish Forest Agency | Oval room |
| 15:15 – 16:00 | **Closing of the Cool Forests Conference**

Closing remarks by:
■ **Raisa Mäkipää**, Natural Resources Institute Finland: "Concluding summary of the conference – major findings and relevance of scientific work to policy processes"
■ **Florian Kraxner**, Conference Chair, IIASA | Oval room |

Session details

Oral presentations

Date: Monday, 17/Sep/2018

10:30am
–
12:20pm/
12:30pm

C1 C1: Cool Forests impacts on the global carbon budget

10:30-12:30
Location: Laxenburg Conference Center, Ovaler Saal
Chair: **Anatoly Shvidenko**
Co-Chair: **Ekaterina Ezhova**

10:30am - 10:45am
Carbon emissions and removals from Mongolian boreal forest

Khongor Tsogt[1], Bat-Ulzii Chultem[1], Sanaa Enkhtaivan[2], Altangadas Janchivdorj[3], Khosbayar Battuvshin[3], Abu Mahmood[4], Mathieu VanRijn[4], Yeseul Byun[4], Ben Vickers[4]

1: UN-REDD Mongolia Naitonal Programme, Mongolia; 2: Climate Change Project Implementing Unit, Environment and Climate Fund, Mongolia; 3: Forest Research and Development Centre, Mongolia; 4: FAO Regional Office for Asia and Pacific

10:45am - 11:00am
Recent Decrease of Carbon Sink to Russian Forests

Dmitry Zamolodchikov[1], Vassily Grabowsky[2], Olga Chestnykh[1]

1: Lomonosov's Moscow State University, Russian Federation; 2: Center for Ecology and Productivity of Forests of Russian Academy of Sciences, Russian Federation

11:00am - 11:15am
Forests and forest-based sector carbon budget – Finland, Norway and Sweden 1960-2015

Hans Fredrik Hoen[1], Tomas Lundmark[2], Gustav Stål[2], Stein M. Tomter[3], Cristina-Maria Iordan[4], Francesco Cherubini[4], Pekka Kauppi[5]

1: Norwegian University of Life Sciences, Norway; 2: Swedish University of Agricultural Sciences, Sweden; 3: Norwegian Institute of Bioeconomy Research, Norway; 4: Norwegian University of Science and Technology, Norway; 5: University of Helsinki, Finland

B1 B1: Cool Forests as a resource

10:30-12:20
Location: Laxenburg Conference Center, Marschallzimmer
Chair: **Titta Majasalmi**
Co-Chair: **Alexander Alekseev**

10:30am - 10:45am
Does expansion of woody biomass material use outrun woody biomass energy use - the effect of socioeconomic development and representative concentration patways on the woody biomass use

Pekka Lauri
IIASA, Austria

10:45am - 11:00am
Developing regional G4M model to support wildlife management in Sweden

Anton Platov[1], Andrey Krasovskii[2], Oskar Franklin[2], Dmitry Schepaschenko[2], Florian Kraxner[2], Sylvain Leduc[2]

1: Vladimir State University (VLSU), Russian Federation; 2: Ecosystems Services and Management (ESM) program, International Institute for Applied Systems Analysis (IIASA)

11:00am - 11:15am
Forest Reference Levels for the EU Member States: Accounting under shared responsibility

Nicklas Forsell, Anu Korosuo
IIASA, Austria

11:15am - 11:30am
Long Rotation Forestry in Boreal Ecosystems of Russia: Special Conditions for Forest Management Planning and Design

Alexander Alekseev[1], Klaus von Gadow[2]

1: Saint-Petersburg State Forest Technical University, Russian Federation; 2: Burckhardt Institute, University of Göttingen

PN1 PN1: Sustainable forest management, biodiversity and wildlife management

10:30-12:20
Location: Laxenburg Conference Center, Marschallzimmer 2
Chair: **Maartje Johanna Klapwijk**
Co-Chair: **Per Angelstam**

10:30am - 10:45am
Species dynamics & dispersal syndromes across isolated Mountan Shola Forest in Western Ghats, India

Dr. Nagaraja BC1, Dr. Chethan HC2

1: Bangalore University, India; 2: university of Trans-Disciplinary, BangalorU

10:45am - 11:00am
Unique boreal forests of European Russia

Olga Smirnova[1], Tatiana Braslavskaya[1], Alexey Aleynikov[1], Vladimir Korotkov[2]

1: Centre for Forest Ecology and Productivity, Russian Academy of Sciences, Moscow (Russia); 2: Institute of Global Climate and Ecology, Moscow (Russia)

11:00am - 11:15am
Sustaining biodiversity in landscapes managed for forest productions, and the added complication of climate change.

Jim Schieck[1], Peter Solymos[2]

1: InnoTech Alberta, Canada; 2: University of Alberta, Canada

11:15am - 11:30am
Capturing complexity: Forests, decision-making and climate change mitigation action

Maartje Johanna Klapwijk[1], Johanna Boberg[1], Johan Bergh[5], Kevin Bishop[1], Christer Björkman[1], David Ellison[1,6], Adam Felton[1], Rolf Lidskog[4], Tomas Lundmark[1], E. Carina H. Keskitalo[2], Johan Sonesson[3], Annika Nordin[1], Eva-Maria Nordström[1], Jan Stenlid[1], Erland Mårald[2]

11:15am - 11:30am

Inland waters as key components of the C balance in northern landscapes

Paul A. del Giorgio[1], Susan Ziegler[2], Jan Karlsson[3], Erik Emilson[4], Lars Tranvik[5], Yves Prairie[6]

1: Université du Québec à Montréal, Canada; 2: University of Newfoundland, Canada; 3: Uninvertsity of Ümea, Sweden; 4: Great Lakes Forestry Centre, Natural Resources Canada; 5: Uppsala University, Sweden; 6: Université du Québec à Montréal, Canada

11:30am - 11:45am

Aerosol – radiation interaction and its effect on gross primary production of boreal and hemiboreal forests

Ekaterina Ezhova[1], Ilona Ylivinkka[1], Joel Kuusk[2], Kaupo Komsaare[2], Marko Vana[2], Steffen Noe[3], Alisa Krasnova[3], Mikhail Arshinov[4], Boris Belan[4], Sungbin Park[5], Jost Lavric[5], Martin Heimann[5], Jaana Bäck[1], Timo Vesala[1], Veli-Matti Kerminen[1], Markku Kulmala[1]

1: University of Helsinki, Finland; 2: University of Tartu, Estonia; 3: Estonian University of Life Sciences, Estonia; 4: V.E. Zuev Institute of Atmospheric Optics SB RAS, Russia; 5: Max Planck Institute for Biogeochemistry, Germany

11:45am - 12:00pm

On the methodological foundations of understanding regional carbon cycling of forest ecosystems

Anatoly Shvidenko[1], Eugene Vaganov[2], Dmitry Schepaschenko[1], Florian Kraxner[1]

1: International Institute for Applied System Analysis, Austria; 2: Siberian Federal University, Krasnoyarsk, Russia

12:00pm - 12:15pm

Large-scale quantifying of sources and sinks of atmospheric carbon in Siberian forests

Alexey Panov[1], Anatoly Prokushkin[1], Vyacheslav Zyrianov[1], Anastasiya Timokhina[1], Nikita Sidenko[1], Sung-Bin Park[2], Jošt Lavrič[2], Martin Heimann[2]

1: V.N. Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russian Federation; 2: Max Planck Institute for Biogeochemistry, Jena, Germany

11:30am - 11:45am

Forecasting forest management impacts on forest structure under changing climate

Titta Majasalmi, Clara Antón Fernández, Rasmus Astrup, Ryan M. Bright

Norwegian Institute of Bioeconomy Research (NIBIO), Box 115, 1431 Ås, Norway

11:45am - 12:00pm

When moose regulated bioenergy

Sylvain Leduc, Andrey Krasovskii, Dmitry Schepaschenko, Oskar Franklin, Florian Kraxner

IIASA, Austria

1: SLU, Sweden; 2: Umeå University, Sweden; 3: Skogforsk, Sweden; 4: Örebro University; 5: Linne University, Sweden; 6: Ellison Consulting, Switzerland

11:30am - 11:45am

How much forest is protected in Sweden? A simple question with many answers

Per Angelstam

Swedish University of Agricultural Sciences, Sweden

11:45am - 12:00pm

Determination of the resource potential of boreal forests using data from the state forest inventory of the Russian Federation.

Aleksei Grigoriev

Roslesinforg, Russian Federation

1:30pm – 3:20pm

| SS1 | **Special Session 1: A strategy for protecting old growth forest in Europe** |

1:30-3:20

Location: Laxenburg Conference Center, Ovaler Saal

This session focuses on old growth forest in Europe – it's most valuable and vulnerable habitat. Presentations by Toby Aykroyd, Wild Europe, Zoltan Kun, Frankfurt Zoological Society, and Steffen Fritz will be followed by a Q&A session.

Old growth forest is Europe's most valuable and vulnerable habitat. Yet everywhere it is coming under threat: from logging (much of it illegal) as timber prices rise, new roads, inappropriate grazing, even climate change.

The Old Growth Forest Protection Strategy, launched by Wild Europe, seeks to provide – for the first time – a coordinated approach to saving the remnants of this precious heritage.

Presentations:

1. **Toby Aykroyd**, Wild Europe, will explain the objectives of the Strategy and its achievements so far

2. **Zoltan Kun**, Frankfurt Zoological Society, will outline the old growth forest project he is leading to implement the Strategy

3. **Steffen Fritz**, IIASA, will provide information on a major interactive mapping instrument he is developing

These presentations will be followed by a plenary Q&A session with participants. This will include focus on answers to the Questionnaire circulated beforehand.

| B2 | **B2: Afforestation, reforestation and plantations** |

1:30-3:20

Location: Laxenburg Conference Center, Marschallzimmer

Chair: **Kjersti Holt Hanssen**

Co-Chair: **Theo Koller**

1:30pm - 1:45pm

High mitigation pathways with low biomass use for energy – tradeoff between afforestation and beccs

Pekka Lauri, Olga Turkovska, Michael Obersteiner, Georg Kindermann

IIASA, Austria

1:45pm - 2:00pm

Utilising forestry data to explain and forecast forest seedling demand

Theo Koller[1], **Martin Braun**[2], **Franziska Hesser**[1], **Peter Schwarzbauer**[2,1]

1: Wood K Plus (Kompetenzzentrum Holz), Market Analysis and Innovation Research Team, Austria; 2: University of Natural Resources and Life Sciences (BOKU), Institute for Marketing and Innovation, Austria

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2:00pm - 2:15pm

Biochar – A Cool new tool for afforestation practices in Cool Forests.

Egle Köster[1], **Jukka Pumpanen**[2], **Kajar Köster**[1]

1: University of Helsinki, Finland; 2: University of Eastern Finland, Finland

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2:15pm - 2:30pm

Mechanical site preparation as a measure to increase the regeneration success of planted conifers in Fennoscandia

Ulf Sikström[1], **Kjersti Holt Hanssen**[2], **Karin Hjelm**[1], **Timo Saksa**[3], **Kristina Wallertz**[4]

1: Skogforsk, Sweden; 2: Norwegian Institute of Bioeconomy Research, Norway; 3: LUKE, Finland; 4: SLU, Sweden

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| PN2 | **PN2: Biogenic disturbances in Cool Forests** |

1:30-3:20

Location: Laxenburg Conference Center, Marschallzimmer 2

Chair: **Evgeny Alexandrovich Vaganov**

Co-Chair: **Mia Landauer**

1:30pm - 1:45pm

Development of bark beetle outbreak in Western Tatra mountains.

Rastislav Jakuš, Miroslav Blaženec, Branislav Hroššo, Pavel Mezei

Slovak Academy of Sciences, Slovak Republic

1:45pm - 2:00pm

Siberian silk moth, pine looper, gypsy moth: why are you so aggressive?

Vladislav Sukhovolkiy[1], **Anton Kovalev**[2], **Olga Tarasova**[3]

1: V.N. Sukachev Institute of Forest SB RAS, Russian Federation; 2: Krasnoyarsk scientific Center SB RAS, Krasnoyarsk, Russia; 3: Siberian Federal University, Krasnoyarsk, Russia

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2:00pm - 2:15pm

Moose or spruce? Systems analysis for managing conflicts between wildlife, forestry, and society in Sweden

Oskar Franklin[1], **Christer Kalen**[2], **Andrey Krasovskii**[1], **Brady Mattsson**[3], **Dmitry Schepaschenko**[1], **Mirja Lindberget**[4], **Sylvain Leduc**[1], **Maria Hörnell-Willebrand**[4], **Hördur Haraldsson**[4], **Florian Kraxner**[1]

1: Ecosystems Services and Management (ESM) program, International Institute for Applied Systems Analysis (IIASA), Austria; 2: Swedish Forest Agency; 3: University of Natural Resources and Life Sciences, Austria; 4: Swedish Environmental Protection Agency

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2:15pm - 2:30pm

Weakeningfactors of boreal forests of Siberia

Vladimir Vladimirovich Soldatov[1], **Sergey Alekseevuch Astapenko**[2], **Dmitrii Viktorovich Golybev**[3], **Aleksei Aleksandrovich Ibe**[4], **Evgenii Aleksandrovich Vaganov**[5], **Anton I. Pyzhev**[5]

1: Branch of The Federal Budget Institution «Russian Center of Forest Health» – «Centre of Forest Health of Krasnoyarsk Region», Russian Federation;

2: Branch of The Federal Budget Institution «Russian Center of Forest Health» – «Centre of Forest Health of Krasnoyarsk Region», Russian Federation; 3: Branch of The Federal Budget Institution «Russian Center of Forest Health» – «Centre of Forest Health of Krasnoyarsk Region», Russian Federation; 4: Branch of The Federal Budget Institution «Russian Center of Forest Health» – «Centre of Forest Health of Krasnoyarsk Region», Russian Federation; 5: Siberian Federal University

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2:30pm - 2:45pm

Critical tipping points of reindeer management in Finland

Mia Landauer[1,2], Sirpa Rasmus[1], Bruce Forbes[1]

1: Arctic Centre, University of Lapland, Finland; 2: Risk and Resilience Program & Arctic Futures Initiative, IIASA, Austria

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C3 **C3: Processes in high latitude and high altitude, mountains and permafrost**	**B3** **B3: Economics of ecosystem services, innovation and technological change**	**PN3** **PN3: Remote sensing and mapping of Cool Forests**

4:00pm – 5:50pm/ 6:00pm

C3 column

4:00-6:00

Location: Laxenburg Conference Center, Ovaler Saal

Chair: **Viacheslav Kharuk**

Co-Chair: **Alma Mendoza**

4:00pm - 4:15pm

Integrated evaluation of the vulnerability to thermokarst disturbance and its implications for the regional carbon balance in boreal Alaska

Helene Genet

University of Alaska Fairbanks, United States of America

4:15pm - 4:30pm

Dissolved carbon in runoff of larch dominated catchments of Central Siberia

Anatoly Prokushkin[1], Alexey Panov[1], Vyacheslav Zyryanov[1], Jan Karlsson[2], Rainer Amon[3], William H. McDowell[4]

1: VN Sukachev Institute of Forest SB RAS, Russian Federation; 2: Department of Ecology and Environmental Science, Umeå University, Sweden; 3: Department of Marine Sciences, TAMUG, USA; 4: Department of Natural Resources and the Environment, University of New Hampshire, USA

B3 column

4:00-5:50

Location: Laxenburg Conference Center, Marschallzimmer

Chair: **Gabriel Fortin**

Co-Chair: **Ching Chuang**

4:00pm - 4:15pm

Regional impacts of new manufacturing technologies on the forest estate of Northland, New Zealand

Juan Jose Monge, Steve J Wakelin, Leslie J Dowling

New Zealand Forest Research Institute (Scion), New Zealand

4:15pm - 4:30pm

Impact of Global Climate Change on Duration of Winter-Felling Season in Siberia

Anton I. Pyzhev, Anna V. Chugunkova

Siberian Federal University, Russian Federation

4:30pm - 4:45pm

Optimal rotation sequence of Norway spruce in a changing climate

Jussi Lintunen, Aapo Rautiainen, Jussi Uusivuori

Natural resources Institute Finland (Luke), Finland

PN3 column

4:00-6:00

Location: Laxenburg Conference Center, Marschallzimmer 2

Chair: **Christiane Cornelia Schmullius**

Co-Chair: **Susan Conard**

4:00pm - 4:15pm

The use of satellite information (MODIS/Aqua) for phenological and classification analysis of plant communities

Yulia Ivanova[1], Vlad Soukhovolsky[2], Anton Kovalev[3], Oleg Yakubailik[4]

1: Institute of Biophysics, Federal Research Center "Krasnoyarsk Science Center SB RAS", Russian Federation; 2: Sukachev Institute of Forest SB RAS, Federal Research Center "Krasnoyarsk Science Center SB RAS"; 3: Federal Research Center "Krasnoyarsk Science Center SB RAS"; 4: Institute of Computational Modeling SB RAS, Federal Research Center "Krasnoyarsk Science Center SB RAS"

4:15pm - 4:30pm

Global harmonised in-situ data repository for forest biomass datasets validation

Dmitry Schepaschenko[1], Christoph Perger[1], Christopher Dresel[1], Liudmila Mukhortova[2], Natalia Lukina[3], Elena Tikhonova[3], Olga Trefilova[2], Leonid Krivobokov[2], Dilshad Danilina[2], Maria Konovalova[2], Andrey Osipov[4], Kapitolina Bobkova[4], Viktor Karminov[5], Olga Martynenko[5], Petr Ontikov[5], Alexey

4:30pm - 4:45pm

Estimating litter and soil carbon stocks on managed forest land in Alaska, USA

Grant Michael Domke[1], Andrew Gray[2], Brian Walters[1], Charles Hobie Perry[1], Lucas Nave[4], Stephen Ogle[3], Brendt Mueller[2]

1: Northern Research Station, USDA Forest Service; 2: Pacific Northwest Research Station, USDA Forest Service; 3: Natural Resource Ecology Laboratory, Colorado State University; 4: University of Michigan Biological Station

4:45pm - 5:00pm

Resilience of mountain forest ecosystems to climate change

Katharina Maria Albrich, Werner Rammer, Rupert Seidl

University of Natural Resources and Life Sciences, Vienna (BOKU), Austria

5:00pm - 5:15pm

Likely future of mountain forests under land use cover change and climate change scenarios in Mexico.

Alma Mendoza[1], Florian Kraxner[1], Rogelio Corona[2]

1: International Institute for Applied Systems Analysis, Austria; 2: Procesos y Sistemas de Información en Geomática S.A de C.V.

5:15pm - 5:30pm

Larch growth response to climate warming in the Central Siberia

Viacheslav I. Kharuk[1,2], Sergey T. Im[1,2], Ilya A. Petrov[1]

1: Sukachev Forest Institute RAS, Krasnoyarsk, Russia; 2: Siberian Federal Univercity, Krasnoyarsk, Russia

5:30pm - 5:45pm

Estimating relative contribution of autotrophic respiration to soil respiration in permafrost region of Alaska, using 13C pulse labeling method

Akira L. Yoshikawa[1], Masako Dannoura[1], Koh Yasue[2], Tetsuoh Shirota[2], Kenshi Takahashi[1], Tomoaki Morishita[3], Tomohiro Saito[2], Ryohei Yamamoto[4], Yojiro Matsuura[3], Kyotaro Noguchi[3], Christian Hossann[5], Roger W. Ruess[6]

1: Kyoto University, Japan; 2: Shinshu University, Japan; 3: FFPRI, Japan; 4: Forestry Agency, Japan; 5: INRA, France; 6: University of Alaska Fairbanks, USA

4:45pm - 5:00pm

Assessing the Payment of Ecosystem Services of Forests in Taiwan

WanYu Liu[1], Ching Chuang[2]

1: Dep of Forestry, National Chung Hsing University, Taiwan; 2: Dep of Forestry, National Chung Hsing University, Taiwan

5:00pm - 5:15pm

Studying wood quality in the context of a spruce budworm outbreak in eastern Canada

Gabriel Fortin
CEDFOB, Canada

5:15pm - 5:30pm

Analysis of the drivers of risks for cool forest management and build ecosystem resilience in Nepal's mountain

Dharam Raj Uprety, Bharat Pokharel, Rabin Niraula
HELVETAS Nepal, Nepal

Aleynikov[3], Tatyana Braslavskaya[3], Nikolay Shevchenko[3], Anatoly Shvidenko[1], Florian Kraxner[1]

1: IIASA, Austria; 2: V.N. Sukachev Institute of Forest, Russia; 3: Center of Forest Ecology and Productivity of the Russian Academy of Sciences, Russia; 4: Institute of Biology, Komi Scientific Center, Russia; 5: Forestry faculty, Bauman Moscow State Technical University, Russia

4:30pm - 4:45pm

Biogeophysical climate impacts of forest management in Europe inferred from satellite remote sensing observations

Jonas Schwaab, Ronny Meier, Sonia Seneviratne, Edouard Davin

ETH Zürich, Switzerland

4:45pm - 5:00pm

Studying Cool Forests at NASA under the Northern Eurasia Earth Science Partnership Initiative (NEESPI): A Retrospect

Garik Gutman[1], Pasha Groisman[2]

1: NASA Headquarters, Washington DC, USA; 2: NOAA National Centers for Environment Information, Asheville, NC, USA

5:00pm - 5:15pm

Satellite-derived Burned Area for Siberia (1979 – 2000)

Amber Soja[1], Brian Stocks[2], Stefano Potter[3], Brendan Rogers[3], Don R. Cahoon Jr.[4], Natasha Jurko[5], Susan Conard[6], William {Bill} deGroot[5]

1: NIA / NASA LaRC, United States of America; 2: B.J. Stocks Wildfire Investigations Ltd.; 3: Woods Hole Research Center; 4: Terra Systems Research; 5: Natural Resources Canada; 6: George Mason University

5:15pm - 5:30pm

Concerted Actions for Biome-related Forest Biomass Monitoring

Christiane Cornelia Schmullius[1], Richard Lucas[2], GlobBiomass and CCI Biomass Teams[1]

1: Friedrich-Schiller-University Jena, Dept. for Earth Observation, Germany; 2: Aberystwyth University, Earth Observation and Ecosystem Dynamics Research Group, UK

Date: Tuesday, 18/Sep/2018

8:45am
–
10:35am/
10:45am

C4: Cool Forests and major biogeochemical cycles

8:45-10:45

Location: Laxenburg Conference Center, Ovaler Saal

Chair: **Alexandr Alexandrovich Onuchin**

Co-Chair: **Raisa Mäkipää**

8:45am - 9:00am

Temperature sensitivity of carbon and nitrogen release in decomposition of boreal organic soils – assessment in different molecule fractions and effect of soil food webs

<u>Ari Laurén</u>[1], **Marjo Palviainen**[2], **Mari Lappalainen**[1]

1: University of Eastern Finland, Finland; 2: University of Helsinki

9:00am - 9:15am

Temperature sensitivity of CO2 and CH4 fluxes from decomposed coarse woody debris in boreal forests

<u>Liudmila Mukhortova</u>, **Svetlana Evgrafova, Maria Meteleva, Leonid Krivobokov**

Sukachev Institute of Forest SB RAS, Russian Federation

9:15am - 9:30am

Variation of non-structural carbon storage within a year in a whole-tree carbon balance framework

<u>Pauliina Schiestl-Aalto</u>[1], **Kira Ryhti**[1], **Annikki Mäkelä**[1], **Jaana Bäck**[1], **Liisa Kulmala**[1,2]

1: University of Helsinki, Finland; 2: Natural Resources Institute, Finland

9:30am - 9:45am

Linkages between diversity of decomposing fungal community, asymbiotic nitrogen (N2) fixation and methane (CH4) in dead wood

Raisa Mäkipää

Natural Resources Institute Finland, Finland

9:45am - 10:00am

A CONCEPTUAL APPROACH TO ASSESSING OF THE HYDROLOGICAL ROLE OF BOREAL FORESTS

B4: Science policy interaction

8:45-10:35

Location: Laxenburg Conference Center, Marschallzimmer

Chair: **Jaana K. Bäck**

Co-Chair: **Jeff Wells**

8:45am - 9:00am

Media coverage of forest fires and their association with climate change in Alberta, Canada

Debra J. Davidson[1], <u>Anthony Fisher</u>[1], **Gwendolyn Blue**[2]

1: University of Alberta, Canada; 2: University of Calgary, Canada

9:00am - 9:15am

The impact of protected area governance and management capacity on ecosystem function in Central America

<u>Carlos L. Muñoz Brenes</u>[1,2], **Kelly W. Jones**[3], **Peter Schlesinger**[1,4], **Juan Robalino**[2,5], **Lee Vierling**[1]

1: Department of Natural Resources and Society, University of Idaho; 2: Economics and Environment for Development Research Program, Tropical Agricultural Research and Higher Education Center (CATIE), Costa Rica; 3: Human Dimensions of Natural Resources, Colorado State University; 4: Postgraduate School, Tropical Agricultural Research and Higher Education Center (CATIE), Costa Rica; 5: School of Economics, Universidad de Costa Rica, San Pedro, San José, Costa Rica

9:15am - 9:30am

Common challenges for functional green infrastructure at high latitude and high altitude forests: a comparison between Sweden and the Carpathian Mountains

<u>Per Angelstam</u>[1], **Mariia Fedoriak**[2], **Johan Svensson**[3], **Taras Yamelynets**[4]

1: Swedish University of Agricultural Sciences, Sweden; 2: Chernivtsi National University, Ukraine; 3: Swedish University of Agricultural Sciences, Sweden; 4: Ivan Franko National University, Ukraine

9:30am - 9:45am

The Last Great Conservation Opportunity in Human History: Conservation in North America's Boreal Forest

PN4: Mid-latitude ecotone

8:45-10:35

Location: Laxenburg Conference Center, Marschallzimmer 2

Chair: **Woo-Kyun LEE**

Co-Chair: **Ivan Lakyda**

8:45am - 9:00am

Assessment of Net Primary Production of Cool forests in South Korea using three different methods

<u>Moonil Kim</u>[1,2], **Florian Kraxner**[2], **Dmitry Schepaschenko**[2], **Anatoly Shividenko**[2], **Andrey Krasovskii**[2], **Chulho Song**[1], **Woo-Kyun Lee**[1]

1: Korea University, Republic of Korea; 2: International Institute for Applied Systems Analysis, Austria

9:00am - 9:15am

Pinus koraiensis seedling mortality increased by decreasing soil water content under experimental warming and drought

<u>Hanna Chang</u>, **Yowhan Son, Seung Hyun Han, Jiae An, Heejae Jo**

Korea University, Korea, Republic of (South Korea)

9:15am - 9:30am

Disturbances impact on carbon emissions in forest ecosystems of Ukrainian Polissya

Petro Lakyda, Andrii Bilous, Victor Myroniuk, Roman Vasylyshyn, <u>Ivan Lakyda</u>, **Maksym Matsala, Petro Dyachuk**

National University of Life and Environmental Sciences of Ukraine, Ukraine

9:30am - 9:45am

Latitudinal approach for ensuring resilient cool forests in Mid-Latitude ecotone

<u>Woo-Kyun LEE</u>[1], **Cholho Song**[1], **Moonil Kim**[1,2], **Guishan Cui**[3], **Chul-Hee Lim**[1], **Sle-gee Lee**[1], **Somin Yoo**[1], **Seongbong Heo**[1], **Jooyeon Moon**[4], **Damin Kim**[5]

1: Korea University, Korea, Republic of (South Korea); 2: International Institute for Applied Systems Analysis (IIASA), Austria; 3: Yanbian University, China; 4: Green Technology Center, Korea, Republic of (South Korea); 5: Korea Environmental Industry & Technology

Alexandr Alexandrovich Onuchin, Tamara Burenina

V.N. Sukachev Institute of Forest Siberian Branch the Russian Academy of Sciences, Russian Federation

10:00am - 10:15am

How to improve current soil carbon models for boreal forests ?

Aleksi Lehtonen[1], Boris Tupek[1], Mikko Peltoniemi[1], Shoji Hashimoto[2]

1: Natural Reources Institute Finland, Finland; 2: Forestry and Forest Products Research Institute (FFPRI)

10:15am - 10:30am

Towards an integrated assessment framework to study the effects of forest management and climate on water fluxes in boreal landscapes

Stephanie Eisner[1], Shaochun Huang[2], Stein Beldring[2], Rasmus Astrup[1]

1: Norwegian Institute of Bioeconomy Research (NIBIO), Ås, Norway; 2: Norwegian Water Resources and Energy Directorate (NVE), Oslo, Norway

Jeff Wells

International Boreal Conservation Campaign, United States of America

9:45am - 10:00am

Sustainability and multi-functionality of European forests

Jaana K. Bäck, Olli Tahvonen, Timo Vesala

University of Helsinki, Finland

10:00am - 10:15am

Methodology for economic evaluation of forest resources: why the system does not work?

Maxim Lobovikov

Institute on Management and Economics of Forest Sector (SPbFTU), Russian Federation

Institute, Korea, Republic of (South Korea)

9:45am - 10:00am

Modelling the future of Ukrainian forests using climate change scenarios

Ihor Buksha[1], Anatoly Shvidenko[2], Svitlana Krakovska[3]

1: Ukrainian Research Institute of Forestry and Agroforestry Melioration, Ukraine; 2: International Institute for Applied Systems Analysis (IIASA); 3: Ukrainian Hydrometeorological Institute

10:00am - 10:15am

Divergent growth trends and climatic response of Picea obovata along elevational gradient in Western Sayan mountains, Siberia

Evgeny Alexandrovich Vaganov[1], Elena Babushkina[3], Liliana Delokopytova[3], Anna Barabantsova[2], Dina Zhirnova[3]

1: Siberian Federal University, Russian Federation; 2: National Park „Shushenskii Bor"; 3: Khakass Technical Institute

11:00am - 12:50pm/1:00pm

C5a **C5a: Climate Change, negative emissions, and Cool Forests**

11:00-12:50
Location: Laxenburg Conference Center, Ovaler Saal
Chair: **José Luis Vicente-Vicente**
Co-Chair: **Elena Tikhonova**

11:00am - 11:15am

The impact of extreme weather events on forests in the Russian Far East

Alexandr Ivanov[1], Mikhail Salo[2], Martin Braun[3], Dmitriy Zamolodchikov[4]

1: Primorskaya State Academy of Agriculture, Russian Federation; 2: Sikhote-Alin State Nature Biosphere Reserve; 3: University of Natural Resources and Life Sciences; 4: Moscow State University

B5 **B5: Transition to susatainable forest management in Cool Forests**

11:00-1:00
Location: Laxenburg Conference Center, Marschallzimmer
Chair: **Stephan Alexander Pietsch**
Co-Chair: **Brady Mattsson**

11:00am - 11:15am

Toward estimating greenhouse gas emissions and removals on managed forest land in Alaska, USA

Grant Michael Domke[1], Stephen Ogle[2], Brian Walters[1], James Smith[1], John Coulston[3], Hans-Erik Andersen[4]

1: Northern Research Station, USDA Forest Service; 2: Natural Resource Ecology Laboratory, Colorado State University; 3: Southern Research Station, USDA Forest Service; 4: Pacific Northwest Research Station, USDA Forest Service

11:15am - 11:30am

Balancing ecological and economic objectives in forestry: A tractable model of uneven-sized management

Elena Rovenskaya[1], Åke Brännström[1,2], Ulf Dieckmann[1],

C5b **C5b: UN and Paris Agreements and the SDGs**

11:00-12:50
Location: Laxenburg Conference Center, Marschallzimmer 2

11:00am - 11:15am

Mongolia – Tackling REDD+ in Boreal Forest Ecosystems: Development of a National Strategy

Khishigjargal Batjantsan[1], Oyunsanaa Byambasuren[2]

1: UN-REDD Mongolia National Programme, Mongolia; 2: Department of Forest Policy and Coordination, Ministry of Environment and Tourism, Mongolia

11:15am - 11:30am

Emissions, transitions and feedbacks

Steffen M. Noe[1], Ülo Niinemets[1], Heikki Junninen[2], Urmas Hõrrak[2], Ülo Mander[2], Kaido Soosaar[2], Alisa Krasnova[1], Dmitrii Krasnov[1], Sandra Metslaid[1], Ahto Kangur[1]

1: Estonian University of Life Sciences, Estonia; 2: University of Tartu, Estonia

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11:30am - 11:45am

Enhancing northeast British Columbia's boreal forest resilience and productivity in a changing climate

Christopher D B Hawkins, Christopher Maundrell

Adlard Environmental Ltd, Canada

11:45am - 12:00pm

Interrelations between soil fertility and vegetation in taiga forests

Natalia Lukina[1], Maria Orlova[1], Olga Bakhmet[2], Elena Tikhonova[1], Anastasia Kuznetsova[1], Daria Tebenkova[1], Alekandr Kryshen[2], Aleksey Gornov[1], Vadim Smirnov[1], Maxim Shashkov[3], Vyacheslav Ershov[4], Svetlana Knyazeva[1]

1: Center for Forest Ecology and Productivity RAS, Russian Federation; 2: Forest Institute of the Karelian Scientific Center RAS, Russian Federation; 3: Institute of Physical-Chemical and Biological Problems in Soil Science of Pushchino Scientific Center RAS, Russian Federation; 4: Institute of the North Industrial Ecology Problems of the Kola Scientific Center RAS, Russian Federation

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12:00pm - 12:15pm

The key role of soils in delivering ecosystem services in forests beyond carbon sequestration assessment: a case study in South Korea

José Luis Vicente-Vicente[1], Sabine Fuss[1], Woo-kyun Lee[2], Cholho Song[2], Yowhan Son[2], Jongyeol Lee[2]

1: Mercator Research Institute on Global Commons and Climate Change, Torgauer Str. 12, 10829 Berlin, Germany; 2: Department of Environmental Science and Ecological Engineering, Graduate School, Korea University, Seoul 02841, Korea

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12:15pm - 12:30pm

The multiple effect of increasing carbon sink (re-foresting and afforesting) on climate

Markku Kulmala[1], Jaana Bäck[1,2], Timo Vesala[1], Veli-Matti

Oskar Franklin[1]

1: IIASA, Austria; 2: Umeå University, Sweden

11:30am - 11:45pm

Gaps in quantitative decision support to inform adaptive management and learning: a review of forest management cases

Brady Mattsson[1], Florian Irauschek[1], Rasoul Yousefpour[2]

1: University of Natural Resources & Life Sciences (BOKU), Vienna, Austria; 2: University of Freiburg, Freiburg, Germany

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11:45pm - 12:00pm

Modelling the impacts of intensifying forest management on carbon budget across a long latitudinal gradient in Europe

Anu Akujärvi[1,2], Stephan Alexander Pietsch[3]

1: Finnish Environment Institute, Ecosystem Processes, Mechelininkatu 34a, P.O. Box 140, FI-00251 Helsinki, Finland; 2: University of Helsinki, Department of Geosciences and G¬¬¬eography, P.O. Box 64 (Gustaf Hällströmin katu 2a), FI-00014 University of Helsinki; 3: International Institute for Applied Systems Analysis (IIASA), Ecosystems Services and Management Program, Schlossplatz 1, 2361 Laxenburg, Austria

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12:00pm - 12:15pm

Is partial cutting a good method to manage black spruce forest on hydromorphic soils?

Samuel Roy Proulx[1], Yves Bergeron[1,3], Sylvain Jutras[2], Alain Leduc[3]

1: Institut de recherche sur les forêts, Université du Québec en Abitibi-Témiscamingue, Rouyn-Noranda, Canada; 2: Centre d'étude de la forêt et Faculté de foresterie, de géographie et de géomatique, Pavillon Abitibi-Price, Université Laval, Québec, Canada; 3: Département des sciences biologiques, Université du Québec à Montréal, C.P. 8888, Succ. Centre-Ville, Montréal, Canada

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12:15pm - 12:30pm

The climate change resilience of Norway spruce at the trailing edge

Juha Honkaniemi, Werner Rammer, Rupert Seidl

Institute of Silviculture, University of Natural Resources and Life Sciences, Vienna (BOKU), Austria

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11:15am - 11:30am

Key aspects for incentivizing land sector accounting rules under the Paris Agreement

Anna Romanovskaya, Vladimir Korotkov, Alexander Trunov, Rodion Karaban´, Polina Polumieva, Victoria Vertyankina

Institute of global climate and ecology, Russian Federation

11:30am - 11:45am

The World in 2050

Caroline Zimm

International Institute for Applied Systems Analysis (IIASA), Austria

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Kerminen[1,3], Tuukka Petäjä[1]

1: Institute for Atmospheric and Earth System Research (INAR), University of Helsinki, Finland; 2: Department of Forest Sciences, University of Helsinki; 3: Finnish Meteorological Institute

Date: Wednesday, 19/Sep/2018

8:45am - 10:35am/ 10:45am

C6a | C6a: Wildfires in Cool Forests

8:45-10:45

Location: Laxenburg Conference Center, Ovaler Saal

Chair: **Amber Soja**

Co-Chair: **Andrey Krasovskii**

8:45am - 9:00am

Dynamics of fire regimes in Russia's forests and its impact on the Earth climate system during the recent decades

Anatoly Shvidenko[1], Dmitry Schepaschenko[1], Andrey Krasovskii[1], Sergey Bartalev[2], Evgeny Ponomarev[3], Myroslava Lesiv[1], Florian Kraxner[1]

1: International Institute for Applied System Analysis, Austria; 2: Space Research Institute RAS, Moscow, Russia; 3: Institute of Forest SB RAS, Krasnoyarsk, Russia

9:00am - 9:15am

Direct carbon emissions from wildfires of Siberia estimated based on remote sensing data

Evgenii I. Ponomarev[1,2,3], Kirill Y. Litvintsev[4], Evgeny G. Shvetsov[1], Viacheslav I. Kharuk[1,3], Susan G. Conard[5]

1: V.N. Sukachev Institute of Forest, Siberian Branch of Russian Academy of Scienses, Russian Federation; 2: Regional Center for Remote Sensing, Federal Research Center «Krasnoyarsk Science Center SB RAS», Russian Federation; 3: Siberian Federal University, Russian Federation; 4: S.S. Kutateladze Institute of Thermophysics SB RAS, Russian Federation; 5: George Mason University, USA

9:15am - 9:30am

Long term effects of fire on carbon and nitrogen pools and fluxes in the arctic permafrost and sub-arctic forests (ARCTICFIRE)

Jukka Pumpanen[1], Kajar Köster[2], Heidi Aaltonen[2], Egle Köster[2], Xuan Zhou[2], Huizhong Zhang-Turpeinen[1], Jussi Heinonsalo[2], Marjo Palviainen[2], Hui Sun[3], Christina

C6b | C6b: Current and future research and information needs

8:45-10:35

Location: Laxenburg Conference Center, Marschallzimmer

Chair: **Hanna Katriina Lappalainen**

Co-Chair: **Garik Gutman**

8:45am - 9:00am

A method for generating leaf-covers for tree structure models

Markku Åkerblom, Pasi Raumonen, Mikko Kaasalainen

Tampere University of Technology, Finland

9:00am - 9:15am

Balancing Greenhouse Gas Budgets: Challenges and Opportunities in Boreal Forest Regions

Daniel Joseph Hayes[1], Benjamin Poulter[2]

1: University of Maine, United States of America; 2: NASA Goddard Space Flight Center, United States of America

9:15am - 9:30am

Climate Change Adaptation within the Boreal Forest: Linkages between science, management, and policy in sustainable forest management in a Canadian context.

Sheri Andrews-Key[1], Colin Laroque[1], Mark Johnston[2]

1: University of Saskatchewan, Canada; 2: Saskatchewan Research Council, Canada

9:30am - 9:45am

Pan-Eurasian Experiment (PEEX) Program and GlobalSMEAR (Stations for Measuring Earth Surface–Atmosphere Relations) Initiative

Hanna K. Lappalainen[1,2,3], Tuukka Petäjä[1,3], Sergej Chalov[4], Pavel Konstantinov[4], Päivi Haapanala[1], Nuria Altimir[1], Heikki Junninen[5], Anton Rusanen[1], Risto Makkonen[2],

SS2 | Special Session 2: Participatory mapping of forest cover changes.

8:45-10:35

Location: Laxenburg Conference Center, Marschallzimmer 2

Chair: **Dmitry Schepaschenko**

Co-Chair: Myroslava Lesiv

The spatial distribution of forests, forest cover change and drivers behind the changes are of great interest. Local knowledge is critical for understanding the status of forests, intensity of disturbances and management. The session will focus on collecting expert knowledge for mapping drivers of forest cover change.

Recently two contradictory papers were published in the authority journals. Hansen et al. (Science, 2013) report enormous tree cover losses in boreal forest, while Song at al. (Nature, 2018) highlight massive tree cover gain in the same biome. During our session we are going to look at a few countries to figure out who is correct and, what is even more important, what are the drivers of changes. The session implies active participation of the attendees, who will be trained to work with on-line tool Geo-Wiki (http://Geo-Wiki.org). The practical outcome of the activities outlined by the session will be a joint publication and European/global maps.

8:45am - 9:00am

Harnessing the power of volunteers and local experts to collect and validate spatial information: Relevance to forestry

Dmitry Schepaschenko, Steffen Fritz, Myroslava Lesiv, Linda See, Christoph Perger, Martina Dürauer, Tobias Sturn, Ian McCallum, Florian Kraxner

IIASA, Austria

9:00am - 9:15am

Crowdsourcing Human Impact on Forest

Martina Dürauer, Dmitry Schepaschenko, Myroslava

Biasi[1], Viktor Bruckman[4], Anatoly Prokushkin[5], Frank Berninger[2]

1: University of Eastern Finland, Finland; 2: University of Helsinki; 3: Nanjing Forestry University; 4: Austrian Academy of Sciences (ÖAW); 5: V. N. Sukachev Institute of Forest, Russian Academy of Sciences

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9:30am - 9:45am

Recovery of carbon stocks after wildfires in boreal forests: a synthesis

Marjo Palviainen[1], Frank Berninger[1], Kajar Köster[1], Jukka Pumpanen[2]

1: University of Helsinki, Finland; 2: University of Eastern Finland, Kuopio, Finland

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9:45am - 10:00am

Wildfire dynamics in Russia: the FLAM model approach

Andrey Krasovskii, Anatoly Shvidenko, Nikolay Khabarov, Dmitry Schepaschenko, Florian Kraxner

Ecosystems Services and Management (ESM) Program, International Institute for Applied Systems Analysis (IIASA), Austria

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10:00am - 10:15am

Reflections on 25 years of international collaboration in wildland fire research

Susan G. Conard

George Mason University, United States of America; US Forest Service, Emeritus Ecologist

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10:15am - 10:30am

Aerial Protection of boreal forest in Russia

Andrey Eritsov

Aerial Forest Fire Protection Service (Avialesookhrana), Russian Federation

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Alexander Mahura[1], Timo Vihma[2], Petteri Uotila[1], Veli-Pekka Tynkkynen[6], Sergey Dobrolyubov[3], Vladimir Melnikov[3,7], Alexander Baklanov[8], Yrjö Viisanen[2], Nikolay Kasimov[4], Huodong Guo[9], Valery Bondur[10], Sergej Zilitinkevich[1,2,3], Markku Kulmala[1,3]

1: University of Helsinki, Finland; 2: Finnish Meteorological Institute; 3: Tyumen State University; 4: Lomonosov Moscow State University; 5: University of Tartu; 6: Aleksanteri Institute; 7: Tyumen Scientific Center; 8: World Meteorological Organization; 9: Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences; 10: AEROCOSMOS Research Institute for Aerospace Monitoring

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9:45am - 10:00am

Analysis of below forest soil moisture times-series data and Sentinel-1 C-band radar backscatter

Christiane Cornelia Schmullius[1], Carsten Pathe[1], Nesrin Salepci[1], Christian Thiel[2]

1: Friedrich-Schiller-University Jena, Dept. for Earth Observation, Germany; 2: DLR Institute for Data Science, Jena, Germany

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10:00am - 10:15am

Assessing the Forest Resources across Europe

Hubert Hasenauer, Mathias Neumann, Adam Moreno

BOKU - University of Natural Resources and Life Sciences, Vienna, Austria

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Lesiv, Steffen Fritz

IIASA, Austria

9:15am - 10:35am

Training session on validation of drivers of forest cover change

Myroslava Lesiv, Dmitry Schepaschenko, Martina Dürauer, Ian McCallum, all interested participants.

IIASA, Austria

Poster presentations

11:00am - 1:00pm

P1 **Poster 1: Poster Session - Climate**

Location: Laxenburg Conference Center, Kaisergang

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Satellites show warming-induced earlier arrival of spring plant growth depletes soil moisture and makes boreal summers water limited ecosystems

Alemu Gonsamo, Jing M Chen

University of Toronto, Canada

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Forecast of dynamics of Ukrainian forests under climate change

Petro Lakyda, Anatolii Karpuk, Ivan Lakyda, Roman Vasylyshyn

National University of Life and Environmental Sciences of Ukraine, Ukraine

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Comparing predictive mapping of paludification in black spruce forests of eastern Canada

Osvaldo Valeria[1], Tatiana Corredor[1], Nicolas Mansuy[2], Ahmed Laamrani[1], Nicole Fenton[1], André Beaudoin[3]

1: Université du Québec en Abitibi Témiscamingue, Canada; 2: Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre; 3: Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre

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A role of moss-lichen cover in CO2 flux estimation from a Larix gmelinii forest soils, central Siberia

Olga Alexandrovna Zyryanova[1], Tomoaki Morishita[2], Viacheslav Igorevich Zyryanov[1], Yojiro Matsuura[2]

1: V.N.Sukachev Institute of Forest SB RAS, Russian Federation; 2: Forestry and Forest Products Research Institute, Japan

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Negative emission of field-protective and anti-erosion forest plantations created in the Russian Federation after the Second World War (1945-2016)

Vladimir Korotkov

Institute of Global Climate and Ecology, Russian Federation

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P2 **Poster 2: Poster Session - Bioeconomy**

Location: Laxenburg Conference Center, Kaisergang

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Closing the fibre gap with precision silviculture under global change

Vincent Roy, Nelson Thiffault, Jean-Martin Lussier, Cosmin Filipescu, Michael Hoepting, Guy Smith

Canadian Wood Fibre Center, Canadian Forest Service, NRCan, Canada

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Effects of fertilization with wood ash and nitrogen in a spruce stand on mineral soil

Kjersti Holt Hanssen

Norwegian Institute of Bioeconomy Research, Norway

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The rank distribution model of tree fractions phytomass: forest database testing and assessment

Anton Kovalev[1], Vladislav Soukhovolsky[2]

1: Krasnoyarsk Scientific Center SB RAS, Krasnoyarsk, Russian Federation; 2: V.N.Sukachev Institute of Forest SB RAS, Krasnoyarsk, Russian Federation

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Local density of live biomass components of Scots pine trunks in SO "Residence "Zalissya" - a case study in Ukrainian Polissya

Maryna Lakyda, Roman Vasylyshyn, Ivan Lakyda

National University of Life and Environmental Sciences of Ukraine, Ukraine

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The experience of clear-cuttings and its influence on natural regeneration in boreal forests on the European part of the Russian Federation

Aleksei Ilintsev[1], Alexander Bogdanov[1], Sergey Tretyakov[2], Sergey Koptev[2]

1: Northern Research Institute of Forestry (SevNIILKh) Arkhangelsk, Russia; 2: Northern (Arctic) Federal University named after M.V. Lomonosov, Department of Silviculture and Forest Management, Arkhangelsk, Russia

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P3 **Poster 3: Poster Session - People and nature**

Location: Laxenburg Conference Center, Kaisergang

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Seeking microrefugia of Japanese pika: combination of broad-scale species distribution modeling and local-scale habitat measurements

Tomoki Sakiyama[1], Junko Morimoto[1], Osamu Watanabe[2], Nobuyuki Watanabe[2], Futoshi Nakamura[1]

1: Hokkaido University, Japan; 2: Sapporo Nature Research and Interpretation Office, Japan

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Modified Combustion Efficiency and Emission Factors for CO2 and Non-CO2 Emission Gases from Surface fuel beds of P. densiflora and Q. variabilis forest in South Korea.

Donghyun KIM[1,2], Florian KLAXNER[2]

1: Jeonju University, Republic of Korea; 2: IIASA/ESM, Austria

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The Protection of Cool Forests, and Diplomacy of Linkage and Interdependence in Kyoto Protocol and Paris Agreement

Yoshihiro Nagata

Nagoya University, Japan

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Forest degradation and carbon mobilization resulting from landslides: A case study from Western Nepal

Juan Antonio Ballesteros-Cánovas[1], Alberto Munoz Torrero Manchado[1], Simon Allen[1], Wei Liu[2], Markus Stoffel[1]

1: Institute for Environmental Science, University of Geneva, Switzerland; 2: International Institute for Applied Systems Analysis, Austria

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Change in the biodiversity of the north taiga forests under the influence of pollution in

The impact of heat stress and drought on carbon and water fluxes at the ecosystem of boreal spruce forest (European Russia)

Svetlana Zagirova, Oleg Mikhailov

Institute of Biology Komi SC, Russian Federation

Market-level implications of regulating forest carbon storage and albedo for climate change mitigation

Aapo Rautiainen, Jussi Lintunen, Jussi Uusivuori

Natural resources Institute Finland (Luke), Finland

Possible climate warming effects on vegetation, forest types, drylands, agriculture, insect and pathogen infestation in Siberia, both recently (1960-2010) and in the future by 2080

Nadezhda M. Tchebakova[1], Elena I. Parfenova[1], Nina A. Kuzmina[1], Yuri N. Baranchikov[1], Vera A. Senashova[1], Eugene G. Shvetsov[1], Olga A. Zyryanova[1], Sergei R. Kuzmin[1], Amber J. Soja[2], Susan G. Conard[3]

1: Sukachev Institute of Forest, Russian Federation; 2: National Institute of Aerospace (NIA); 3: USDA Forest Service (retired)

Method of estimating long-term growth trends of forest aboveground biomass in the circumpolar boreal region

Mouctar Kamara[1], Akira Osawa[1], Yukihiro Tamura[1], Yojiro Matsuura[2], Tomiyasu Maiyaura[3]

1: Kyoto University, Japan; 2: Forestry and Forest Products Research Institute (FFPRI), Japan; 3: Ryukoku university, Japan

Pinus sibirica-and- Abies sibirica forest ecosystems on the south border of boreal zone: risks for survival and means to manage the productive stands

Dina I. Nazimova, Dilshad Danilina, Maria Konovalova, Ludmila Mukhortova

Forest institute FRC KSC SB RAS, Russian Federation

Response of larch forest ecosystem to wetting permafrost active-layer in eastern Siberia

Ayumi Kotani[1], Takeshi Ohta[1], Yoshihiro Iijima[2], Trofim C Maximov[3]

1: Nagoya University, Japan; 2: Mie

Fitting the Nonlinear Mixed-effects Taper Equation Dependent Variables for Cunninghamia lanceolata (Lamb.) Hook.

Lei Pan, Guangyi Mei, Yujun Sun, Yuanshuai Cao, Yifu Wang

State Forestry Administration Key Laboratory of Forest Resources & Environmental Management, Beijing Forestry University, Beijing, China.

The effects of salvage logging after a catastrophic wind disturbance on the wood carbon stock in northern Japan

Junko Morimoto[1], Toshihiro Umebayashi[1], Satoshi Suzuki[2], Toshiaki Owari[3], Tohru Suzuki[4], Hideaki Shibata[5]

1: Research Faculty of Agriculture, Hokkaido University; 2: The University of Tokyo Chichibu Forest; 3: The University of Tokyo Chiba Forest; 4: Rakuno Gakuen University; 5: Field Science Center for Northern Biosphere, Hokkaido University

A large vegetation-plot database for research and conservation of boreal forest diversity in Europe

Anni Kanerva Pyykönen[1], Tatyana Yuryevna Braslavskaya[2], Elena Yuruevna Churakova[3], Martin Diekmann[4], Nadezhda V. Genikova[5], Rune Halvorsen[6], Elena I. Kirichok[7], Ilona Knollová[1], Vladimir Nikolaevich Korotkov[8], Ilya V. Kucherov[9], Māris Laiviņš[10], Daria L. Lugovaya[2], Jaanus Paal[11], Petr V. Potapov[12], Tatiana S. Prokazina[2], Solvita Rūsiņa[13], Fride Høistad Schei[14], Nikolai E. Shevchenko[2], Oksana V. Sidorova[15], Nikolay, S Smirnov[16], Olga V. Smirnova[2], Elena V. Tikhonova[2], Ruslan Tsvirko[17], Svetlana A. Turubanova[12], Milan Chytrý[1]

1: Department of Botany and Zoology, Masaryk University, Brno, Czech Republic; 2: Centre for Forest Ecology and Productivity, Russian Academy of Sciences, Moscow, Russia; 3: N. Laverov Federal Center for Integrated Arctic Research, Russian Academy of Sciences, Arkhangelsk, Russia; 4: Faculty of Biology/Chemistry (FB 02), Institute of Ecology, Vegetation Ecology and Conservation Biology, University of Bremen, Bremen, Germany; 5: Forest Research Institute of Karelian Research Centre, Russian Academy of Sciences, Petrozavodsk, Russia; 6: Natural History Museum, University of Oslo, Oslo, Norway; 7: Lyceum ‚Vorobyovy Gory‘, Moscow, Russia; 8: Department for monitoring of greenhouse gas flows in natural and anthropogenically disturbed ecosystems, Institute of Global Climate and Ecology, Moscow, Russia; 9: Laboratory of Vegetation Science, Komarov Botanical Institute of the Russian Academy

the central part of the Murmansk Region

Tatiana Chernenkova[1], Mikhail Puzachenko[2]

1: Center for Forest Ecology and Production RAS, Russian Federation; 2: Institute of Geography, RAS, Russian Federation

FotoQuest Crowdsourcing European Land Cover and Land Use

Ian McCallum, Tobias Sturn, Steffen Fritz

IIASA, Austria

Calculation boundaries forest damage from large industrial source of air pollution by the phase transitions model

Yulia Ivanova[1], Vlad Soukhovolsky[2]

1: Institute of Biophysics, Federal Research Center "Krasnoyarsk Science Center SB RAS", Russian Federation; 2: Sukachev Institute of Forest SB RAS, Federal Research Center "Krasnoyarsk Science Center SB RAS"

Mapping the historical evolution of Fennoscandic forest cover and structure for application in regional hydrological and climate modeling

Jonathan Rizzi, Clara Antón Fernández, Titta Majasalmi, Ryan M. Bright, Rasmus Astrup

Norwegian Institute of Bioeconomy Research - NIBIO, Norway

University, Japan; 3: Institute for Biological Problems of Chryolithozone, Russia

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PEEX Modelling Platform: concept, models, components, infrastructure and virtual research platforms – applicability for seamless environmental prediction

Alexander Mahura[1], Alexander Baklanov[2], Stephen R. Arnold[3], Risto Makkonen[4,1], Michael Boy[1], Tuukka Petäjä[1], Veli-Matti Kerminen[1], Hanna K. Lappalainen[1,4,15], Markus Jochum[5], Roman Nuterman[5], Anatoly Shvidenko[6,7], Igor Esau[8], Evgeny Gordov[9,10,11], Vladimir Penenko[12], Alexey Penenko[12], Mikhail Sofiev[4], Andreas Stohl[13], Sergej Zilitinkevich[4,1,14], Markku Kulmala[1,15], and PEEX-Modelling-Platform team[1]

1: Institute for Atmospheric and Earth System Research (INAR) / Physics Faculty of Science, University of Helsinki (UHEL), Finland, Finland; 2: World Meteorological Organization (WMO), Geneva, Switzerland; 3: Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, UK; 4: Finnish Meteorological Institute (FMI), Helsinki, Finland; 5: Niels Bohr Institute, University of Copenhagen (NBI-UCPH), Copenhagen, Denmark; 6: International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria; 7: Institute of Forest, Siberian Branch, Russian Academy of Sciences (IF-SB-RAS), Krasnoyarsk, Russia; 8: Nansen Environmental and Remote Sensing Center (NERSC), Bergen, Norway; 9: Institute of Monitoring of Climatic and Ecological Systems SB RAS (IMCES-SB-RAS), Tomsk, Russia; 10: V.E. Zuev Institute of Atmospheric Optics SB RAS (IAO-SB-RAS), Tomsk, Russia; 11: Siberian Center for Environmental Research and Training (SCERT), Tomsk, Russia; 12: Institute of Computational Mathematics and Mathematical Geophysics, Siberian Branch, Russian Academy of Sciences (ICM&MG SB RAS), Novosibirsk, Russia; 13: Norwegian Institute for Air Research (NILU), Kjeller, Norway; 14: Moscow State University (MSU), Faculty of Geography, Moscow, Russia; 15: Tyumen State University (TSU), Department of Cryosphere, Tyumen, Russia

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Risk assessment of climate related hazards in Norwegian boreal forests – Integration of field data and statistical risk models

Jonathan Rizzi, Svein Solberg, Even Bergseng, Torfinn Torp

Norwegian Institute of Bioeconomy Research - NIBIO, Norway

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of Sciences, Saint Petersburg, Russia; 10: Latvian State Forest Research Institute Silava, Salaspils, Latvia; 11: Department of Botany, University of Tartu, Tartu, Estonia; 12: Department of Geographical Sciences, University of Maryland, College Park, United States; 13: Department of Geography, University of Latvia, Riga, Latvia; 14: Department of Forestry and Forest Resources, Norwegian Institute of Bioeconomy Research, Fana, Norway; 15: Department of Biology, Ecology and Biotechnology, Northern (Arctic) Federal University named after M.V. Lomonosov, Arkhangelsk, Russia; 16: Pechora-Ilych State Nature Biosphere Reserve, Yaksha, Komi Republic, Russia; 17: Laboratory of geobotany and vegetation mapping, V.F. Kuprevich Institute of Experimental Botany of the NAS of Belarus, Minsk, Belarus

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Novel peatland management practices - key for sustainable bioeconomy and climate change mitigation

Raisa Mäkipää, Aleksi Lehtonen, Mikko Peltoniemi, Raija Laiho

Natural Resources Institute Finland, Finland

Development of explanatory model for bark beetle infestations based on a 10-years long outbreak in the High Tatra Mts.

Pavel Mezei[1], Mária Potterf[1], Jaroslav Škvarenina[2], Rastislav Jakuš[1]

1: Institute of Forest Ecology, Slovak Academy of Sciences, Slovak Republic; 2: Faculty of Forestry, Technical University in Zvolen, Slovak Republic

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Assessing ecosystem dynamics of East Asian Mid-Latitude Ecotone forests under different management regimes

Cholho Song[1], Stephan A. Pietsch[2], Anatoly Shvidenko[2], Dmitry Schepaschenko[2], Moonil Kim[1,2], Sle-gee Lee[1], Woo-Kyun Lee[1]

1: Korea University, Korea, Republic of (South Korea); 2: International Institute for Applied Systems Analysis (IIASA), Austria

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Understory vegetation diversity and canopy structure in Abies religiosa dominated forests in central Mexico

Pedro Plateros-Gastelum[1], Valentín J. Reyes-Hernandez[1], Alejandro Velazquez-Martinez[1], Patricia Hernandez-de-la-Rosa[1], Gisela Campos-Angeles[2]

1: Colegio de Postgraduados, Mexico; 2: Instituto Tecnologico del Valle de Oaxaca, Mexico

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Forest fires and soil carbon turn-over – comparison of permafrost and non-permafrost areas in Canadan cool forests.

Kajar Köster[1], Egle Köster[1], Heidi Aaltonen[1], Xuan Zhou[1], Frank Berninger[1], Jukka Pumpanen[2]
1: University of Helsinki, Finland; 2: University of Eastern Finland, Finland

Welcome notes

Florian Kraxner

(Conference Chair), Deputy Director, Ecosystems Services and Management Program (ESM), Head, Center for Landscape Resilience & Management (CLR), IIASA

Welcoming notes, Monday, 17 September, 09:00

Florian Kraxner has been Deputy Director of IIASA's Ecosystems Services and Management Program (ESM) since 2014 and was formerly Deputy Program Leader of IIASA's Forestry Program. Dr. Kraxner also heads ESM's Center of Landscape Resilience & Management (CLR) which concentrates on developing a biophysical land-use modeling cluster. He has a longstanding research experience and publication track record in sustainable forest ecosystem management, forest modeling, the socioeconomics and policies of the land use change and forestry sectors. Furthermore, he investigates sustainable bioeneconomies, renewable energy feedstocks and Global Greenhouse Gas Reduction (GGR) Technologies.

Nebojsa Nakicenovic

IIASA Acting Director General/ Chief Executive Officer

Welcoming notes, Monday, 17 September, 09:00

Nebojsa Nakicenovic is Acting Director General of the International Institute for Applied Systems Analysis (IIASA). He is a former tenured Professor of Energy Economics at Vienna University of Technology. He is the Executive Director of The World in 2050 (TWI2050); Member of the UN Technical Advisory Group on SDG7; Member of the Scientific Advisory Board of the Fondazione Eni Enrico Mattei (FEEM); Member of the Scientific Advisory Board of the Potsdam Institute from Climate Impact Research (PIK); Steering Committee Member of the Renewable Energy Policy Network for the 21st Century (REN21).

Rasmus Astrup

Norwegian Institute for Bio-economy Research, Division for Forestry and Forest Resources

Welcoming notes, Monday, 17 September, 09:00

Rasmus Astrup, current IBFRA president and head of research at the division of forestry and forest resources at the Norwegian institute for Bioeconomy Research in Ås Norway. Rasmus Astrup works with inventory, measurement, and modelling of boreal forest with a focus on method development. Rasmus Astrup is obtained his PhD at the University of British Columbia, Canada and has worked the past 10 years in Norway.

Anni Reissell

Guest Research Scholar, Arctic Futures Initiative Coordinator, IIASA, Research Coordinator at the INAR institute for atmospheric and Earth system research, University of Helsinki

Welcoming notes, Monday, 17 September, 09:00

Anni Reissell is Guest Research Scholar at IIASA coordinating the Arctic Futures Initiative (AFI) and Research Coordinator at the University of Helsinki, Finland. She holds a PhD in chemistry, with thesis on ambient air and chamber studies on biogenic volatile organic compounds linking emissions, chemistry, meteorology and topography in the Los Angeles Basin area. Previous positions include research chemist at the Finnish Meteorological Institute and the Air Pollution Research Center, University of California, Riverside, and Executive Director of the Integrated Land Ecosystem-Atmosphere Processes Study (iLEAPS). Dr. Reissell has over 20 years' experience in global change research, international global change research programs and policies. During her career, Anni Reissell has brought together scientific communities to work on new lines of thinking, across disciplinary and community boundaries.

Alexander Buck

Executive Director, International Union of Forest Research Organizations (IUFRO)

Welcoming notes, Monday, 17 September, 09:00

Alexander Buck is the Executive Director of the International Union of Forest Research Organizations (IUFRO), a global network for science collaboration uniting over 15,000 scientists in more than 600 member organizations in 125 countries. He studied forestry and law and is an expert on international forest, environment and resource policy. Alexander has 20 years of experience in working in research management and at the science-policy interface. He is a member of the advisory boards of various forest-related international initiatives, including the Program of Forests (PROFOR) hosted by the World Bank and Yale University's Governance, Environment and Markets (GEM) Initiative.
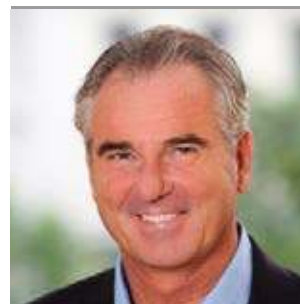
Ingwald Gschwandtl

Director, Head of Forest Policy, Forest Economics and Forest Information in the Federal Ministry for Sustainability and Tourism of Austria

Welcoming notes, Monday, 17 September, 09:00

Ingwald Gschwandtl is Head of Forest Policy, Forest Economics and Forest Information in the Federal Ministry for Sustainability and Tourism of Austria.

He holds a University degree in Forestry from the University of Natural Resources and Applied Life Sciences Vienna. He is University Lecturer for forest policy and sustainable development matters at several international Universities and Faculties. He has worked in different positions in the forestry sector in Austria before joining the Ministry. He has been envoy of the Government of Austria to various international forest and environment related treaties and processes.

Keynote speakers

Maria Patek

Director-General for Forestry and Sustainability in the Austrian Federal Ministry for Sustainability and Tourism

Stakeholder Keynote 1: The significance of mountain forests in Austria, Wednesday, 19 September, 14:00

Maria Patek holds a degree in Forestry & Wood Management as well as a Master in Business Administration. She started her career in 1983 at the Federal Ministry of Agriculture, Forestry, Environment and Water Management. In 1994 she continued her career in the field as Head of a regional headquater of the Service for Torrent and Avalanche Control. In 2002 she returned to the ministry as Head of the Austrian Service for Torrent and Avalanche Control. From 2016 to July 2018 Maria Patek held the position of Director General for Water Management in the Federal Ministry of Sustainability and Tourism, and since August 2018 she is Head of the Directorate-General for Forestry and Sustainability.

Univ.Prof. Dipl.-Ing. Dr. Hubert Hasenauer

President, Professor of Forest Ecosystem Management, BOKU-University of Natural Resources and Life Sciences, Vienna

Stakeholder Keynote 2: The role of research and education to ensure sustainable development, Wednesday, 19 September, 14:15

Univ.Prof. Dipl.-Ing. Dr. Hubert Hasenauer is professor for Forest Ecosystem Management, at BOKU - the University of Natural Resources and Life Sciences, Vienna. His scientific interests are forest management, ecosystem modeling, and the carbon dynamics of forests. He worked in more than 60 projects and has published about 250 scientific papers in peer-reviewed journals, as book chapters or conference contributions. He served as the chairman of the European Forest Institute, was editor of Forest Ecology and Management and acted 7 years as the chairman of the Senate, the academic body of the University. Since February 1, 2018, he is the President of BOKU.

Dr. Werner Kurz

Canadian Forest Service, Natural Resources Canada/ Government of Canada

Science Keynote on Climate, Wednesday, 19 September, 14:30

Dr. Werner Kurz is a Senior Research Scientist at the Canadian Forest Service (Natural Resources Canada) in Victoria, BC. He leads the development of Canada's National Forest Carbon Monitoring, Accounting and Reporting System and the Forest Carbon Management Project of the Pacific Institute for Climate Solutions. His research focuses on carbon dynamics in forests and harvested wood products and the opportunities of the forest sector to contribute to climate change mitigation. Dr. Kurz co-authored eight reports of the Intergovernmental Panel on Climate Change (IPCC) and published over 135 peer-reviewed scientific papers. He is an International Fellow of the Royal Swedish Academy of Agriculture and Forestry.

Dr. Maartje Johanna Klapwijk

Assoc Professor / Assoc Senior Lecturer, Swedish University of Agricultural Sciences, Faculty of Forest Science, Department of Ecology

Science Keynote on Bioeconomy, Wednesday, 19 September, 16:00

Maartje Klapwijk has always been interested in the question anthropogenic effects influence interactions between species within ecosystems. During her PhD at Oxford University, she worked with effects on climate and habitat fragmentation on herbivorous insects and their predators. After moving to SLU in Sweden, her research developed towards forest management methods and its effect on outbreak risk. Forests are socio-ecological systems fulfilling many functions in society which has resulted in an interest in investigating forest in a multidisciplinary context.

Dipak Gyawali, Pragya (Academician)

Nepal Academy of Science and Technology (NAST)

Science Keynote on People and Nature, Wednesday, 19 September, 17:10

Dipak Gyawali, Pragya (Academician) of Nepal Academy of Science and Technology. Conducts interdisciplinary research at technology-society interface from perspectives of Cultural Theory. A hydroelectric power engineer and a political economist, he served as Nepal's Minister of Water Resources in 2002/03, and has chaired or served in advisory boards and review missions of various international organizations, including EU's review of its water research between FP4 to FP6, UNESCO's International Hydrological Program IHP-6, UNESCO IHE-Delft for its institutional aspects, US Pacific Northwest National Lab for Human Choice and Climate Change, and management specialist to Myanmar's Ayeyarwadi IRBM.

Bhaskar Vira

Professor of Political Economy, Department of Geography, University of Cambridge; Fellow, Fitzwilliam College. Founding Director, University of Cambridge Conservation Research Institute.

SDG Keynote 1: "Integrating across themes & SDGs. The critical role of forests for the SDGs", Thursday, 20 September, 09:40

Bhaskar Vira is Professor of Political Economy, at the Department of Geography, University of Cambridge, and a Fellow of Fitzwilliam College. He is the Founding Director of the University of Cambridge Conservation Research Institute. Bhaskar's work brings a critical political economy perspective to contemporary debates in relation to conservation, natural capital, food and nutrition security and water, and the importance of nature for human well-being. He has worked extensively across the Himalayas, especially in northern India and Nepal. He Chaired the Global Forest Expert Panel on Forests and Food, and was a member of the recent Global Forest Expert Panel on Forests and Water.

Dr. Justina Ray

President and Senior Scientist, Wildlife Conservation Society Canada, wildlife ecologist and conservation biologist

SDG Keynote 2: "The exceptional value of intact forests in the boreal realm, with a focus on biodiversity", Thursday, 20 September, 09:55

Dr. Justina Ray has led the Wildlife Conservation Society Canada since its incorporation in 2004. A wildlife biologist by training, Dr. Ray is involved in research and policy for conservation planning in northern landscapes, with a focus on large mammals. She has served on numerous government-led advisory panels related to policy development for species at risk and land use planning in Canada. She is Adjunct Professor at the University of Toronto and Trent University, and Research Associate at the Center for Biodiversity and Conservation Biology at the Royal Ontario Museum.

Mette Wilkie

Forestry Policy and Resources Division Forestry Department of FAO

SDG Keynote 3: "Mountain Forests and the SDGs", Thursday, 20 September, 10:10

Mette Wilkie is the Chief of Forest Policy and Resources within the Forestry Department of the Food and Agriculture Organization of the United Nations (FAO). She is a forester and environmentalist by training and has more than 30 years of experience in issues related to the sustainable management of forests and other ecosystems across the globe. She commenced her career in Africa and Asia, where she worked for more than 10 years for the UN, bilateral aid programmes, NGOs and private sector companies. This was followed by 16 years at FAO's Headquarters in Rome and 4 years with the United Nations Environment Programme in Nairobi, Kenya. She returned to FAO earlier this year.
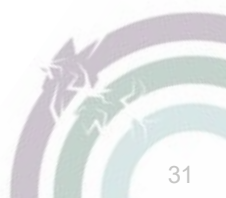
Dr. Jack A. Kaye

Associate Director for Research, Earth Science Division, Science Mission Directorate, NASA Headquarters

Science strives for impact, Keynote 1 (live video): "NASA approach to Cool Forests", Thursday, 20 September, 14:00

Frank Martin Seifert

Earth Observation Programme, Science, Application and Climate Department, ESA / ESRIN

Science strives for impact, Keynote 2: "Space for Forests", Thursday, 20 September, 14:00

Dr. Jack Kaye is Associate Director for Research of the Earth Science Division (ESD) within NASA's Science Mission Directorate (SMD). He is responsible for the research and data analysis programs for Earth System Science, covering the broad spectrum of scientific disciplines that constitute it. Dr. Kaye has been a member of the Senior Executive Service since August 1999, managing NASA's Earth Science Research Program. He has also held temporary acting positions as Deputy Director of ESD and Deputy Chief Scientist for Earth Science within SMD. His academic training is in chemistry (Ph.D., California Institute of Technology). Dr. Kaye represents NASA in many interagency and international activities, and has been an active participant in the US Global Change Research Program (USGCRP) in the Subcommittee on Global Change, currently serving as NASA's representative to the Subcommittee on Ocean Science and Technology. Since 2014 he has been the chair of the WMO Expert Team on Satellite Systems.

Frank Martin Seifert has been working for the European Space Agency at ESRIN in Frascati, Italy since 2000 as Earth Observation Application Engineer. He has been ESA's focal point for land and forest services from local to global scale for GMES, now Copernicus and is active in ESA's Climate Change Initiative with applications in the cryosphere and for biomass. His current interest lies in the use of remotely sensed data supporting developing countries to measure, report and verify the status of their forests in the framework of REDD+. To maximize the information value and impact of satellite images he is a Lead in GEO's Global Forest Observation Initiative and advocates for Earth Observation at UNFCCC.

Panelists

Markku Kulmala

Academian, Professor, Institute of Atmospheric and Earth System Research (INAR), University of Helsinki

Stakeholder Dialogue on Climate, Wednesday, 19 September, 14:30

Dr. Stephan Singer

Senior Advisor Global Energy Policies, Climate Action Network International

Stakeholder Dialogue on Climate, Wednesday, 19 September, 14:30

Professor Kulmala's research focus is on atmospheric aerosol science and biosphere-aerosol-cloud-climate interactions. His main scientific goal has been to reduce scientific uncertainties concerning global climate change issues, particularly those related to aerosols and clouds. Kulmala is active in terms of publications, acquisition of research funding, co-ordination of research projects, establishment of infrastructure (measurement stations), education, and international networking. He has published over 1000 original research papers (fist in citation rankings in geosciences), principal investigator or coordinator in more than 40 EU/Nordic projects, he has supervised over 60 PhD students, 13 of them are presently professors.

Singer is Chief Advisor Global Energy Policy for Climate Action Network (CAN), representing about 1300 Civil Society Organisations (CSO) globally. CAN members work on all issues regarding climate change. CAN is supporting moves to stay within the boundaries of the 1.5 C global warming objectives by the ratified Paris Agreement, fully halting deforestation and move to 100% renewable energy by mid-century. Stephan is a regular invited peer reviewer of the International Energy Agency`s (IEA) annual World Energy Outlook (WEO) and external peer reviewer of IPCC documents. Before joining CAN, Stephan worked for WWF International and the German GIZ in India and Kenya on sustainable agriculture.

Dr. Eugene Vaganov

Academic Supervisor of the Siberian Federal University

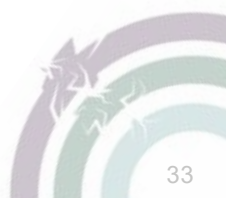**Stakeholder Dialogue on Climate, Wednesday, 19 September, 14:30**

Jaana Bäck

Professor in Forest-atmosphere interactions, Institute for Atmospheric and Earth System Research INAR / Forest Sciences, University of Helsinki

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Born 10 October, 1948 in Krasnoyarsk, Russia. Graduated from Krasnoyarsk State University (1971). Candidate (PhD, 1975), and Doctor (1985) of Biological Sciences, Professor (1994) in Biophysics, Academician of the Russian Academy of Sciences (1997). Director for V.N. Sukachev Institute of Forest, Russian Academy of Sciences, Siberian Branch (1994-2006). First Rector of Siberian Federal University (2006-2017). Research Director Emeritus at Siberian Federal University (2017–). Founder and Chair for scientific school on ecology of woody plants and dendrochronology. Builder of system for dendroclimatological monitoring of Russian forests.

Prof. Jaana Bäck is an expert in forest ecology and ecophysiology, especially in the ecosystem-climate inter¬actions in boreal and Arctic regions. Her work is multidisciplinary, including both natural and social scientific methods and aspects. Prof. Bäck is author of 123 papers in peer-review journals and peer review books. Recently she led the European Academies of Science Advisory Council (EASAC) assessment on 'Multi-functionality and Sustainability in the European Union's Forests' (www.easac.eu/home.html). She is partner in eLTER RI, aiming at developing the European long-term ecosystem observation network infrastructure.

Johann Kottulinsky,

VP Biorefinery and Pulp Trading, Lenzing

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Hans grew up in a farming community in Austria, is forester by training and holds a business degree from the University of Buckingham/UK. He has spent the majority of his professional career in China, Africa and South America developing businesses and local presence for Austrian industry leaders. As VP Biorefinery & Pulp Trading for Lenzing AG, Hans is deeply involved in responsibly managing a global forest based value chain and the development and marketing of wood based performance materials.

Markus Lassheikki

Head of Development, Central Union of Agricultural Producers and Forest Owners (MTK), Finland

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Markus Lassheikki is Head of development at the Central Union of Agricultural Producers and Forest Owners (MTK) in Finland. He received his M.Sc. in Forestry from the University of Helsinki and has a Specialist Qualification in Business Management. He has a thirty-year career in forestry and agriculture including extension and management services, business development and logistics. Mr. Lassheikki is employed by MTK since 2002. Earlier he has worked as a head of unit at the Forestry Development Centre Tapio and as manager at the Forest Management Association in the Helsinki region. He has his homestead in the countryside outside the metropolitan area and spends time in the forest also in leisure.

Sten Nilsson

CEO and Professor, Forest Sector Insights and Visiting Scholar, IIASA

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Professor Sten Nilsson is former IIASA Deputy and Acting Director as well as former leader of the Forestry Program. He is a Swedish citizen, a member of four Academies and has authored and co-authored some 400 scientific publications. Professor Nilsson is an expert on global forest sector policy analysis and the transition of the sector. He is frequently asked to address industry, governments and international organizations on different issues concerning the sector. After retirement from IIASA, Professor Nilsson is serving as independent adviser to the sector and has worked e.g. with policy and transition issues in Canada, USA, and Southeast Asia and the development of the NFP in Sweden

Michael Proschek-Hauptmann

Head of Compliance and Sustainability, Schweighofer Group

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Since March 2017 Mr. Proschek-Hauptmann is Head of Compliance and Sustainability in the Schweighofer Group. He is responsible for strengthening the group's compliance and sustainability agenda as well as for further engaging in dialogue with external stakeholders. Prior to his engagement with the Schweighofer Group, Proschek-Hauptmann was Managing Director of the Austrian Umbrella Association of Environmental NGOs (Umweltdachverband) and also served as a long standing member of the Board of Directors of the forest certification organization PEFC International. He is a biologist by training and has been actively engaged in the environmental, NGO and sustainability fields ever since he embarked on his career.

Lukas Mandl

Member of the European Parliament

Stakeholder Dialogue on People and Nature, Wednesday, 19 September, 17:10

Dolores Pavlovic

President of The International Forestry Students' Association, focusing on global youth engagement regarding forestry and related sciences

Stakeholder Dialogue on People and Nature, Wednesday, 19 September, 17:10

Lukas Mandl (39) works for Austria as a Member of the European Parliament. Previously, he was a member of the Lower Austrian Parliament. A native of Gerasdorf, he was a lecturer at the Vienna University of Economics and Business and is Vice President of the Assembly of European Regions. As a Southeastern Europe expert, he also wants to build bridges for peaceful coexistence (Lukasmandl.eu)

My name is Dolores Pavlovic. I'm the current President of the International Forestry Students' Association, an association run by students, for students. My passion for forests stems from my childhood. I grew up in British Columbia where every free moment was spent exploring and getting very lost in the great outdoors. When I was 15, I moved to Serbia which had a tremendous impact on my life. I knew that there is no single approach to landscape management which is what motivated me to pursue an international career. To break formality, I am also black belt in Tae Kwon Do and used to work as an instructor.

Denis Popov

Dipl.Eng. (IT), M.Sc (Arg. & For.), Mondi Group, Sustainable Development, Group Natural Resources Manager, Vienna, Austria

Stakeholder Dialogue on People and Nature, Wednesday, 19 September, 17:10

Nikolay Shmatkov

Forest Program Director, WWF Russia

Stakeholder Dialogue on People and Nature, Wednesday, 19 September, 17:10

Denis Popov is a Group Natural Resources Manager at Mondi since 2017. Before joining Mondi's headquarters in Vienna he had been working in Mondi's forestry operations in Russia in various leadership roles, dealing with operational excellence and best practice implementation, sustainable forest management and wood tracing. Denis graduated from St.Petersburg Forest Technical Academy as an Engineer in Forestry Information Systems in 2005, then completed qualification in forest machinery at Lapland College of Natural Resources in 2006 and continued with a Master of Science in Agriculture and Forestry from University of Eastern Finland and Swedish University of Agricultural Sciences in 2006-2008.

Nikolay was born in 1973 and graduated from the Moscow State Forest University in 1995. Nikolay is based in Moscow. Before joining WWF Russia Nikolay worked at IUCN – The World Conservation Union where he was responsible for coordination of projects on alternative livelihoods and sustainable business development for Indigenous communities based on sustainable use of non-timber forest products. Since 2010 Nikolay works for WWF Russia, also he is the Editor-in-Chief of the Sustainable Forestry magazine and the Chairperson for the FSC Russia Board.
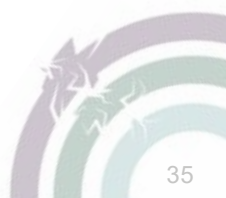
Janice Burns

Thematic Networking
Manager, IUFRO

**Science Focus – Looking into the
Future – Early Career Scientists,
Thursday, 20 September, 09:00**

**Msc. Adriana
Gomez Sanabria**

Research Assistant, Air Quality and
Greenhouse Gases (AIR), IIASA

**Science Focus – Looking into the
Future – Early Career Scientists,
Thursday, 20 September, 09:00**

Janice Burns is IUFRO's Thematic Networking Manager and acted as Deputy Coordinator of the Joint IUFRO-IFSA Task Force on Forest Education from 2016-2018. She received her double MSc in European Forestry from the University of Eastern Finland and AgroParisTech, France. Her specialisations are remote sensing, forest education, and forest landscape restoration. She has practical experience as a forest manager, firefighter, and aviation coordinator. In addition to supporting the implementation of IUFRO's thematic networking projects and capacity building activities, Janice is interested in foresight processes and interdisciplinary cooperation.

Adriana Gómez-Sanabria has a degree in Environmental and Health and MSc in Forestry. Currently, doing her PhD at the University of Natural Resources and Life Sciences, Austria. Ms. Gómez Sanabria in Colombia worked in the field of deforestation and illicit crops, REDD projects and climate change. She carried out research work on illicit crop monitoring and impacts on deforestation in Colombia at the UNODC. She then worked as a consultant for the IAEA in the topic of agriculture and climate change. She has been a research assistant at IIASA's Air Quality and Greenhouse Gases Program where she is working on the assessment of non-CO2 greenhouse gases.

Hélène Genet

Research assistant professor,
Institute of Arctic Biology, University of Alaska Fairbanks

**Science Focus – Looking into the
Future – Early Career Scientists,
Thursday, 20 September, 09:00**

Manuel Rakos

Student of forestry sciences, University of Natural Resources and
Life Sciences (BOKU), former
President of IFSA BOKU

**Science Focus – Looking into the
Future – Early Career Scientists,
Thursday, 20 September, 09:00**

Hélène Genet is a terrestrial ecologist and uses a multidisciplinary approach to characterize complex interactions between climatic and ecological processes at play in the soil, the vegetation and the atmosphere in high latitude ecosystems. She uses this information to improve the ability of biosphere models to project the response of terrestrial ecosystems to current and future climate change at local and regional scales. Currently, she is particularly involved in characterizing the vulnerability of boreal ecosystems to deep permafrost thaw.

Manuel Rakos graduated from Höhere Bundeslehranstalt für Forstwirtschaft (College of Forestry) in Bruck an der Mur in 2009. He then worked at the Austrian Federal Forests for 3.5 years and gathered international experience during an internship in British Columbia, Canada. In 2017 he finished his Bachelor's degree in Forestry at BOKU. Currently he is writing his master thesis on sustainable plenter management. Manuel Rakos was a board member of the International Forestry Students Association BOKU (two years vice treasurer and two years president). Moreover, he worked as an assistant lecturer (tutor) at the Institute of Botany and the Institute of Silviculture. He is also a certified forest educator.

Dr. Hillevi Eriksson

Climate and Bioenergy Specialist, Policy and Analysis Unit, The Swedish Forest Agency

Science strives for impact: Action & Collaboration, Thursday, 20 September, 14:30

Hillevi Eriksson did her PhD 1996 on nutrient balances in managed boreal forests. Afterwards she continued doing research on human influence on nutrient and carbon budgets until year 2000 when she got a position as climate/soils/bioenergy specialist at the Swedish Forest Agency. She has worked with communication and policy development on climate change/forest related adaptation and mitigation and on sustainability of forest management in national and international projects and processes.

Moderators

Prof. Dr. Christiane C. Schmullius

Department for Earth Observation, Faculty of Chemistry and Earth Sciences, Friedrich Schiller University Jena (FSU)

Stakeholder Dialogue on Climate, Wednesday, 19 September, 14:30

Prof. Schmullius' research focuses on terrestrial surfaces ranging from operational vegetation mapping (specifically biomass and crop phenology) to land cover and soil moisture monitoring. Technical expertise includes operational and experimental Earth observation sensors with a focus on microwaves. Special interest is on global satellite monitoring concepts and big data handling jointly from the Sentinel-satellites and in situ networks.


DI Gerald Steindlegger

ISS – Integrated Sustainability Solutions

Stakeholder Dialogue on Bioeconomy, Wednesday, 19 September, 16:00

Gerald Steindlegger is a consultant advising and guiding companies, policy makers, international organizations and NGOs on global sustainability issues. He is aiming for integrated sustainability solutions and is building bridges between stakeholders for one common good: Sustainable Development. He is closely working with national and international research organizations to leverage the relevance of science for decision makers. He was CEO at WWF Austria and Policy Director for the Forest and Climate Change Programme at WWF International. He studied forestry at the University of Natural Resources and Life Sciences (Vienna) and participated in management and leadership trainings at IMD in Lausanne.
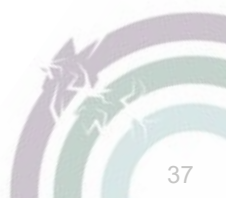
Peter Mayer

Managing Director, Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)

Stakeholder Dialogue on People and Nature, Wednesday, 19 September, 17:10

DI Katharina Albrich

PhD student, University of Natural Resources and Life Sciences Vienna, Department of Forest and Soil Sciences, Institute of Silviculture

Science Focus – Looking into the Future – Early Career Scientists, Thursday, 20 September, 09:00

Peter Mayer is the Managing Director of the Austrian Research Centre for Forests (BFW), responsible for the development and implementation of the overall strategy and financial operations of BFW. From 2003 to 2010 he was Executive Director of IUFRO, the International Union of Forest Research Organizations. From 1998 to 2003 Peter Mayer was the head of the Liaison Unit of Forest Europe responsible for developing pan-European forest policy. He holds a Masters degree in forestry and political science and a PhD in forest policy.

Katharina Albrich is a PhD student at the University of Natural Resources and Life Sciences, Vienna. In her thesis, she investigates forest resilience to climate change and disturbances using simulation modelling. She is particularly keen to understand the mechanisms at work in mountain forests and how a sustainable future can be insured for these forests and the people who depend on them. Since the beginning of her bachelor studies, she is closely affiliated with the International Forestry Students' Association and she has a special interest in forestry education and science communication.

Raisa Mäkipää

Research Professor Natural Resources Institute Finland (Luke), Bioeconomy and environment unit, Sustainability science and indicators group

Science strives for impact: Action & Collaboration, Thursday, 20 September, 14:30

Ping Yowargana

IIASA, Ecosystems Services and Management (ESM) Program

Communication pitch presentations, Thursday, 20 September, 12:00

Research professor Raisa Mäkipää (Luke) has wide expertise on ecosystem modelling, carbon and nutrient cycling and biodiversity. She has coordinated multidisciplinary projects focused on optimization of ecosystem management and mitigation of climate change. Currently, her research consortium is studying Novel soil management practices as a key for sustainable bioeconomy and climate change mitigation. She has highly recognized merits from international and national activities including the award certificate for her contribution to the Nobel Peace Prize which was bestowed on the IPCC in 2007.

Ping Yowargana focuses on enhancing the policy relevance of scientific assessments in the fields of tropical land sustainability and sustainable energy landscapes. Identifying the needs of policy makers and broader stakeholders and translating them into clearly articulated research questions are key steps of evidence based policy making. Furthermore, feedback and continuous iteration that involve stakeholders throughout the research process are necessary to generate impactful and operational results. Instead of „science to policy interface", he prefers the term „science and policy integration" to describe the nature of his work.

Science communication

Maria De Cristofaro

FAO Forestry Officer, Forestry Department, Food and Agriculture Organization of the United Nations

Are you being heard? Find out how to communicate complex issues, Thursday, 20 September, 11:10

Maria De Cristofaro is Outreach and Capacity Building Officer for the FAO Forestry department. In this role she has been instrumental in the creation of six Regional Forest Communicators Networks building on her many years of experience in communication and in international broadcasting and newspapers to increase the communication capacity of the global forestry community.

Faheem Chaudry

Senior Strategist M&C Saatchi London, global headquarters of M&C Saatchi Worldwide Founding Partner Black&White – the M&C Saatchi Consultancy.

Are you being heard? Find out how to communicate complex issues, Thursday, 20 September, 11:10

Faheem has a BSocSci in Politics and Organisational Psychology from the University of Cape Town and a post graduate in Marketing and Communications Management from the Red & Yellow School of Business. In 2017, he was named Rising Star by the South African Chamber of Commerce in the UK, having previously been ranked in the top ten strategists in South Africa and named Young Marketer of the Year. Faheem has won over 30 creative & effectiveness awards for clients spanning government, blue chip and non-profit organisations. He has consulted in over 15 countries across Europe, Asia, Middle East and Africa. Faheem cofounded The Street Store, helping clothe 350,000 homeless people in 130 cities worldwide.

Jennifer Hayes

interim Assistant Station Director for Science Application and Communication, USDA Forest Service, Research and Development – Rocky Mountain Research Station

Are you being heard? Find out how to communicate complex issues, Thursday, 20 September, 11:10

Jennifer Hayes is a science storyteller and promoter of innovative research. She works with scientists to communicate and deliver their science, creates awareness for the work of her Agency, and ensures the best available science is out there for sustaining America's forests and grasslands. Prior to her current position as the interim Director of Communication and Science Delivery for the USDA Forest Service Rocky Mountain Research Station, she served as a Communication Specialist and before that, as the Project Manager for the 2014 International Union of Forest Research Organizations World Congress.

Kai Lintunen

Head of international communications, Finnish Forest Association

Are you being heard? Find out how to communicate complex issues, Thursday, 20 September, 11:10

Kai Lintunen is the Head of International Communication at the Finnish Forest Association, the Finnish forest sector cooperative body. Previously he has held several positions in industries, environmental communications and consultancy institutions, specializing in international issues. He is the Team Leader of the European UNECE/FAO Forest Communicators Network, and member of the FAO global forest communications coordination group, representing Europe. Kai holds a Master of Science in Agriculture and Forestry, M.Sc.(Agr.&For.) degree from the University of Helsinki, specializing in Environmental/land use economics and communications.
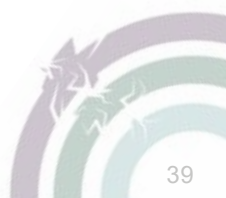
Special sessions
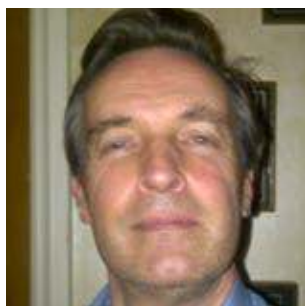
Toby Aykroyd

Coordinator, Wild Europe Initiative

Special Session 1: A strategy for protecting old growth forest in Europe, Monday, 17 September, 1:30

Toby Aykroyd worked initially with the UN Development Programme in Central America. His background also includes business management and lobbying. He was co-founder of the Population & Sustainability Network, and chair of the Funding Support Group for the BBC Wildlife Fund, financing 87 conservation projects worldwide. Since 2005 he has coordinated the Wild Europe initiative, which developed the Protection Strategy for Old Growth Forest. He is trustee of Fundatia Conservation Carpathia (FCC) Romania, European Nature Trust, Rewilding Britain and CHASE Africa. He studied economics & geography at Cambridge University, and has a Master of Business Administration from Cranfield Institute of Technology.

Dr. Steffen Fritz

Deputy Program Director, Ecosystem Services and Management (ESM) Program, Leader, Center for Earth Observation and Citizen Science (EOCitSci), IIASA

Special Session 1: A strategy for protecting old growth forest in Europe, Monday, 17 September, 1:30

Dr. Steffen Fritz is Deputy Program Director of the Ecosystem Services and Management (ESM) Program, and Leader of the Center for Earth Observation and Citizen Science (EOCitSci) at IIASA. He joined IIASA in 2007, and since then he has become the initiator and driving force behind the Geo-Wiki.org and the Geo-Wiki mobile, a global land cover validation tool that aims to investigate and reduce the uncertainties in global land cover data using crowdsourcing. The research interests of Dr. Fritz include earth observation, citizen science, crowdsourcing, food security, land-use science via mobile technologies, as well as citizen science for SDG monitoring and implementation.

Zoltan Kun

European Wilderness Officer, Europe department of Frankfurt Zoological Society

Special Session 1: A strategy for protecting old growth forest in Europe, Monday, 17 September, 1:30

Zoltan Kun studied forestry, landscape architecture and soil sciences. He worked in the nature conservation sector at various organization mainly focused on wilderness preservation in Europe. He was involved in drafting the European Parliament's resolution on wilderness which was adopted in February 2009. He currently works at Frankfurt Zoological Society as European Wilderness Officer aiming to support field projects with advocacy capacity. One of his current projects carried out in cooperation with Griffith University and Wild Europe is to look into the ecosystem services values of primary forests in the temperate and boreal region.

Prof. Dmitry Schepaschenko

Senior Researcher, IIASA, ESM, CLR/EOCitsci

Special Session 2: Participatory mapping of forest cover changes, Wednesday, 19 September, 08:45

Dmitry Schepaschenko have been working for IIASA since 2007 as a Research Scholar at the Forestry Program, now Ecosystems Services and Management Program. His recent projects have included full carbon account for Northern Eurasia, global forest/biomass/land cover mapping, remote sensing application and forest modeling. Dr. Schepaschenko was graduated in forestry from the Moscow State Forest University (MSFU). He received a PhD degree in soil science in 1993 from Dokuchaev Soil Science Institute in Moscow. He took part of IIASA's Young Scientists Summer Program in 1995. He was awarded a university professor degree in ecology in 2005 from MSFU.

Special IBFRA member

Prof. Anatoly Shvidenko

Senior Research Scholar Ecosystems Services and Management (ESM), IIASA

Professor Shvidenko graduated from the National Agricultural University of Ukraine (forestry) and the Kiev State University (applied mathematics and theory of probability). He received his Candidate of Science (PhD) degree in mathematical modeling of growth and productivity of forest in 1968 and his Doctor of Science degree in forestry in 1982.

Founding and board member of the International Boreal Forest Research Association (IBFRA). Former director of the All-Russian Scientific Research and Information Center for Forest Resources, Moscow. Lead author and coordinating lead author in the Third Millennium Ecosystem Assessment, IPCC AR 2-4, board member of the Global Terrestrial Observing System, Terrestrial Carbon Observation Panel, FAO Forest Resource Assessment, Scientific Council of the World Commission on Forestry and Sustainable Development, Siberian National Committee on IGBP, etc. He shared the Nobel Peace Prize awarded to the IPCC in 2007. In 2008 he has been elected Academician of the Ukrainian Forestry Academy, and awarded Honorary Professor of the Ukrainian National Agricultural University. He has co/-authored over 340 scientific publications and 14 books in the fields of forest inventory, monitoring, mathematical modeling, global change, and boreal forests.
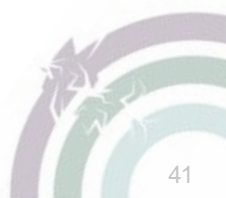
Presentation details

C1: Cool Forests impacts on the global carbon budget

Time: Monday, 17/Sep/2018: 10:30am - 12:30pm · *Location:* Laxenburg Conference Center, Ovaler Saal
Session Chair: Anatoly Shvidenko
Session Co-Chair: Ekaterina Ezhova

10:30am - 10:45am

Carbon emissions and removals from Mongolian boreal forest

Khongor Tsogt[1], Bat-Ulzii Chultem[1], Sanaa Enkhtaivan[2], Altangadas Janchivdorj[3], Khosbayar Battuvshin[3], Abu Mahmood[4], Mathieu VanRijn[4], Yeseul Byun[4], Ben Vickers[4]

[1]UN-REDD Mongolia Naitonal Programme, Mongolia; [2]Climate Change Project Implementing Unit, Environment and Climate Fund, Mongolia; [3]Forest Research and Development Centre, Mongolia; [4]FAO Regional Office for Asia and Pacific; khongor@unredd.mn

Abstract

Boreal forest constitutes about 87% of the Mongolia's total forest cover and is mainly dominated by Larch (Larix sibirica). In this paper we quantified emissions and removals of carbon dioxide (CO_2) from boreal forest in Mongolia with the aim to establish a forest reference level (FRL), which enables the assessment of performance of Reduced Emissions from Deforestation and forest Degradation Plus (REDD+) measures associated with the implementation of the national REDD+ strategy for Mongolia under the UN-REDD national programme. Mongolia is the only country having boreal forest under the UN-REDD programme and has submitted a national FRL in January 2018. CO_2 emissions from boreal forest through deforestation and forest degradation from four drivers - fire/pest, grazing, soil erosion, and logging, as well as through afforestation and/or reforestation activities have been estimated during the reference period 2005-2015.

Our methods are based on the United Nations Framework Convention on Climate Change (UNFCCC) decisions, technical documentations, good practice guides, and a review of other available tools and methodologies. We derived the area changes or activity data (AD) in boreal forest cover during the reference period through an assessment of 123,472 systematically gridded sample points covering the entire country. Using FAO's Collect Earth System the samples were assessed through visual interpretation of high to medium spatial resolution Earth Observation data. The emission/removal factor (EF/RF) estimates for four carbon pools were derived from national forest inventory data collected during 2014-2017.

During 2005-2015, 1.4 million ha (SE ±28,504 ha) of intact boreal forest has been degraded due to fire/pest, repeated burning, logging and other activities while 52,660 ha (SE ± 5,1560 ha) of intact boreal forest has been lost due to similar drivers. Among the drivers, majority of the deforestation has been occurred by forest fire and/or pest infestation, about 51,647 ha (SE ± 5,110 ha). Compared with the deforestation, only 3038 ha (SE ±1,240 ha) of other land has been converted to boreal forest (enhancement). Mongolian boreal forest annual CO_2 emissions from deforestation, forest degradation and removals from enhancement activities were estimated as 3,551,439 tCO2e at 95% CI (±623,168 tCO2e) and -74,055 tCO2e at 95% CI (±59,248 tCO2e), respectively. Therefore, the net annual emissions from boreal forest were estimated at 3,477,384 tCO2e, 95% CI (±625,978 tCO2e) during 2005-2015. The drivers of deforestation and forest degradation are a complex mixture of anthropogenic and natural impacts, compounded by poor forest management.

Focus of Research

Carbon emissions and removals of Mongolian boreal forest

Key Challenges

The key challenge for the study were deriving a reliable emission/removal factors from different activities in boreal forest.

Suggestion to Address these Challenges

Data from repeated field inventory work on the areas that undergone changes will solve this problem.

10:45am - 11:00am

Recent Decrease of Carbon Sink to Russian Forests

Dmitry Zamolodchikov[1], Vassily Grabowsky[2], Olga Chestnykh[1]

[1]Lomonosov's Moscow State University, Russian Federation; [2]Center for Ecology and Productivity of Forests of Russian Academy of Sciences, Russian Federation; dzamolod@mail.ru

Abstract

Earlier we developed the system of carbon balance inventory in forestry of Russia, called Regional Evaluation of Carbon Budget of Forests (ROBUL). Since 2010, the ROBUL system has been used in the National Greenhouse Gas Cadaster.This study aims at characterization of the changes in carbon balance in the forests of Russia during the period from 1998 to 2015.The RECBF system uses the data from the State Forest Register or archival materials of the State Forest Fund Account as the source. Evaluations given

in this article refer to the forested lands of the Forest Fund, the area of which increased from 758.7 to 785.6 million hectares from 1988 to 2015. Carbon sink to the forests of Russia was minimal in 1988 (80.3±65.1Mt C/year). Since the first half of the1990s, there was an increase in the carbon sink to 200.9±of 59.5 Mt C/year in 1998 and 239.4 ±57.7 Mt C/year in 2008. This increase was connected with a significant reduction of the timber harvesting in connection with socioeconomic reforms in the country. After reaching the maximum value in 2008, the carbon sink was gradually reduced, the reduction reaching 33.3 Mt C/year by 2015, when the carbon sink was 206.1 ± 58.9 Mt C/year. This reduction of the carbon sink was by 44.5% due to increased losses in logging operations, by 21.5% due to forest fires and by 34.5% due to a decrease in absorption. Growth trends of carbon loss were confirmed by independent information on the annual values of felling and fires. The reduction in carbon sink by forests is associated with the decline of forested areas (1.6 million hectares during the 2008–2015) on the background of growing disturbances. Earlier, we predicted a reduction of the carbon sink to forests of Russia in a series of studies carried out using the Canadian model CBM-CFS3. According to these forecasts, with increasing disturbances the reduction of the carbon sink in forests should be traced since the beginning of the 2010s. It was accelerated since the second half of the 2010s.These predictions are supported by the modern dynamics of the carbon sink. The attention of scientific community and decision-making governmental and regulatory bodies to the values of carbon absorption in Russia in general and forests in particular has increased significantly in connection with the discussion on feasibility of the Paris agreement ratification.

Focus of Research

The focus of research is the inventory of carbon balance of Russian forests. It is relevant to Climate change process through CO2 emissions and absorptions and to people through Paris Agreement.

Key Challenges

Yes, key challenges are forest exploitation, forest fires and forest fire protection.

Suggestion to Address these Challenges

It is necessary to regulate forest exploitation, to introduce highly productive forest planting, to improve the system of forest fire protection in Russia.

11:00am - 11:15am

Forests and forest-based sector carbon budget – Finland, Norway and Sweden 1960-2015

Hans Fredrik Hoen[1], Tomas Lundmark[2], Gustav Stål[2], Stein M. Tomter[3], Cristina-Maria Iordan[4], Francesco Cherubini[4], Pekka Kauppi[5]

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Abstract

Forests and the forest-based sector (FBS) play a significant role in the carbon cycle. The national data from Nordic forests are complete and accurate and provide an excellent empirical test for model-based analyses.

Considering how the FBS influence the carbon-cycle (biogeochemical cycle) there are five main elements to keep track of:

a. Carbon stored in living and dead biomass in forests and forest soil (biosphere)

b. Carbon stored in HWPs (technosphere)

c. Product substitution; when HWPs substitute (displace) alternatives (e.g. when wood substitute concrete and steel in construction or bio-chemicals substitute petro-chemicals)

d. Rate of change in Net Annual Increment, which is the root cause of the sequestration and substitution potential

e. Energy substitution; when forest biomass replace fossil fuels in energy-conversion (either "virgin" biomass from the forest, redundant biomass (sidestreams) from processing industries or HWPs at end of life cycle used for energy conversion)

In the long run (centuries or millennia) the cumulative effect of substitution (c, d) will dominate over the effect of stock changes (a, b) when it comes to the impact of the FBS on the amount of carbon (CO2) in the atmosphere.

Based on historical data with high (known) accuracy on wood biomass in growing stocks (national forest inventories (NFI-data)) and in removals (official statistical records on industrial consumption), combined with best available estimates of substitution or displacement ratios for main categories of HWPs, we estimate the FBS's carbon budgets in the main part of Fennoscandia (Finland, Norway and Sweden) for the period 1960 – 2015. We found similarities and interesting differences in sequestration and substitution between Finland, Norway and Sweden, respectively.

The mitigation impact of the FBS on increasing CO2 concentrations in the atmosphere has been much larger in Fennoscandia than in the EU on average, relative to the fossil emissions. The observed patterns could become recommended as models for global, universal mitigation goals "to harvest, to substitute and to save". The findings from Fennoscandia demonstrate that forests have a great long-term potential in climate mitigation.

Focus of Research

Focus is on the forest-based sector in Fennoscandia and its historic impact on the amount of carbon in the atmosphere. The forest-based sector in Fennoscandia constitutes a large part of the economies of the associated countries and has been proposed to have a great climate change mitigation potential.

Key Challenges

In order for forests and the forest-based sector to continue to be a strong carbon sink while providing an expanded product portfolio to stimulate the transition to a bioeconomy, future efforts must aim for increased growth in forests. Challenges will be to meet the forests, social, ecological and cultural values.

Suggestion to Address these Challenges

Transdisciplinary science and research on alternative forest management regimes and strategies.

11:15am - 11:30am

Inland waters as key components of the C balance in northern landscapes

Paul A. del Giorgio[1], Susan Ziegler[2], Jan Karlsson[3], Erik Emilson[4], Lars Tranvik[5], Yves Prairie[6]

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Abstract

Freshwaters are a major component of the boreal landscape, and hotspots of biogeochemical activity, yet their role in boreal regional C budgets is still largely underestimated. For example, the loss of carbon from terrestrial ecosystems through leaching of dissolved organic matter and inorganic C into surface waters is increasingly recognized as a potentially significant component of landscape C budgets, yet this component is still poorly characterized and therefore, seldom included in terrestrial C models. In order to understand the role of lateral C loss, it is necessary not only to quantify the actual export of C from watersheds, but also determine its fate within the inland water network. A portion of this terrestrial C will end up in the bottom of lakes within the catchment, and in these northern regions this may account for 25% to over 50% of the total long-term C storage in the entire landscape. The largest fraction of the exported C, however, is returned to the atmosphere via aquatic CO2 and CH4 emissions in lakes and rivers, which represent a significant loss in terms of C fixed in land, potentially on par with regional fire-mediated emissions and peatland C sinks and CH4 fluxes. Yet another non-negligible fraction of this terrestrial C is transported to the coastal oceans, where it is further processed and buried. In this talk we will provide examples of the work that is being done across the boreal biome to characterize and model aquatic C storage, gas emissions and export and their potential role in the overall C budget in various northern landscapes. Although accurate modeling of some aspects of terrestrial C dynamics, such as tree growth, biomass accumulation or soil accretion, do not necessarily require the inclusion of an aquatic dimension, C budgets and models that aim at representing whole watershed and landscape-level C footprints cannot find closure unless this aquatic component is explicitly incorporated. Landscape-level C accounting, therefore, will require a collaborative effort between the aquatic and terrestrial biogeochemical communities working across the boreal biome.

Focus of Research

Our research focuses on the role of inland waters on the carbon balance of northern landscapes, and on the coupling of terrestrial and aquatic processes at the whole watershed scales. This coupling is particularly important in the boreal biome, which has the highest water density in the biosphere.

Key Challenges

The key challenge we identify in our talk is how to effectively incorporate processes occurring in inland waters into current regional C budgets, and into models of terrestrial C dynamics. Other challenges include developing robust conceptual frameworks that identify potential conflicts and double dipping, gaps and emergent properties.

Suggestion to Address these Challenges

Integrating inland waters into terrestrial C budgets and models requires the development of upscaling and modeling tools that capture the complexity and heterogeneity of these processes, and will also require extensive collaboration between the terrestrial and aquatic communities to agree on conceptual frameworks, tools and approaches.

11:30am - 11:45am

Aerosol – radiation interaction and its effect on gross primary production of boreal and hemiboreal forests

Ekaterina Ezhova[1], Ilona Ylivinkka[1], Joel Kuusk[2], Kaupo Komsaare[2], Marko Vana[2], Steffen Noe[3], Alisa Krasnova[3], Mikhail Arshinov[4], Boris Belan[4], Sungbin Park[5], Jost Lavric[5], Martin Heimann[5], Jaana Bäck[1], Timo Vesala[1], Veli-Matti Kerminen[1], Markku Kulmala[1]

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Abstract

Climate feedback loops play an important role for our understanding on the global climate change. Feedback loops are relevant for future global Earth system models, which have to include self-regulatory processes controlling carbon exchange.

The continental biosphere-atmosphere-cloud-climate feedback loop considers interactions between biogenic volatile organic compounds, aerosol, solar radiation and photosynthesis. We present the results corresponding to aerosol - solar radiation - photosynthesis interactions in boreal and hemiboreal forests. In particular, we quantify the effect of aerosol loading on the diffuse

fraction of solar radiation. Further, diffuse radiation may increase the ecosystem light use efficiency (LUE) and consequently, the ecosystem gross primary production (GPP, characterizing carbon dioxide uptake by an ecosystem). We quantify the effect of diffuse radiation on LUE and GPP for ecosystems in boreal and hemiboreal forests.

The analysis is based on observations from five remote sites being partners of the PEEX program. Two stations are located in Finland (SMEAR I and II), one station is in Estonia (SMEAR Estonia) and two stations are in Russia (Zotto and Fonovaya in Siberia). Three sites represent coniferous forests and two sites – mixed forests. Currently these five sites provide the largest possible data set on simultaneous observations of aerosol, radiation and photosynthesis in Eurasian boreal forests.

We use a simplified clear sky model employing Aeronet data to model diffuse and global radiation under clear sky. Together with aerosol and radiation observations, the model makes it possible to estimate aerosol and cloud effects on solar radiation. The diffuse fraction of solar radiation due to Rayleigh scattering is around 10% at all sites. It can be increased due to observed aerosol loading up to 20-27%. Higher percentage of the diffuse fraction of solar irradiance can be associated with clouds or plumes from forest fires.

If aerosol loading is increased from the minimum to the maximum observed values at all sites, GPP is increased by 6 - 14% depending on the type of the ecosystem and its location. For all ecosystems, maximum GPP values due to enhanced diffuse radiation are observed under cloudy sky with the diffuse fraction of solar radiation around 30 - 55%. The associated increase in GPP varies from 6.5% to 27% for different ecosystems as compared to GPP values under clear-sky, clean atmosphere conditions. Finally, we make simple estimates to highlight the role of LUE for the possible increase in GPP of different ecosystems under diffuse light.

Focus of Research

My research is focused on the quantification of climate feedback loops using atmospheric observations in boreal forests. My aims are to improve our understanding on the complex biosphere-atmosphere interactions and provide results which can be utilized for verification of current modelling and satellite data analysis.

Key Challenges

Observations in boreal forests are sparse: only five sites in boreal forests of Eurasia currently run measurements, which at least partially cover the needs of multidisciplinary approach. Working with data from several sites allows tracking processes and trends that are common for different sites.

Suggestion to Address these Challenges

If possible to have more measurement sites and more collaborations. Clustering of already existing measurements run by different research groups and joining efforts towards understanding on the critical processes in cool forests and the mechanisms controlling these processes.

11:45am - 12:00pm

On the methodological foundations of understanding regional carbon cycling of forest ecosystems

<u>Anatoly Shvidenko</u>[1], Eugene Vaganov[2], Dmitry Schepaschenko[1], Florian Kraxner[1]

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Abstract

Diversity of results of regional carbon budget assessments is high. Ten publications were published in peer-reviewed editions during recent years reported the net carbon sink of Russian forests from 150 to about 1000 Tg C yr-1. Such a variability cannot be explained by only references to different periods of the account and research methods. We consider a methodology of a Full and Verified Carbon Account (FCA), which follows major prerequisites of the applied systems analysis and takes into account a fuzzy (underspecified) character of the FCA. The methodology allows us to assess and minimize uncertainties of the FCA in a possible comprehensive and reliable way. The major systems requirements to the FCA include inter alia: 1) justification of completeness of the account; 2) possibility of scientifically solid assessment of uncertainty of major intermediate and final proxies (NPP, HR, NBP, NECB etc.); 3) presenting all components of the FCA in a spatially and temporally explicit way; 4) use of compatible monosemantic definitions and logically consistent classification schemes; 5) strict formal structuring of the studying system, particularly defining its interim and outward boundaries; and 6) use of formal algorithms of the carbon account and its uncertainty. Uncertainty is interpreted as an aggregation of insufficiencies of outputs of the accounting system, regardless of whether those insufficiencies result from a lack of knowledge, intricacy of the system, or other causes. "Fuzziness" of the FCA defines that results received by any individual method of carbon accounting does not allow assessing the structural uncertainty of the methods, and "within-method" uncertainty is incomplete that supposes consideration of "uncertainty of uncertainty". The considered methodology puts a number of specific requirements to input information, which is presented in form of an Integrated Land Information System and is based on 1) relevant combination of the pool- based and flux-based methods, 2) use of a Landscape-Ecosystem Approach for overall designing and empirical assessment of the FCA (past and current); 3) application of independent results received by other methods (process-based models, eddy covariance, inverse modeling, remote sensing) for mutual constraints of the "within-method" results and estimation of the "full" uncertainty of FCA using the Bayesian approach. We present results of the FCA for Russian forests for 2000-2015. Our analysis of the available published results for Russia's forests leads to a conclusion that substantial part of diversity of the results is explained by violation of one or several systems requirements to the FCA.

Focus of Research

Systems approach to the carbon account of forest ecosystems, minimizing the uncertainties

Key Challenges

The research is directly tied with comprehensive and reliable assessment of carbon sequestration service of boreal forest ecosystems

Suggestion to Address these Challenges

Improvements of methodology of carbon account of forest ecosystems at national and international level, e.g. reporting to the Secretariat of IPCC

Large-scale quantifying of sources and sinks of atmospheric carbon in Siberian forests

Alexey Panov[1], Anatoly Prokushkin[1], Vyacheslav Zyrianov[1], Anastasiya Timokhina[1], Nikita Sidenko[1], Sung-Bin Park[2], Jošt Lavrič[2], Martin Heimann[2]

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Abstract

The boreal and arctic zone of Siberia represent a «hot spot» area in the global Earth climate system, containing large and potentially vulnerable carbon stocks as well as considerable carbon dioxide (CO_2) and methane (CH_4) exchange fluxes with the atmosphere.

Since 2006, in order to monitor long-term biogeochemical changes, the Zotino Tall Tower Observatory (ZOTTO; www.zottoproject.org), a research platform for large-scale climatic observations, is operational in Central Siberia (60°48' N, 89°21' E) about 20 km west of the Yenisei river. Observatory consists of a 304-m tall mast for continuous high-precision measurements of greenhouse gases, meteorology and multitude of aerosol properties in the atmospheric boundary layer (ABL). Sampling of the ABL is essential for the «top-down» approach in observational strategy, since it minimizes local effects and permits to capture regional concentration signals. Such measurements are used in atmospheric inversion modelling to estimate sinks/sources at the surface over the large Siberian territory. In turn the tall tower observations are linked with eddy covariance measurements of exchange carbon fluxes, introducing a «bottom-up» observational approach, over locally representative ecosystems: pine forest – bog complexes (60°48' N; 89°22' E); a mid-taiga dark coniferous forest (60°01' N; 89°49' E); a northern taiga mature larch forest (64°12' N; 100°27'E) and a forest-tundra ecotone (67°28' N; 86°29' E). This meridional observational network captures exchange fluxes of CO_2 and CH_4 in ecosystems of the main biogeochemical provinces for the Yenisey river basin of 2580 thousand km², that can be scaled up to the region using vegetation maps, forest biomass inventories and remote sensing information.

Here we summarize the scientific rationale of the observation network, infrastructure details of the stations, the local environments and results obtained from the measurements. Within 3 yrs of complete observations all studied ecosystems represented carbon sinks, but greatly differed by values of C uptake throughout the growing seasons and over the ecosystems with highest values of cummulative net ecosystem exchange (NEE) found out in Pinus sylvestris forest, mid-taiga dark coniferous forest and northern taiga mature larch forest (14,5 - 11,5 µmol m–2 s–1), moderate – in peat bog (9 µmol m–2 s–1) and lowest NEE in forest tundra (3,5 µmol m–2 s–1). Since the large percentage of growing season C uptake can be lost during winter, this study also presents observational results of an experiment to estimate CO_2 flux through a seasonal snowpack over the ecosystems with comparison of different methodologies.

Focus of Research

We are focusing on studying fate of carbon pools in a warming climate that constitutes a pressing question in Earth science. Siberian forests contain large amounts of carbon stored in the forests and soils, in wetlands and the underlying permafrost. Knowledge of their response to climate change is vital.

Key Challenges

During 10 yrs of high-precision observations of atmospheric trace gases in the pristine conditions of Siberia we have recorded a year-to-year growth of carbon dioxide concentration. However to distinguish between short-term variations and multi-decade climate variability longer periods of measurements are necessary to improve the statistical significance of the observations.

Suggestion to Address these Challenges

Global warming, urban air pollution, biogeochemical changes, biodiversity etc. These environmental challenges are linked, but each is studied separately. This results in a cacophony of information that yields comparably little. While a multidisciplinarity and coordination of efforts would be of a great importance in addressing these challenges.

B1: Cool Forests as a resource

10:30am - 10:45am

DOES EXPANSION OF WOODY BIOMASS MATERIAL USE OUTRUN WOODY BIOMASS ENERGY USE – THE EFFECT OF SOCIOECONOMIC DEVELOPMENT AND REPRESENTATIVE CONCENTRATION PATWAYS ON THE WOODY BIOMASS USE

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Abstract

Integrated assessment models predict a significant increase in the woody biomass use for energy and harvest volumes in the high mitigation scenarios, which has raised concern about disturbances to natural forests ecosystems. Considerable less attention is paid to the effect of socioeconomic development on the woody biomass material use, which can potentially lead even a higher increase of harvest volumes in the future. In this study, we consider the trade-off between these two effects on the woody biomass use. The analysis is conducted by using the Global Biosphere Management Model (GLOBIOM) and RCP-SSP scenario results from MESSAGE-GLOBIOM-G4M integrated assessment model. RCP-SSP scenario results separate between the socioeconomic development pathways (SSPs) and the representative concentration pathways (RCPs). SSPs and RCPS might impact woody biomass use in several ways. However, because there are no common agreement on the SSP and RCP narratives for forest sector, we restrict our analysis to factors that are quantitatively documented in the SSP-RCP scenario data (GDP and POP growth, bioenergy demand and carbon prices). We show that SSPs might affect the harvest volumes as much as RCPs. Moreover, we show that the effect of SSPs on harvest volumes is different in the different RCPs. In the low mitigation scenario (RCPref) industrial roundwood is not used for bioenergy, which means that harvest volumes are determined by SSPs. In the high mitigation scenario (RCP2.6) industrial roundwood is used for energy, which means that harvest volumes are determined by interaction of SSPs and RCPs. We show also that the effect of RCPs on harvest volumes can be decreased by implementing carbon tax on degradation, which directs biomass use for energy to residues and energy crops. It is more difficult to control the effect of SSPs on harvest volumes without reducing the final products demand, because in the material production there are no substitutes for roundwood. For this reason, the expansion of woody biomass material use might cause a larger threat for natural forests ecosystems than the expansion of woody biomass energy use.

Focus of Research

The effect socioeconomic development on woody biomass use for material products and possible consequences to natural forests ecosystems.

Key Challenges

Woody biomass use for material products might increase harvest volumes more in the future than woody biomass use for energy.

Suggestion to Address these Challenges

Try to avoid bad socioeconomic development in the future.

10:45am - 11:00am

Developing regional G4M model to support wildlife management in Sweden

Anton Platov[1], Andrey Krasovskii[2], Oskar Franklin[2], Dmitry Schepaschenko[2], Florian Kraxner[2], Sylvain Leduc[2]
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Abstract

Challenges of wildlife management in different regions of the world, and particularly in boreal forests, call for new model developments. For example, in Sweden there is a need for integrated framework to model complex dynamics linking forest management, moose population, hunting, traffic accidents, and predators (bear, wolf). In this study we demonstrate how global forestry model (G4M) can be adjusted to requirements of wildlife management in Sweden.

New regional version, G4M-Sweden, provides several new features compared to the original G4M algorithm. Firstly, spruce and pine species are introduced in the model, as they are of particular interest to forest owners and the moose. Secondly, browsing is included in the model by implementing feedback loop between moose population and spatial forest dynamics in the management moose area (MMA). The moose population submodel, developed in the study, includes spatial mortality from hunting, predator, and traffic accidents (depending on the road density and spatial forage distribution in MMA). The developed regional model allows analyzing policy alternatives from perspectives of different stakeholders.

Focus of Research

The focus of our research is on modeling interaction between forest dynamics and wildlife. Modeling interaction of forest and the moose, under different management scenarios, will allow analysing trade-offs for multiple objectives of hunters and forest owners in Sweden. The study is also linked to climate and bioeconomy.

Key Challenges

Yes, in particular in Sweden, the challenge is to assess risks under different wildlife and forest management scenarios, e.g. to look at interaction of spruce and pine.

Suggestion to Address these Challenges

Our suggestion would be to use our modeling approach to assess the impacts of management decisions on dynamics of forest and wildlife, and look for trade-off solution.

11:00am - 11:15am

Forest Reference Levels for the EU Member States: Accounting under shared responsibility

Nicklas Forsell, Anu Korosuo

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Abstract

On 14th of May 2018, the Council of the European Union adopted a regulation that sets a framework for the inclusion of greenhouse gas (GHG) emissions and removals from the Land Use, Land Use Change and Forestry (LULUCF) sector into the EU 2030 energy and climate targets. The new regulation provides a framework for ensuring that emissions and removals generated by LULUCF sector are taken into account within the EU's target to reduce GHG emissions by at least 40% by 2030 compared to 1990 level.

In the LULUCF Regulation, GHG emissions and removals from Managed Forest Land are accounted using the concept of Forest Reference Levels (FRLs). The FRL is a country-specific projected baseline of future emissions and removals, against which the actual reported emissions and removals will be compared to for accounting purposes during the compliance period 2021-2030. According to the new Regulation, the FRL is calculated based on the projected continuation of historical forest management practice, i.e. reflecting age-related forest dynamics but not the future impact of policies or expected demand for wood. Compared to the historical practice, a country may thereby receive "debits" or "credits" that counts toward its economy-wide target. Such calculations allow a rich portfolio of management options within forests to be transparently accounted for, including conserving and enhancing existing forest carbon sinks, increased consumption of wood-based products to substitute carbon-intensive products, and enhanced production of bio-based energy to mitigate climate change.

This study is based on a Technical Guidance document developed by the authors, which provides technical guidance to Member States in the development of their national, country-specific FRLs. We outline important concepts of the LULUCF and provide guidance on how to develop the FRL so that it is in line with the adopted LULUCF Regulation. Furthermore, we describe science-based practical approaches that Member States may use in the preparation of their FRL. The Technical Guidance document sets a preference for how countries may account for Managed Forest land after the Kyoto Protocol to ensure that efforts as implemented within the sector are credibly accounted for within the Paris Agreement.

Focus of Research

Key focus of this work is to describe the new LULUCF policy and accounting principles, and provide approaches with a sound scientific basis that help the Member States to develop their FRL that both comply with the new Regulation, and contribute to credible forest sector accounting under the Paris Agreement.

Key Challenges

Key challenge is to ensure that the Forest Reference Levels as calculated by Member States only account for verifiable changes to the forests, thereby avoiding inflated projections of future harvest levels and a potential generation of credits without measurable improvement in management of the forests.

Suggestion to Address these Challenges

Main aim of this work is to provide credible and applicable science-based approaches that countries may apply to calculate their Forest Reference Levels so that improvement in the management of their forests can be accounted for in credible manner.

11:15am - 11:30am

Long Rotation Forestry in Boreal Ecosystems of Russia: Special Conditions for Forest Management Planning and Design

Alexander Alekseev[1], Klaus von Gadow[2]

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Abstract

This paper describes some conditions and constraints which are characteristic for the Boreal forest ecosystems in Russia and their sustainable use. Considering possible social, economic and technological changes during rotation period equal to century, key economic parameters, such as timber price, cost structure and rate of interest have become completely unpredictable. Details are presented which support the notion that net present value is not a suitable decision aid for comparing alternative long-term investments in Boreal forest ecosystems. Discounting makes it unreasonable to invest for long periods of time and may facilitate the overexploitation of a natural resource. The reasonable way to manage forests under such great uncertainty is to apply the sustainability principles as a basic premise. Two principles of sustainable forest design are dominant, first, the principle of inexhaustibility which ensures that it is possible to use the current forest resources in the future and, second, the principle of continuous use. For the practical implementation of the above principles a specific optimization model may be used. Differential forest rent, is an extra income which arises due to differences in natural site conditions and transportation costs which both are significant for Russia having large area with a variety of environmental conditions. A special model is introduced which maximizes total income for a forest area subject to restrictions and offer a possibility to calculate forest rent. Geographic information systems provide the required data for rent calculations. They contain information about the productivity of stands scheduled for harvesting, and their location relative to the transportation network. A spatial optimization of forest use offers the potential to estimate both types of forest rent, using the cost of the primal constraints in the dual formulation. An example involving Lisino training and experimental forest of Saint-Petersburg State Forest Technical University is presented to demonstrate the approach. The main focus of the paper concentrates around problems of long rotation forestry system and its characteristics; unpredictability and variability of main economic parameters for long periods of time; principles of forest resources use for long rotation forestry; models for optimization of forest resources use; forest rent as extra income arising due to differences in natural site conditions and transportation costs; GIS technology and special model for forest rent calculations.

Focus of Research

Focus of the paper concentrates around problems of long rotation forestry system and its characteristics; unpredictability and variability of economic parameters for long time periods; principles of forest resources use for long rotation forestry; models for optimization of forest resources use; GIS technology and special model for forest rent calculations.

Key Challenges

Long rotation period, wide spatial distribution, severe environmental conditions, slow growth, high environmental and social value, unpredictability and variability of economic parameters for long time periods, need for sustainable management, estimation of differential forest rent as an extra income arising due to differences in natural site conditions and transportation costs

Suggestion to Address these Challenges

Use of sustainability principles as a basic premise. Two principles suggested, first, the principle of inexhaustibility which ensures that it is possible to use forest resources in the future and, second, the principle of continuous use. For the practical implementation of the principles a specific optimization model may be used.

11:30am - 11:45am

Forecasting forest management impacts on forest structure under changing climate

Titta Majasalmi, Clara Antón Fernández, Rasmus Astrup, Ryan M. Bright
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Abstract

Forest structural properties have direct impact on surface fluxes, and attributing forest management impacts on forest structure under current and future climate requires characterization of forests structural diversity both spatially and temporally. The large variability in forest structure is not sufficiently represented in today's land surface models because the underlying land cover maps have a limited number of forest types which do not represent the diversity in species and structural attributes. Our framework describes the current state of forests in the form of a land cover map with corresponding look-up table of key forest structural attributes, which can be used to prepare surface data for a land surface model. The scenario driven approach was used to add the temporal dimension to recently developed land cover product based on multisource NFI data (Majasalmi et al., 2018). In this study a geospatial climate-sensitive matrix model approach was developed based on fifteen years of Norwegian National Forest Inventory (NFI) data for forecasting forest growth based on different Representative Concentration Pathways (RCPs) and harvest following two contrasting Shared Socio-economic Pathways (SSPs). Transitions between different forest classes were modeled using matrix model which uses growing season temperature and precipitation and depth to bedrock as covariates. To demonstrate the approach, the state of Norwegian forests in 2100 was forecasted using two contrasting scenarios: 1) SSP1 'taking the green road' assuming RCP scenario 4.5, and 2) SSP5 'Fossil-fueled development – taking the highway' with underlying RCP of 8.5. Sensitivity analysis was used to identify areas where forest growth may be expected to decline due to changing climatic conditions, and thus require forest management actions, such as species change. The spatially explicit predictions showing expected forest class distributions are required for more accurate estimates of future harvest potentials. Outcomes of combined RCP and SSP trajectories may be used to assess future needs in terms of forest management related adaptation and mitigation.

Focus of Research

Our NFI data-based framework quantifies current state and development of Norwegian boreal forest under variant forest management scenarios and different climate projections. The resulting maps of different forest classes are required to parameterize different land models to reach more accurate predictions on surface fluxes and future harvest potentials.

Key Challenges

Our growth model can be used to identify areas where forest growth may be expected to decline due to changing climatic conditions, and forest management actions might be required to sustain forest. Outcomes of different adaptation and mitigation actions may be compared via combinations of climate conditions and harvests.

Suggestion to Address these Challenges

Our modelling approach may be used to assess the future impacts of different forest management actions on forest growth and yield under changing climate. Key challenge could be to develop management plans (via altering harvest and planting) to optimise spatial species distributions.

When moose regulated bioenergy

Sylvain Leduc, Andrey Krasovskii, Dmitry Schepaschenko, Oskar Franklin, Florian Kraxner
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Abstract

Sweden has the highest density of moose population in the world. Mooses provide many services such as hunting or food, but a high moose population may also cause damages on young forest, or increase the probability for road accidents. Those risks and damages can be minimized when the right management of the forest is applied, without compromising the recreation that mooses provide. Moreover the forest based industries (e.g., bioenergy) touch the forest that in its turn impact on the moose disparity and its food. It is therefore of interest to understand how a well-structured harvest planning can occur to satisfy the need of feedstock from the industries, without affecting the moose population.

We present a method that apply a forest mode, a techno-economic model, called BeWhere, and a moose population model. The Global forest model, G4M, will provide the optimal forest management, yields and cost of harvest over time based on different climate scenarios. Based on the forest data, the BeWhere model will identify where the feedstock will be harvested from for some forest industries over time, based on the minimization of the cost of the supply chain. The results will be sent to the moose model, and in its turn it will identify the development of the moose population over the same time period. Based on different scenarios of type of harvest, the model framework will finally identify the optimal way of harvest over a given time period so that forest industry and moose population do not compete against each other.

Focus of Research

This research is based on the optimal allocation of harvesting for the forest based industries and in particular for the bioenergy. And the study also links moreover with a moose model to study the impact on less road accident, less damages on the forest, but at the same time still some hunting opportunities.

Key Challenges

The study includes forestry models that analyses the optimal forest management and development under different climate scenarios for Sweden. It includes both the threat from climate, at the same time it provides alternative to well manage the forest for increased bioenergy production

Suggestion to Address these Challenges

The BeWhere model addresses some suggestions to better manage the forest for bioenergy production. The moose model deliver suggestion for a controlled moose populaiton, by still being beneficial for the people. The forest model provides suggestions on how a certain forest management can better adapt to climate change.

PN1: Sustainable forest management, biodiversity and wildlife management

Time: Monday, 17/Sep/2018: 10:30am - 12:20pm · *Location:* Laxenburg Conference Center, Marschallzimmer 2
Session Chair: Maartje Johanna Klapwijk
Session Co-Chair: Per Angelstam

10:30am - 10:45am

SPECIES DYNAMICS & DISPERSAL SYNDROMES ACROSS ISOLATED MONTANE SHOLA FOREST IN WESTERN GHATS, INDIA

Dr. Nagaraja BC[1], Dr. Chethan HC[2]

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Abstract

Montane forest-grassland mosaics in the tropics supporting several endemic species and are recognized as living fossils and it is centre of speciation for some taxa. In Western Ghats these e forest as numerous, isolated, sharply defined and usually small woods composed of stunted evergreen trees classified as 'Southern Montane wet Temperate forest' locally known as 'Sholas' forest or Sky Island. Shola forest biodiversity is under threat due to climate change, forest fire, invasive species, ecotourism and encroachment and are already considered as living fossils' due its constraints of their antiquity and lack of regeneration. The study was carried out within Kudremukh National Park cliffs of undulating mountain ranges of 1200 m to 1800 m elevation. The present study has been visualized to examine the plant species dynamics and compositional changes across the different sized isolated fragmented forest and to understand the dispersal syndromes. Tree vegetation was carried in 25 m x 25 m plots were laid grassland- shola forest edge to interior. Each plant species dispersal syndromes were collected from literature and cross verified on the field.

Our study on 30 Montane evergreen shola forests of the Kudremuk National Park revealed that five species represented 20% of the stems across commonly recorded in the Shola, these species includes Litsea floribunda, Mastixia arborea, Neolisea zeylanica, Olea dopoca, Syzygium rubicundum and low levels of rarity, with only three species represented by just one individual, such as Apodytes dimidiate, Ficus nervosa, and Olea dopoca. Large Shola got 55% of total stems than Medium (33%) and Small Shola (12%). We recorded 70 species of trees in Large Shola. The results also revealed that higher species and dispersal modes recorded at larger shola followed by Moderate and smaller shola. The dispersal modes shown higher number of species are either mammal and duel mammal-birds seen at Large and Moderate shola than Small shola forest could see more passive dispersal and duel bird-mammals' dispersal modes. This is evident that mode of species may structure forest communities across the Large, Medium and Small Montane forest, and size of the islands directly proportional to the diversity of the dispersal modes of tree species.

Focus of Research

People and Nature

Key Challenges

Yes, these high altitude montane shola forests are already threatened due to climate change, fire, invasive species and anthropocentric disturbances

Suggestion to Address these Challenges

It is essential to take the help of UNESCO, IUFRO and other organisations to protect these living fossils. Also it is important to make a policy at national level to protect montane forest.

10:45am - 11:00am

Unique boreal forests of European Russia

Olga Smirnova[1], Tatiana Braslavskaya[1], Alexey Aleynikov[1], Vladimir Korotkov[2]

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Abstract

The northern (taiga) forests of Russia have preserved the integrity of their cover in the greatest degree; however most of forests lost by now their primary structure, soil richness and biological diversity due to clear felling, fires and other anthropogenic impacts. Therefore, search and research of unique areas of forest cover that have preserved a pre-anthropogenic structure and taxonomic composition is of great importance now for deep understanding of the principles of natural self-regulation and the stability of taiga ecosystems.

Detailed studies of forest vegetation, soils and the ontogenetic structure of tree populations were conducted in the large intact areas of the northern taiga of European Russia. Together with green moss spruce(-fir) forests (association Linnaeo borealis-Piceetum abietis Caj., 1921) investigated in detail in this zone, unique type of boreal tall herb forests dominated by Picea spp. and Abies sibirica and tall herb spruce-fir forests with Pinus sibirica (association Aconito septentrionalis-Piceetum obovatae Zaugolnova et al., 2009) was distinguished and described. Dotted maps of distribution of boreal tall herb forests and areas of tall herb species have been compiled on the basis of field studies and the analysis of herbarium collections. Historical and archival data on the types of nature

management in the north taiga forests, as well as paleontological data on the taxonomic composition of paleo-ecosystems in the studied areas were summarized to identify the root causes of the differences in green moss and tall herb types of boreal forests.

A comparison of the two types showed that old-growth tall herb forests have a full set of features characterizing long-existing and self-sustaining forests. Tall herb forests are characterized by: clearly expressed gap-mosaics, full-scale ontogenetic spectra of tree populations, treefalls pit-and-mound topography, high soil fertility, high species richness and species density, a significant variety of functional groups of vascular plants and mosses. Analysis of the obtained data in combination with paleontological and historical data made it possible to conclude that (1) boreal tall herb forests were spread over a significant part of European Russia and Western Siberia in prehistoric times; 2) widespread modern green moss forests are secondary and formed as a result of anthropogenic fires and felling. The obtained data on the composition, structure and distribution of boreal tall herb forests allow us to consider them as an etalon of prehistoric taiga forests.

Focus of Research

The main tasks of modern nature management are a reorientation to conservation and restoration of ecosystem functions of the Biosphere. The remaining forests of Northern Eurasia play a huge role in maintaining stable climate, hydrological regime and cycle of biogenic elements.

Key Challenges

Reduction of the area of intact forest lanscapes as a result of logging and anthropogenically initiated fires

Suggestion to Address these Challenges

Great importance is given to in-depth studies of fragments of tall herb forests still preserved within North Eurasia. Such studies will make it possible to propose forest management systems aimed at restoring the potential biological diversity of taiga forests.

11:00am - 11:15am

Sustaining biodiversity in landscapes managed for forest productions, and the added complication of climate change.

Jim Schieck[1], Peter Solymos[2]

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Abstract

To achieve environmental certification, forest companies commit to managing their harvest in ways that sustain native ecosystems and biota. We used information collected by the Alberta Biodiversity Monitoring Institute throughout the boreal forest of Alberta, Canada, to determine the distribution and abundance of approximately 500 species (including mammals, birds, vascular plants, mosses, and mites), and the degree to which their relative abundance varied among native and human-created habitat types. In addition, habitats were mapped on Alberta-Pacific Forest Industries Inc. (Al-Pac) forest management area to describe current conditions. Reference vegetation conditions where determined by "backfilling" human footprints with the vegetation expected if human footprint had not been present. Coefficients from species models were applied to both current and reference conditions to determine the difference (ie., cumulative effects of human development on each species). On average predicted difference in abundance from reference to current conditions was +4% (range -15 to +71%), with approximately half of the species predicted to be more abundant under reference than current conditions, and the other half less abundant. Mature and old forests are targeted for harvest by forest companies. For birds associated with these older forests, only modest changes were predicted between reference and current conditions (mean -1%, range -15 to +19%). This occurred because forest fires during the past centaury have resulted in a skewed age-class distribution in the Al-Pac area, with the result that each year similar amounts of forest became mature/old as were harvested. However, based on simulations of continued forest harvest into the future, old forest birds are expected to decline 20-30% by the year 2100. Incorporating the effects of climate change, however, will greatly overshadow changes caused by forest harvest. By 2080, much of the Al-Pac area (20-100%, depending on which climate-change model is used) is expected to have grassland or parkland climates. This creates a dilemma for forest companies; even with sound environmental management it will be difficult to maintain sustainable populations for many native species that currently live in the area. Alternative goals are needed in a climate change world.

Focus of Research

This research helps managers understand how forest harvest alters native boreal ecosystems. Harvest effects biota to a moderate degree, but through careful management it is possible to reduce environmental degradation. However, climate change may greatly affect boreal ecosystems and overshadow current forest management activities.

Key Challenges

Key challenges include:

• To what degree are forest biota (especially old-forest biota) affected by forest harvest?

• Can we harvest boreal forests in ways that maintain environmental sustainably?

• What are the implications of climate change on forest management?

Suggestion to Address these Challenges

Through rigorous data collection, analyses and modeling it is possible to understand how species are effected by forest harvest. Regional landscape management, including having some areas protected from development, is necessary to manage sensitive forest species. Identifying and managing climate refugia will be very important if climate change becomes extreme.

11:15am - 11:30am

Capturing complexity: Forests, decision-making and climate change mitigation action

Maartje Johanna Klapwijk[1], **Johanna Boberg**[1], **Johan Bergh**[5], **Kevin Bishop**[1], **Christer Björkman**[1], **David Ellison**[1,6], **Adam Felton**[1], **Rolf Lidskog**[4], **Tomas Lundmark**[1], **E. Carina H. Keskitalo**[2], **Johan Sonesson**[3], **Annika Nordin**[1], **Eva-Maria Nordström**[1], **Jan Stenlid**[1], **Erland Mårald**[2]

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Abstract

Forests play an important role in climate change mitigation due to their capacity to sequester carbon. However, the interplay between biophysical and social systems affects use and management of natural resource, in our case forests and it has proven difficult to incorporate the full potential of climate change mitigation through forests into management practices. We present an heuristic framework to grasp and order this complexity by identifying four types of obstacles to change that are described in published literature: cognitive, strategic, institutional and normative. We review climate change mitigation in the context of Swedish forest research. A key finding in the literature was the perception that current uncertainties regarding the reliability of different methods of carbon accounting acts to inhibit international agreement on the use of forests for climate change mitigation. This leads to strategic obstacles affecting the willingness to implement carbon emission reduction policies by individual countries. Furthermore, generating bioenergy from forest is hindered by a lack of knowledge regarding the resultant biophysical and social consequences, inhibiting the development of institutional incentives with regards to the production of bioenergy using forest products. Ideas about acceptable forest use further affects these scientific discussions and associated research.

Focus of Research

In our work we focus on obstacles that inhibit using managed forests in climate change mitigation. We use an approach that enables us to take a multidisciplinary perspective including generating scientific knowledge, institutional/policy context, strategic decision making and values.

Key Challenges

We identify inhibition to using for forests for climate change mitigation purposes from a Swedish perspective where the role of boreal forest is crucial.

Suggestion to Address these Challenges

To address problems in their complexity and find the weak points in the system. See at what level the inhibitions act, either national or international, whether it depends on a lack of knowlegde, lack of governance, lack of trust, or norms that do not support a goal.

11:30am - 11:45am

How much forest is protected in Sweden? A simple question with many answers

Per Angelstam
Swedish University of Agricultural Sciences, Sweden; per.angelstam@slu.se

Abstract

Bio-economy, which links closely to terms like bio-based economy, knowledge-based bio-economy and forestry intensification, is becoming a new influential discourse affecting forestry. There are indications that the bio-economy discourse is beginning to dominate the previous sustainable forest management discourse, which simultaneously considers economic benefits, biodiversity conservation and rural development. There are thus increasing tensions among different forestry objectives. The current debate in Sweden is a good illustration. In response to the emergence of increasingly polarised narratives this study aims at clarifying the meanings of the different numbers presented by different actors about how much "protected forest" there is in Sweden. There are many ways to interpret and summarise figures on the area of formally protected and voluntary set aside forests in Sweden. Some actors also include green tree retention and non-productive forest and wooded land. This means that figures for the proportion of "protected forest" range from 4 to 31%, something which hampers evidence-based constructive dialogue at all levels of forest and landscape governance. Given the fact that most of the Swedish forest products are exported, some of the so-called Aichi targets of the Convention on Biological Diversity party meeting in Nagoya in Japan 2010 are key to "counting correctly". Target 11 states that 17 percent of the land area should be protected as an ecologically representative and functional green infrastructure for biodiversity conservation and provision of ecosystem services. Target 11 should not be mixed with Objective 7 that deals with sustainable use of the surrounding landscape. Using this approach there is large variation between the proportion of protected areas of productive forests (8-9%) and mountain forests (43%). However, the small size of especially voluntary set-asides, limited quality and severe fragmentation, which continues, means that the effective area forming functional green infrastructures is considerably lower especially for productive forests. This calls for spatial planning and long-term habitat restoration linked through a landscape approach.

Focus of Research

Focus on sustainability science by knowledge production about both social and ecological systems in landscapes and regions representing different contexts on the European continent, as well as collaboration with practitioners to encourage evidence-based learning at different levels of governance, planning and management.

Key Challenges

Stakeholder collaboration towards sustainability in landscapes as coupled social and ecological systems.

Suggestion to Address these Challenges

Transdisciplinary place-based knowledge production and learning that engages social and natural science disciplines, and stakeholders across sectors and levels of governance

Determination of the resource potential of boreal forests using data from the state forest inventory of the Russian Federation.

Aleksei Grigoriev
Roslesinforg, Russian Federation; rossilva@mail.ru

Abstract

State Forest inventory. Its place in the system of forest inventory of the Russian Federation. The State Forest Inventory is one of the relatively new types of forest inventory operations in the Russian Federation. It does not replace or duplicate the classical forest management, but it was created for comprehensive assessment of forest resources necessary for strategic planning.

The technology of performing the work of the SFI. The report will describe in detail the technology used to carry out the work of determining the quantitative and qualitative characteristics of forests under the state forest inventory.

Distribution of boreal forests on the territory of the Russian Federation. About 70% of boreal forests are located on the territory of the Russian Federation, therefore it is difficult to underestimate the importance of these forests. 17% of all carbon stocks are concentrated in boreal forests.

Use of the Russian SFI data to determine the resource potential of boreal forests. The state forest inventory data can be used to update existing information on boreal forests: their resource potential, carbon deposition, renewal, biodiversity, and for assessing the state of plantations.

Focus of Research

The research is focused on the SFI, its methodology and possibilities of use of the data for efficient SFM, social and economic development, as well as monitoring clemate-related changes in forests.

Key Challenges

The challenges are related to the evaluation of the resource potential of boreal forests that are spread on large territories in Russia.

Suggestion to Address these Challenges

Use of the comprehensive approach for the SFI, technological update.

Special Session 1: A strategy for protecting old growth forest in Europe

Time: Monday, 17/Sep/2018: 1:30-3:20   *Location*: Laxenburg Conference Center, Ovaler Saal

This session focuses on old growth forest in Europe – it's most valuable and vulnerable habitat. Presentations by Toby Aykroyd, Wild Europe, Zoltan Kun, Frankfurt Zoological Society, and Steffen Fritz will be followed by a Q&A session. Old growth forest is Europe's most valuable and vulnerable habitat. Yet everywhere it is coming under threat: from logging (much of it illegal) as timber prices rise, new roads, inappropriate grazing, even climate change. The Old Growth Forest Protection Strategy, launched by Wild Europe, seeks to provide – for the first time – a coordinated approach to saving the remnants of this precious heritage.

Presentations:
1. **Toby Aykroyd**, Wild Europe, will explain the objectives of the Strategy and its achievements so far
2. **Zoltan Kun**, Frankfurt Zoological Society, will outline the old growth forest project he is leading to implement the Strategy
3. **Steffen Fritz**, IIASA, will provide information on a major interactive mapping instrument he is developing

These presentations will be followed by a plenary Q&A session with participants. This will include focus on answers to the Questionnaire circulated beforehand.

B2: Afforestation, reforestation and plantations

1:30pm - 1:45pm

HIGH MITIGATION PATHWAYS WITH LOW BIOMASS USE FOR ENERGY – TRADEOFF BETWEEN AFFORESTATION AND BECCS

Pekka Lauri, Olga Turkovska, Michael Obersteiner, Georg Kindermann
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Abstract

In the high mitigation scenarios typically large amount of biomass is used for energy due to late-century peak of negative emissions and high share of BECCS in the negative emissions portfolio. High biomass use for energy has raised concern about increasing disturbances to natural forests ecosystems and food security. In this study, we consider alternative high mitigation pathways, where higher afforestation uptake and early timing of mitigation leads to lower biomass use for energy. The analysis is conducted by the Global Biosphere Management Model (GLOBIOM), which is updated to include three negative emissions technologies, afforestation uptake (AFFOR uptake), short rotation plantation uptake (SRP uptake) and bioenergy and carbon capture and storage (BECCS). The negative emissions time path is based on the carbon budget that satisfies the 2 °C target (RCP2.6 SSP2). The advantage of our modelling approach is that we can analyze explicitly the land- and biomass use competition between AFFOR uptake, SRP uptake and BECCS without suffering the linkage problems between separate energy sector, land-use sector and vegetation models. Our results indicate a significant decrease in the biomass use for energy (from 206 EJ/yr to 102-142 EJ/yr in 2100) and a significant increase in the afforestation (from 846 Mha to 1741-1872 Mha in 2010-2100) compared to original RCP-SSP scenario results. Lower biomass use for energy decreases harvest volumes 30-35% while higher afforestation increases food prices 0-10%. We observe also a clear regional distinction between BECCS and AFFOR uptake. BECCS will be a dominant negative emissions technology in the boreal and temperate zones while AFFOR uptake in the tropical zone. BECCS is more suitable negative emission technology for boreal and temperate zones, because it suffers less from slow increase of vegetation carbon than AFFOR uptake. On the other hand, AFFOR uptake is more suitable negative emission technology for tropical zone, because it is labor intensive technology and it benefits from fast increase of vegetation carbon.

Focus of Research

If you think that forests should be used for carbon sequestration instead of bioenergy production you should read this.

Key Challenges

High biomass use for energy

Suggestion to Address these Challenges

High biomass use for energy could be avoided by increasing afforestation uptake and early deployment of negative emissions.

1:45pm - 2:00pm

Utilising forestry data to explain and forecast forest seedling demand

Theo Koller[1], Martin Braun[2], Franziska Hesser[1], Peter Schwarzbauer[2,1]
[1]Wood K Plus (Kompetenzzentrum Holz), Market Analysis and Innovation Research Team, Austria; [2]University of Natural Resources and Life Sciences (BOKU), Institute for Marketing and Innovation, Austria; theo.koller@boku.ac.at

Abstract

The production of forest seedlings in nurseries is an important element of sustainable forest management to support the transformation towards a circular bio-economy. It enables the production of specific species to provide reforestation efforts after logging activities and natural hazards. Furthermore, forest seedling production enables assisted migration of tree species, populations or phenotypes, which facilitates climate change adaptation of forests and preserves or enhances forest productivity. Currently, producers of seedlings face high uncertainty in the production process, due to the delay (1-4 years) from the initial start of the production process until sale of seedlings. To minimise the risks for producers and to provide sufficient supply for market demand, an estimation of future seedling demand is required to support production decisions.

By applying an econometric model, we explain seedling demand and estimate the future demand of forest seedlings in Austria. Relevant forestry data (on logging activity, fallen timber, prices of wood assortments) and data on economic development and forest nurseries was collected, edited and tested according to their correlation to seedling demand. Thereby, qualitative properties of the raw data were analysed regarding trends, errors, discontinuities and in-between correlation. Based on this evaluation, correlation analysis between the target variable (seedling demand) and explanatory variables was conducted. Furthermore, explanatory variables were tested in econometric models with sequential forward selection. Predictors were added in blocks and tested based on their theoretical relevance, statistical significance and general meaningfulness. Finally, four model variations were established, each for

coniferous and deciduous seedling demand, which are based on absolute values and first differences as well as on instantaneous and lagged effects.

Our approach of explaining and forecasting seedling demand is novel and, to our knowledge, has not been proposed in scientific literature before. Results from the data analysis show a decreasing trend for both deciduous and, even more, for coniferous seedling demand, which indicates an increasing trend towards natural regeneration. Species level data implies a shift towards increased utilisation of mixed-stand species, such as silver fir, larch, sessile oak, common oak or sycamore maple. Results show that logging affects the seedling demand for subsequent years. Furthermore, there is a significant lagged effect of (mainly storm-induced) damaged timber, in particular on coniferous seedling demand. These factors can be utilised to explain and forecast future seedling demand and support production decisions for forest nurseries.

Focus of Research

Adaptive sustainable forest management will affect future seedling demand considerably which will affect the entire forest-based sector in the long run. Our study explains a missing link to understand seedling supply and demand within the context of the bioeconomy and climate change.

Key Challenges

The main challenge will be the adaptation of forest industries to a shift in raw material supply following the changes in seedling supply due to adaptive forest management.

Suggestion to Address these Challenges

An analysis of the impacts on the entire forest-based sector will help to understand the effect of assisted migration compared to a business-as-usual case (work in progress).

2:00pm - 2:15pm

Biochar – A Cool new tool for afforestation practices in Cool Forests.

Egle Köster[1], Jukka Pumpanen[2], Kajar Köster[1]

[1]University of Helsinki, Finland; [2]University of Eastern Finland, Finland; egle.koster@helsinki.fi

Abstract

Planting is the most important tool for afforestation in conifer-dominated forests of Northern Europe. Seedling production in nurseries can be divided bare rooted and container plants, but since 1960's the containerized planting stock is mainly produced. The survival of the seedlings after the planting is problematic, as about 20% of seedlings die during the first couple of growing seasons. Thus, from economical point of view we are facing with a loss of money, as the payments for the planting material and labor are done, but due to survival issues investments are lost.

Water and nutrient retention capacity of soil is important for the seedlings survival, and to improve different chemical and natural compounds are added to the growing media. Biochar could be an option to gain this kind of improvement of growing media due to its features. It contains certain amount of fertilizers, its porous structure is effective at retaining water and water-soluble nutrients, and its recalcitrant nature helps to keep carbon stored in the ground for centuries. As in today's world the climate change, greenhouse gas emissions and carbon dynamics issues are important, the forestry section must also take into account these questions, and the use of biochar in afforestation practices would have a positive impact on these issues.

To estimate possible impacts of biochar on growth of containerized planting stock, we established the greenhouse experiment. The main aim was to evaluate whether biochar application to the growing media affects the growth of tree seedlings during the first year of growing in the nursery.

We used raw peat as a basic growing media and amended it with a biochar. Treatments included 5%, 10% and 20 % from the volume of the peat replaced with biochar, and control with no added biochar. Also co-effect of biochar amendment and fertilizing was tested. For that three sub-treatments were conducted: control with no added fertilizers, and fertilizers used 50% and 100% as in current nurseries. We tested these conditions on Norway spruce, Scots pine and silver birch.

Results of this experiment will allow us to analyze if and how biochar application would affect the need for liming, fertilization and irrigation during the nursery period. We aim to provide for the public (forest practitioner, other stakeholders and general public) practical tools to improve the available afforestation practices and at the same time try to produce a new environmental supportive method.

Focus of Research

Focus of the research and importance to all three groups is to provide a practical tool for forest practitioners and general public to improve the afforestation practices, and to provide a new environmentally supportive method.

Key Challenges

Our research did not identify any threats or risks for boreal ecosystems, but the received results support the new environmental friendly method to reduce the fertilizing and watering in the tree seedlings growing nurseries.

Suggestion to Address these Challenges

We suggest the world wide use of biochar in the growing media to reduce the need for fertilizing and watering, and to keep the carbon out from the system for longer period without any environmental harming consequences.

Mechanical site preparation as a measure to increase the regeneration success of planted conifers in Fennoscandia

Ulf Sikström[1], <u>Kjersti Holt Hanssen[2]</u>, Karin Hjelm[1], Timo Saksa[3], Kristina Wallertz[4]
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kjersti.hanssen@nibio.no

Abstract

Successful and cost-efficient reforestation is essential for sustainable forest production. In the Nordic countries Finland, Norway and Sweden, the most common regeneration method is planting after clear-cutting and often mechanical site preparation (MSP). We have reviewed the reported quantitative effects of five main MSP methods in terms of survival and growth of manually planted coniferous seedlings of Norway spruce (Picea abies), Scots pine (Pinus sylvestris) and lodgepole pine (Pinus contorta) in these countries. MSP-effects, i.e. differences between results of the MSP methods and no MSP (control areas), are also considered in relation to temperature sum and number of years after planting. The MSP methods considered are patch scarification, disc trenching, mounding, soil inversion and ploughing. Studies performed at sites with mineral soils in boreal, nemo-boreal and nemoral vegetation zones in the three Fenno-Scandinavian countries are included. Data from 36 studies in total were compiled and evaluated. The results indicate that survival rates of planted conifers are generally higher than after planting in non-prepared sites. The calculated effect of patch scarification seem to be somewhat weaker than those of the other four methods. The MSP-effects on survival seem to be independent of the temperature sum. MSP generally results in greater height 10–15 years after planting than no MSP. This may be a temporary growth response; after that the difference in height probably persists, but without further increases. The strength of the growth effect appears to be inversely related to the temperature sum. The quantitative MSP-effects on survival rates and tree heights will be presented and discussed.

Focus of Research

We review the effect of mechanical site preparation on establishment and growth of conifers. Successful and cost-efficient reforestation throughout the "regeneration chain" is essential for sustainable forest production, in terms of both forest economy and carbon sequestration.

Key Challenges

Our study shows that regeneration by planting is substantially increased by mechanical site preparation, i.e. in northern forests regeneration success may be suboptimal without such measures. The focus today is often on minimizing the cost of each regeneration measure rather than optimizing the cost-effectiveness of the entire "regeneration chain".

Suggestion to Address these Challenges

To increase knowledge, both establishing and maintaining field trials, comparative studies and the development of predictive models are needed. Our compiled data may assist the design, evaluation and comparison of possible regeneration chains, i.e. analyses of the success and cost-effectiveness of multiple combinations of reforestation measures.

PN2: Biogenic disturbances in Cool Forests

Time: Monday, 17/Sep/2018: 1:30pm - 3:20pm · *Location:* Laxenburg Conference Center, Marschallzimmer 2
Session Chair: Evgeny Alexandrovich Vaganov

1:30pm - 1:45pm

Development of bark beetle outbreak in Western Tatra mountains.

Rastislav Jakuš, Miroslav Blaženec, Branislav Hroššo, Pavel Mezei
Slovak Academy of Sciences, Slovak Republic; rasti.jakus@gmail.com

Abstract

In 2014, the mountain forests were seriously damaged by wind in Western Tatra mountains (Slovakia). Later, bark beetle outbreak started in spruce forests. We established a system of monitoring transects in wind damaged areas. Wind damaged areas were scanned by terrestrial laser scanner. Landscape, forest stands, trees and bark beetle damage related parameters were recorded by terrestrial methods in wind and in bark beetle damaged areas in time series. We will present first results of the data analyses, focused on development of bark beetle outbreak on wind damaged areas. The main factors influencing the development of outbreak on downed trees were the tree quality and potential solar radiation.

Focus of Research

Our research is focused on bark beetle outbreak in mountain forests. Bark beetle outbreaks are the key disturbance in mountain forests in Central Europe.

Key Challenges

One of the key challenges are bark beetle outbreaks.

Suggestion to Address these Challenges

I would increase the focus on bark beetle outbreaks, especially in relation to climatic changes.

1:45pm - 2:00pm

Siberian silk moth, pine looper, gypsy moth: why are you so aggressive?

Vladislav Sukhovolkiy[1], Anton Kovalev[2], Olga Tarasova[3]
[1]V.N. Sukachev Institute of Forest SB RAS, Russian Federation; [2]Krasnoyarsk scientific Center SB RAS, Krasnoyarsk, Russia; [3]Siberian Federal University, Krasnoyarsk, Russia; soukhovolsky@yandex.ru

Abstract

A regime of outbreaks is observed in several hundred species from more than a million known insect species. Other types of insects are characterized by fairly stable dynamics. And a natural question arises - what is the reason for the aggressiveness of species that give outbreaks. The present work is devoted to the analysis of the ecological features and population dynamics of forest insects aggressive species. ADL (autoregressive distributed lag)- models of these species under different conditions are considered and compared in different conditions, the features of the weather conditions influence on the population dynamics of these species are discussed, the models of food consumption and interaction with parasites are considered, and the features of the spatial distribution of individuals in forest stands are discussed.

A method is proposed to determine the periods of seasonal development, when the weather influences population dynamics, a model of the outbreak as a first-order phase transition is proposed, the relationship between the stability of trees in stands and the attack of pests with the characteristics of radial tree growth is discussed. The issue of estimation of stands, potentially unstable to pest attacks, has been studied using space data.

Evolutionary factors that contributed to the emergence of aggressive species and the possible risks of outbreaks of forest insects in connection with climate change are discussed.

Focus of Research

models of population dynamics forecasts for forest management

Key Challenges

forest insect outbreak risk

Suggestion to Address these Challenges

forecasts and analysis

2:00pm - 2:15pm

Moose or spruce? Systems analysis for managing conflicts between wildlife, forestry, and society in Sweden

Oskar Franklin[1], Christer Kalen[2], Andrey Krasovskii[1], Brady Mattsson[3], Dmitry Schepaschenko[1], Mirja Lindberget[4], Sylvain Leduc[1], Maria Hörnell-Willebrand[4], Hördur Haraldsson[4], Florian Kraxner[1]

[1]Ecosystems Services and Management (ESM) program, International Institute for Applied Systems Analysis (IIASA), Austria; [2]Swedish Forest Agency; [3]University of Natural Resources and Life Sciences, Austria; [4]Swedish Environmental Protection Agency; franklin@iiasa.ac.at

Abstract

Sweden has the world's highest density of moose. Moose is not only a valuable game species, it also causes forest damages and traffic accidents. To avoid moose browsing, foresters respond by planting spruce to an extent that reshapes the forest landscape with impact on both production and biodiversity. To address this problem and maintain a healthy moose population in balance with the other interests, an adaptive management based on the knowledge and experiences of local hunters and landowners is advocated. However, the different stakeholders do not agree on what is an appropriate moose population, which leads to conflicts that are hard to resolve. A key problem is that it is very difficult to encompass and foresee long term consequences of different options for moose hunting and forest management. This makes it challenging to form coherent strategies that integrate different sectorial interests at a national level. To address this issue we have developed a systems analysis framework for integrated modeling of the moose population, forestry, and their interactions and consequences for biodiversity and traffic accidents. We analyze the short and long term consequences for multiple scenarios of moose hunting and forest management. Based on the results we elucidate and quantify the trade-offs and possible synergies between moose hunting, forest production, biodiversity and the risk of traffic accidents. This analysis will be used to support better informed and more constructive discussions among the stakeholders in the Swedish forest sectors, and to support policies for long term sustainable forest and moose management.

Focus of Research

The focus is on forest and moose management and their interactions and consequences for biodiversity and society. Forestry is one of the most important economic sectors in Sweden and moose hunting is important both economically and culturally. There are conflicts between these ecosystem services.

Key Challenges

The key challenge is to maintain a long-term sustainable coexistence of a healthy moose population, profitable forestry, and biodiversity, that satisfies all stakeholders.

Suggestion to Address these Challenges

Systems analysis for integrated modeling of the moose population, forestry, and their interactions and consequences for biodiversity and traffic accidents. This supports better informed and more constructive discussions among the stakeholders in the Swedish forest sectors, and supports policies for long term sustainable forest and moose management.

2:15pm - 2:30pm

Weakeningfactors of boreal forests of Siberia

Vladimir Vladimirovich Soldatov[1], Sergey Alekseevuch Astapenko[2], Dmitrii Viktorovich Golybev[3], Aleksei Aleksandrovich Ibe[4], Evgenii Aleksandrovich Vaganov[5], Anton I. Pyzhev[5]

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Abstract

Boreal forests are one of the most important regulators of the planet's climate, serve as a storage of huge reserves of carbon and surface fresh water. Along with global changes boreal forests are significantly affected by fires, pests and diseases.

Due to its remoteness and inaccessibility, timely measures in the prevention of these impacts are associated with significant financial and technological difficulties.

One of the main reasons of weakening and destruction of boreal forests has long been forest fires, but in the last decade the role of insect pests has dramatically increased. In Siberia, the largest outbreak of Siberian moth (Dendrolimus sibiricus Tschetv) for the last 14 years was realized on the Northern border of its area, covering forests of Tomsk, Kemerovo, Irkutsk, and Krasnoyarsk regions. Only in the Krasnoyarsk kray from 2015 to 2017, the area of forests with a focal number of Siberian moth amounted to 1596 thousand hectares. Thanks to promptly conducted fighter activities, it was possible to save 1115 thousand hectares of valuable coniferous stands.

In 2008, forest stands damaged by Far Eastern invasive species of bark beetle (Polygraphus proximus Blandf.) were revealed in the Krasnoyarsk territory and Tomsk region. Despite the measures taken to limit the amount of this pest, the area of damaged fir forests is currently about 480 thousand hectares in the Krasnoyarsk kray.

The presence of such a large amount of dry fuel material in the coming years will critically increase the risk of an explosive growth of the area and number of catastrophic forest fires that will impact the Earth climate system substantially.

The active application of earth remote sensing methods, especially in difficult to access boreal forest areas, contributes to the rapid identification of stands with disturbed and lost stability, but these methods allow to identify already occurred significant changes of forest ecosystems. Long-term forecasting of pest and disease population dynamics needs to be improved. New systems of entomological and phytopathological monitoring, including the use of methods of DNA analysis of pathogens (Rhizina undulata Fr., Hetebasidion annosum Bref., etc.) and pests (e.g., identification of races of the gypsy moth) must be actively implemented. This will allow to carry out the measures on regulation of populations of harmful organisms and prevent large-scale death of boreal forests at the early stages of the outbreaks' dynamics.

Focus of Research

Impact of forest fires and insects on the earth's climate

Key Challenges

Yes

Suggestion to Address these Challenges

Improvement of the forecast system

Critical tipping points of reindeer management in Finland

Mia Landauer[1,2], Sirpa Rasmus[1], Bruce Forbes[1]
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Abstract

Economic activities are intensifying in Arctic and boreal forest regions, bringing along ecological and socio-economic impacts on traditional livelihoods. Reindeer management has cultural, ecological, and economic importance in these regions but in recent decades, Fennoscandian reindeer management has experienced land use conflicts, especially due to forestry. This study introduces an approach to better understand the possibilities for co-existence of economic activities and traditional livelihoods sharing the same operational space. We study how climate change and land use change are affecting the preconditions for reindeer management in Finland. Research is lacking on critical tipping points that should be better understood in order to ensure that this traditional livelihood will remain viable.

Social-ecological systems (SESs) characterized by reindeer management in Finland lie at the nexus of regionally significant ecosystem services. Therefore, issues such as fragmentation of pastures due to forestry, or climate change affect the quality of pastures. The basis of successful reindeer management depends, for example, on the quantity, quality and accessibility of forage. However, limited access to certain pasture resources in space and time often constrains the amount of available forage as such. In order to understand factors that determine the tipping points of this livelihood, we review scientific peer-reviewed publications. Based on this review we select a sample (N=93) of the most relevant literature from the last two decades of studies focusing on reindeer management in Finland. It encompasses several disciplines, theoretical and methodological approaches. In addition, by analyzing herders' (N=9) perceptions and experiences based on interview data, the scientific knowledge on risks and critical thresholds in reindeer management can be compared with practitioners' knowledge.

Based on our findings, we argue that because the distribution of land use and exposure to climate change exhibit large regional variations, one should examine these differences from the viewpoint of herding practices that vary geographically but also culturally together in order to understand critical tipping points. Our study demonstrates that the tipping points are dependent on cumulative effects and consist of ecological, socio-economic and institutional interactions.

Focus of Research

The main focus of our study is to understand what determines tipping points of a traditional livelihood, reindeer management, which has been adapting to changes for centuries, but is now affected by rapid climate change and land use change.

Key Challenges

Reindeer and reindeer management are a significant part of Arctic and boreal ecosystems. The key challenge is how to maintain this ecologically, socially and culturally important traditional livelihood in the face of global change.

Suggestion to Address these Challenges

In addition to scientific knowledge, it is important to take into account traditional and local knowledge in order to understand what sustainable development pathways for the Arctic and boreal regions mean.

C3: Processes in high latitude and high altitude, mountains and permafrost

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4:00pm - 4:15pm

Integrated evaluation of the vulnerability to thermokarst disturbance and its implications for the regional carbon balance in boreal Alaska

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Abstract

Our capacity to project future ecosystem trajectories in northern permafrost regions depends on our ability to characterize complex interactions between climatic and ecological processes at play in the soil, the vegetation, and the atmosphere. We present a study that uses remote sensing analyses, field observations, and data synthesis to inform models for the prediction of ecosystem responses to climate change in the boreal zone of Alaska.

Recent warming, altered precipitation and fire regimes are driving permafrost degradation, threatening to mobilize vast reservoirs of ancient carbon previously protected from decomposition. Although large scale, progressive, top-down permafrost thaw have been well studied and represented in high-latitude ecosystem models, the consequences of abrupt and local thermokarst disturbances (TK) are less well understood. To fill this gap, we conducted a detection analysis characterizing 60 years of land cover change in the Tanana Flats, a wetland complex subjected to TK disturbance in Interior Alaska, using aerial and satellite images. We observed a nonlinear loss of permafrost plateau forest associated with TK and driven by precipitation and forest fragmentation. The results of this analysis were integrated into the Alaska Thermokarst Model (ATM), a state-and-transition model that simulates land cover change associated with TK disturbance. Thermokarst-related land cover change was simulated from 2000 to 2100 across the Tanana Flats. By 2100, the model predicts a mean decrease of 7.4% (sd 1.8%) in permafrost plateau forests associated with an increase in TK fens and bogs.

Transitions from permafrost plateau forests to TK wetlands are accompanied with changes in physical and biogeochemical processes affecting ecosystem carbon balance. We evaluated the consequences of TK disturbances on the regional carbon balance by coupling outputs from the ATM and from a process-based biogeochemical model. We used long-term field observations of vegetation and soil physical and biogeochemical attributes to develop new parameterizations for TK wetlands and permafrost plateau forest land cover types. Preliminary simulations from 2000 to 2100 estimate that the conversion of permafrost plateau forest to young TK wetlands would result in a 7.5% (sd 3.5%) decrease in Net Ecosystem Exchange.

Focus of Research

My research focuses on assessing the consequences of changes in climate and disturbance regimes on boreal ecosystems services, using remote sensing, empirical observations and process based models.

Key Challenges

Changes in climate and disturbance regimes in the circumboreal region are driving massive transitions across the landscape that have the potential to alter the suite of ecosystem services that the region can provide.

Suggestion to Address these Challenges

1) Accurate assessment of the fate of boreal ecosystems in a changing environment.

2) Consistent dialog between scientist and managers and policy makers for efficient co-production of knowledge and management tools.

3) Local to international commitment of political organizations to climate change mitigation and adaptation strategies.

4:15pm - 4:30pm

Dissolved carbon in runoff of larch dominated catchments of Central Siberia

Anatoly Prokushkin[1], Alexey Panov[1], Vyacheslav Zyryanov[1], Jan Karlsson[2], Rainer Amon[3], William H. McDowell[4]
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Abstract

Absorption and storage of large amounts of atmospheric carbon (C) in the forest biomass and soil of the Northern hemisphere are among the central issues of the global greenhouse gas balance. On the other hand, long-term CO_2 sequestration in subarctic larch ecosystems is counteracted by regular fire disturbance and ongoing permafrost degradation which increase C losses from the warmer soils. One of the still poorly understood questions about the C balance of larch forests is the release of terrigenic C to drainage networks and the fate of this C during transport to the ocean. Our aims were (i) to analyze seasonal dynamics of C in different order

streams of larch-dominated landscapes in Central Siberia with emphasis on their fire history and (ii) to quantify annual hydrologic C losses relative to NEP estimates for old-growth larch forest.

The study region is located near the Tura settlement (64oN, 100oE) where we chosen 20 streams whose catchments experienced fires from 1 to 120 years ago. Regular water sampling was arranged throughout the frost-free season with analysis of dissolved organic C (DOC) and inorganic C (DIC). In a control stream (no fire for >120 years) we measured DOC (fDOM sensor, YSI EXO2) and pCO_2 (GMP222, Vaisala) continuously, and CO_2emissions (floating chamber, GMP222, Vaisala).

As in the majority of forested watersheds of boreal zone, concentrations of DOC and DIC in study streams followed the hydrologic regime. Highest DOC concentrations occurred during periods of high flow with maximum at freshet. DIC concentrations had the opposite dynamic, gradually increasing during the frost-free season. Fire-induced decreases of DOC appear immediately after the fire event and last for at least 40 years. DIC peak concentrations appeared after 25-30 years after a fire, corresponding to a maximum of the soil thawing depth. On a spatial scale, DOC concentrations during freshet decreased from ca. 40 mg C/l in first order streams to 20-25 mg C/l in 3rd and 4th order streams/rivers, suggesting that 25-40% of DOC might be mineralized to CO_2 and emitted to the atmosphere before entering the large rivers. Elevated CO_2 emissions, measured in the floating chambers in headwaters, corroborate that conclusion. Thus, the export of C at the mouths of larger rivers represents only a part of the C released from the forests to the drainage network and such losses need to be accounted accurately to determine the carbon sink strength of the boreal forest of central Siberia.

Focus of Research

research focuses on carbon released from terrestrial ecosystems to drainage network in permafrost terrain, subjected to ongoing warming. This has importance for (i) our understanding of C budget of the vast larch-dominated area of Siberia and (ii) changes in surface water quality for local populations.

Key Challenges

abrupt changes in water quality of boreal streams induced by fires and permafrost degradation is the threat for boreal zone

Suggestion to Address these Challenges

decrease CO_2 emissions...

4:30pm - 4:45pm

Estimating litter and soil carbon stocks on managed forest land in Alaska, USA

Grant Michael Domke[1], Andrew Gray[2], Brian Walters[1], Charles Hobie Perry[1], Lucas Nave[4], Stephen Ogle[3], Brendt Mueller[2]
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Abstract

Soil organic carbon (SOC) is the largest terrestrial carbon (C) sink on earth and management of this pool is a critical component of global efforts to mitigate atmospheric C concentrations. Soil organic carbon is also a key indicator of soil quality as it affects essential biological, chemical, and physical soil functions such as nutrient cycling, water retention, and soil structure and maintenance. Much of the SOC on earth is found in forest ecosystems and is thought to be relatively stable. That said, several studies have documented the sensitivity of SOC to global change drivers, particularly in the northern circumpolar region where approximately 50% of the global SOC is stored. The Forest Inventory and Analysis program within the United States Department of Agriculture, Forest Service has been measuring litter and soil attributes in forests as part of the national forest inventory (NFI) in the US since 2001. These data have recently been harmonized with auxiliary biophysical and geospatial data to develop models for predicting litter and soil carbon stocks on forest land in the conterminous US. In this study we will expand on those methods using NFI data from southeast and south central coastal Alaska (AK) and the recent expansion of the NFI in interior AK to estimate litter and soil carbon stocks and associated uncertainties for managed forest land in AK. Specifically, we will 1) describe the inventory of soil variables in the US NFI, 2) compare model predictions of litter and soil carbon density with estimates from the NFI, 3) evaluate new estimation approaches to replace existing model predictions, and 4) expand estimates beyond regions with operational NFI data to the entirety of the managed forest land in AK.

Focus of Research

Soil carbon is a key indicator of soil quality as it affects essential biological, chemical, and physical soil functions such as nutrient cycling, water retention, and soil structure and maintenance.

Key Challenges

The remote nature of much of the forest land in AK has presented many challenges to measuring and monitoring forests in the State. This is particularly true for litter and soil variables which are thought to be highly variable over space and through time.

Suggestion to Address these Challenges

Sustained investment in measuring and monitoring forest ecosystems in AK.

4:45pm - 5:00pm

Resilience of mountain forest ecosystems to climate change

Katharina Maria Albrich, Werner Rammer, Rupert Seidl

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Abstract

Mountain areas such as the European Alps are disproportionally affected by climate change. This puts mountain forests under considerable stress. Characterized by large variability in topography and therefore environmental conditions, mountain forests are expected to show heterogeneous responses to climate change. These forests play an important role for people's livelihoods, providing biomass, clean water and protection from natural hazards, among other things. This generates considerable interest in the future of mountain forests under a changing climate. It remains unclear if and how mountain forests can retain their characteristics and functions under climate change, and whether they can potentially recover after a period of substantial climate change, once measures to combat climate change come into effect and cool the climate.

In this simulation study we focused on a mountain landscape in the Austrian Alps (Stubai valley, Tyrol) covering almost 5000 ha of forested area between 900 and 2200 m a.s.l. We used iLand, a process-based forest landscape model, to simulate climate change impacts on the forest vegetation. Starting from a state of undisturbed potential natural vegetation, the landscape was exposed to gradually increasing levels of climate change (up to a warming of + 6°C, RCP8.5 scenario), with different levels of precipitation change. To assess forest resilience, here defined as the ability to recover from climate change, we subsequently reversed the climate forcing, returning to the baseline climate conditions of 1961-2014. We investigated the influence of topography by comparing the original landscape featuring complex topographic gradients to an artificial version with homogenous conditions. Focal indicators of the analyses were the presence of conifer species characteristic for cool mountain forests and of large mature trees. These indicators were chosen as they quantify both the departure from the current mountain forest conditions and are of relevance for the fulfillment of forest functions (e.g. protection from natural hazards) under climate change.

Climate change had a pronounced effect on forest conditions. The landscape tipped into a different state, from a conifer-dominated system dominated by large trees to a system characterized by broadleaves and small trees. We observed a clear influence of topography on landscape resilience, with the homogenous landscape showing a more abrupt transition in forest characteristics as a result of climate change. Taking into account topographic effects, changes in species composition and presence of large trees were more gradual and their recovery after the reversal of climate change was more pronounced.

Focus of Research

My research focuses on the resilience of mountain forests to climate change. These forests are of tremendous importance for the livelihood of people in mountain regions. To manage these forests so they can provide ecosystem services in warming world we need to know how resilient they are to environmental change.

Key Challenges

In the research presented here I identified climate change as a major factor threatening the compositional and structural resilience of mountain forest ecosystem, and the related functions and services they provide.

Suggestion to Address these Challenges

It is crucial to combat climate change at the global scale in order to limit negative effects on forest ecosystems and people depending on them. At the local scale, forest management can contribute to the stability and resilience of mountain forest ecosystems.

5:00pm - 5:15pm

Likely future of mountain forests under land use cover change and climate change scenarios in Mexico.

Alma Mendoza[1], Florian Kraxner[1], Rogelio Corona[2]

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Abstract

Mexican mountain forests represented 20% of the country and it is the dominating ecosystem in sites over 1,000 meters above sea level. Mexico's mountain forests are the richest in species of pines and oaks in the world. This diversity has been the result of complex topography and highly diverse climates. These ecosystems are threatened by land use cover change (LUCC), logging and climate change. By 1985 mountain forests had decreased about 20% of its original extent. Rain-fed agriculture expansion explains more than 80% of these forests loss, followed by grasslands for livestock. However, their spatial constraints are different. While rain-fed agriculture expansion is associated with closeness to roads, to rivers, and to human settlements in slight slopes, livestock progression did not show constraints. This study projects possible futures trajectories of mountain forests and LUCC under two socioeconomic and climate change scenarios in Mexico. The scenarios integrated the Shared Socioeconomic Pathways (SSPs), the Representative Concentration Pathways (RCPs) and Markov chains. A business as usual scenario (BAU) that links SSP2, RCP 4.5 and historical medium rates of change, depicts that these forests could decrease due to LUCC by 2050s and 2070s, 27% and 29% in comparison to their potential distribution. Contrastingly, the green scenario, based on the SSP1, RCP 2.6 and the lowest deforestation rates and the highest regeneration rates, shows that by the same time slices high mountain forest could have been converted to anthropogenic covers in 11.0% and 12.0% of these ecosystems, respectively. The largest transformations are expected in the Pacific Coast where there are some of the poorest and more marginalized municipalities of Mexico. Although climate change is expected to slightly impact the extent of mountain forests in comparison to LUCC. Our study suggests that climate change may promote the reduction of their distribution in up to 2.0% by 2050. This not only would have impact on forest extent but also the species distribution and composition.

Mexican mountain forests will face not only the constraints of climate change but also the pressure of the growing population and the drugs plantation associated to the rain-fed agriculture. Therefore, to reduce the loss of the mountain forest in Mexico it is necessary to focus on integral policies and management. These policies should be multidirectional to reduce the LUCC impacts by attending the constraints of climate on the food production, and the challenges related to the illegal- drugs plantations and illegal logging.

Focus of Research

The impacts of land use and cover change on the mountain forests in Mexico and the drivers of change. It is important for people because it is necessary to control the expansion of agriculture that is the principal direct driver of forest loss

Key Challenges

In Mexico, rain-fed agriculture is the principal cause of mountain forest loss and it is extremely dependent on climate conditions. New conditions differentially impact the agricultural expansion and further studies are necessary. Also, include the effects of climate change on the species composition.

Suggestion to Address these Challenges

1. Evaluate how many people live and depend on the provision of the mountain forest. 2. Estimate the rate of growth of these populations.3. Estimate the productivity of principal crops in these areas under current and future conditions. 4. Analyse different management to reduce the agricultural expansion.

5:15pm - 5:30pm

Larch growth response to climate warming in the Central Siberia

Viacheslav I. Kharuk[1,2], Sergey T. Im[1,2], Ilya A. Petrov[1]

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Abstract

Viacheslav I. Kharuk§1,2, Sergey T. Im1,2, Ilya A. Petrov1

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This study aims to analyze Larix sibirica Ledeb and Larix dahurica Turcz growth response to warming within "south-north" larch range (49°N/72°N) within Central Siberia.

Methods included dendrochronology derived growth index (GI), an analysis of climate variables, root habitat moisture content, satellite MODIS - derived gross (GPP) and net (NPP) primary productivity.

Main results. In the Central Siberia, there two basic patterns of larch response to warming, and these patterns determined by water regime. Within humid and 'semi-humid' areas larch responded to warming by GI increase since ca. 1970th, although severe droughts caused local GI decrease. In 'semi-arid' areas larch GI positive response to warming since 1970th with followed switch to growth depression ca. 1990-95. Larch GI increase correlated with summer air temperature, whereas GI depression caused by water stress (vapor pressure deficit and drought increase) via elevated air temperature. Running correlation indicated GI sensitivity decrease to air temperature (since ca 1990-95), whereas GI sensitivity to vapor pressure deficit and drought index SPEI increased. Within the permafrost the phenomenon of water stress impact on larch growth not observed before the onset of warming ca 1970. Water limitation also indicated by GI dependence on soil moisture stored during the previous year. Water stress especially pronounced at the beginning of growth period and for stands on the soils with low water capacity.

GPP within majority of larch communities showed increasing trends, whereas NPP values mainly stagnated. The latter attributed to increased respiration demands in response to elevated temperatures. Larch GI show good correlation with GPP, whereas correlation with NPP is lower.

A similar pattern of growth increment response to climate warming was has also been observed for Pinus sibirica Du Tour and Abies sibirica Ledeb in the southern Siberian taiga forests.

Main conclusions. The basic larch response to climate warming included period of positive response to warming (ca 1990-95) with GI depression by water stress via elevated temperatures. Within areas with sufficient available water larch GI is following warming. Water regime within the permafrost zone, alongside with temperature, became a limiting factor of larch growth.

Russian Fund of Fundamental Investigations (RFFI) (grant No.18-05-00432A) supported this research.

Focus of Research

We are focusing on the climate warming impact on the larch trees growth within Central Siberia, including permafrost zone. This is the area of carbon stock and potential carbon emission increase, as well as zone of forest harvesting.

Key Challenges

We found that period of positive larch growth response to warming within part of Central Siberia change to the growth depression by water stress via elevated temperatures.

Estimating relative contribution of autotrophic respiration to soil respiration in permafrost region of Alaska, using 13C pulse labeling method

Akira L. Yoshikawa[1], Masako Dannoura[1], Koh Yasue[2], Tetsuoh Shirota[2], Kenshi Takahashi[1], Tomoaki Morishita[3], Tomohiro Saito[2], Ryohei Yamamoto[4], Yojiro Matsuura[3], Kyotaro Noguchi[3], Christian Hossann[5], Roger W. Ruess[6]

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Abstract

Boreal forest soil acts as one of the largest carbon storages in terrestrial ecosystems (Lal 2005). Carbon stored belowground is eventually released back into the atmosphere through soil respiration, which constitutes up to two thirds of total ecosystem respiration in forests (Janssens et al. 2001). Soil respiration (Rs) is a mixture of autotrophic respiration (Ra) from plant roots and heterotrophic respiration (Rh) from microorganisms (Hanson et al. 2000). However, estimating each component separately without disturbing the soil has been problematic. We used the 13C pulse labeling technique and labeled Ra with stable carbon isotope (13C) to identify Ra 's relative contribution to soil respiration during spring, summer, and autumn.

In each season, three mature black spruce trees (Picea mariana) on permafrost soil were labeled using CO2 containing 13C. Sixteen soil chambers were placed around each tree, and three root chambers were placed on the roots (ø≥0.3cm). Gas samples from the chambers were collected a day before and periodically after labeling to analyze for δ13C. The Isotope ratios of Rs and Ra (δRs and δRa respectively) were calculated using the Keeling plot method (Keeling 1961). Finally, δRs and δRa, before and after labeling, was used to estimate the relative contribution of Ra based on the isotope mixing model. Findings were compared between spring, summer, and autumn.

Mean daytime Rs and the relative contribution of Ra to Rs was the highest in the summer, and the lowest in the spring (13.8 µmol m-2 s-1 with up to 60 autotrophic respiration, respectively). The changes in the relative contribution of Ra to Rs between seasons suggests that Ra and Rh are affected differently by seasonal changes. During the summer, faster translocation of carbon to belowground was observed as the peak isotopic signal appeared more quickly in soil after labeling. Such belowground allocation pattern and environmental variables likely affect Ra and Rh independently. The results suggest that understanding Ra and Rh as separate processes that respond differently to seasonal change is crucial to accurately predict the impact of climate change on carbon dynamics of boreal permafrost.

Focus of Research

Positive feedback between warming climate and release of soil organic carbon to the atmosphere will have a great impact on global carbon cycle. Understanding the responses of autotrophic and heterotrophic soil respiration to its environment will be essential to accurately predict the future climate.

Key Challenges

Results suggest that the relative contribution of Ra varies between seasons. With changing behavior of autotrophic and heterotrophic soil respiration under warming climate, boreal forest soil can act as a large source for greenhouse gasses and accelerate climate change.

Suggestion to Address these Challenges

We must accurately assess the risk of carbon emission increase from boreal forest soil, and address them in a globally coordinated fashion between various parties.

B3: Economics of ecosystem services, innovation and technological change

4:00pm - 4:15pm

Regional impacts of new manufacturing technologies on the forest estate of Northland, New Zealand

Juan Jose Monge, Steve J Wakelin, Leslie J Dowling

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Abstract

The forestry sector in New Zealand poses an interesting case study as more than half of the supply of raw logs are exported internationally due to the lack of regional investment in new high value-add manufacturing technologies. This disincentive to invest in regional manufacturing capacity is partly caused by the division of the ownership of the land and the forest as well as a lack of government incentives recognising the benefits from the use wood products. The industry is currently vertically dis-integrated since most of the land is owned by Māori (indigenous people of New Zealand) and the forests are owned by multinational pension funds. Furthermore, the New Zealand government is aiming at transitioning to a low-carbon economy without considering the benefits generated by wood products such as the displacement of carbon-intensive construction material, e.g. concrete and steel.

Most recently due to land settlement processes between the government and Māori representatives, the forests planted in Māori-owned land are being returned to Māori businesses to handle the forest management. Māori have intentions of generating greater returns from their forest assets potentially through investment in manufacturing capacity to create vertically-integrated value chains. Due to the opportunity created to vertically integrate the industry in certain regions of the country, we have chosen the Northland region of New Zealand as a specific case study since a high proportion of the forest estate in the region is owned by Māori and is widely dispersed.

To assess the regional impacts of investments in high-value wood processing technologies, we developed a geographically-explicit, dynamic partial equilibrium model of regional value chains, which we call the Primary Value Chains (PVC) model. The model identifies the optimal value chains in a region by linking spatially-distributed resources, technologies and markets. Specifically, the model identifies: the equilibrium price-quantity bundles, optimal harvest schedules, market destinations, individual processing plant locations, and transportation routes. The model's discrete representation of space simplifies the generation of maps to present results in a simple graphical manner.

Through a set of simple representative scenarios including traditional and new technologies as well as forecasting potential international demands for innovative products, we identified that the highest regional producer surplus (i.e. profitability) is generated in the scenario considering investments in new technologies such as Optimized Engineered Lumber (OEL) even after accounting for the higher capital expenses incurred in such technology.

Focus of Research

We assessed the regional impacts of investing in high value-add technologies as opposed to exporting low value raw logs. The research is important to the New Zealand economy as it opens the possibility of new employment in the community (people) and GDP increments based on a renewable resource (bioeconomy).

Key Challenges

Our research identified a few critical factors that preclude investments in value-add technologies such as separation of the land and forest ownership and lack of government incentives recognizing the benefits of using wood products.

Suggestion to Address these Challenges

Investing in high value-add technologies with promising international markets and making a more efficient use of the forest estate by creating additional jobs and increasing the regional GDP.

4:15pm - 4:30pm

Impact of Global Climate Change on Duration of Winter-Felling Season in Siberia

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Abstract

Nowadays global climate change is taking a lead position along with the rest today's global challenges and is a subject of a wide discussion for a while. Despite that for some geographical areas the effect of climate-change is quite positive as for forestry (Garcia-Gonzalo et al., 2007), in some cases it is not. Special attention is given in this matter to effects that are negative for the environment as well as for the economy. One of the effects relating to logging industry is a gradual shortening of winter-felling season due to average temperature rise that may implicate wood harvesting reduction (Goltsev, Lopatin, 2013). In order to test this hypothesis, our study gives an estimation of expectable duration of winter-felling season based on temperature data derived from meteorological stations in the two regions of Siberia with the most intensive logging activity--Irkutsk Oblast and Krasnoyarsk Kray. We used the well-

known ARIMA and VAR modeling framework (Asteriou, Hall, 2011) to establish the link between temperature tendencies and the duration of winter-felling season. The results of estimation showed that despite global climate change leads to gradual increase of annual mean temperature, the limits of winter-felling season are moving together, and then the season starts later and ends earlier with time in general. As a result, a total duration of winter-felling season is expected to be permanent and stable for most of meteorological stations. However, on some stations one may observe an obvious tendency of shortening of the winter-felling season. That means that there is a reason to not reject the hypothesis of an existing negative link between the dynamics of temperature and winter-felling season in boreal area of major Siberian timber-logging regions.

Focus of Research

We study the link between the duration of winter-felling season in boreal forests of Siberia and the trends of global climate change. The duration of logging season is a key factor that determines the growth rates of timber industry and provides the social and economic sustainability for involved settlements.

Key Challenges

The key threat for Siberian forests is a changing climatic regime that could reduce the resource potential of timber logging. Along with other institutional problems of Russian timber industry this issue is a major challenge in the long-run.

Suggestion to Address these Challenges

Our findings may be useful for policy-making as a basic framework to produce the long-run scenario of sector development. The tendency of winter-felling season shortening should be compensated with a policy that implies the intensification of timber logging activity.

4:30pm - 4:45pm

Optimal rotation sequence of Norway spruce in a changing climate

Jussi Lintunen, <u>Aapo Rautiainen</u>, Jussi Uusivuori
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Abstract

The changing climate is likely to alter environmental and economic conditions in the coming decades and even centuries. Given the long planning horizon of forestry, these changes affect the optimal management decisions of the current forest stands. The notable changes in growing conditions, economic growth, and climate regulation, make the usual static Faustmann framework unwarranted.

We optimize the even-aged management of a Norway spruce stand for timber and climate benefits in a changing climate. We assume that the climate forcing caused by both atmospheric carbon and surface albedo, is regulated by a climate policy that becomes more stringent over time, until climate change has been globally brought under control. We derive a consistent scenario for the global climate and the climate policy using the DICE-2013R integrated assessment model and synchronize the local growth conditions (Kuusamo, Finland) with the global climate scenario. Thus, the scenario includes a decreasing interest rate, changing growth conditions, and changing prices of carbon and albedo forcing. The resulting optimal forest management is different for each present-day and future tree cohort and the optimal solution is a rotation sequence – rather than a single rotation.

In line with previous studies, we find that carbon regulation lengthens rotations, whereas albedo regulation shortens them. Carbon regulation has a stronger impact than albedo regulation. Therefore, the outcome of regulating both forcing mechanisms is relatively similar to that of regulating carbon only. A relatively stringent climate policy encourages longer rotations despite the rotation shortening impact of improving growth conditions. In the climate scenario, the global mean temperature is eventually brought to its preindustrial level, which implies that the growing conditions in Northern Finland become worse than they are today. Thus, rotations become very long. This impact is further magnified by the low interest rates projected for the distant future by the DICE model. Potential timber price increases, caused by carbon pricing, soften the policy's impacts on forest management.

Focus of Research

We focus on the optimization of the even-aged management of a Norway spruce stand for timber and climate benefits in a changing climate.

Key Challenges

Young Norway spruce stands store little carbon but have a higher albedo than older carbon-rich stands. Thus, from a climate change mitigation point-of-view, there is a trade-off between the cooling impact of increased carbon storage and the warming impact of decreased albedo, especially in the boreal region.

Suggestion to Address these Challenges

The challenge can be addressed by jointly optimizing forest management for timber and climate benefits (which are obtained by regulating carbon storage and albedo).

Assessing the Payment of Ecosystem Services of Forests in Taiwan

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Abstract

Recent environmental and climate change has raised the global attention to environmental issues. All countries of the world have formulated and implemented environment-related programs and policies, among which Payment of Ecosystem Services (PES) has received increasing attention. The PES programs for land-use change are essential because land-use change influences the quality of Ecosystem Services (ES). However, most previous studies focused on analyzing the willingness of participation in PES programs or assessing the ES value in the PES, but few studies investigated the PES programs for land-use change. Therefore, this study focuses on the PES program for land-use change in Taiwan. Taking areca gardens, fallow farmland, and barren land as the target, this research evaluates the change from different land-use types to afforestation, and investigates the PES amount for biodiversity, carbon storage, and pest control. This research applies Choice Experiment (CE) and Cost Benefit Analysis (CBA) to examine the PES amount. By the results conducted by this study, the PES amount would be influenced by environmental attitude, government incentives, and socio-economic background. Moreover, for the lower bound of the PES amount, barren land had the lowest bound, and areca gardens had the highest bound. For the government, the PES amount for changing an areca garden to afforestation is highest. The results can be applied to adjusting the current policies, and can provide the government to formulate the PES programs for land-use change in the future.

Focus of Research

This study focuses on the PES program for land-use change in Taiwan. Taking areca gardens, fallow farmland, and barren land as the target, this research evaluates the change from different land-use types to afforestation, and investigates the PES amount for biodiversity, carbon storage, and pest control.

Key Challenges

Most previous studies focused on analyzing the willingness of participation in PES programs or assessing the ES value in the PES, but few studies investigated the PES programs for land-use change.

Suggestion to Address these Challenges

Taking areca gardens, fallow farmland, and barren land as the target, this research evaluates the change from different land-use types to afforestation, and investigates the PES amount for biodiversity, carbon storage, and pest control. This research applies Choice Experiment (CE) and Cost Benefit Analysis (CBA) to examine the PES amount.

Studying wood quality in the context of a spruce budworm outbreak in eastern Canada

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Abstract

A spruce budworm outbreak is in progression in eastern Canada. The defoliation is observed since 2006 and the annual defoliated area is increasing each year. In 2017, 7 161 141ha of boreal and temperate forest were defoliated. The defoliation causes growth reduction, mortality as well as loss in wood quality.

In the study area (the North shore region of Quebec), the forest industry is crucial to the local economy. To stay competitive, the companies need to deliver high quality products to their clients. The recent presence of bioethanol industry in the region complements the more traditional pulp and paper mill and sawmill industries. In this context, and particularly in the context of a spruce budworm outbreaks that causes high variability in the quality of the harvested wood, the fiber must be routed to its optimal sector.

The effects of defoliation on wood quality of balsam fir and spruces are studied by our team since 2014. In our studies, the defoliation and the condition of trees are measured, from the landscape spatial scale to the individual tree. Wood coloration and decay of harvested logs are characterized, as well as wood quality according to several metrics, such as the length of the fiber, the density, the humidity, the luminance and the proportion of dark fiber. The quantity of residual wood left in the forest consequent to tree processing following harvesting, in an operational context, is also measured. These results aim to 1. identify the indicators that accurately and usefully predict the quality of the wood to harvest; 2. develop a predictive tool that could help with the harvesting planning and 3. develop an optimization tool that would suggests the optimized uses and transformations of the wood fiber between economic sectors (pulp and paper, sawmills or biofuel production).

Focus of Research

The North shore region of Quebec, as well as other regions, is heavily dependent on forest industries. To stay competitive, the forest companies need to deliver high quality products to their clients. The forest sector must route the wood fiber to its optimal sector.

Key Challenges

The spruce budworm is a native insect to eastern North America. Since at least the last 400 years, spruce budworm outbreak occured every 35 years or so. The forest industry needs to adapt its practices to the reality of recurring insect outbreaks

Suggestion to Address these Challenges

Understand the insect outbreak dynamic. Understand the impact of these outbreaks on the tree physiology and wood quality. Develop economic sectors that complement each other by using different wood fiber of different origin and quality.

Analysis of the drivers of risks for cool forest management and build ecosystem resilience in Nepal's mountain

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Abstract

The research is mainly analyses of drivers that contribute to reduce risks in making resilient mountain forests in Nepal. The study is based on review, and empirical study conducted to measure forest cover change using geographic information system (GIS) over the period 1992 and 2014. Results show that forests cover in the mid-mountain region have increased by 7500 ha (1%) over the period of 22 years, i.e. 1.35 million ha (76%) in 1992 compared to 1.36 million ha (77%) in 2014. It is also found that the area of dense forest has increased by 42,000 ha whereas; the area covered by bushes and grassland has reduced by 39,000 ha. The Study further shows that there is a decline in cultivated land by 20,000 ha for the same period. There are different forests management modalities like Community Forestry, Collaborative Forest management, and Leasehold Forestry for the management and restoration of forest ecosystem, and thereby meeting the livelihood needs of people. The study aimed to compare the suitability of the management model in the middle mountain range of Nepal that can foster the forest ecosystem, and there by contribute to enhance local livelihoods. Comparing the forest cover change in community managed forests with that of other management regimes, has shown that the community managed forests demonstrate the best in reducing the risk of forest loss, and thereby enhancing the forest cover leading to build resilience ecosystem in the mountain region of Nepal.

Focus of Research

The main focus of the research is to analyses of the knowledge gaps, drivers of forest loss and forest gain, and also to feed the knowledge into national policy making process.

Key Challenges

Yes, my research identifies the key challenges of forest loss, and the drivers of forest gain in the mountain region. It has compared the loss and gain based on different forest management regime.

Suggestion to Address these Challenges

The government managed forests should be handed over to the local communities for management, and sustainable utilization in order to reduce the risks of forest loss, and build ecosystem resilience.

PN3: Remote sensing and mapping of Cool Forests

4:00pm - 4:15pm

The use of satellite information (MODIS/Aqua) for phenological and classification analysis of plant communities

<u>Yulia Ivanova</u>[1], Vlad Soukhovolsky[2], Anton Kovalev[3], Oleg Yakubailik[4]

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Abstract

Classification of vegetation cover by satellite data (MODIS/Aqua) allows to automate the process of constructing vegetation maps and minimize the inclusion of ground data in this process. The use of satellite information makes it possible to describe the phenological development of plant communities and to find their differences. The object of the study were plant communities of meadows, steppes of Khakassia and forest communities of the Krasnoyarsk Territory, Russia.

For the analysis of phenological dynamics in plant communities we have used the value of NDVI (Normalized Difference Vegetation Index). With the help of the original computer program, a nonlinear regression analysis of the NDVI (t) time series was carried out from 2003 to 2017. The penology indicators (the beginning and end of the growing season, the absolute value of the maximum of photosynthetic activity, etc.) during the season were calculated from the values of the coefficients of the regression equations .Analysis of the relationships between the values of the parameters of regression equations in different years has shown that the "clouds" of values in the parametric space for different plant communities (forest, meadow, steppe) differ significantly from one another, which makes it possible to classify plant communities. Thus, using multi-year NDVI data and weather data, it is possible to classify plant communities and divide forest, steppe and meadow communities.

The reported study was funded by RFBR and Russian Geographical Society according to the research project № 17-05-41012.

Focus of Research

The focus of our research is using multi-year NDVI data and weather data to classify plant communities and divide forest, steppe and meadow communities.

Key Challenges

Classification of vegetation cover by satellite data allows to automate the process of constructing vegetation maps.The use of satellite information makes it possible to describe the phenological development of plant communities and to find their differences.

Suggestion to Address these Challenges

Our research allows to monitor the boundaries of plant communities by satellite data.

4:15pm - 4:30pm

Global harmonised in-situ data repository for forest biomass datasets validation

<u>Dmitry Schepaschenko</u>[1], Christoph Perger[1], Christopher Dresel[1], Liudmila Mukhortova[2], Natalia Lukina[3], Elena Tikhonova[3], Olga Trefilova[2], Leonid Krivobokov[2], Dilshad Danilina[2], Maria Konovalova[2], Andrey Osipov[4], Kapitolina Bobkova[4], Viktor Karminov[5], Olga Martynenko[5], Petr Ontikov[5], Alexey Aleynikov[3], Tatyana Braslavskaya[3], Nikolay Shevchenko[3], Anatoly Shvidenko[1], Florian Kraxner[1]

[1]IIASA, Austria; [2]V.N. Sukachev Institute of Forest, Russia; [3]Center of Forest Ecology and Productivity of the Russian Academy of Sciences, Russia; [4]Institute of Biology, Komi Scientific Center, Russia; [5]Forestry faculty, Bauman Moscow State Technical University, Russia; schepd@iiasa.ac.at

Abstract

Forest monitoring is high on the scientific and political agenda. Global measurements of forest height, biomass and how they change with time are urgently needed as essential climate and ecosystem variables. The Forest Observation System – FOS (http://forest-observation-system.net/) is an international cooperation to establish a global in-situ forest biomass database to support earth observation and to encourage investment in relevant field-based observations and science. FOS aims to link the Remote Sensing (RS) community with ecologists who measure forest biomass and estimating biodiversity in the field for a common benefit. The benefit of FOS for the RS community is the partnering of the most established teams and networks that manage permanent forest plots globally; to overcome data sharing issues and introduce a standard biomass data flow from tree level measurement to the plot level aggregation served in the most suitable form for the RS community. Ecologists benefit from the FOS with improved access to global biomass information, data standards, gap identification and potential improved funding opportunities to address the known gaps and deficiencies in the data. In the Boreal region FOS closely collaborates with the V.N. Sukachev Institute of Forest, Institute of Biology

of the Komi Scientific Center, Forestry faculty of the Bauman Moscow State Technical University, Center of Forest Ecology and Productivity of the Russian Academy of Sciences and the International Institute for Applied Systems Analysis. FOS is an open initiative with other networks and teams most welcome to join. The online database provides open access for both metadata (e.g. who conducted the measurements, where and which parameters) and actual data for a subset of plots where the authors have granted access. A minimum set of database values include: principal investigator and institution, plot coordinates, number of trees, forest type and tree species composition, wood density, canopy height and above ground biomass of trees. Plot size is 0.25 ha or large. The database will be essential for validating and calibrating satellite observations and various models. Comparison of plot biomass data with available global and regional maps (incl. IIASA global biomass map by Kindermann et al., 2013; Boreal and temperate forest by Thurner et al., 2013; WHRC global biomass map by Baccini et al., 2018; IB-CAS global map by Hu et al., 2016; GlobBiomass map, 2018) shows wide range of uncertainties associated with biomass estimation.

Focus of Research

Validation of global and regional forest biomass dataset

Key Challenges

Sharing in situ measurements

Suggestion to Address these Challenges

Provide recognition and benefits for the scientists who open access to the sample plot data

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4:30pm - 4:45pm

Biogeophysical climate impacts of forest management in Europe inferred from satellite remote sensing observations

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Abstract

Forest management influences climate by altering the concentration of CO_2 or other atmospheric compounds (biogeochemical effects) and through its impact on albedo, evapotranspiration and surface roughness (biogeophysical effects). Forest management measures aiming at reducing or counteracting climate change need to account for both biogeochemical and biogeophysical effects. However, the biogeophysical climate effect of forest management is still poorly constrained and decision-makers lack scientific evidence when designing sustainable forest management strategies.

To bridge this gap, we used hourly, high resolution (5km), land surface temperature (LST) over Europe derived from satellite remote sensing observations (EUMETSAT, Land Surface Analysis) and performed several types of regression-based analysis to assess the link between LST and spatial patterns of forest structure and forest type. As an indicator for forest structure and forest type we included data on tree cover density and broadleaved tree fraction (Copernicus High Resolution Layers). As potential confounding factors (i.e. variables that coincide with the spatial distribution of broadleaf tree fraction and tree cover density) we included additional variables like elevation and exposition.

Our results show that a higher fraction of broadleaved trees as well as a higher tree cover density provide cooling during the day in summer. Analyzing the mean diurnal cycle in June, July and August we found that an increase of 50% in tree cover density causes the highest reduction of temperatures (~ 1.5-4.5°C) at 12:00 UTC. An increase of 50% in broadleaved tree fraction provides a cooling that is highest at around 16:00 UTC (~ 0.5 to 2°C). The effect of an increased tree cover density at around 15:00-16:00 UTC is similar to the effect of an increased broadleaved tree fraction, which means that both strategies may be important when trying to reduce daily maximum temperatures in summer. In high latitudes and high altitudes an increase in tree cover fraction and broadleaved tree fraction cause warming during day and night in winter. However, during the day in summer there is a cooling effect of a higher broadleaved tree fraction and a slight cooling effect of a higher tree cover density. For boreal and alpine forests, an increase in tree cover density and broadleaved tree fraction could therefore lead to an increase in yearly mean temperatures while reducing maximum temperatures in summer and potentially during heatwaves.

Focus of Research

The focus of our research is on the biogeophysical climate effects of forest management. It is important for decision-makers that are seeking to mitigate climate change.

Key Challenges

Our research shows that maximum temperatures occuring in boreal and mountain ecosystems may be reduced if forests are adequately managed.

Suggestion to Address these Challenges

Changes in forest structure (i.e. an increase in tree cover density) and in forest composition (i.e. increasing the amount of broadleaved trees) could be two strategies to reduce extreme temperatures in summer.

4:45pm - 5:00pm

Studying Cool Forests at NASA under the Northern Eurasia Earth Science Partnership Initiative (NEESPI): A Retrospect

Garik Gutman[1], Pasha Groisman[2]

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Abstract

During the past 12 years, the Northern Eurasia Earth Science Partnership Initiative (NEESPI) has produced over 1500 scientific papers based on 170+ projects with international teams from over 200 institutions in 30 countries. The NEESPI geographic domain covers a vast area with numerous geo-botanic zones from the Arctic to boreal forest and further south to steppe and desert. A large portion of NEESPI contributions are pertinent to the boreal zone (Cool Forests) and include analysis of case studies and synthesis. One of the reasons the NEESPI geographic domain is important for global change studies is because about quarter of the world's forests are located in Northern Eurasia. The NASA Land-Cover/Land-Use Change (LCLUC) Program has been supporting the NEESPI since its inception. Northern Eurasia is of special interest for studying LCLUC processes due to the dramatic socio-economic shifts throughout this region during the past decades and the strong land cover - climate interactions that are not yet well understood. The rapid land-use and land-cover changes create a possibility for large and significant biological and climatic regional feedbacks that all appear to be of global importance. Fires, insect invasions leading to trees defoliation, and forest exploitation by humans are the major disturbances in forests. Interactions between these disturbances and climate variability are complex, with consequences for carbon dynamics yet to be quantified. This retrospective talk will provide an overview of the findings resulted from the 12-year research on Cool Forests under the NASA LCLUC Program. It will include examples of forest changes, and their implications to carbon and hydrologic cycles, environmental pollution, and impacts on society. The presentation will be based on the results from the NEESPI synthesis projects and contributions to the compilation NEESPI LCLUC book on Siberia. Under the Future Earth Program, NEESPI has transitioned to Northern Eurasia's Future Initiative (NEFI), with a special focus on extreme events that affect the biosphere and their temporal and spatial changes. Human-induced wildfires are the dominant disturbance agents in the boreal forests, which are in turn the largest global reservoir of terrestrial carbon. Extreme fire events and changing fire regimes intensify the impacts of climate change and variability on ecosystem state. During extreme events, wildfires have a direct adverse impact on human health, pose a considerable threat to life and property, and impose a substantial economic burden. Plans for NEFI studies on extreme events will be included in the presentation.

Focus of Research

The focus of the NEESPI research program is studying land-cover/change interactions with climate in Northern Eurasia in general, and processes in the boreal forests of Russia and northern China, specifically. Those include slow processes, like forest type change, and fast, extreme processes, like wildfires.

Key Challenges

yes

Suggestion to Address these Challenges

targeted funding, more in situ observations, support of more ground stations, availability of frequent, high resolution satellite data and better reprocessing of the available long-term time series

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5:00pm - 5:15pm

Satellite-derived Burned Area for Siberia (1979 – 2000)

Amber Soja[1], Brian Stocks[2], Stefano Potter[3], Brendan Rogers[3], Don R. Cahoon Jr.[4], Natasha Jurko[5], Susan Conard[6], William {Bill} deGroot[5]

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Abstract

Siberia is a distinct and crucial region because it has the physical size necessary to effect regional and global climate. The circumboreal zone contains the largest stock of terrestrial carbon on Earth, and Russia holds 2/3 of that carbon pool. Fire is the primary natural disturbance in boreal forest that acts to cycle carbon and maintain ecosystem diversity in sync with the climate. A long-term burned area database has been developed that will enable long-term analysis of carbon cycling, fire emissions, and most importantly assessments of the links between fire regimes, fire weather, ecosystems, and climate.

In this talk, we will present a long-term burned area database that has been developed using Advanced Very High Resolution Radiometer data from 1979 2000. These data have been verified using Total Ozone Mapping Spectrometer data, and these data have been validated using available Landsat imagery (160 scenes thusfar). Visually the burned scar data compare well. Validation is in ongoing, though initial analyses shows an intersection of 42% with commission and omission error of 31% and 25%, respectively. Correlation in burned scar area between the AVHRR and Landsat data is 0.98 for all fires and 0.68 for fires that are < 1000 km2.

Focus of Research

long-term burned area database. These data have never existed before and it is important to carbon cycling and fire feedbacks with the climate

Key Challenges

Fire disturbance sets the beginning and end to the succession processes and maintains the diversity of and within boreal ecosystems

Suggestion to Address these Challenges

The data we are presenting will be shared with the community. Without these, there can be no long-term analyses.

Concerted Actions for Biome-related Forest Biomass Monitoring

Christiane Cornelia Schmullius[1], Richard Lucas[2], GlobBiomass and CCI Biomass Teams[1]

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Abstract

For the last three years, the ESA Data User Element (DUE) GlobBiomass project had focussed on creating improved knowledge about the Essential Climate Variable Biomass. The main purpose of the project was to better characterize and to reduce uncertainties of Above-Ground Biomass (AGB) estimates by developing an innovative synergistic mapping approach in five regional sites (Sweden, Poland, Mexico, Kalimantan, South Africa) for the epochs 2005, 2010 and 2015 and its change; and for one global map for the year 2010.

GlobBiomass has demonstrated how EO observation data can be integrated with in situ measurements and ecological understanding to provide improved biomass estimates. GlobBiomass provided a harmonised structure that can be exploited to address user needs for biomass information, but will be capable of being progressively refined as new data and methods become available. This presentation will give an overview of the technical prerequisites, final biomass maps and their validation from the GlobBiomass project for the boreal biome.

The recently started CCI Biomass Project aims to use long-term Earth Observation datasets to generate global estimates of the ECV Biomass, primarily for use in climate change science. The intention is to integrate recent EO missions and advanced methods to support the generation of global Above-Ground Biomass maps for 2007-2010, 2017/18 and 2018/19. This endeavour builds on the previous ESA DUE GlobBiomass project, but also includes partners from further comparable international remote sensing programmes and organisations with expertise in climate science, vegetation biomes and crucially, in situ data. This presentation will give an overview of the technical challenges and methodological concepts to be adressed in the CCI Biomass project for the boreal biome.

Focus of Research

The ESA GlobBiomass project performed ground-breaking methodological developments to produce 5 country-wide forest biomass maps for three epochs and their change in a consistent and validated manor - as well as one consistent global product. The developed procedures prepare the ground for operational monitoring capacities with any freely available Earth observation data set.

Key Challenges

Our research adressed key challenges for operational monitoring.

Suggestion to Address these Challenges

Big Data approaches employing space-time cubes of freely available remote sensing data and machine learning methods based on a well structured in situ reference information accessable by the national entities (such as Forest Agencies or Environmental Institutions) should be - and certainly will be - established.

C4: Cool Forests and major biogeochemical cycles

8:45am - 9:00am

Temperature sensitivity of carbon and nitrogen release in decomposition of boreal organic soils – assessment in different molecule fractions and effect of soil food webs

Ari Laurén[1], Marjo Palviainen[2], Mari Lappalainen[1]
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Abstract

We collected 36 samples of boreal mor material and 36 samples of slightly decomposed Carex-Sphagnum peat and incubated them in constant moisture and constant ambient temperature for 6 months of time. Soil mesofauna was removed from the samples by freezing treatment and then half of the samples were inoculated with fungivore echytraeid worms (Cognettia sphagnetorum). The release of carbon dioxide (CO_2), dissolved organic carbon (DOC) in low molecular weight fraction (LMW) and high molecular weight fractions (HMW), together with nitrogen (N) in ammonium (NH4-N), and dissolved organic nitrogen (DON) in LMW and HMW fractions were determined. The release rates were measured in +5 ℃, +10 ℃, and +20 ℃, and temperature sensitivity function Q10 was fitted to the data.

C release in mor material was considerably higher in when worms were present, but the Q10-values were rather similar between worm and control treatments. DOC release drastically increased when temperature rose from 10 ℃ to 20 ℃ and in the highest temperature the worms had the largest effect on DOC release. HMW-DON had positive Q10- value, whereas LMW-DON had negative Q10 manifesting a high rate of biodegradation of labile DON compounds under high temperature conditions.

In peat enchytraeids increased temperature sensitivity of C release. Temperature sensitivity of N release was lower than that of C. The difference in C release with and without worms emerged with increasing temperature. The new finding in our study was that mineral N release was totally dependent on worms: there was no net release of N in samples without worms. On the contrary, N keeps accumulating to samples in absence of worms, and thus an inverse temperature sensitivity emerged: immobilization increased with increasing temperature.

Focus of Research

It reveals temperature sensitivities of biogeochemical processes that have not been shown before.

Key Challenges

Yes. It shows interaction of soil food webs, temperature and boigeochemical cycles.

Suggestion to Address these Challenges

Increase awerness of complex interactions within biogeochemical cycles.

9:00am - 9:15am

Temperature sensitivity of CO2 and CH4 fluxes from decomposed coarse woody debris in boreal forests

Liudmila Mukhortova, Svetlana Evgrafova, Maria Meteleva, Leonid Krivobokov
Sukachev Institute of Forest SB RAS, Russian Federation; l.mukhortova@gmail.com

Abstract

Increasing of greenhouse gases in the atmosphere is recognized as a one of the main reasons of the contemporary climate warming. Forest ecosystems have sequestered a significant amount of atmospheric carbon in the tree phytomass. Tree death during growth and development of tree stands supplements pool of coarse woody debris (CWD) that are a one of the sources of greenhouse gases emission due to decomposition processes of wood. Recent studies showed that CWD can be one of the sources of not only carbon dioxide (CO_2), but also of methane (CH4) emission.

The objective of this study was experimental assessing the temperature sensitivity of emission of greenhouse gasses (CO_2, CH4) from decomposing coarse woody debris (CWD) in northern boreal forests of Siberia.

Samples of CWD were collected in northern boreal forests of Central Evenkia (64°N, 100°E), Central Siberia, Russia. The main forest-forming tree species in this region are larch (Larix gmelinii (Rupr.) Rupr.) and birch (Betula tortuosa Ledeb.). Cross-sections from logs of larch and birch at different stages of decomposition were taken, transported to the laboratory and placed in gas-tight boxes. Samples were incubated at +5, +15 and +25°C. Concentrations of CO_2 and CH4 were measured in dynamics: at the beginning of the experiment and after 3, 24, 72 and 144 hours incubation using Picarro G2201-i analyzer. In total 24 wood samples were measured.

It was found that carbon dioxide concentration increased gradually during incubation for wood at all decomposition stages. Flux of carbon dioxide from coarse woody debris at the advanced stage of decomposition (decomposition class III) was higher than from wood of early decomposition stages (decomposition classes I and II). Carbon dioxide emission showed close correlation with temperature, class of decomposition and type of rot (white or brown rot fungi consortia decomposed wood).

Concentration of methane also showed gradual increasing during 6 days incubation. Rate of methane increasing was dependent on temperature. If at the temperature +5°C increasing of methane concentration was slow and observed only for decomposition class I and II, at the temperature +25°C wood samples of all decomposition classes increased concentration of methane (from 1.82-1.84 ppm to 2.06-2.87 ppm) over the 6 days of incubation.

Focus of Research

Our research was focused on experimental measurements of fluxes of greenhouse gasses from decomposing coarse woody debris in boreal forest ecosystems. Studies of temperature sensitivity of carbon dioxide and methane fluxes are important to assess possible emission of these greenhouse gasses under the climate changes.

Key Challenges

Results of our research showed that decomposing coarse woody debris in northern boreal forests can be a source of methane emission and temperature is one of the key factors influencing on the rate of its production.

Suggestion to Address these Challenges

More detailed studies of this challenge are necessary. We need to ascertain mechanisms and main agents of methane production in decomposing coarse woody debris.

9:15am - 9:30am

Variation of non-structural carbon storage within a year in a whole-tree carbon balance framework

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Abstract

Photosynthesis is not entirely synchronized with carbon sinks meaning trees are capable of storing non-structural-carbon (NSC) such as labile sugars and starch. These storages provide a buffer between carbohydrate supply and demand and also allow trees to resist drought through osmoregulation. However, the estimates of the total NSC storage of a mature tree are still rare.

Trees form symbiosis and allocate NSC to the root-associated fungi. Root exudation is beneficial for trees especially in nutrient poor soils, because mycorrhizal fungi produce extracellular enzymes and decay soil organic matter. However, the quantity and dynamics of root exudation are difficult to estimate in field conditions.

The aim of this study was to:

1. Survey the dynamics of whole-tree total NSC storage during a year and their connection to main carbon flows

2. Quantify the significance of root exudates as a carbon sink

We measured the total NSC storage of mature pines in a boreal Scots pine stand at the SMEAR II in southern Finland. We took samples every 2-4 weeks of needles, roots, stem, shoot wood and phloem from 1-3 trees in 2015. Concentrations of fructose, α and β-glucose, raffinose, sucrose and starch were analyzed from the samples.

The concentrations in each fraction were upscaled to tree level with available allometric relationships for each measurement day. The upscaled total storage was included in a tree carbon balance model CASSIA (Schiestl-Aalto et al. 2015) where daily photosynthesis and carbon sinks are modelled with respect to environmental factors.

The whole-tree labile sugar concentration stayed rather stable throughout the year whereas starch was more dynamic. This could be linked with the water-holding capacity of labile sugars. Total NSC increased in spring, peaked during mid-summer and decreased again in autumn. Contrary to our previous CASSIA-estimates we did not find second NSC peak in late autumn. We explained this behavior with root exudates that were previously not included in the model. In this analysis, 5 % of yearly photosynthesis was used for root exudates. This acts as an example of using carbon balance approach to evaluate the importance of processes that cannot yet be measured.

Focus of Research

The focus of our research is to increase knowledge on boreal tree carbon processes and flows, which is critical for understanding how forests interact with current and future climate. Connecting whole-tree carbon balance with environmental factors allows us to estimate how changing environment affects carbon flows between forest and atmosphere.

Key Challenges

Studies on the survival of northern conifers have indicated that boreal Scots pine will benefit from the expected changes in the climate. However, the estimation of tree growth and their ability to sequester atmospheric carbon under future climate requires an all-inclusive view on whole-tree behavior, which is yet lacking.

Suggestion to Address these Challenges

We need more research on whole-tree carbon budject and its dependence on environmental variations. Specifically, we need to know how the responses of carbon uptake and carbon use for growth and other consumption to environmental factors differ.

Linkages between diversity of decomposing fungal community, asymbiotic nitrogen (N2) fixation and methane (CH4) in dead wood

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Abstract

Wood inhabiting fungi are directly dependent on the amount and quality of dead wood. In managed boreal forests, a loss of dead wood habitats is threat species diversity. In this study, we analyzed the changes in the wood quality along the decay gradient, modelled habitat requirements of the wood-inhabiting fungi, nitrogen dynamics in decaying wood and dead wood continuum in boreal forests as well as reflected changes in species abundances in managed and unmanaged forests.

We found that wood N content increases during decay and asymbiotic N2 fixation has a major role in observed increase accounting for 60% of the total N accumulation. In addition, wood moisture and lignin content increased along decay continuum. Furthermore, wood inhabiting fungal community changes with the changes in the wood properties being similar to soil community in the late decay phase. One third of the species were specific to decaying wood, whereas one third was common to soil and dead wood substrate. According to species specific models habitat requirements of wood-inhabiting fungi varied. For instance, the abundance of Phellinus viticola and brown-rot fungi (e.g., Fomitopsis pinicola, Antrodia serialis, Coniophora olivaceae) peaked during intermediate decay and mycorrhizal fungi (e.g., Piloderma, Tylospora, Russula) increased in the later stages. The models based on modern DNA sequencing data were consistent with earlier models that are based on polypore inventory data. We implemented an ensemble of polypore habitat models to simulations of stand and dead wood availability estimated with a decomposition model. In a managed stand, diversity thrived after final harvesting, but declined to low level by mid-rotation. Our study suggests that dead-wood supply of managed stands could be optimized to lift lowest species expectations towards levels in natural-like forests, but it seems that reaching these levels requires deadwood quantities much higher than provided by conventional management.

Focus of Research

Species diversity has a major influence on ecosystem processes and fungal community particularly is a driver of the decomposition process in boreal forests.

Key Challenges

Loss of species diversity is a threat to ecosystem functioning.

Suggestion to Address these Challenges

Improve understanding of the drivers of the species diversity and develop sustainable forest management practices that maintain/enhance species diversity and productivity of the forests

A CONCEPTUAL APPROACH TO ASSESSING OF THE HYDROLOGICAL ROLE OF BOREAL FORESTS

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Abstract

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Based on a system analysis of information on objects located in different geographical conditions, we analyzed the mechanisms of the hydrologic cycle in watersheds of any level from the point of view of landscape determinism, which causes a different hydrological effect of forest ecosystems depending on geographical conditions.

Specificity of hydrological cycles of boreal forests at both global and regional levels is determined by the peculiarities of the hydrologic cycle in the seasons of the year. In the warm period of the year, liquid atmospheric precipitations are immediately included in the active moisture flow, part of them goes for the replenishment of soil moisture reserves and the subsequent formation of river runoff, and part is spent for transpiration and physical evaporation from the earth's surface, including evaporation from the surface of the soil and plants. The ratio between evaporation and runoff in this period depends mainly on the productivity of the land in the catchment areas. In the cold period of the year, when precipitation falls out in the form of snow and is permanently preserved in a snow cover, and transpiration is terminated, active hydrologic cycle occurs mainly above the ground. The most important components of the water balance in winter are the interception of solid precipitation by the forest canopy and their evaporation from the surface of the tree crowns, evaporation from the surface of the snow cover, horizontal redistribution of snow by wind and evaporation of snow during snowstorms. In winter, the intensity and direction of snow moisture cycle are not related to the productivity of the vegetation cover, but are determined primarily by the nature of the vegetation (forest, treeless space) and environmental conditions.

The obtained patterns of snow accumulation in the forests of the boreal zone made it possible to estimate the relationship between the amount of solid precipitation, winter evaporation and accumulation of snow under the canopy of the forest. It has been established that interception of solid precipitation increases with an increase in the proportion of coniferous trees in the composition of the stand

and the closeness of the canopy. In this case, larch stands are intercepted by about two and a half times less of solid precipitation than other conifers

Focus of Research

In the formation of water resources and the preservation of water quality at the planetary level, a special role belongs to boreal forests. The focus of our study is hydrological role of boreal forests.

Key Challenges

The main reason for the contradictions in assessing the hydrological role of boreal forests and the differences in their hydrological effect is the underestimation of specificity of snow moisture balance of in forest and non-forest areas in various weather and climate conditions.

Suggestion to Address these Challenges

To develop the principles on which ecosystem management of forests should be based, ensuring both the permanence of forest management and the preservation of water resources.

10:00am - 10:15am

How to improve current soil carbon models for boreal forests?

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Abstract

Several countries apply SOC models for estimating soil C stock changes for their forests. In addition to GHG inventories, these models are also used to quantify soil carbon sinks for climate change mitigation purposes. To sum up, we need precise and accurate soil C models.

(i) Here we used Yasso07, Century and Q models to estimate SOC levels for Sweden. We compared models estimates and measured data and evaluated conditions where these models fail (Tupek et al. 2016). (ii) We also tested Yasso07 and ROMULv models against Finnish SOC data (Lehtonen et al. 2016). (iii) We also tested Yasso07, Yasso15 and Century models against soil respiration data from Finnish conifer stands (Tupek et al. in revision). In addition to that, (iv) we compared ESM SOC estimates against with global SOC databases and we identified those conditions where these global vegetation models fail with soil C (Hashimoto et al. 2016). The overall objective of our works has been identify conditions under which typical soil C models fail.

In study (i) we found that Yasso07, Century and Q models were able to estimate SOC stocks on 2/3 of cases. Models were successful on typical nutrient poor and medium fertility sites on Sweden. On the other hand these models failed on nitrogen rich forest soils.

In study (ii) we found that generally models failed on Southern Finland to estimate right SOC levels. This was due to fact that these models did not have decay limitation due lack of moisture. We also found out that understorey vegetation has a major role providing litter input especially in Northern Finland. The role of understorey vegetation has been often neglected. Study (iii) underlined the importance of the formulation of soil moisture dependency when modelling soil heterotrophic respiration.

Study (iv) identified that ESM drives were different than those with global soil data. Our analyse indicated that providing use of C:N ratios of soils and soil texture information with SOC models would improve their performance.

We conclude that future soil carbon models for boreal forest should have appropriate formulation that takes into account soil moisture regulating organic matter decay. In addition to that we should also incorporate the role of understorey as providing litter of varying quality. Moreover, these models should have definition of key processes (e.g. fate of microbial residuals) that drive long term accumulation of C into soils.

Focus of Research

To improve soil carbon modeling for forests. Soils are needed for creating negative emissions on land-use sector.

Key Challenges

Existing soil models are not appropriate for current needs for soil C quantification.

Suggestion to Address these Challenges

More research about soil processes and how those should be incorporated into the new generation of soil C models.

Towards an integrated assessment framework to study the effects of forest management and climate on water fluxes in boreal landscapes

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Abstract

Boreal forests play a central role in the landscape water balance in Northern latitudes, and structural forest characteristics as stand density or species composition are known to govern energy partitioning and dominant flow paths. Around 38% of Norway's land area is covered by forest, of which 71% is productive forest. Over the past 100 years, extensive planting of spruce and reduced grazing pressure have led to a large-scale transition in forest structure with a three-fold increase in standing timber volume, even though the forested area has only been marginally increased. The effect of this large-scale transition in forest structure on landscape water balances and streamflow regimes has not yet been quantified or studied, partly because most existing hydrological modelling frameworks do not represent spatial and temporal variability in forest structure. Especially in regional to large scale simulations are boreal forests often represented by one lumped land cover type for which parameters are derived from literature or are determined by calibration.

In this study, we present a modeling framework explicitly designed to study the combined and isolated impacts of climate change and forest management on hydrological fluxes in boreal landscapes. The modeling framework, set up for the entire of continental Norway at 1 km spatial resolution, utilizes forest structural information derived from the Norwegian National Forest Inventory (NFI) and multi-source remote sensing data to improve and refine the representation of forested landscapes in the distributed hydrological model HBV. While NFI data provide comprehensive, detailed information on hydrologically relevant forest characteristics, their potential to inform hydrological simulation over larger spatial domains has rarely been exploited so far. In the hydrological simulation, different forest types are distinguished according to structural characteristics and are represented by three key parameters: leaf area index, mean tree height and surface albedo. The classification approach based structural characteristics rather than biomes allows to implicitly account for effects of forest management. Seasonal cycles of LAI and surface albedo are calculated online as a function of air temperature and snow cover to make the framework applicable under transient climate conditions. We will present results from a sensitivity analysis and will show how large scale transitions in forest structure have affected regional hydrological fluxes during the second half of the 20th century as contrasted to climate variability.

Focus of Research

My research focusses on the interactions between land cover and management, climate, and the hydrological cycle in boreal landscapes. Increased knowledge of these interactions is essential to identify future adaptation challenges and options.

Key Challenges

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Suggestion to Address these Challenges

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B4: Science policy interaction

8:45am - 9:00am

Media coverage of forest fires and their association with climate change in Alberta, Canada

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Abstract

42 percent of the Province of Alberta, in western Canada, is covered in forest, supporting recreation, many rural and indigenous communities, and a forest industry. This ecosystem is also increasingly considered among the most threatened by climate change. Alberta's forests have already experienced recent pest outbreaks such as the mountain pine beetle, and a trend of increasing frequency and intensity of fires, a trend that has been attributed to climate change. Considering the importance of forests to Albertans, and the current and future climate threats they face, one might anticipate the emergence of public dialogues about the impacts of climate change to forests. In this paper, we present the findings of a media analysis of coverage of extreme events in forests in the two largest mainstream newspapers in the province, as well as three newspapers representing rural communities in forest-based regions, from 2008-2018. Findings indicate a general decline in coverage of forest issues overall, combined with a shift over time in emphasis on themes such as forest management and economic development. Importantly, we observe the absence of discussion of anthropogenic climate change in forest fire coverage, with such events more often attributed to natural causes. The implications of this media coverage and what it implies about public discussions of, and social responses to, climate change are discussed.

Focus of Research

Issues such as climate change must compete in the political arena with multiple other issues. How issues get prioritized, and the resulting responses, are influenced to a large degree by the shifting discourses on those topics that take place in the public sphere. Mainstream media are a key player in shaping those discourses.

Key Challenges

A key challenge we will discuss is the means by which political responses to climate change are shaped by factors other than scientific information.

Suggestion to Address these Challenges

Improvements in scientific communication practices; developing response options that accommodate regional political context

9:00am - 9:15am

The impact of protected area governance and management capacity on ecosystem function in Central America

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Abstract

Protected areas (PAs) are a prominent approach to maintaining and enhancing biodiversity and ecosystem services. A critical question for safeguarding these resources is how PA governance processes and management structures influence their effectiveness. We conduct an impact evaluation of 12 PAs in three Central American countries to assess how processes in management restrictions, management capacity, and decentralization affect the annual rate of change in the satellite-derived Normalized Difference Vegetation Index (NDVI). NDVI varies with greenness that relates to plant production, biomass, and important ecosystem functions related to biodiversity and ecosystem services such as water quality and carbon storage. Any loss of vegetation cover in the form of deforestation or degradation would show up as a decrease in NDVI values over time and gains in vegetation cover and regeneration as an increase in NDVI values. Management restriction categories are based on international classifications of strict versus multiple-use PAs, and capacity and decentralization categories are based on key informant interviews of PA managers. We use matching to create a counterfactual of non-protected observations and a matching estimator and regression to estimate treatment effects of each sub-sample. On average, strict and multiple-use PAs have a significant and positive effect on NDVI compared to non-protected land uses. Both high and low decentralized PAs also positively affect NDVI. High capacity PAs have a positive and significant effect on NDVI, while low capacity PAs have a negative effect on NDVI. Our findings advance knowledge on how governance and management influence PA effectiveness and suggest that capacity may be more important than governance type or management restrictions in maintaining and enhancing NDVI. This paper also provides a guide for future studies to incorporate measures of PA governance and management into impact evaluations.

Focus of Research

This research provides a guide for future studies to incorporate measures of PA governance and management into impact evaluations.

Key Challenges

Despite global commitments to establish more PAs, poor management, lack of funding, unenforced legislation, and outside threats, hinder their effectiveness. Some of these challenges include lack of management plan, law enforcement activities, PA budget and staff, hunting and logging, poor infrastructure, low political will.

Suggestion to Address these Challenges

Our findings advance knowledge on how governance and management influence PA effectiveness and suggest that capacity may be more important than governance type or management restrictions in maintaining and enhancing NDVI.

9:15am - 9:30am

Common challenges for functional green infrastructure at high latitude and high altitude forests: a comparison between Sweden and the Carpathian Mountains

Per Angelstam[1], **Mariia Fedoriak**[2], **Johan Svensson**[3], **Taras Yamelynets**[4]

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Abstract

Increased demand for forest goods, services and values, and socio-economic transitions, threaten natural and biocultural capital in boreal and mountain forest landscapes, and thus the supply of ecosystem services for human well-being. Supporting strategic and tactical planning towards representative green infrastructures that can deliver multiple ecosystem services, we compared boreal Sweden and the Ukrainian Carpathian Mountains as case studies. Gap analyses of different forest types showed that representation was uneven with 62 % versus 98%, respectively, of the most productive land cover types transformed to other land covers, while 2 % versus 55% of other forests had been lost. Note, however, that in the Carpathian Mountains forests were transformed to valuable cultural woodland landscapes supporting local rural development. In both case studies spatial analyses of green infrastructure functionality demonstrate severe challenges for the long-term provisioning of supporting and cultural ecosystem services. To maintain biodiversity more areas need to be protected and planned to form functional green infrastructures that represent the diversity of forest types. In Sweden social innovations such as different forms for landscape approach concepts are needed, and which can encourage stakeholder collaboration built on evidence-based knowledge about state and trends of different ecosystem services. Traditional village systems with biocultural values need support to be sustained in the Carpathian Mountains. We stress the need to abandon the belief in land-sharing, which combines wood/fibre/biomass commodities with multiple-use and biodiversity conservation across entire landscapes; and instead focus on approaches to land-sparing whereby intensive land use is segregated from both multiple-use supporting rural development and functional protected area networks for biodiversity conservation. However, major limitations are availability of spatial data with sufficient thematic resolution, poorly development knowledge-policy interface at multiple levels, and multiple barriers for spatial planning. We discuss the opportunity for cross-border and transnational learning among regions with different legacies of stakeholder collaboration and forest landscape history.

Focus of Research

Focus on sustainability science by knowledge production about both social and ecological systems in landscapes and regions representing different contexts on the European continent, as well as collaboration with practitioners to encourage evidence-based learning at different levels of governance, planning and management.

Key Challenges

Stakeholder collaboration towards sustainability in landscapes as coupled social and ecological systems.

Suggestion to Address these Challenges

Transdisciplinary place-based knowledge production and learning that engages social and natural science disciplines, and stakeholders across sectors and levels of governance

9:30am - 9:45am

The Last Great Conservation Opportunity in Human History: Conservation in North America's Boreal Forest

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Abstract

The North American Boreal Forest biome has been recognized as containing some of the highest proportions of intact, primary forest left on Earth. About 5.8 million km2 of the Boreal Forest biome is found in Canada across 10 provinces and territories and the traditional lands of hundreds of Indigenous communities. The Boreal Forest biome's intactness has allowed it to retain many globally significant conservation features including long-distance mammal and fish migrations, healthy populations of large predators, a billion

nesting birds, massive stores of carbon and ecological functionality. The region's forests, minerals, and hydropower potential are also recognized as economic opportunities so that the industrial footprint is rapidly increasing, sometimes without careful land-use planning decisions. We will describe the globally significant conservation values of the North American Boreal Forest and the innovative work of Indigenous governments and conservation organizations that has strived over the last 15 years to recognize the conservation opportunity inherent in such a still-intact landscape, resulting in implementation of some of the world's largest land conservation set-asides.

Focus of Research

This work examines the current global biodiversity values of one of the world's last very large landscapes of ecologically intact forests and wetland systems -- the Boreal Forest of North America--and describes and quantifies potential threats and new conservation and sustainability solutions.

Key Challenges

Yes, the combination of continued large scale industrial development and climate change impacts including from large fires and loss of soil organic carbon from warming soils and wetlands.

Suggestion to Address these Challenges

Maintaining and conserving remaining still very large intact forest and wetland systems within the boreal forest biome is an essential step toward decreasing the risk of loss of the globally significant conservation values of the boreal forest biome.

9:45am - 10:00am

Sustainability and multi-functionality of European forests

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Abstract

The interaction of forests with climate change is complex. The function given the highest priority in the 2015 Paris Agreement of the UNFCCC is to manage forests sustainably so as to enhance forest carbon stocks in order to help mitigate climate change. The overall impacts of forests on the atmospheric carbon budget depend heavily on the uses made of the harvested forest products (wood). In addition, forests influence climate by biophysical and biogeochemical processes, such as e.g., cloud formation processes and albedo, which depend on tree species diversity, stand density, types of forest management, and location. Depending on the combination of the above factors, the impacts of forests on global average temperatures can be positive or negative. This presentation examines aspects related to the net effect of forests on climate, including the net effects on climate of using forest biomass as a source of fuel and its comparison with fossil fuels.

Recent scientific analyses show tensions between some of the objectives in the current forest management schemes – especially between demands for increased extraction of biomass from forests and the contributions made by the same biomass in situ to soil fertility, biodiversity and protective functions. Other synergies and trade-offs exist in the way in which forests' interaction with climate change mitigation is managed.

Overall, the current scientific evidence on forests' role in climate change and on the current status of both biodiversity and forest vitality has significant implications for future forest policies and management. Policies should better account for the multi-functionality of forests and should better optimize the balance between social, economic and ecological contributions. To find a better balance between the competing demands on Europe's forests may require different management approaches. For instance, depending on location, forest management strategies such as continuous cover silviculture and the enhancement of native tree species diversity and of landscape heterogeneity may simultaneously contribute to the maintenance of forest cover, the conservation of carbon stocks and biodiversity, whilst improving the social and cultural values of forests

Focus of Research

quantifying the full climate impacts of forestry, forest and climate policy interface

Key Challenges

A big risk/threat is that we overexploit the forest resources to provide bioenergy while simultaneously reducing the sink strength and especially carbon storage in boreal forests and warming the climate.

Suggestion to Address these Challenges

Assess management options on the basis of their climate impacts; create pilots which test novel schemes for forest owners to manage their forests in a climate-friendly way; promote sustainable and climate-friendly forest management options locally, nationally, at EU level and globally

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Methodology for economic evaluation of forest resources: why the system does not work?

Maxim Lobovikov

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Abstract

The methodology for total economic evaluation of forest resources does not work in practice, because it is based on the outdated paradigm of multi-purpose sustainable forest management, which does not meet the objectives of the new environmental era of modern society.

Focus of Research

The research is focused on science-policy interaction.

The findings are important to ensure SFM and to forecast the development of forestry, as well as to strenghten the role of forestry in economic and social development.

Key Challenges

The methodology for total economic evaluation of forest resources should be improved to meet real needs and conditions.

Suggestion to Address these Challenges

The suggestion is to develop the ways to meet the objectives of the new environmental era of modern society.

PN4: Mid-latitude ecotone

8:45am - 9:00am

Assessment of Net Primary Production of Cool forests in South Korea using three different methods

Moonil Kim[1,2], Florian Kraxner[2], Dmitry Schepaschenko[2], Anatoly Shividenko[2], Andrey Krasovskii[2], Chulho Song[1], Woo-Kyun Lee[1]

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Abstract

Estimation of productivity is important measures to characterize the mass budget of a forest ecosystem. An assessment of national trends of the Net Primary Productivity (NPP) considering ecological and geographical factors can enhance knowledge about status of the Cool forests and contribution toward global scale research. This study aims to identify NPP changes in the Cool forests according to forest type and elevation during the 2000–2015 using (1) National Forest Inventory (NFI) data, (2) inventory-based dynamic growth model (KO-G-Dynamics) and (3) spatio-temporally continuous MODIS (MODerate resolution Imaging Spectroradiometer) remote sensing data for South Korea. While NFI and KO-G-Dynamics assess the change in forest growth based on annual individual tree measurement (DBH, height etc.), the MODIS NPP estimates are based on ecophysiological processes such as photosynthesis, respiration and carbon allocation. Differences among methods for estimating NPP were also examined and compared. The results showed that the mean value for NPP estimates of total South Korean forests derived from NFI, KO-G-Dynamics model and MODIS data from 2000 to 2015 exhibit 9.02, 8.79 and 8.87 Mg ha-1 year, respectively. In addition, the estimated NPP from each method showed a tendency to increase in during the same period. As the results were similar, it could be inferred that each method successfully reflected the NPP trends of Korean forests while uncertainties remain for individual stands. Geographically, the NPP exhibited a decreasing trend along elevation. This tendency was significantly showed the forest area in an altitude greater than 800 meters based on results drawn from NFI and KO-G-Dynamics model than MODIS NPP. This reveals that MODIS NPP tends to overestimation of terrestrial NPP at high elevation forest area such as Cool forests. In addition, the forests at high-elevation were observed the relatively larger annual variation in NPP than low-elevation from 2000 to 2015. This indicated that the Cool forests may be more sensitive to changes in climatic and environmental conditions than other forests in South Korea. The findings of this research can not only contribute to an understanding of the NPP distribution and changes of Cool forests in South Korea but also improve to forest productivity predictions across large scales such as Mid-Latitude Ecotone.

Focus of Research

This study aims to identify NPP changes in the Cool forests according to forest type and elevation during the 2000–2015 period using three different methods.

Key Challenges

The challenges of this study is assessing the accuracy of MODIS NPP according to the elevation and forest type. It can contribute to improve forest productivity predictions in Cool forests across large scales such as Mid-Latitude Ecotone.

Suggestion to Address these Challenges

For the future analysis, we need more site-specific data in Cool forests for accessing the accuracy of MIDIS NPP which can monitor and simulate forest ecosystem changes. In addition, applying future climate scenarios as well as proper validation will be required.

9:00am - 9:15am

Pinus koraiensis seedling mortality increased by decreasing soil water content under experimental warming and drought

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Abstract

The objective of research was to investigate the effect of warming and drought on physiological responses of Pinus koraiensis seedlings which grows naturally in cool forests (at altitudes over 1,000m) and is the major afforestation species in Korea. 90 seedlings of 2-year-old P. koraiensis were planted in 20 plots of an open-air nursery that composed of 2 levels of temperature (control (TC) and warming (+3 °C; TW)) and 2 levels of precipitation (control (PC) and drought (-30% of precipitation; PD)) with 5 replicates in May 2016. Warming treatment was conducted by infrared heaters, and drought treatment was conducted by transparent panels which can block the precipitation. Soil water content (SWC) was monitored using sensors during the study period, and leaf relative water content (RWC), net photosynthetic rate (Pn), stomatal conductance (gs), and total chlorophyll content (Tchl) were measured every month from April to August 2017, and seedling mortality was observed in December 2017 (n=5). SWC decreased by warming and drought, but a significant difference occurred only in TW plots. RWC was not changed by both treatments. Pn and gs were significantly 24.6% and 31.7% lower in TW plots than in TC plots and 9.5% and 15.0% lower in PD plots than in PC plots, respectively, while Tchl was significantly 12% higher in TW plots compared to TC plots. There were interactions between warming and drought on Pn and RWC.

Seedling mortality significantly increased by warming (TC+PC: 1.1%, TW+PC: 10.7%, TC+PD: 1.8%, TW+PD: 9.6%). Reduction of soil water might result in decreasing stomatal conductance. According to the following stomatal closure for preventing water loss, leaf water content was kept under dry condition. In addition, photosynthesis decreased by stomatal closure despite of increasing total chlorophyll content by warming. Seedling mortality might be derived from continuously reduced photosynthesis that could lead to carbon starvation.

Focus of Research

We focused on the physiological responses of Pinus koraiensis seedlings to climate change and its relationship with seedling death. These results could be used to improve forest management strategies such as forest regeneration for adapting to climate change in cool forests.

Key Challenges

Reduction of soil water by climate change affected decreasing photosynthesis and seedling mortality, although elevated temperature might be lower than threshold temperature that could decrease the photosynthetic capacity of leaf. Therefore, changes in soil water seems a risk factor to cool forests.

Suggestion to Address these Challenges

We should consider the seedling responses by changes in soil water when we make the forest management plan for afforestation under climate change in cool forests.

9:15am - 9:30am

Disturbances impact on carbon emissions in forest ecosystems of Ukrainian Polissya

Petro Lakyda, Andrii Bilous, Victor Myroniuk, Roman Vasylyshyn, <u>Ivan Lakyda</u>, Maksym Matsala, Petro Dyachuk
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Abstract

Growing in the Mid-latitude region, i.e. transition zone between boreal forests and steppe, forests of Ukraine are very sensitive to climatic parameters change. Global challenges, caused by climate and land use changes are currently influencing Ukrainian forests, namely their condition, health and biogeochemical cycles, carbon in particular. Aiming at understanding major drivers of carbon cycling of forest ecosystems and specifically the role of disturbances, we followed basic requirements of systems analysis integrating on-ground and remote sensing information and combining different methods and models.

The research area of this local intensive study was represented by a mostly forested test polygon of 45 sq. km located in Ukrainian Polissya and covered by forests of Scots pine, Silver birch, Black alder, European aspen, and Common oak. The ground-based survey has enabled to present detailed characteristics of forests needed for assessing the major indicators of carbon cycling (live biomass, detritus, soil carbon, net primary production etc.) and develop corresponding regional models for their estimation.

The forest inventory data collected during the ground-based forest survey served also a reference dataset for classification of satellite images. As a spatial reference, we used RapidEye (2010) and Spot-6 (2015) multispectral satellite imagery complemented by a 10 m spatial resolution digital elevation model. The research region was mapped by means of the RandomForest classification model using five types of land cover: forests, croplands, shrublands, wetlands, water bodies. To create forest mask we performed a binary reclassification of the thematic map assigning 1 to forested areas and 0 – to other types of land cover. The k-Nearest Neighbours imputation technique was used to predict spatial distribution of sequestered carbon and NPP within the forest mask.

During years 2010-2015, carbon emissions on the test territory were caused by natural disturbances such as wildfires, storms (wind breakage), pest and diseases, and timber logging. Conversely, regrowth of forests on former agricultural lands has increased the mean NPP from 4.7 to 4.8 MgC/ha/year for the time frame covered by this research.

For five-year period, nearly 21 % of carbon emission were triggered by disturbances in forest ecosystems. From the total carbon emissions, 57 % was caused by timber logging, 34 % – by storms, 6 % – by pests and diseases and 3 % – by wildfires. The study presented interesting results for comparison of regional models and processes with those developed at national and macro-regional level, as well as for assessing uncertainties of carbon account at different spatial scale.

Focus of Research

Our project focuses on specific biotic, abiotic and anthropogenic disturbances impact on carbon cycle of forests growing in ultimate borderland between Forest and Steppe zones. This may help to systematically analyze disturbances patterns and their impact on carbon cycle.

Key Challenges

We have found considerable disturbances impact on carbon cycle of forest ecosystems. From the main threats for forests, there were estimated the negative trend of increasing wildfires, storms, pests and diseases severity, which cause logging enlargement related to those.

Suggestion to Address these Challenges

In the future efforts for mapping and detection of specific current changes in the forests, assessment of their ecosystem services must been increased.

9:30am - 9:45am

Latitudinal approach for ensuring resilient cool forests in Mid-Latitude ecotone

Woo-Kyun LEE[1], Cholho Song[1], Moonil Kim[1,2], Guishan Cui[3], Chul-Hee Lim[1], Sle-gee Lee[1], Somin Yoo[1], Seongbong Heo[1], Jooyeon Moon[4], Damin Kim[5]

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Abstract

The Mid-Latitude Region (MLR) can be geographically defined as horizontal belt between 30–45° latitude and characterized as temperate climate with average temperature ranges from 10 to 20 ℃, representing the semi-dry climate and environment. Major part of this MLR is known as transition zone from forest to steppe, ecologically the Mid-Latitude Ecotone (MLE). In the MLR, mixed forest, croplands, and grasslands are distributed with latitudinal belt, and there are land cover/use conflicts among land cover/use types. Especially, forest cover conflicts with limited water supply bring about environmental inequality in the MLE.

The ongoing climate change reveals a substantial increase of temperature and simultaneous decrease in precipitation across vast continental regions in the MLR. According to climatic predictions, these tendencies will continue during the 21st century, which will likely increase the frequency and severity of droughts and water stress of vegetation. Along with climate change, ongoing forest degradation and deforestation are observed and expected in many regions of the MLE. Recently, high temperature and drought in spring season has caused serious mortality of alpine tree species in South Korea. In addition, human-caused deforestation or forest degradation was found in MLE. Especially, Cool forests have been seriously destroyed in North Korea due to crop and fuel production for livelihood. This causes to decrease carbon storage and sequestration. It also causes poor water use efficiency and low productivity in agricultural and forest area. We found the serious carbon decrease and poor water use efficiency in North Korea due to forest degradation. Most of MLE are proven to be still experiencing land degradation, which means, Cool forests in MLE is in danger to be disappeared. Some Mid-Latitude countries are now restoring the degraded forest for ensuring stable forest and ecosystem. Afforestation in degraded forest in MLE including North Korea can contribute to global carbon budget and water/hydrological cycle. We suggested stepwise restoration of degraded Cool forest in North Korea and found it help to improve carbon budget in North. Regarding Sustainable Development Goals (SDGs), we suggested also to manage Cool forest in MLE in the pathway that the responsible consumption and production (Goal 12) of food (Goal 2), water (Goal 6), bioenergy (Goal 7) on the land and terrestrial ecosystem of Cool forest (Goal 15) helps climate change adaptation (Goal 13). International cooperation under climate change adaptation mechanism and SDGs, for example REDD+ project in North Korea, can help implementation pathway.

Focus of Research

This study focuses on identifying current environmental status, climatic condition, and management practices of Cool forest in Mid-Latitude ecotone, and suggesting Latitudinal Approach for ensuring resilient Cool Forests in Mid-Latitude ecotone.

Key Challenges

The challenges of this study is introducing so called "Latitudinal Approach" for finding problems and solutions of Cool forest management in Mid-Latitude ecotone.

Suggestion to Address these Challenges

Further study for "Latitudinal Approach or Solution" of Cool forest management should be continued with internationally collaborative research.

9:45am - 10:00am

Modelling the future of Ukrainian forests using climate change scenarios

Ihor Buksha[1], Anatoly Shvidenko[2], Svitlana Krakovska[3]

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Abstract

By support of EU ClimaEast project the relevant approaches and models for assessment of forest vulnerability have been analyzed; an analysis of different scenarios of expected climate change has been provided and the scenarios that are most adequate for Ukraine were selected; the current state of the forests of Ukraine and the impacts of climate change on these were assessed; and the results of modelling of impacts of future climates on vulnerability of Ukrainian forests are presented in a number of maps and tables which describe levels of vulnerability, risks and threats of forest degradation within selected scenarios.

Scenario A1B which is considered by climate change science as one of most likely scenarios of the future world development due to anthropogenic impacts on the climatic system of the planet, has been selected as a major climatic scenario within this study. Taking into account that the expected dryness of the Ukrainian climate generates major challenges for vulnerability of Ukrainian forests, a modification of A1B Scenario that is characterized by increasing temperature and decreasing precipitation (A1B+T-P) was also analyzed.

The spatially distributed climatic indicators were assessed based on the most adequate regional climatic models. In order to estimate climatic impacts on vulnerability of forests, the bioecological portraits of major forest forming tree species of Ukraine were developed. Vulnerability of forests was considered in a regional approach – in limits of 5 climatic regions which are homogeneous by forest growing conditions and are similar by expected climate change.

The impacts of climate change on Ukrainian forests are diverse dependently upon geographical location, geomorphology and relief, forest types and regimes of forest management. The state and dynamics of forest ecosystems is a result of complicated interactions and mutual conditionality of impacts, ecosystem responses and feedbacks, as well as of influence of economic and social factors. Trends of major climatic indicators (temperature, precipitation) in limits of current and expected values is less dangerous than climate variability, particularly frequency and severity of climatic extremes (such as heat waves) and initiated by the extreme natural disturbances (such as fires or outbreaks of dangerous pests). The biggest vulnerability was recognized in the forests growing in steppe and southern forest steppe, where there is a high probability of impoverishment, degradation and death of forests over large areas. At the same time, there is also a threat of critical increase of vulnerability in other regions, particularly under more tough scenarios of climate change.

Focus of Research

Modelling the future of forests under climate change, assessment of vulnerability of forests and investigation of adaptation strategy for forestry

Key Challenges

Trends of major climatic indicators (temperature, precipitation) in limits of current and expected values is less dangerous than climate variability, particularly frequency and severity of climatic extremes (such as heat waves) and initiated by the extreme natural disturbances (such as fires or outbreaks of dangerous pests).

Suggestion to Address these Challenges

It would be taking into consideration for development of forest adaptation strategy

Divergent growth trends and climatic response of Picea obovata along elevational gradient in Western Sayan mountains, Siberia

Evgeny Alexandrovich Vaganov[1], Elena Babushkina[3], Liliana Delokopytova[3], Anna Barabantsova[2], Dina Zhirnova[3]
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Abstract

: In mountain ecosystems plants are sensitive to the climate changes, and due to variety of terrain and elevation the entire range of species distribution is observed in the small area. Therefore mountains are convenient testing polygon for climate–growth relationship analysis in the changing world. In the study, Siberian spruce radial growth patterns and the climatic response were considered along the altitudinal gradient in Western Sayan mountains, near Sayano-Shushenskoe Reservoir. Divergence of growth trends between individual trees was revealed at each site, with micro-site landscape-soil conditions as the most probable driver of this phenomenon. Cluster analysis of individual tree-ring width series based on inter-serial correlation was carried out, resulting in two sub-set chronologies development for each site. These chronologies appear to have substantial differences in climatic response, mainly during cold season. This response is not constant due to regional climatic change and local influence of Sayano-Shushenskoe Reservoir. Some chronologies are very sensitive to the cold season temperatures and precipitation, and percept both interannual and long-term climatic variation. Consequently, they can be used to analyze Siberian High anticyclone as the main driver of these conditions.

Focus of Research

climate change and tree growth response

Key Challenges

boreal and mountain ecosystems

Suggestion to Address these Challenges

ecologists, national parks managers

C5a: Climate Change, negative emissions, and Cool Forests

Time: Tuesday, 18/Sep/2018: 11:00am - 12:50pm · *Location:* Laxenburg Conference Center, Ovaler Saal
Session Chair: José Luis Vicente-Vicente
Session Co-Chair: Elena Tikhonova

11:00am - 11:15am

The impact of extreme weather events on forests in the Russian Far East

Alexandr Ivanov[1], Mikhail Salo[2], Martin Braun[3], Dmitriy Zamolodchikov[4]

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Abstract

The impacts of global climate change, caused by the growth of anthropogenic emissions of greenhouse gases, are becoming more pronounced. The average global temperature of the surface layer of air over the last 100 years has increased by approximately 1°C, while at the same time the average temperature in Russia has increased twice as fast. While there are no general regional patterns for precipitation change, precipitation showed a positive feedback: increasing where it was abundant already and decreasing in arid regions. One of the negative aspects of climate change is the increase in the number of natural hazards (hurricanes, floods, draughts, etc.).

Since the beginning of the 1990s, the number of severe weather events has increased threefold in Russia and now amounts to 400-450 cases per year, having a considerable impact on forestry in Russia.

A striking example of such impacts are the catastrophic consequences of floods and windthrows in 2016-2017 in the southern part of the Russian Far East. In August 2016, after prolonged and abundant precipitation, a river in central Sikhote-Alin flooded and destroyed two settlements.

In another case, about half of the total precipitation for the whole year of 2017 occurred on two days (August 7-9, 2017). In the resulting flood event hundreds of Ussuriysk residents lost their homes.

While it is important to improve early warning systems and flood management, the strong floods are associated with a larger-scale problem: the loss of the runoff-regulating function by forests on the slopes and terraces of the Sikhote-Alin mountain range as a result of forest fires and logging.

The direct impact of extreme weather events on forests is also intensifying, as exemplified by large scale wind throws in Primorsky Krai during the typhoon Lionrock (2016). It was found that the area of continuous windthrows in Sikhote-Alin Biosphere Reserve amounted to 34,000 ha or 9% of the entire area of the biosphere reserve, which is comparable to the area of all forest fires recorded in the reserve since the 1950s. The mass loss of trees during the typhoon occurred due to an abnormally high amount of precipitation on the eve of the typhoon, because the anchoring of the root systems in the soil substrate was greatly weakened.

Thus, the increase in the number of extreme events associated with forest ecosystems requires adaptive forest management measures aimed at reducing the risks of occurrence of these phenomena and mitigating their consequences.

Focus of Research

Determination of the degree of negative impact of extreme weather events on forest ecosystems and identification of the causal factors. Rationale for the need for political/administrative measures to reduce risks in the forest of the Russian Far East due to extreme weather events.

Key Challenges

Not enough attention from forest management authorities to the problem of forest degradation due to extreme events. Large economic losses due to the loss of resources. Impact on the livelihood of population in affected regions

Suggestion to Address these Challenges

It is necessary to draw the attention of forest management authorities to the problem of the impact of climate change on forests. Elaboration of laws, regulations, and standards is crucial.

11:15am - 11:30am

Emissions, transitions and feedbacks

Steffen M. Noe[1], Ülo Niinemets[1], Heikki Junninen[2], Urmas Hõrrak[2], Ülo Mander[2], Kaido Soosaar[2], Alisa Krasnova[1], Dmitrii Krasnov[1], Sandra Metslaid[1], Ahto Kangur[1]

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Abstract

Forest ecosystems are constantly in a transitional state. Transitions may be slow, like reactions to climatic shifts, or fast, like the impact of disturbances maybe by storms or forest management actions. Recent trends in global warming, rising carbon dioxide concentrations, and the growing global population are leading to increasing pressure on forest ecosystems.

We based our research on observations and theoretical formulations, of the complex adaptive system formed by atmosphere-ecosystem dynamics. This unites the observational platform SMEAR Estonia providing a stream of comprehensive data on greenhouse gases, reactive trace gases, air ions and aerosols, together with data on the status of trees, stands and the soil and laboratory experiments. Based on this data in cooperation with the Finnish SMEAR stations and the PEEX (Pan-Eurasian Experiment) networks we seek for deep insight into processes related to the transitions, emissions and feedbacks that determine the dynamics of the whole system.

Our observations are focused on the hemiboreal forest ecosystem, located at the southern edge of the boreal biome. This transition zone is, however, often not explicitly represented even though its latitudinal span in Europe is between 800 to 1000 km and in Siberia it spans even a larger distance. It is characterised by mixed forests with a share of deciduous trees up to 50%. Other than maybe expected, the emissions of biogenic volatiles (BVOC) are dominated by monoterpenes. The capacity to form new particles and grow secondary organic aerosol are thus more similar to the boreal forests than to the temperate ones. Future predications see an increase in area and a movement northwards of the hemiboreal ecosystems. Today, forest ecosystems are under diverse management regimes by societies and these activities lead to new interactions and transitions.

Our theoretical and laboratory work are focused on multiple scales. Laboratory experiments regarding stress physiology are done on species collected all over the world including cultivated plant species. Modelling allows to us extrapolate results of the processes observed from cells to global scale. Especially the impact of abiotic and biotic stressors on the biosphere-atmosphere system is in focus here. The link between constitutive and stress elicited BVOC emissions are modelled and mechanisms of insect or pathogen attacks on plants are investigated.

We present therefore results from measurements and models. These include biogeochemical cycles, atmospheric pollution, insect-plant interactions and specific results on hemiboreal forests dynamics.

Focus of Research

We are focused on deep understanding and systems thinking of processes determining the dynamic behaviour of the complex adaptive atmosphere-ecosystem-soil-society system. Society impact determining fast changes in land-use and global emissions is a factor that beside the slower climatic changes impacts on feedbacks and dynamics of the system named before.

Key Challenges

Understanding and quantifying the amplitude of feedback transitions and possible tipping points within the atmosphere-ecosystem-soil-society system are the key challenge. Forest management is in the challenging position of finding a trade-off between short termed economical profit and long-term carbon sequestration and sustainable maintenance of the resource.

Suggestion to Address these Challenges

Increasing our understanding of the system and building a "systems thinker" approach to use scientifically justified strategies in implementing mitigation policies. We also need a more "holistic" training and education to get people to understand the "big pictures".

11:30am - 11:45am

Enhancing northeast British Columbia's boreal forest resilience and productivity in a changing climate

Christopher D B Hawkins, Christopher Maundrell

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Abstract

Generally, management of northeast British Columbia's (BC) boreal forest, an area of about 15 M ha, results in conversion after logging to simple even aged conifer structures from a complex conifer – broadleaf species' mixture. The rationale is to enhance growth of the more valuable conifers. The conversion is achieved by removal of broadleaf species shortly after establishment, usually with aerial herbicide application or mechanical treatment. The current management practice reduces species and structural diversity and likely stand resilience too. Climate projections for the region suggest a different future: increases for mean annual temperature (1.9 – 4.7 C), precipitation (11 – 19 %), and frost free days (25 – 40 days) by 2050. Mean annual temperature ranges from +3 C in the south to -0.4 C in the north with extremes from -52 C to +36 C. Annual precipitation across the region is about 450 mm. The frost free period is variable ranging from 90 to 125 days depending on local topography rather than latitude. Given the projected changing climate and the decreased diversity of the managed stands, a series of trials were initiated between 2004 and 2007 across the region in five to 18 year old post logging stands. The design was a single crop tree permanent sample plot with various broadleaf competition free radii. The objective was to investigate the impact of broadleaf (aspen (Populus tremuloides) or birch (Betula papyrifera)) competition on crop tree (spruce (Picea glauca) or pine (Pinus contorta latifolia)) growth. Results after the 2009 growing season (2 – 5 years of post treatment growth) indicated that except at extreme broadleaf densities (greater than 6000 stems per ha) conifer growth was not impacted and in many cases was enhanced by having some broadleaf neighbors. Total site productivity was greater in the complex mixture than in the conifer stand. This resulted in greater site carbon sequestration. The model SORTIE projected these findings to the next harvest. Not only were the early results of biological interest, they suggested the need and cost of much of the broadcast vegetation management was not warranted. Some of the sites were remeasured after the 2017 growing season and the basic observations did not change appreciably. The findings from a 25 year old stand, 10 years after treatment will be detailed to reinforce the observations from northeast BC.

Focus of Research

Maximizing forest resilience and productivity in a rapidly changing environment

Key Challenges

Modifying legislation requiring much of the current broadleaf removal

Changing the current forest regeneration management paradigm in northeast BC

Suggestion to Address these Challenges

Introducing these finding (not unique to northeast BC) into the university forestry curriculum

Developing "acceptable" mixed species growth and yield models for BC

Field tours for on the ground foresters

11:45am - 12:00pm

Interrelations between soil fertility and vegetation in taiga forests

Natalia Lukina[1], Maria Orlova[1], Olga Bakhmet[2], Elena Tikhonova[1], Anastasia Kuznetsova[1], Daria Tebenkova[1], Alekandr Kryshen[2], Aleksey Gornov[1], Vadim Smirnov[1], Maxim Shashkov[3], Vyacheslav Ershov[4], Svetlana Knyazeva[1]

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Abstract

Evaluation of the interrelations between the soil fertility and vegetation is of great importance for predicting the dynamics of forests under global changes. This work is aimed at assessing the interrelations between vegetation and soil fertility characteristics (soil acidity, content of organic carbon and nutrients, C / N ratio) in the north and middle taiga forests (Republic of Karelia, Murmansk region, Russia). An analysis of the data received at permanent plots of Level I and Level II during the implementation of ICP Forests in Russia was carried out. Forests under investigation were dominated by pine (Pinus sylvestris), spruce (Picea abies) and birch (Betula pubescens), and among soil types Albic Podzols were widely distributed. Differences in the characteristics of soil fertility found at the level of forest types and formations within and between the taiga subzones were explained by the variation in chemical and mechanical composition of soil-forming rock, amount of precipitation, and by the influence of vegetation. The mechanisms of the influence of vegetation on soil fertility included:(1) effects of the chemical composition of litterfall produced by different plant functional groups, (2) regulation by trees of different species of the precipitation amount penetrating the canopy and, correspondingly, of intensity of leaching the organic carbon and nutrients from soil. The most intensive leaching from soil was observed in pine forests. The soil of spruce forests dominated by old spruce trees with long and low crowns contained more carbon and nutrients.

Focus of Research

The research is aimed at assessment of interrelations between the soil fertility and vegetation in taiga forests which is of great importance for predicting the dynamics of forests under global changes

Key Challenges

The key challenge to maintain the critical values of boreal forests is to keep a variety of forest types.

Suggestion to Address these Challenges

Our suggestion to address this challenge is to introduce climate-smart forestry

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12:00pm - 12:15pm

The key role of soils in delivering ecosystem services in forests beyond carbon sequestration assessment: a case study in South Korea

José Luis Vicente-Vicente[1], Sabine Fuss[1], Woo-kyun Lee[2], Cholho Song[2], Yowhan Son[2], Jongyeol Lee[2]

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Abstract

Since the second half of the 20th century, after the Korean War, an important process of reforestation took place in South Korea. The Government established several reforestation programs, which have been successful, especially after the 1970's. Since the last years, some studies have focused on the positive impacts of the reforestation on different ecosystem services (water supply, biomass production or carbon (C) sequestration). However, these studies do not usually consider the role of soils on sequestering organic C nor the effect of the soil organic carbon (SOC) levels on the ecosystem functioning. Currently, national authorities and also the Scientific Community of South Korea are thinking about introducing new managements to increase the timber production and tree species diversity. The purpose of this study was to assess the influence of reducing the cutting age and replacing with trees of different species (i.e. increase tree species diversity) on SOC accumulation. For that purpose, the FBDC model was used. The preliminary

results suggest that there is a decrease in the SOC accumulation after reducing the cutting age and replacing with trees of different species.

The other purpose of the study was to assess theoretically the synergies and trade-offs between the managements, ecosystem services and functions. The result was that the decrease in the SOC accumulation after reducing the cutting age could be compensated by the improvement in soil functioning when replacing with trees of different species (higher microbial diversity, more efficiency in water and nutrient exploitation), making the soil more resilient (i.e. higher capacity to maintain its structure and functions despite pressure to the system). However, future studies quantifying the effect of the increase of tree biodiversity in soil forest functioning are needed.

Quantifying the improvement or deterioration of the ecosystem services is of vital importance in the decision-making process to implement a specific forest management. On the other hand, assessing the relationships between the different ecosystem functions and managements is the basis to implement suitable financial or policy instruments (e.g. C-price, revenue recycling). In summary, this study shows the importance of going beyond C sequestration in forest management and the need to study and quantify the effect of the forest management on different ecosystem services from a holistic perspective in which soils play a key role.

Focus of Research

Our study was focused on assessing soil functions in forests under different managements. Furthermore, we have also assessed the synergies and trade-offs existing between ecosystem services, functions and managements in order to propose suitable financial/policy instruments to manage South Korean forests.

Key Challenges

We have assessed the key role of soils in delivering ecosystem services and also meeting the sustainable development goals. The assessment of the synergies and trade-offs between soils (forming the ecological infrastructure), other ecosystem services and managements will be crucial to preserve forest services in the future.

Suggestion to Address these Challenges

To establish the suitable financial/policy instruments by Governments in order to have a holistic perspective that can allow Governments to address the trade-offs between forest managements and ecosystem services.

The multiple effect of increasing carbon sink (re-foresting and afforesting) on climate

Markku Kulmala[1], Jaana Bäck[1,2], Timo Vesala[1], Veli-Matti Kerminen[1,3], Tuukka Petäjä[1]
[1]Institute for Atmospheric and Earth System Research (INAR), University of Helsinki, Finland; [2]Department of Forest Sciences, University of Helsinki; [3]Finnish Meteorological Institute; Markku.Kulmala@helsinki.fi

Abstract

It has been recognized for decades that the biosphere plays an important role in climate (Barth et al. 2005) affecting regional water cycle (Ellison et al. 2017, Teuling, et al. 2017, Bennet and Barton, 2018). Kulmala et al. (2004) suggested a negative climate feedback mechanism whereby higher temperatures and CO2-levels boost continental biomass production, leading to increased biogenic secondary organic aerosol (BSOA) and cloud condensation nuclei (CCN) concentrations, tending to cause cooling.

Overall, these feedbacks and interactions connect the biogeochemical cycles of water, carbon and nitrogen. Particularly the steps governing the aerosol-cloud-precipitation interactions and their connection to the terrestrial ecosystem well-being have not been resolved. The processes affecting the ecosystem-atmosphere relations operate in different spatial and temporal scales from nanoscale to a continental scale and from seconds to millennia. The detailed spatial scale (footprint) for the chain as a whole is unknown and upscaling from process-level to regional scales has not yet been resolved.

The consolidated process-level understanding together with scientific synthesis of the feedbacks facilitates breakthroughs in supporting the resilience of ecosystems to environmental stresses caused by the climate change. It will provide tools 1) to optimize afforestation and reforestation activities in semi-arid environments, and 2) to increase the carbon uptake of terrestrial ecosystems to tackle anthropogenic emissions of greenhouse gases and consequent warming.

The key scientific questions to be discussed in the presentation are:

• What is the minimum spatial scale of boreal or other forest that can produce its own clouds and thereby its own precipitation, and modify the regional water cycle and sustain forest growth?

• Under which conditions is the water cycle self-sustained on the regional scale?

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Focus of Research

Climate science, active mitigation of climate change via climate-ecosystem feedbacks and interactions.

Key Challenges

Ecosystem services like maintaining carbon and water cycles and regulating climate are crucial for future sustainability of the Earth's climate system.

Suggestion to Address these Challenges

We suggest analysing the potential for reforestation and afforestation in regions where currently the land cover is either degraded or nonvegetated.

B5: Transition to sustainable forest management in Cool Forests

Time: Tuesday, 18/Sep/2018: 11:00am - 12:50pm · *Location:* Laxenburg Conference Center, Marschallzimmer
Session Chair: Stephan Alexander Pietsch
Session Co-Chair: Brady Mattsson

11:00am - 11:15am

Toward estimating greenhouse gas emissions and removals on managed forest land in Alaska, USA

<u>Grant Michael Domke</u>[1], Stephen Ogle[2], Brian Walters[1], James Smith[1], John Coulston[3], Hans-Erik Andersen[4]

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Abstract

As signatories to the United Nations Framework Convention on Climate Change (UNFCCC), the United States (US) has been estimating and reporting greenhouse gas emissions and removals on managed forest land in the 48 conterminous states of the US since the mid 1990s. Estimates are primarily based on national forest inventory (NFI) data from the US Department of Agriculture Forest Service. Availability of NFI data for southeast and southcentral coastal Alaska (AK) resulted in including a portion of AK forests in UNFCCC reporting beginning in 2008. A recent analysis of the managed land in AK indicated that some of the forest land historically included in UNFCCC reporting does not fit the US definition of managed land. In 2015, the forest land area included in UNFCCC reporting for coastal AK was modified to include only the managed lands in this region. The analysis also revealed that much of the forest land in interior AK, previously characterized only by remote sensing and very few ground plots, that has not been included in UNFCCC reporting does fit the managed land definition. This analysis of managed land in AK coincided with the expansion of the NFI beyond coastal AK into forested regions in interior AK. Here, we describe, for the first time, estimates of emissions and removals for all managed forest land in AK. Specifically, we will: 1) provide an overview of the approach used to identify managed land in AK, 2) detail the expansion of the NFI in interior AK, and 3) describe the methods and data used to compile estimates of greenhouse gas emissions and removals on all managed forest land in AK.

Focus of Research

Estimating GHG emissions and removals on managed land is a requirement as part of the US commitment to the UNFCCC. Understanding the role of managed forest land in AK within the US and global GHG budgets will help to evaluate existing land use policies and practices and inform future activities.

Key Challenges

The remote nature of forest land in much of AK has posed many challenges to measuring and monitoring these ecosystems.

Suggestion to Address these Challenges

Sustained investment in measuring and monitoring forests through field campaigns and remote sensing applications.

11:15am - 11:30am

Balancing ecological and economic objectives in forestry: A tractable model of uneven-sized management

Elena Rovenskaya[1], Åke Brännström[1,2], Ulf Dieckmann[1], <u>Oskar Franklin</u>[1]

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Abstract

While uneven-sized management is a promising approach to combine multifaceted economic and ecological objectives in forestry, our ability to model and understand uneven-sized management is strongly limited by the complexity of the underlying forest dynamics. The perfect-plasticity approximation (PPA) model was suggested in literature as a simple and yet realistic size-structured population model of unmanaged single-species forest dynamics under the asymmetric competition for light. Here, we extend the PPA by introducing a harvesting mortality, and, additionally, to add realism necessary for addressing management problems, we introduce a maximal tree size. The resultant model enables managers to account for tradeoffs between economic and ecological objectives for an uneven-sized forest management in a tractable and computationally efficient way. For illustration, we apply the model to red maple – a common temperate forest tree species. We consider cutting regimes that harvest trees only above a critical diameter at a certain rate. By analyzing such regimes, we find that maximal economic value can be obtained by cutting all trees (i.e., applying 'infinite' cutting rate), exactly when they reach an optimal critical diameter. Cutting smaller trees hampers both economic and ecological values. However, both the economic value and the ecological value change only slightly when reducing the cutting frequency, i.e., the results are robust to cutting less frequently and letting some trees grow larger than optimal size. Increasing the cutting diameter above the optimal one improves the ecological value at the expense of the economic value, according to a tradeoff relationship quantified by a Pareto front. Maximal economic values are obtained at surprisingly high ecological utilities, underlining the generally high ecological value of uneven-aged forest management as compared to even-aged management. We also show that accounting for light competition is necessary for realistic modeling of uneven-aged forest management – ignoring it leads to overestimating the gain in ecological utility obtainable by sacrificing economic utility. In summary, based on efficient approximations of forest structure and light competition, our model provides a tractable yet realistic framework of the relationship between forest economic productivity and ecological value.

Focus of Research

Balancing ecological and economic objectives in forestry is important for sustainability, and it is important to develop understanding of how these factors interact.

Key Challenges

In uneven-aged forest management a key challenge is to make it profitable at the same time as its benefits for ecological values are not lost.

Suggestion to Address these Challenges

More research in adapting management to optimize both ecological and economic aspects, rather than just looking at the two categories even-aged versus uneven-aged forest management

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11:30am - 11:45am

Gaps in quantitative decision support to inform adaptive management and learning: a review of forest management cases

Brady Mattsson[1], Florian Irauschek[1], Rasoul Yousefpour[2]

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Abstract

Theoretical frameworks for adaptive natural resource management are quite common, whereas documented examples showing successful implementation of adaptive management and learning through multiple time intervals have remained uncommon. Measures of quality of adaptive natural resource management processes are needed to examine potential factors driving the successful implementation. To address this gap, we developed a multi-metric index composed of 22 metrics to assess quality of case studies using quantitative decision support (QDS) to inform adaptive forest management (AFM). Metrics represented three main tasks, including conceptual set-up, modeling, and application. We further distinguished these into subtasks: definition of objectives and management options (set-up); specifying uncertainty, prediction, and optimization (modeling); and stakeholder involvement along with practice and learning (application). We used a multi-metric index to examine temporal and geographic variation in quality of reviewed case studies using QDS to inform AFM. We then conducted a structured literature review of 179 articles, wherein 34 case studies met a priori criteria. When applying the multi-metric index to these case studies, we found that over the past decade the index has been intermediate and annual average scores declined by 33% from 4.5 to 3.0 of 10 (where 10 is the highest possible quality score). Aligning with reviews of adaptive natural resource management, reported on-ground application of QDS to inform AFM was rare (n=2). We also confirmed the expectation that there has been a substantial lack of stakeholder engagement during QDS development tasks. Our multi-metric index provides a novel tool to examine gaps in use of QDS for adaptive management in diverse domains including but not limited to forests.

Focus of Research

We identify key gaps in development and application of quantitative decision support for adaptive forest management, considering attributes such as diversity of objectives, quality of modeling, and level of implementation. Such decision support approaches have the potential to ensure sustainable forest management in a dynamic and uncertain world.

Key Challenges

We hypothesized that a decline in quality of quantitative decision support for adaptive management has been driven by reduced funding to support such endeavors, which puts sustainable forest management at risk in a dynamic and uncertain world.

Suggestion to Address these Challenges

Bayesian decision networks offer a cost-effective decision support tool that is amenable to stakeholder engagement but is underused for adaptive forest management. Increased funding to support expanded use of such tools while involving stakeholders throughout decision support process will improve the science and practice of adaptive forest management.

11:45am - 12:00pm

Modelling the impacts of intensifying forest management on carbon budget across a long latitudinal gradient in Europe

Anu Akujärvi[1,2], Stephan Alexander Pietsch[3]

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Abstract

Global wood demand is projected to increase with accompanying intensification in forest management practices. There are concerns that intensive management practices such as whole-tree harvest and shortened rotation lengths could risk the long-term productivity and carbon sink capacity of forest ecosystems. The historical (1900-2005) and future (2006-2099) development of five Scots pine (Pinus sylvestris) and five Norway spruce (Picea abies) stands were simulated across a long latitudinal gradient in Europe. The effects of management practices and changing climate on biomass, litter and soil carbon stocks were simulated using the BGC-MAN and Yasso15 models. The uncertainty deriving from the varying year of stand establishment was quantified with Monte Carlo analysis. BGC-MAN estimated the historical stand development similarly to measurement-based estimates derived from growth and yield tables, supporting the validity of the modelling framework. The litter and soil carbon stocks decreased significantly in 2006-2099 as a result of whole-tree harvest whereas the stem carbon stock tended to increase at the same time. Shortened rotation length reduced especially the biomass carbon stock. The responses of the litter and soil carbon stocks to forest management were very similar irrelevant of the model used demonstrating the pattern to be robust. The carbon stocks and productivity increased drastically in 2006-2099 compared with the historical simulation while the effects of harvesting practices were smaller. The modelling framework accounts for the effects of changing management and climate on the coupled biogeochemical cycles in ecosystems. The results can be applied in evaluating the climate change mitigation potential of alternative forest management strategies in boreal and temperate regions.

Focus of Research

Biogeochemical cycles of water, Carbon, Energy and nutrients determine the productivity and stability of ecosystems, exert key influence on regional and continental Climate feedback loops and provide a multitude of ecosystem service to single people, populations and mankind. Modelling these cycles properly, is key for responsible scenario based decision making.

Key Challenges

yes

Suggestion to Address these Challenges

Meet at Schlossplatz 1 in September

12:00pm - 12:15pm

Is partial cutting a good method to manage black spruce forest on hydromorphic soils?

Samuel Roy Proulx[1], Yves Bergeron[1,3], Sylvain Jutras[2], Alain Leduc[3]

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Abstract

The goal of this project was to study the hydrology, ecology and dendrometry changes occurring after a partial cut in a black spruce stand on hydromorphic soils. Our study region is in northwestern Québec in the Clay Belt region. Partial cuts are good to mimic the natural disturbances of the boreal forest such as insect outbreaks, windthrow and fire. To this day, there is no better option to recreate the irregular structure that characterizes the naturally disturbed forest stands. We also think this type of forest management his still under use in Canada, especially in Québec and we want to give strong arguments in its favour. This idea is part of the concept of ecosystem-based management who is the foundation of the forest management in the province of Québec. In the Clay Belt region, forest managers must deal with organic matter accumulation (paludification) which influence soil water content, decomposition rates and stand productivity. In this context, we wanted to know the effect of water table variations on the radial growth of the black spruce (Picea mariana [Mill] BSP). Usually, natural disturbance such as fire would periodically burn the organic matter which would keep the stand productivity. The experimental design consisted of two different treatments and control plots of 400 m². The treatments applied on the plots were partial cutting and girdling. Gridling consist of the removal of the bark and the cambium so the water uptake of the tree is interrupted, but the tree cover remains the same for at least one year. Since our focus is on the hydrology we took water table data and we put dendrometers on 45 black spruces to monitor their water uptake. Furthermore, we monitor their annual radial growth with micro-core. One of our main goal is to know if there is a relation between the water table and radial growth of black spruce. A better knowledge of this dynamic will provide useful information to evaluate all the outcomes and the feasibility of the partial cut. When we use the conventional harvesting method in this environment, we face problems such as maintaining stand productivity. In our case, we also want to know if we can mitigate the rise of the water table after a cut on hydromorphic soils. We expect that a rise of the water table is the driving factor of the lower productivity and regeneration problems.

Focus of Research

The main point of my research is ecosystem-based management and also to deal with the natural restrictions of the Clay Belt region. This is due to the reduction of natural fire frequency in boreal forest.

Key Challenges

In our sutdy area, the reduction of fire frequency risk to transform the forest into peatland. This is due to traditionnal forest management and because of the clay deposit of the last glaciation.

Suggestion to Address these Challenges

We argue that ecosystem-based management mimic natural disturbances so it is the best way to make a sustainable management of the boreal forest.

The climate change resilience of Norway spruce at the trailing edge

Juha Honkaniemi, Werner Rammer, Rupert Seidl

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Abstract

Norway spruce (Picea abies) dominated forests shape the boreal forests and temperate mid- to high elevation mountain forests in Europe. However, the high economic value of Norway spruce timber has increased the use of the species in forest management also in areas where it is at the fringe of its distribution. In Central Europe, low elevation landscapes naturally dominated by beech (Fagus sylvatica) and mixed stands have been converted to Norway spruce-dominated stands in the past to support timber production. Similar patterns of favoring Norway spruce are reported also from the Nordic countries. Areas where Norway spruce is at the trailing edge of its distribution are expected to suffer particularly from changes in the climate system. They thus offer a unique opportunity to study the resilience of the species to increasing pressures associated with climate change, such as bark beetle outbreaks and extended periods of drought. The main objective of this study is to analyze the resilience of Norway spruce to climate change at the trailing edge of its current distribution. In particular, we test the effect of spatial configuration and species composition on Norway spruce resilience at the landscape scale. The study landscape is a managed lowland (200-750m a.s.l.) area with forested area of 6700 hectares in Eastern Austria. It is a typical example of a landscape in which past management has been favoring Norway spruce. Currently, the species is making up 45% of the growing stock, whereas the natural potential vegetation is dominated by beech and silver fir (Abies alba). We simulate the forest dynamics under different climate change scenarios using iLand, the individual-based forest landscape and disturbance model. Different spatial configurations (evenly dispersed – clumped) and compositions (mixed – monoculture stands) of Norway spruce on the landscape are simulated to analyze if they have significant influence on resilience. We measure resilience by quantifying the impact and recovery of Norway spruce under climate change, specifically assessing mortality and recovery rates relative to a baseline scenario of historic climate. Our study identifies the key challenges of Norway spruce management in areas where a tree species population is at the trailing edge. The results provide important insights for ecosystem managers and policy makers on adapting cool forests to a warming world.

Focus of Research

The research focuses on Norway spruce resilience to climate change, concentrating on areas where the risks are expected to be highest in the coming decades. Norway spruce is a keystone species in the cool forests of Europe and is one of the most important tree species for the emerging bioeconomy.

Key Challenges

Yes, we identify that climate change (i.e. particularly warmer and drier conditions) poses a risk to Norway spruce especially in areas where the species is already at the fringe of its distribution. Understanding the resilience of such an important tree species is a crucial prerequisite for future ecosystem management.

Suggestion to Address these Challenges

Our results suggest that fostering mixed stands and distributed landscape configuration can foster resilience at the current trailing edge of Norway spruces' distribution. However, under severe climate change physiological limits are exceeded and the range of Norway spruce may contract, underlining the importance to mitigate climate change.

C5b: UN and Paris Agreements and the SDGs

Time: Tuesday, 18/Sep/2018: 11:00am - 12:50pm · *Location:* Laxenburg Conference Center, Marschallzimmer 2
Session Chair: Vladimir Korotkov

11:00am - 11:15am

Mongolia – Tackling REDD+ in Boreal Forest Ecosystems: Development of a National Strategy

Khishigjargal Batjantsan[1], Oyunsanaa Byambasuren[2]
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Abstract

The country is very sensitive to climate change due to its continental location - sandwiched between the Gobi desert and the Siberian forest, its relatively low socioeconomic status and its fragile ecosystems - more than 80% is considered as highly vulnerable to climate extremes. The impacts of climate change are already apparent, with an increase in average annual temperature of more than 2.3°C over the past 70 years. The future effects on forests are likely to include greater risk of forest fire, vulnerability to pest infestation, decreased soil water levels, and changes in the phenology and seeding patterns of the tree species. Currently, the biggest cause of degradation in Mongolia is human-induced forest fires and pest infestations which account for over 150,000 ha of forest annually (MET, 2018). Deforestation, as exhibited by permanent land use change, is relatively modest with 5,000 ha per year because of urbanisation, mining and change to permanent pasture.

Mongolia is the only country with significant boreal forest cover who is making significant efforts to implement REDD+, an international climate change mitigation policy adopted under the United Nations Framework Convention on Climate Change. It seeks to reduce greenhouse gas emissions (GHG) from the land use sector which accounts for approximately 17% of global emissions .

Result-based finance mechanisms require the four elements of REDD+ to be developed: A National REDD+ Strategy or Action Plan; National Forest Reference Level (FRL); National Forest Monitoring System (NFMS) and a Safeguards Information System (SIS).

The Mongolian National Program and Action Plan sets out a clear vision for REDD+ and a funding strategy which should be implemented using government, private sector and international donor support. The strategy identifies twelve focal areas for the implementation of Policy And Measures (PAMs) under four main components which aim to increase resilience, reduce forest degradation and contribute towards sustainable development. The National Program and Action covers both boreal and saxaul forest biomes but with a marked emphasis upon the boreal forests, especially the large boreal forest belt straddling the north which covers five main forested provinces.

Focus of Research

Currently, Mongolia is the only country with significant boreal forest cover attempting to implement REDD+, the experiences, lessons learned from Mongolia's REDD+ efforts can be important for climate, bioeconomy or people as REDD+ is seen by the Government of Mongolia as a mechanism to build resilience, livelihoods and economy.

Key Challenges

Mongolia is highly impacted by climate change and the effects on forest include greater risk of forest fire, vulnerability to pest infestation, decreased soil water levels, and changes in the phenology and seeding patterns of the tree species. The relatively low socioeconomic status of Mongolia affords little resilience.

Suggestion to Address these Challenges

Development and Implementation of a National REDD+ Strategy, which would help in meeting the requirements under the UNFCCC Warsaw Framework, but more importantly it would also establish a framework for the country to transition to adaptive, sustainable, and risk-resilient Forest management.

11:15am - 11:30am

Key aspects for incentivizing land sector accounting rules under the Paris Agreement

Anna Romanovskaya, Vladimir Korotkov, Alexander Trunov, Rodion Karaban', Polina Polumieva, Victoria Vertyankina
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Abstract

The rules and procedures for the implementation of the Paris Agreement should be developed and adopted in 2018. No one of the existing so far accounting systems under the 1st and 2nd Kyoto protocol commitment periods provide incentives for further actions in forests due to artificial limitations on the accounting. The goal of the Paris Agreement in achieving climate neutrality in the second half of this century and assessing a collective progress towards limiting a global temperature raise, both require a full accounting of reached GHG emission reductions and increase of sinks "as atmosphere sees".

Furthermore, accounting systems should ensure incentives to allow stakeholders to continue mitigation actions on the permanent base.

In order to stimulate mitigation actions and further develop additional measures in forests with decreasing removal trend due to aging (most boreal forests) – the possibility to exclude legacy effects from the accounting should be provided with a "projected forest reference level" considering age structure dynamic and current management practices (Grassi et al., 2018).

In order to exclude from the accounting non-anthropogenic emissions and removals the approach of "managed land" proxy should continue under the Paris Agreement framework. With that all emissions and removals within the managed land boundaries are accounted and nothing accounted from unmanaged land. That approach would provide further incentives for countries to increase managed land area, e.g. with creation of new forests (afforestation) and development of the forest protection network on previously unmanaged lands.

High permanence risks for actions in forests could be addressed with both the development of national insurance systems and exclusion of the effects of non-anthropogenic factors (extreme weather events) from the accounting. In latter case all related GHG emissions and subsequent removals are to be excluded.

To incentivize improved use of harvest wood products (HWPs) the single common approach for HWPs accounting should be agreed. Currently 3 approaches are recommended (2006 IPCC Guidelines, 2006) with different consideration of imported-exported wood materials. It is important that the chosen approach would provide incentives for countries to better manage wood products on their territory.

Finally, possibility for the accounting of co-benefits of adaptation measures in forests and other land categories would further stimulate such actions.

The careful consideration of all above-stated key aspects in the accounting rules of the Paris Agreement would result in the effective incentivizing system for sustainable management of carbon stocks and GHG removals in forests.

Focus of Research

Accounting rules of the Paris Agreement should provide effective incentivizing system for sustainable management of carbon stocks and GHG removals in forests

Key Challenges

Yes. The risk of non-effective management of carbon stocks and GHG removals in forests. It very much depends on the accounting rules of the Paris Agreement to be agreed this year.

Suggestion to Address these Challenges

To consider key aspects while develop accounting rules - please, see the abstract.

The World in 2050

Caroline Zimm

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Abstract

Humanity is at crossroads. Unbounded growth is endangering planetary support systems and increasing inequalities, the rich are getting richer and the poor even poorer. The transformation towards sustainable futures is an alternative possibility for people and the planet – a just and equitable world for all. This is exactly what the United Nations 2030 Agenda (adopted on 27 September 2015) offers and is thus a great gift to humanity. It presents a new social contract with its 17 Sustainable Development Goals (SDGs). It is an aspirational and ambitious vision for the future betterment of humanity and it gives strong reasoning for fact-based understanding of the interrelationships and synergies among the SDGs.

The World in 2050 (TWI2050) was established by the International Institute for Applied Systems Analysis (IIASA) to provide scientific foundations for the 2030 Agenda. It is based on the voluntary and collaborative effort of more than 60 authors from about 20 institutions, and some 100 independent experts from academia, business, government, intergovernmental and non-governmental organizations from all the regions of the world, who met three times at IIASA to develop pathways toward achieving the SDGs. Presentations of the TWI2050 approach and work have been shown at many international meetings including the United Nations Science, Technology and Innovation Forums and the United Nations High-level Political Forums. Two important meetings were held, one focusing on governance organized by the German Development Institute (DIE) in Bonn, Germany and the other on regional perspectives organized by the Stockholm Resilience Centre (SRC) held in Kigali, Rwanda.

This report examines the current trends and dynamics that promote and jeopardize the achievement of the SDGs. It presents the TWI2050 framework, the integrated pathways which harness the synergies and multiple benefits across SDGs, and approaches to governing this sustainability transformation. TWI2050 identifies six exemplary transformations which will allow achieving the SDGs and long-term sustainability to 2050 and beyond:

Human capacity & demography

Consumption & production

Decarbonization & energy

Food, biosphere & water

Smart cities

Digital revolution

The report provides policy recommendations on how to achieve integrated pathways that implement these transformations which were presented at the UN High-level Political Forum 2018 in New York.

Focus of Research

Integrated pathways to achieve the SDGs

Key Challenges

NA

Suggestion to Address these Challenges

NA

C6a: Wildfires in Cool Forests

8:45am - 9:00am

Dynamics of fire regimes in Russia's forests and its impact on the Earth climate system during the recent decades

Anatoly Shvidenko[1], Dmitry Schepaschenko[1], Andrey Krasovskii[1], Sergey Bartalev[2], Evgeny Ponomarev[3], Myroslava Lesiv[1], Florian Kraxner[1]

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Abstract

Average trend of warming over the Russian territories was 2.5 times higher than the global one in 1976-2017 accompanied by dramatically increased variability of seasonal weather. Severe heat waves occured almost annually in different geographical regions. This changes the fire regimes (extent, severity, frequency, seasonal and spatial distribution of fire) and accelerates their impacts on the country's forest ecosystems, environment, and the Earth climate system. Catastrophic (mega-) fires become a typical feature of the fire regimes. We consider extent, spatial and seasonal distribution of wildfire in Russia during 1997-2015 based on 3 different sources: Space Research Institute (Moscow), Institute of Forest SB RAS (Krasnoyarsk) and Global Fire Emission Database (GFED4.1s), attempting to harmonize the data of different origin as a background for assessment of the areas enveloped by fire. The assessment of direct and post fire emissions of greenhouse substances (CO_2, CO, CH_4, aerosols) was provided using IIASA methodology of the Full and Verified Carbon Account (FCA). We conclude that the total carbon, which was annually consumed by fire in Russian forests in 2000-2015 accounted for about 100 Tg C yr-1 with substantial inter-annual variability. The average area of fire-caused death of the forests during three post-fire years (including year of burning) was ~2.5 million ha. The amount of carbon emissions due to following decomposition of forest vegetation, which is killed by fire, is of about the same that was estimated for direct fire emissions. The uncertainty of the reported results is discussed. The presentation considers the system of forest management actions, which would be able to minimize the damage caused by forest fire and provide a background for satisfactory transition to adaptive sustainable (i.e. risk resilient) forest management of Russian forests in a changing world.

Focus of Research

Estimate dynamics of fire regimes in Russia and their impact on the global carbon budget

Key Challenges

Unsatisfactory fire protection in Russian forests

Suggestion to Address these Challenges

Urgent need of transition of the Russian forest sector to sustainable management

9:00am - 9:15am

Direct carbon emissions from wildfires of Siberia estimated based on remote sensing data

Evgenii I. Ponomarev[1,2,3], Kirill Y. Litvintsev[4], Evgeny G. Shvetsov[1], Viacheslav I. Kharuk[1,3], Susan G. Conard[5]

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Abstract

Method for estimating of direct fire emissions is proposed, considering the intensity of burning based on remote sensing data (Terra and Aqua/MODIS). The study was carried out for wildfires under conditions of Siberia. The wildfire database was originally collected during 1996–2017 in GIS-layer format provided with daily attributive information for each record. Additionally we used adopted data on Fire Radiative Power (FRP) to classify the varieties of burning condition for different stages of wildfire presented in the database. The classification of the annual burned Siberian forest area was obtained in accordance with the burning intensity ranges categorized by FRP. Depending on the fire danger scenario, 47 ± 13% of the total wildfire areas were classified as low-intensity burning, 42 ± 10% as medium-intensity fire areas, and 10 ± 6% as high-intensity. Next to evaluate biomass burned and direct carbon emission we considered various empirical estimates of forest fuels combusted during wildfires of various intensities. The coefficient of combustion completeness was varied also depending on the FRP category. The average estimate on direct fire emissions in Siberia was 83 ± 21 Tg C per year during 2002–2016, which was strongly dependent of fire season scenario. That is lower than estimates made without burned area classifying (112 ± 25 Tg C per year). We evaluated also the probability (~18%) of the extreme fire scenario for Siberia resulted to 227 Tg C per year (as it was in 2012). A significant trend of the increase in direct fire emissions is observed which correlates with average temperature anomalies for Siberia. According to the dependence it was estimated that fire emissions could rising up to 220, 700 и 2300 Tg C per year under RCP2.6, RCP4.0 and RCP8.5 scenarios, correspondingly, in the end of 21 century.

Focus of Research

System of wildfire monitoring and estimating and prognosis of direct wildfire emissions.

Key Challenges

Wildfire regimes and rising strong impact on forests of Siberia

Suggestion to Address these Challenges

Adaptation of the system of fire detection and management

9:15am - 9:30am

Long term effects of fire on carbon and nitrogen pools and fluxes in the arctic permafrost and subarctic forests (ARCTICFIRE)

Jukka Pumpanen[1], Kajar Köster[2], Heidi Aaltonen[2], Egle Köster[2], Xuan Zhou[2], Huizhong Zhang-Turpeinen[1], Jussi Heinonsalo[2], Marjo Palviainen[2], Hui Sun[3], Christina Biasi[1], Viktor Bruckman[4], Anatoly Prokushkin[5], Frank Berninger[2]

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Abstract

Boreal forests, which are to a large extent located on permafrost soils, are a crucial part of the climate system because of their large soil carbon (C) pool. Even small change in this pool may change the terrestrial C sink in the arctic into a source with consequent increase in CO_2 concentrations. About 1% of boreal forests are exposed to fire annually, which affects the soil and permafrost under them. Thawing of permafrost increases the depth of the active layer containing large C and N stocks. In addition to temperature, the decomposition of soil organic matter depends on its chemical composition which may also be affected by fires. Part of the soil organic matter is turned into pyrogenic C and N resistant to decomposition.

We studied the effect of forest fires on soil greenhouse and trace gas fluxes (CO_2, CH_4, N_2O and BVOC) using portable chambers. The amount of easily decomposable and recalcitrant fractions in soil organic matter were determined with water, ethanol and acid extraction, and the natural 13C and 15N abundances as well as chemical quality with Fourier Transform Infrared Spectroscopy (FTIR) were studied. Also, changes in microbial community structure and composition were analyzed with next generation pyrosequencing.

Forest floor acted as a source of CO_2 and a sink of CH_4. The time since the last wildfire was the main factor affecting soil greenhouse gas fluxes. The CO_2 emissions were lowest in the most recently burnt area and increased with forest age throughout the fire chronosequence. The uptake of CH_4 was highest in the most recently burnt area. Our results show that the impacts of a forest fire on CO_2 fluxes are long-lasting in both Canadian and Siberian boreal forests – continuing for even more than 50 years. Our results show that boreal forest floor acted as source of a large number of BVOCs, and forest fire plays an important role in the amount and composition of BVOC fluxes.

The effect of fires on soil organic matter (SOM) quality seems to be mostly on the top (5 cm depth) soil. Fire decreased the quality of SOM: the fraction of labile SOM was lower after fire, but as the forest succession proceeds, the ratios of the SOM fractions seem to revert towards pre-fire status.

Focus of Research

Climate change and forest disturbances. As a result of climate change, northern forest will be exposed to more extreme weather events such as droughts. These events may have large consequences on soil carbon stocks and greenhouse gas emissions from soils.

Key Challenges

We observed that wildfires play an important role in affecting the greenhouse gas emissions from soils and the effects last for decades. Wildfire also affected the permafrost thawing which could lead to changes in greenhouse gas emissions between soil and the atmosphere.

Suggestion to Address these Challenges

Primary way to address these challenges is to reduce the anthropogenic greenhouse gas emissions to reduce the climate warming. The intensity of forest fires can to some extent be reduced by forest management.

9:30am - 9:45am

Recovery of carbon stocks after wildfires in boreal forests: a synthesis

Marjo Palviainen[1], Frank Berninger[1], Kajar Köster[1], Jukka Pumpanen[2]

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Abstract

Climate warming has been predicted to increase the frequency and severity of wildfires in boreal forests. Fires decrease forest carbon (C) stocks, increase CO2 emissions to the atmosphere and may cause long-term changes in forest C dynamics by altering forest regrowth, successional trajectories, litter production, organic matter decomposition, permafrost melting and the fluxes of energy, water and nutrients. Quantifying the magnitude of post-fire C changes and the rate of recovery of C stocks is necessary for understanding how changing fire frequency and intensity influence regional and global C budgets over both short and long temporal scales and for predicting future changes in C budgets. We compiled data from fire chronosequence studies from different parts of boreal zone to examine how fires change the distribution of C among different ecosystem components, how quickly forest C pools recover after fire and how the recovery of C stocks vary across boreal zone. Our objective was also to determine to what extent climatic conditions, soil properties, tree species, time since fire and fire severity explain the variation in C accumulation rate. We present a synthesis of key ecosystem parameters determining C accumulation rate in boreal forests after fire and discuss the potential implications of increased fire frequency on the recovery of C stocks and C budgets in boreal region.

Focus of Research

We present a synthesis of key ecosystem parameters determining C accumulation rate in boreal forests after fire and discuss the potential implications of increased fire frequency on the recovery of C stocks and C budgets in boreal region.

Key Challenges

Quantifying the magnitude of post-fire C changes and the rate of recovery of C stocks in boreal forests is needed to understand how changing fire frequency and intensity influence regional and global C budgets over both short and long temporal scales.

Suggestion to Address these Challenges

International register of forest fires would help to quantify the effect of forest fires in global C balance.

9:45am - 10:00am

Wildfire dynamics in Russia: the FLAM model approach

Andrey Krasovskii, Anatoly Shvidenko, Nikolay Khabarov, Dmitry Schepaschenko, Florian Kraxner

Ecosystems Services and Management (ESM) Program, International Institute for Applied Systems Analysis (IIASA), Austria; krasov@iiasa.ac.at

Abstract

Over 2000-2015, wildfire enveloped of about 10 million hectares in Russia annually, mainly in the boreal zone leading to carbon emissions of above 130 Tg C yr-1. Almost two-third of this area is located on forest land. Climatic projections, particularly for the harsh scenarios (RCP6.5 or RCP8.5 IPCC Scenarios), indicate a substantial increase of fire risks in Russian forests during the 21st century. This raises substantial challenges in planning adaptation policies in the Russian forest sector. In this study, we apply mechanistic fire model (the wildfire climate impacts and adaptation model, FLAM) to project future fire regimes in Russia. The model estimates burnt area under different suppression activities and allows for assessing fire impacts on the carbon cycle. FLAM operates at a daily time step on the grid cell of 0.25 arc degree, the same spatio-temporal resolution as in the Global Fire Emissions Database v4.1s (GFED). By applying historical climate data, we calibrate FLAM against observed burnt areas from the global database (GFED) for the period 2000-2016. Calibration of the spatial suppression efficiency in FLAM accounts for seasonality of wildfires in Russia. Fire ignition is modelled in a traditional way, i.e. human ignition based on population density, and natural ignition from lightning (daily lightning frequency). FLAM projections of burnt areas in Russia are generated for major IPCC scenarios. Results of the study provide a basis for discussion of appropriate mitigation and adaptation options to minimize the impacts of wildfires on the Russian forest ecosystems, as well as the Earth climate system.

Focus of Research

The focus of the study is on modelling wildfire in Russia. Over 2000-2015, wildfire enveloped of about 10 million hectares in Russia annually, mainly in the boreal zone leading to carbon emissions of above 130 Tg C yr-1.

Key Challenges

yes, wildfire is one of the key risks

Suggestion to Address these Challenges

Results of the study provide a basis for discussion of appropriate mitigation and adaptation options to minimize the impacts of wildfires on the Russian forest ecosystems, as well as the Earth climate system.

10:00am - 10:15am

Reflections on 25 years of international collaboration in wildland fire research

Susan G. Conard

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Abstract

Until the early 1990's my career in wildland fire research focused almost entirely on the Western US. This changed dramatically after my first trip to Siberia in 1993. There I met fire researchers from many different countries and had the wonderful opportunity to participate in a research prescribed burn in the "wilds" of Siberia (the FIRESCAN experiment). Over several years of talks around the campfire at this site, we developed a joint project between Russian, US, and Canadian scientists, which we dubbed the FireBEAR Project (for Fire Research in the Boreal Eurasian Region). This project began in earnest with seed funding from US Department of Agriculture in 1999 and was funded by NASA Earth Science Research and US Forest Service programs from 2000-2014. Research started under the project continues today. Initial studies focused on a series of experimental fires in Scots pine forests, designed to study fire behavior, ecosystem effects, and emissions under a range of burning conditions. A secondary focus of this work was development of remote sensing approaches and products for better quantifying annual burned area across the Asian part of Russian. Research conducted by this project and others over several decades has greatly changed our understanding of the extent, patterns, and impact of wildfire the Russian boreal and steppe zones, and for developing initial understanding of interactions between fire and atmospheric circulation. A second phase of this research has looked at the interactions between fire and logging and between increased fire and vegetation change. Dendrochronological data on fire in selected regions is providing information on historical fire regimes. At last count this project has resulted in about 50 journal articles and numerous presentations and proceedings publications. In this presentation I focus on the development and long-term evolution of this research project and present some examples of recent published and unpublished research.

Focus of Research

Fire regimes, fire effects, and fire/climate interactions in Siberia. Feedbacks between fire and climate from fire severity, size, and frequency, and effects of fire on carbon cycle and the atmosphere: CO_2, "black" carbon, carbon stocks and albedo. Fire damages forest resources, destroys structures, impacts human health, affects tourism, etc.

Key Challenges

Yes, including effects of logging on forest health, effects of increased fire frequency on ability of forests to regenerate, increases in burned area over time with warming climate.

Suggestion to Address these Challenges

Improving forest management, enhancing understanding of importance of fire/climate feedback, better projections of effects of climate/vegetation/fire interactions. Mitigation (limit atmospheric forcing from all sources) and adaptation of forest and fire management practices to changing climate.

AERIAL PROTECTION OF BOREAL FOREST IN RUSSIA

Andrey Eritsov

Aerial Forest Fire Protection Service (Avialesookhrana), Russian Federation; aeritsov@mail.ru

Abstract

Boreal forests of Russia play a huge ecological role not only at the regional level but also on a global scale as well. However annually in these areas acting forest fires. The lack of roads in remote areas of Russia requires development of aerial forest protection technologies.

Forest protection in remote areas is currently carried out by 4 thousand so called aerial firefighters - paratroopers (smokejumpers) and helirapellers for initial attack and with the use of about 300 aircraft to deliver firefighters and aerial attack. In the protected zones aerial firefighters are promptly delivered to fires for initial attack. There are remote sensing technologies as well for fire monitoring and decision making in extended areas. If necessary, aerial firefighters initially put out fires in those territories with the use of hand tools, small-size pumps, other modern tools and techniques, and also conduct explosive operations to create fire lines. In addition, experts of Avialesoohrana conduct artificial precipitation if there are suitable clouds.

Aviation is widely used in those areas to assist in fire management. Aerial firefighting technologies are constantly evolving.

Russian helicopters Mi-8, Ka-32, Mi-26 with helibackets VSU-5A, VSU-15A most widely used to extinguish fires, as well as aircraft Be-200 amphibian with a tank capacity for extinguishing liquid up to 12 tons, IL-76 aircraft with the tank capacity 42tons.

FBU "Avialesookhrana", research institutions, wildfire equipment companies develop aerial firefighting technologies with the use of helicopters. Upgraded helicopter device VSU-5A currently manufactured from soft material that allows to adjust the amount of extinguishing liquid, depending on the carrying capacity of the helicopters. It provides efficient use of the device by helicopters of various capacities. It is developed and implemented foam injection system to the helibacket VSU-5A that 3 times increases the effectiveness of this technology.

It is implemented new technology on creation of fire resistant strips with quick drying fire retardant foam using a helicopter device VVSU UPTK "Purga" located on external suspension bracket of helicopter MI-8MTV in 2015. It is possible to create 700 meters fire resistant foam strip for wildfire management using a quick drying foam after single drop with the use of helicopter Mi-8 MTV.

Focus of Research

The research is focused on development of aerial forest protection technologies to ensure safe well-being of people and meet current demands of economic and social development, as well as changes in forestry.

Key Challenges

The lack of road system in remote areas of Russia requires development of aerial forest protection technologies.

Suggestion to Address these Challenges

The lack of road system in remote areas of Russia requires constant evolving of aerial forest protection technologies and remote sensing technologies.

C6b: Current and future research and information needs

Time: Wednesday, 19/Sep/2018: 8:45am - 10:35am · *Location:* Laxenburg Conference Center, Marschallzimmer
Session Chair: Hanna Katriina Lappalainen

8:45am - 9:00am

A method for generating leaf-covers for tree structure models

Markku Åkerblom, Pasi Raumonen, Mikko Kaasalainen
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Abstract

Leaves are a key component in the interaction between a tree and the atmosphere, enabling the tree to grow. However, when recording the structure of a tree with terrestrial laser scanning technology, leaves are mostly viewed as a nuisance. Leaf-cover can occlude the woody structure supporting it, as well as parts of itself, making leaf-off scans the de facto procedure where and when possible. Methods have been presented to approximate the distribution of leaf orientation and distribution with respect to the woody structure, but reconstruction of the shape and location of individual leaves remains an open problem. As an alternative to leaf reconstruction from laser scanning data, we present a method for generating leaves -- both broadleaves and needle-leaves -- for tree structure models, that can be received for example from laser scanning based reconstruction.

The leaf generation method is designed such that nearly every aspect of the resulting leaf-cover can be customized. Leaf shape, size, orientation as well as leaf area density distribution can be defined by the user. The generated leaves do not intersect with the woody structure or each other. The method is suitable for both scientific simulations and visualization applications. Currently the method is implemented in Matlab, allowing it to be seamlessly combined with the TreeQSM reconstruction method previously presented by the authors, but the leaf generation algorithm is such that it could easily be ported to other computational environments as well, if necessary. In the current version, structure models consisting of circular cylinders and leaf shape consisting of any number of triangles, are supported. However the modular structure of the implementation allows easy extension for other structure model geometric primitives as well as leaf shapes.

Focus of Research

We develop tools for forest measurements and simulations for both the forest science community and industries relying on forests. The presented leaf generation method is designed to enable more accurate tree and forest simulation studies involving plant-atmosphere interactions and remote sensing.

Key Challenges

Better understanding of trees can improve our understanding of natural carbon cycle in forests. Possibility to include realistic leave or needle cover in real reconstructed tree models is an important development step in tree and forest simulations.

Suggestion to Address these Challenges

Reconstructed tree models with generated leaves are first steps towards comprehensive tree simulations. Next steps will be to include functional models and growth, but the process has to start with including leaves.

9:00am - 9:15am

Balancing Greenhouse Gas Budgets: Challenges and Opportunities in Boreal Forest Regions

Daniel Joseph Hayes[1], Benjamin Poulter[2]
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Abstract

The monitoring, reporting and verification of the stocks and flows of greenhouse gases (GHG) represent a critical component of international efforts to mitigate climate change, meet emissions targets and manage carbon resources. GHG accounting is required of nations in fulfilling policy commitments for the United Nations Framework Convention on Climate Change. Driven by such requirements, as well as a general scientific interest in understanding the GHG stocks and fluxes among the various major sectors, there has been a recent proliferation of studies attempting to balance GHG budgets at the national, regional and global scale. A key challenge is in reconciling stock change and flux estimates and their uncertainties across alternative scaling approaches to GHG gas accounting, including bottom-up (i.e, forest inventory and biosphere modeling) and top-down (i.e., flux measurements and atmospheric modeling) methods.

As the world's largest terrestrial biome, the Boreal Forest region plays an outsized role in the climate system in part by storing substantial amounts of carbon in its vegetation and soils. There are several socio-political-ecological attributes of boreal forest regions that present unique challenges and opportunities relative to other areas of GHG accounting. Here, we review the historical and current context for our scientific understanding of the major components of the GHG budget in Boreal Forest regions. Forest inventories and ecosystem models can reasonably track CO2 uptake from growth in the low productivity forests of the region, but have more sparse information and higher uncertainty around potentially large soil organic carbon stocks stored in slow-turnover pools under a cold climate. Furthermore, forest inventories are limited in their geographic coverage, which excludes large tracts of unmanaged lands across Alaska, Canada and Siberia. While the impacts of land use change and forest harvest are lighter than in other, more populated

regions, natural disturbances such as wildfire, insects and permafrost thaw play a large role in the Boreal Forest GHG budget. Remote sensing offers the best opportunity to improve GHG accounting of disturbances, especially in over the large and remote areas of unmanaged forest. Moreover, progress is being made on GHG accounting from the science perspective by integrating traditional inventory measurements with these emerging technologies under multiple constraints from bottom-up and top-down modeling. As examples, we discuss the latest science-driven efforts among countries across Boreal Forest regions for GHG accounting toward informing national and international climate policy.

Focus of Research

The research focus is on scientific methods for greenhouse gas accounting to inform management and policy.

Key Challenges

The are large uncertainties and gaps in GHG accounting of Boreal Forest regions due to limited measurements, large areas of unmanaged forest and high variability from climate and disturbances.

Suggestion to Address these Challenges

These challenges should be addressed by integrating emerging technologies from remote sensing with improved modeling frameworks based on both bottom-up and top-down approaches.

9:15am - 9:30am

Climate Change Adaptation within the Boreal Forest: Linkages between science, management, and policy in sustainable forest management in a Canadian context.

Sheri Andrews-Key[1], Colin Laroque[1], Mark Johnston[2]
[1]University of Saskatchewan, Canada; [2]Saskatchewan Research Council, Canada; sherianne1973@gmail.com

Abstract

As the climate continues to change, forest ecosystems are experiencing stresses that have not been seen in the historical past. These changes are impacting many facets of the boreal forests around the world. In Canada, the Canadian Council of Forest Ministers (CCFM) has recommended that it is essential to consider both climate change and future climatic variability in all aspects of sustainable forest management (SFM). Policy and management practices need to evolve in the face of a changing climate in order to be sustainable.

In Saskatchewan, Canada, the Ministry of Environment has recognized that adaptation in forest policy and management practices is required. In December 2014, stakeholders from Saskatchewan forest industry and government came together to explore potential future climate scenarios, impacts on operations and management, and how to address adaptation for SFM in the future. Using this workshop as a jumping off point, we are now addressing, in more detail, some of these concerns and the gaps between policy and management tools and adaptations. It is apparent to all parties involved that this is important and must be addressed in order to put policy makers and practitioners in a better position to assess and manage SFM vulnerabilities and mainstream adaptation options into planning and management of Saskatchewan's forests for the future.

The Saskatchewan provincial government and Mistik Management Ltd. (a forestry company in Saskatchewan, Canada) partnered to undertake a vulnerability assessment in order to assess climate change and sustainable forest management. Mistik is currently developing a 20-year forest management plan and the vulnerability assessment will be incorporated into their plan. The vulnerability assessment of their management area was completed using a practitioner's guidebook developed by the CCFM. Through this assessment, climate change impacts were identified, and Mistik's adaptive capacity was analyzed. Based on the vulnerability assessment and the analysis of their adaptive capacity, Mistik has now begun mainstreaming the results into their forest management plan and their SFM system. The Forestry Branch of the Saskatchewan government is also utilizing the results of the Mistik vulnerability assessment to help guide forest policy direction to increase flexibility and promote adaptation in an environment of increasing climatic uncertainty in Saskatchewan.

Focus of Research

The purpose of this research is to examine Saskatchewan's boreal forest with respect to the impacts of changing climate and how this makes sustainable forest management (SFM) systems vulnerable. In addition, this research will assist SFM practitioners to develop tools that address priority issues facing industry, government, and First Nations.

Key Challenges

Key issues that have been identified through this research included SFM vulnerability, adaptive capacity, decision-making that addresses a changing climate, risk management solutions, mainstreaming adaptation into operations and planning, building capacity and resilience within boreal SFM systems, and providing direction for policy development that will promote flexibility in SFM management.

Suggestion to Address these Challenges

The key issues identified above are in the process of being prioritized and addressed by a team of collaborators from industry, government, First Nations, other stakeholders, and scientists, at regional, provincial, and national levels within Canada to develop tools that will aid in building capacity and resilience within SFM systems.

Pan-Eurasian Experiment (PEEX) Program and GlobalSMEAR (Stations for Measuring Earth Surface–Atmosphere Relations) Initiative

Hanna K. Lappalainen[1,2,3], Tuukka Petäjä[1,3], Sergej Chalov[4], Pavel Konstantinov[4], Päivi Haapanala[1], Nuria Altimir[1], Heikki Junninen[5], Anton Rusanen[1], Risto Makkonen[2], Alexander Mahura[1], Timo Vihma[2], Petteri Uotila[1], Veli-Pekka Tynkkynen[6], Sergey Dobrolyubov[3], Vladimir Melnikov[3,7], Alexander Baklanov[8], Yrjö Viisanen[2], Nikolay Kasimov[4], Huodong Guo[9], Valery Bondur[10], Sergej Zilitinkevich[1,2,3], Markku Kulmala[1,3]

[1]University of Helsinki, Finland; [2]Finnish Meteorological Institute; [3]Tyumen State University; [4]Lomonosov Moscow State University; [5]University of Tartu; [6]Aleksanteri Institute; [7]Tyumen Scientific Center; [8]World Meteorological Organization; [9]Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences; [10]AEROCOSMOS Research Institute for Aerospace Monitoring; hanna.k.lappalainen@helsinki.fi

Abstract

The Pan-Eurasian Experiment (PEEX) program was initiated as a bottom-up approach by the researchers coming from Finland and Russia in 2012. During its operation, the program has built extensive research network, especially in Russia and China, and delivered a Science Plan (Lappalainen et al., 2016) for the Northern Eurasian region. PEEX has introduced a concept design for a seamless modelling platform (Baklanov et al., 2018), ground-based in situ observation systems (Hari et al., 2016) for detecting land/ocean–atmosphere interactions and the arctic marine PEEX concept (Vihma et al., 2018). The main scientific mission of the PEEX program is to understand large-scale feedbacks and interactions between the Earth surface–atmosphere continuum in the changing climate of northern high latitude and in China.

PEEX is currently carrying out its research activities on a project basis and promoting the research infrastructure framework GlobalSMEAR (Stations for Measuring Earth Surface–Atmosphere Relations) outside Europe, especially in Russia and China. The GlobalSMEAR is an approach towards integrated Global Earth observatory (Kulmala, 2018) initiated by Academician Markku Kulmala and coordinated by Institute for Atmospheric and Earth System Research (INAR) of University of Helsinki. The mission is to establish a global network of well-equipped environmental observatories, carrying out comprehensive, continuous observations to observe Earth surface–atmosphere relations. The SMEAR concept is supporting the implementation of the GlobalSMEAR initiative and offers an observation platform that provides continuous, comprehensive environmental information from local level up-to the global Grand Challenges. GlobalSMEAR enables upgrading of the existing stations by adding a site-specific SMEAR-concept instrument setup together with technical guidance. The most well-equipped station implementing the SMEAR concept is the SMEAR II (a Station for Measuring Ecosystem-Atmosphere Relations) in Hyytiälä, Finland. During the past ten years, the SMEAR II station has been a major contributor to several Pan-European research infrastructure design, integrated activity and preparation projects that are currently on the ESFRI Roadmap, such as ICOS (Integrated Carbon Observation System), ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure), eLTER (Integrated European Long-term Ecosystem, critical zone and socio-ecological system Research Infrastructure), and AnaEE (Infrastructure for Analysis and Experimentation on Ecosystems).

PEEX has also just recently released its Silk Road agenda (Lappalainen et al., 2018) together with the Digital Belt and Road (DBAR) Initiative. The near-future challenge is to achieve a successful integration of the methodological approaches of the socio–economic research to environmental sciences and to release the 1st scientific overview of the PEEX region.

Focus of Research

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Key Challenges

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Suggestion to Address these Challenges

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Analysis of below forest soil moisture times-series data and Sentinel-1 C-band radar backscatter

Christiane Cornelia Schmullius[1], Carsten Pathe[1], Nesrin Salepci[1], Christian Thiel[2]

[1]Friedrich-Schiller-University Jena, Dept. for Earth Observation, Germany; [2]DLR Institute for Data Science, Jena, Germany; c.schmullius@uni-jena.de

Abstract

Biomass retrieval from SAR is one of the main applications of radar remote sensing. Different sensor configurations have been tested in recent years. They are ranging from single polarization SAR data to fully polarimetric and tomographic SAR data sets either at one radar band or at different radar bands. However, it must be said that especially fully polarimetric or multi-band sensors are mostly limited to experimental campaigns. Operational space borne SAR missions offer SAR data at one radar band with mostly on like (HH/VV) and one cross-polarization (HV/VH).

Algorithms to retrieve biomass information from these data sets comprise simple regression models as well as sophisticated semi-theoretical radar backscatter models. Since the 1990s, SAR data were regularly acquired by the space agencies (ESA, JAXA, CSA).

Latest with the advent of the ESA SAR sensors using the ScanSAR technique (ENVISAT mission with the ASAR instrument and the Copernicus Sentinel-1 satellite series with the C-SAR instrument), C-band data coverage of land surfaces increased substantially. Thus, multi-temporal to hyper-temporal data sets became available. They have been exploited successfully for biomass mapping from regional to global scales using change detection methodologies.

Even the SAR data acquired by the latest SAR sensors are still containing ambiguous information. Besides the geo-physical variable of interest (e.g. biomass), other environmental factors may have an influence on the backscattered signals. Soil moisture is one of these environmental factors. There are authors, who assume that even at C-band (radar band used by ESA SAR satellites since the 1990s) the water content of the soil layer below forests may have an effect on the radar backscatter at C-band.

Since 2015, the Department of Remote Sensing at the University of Jena maintains a measurement network with 240 sensors measuring soil moisture and soil temperature in a managed forest in Thuringia, Germany. In parallel, all Sentine-1a and b data sets acquired over the region are collected. Additional meteorological information will be used for data interpretation and analysis. We intend to present the results of our ongoing research activities and try to answer the question, if an influence of soil moisture below forest on C-band radar backscatter has been found for our test site region. This may also help with the interpretation and analysis of biomass maps produced by the ESA DUE GlobBiomass and the ESA CCI Biomass projects, where the department has been and is involved.

Focus of Research

Validation of biomass retrieval methods for boreal forests. Above-ground biomass is a crucial parameter for carbon estimates, logging value and thus ecologically and economically for people's wellfare.

Key Challenges

The key challenge that we are adressing is the reliability of forest biomass monitoring by Earth observation.

Suggestion to Address these Challenges

A multi-sensor monitoring network including a super-site concept and in situ sites for validation.

Assessing the Forest Resources across Europe

Hubert Hasenauer, Mathias Neumann, Adam Moreno

BOKU - University of Natural Resources and Life Sciences, Vienna, Austria; hubert.hasenauer@boku.ac.at

Abstract

A consistent pan-European gridded data set on the state of forest resources would allow researchers, policy makers and conservationists to study and understand European forests independent of political boundaries and along different gradients such as elevation, latitude, and climate. Although National Forest Inventory (NFI) data provide information on the characteristics of forests including carbon content, volume, height, and age such data does not exist across Europe. Remotely sensed data, which can cover all of Europe, has not been utilized to produce multiply European focused forest structure data sets over the entire continent. The purpose of this study is to use existing European data to develop a consistent pan-European data set for live tree carbon/hectare, volume/hectare, mean tree height and mean tree age by integrating remotely sensed and harmonized NFI data from 13 different European countries. We produce a pan-European map for each of the four key variables on a 0.133° grid representing the time period 2000-2010 and assess the state of forest resources across Europe. We compared our carbon and volume data with that of the UN Food and Agriculture Organization's Forest Resources Report which indicate similar results though forest definition and forest area data proves to be a difficult obstacle to overcome when comparing country level statistics with spatially explicit gridded data. We also compared our height and age data with global height and European age datasets and found that these forest characteristics are more difficult to compare because of differences in the definitions used for age and height and their underlying datasets. Our gridded datasets provide consistent information on the state of forest resources across Europe and.

Key words: Carbon, volume, forest resources, gridded data, Europe, age, height

Focus of Research

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Key Challenges

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Suggestion to Address these Challenges

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Special Session 2: Participatory mapping of forest cover changes

Time: Wednesday, 19/Sep/2018: 8:45am - 10:35am · *Location:* Laxenburg Conference Center, Marschallzimmer 2
Session Chair: Dmitry Schepaschenko
Session Co-Chair: Myroslava Lesiv

The spatial distribution of forests, forest cover change and drivers behind the changes are of great interest. Local knowledge is critical for understanding the status of forests, intensity of disturbances and management. The session will focus on collecting expert knowledge for mapping drivers of forest cover change. Recently two contradictory papers were published in the authority journals. Hansen et al. (Science, 2013) report enormous tree cover losses in boreal forest, while Song at al. (Nature, 2018) highlight massive tree cover gain in the same biome. During our session we are going to look at a few countries to figure out who is correct and, what is even more important, what are the drivers of changes. The session implies active participation of the attendees, who will be trained to work with on-line tool Geo-Wiki (http://Geo-Wiki.org). The practical outcome of the activities outlined by the session will be a joint publication and European/global maps.

8:45am - 9:00am

Harnessing the power of volunteers and local experts to collect and validate spatial information: Relevance to forestry

Dmitry Schepaschenko, Steffen Fritz, Myroslava Lesiv, Linda See, Martina Dürauer
IIASA, Austria; schepd@iiasa.ac.at

Abstract

Presentation will outline experience in validation of forest maps using Geo-Wiki tool (http://Geo-Wiki.org)

Focus of Research

Accuracy estimation of existing forest maps and elaboration of hybrid maps

Key Challenges

lack of local expertise

Suggestion to Address these Challenges

Actively involve public and local experts

Crowdsourcing Human Impact on Forest

Martina Dürauer, Dmitry Schepaschenko, Myroslava Lesiv, Steffen Fritz
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Spatial information on human impact on forest, forest management intensity, location and amount of primary forest are essential for a wide range of applications such as climate change adaptation and mitigation, estimation of sustainable biomass use potential, land use and economic models. Up to now there are a few maps related to human impact intensity at global scale (See et al. 2016, Venter et al., 2016, Kindermann et al., 2013; Schulze et al., 2018). However some of them do not specifically consider forest or the accuracy is not satisfactory in many places. To collect information about human impact on forest in a systematic way, we have developed a new Geo-Wiki branch devoted to identification of human impact on forest by visual interpretation of very high resolution imagery available in Google and Bing. We are recording following land use features, related to human impact on forest and forest management: mature forest, plantations or planted forests, clearcuts, thinning or selective logging patterns; forest or paved roads; agriculture land and urban area adjacent to forest. A sample for this exercise is random stratified and consists of ca 7000 unique locations. As a strata, we have chosen combination of a number of existing maps, including existing human impact datasets, forest change maps, protected areas, intact forest landscapes and other auxiliary information. Experts (including participants of IBFRA 2018 conference) are asked to review these locations and to record land use and forest features at a visual interpretation of a 1km pixel based on their local knowledge and high-resolution satellite imagery via Geo-Wiki. The final dataset will form a basis for the future crowdsourcing campaign and will be considered as a control sample.

The collected data will be used to create a new up-to-date global map of primary forest and map of forest management intensity. These maps will be essential for a wide range of applications, including climate change adaptation, estimation of sustainable biomass use potential and mitigation, land use and economic models.

Focus of Research

Create a new up-to-date global map of primary forest and map of forest management intensity.

Key Challenges

Missing local knowledge of many places

Suggestion to Address these Challenges

involve local experts and crowd

Poster 1: Poster Session - Climate

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Satellites show warming-induced earlier arrival of spring plant growth depletes soil moisture and makes boreal summers water limited ecosystems

<u>Alemu Gonsamo</u>, Jing M Chen
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Abstract

Over the past four decades, satellite observations have shown intensified global greening in response to changes in Earth's climate system and atmospheric chemistry. The observed increase in greening is higher in temperature limited ecosystems and seasons. Parallel to greening trends, widespread browning, reversal of greening, and stalled response of greening to temperature increase have also been reported at high latitudes where warming-induced greening is expected to continue. One of the main causes is often speculated to be the warming-induced increase in water stress − the soil moisture depletion caused by earlier arrival of spring growth and increased summer evapotranspiration. We use six satellite datasets including the GIMMS NDVI3g, MODIS collection 6, SPOT VGT, GOME-2 sun-induced fluorescence (SIF), satellite-based root-zone soil moisture and gridded climate data to study the influence of spring plant growth to summer photosynthetic activity and soil moisture. Conventional satellite vegetation indices (e.g., NDVI) are responsive to changes in green leaf area and leaf chlorophyll content while SIF provides an alternative method of assessing photosynthetic activity including environmental stress from remote sensing. The study area is the Far North of Ontario (FNO), 453,788 km2 heterogeneous landscapes typical to tundra-taiga interface, consisting unmanaged boreal forest, wetland, and the most southerly area of tundra. For years with decreased plant growth in spring, we find that the summer plant growth is the highest while soil moisture reaches its lowest value in late summer. Conversely, for years with increased plant growth in spring, we find that the summer plant growth is the lowest while soil moisture reaches its lowest value in early summer. We find 51.2% decrease in summer NDVI (e.g., plant growth) sensitivity to temperature, partly explained by soil moisture depletion from the increased plant growth in spring. Therefore, summer plant growth on FNO changed from temperature limited in earlier years to temperature and soil moisture limited in recent years. Our analysis, in a study area representative of the northern high latitude terrestrial ecosystems, contributes to better understanding of the changing coupling between vegetation dynamics and Earth's climate.

Focus of Research

The focus of our research is on the impact of climate change on high latitude vegetation seasonality and productivity. Warming-induced increase in cold region plant growth is well reported but the impact of the resulting soil moisture depletion caused by earlier arrival of spring growth is unknown.

Key Challenges

Summer plant growth in tundra-taiga interface, central Canada, changed from temperature limited in earlier years to temperature and soil moisture limited ecosystems in recent years. Therefore, the expected warming-induced increase in cold region plant growth may not continue.

Suggestion to Address these Challenges

We suggest concerted international effort to study whether the warming-induced increase in carbon uptake at high latitudes is sustainable enough to alleviate the increased carbon lose from enhanced soil respiration.

11:00am - 11:15am

Risk assessment of climate related hazards in Norwegian boreal forests – Integration of field data and statistical risk models

<u>Jonathan Rizzi</u>, Svein Solberg, Even Bergseng, Torfinn Torp
Norwegian Institute of Bioeconomy Research - NIBIO, Norway; jonathan.rizzi@nibio.no

Abstract

Norway is covered for around one third of its mainland surface (around 120 000 km2) by forests with high environmental and economic value, therefore they represent a very important ecosystem to be preserved and managed. Those forests are exposed to a number of climate related hazards such as wind throw and snow breakages leading to potential risks for both the environment and the local communities. During last decades, several cases of treefall driven by wind storms and/or snow have been recorded over all Norway. These events led to damages of power lines (with the interruption of power supply for local communities) or interruption of transport infrastructures (i.e., road and railways). Future climate change can worsen the situation with an increased magnitude/frequency of climate extreme conditions leading to hazardous events. It is therefore strategic to understand the causes of these events in order to estimate their risk and take effective measures to prevent further negative consequences.

Several datasets are available providing information on trees and climate conditions in Norway. In particular, the Norwegian Forest Inventory can provide information about forest plots and the presence of wind/snow damages at regular time steps, while some additional datasets have been collected for single trees for all Norway with a higher time frequency or for specific regions where

particularly relevant events occurred. At the same time climate models outputs have been used to retrieve the climate condition of the areas under investigation reconstructing past climate or simulating future climate up to the end of the century.

This contribution presents an analysis that has been conducted over South Norway integrating National Forest Inventories data (e.g., tree species, diameter, height), climate simulations (e.g., wind speed, wind direction, soil wetness) and local conditions (e.g., the TOPEX indicator, based on elevation and exposure). Preliminary results showed that the main risk factors are represented by the dominant tree species (being pine the species with lower risk and birch the one with higher risk), height (taller trees have higher risk) and diameter (slender trees have higher risk). The presence of edges, and new edges in particular, also increases the risk of treefall caused by wind. The conditions of the soil, which can affect the anchorage of trees, and the presence of wet snow can also represent important climate related risk factors that are under investigation. Other factors also contribute to the treefall risk, but plays a minor role.

Focus of Research

This research focus on the risk assessment of climate hazards in Norwegian boreal forests. Based on this several initiatives can be taken in order to reduce the risk, which is having both environmental and economic consequences. The approach can be applied to all Fennoscandia and also other boreal forests.

Key Challenges

The research is focused on the assessment of climate related risks in Norwegian forests , which is a tool that can support decision maker and forest managers in the definition of strategies aiming at reducing the risk, also taking into account potential negative effects of the future climate.

Suggestion to Address these Challenges

Applying a risk assessment method to larger regions and the continuous availability of new dataset can allow a better evaluation of the risk and therefore to the definition of better strategies leading to the reduction of the risk.

Forecast of dynamics of Ukrainian forests under climate change

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Abstract

This research is devoted to the problem of forecasting the state of Ukrainian forests under climate change conditions. The current state of land and environment in Ukraine is unsatisfactory. Forecasting forests and forestry for the future is a rather difficult problem, given its fuzzy nature and significant uncertainties in economic, social and environmental foresight in a changing world. The forecasting methodology and main factors to be taken into account highly depend on the period for which the forecast is conducted. It is clear that predictive estimates cannot provide any precise answer, they rather give a general guiding information capable of enhancing understanding of a situation in context of possible variants of future. It is obvious, that approaches to forecasting are mainly national by their nature, although in modern world it is impossible to avoid the effects of globalization.

In our consideration, the short-term forecast of forest cover dynamics, forests state and productivity of Ukrainian forests is based on two scenarios:

- "Inertial" ("Business as usual"), which uses the current understanding of forests' role in the country's future development, trends in forest cover dynamics, national economic indicators and volumes of forest management activities during years 1990-2010;

- "Progressive", which is based on necessity of transition to sustainable forest management and which takes into account current economic opportunities, level of legislative support etc., accounts for global changes, program and governmental decisions in spheres national economy, agriculture, forestry, and requirements for protection and improvement of the environment.

Within the above scenarios, the dynamics of Ukrainian forests and their carbon budget for time period up to 2030 are highlighted. The influence of environmental changes on productivity of forests is substantiated. Conclusions are made regarding steps necessary for preserving and enhancing environment-forming and stabilizing roles of forest phytocoenoses under conditions of climate change.

Focus of Research

Our research aims at forecasting forest cover dynamics, forest state and productivity of Ukrainian forests for two scenatios - inertial and progressive, presenting comparative analysis of possibilities for improving functioning of Ukraine's forestry branch and quantifying the positive outcomes of progressive scenario as compared to the baseline scenario.

Key Challenges

According to the two scenarios that we have applied, the main challenge is transition of Ukrainian forestry branch to sustainable forest management, given the reform inertia and current understanding of the role of forests and forestry for the society.

Suggestion to Address these Challenges

The proposed research underlines an importance of general progress in different activity spheres in forest sector. It also quantifies the possible gains from positive changes. This can facilitate implementation of progressive forest management approaches and shifts in other forestry-related spheres.

Comparing predictive mapping of paludification in black spruce forests of eastern Canada

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Abstract

In northern boreal ecosystems of Canada, black spruce forests are naturally prone to paludification. Paludification is the process of accumulation of organic matter on the forest floor over time that could leads to reducing tree regeneration and forest growth. Spatial prediction of paludification in black spruce stand is of particular importance in forest management given its effect on forest productivity. Using the organic layer thickness (OLT) as a proxy of the paludification process, we compared a Random Forest (RF) using Landsat, Radar and SRTM 30 data and Regression Tree (RT) Based Landscape Segmentation using LiDAR topographic derivatives (i.e., slope, wetness index) for predicting OLT. RF show a cross-validated relative root mean square error (RMSE) for the regression model of 20.70% ±0.476 with an R2 of 0.41 ±0.021. And while RT show, an overall matching of 71% (validating data set n=97 and CV=0,56). A Landscape patterns analysis between RF and RT was performed using indices measuring spatial diversity (H), dominance (D) and contagion (C). Qualitative and quantitative changes in measurements across spatial scales from the two approaches differ depending on scale (i.e., 30 m vs 10 m). Characterizing the relationships between ecological paludification process and the grain of the data may make it possible to better predict OLT variability in space. Results from this study is critical to support forest land manager's decision-making and increase knowledge regarding the occurrence of unproductive stands related to paludification at difference scale (i.e., landscape, regional).

Focus of Research

Forest productivity (bioeconomy) and natural process

Key Challenges

Critical issues to better understand Paludification under forest management in the boreal forest

Suggestion to Address these Challenges

Better estimation of the thickness of the organic layer in the boreal forest.

A role of moss-lichen cover in CO2 flux estimation from a Larix gmelinii forest soils, central Siberia

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Abstract

Larix gmelinii (Rupr.) Rupr. is one of two forest-forming species which together with Larix cajanderi Mayr form the largest larch biome on the Earth, distributed on the continuous permafrost of the northeastern Eurasia. These northern boreal forests of Gmelin larch cover 1.9 million km2 in Siberia (Abaimov et al. 1998) and comprise 35% of the total area of larch forests in Russia (Milyutin 1983). The CO2 flux from the soil might be a very important component of the carbon budget.

L. gmelinii is the main component of the forests in central Siberia. A forest floor carpet in Gmelin larch forests consist of mainly three dominant species Pleurozium schreberi, Aulacomnium turgidum and Cladonia stellaris, but larch ecosystems with one dominant in the forest floor rarely occur in the northern forests (Zyryanova et. al. 2009). Three dominant species usually accompany each other occupying appropriate areas in the ecosystem according to the ecology of each moss or lichen.

The purpose of our study was to estimate CO2 fluxes from the soils as related to the vegetation of a larch forest floor in central Siberia, i.e. for the larch forest types and their groups.

The study was conducted in Tura (64°12'N, 100°27'E), central Siberia. The model area of 1539 ha was established. Large-scale map of the forest types and middle-scale map of the forest type groups have been elaborated for the model area with GIS and remote sensing methods.

Estimated soil emission for the model area of 1539 ha was equal to 42467 C kg season-1 when calculations were done for large-scale map with forest type as a unit. And estimated soil emission for the same area was equal to 42064 C kg season-1 when calculations were done for middle-scale map of the forest types group as a unit. Thus, during generalization of the mapped unit from the forest type to the forest type group we can loose 403 C kg season-1. For the northern boreal Gmelin larch forests growing on the territory of central Siberia the calculation losses might be resulted in 9102561 C kg season-1.

Focus of Research

The Russian forests, because of their large area, might be expected to play an important role in controlling the dynamics of CO2. Most studies of CO2 fluxes, however,have been conducted in northern Europe and Alaska.

Key Challenges

In "hot spots" where Gmelin larch forests on permafrost might be replaced by the Scots pine forests that follow the permafrost retreat in a warming climate, C-sink would increase uptaking CO_2 from atmosphere. Positive potential feed-backs to the climate system that slow down climate warming may take place.

Suggestion to Address these Challenges

The northern boreal forests of Larix gmelinii in Siberia can not be involved into any economical activity

Negative emission of field-protective and anti-erosion forest plantations created in the Russian Federation after the Second World War (1945-2016)

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Abstract

Reporting under UNFCCC and the Kyoto Protocol requires the inclusion in the annual national greenhouse gas inventory report an assessment of negative emissions from afforestation associated with human activities. The activities on afforestation include the creation of anti-erosion (AEP) and field-protective (FPP) plantations on agricultural land. Benefits of field-protective and erosion-preventive afforestation are protection of agricultural lands from droughts, harmful winds and other unfavorable climatic factors and significant increase of crop production.

The aim of the study is to assess the carbon sequestration of the planted forests created after 1946. Information about areas of AEP and FPP created from 1946 to 1989 was used according (Matis, Stepanov, 1998; Kulik, Pavlovsky, 2008). Also I used official statistic data about areas of the forest plantation created since 1990. The growth tables were used for calculation of carbon accumulation in phytomass, deadwood and litter, as well as the latest data on the accumulation of carbon in organic matter of the soil (Kurganova, Lopes de Gerenyu, 2008).

Annual area of AEP and FPP varied greatly over the period. Significant areas of plantations were established during the Soviet period. 1286 thousand ha of protective forest plantations were established during 1949-1953 after adoption "Stalin Plan for the Transformation of Nature" in 1948 however only 286 thousand ha (22%) remain till now. Total area of AEP established before 1991 was 770.8 thousand ha and total area of FPP was 937 thousand ha. Unfortunately annual area of new AEP and FPP is sharply decreased in recent years. Over the past 5 years, an average area of AEP is about 3.5 thousand ha per year and area of FPP – only about 60 ha per year.

Although the rate of creation of protective forest plantations has sharply decreased, net carbon sequestration is maintained at a relatively high level reaching 3.1 mill. tonnes C per year for all carbon pools in 2016. Plantations established before 1990 were provided maximum contribution to negative emission in connection with large-scale works on artificial afforestation in the Soviet period.

Focus of Research

Afforestation play significant role in carbon sequestration, protection of agricultural lands from droughts, harmful winds and other unfavorable climatic factors and help to increase of crop production

Key Challenges

Unfortunately annual area of new antierosion and field-protective forest plantation is sharply decreased in recent years.

Suggestion to Address these Challenges

It is necessary to increase the areas of protective forests

The impact of heat stress and drought on carbon and water fluxes at the ecosystem of boreal spruce forest (European Russia)

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Abstract

The rise of the carbon sequestration in the forests of European Russia in recent decades has been caused by an increase in global temperature and precipitation [Lapenis et al., 2005]. However, forest ecosystems in some regions, especially in the permafrost zone, can turn from a sink into a carbon source due to climate change by the end of this century [Gauthier et al., 2015]. Climate change is rapidly altering the boreal forest environment that will determine ability of forests to carbon sequestration. Because of expected extreme climate events in this century, an understanding of their impacts on carbon and water change is crucial.

Spruce forests dominate in boreal zone of the European part of Russia. They are large reservoirs of biogenic carbon and terrestrial carbon stock. Measurements of carbon dioxide and moisture fluxes by eddy-covariance technique were carried out in the mature spruce forest ecosystem (62° 16'01.9"N, 50°41'04.5"E) from April to August in 2013 and 2016. We found a significant difference between daily net CO_2 exchange (NEE) in 2013 and 2016. In 2016, the spring was warmer and the snow cover melted early, so the turn of forest ecosystem from source of CO_2 to its sink occurred two weeks earlier than in 2013. However, high air temperature and low precipitation level at the beginning of the growing season 2016 caused a decreasing of NEE, which was associated with increase

in ecosystem respiration (Reco) and decrease in gross photosynthesis (Pgross). The maximum values of NEE in the middle of the vegetation period were not differed significantly in two years. Spruce forest showed earlier turn from sink to source in the end of the growing season 2016 because of high rainfall in August. The mature spruce forest was a carbon sink of 327 g C/m2 in 2013 and 174 g C/m2 in 2016, Pgross was 839 g C/m2 and 542 g C/m2 respectively. The evapotranspiration (ET) of spruce forest was estimated to 239-247 mm in these years, and the mean water use efficiency for photosynthesis (WUE) varied from 3.3 g C/kg H2O in 2013 to 2.3 g C/kg H2O in 2016. A close relationship between daily NEE and ET was established. Overall we found that heat stress and drought at the beginning of the growing season can reduce carbon uptake and water use efficiency.

Focus of Research

negative impact of extrim climate events on carbon and water fluxes in boreal forests

Key Challenges

It has been shown that abnormally high temperatures with a deficit of precipitation during the growing season lead to a decrease of carbon sequestration in the mature boral spruce forest

Suggestion to Address these Challenges

afforestation of woody plants resistant to extreme climatic events

Market-level implications of regulating forest carbon storage and albedo for climate change mitigation

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Abstract

We explore the optimal regulation of forest carbon and albedo for climate change mitigation. We develop a partial equilibrium market-level model with socially optimal carbon and albedo pricing and characterize optimal land allocation and harvests. We numerically assess the policy's market-level impacts on land allocation, harvests and climate forcing, and evaluate how parameter choices (albedo strength, productivity of forest land and carbon and albedo prices) affect the outcomes. Carbon pricing alone leads to the overprovision of climate benefits at the expense of food and timber production. Complementing the policy with albedo pricing reduces these welfare losses.

Focus of Research

The study focuses on the market-level implications of regulating forest carbon storage and albedo for climate change mitigation.

Key Challenges

Removing carbon from the atmosphere and storing it in forests cools the climate. However, increasing storage means increasing forest area or density, both of which make Earth's surface darker. This has a warming effect on the climate, especially in the boreal region. The challenge is to balance these two effects.

Suggestion to Address these Challenges

Carbon storage can be increased by subsidizing it. However, forest carbon subsidies alone lead to the overprovision of climate benefits at the expense of food and timber production. Complementing the policy with albedo pricing reduces these welfare losses.

Possible climate warming effects on vegetation, forest types, drylands, agriculture, insect and pathogen infestation in Siberia, both recently (1960-2010) and in the future by 2080

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Abstract

Global simulations have demonstrated the potential for profound effects of GCM-projected climate change on the biosphere. We modeled progressions of potential vegetation cover, forest types, forest tree species and their climatypes, agriculture and biotic disturbances at the subcontinental scale in Siberia in the warming climate during the 21st century. We developed and used large-scale bioclimatic models and statistical models to evaluate climate effects on: vegetation shifts, changes in forest structure and productivity, agricultural benefits of warming; biotic disturbances, such as infestations of the Siberian moth (Dendrolimus sibiricus Tschetv) and a pathogen (Lophodermium pinastri Chev) in Central Siberia for the baseline period 1961-1990 and for the 2080s using the rcp 2.6 and rcp 8.5 scenarios of 20 GCMs from CMIP5 (AR5).

Principal results are:

• In the warmer and drier climate projected by these scenarios, Siberian forests are predicted to decrease and shift northwards and forest-steppe and steppe ecosystems are predicted to extend over Siberia due to the 2080 dryer climate. Permafrost is not predicted to thaw deep enough to sustain dark (Pinus sibirica, Abies sibirica, and Picea obovata) taiga. Over eastern Siberia, larch (Larix

dahurica) taiga is predicted to continue to be the dominant zonobiome because of its ability to withstand continuous permafrost. The model also predicts new temperate broadleaf forest and forest-steppe habitats currently not existant;

• Siberia is predicted to be climatically more suitable for agriculture although potential croplands would be limited by the availability of suitable soils. Crop would likely benefit from climate warming and production may increase by twofold; traditional crops could gradually shift northward; new crops may be introduced in the far south, and these would necessitate irrigation in a drier 2080 climate;

• Biotic disturbances. The Siberian moth habitat is predicted to considerably shrink in the future and be limited in a warmer climate because the main food resources - tree species Larix spp., Abies sibirica, and Pinus sibirica would not establish in predicted moth habibtats due to low migration rates; Siberian moths may not be considered a threat in climates with mild winters with repeated thawing-freezing conditions because larvae require continuous continental type winters; Needle-cast of Pinus sylvestris caused by Lophodermium pinastri Chev is found to be strongly related to precipation including snow depth rather than summer temperature. In the predicted dryer climate, it would shift northwards followed sufficient water and the tree-host Pinus sylvestris distribution.

Focus of Research

Summarize results of research we have done for the last couple decades in the context of climate warming and its consequences for biosystems in Siberia

Key Challenges

Our reaserch is directly related to threats and risks of climate warming consequences for biotic disturbances in cold climate forests of Siberia

Suggestion to Address these Challenges

To minimize negative consequences and benefit from climate change in Siberian forests, adaptive measures may be applied depending on management goals: 1) failing forests may be maintained by moving proper climatypes from suitable locations; 2) failed forest lands may be used for agriculture which would benefit in a warming Siberia.

Method of estimating long-term growth trends of forest aboveground biomass in the circumpolar boreal region

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Abstract

Boreal forests are strongly affected by global environmental changes with factors such as increase in air temperature, drought intensity and frequency, atmospheric CO2 level etc. (Ma et al. 2012). Therefore, they are considered more vulnerable than temperate and tropical ecosystems. However, assessing the potential impact of climate change in the boreal region requires long-term data, which are relatively rare and limited in geographical scope. We also often lack empirical information on stand development in the past and studies on long-term changes of forest structure have been few in many parts of the boreal region. On the other hand, history of stand level changes of aboveground biomass over decades has never been examined due to lack of appropriate data. Meanwhile, by using the stand reconstruction algorithm of Osawa et al. (2005), which utilizes information of present stand structure (DBH, tree height H), and data of tree rings from selected sample trees has enable to estimate stands structure in the past and their annual changes (i.e. stand biomass, annual growth, and stand density). Thus, in this study to identify and describe the growth history and the growth pattern that stands have been following over the years including possible growth shifts events, the stand reconstruction algorithm, and the s-w phase diagram were applied on several stands in Pinus sylvestris and Picea mariana at different sites around the circumpolar boreal forest (Scandinavia, Alaska, and Canada). Trends observed in the s-w diagram showed occurrences of abrupt shifts of the growth curve to another growth curve, which represent changes in long-term stand growth patterns at sudden and discret time. Simultaneously, it is generally observed that the parameters of the growth curves were fixed for several decades while the growth followed one curve. Growth-shifts have been detected in all studied plots and nearly at the same time especially around the late 1970s. It coincides to the shift from a cooling temperature to a more warmer temperature that has continued until today. This suggests that the boreal have changed their growth patterns in unison in the past century in response to changing climate. Unlike fitting a smooth spline curve, the s-w diagram represents a growth curve that is biologically more meaningful than those traditionally being used to express growth trends in dendrochronology.

Focus of Research

Reconstruct development of past aboveground biomass using stand reconstruction and analyze growth trend of the forest.

Key Challenges

Try to understanding past stand development of the boreal forest, which is an important line of evidence about reference condition that can guide a management or a restoration activity.

Suggestion to Address these Challenges

Reconstruction of long-term stand development

Pinus sibirica-and- Abies sibirica forest ecosystems on the south border of boreal zone: risks for survival and means to manage the productive stands

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Abstract

Formations of chern forests (Abies sibirica Ledeb., Pinus sibirica Du Tour, Populus tremula L.) represent a separate class of subboreal (hemiboreal) ecosystems in Altai-Sayan Ecoregion (1).

Results of long term researches on permanent sample plots of Institute of Forest SB RAS

(Ermakovsky Station in low mountain chern zone of West Sayan) are presented.

Low mountain chern forest ecosystems are characterized by specific features of biodiversity, structure and forest-forming process after disturbances. Week regeneration of Siberian pine makes these ecosystems vulnerable and demand special ways for their restoration.

Formation of Siberian pine stands with help of special thinning on experimental plots in the mixed fir-aspen young stands with Siberian pine undergrowth is conducted since 1966. The dynamics of tree layer and the other structural elements of communities were investigated in comparison with the control plots; each of them is 2500 m2 in size. Methods of forest inventory, detailed mapping of each layer (tree, bush, undergrowth, herb layer and its mosaics), estimation of carbon budget and others ones were applied.

The twice repeated thinning results to the dominance of Siberian pine on the experimental plots. The successful result is achieved in a short period (50 years) while the same result is not available during 200 and even more years of natural succession. The composition of communities, their sinuzial structure and wood stock (182 m3 ha-1 at the age of 70-80 years and 270 m3 ha-1 at the age of 80-90 years) are comparable with the same ones in the old-growth primary Siberian pine-and-fir chern forests.

Focus of Research

Focus of our research is biodiversity, structure and dynamics of low mountain forests because these features determine the sustainability of mountain forests, especially Pinus sibirica forests.

Key Challenges

Our research identify key challenges to maintain mountain ecosystems: the methods of Pinus sibirica restoration on old cuts and in young stands in the optimal zone of Pinus sibirica productivity .

Suggestion to Address these Challenges

To forest management and biologists.

Response of larch forest ecosystem to wetting permafrost active-layer in eastern Siberia

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Abstract

This study investigates decadal changes in soil environment of the upper permafrost and vegetation in boreal larch forest during and after the wet climate based on field observation in central Yakutia lowland, eastern Siberia. This study forest located on continuous permafrost region experienced unusual wet climate years through 2005 to 2008 and prolonged until 2009 nearly saturated soils resulted in decline and dieback of larch trees which compose upper canopy. During the wet years, thaw layer of the upper permafrost (active layer) deepened and forest floor was partly inundated through growing season. Some mature larch trees in areas with poor water drainage in their root-concentrating depth reduced leaves and its ability of transpiration (Iijima et al 2014), whereas young birch and willow trees developed and grasses with water tolerance expanded. After the wet years, the soil water close to the ground surface became dry but the deeper part remained relatively wet. Sufficient soil water would lead to growth of understory vegetation, and, simultaneously, the partial decline of the larch crown altered the environment inside the forest by increasing light. Consequently, the understory canopy continuously increased CO2 uptake and respiration toward recent years. These varying soil water and vegetation is expected to affect CO2 and water cycles of forest ecosystem scale. Partly damage of larch trees, which has relatively large contribution to ecosystem scale fluxes, resulted in reduced CO2 uptake and evapotranspiration in forest ecosystem scale (Ohta et al 2014). However, such reduction was observed just after the wet years and gradually recovered. The decline in the larch contribution was compensated for by understory growth, resulting in a relatively stable whole-forest exchange rate at least during this study period. Different response to wet environment found between larches and understory vegetation would support resilience in forest scale carbon and water cycle.

Focus of Research

We focus on decadal changes in seasonal thaw layer of upper permafrost and vegetation during and after extremely wet years. These changes can be a part of influence of arctic environmental changes.

Predicting influence of climate change on boreal forest, forest disturbance due to too much water has not been considered as well as that due to drought stress on vegetation. Wet stress disturbance like our study is repeatedly possible under influence of ongoing arctic warming and interacts with permafrost degradation.

Suggestion to Address these Challenges

Expanding forest disturbance in this region will affect livelihoods of local people through permafrost degradation as well as those on settlement and fodder land. It can be involved with the local and governmental activity of permafrost protection.

PEEX Modelling Platform: concept, models, components, infrastructure and virtual research platforms – applicability for seamless environmental prediction

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Abstract

The Pan-Eurasian EXperiment (PEEX; https://www.atm.helsinki.fi/peex) Modelling Platform (PEEX-MP; https://www.atm.helsinki.fi/peex/index.php/modelling-platform) is integral part of the PEEX research programme and one of the key blocks of the PEEX research infrastructure. The seamless coupling multi -scale and -processes modelling concept developed is important and advanced step towards realization of the PEEX research agenda presented in the PEEX Science Plan (http://www.atm.helsinki.fi/peex/images/PEEX_Science_Plan.pdf).

Currently, PEEX-MP includes more than 30 different models capable of helping to address urgent scientific questions and grand challenges of the Arctic-boreal and China domains. These models cover main components - atmosphere, hydrosphere, pedosphere and biosphere - and resolve physical-chemical-biological processes at different spatial-temporal scales and resolutions. The Earth system modelling, online coupled integrated modelling, forward and inverse modelling, socio-economical modelling, and others are valuable and useful approaches for further development of the state-of-the-art and breaking-through research in the PEEX domain.

Among PEEX-MP models, there are models which are employed for realization of the PEEX research agenda, and in particular, there are: (i) Earth system models coupled with different components such as atmosphere-ocean-sea/ice-etc; (ii) online integrated meteorology-chemistry-aerosols multi-scale models simultaneously simulating meteorological and atmospheric composition patterns; (iii) multi-scale atmospheric chemical transport models with different complexity of physical-chemical processes, gas-phase chemistry/ aerosol and meteorological input to drive the simulations; (iv) multi-scale ocean-sea/ice modeling systems; (v) modeling systems for research on atmospheric processes at different scales; (vi) models for studying atmosphere-vegetation-ecosystems physical-chemical/aerosol processes and interactions taking into account emissions of different types; (vii) large eddy simulation models; (viii) tools for inverse modelling for emissions of pollutants including greenhouse gases; and even (ix) models applicable for emergency response on nuclear-biological-chemical danger in cases of accidental releases.

More details (contact persons; modes of runs – research, operational, semi-operational; brief models descriptions with references) on these models is available at: https://www.atm.helsinki.fi/peex/index.php/modelling-tools-demonstration.

The high performance computing facilities and capabilities are of critical importance for modelling activities. Expected generated large volumes of model data will be further processed and will became freely available for research, decision-makers, stakeholders and end-user communities.

The virtual research platforms - PEEX View, Virtual Research Environment, Web-based Atlas - will allow to improve both visualization of modelling and observational results with GIS and web-based technologies, in depth complex and sophisticated analysis of various components of the Earth's system interactions and feedbacks, evaluation of processes and parameterizations for models' improvements, etc.

Focus of Research

The focus is developing and application of the seamless approach for environmental predictions in PEEX domain. It emphasizes that solving challenges related to climate change, impact-on-society, etc. will require advanced approach. PEEX-MP will help to address urgent scientific questions and grand challenges (see http://www.atm.helsinki.fi/peex/images/PEEX_Science_Plan.pdf).

Key Challenges

The PEEX list of grand challenges cover subjects such as climate change, air quality, biodiversity loss, chemicalization, food supply, energy production and fresh water supply. The PEEX-MP presentation is focused on describing and promoting the developed concept for seamless environmental prediction in the PEEX domain including the Arctic-boreal regions.

Suggestion to Address these Challenges

Proposed PEEX-MP set of models, components, infrastructure and virtual research platforms allow to address mentioned challenges. Selected models and tools can be successfully applied for seamless environmental prediction in the PEEX Arctic-boreal and China domains.

Poster 2: Poster Session - Bioeconomy

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Closing the fibre gap with precision silviculture under global change

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Abstract

Projected climate warming in cold forests around the globe will lead to increasing climatic stresses, constraining their capacity to provide goods and services to society. However, climate change may also create new opportunities in some regions, with more favourable conditions for increased productivity and high-value species. The transition to a low-carbon global economy and the emerging bioeconomy, coupled with technological advancements and innovation will open new wood product possibilities, increasing the demand for forest fibre as a substitute for competing products sourced from steel, concrete, and petroleum.

The Canadian Wood Fibre Centre is developing a collaborative, inter-disciplinary initiative to respond to opportunities for supplying high value fibre material while adapting to more frequent environmental extremes. The project will respond to a foundational research question: what are the interactions between genotype, environment, and tree responses to silvicultural treatments? Through a multiregional network of replicated operational-scale research sites, the project will deliver innovative and adaptive applications and tools as silvicultural solutions for forest managers. This will include disturbance mitigation, stand rehabilitation, transition to second-growth stands, changing markets, emerging technologies, and new product streams.

Here we present the framework of the project, which will include knowledge exchange and demonstrations for end-users as an integral part of its program.

Focus of Research

The project has three sub-themes to leverage expertise and capacity with partners from universities, research institutes and end-users from the private and public Canadian forest sectors: 1) Precision silviculture, 2) Adapting wood production to climate change and large-scale disturbances, and 3) Adapting wood production to changing markets .

Key Challenges

Forest managers in cold forests need climate-adapted strategies in the face of observed and projected climate change. In order to be sustainable, forest management and silviculture policies, practices and technologies need to be constantly revised and adapted to a changing ecological, social and economic environment.

Suggestion to Address these Challenges

This project will provide tools and methods that enable a predictable, high-value fibre supply, calibrated for the risks associated with changing climate, and scalable to the needs of new inputs into forest value chain, including niche-oriented producers from community-based forest enterprises.

Effects of fertilization with wood ash and nitrogen in a spruce stand on mineral soil

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Abstract

The production of ash from wood has greatly increased over the last years, because biofuels are increasingly being used for heating and energy production. A more intensive use of forest biomass for bioenergy will lead to increased export of nutrients from forest ecosystems. In order to maintain forest vitality and nutrient balance, recirculation of nutrients may sometimes be necessary.

Wood ash contains essential nutrients and lime which can be exploited for soil fertilisation, alone or together with other nutrients. Application of ash increases the pH and the contents of most of the main nutrients in the soil, except for nitrogen.

In mineral soils there is usually a lack of nitrogen, which limits the growth of the forest. Because ash does not contain nitrogen, effects on tree growth after pure ash fertilisation are often small. However, earlier studies have shown that on a good site, one can get a certain positive effect. Wood ash supplied together with nitrogen has also been shown to prolong the effect of nitrogen fertilisation in Scots pine stands.

We fertilized a 60 year old Norway spruce (Picea abies) stand on mineral soil with a relatively high site index with 3 t ha-1 of wood ash (ASH), 150 kg ha-1 of nitrogen (N) or a combination of wood ash and nitrogen (ASH + N), in addition to control plots without fertilization. After five years, forest growth was best in the ASH + N treatment and least in the control plots. N gave a small positive effect which seemed to be diminishing after only 4-5 years. The ASH + N treatment, on the other hand, showed an increasing growth trend throughout the period. With enhanced knowledge about where and how wood ash addition may increase forest growth, without having negative effects on other parts of the environment, wood ash may go from being a waste problem to being a renewable nutrient source.

The rank distribution model of tree fractions phytomass: forest database testing and assessment

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Abstract

Knowledge of the trees phytomass makes it possible to estimate many biological parameters of forest stands. In addition, the phytomass allows to calculate current and future stock of wood for forest management.

The evaluation of phytomass fractions by the taxation characteristics of a tree is hampered by many circumstances. The classical approach requires knowledge of coefficients of regression equations, between phytomass and height and diameter of trees. If coefficients are specific for different environmental conditions, this means that preliminary calibration of the regression between phytomass and tree characteristics is required for each territory. In fact, it is necessary to come into the forest and do a hard job measuring the phytomass of the above-ground part of the tree, digging and weighing the roots. In fact, after performing these works, calculations of regression coefficients are no longer needed.

For the first time, the proposed approach for describing ratios of phytomass fractions of tree (Sukhovolsky, 1996) is theoretical and can be explained in the framework of the resource allocation model (Mandelbrot, 2004) used in economics, linguistics. Previous works confirms the correctness of the application resource distribution model to the distribution of tree fractions phytomass (Komarov et al., 2017; Tarasov et al., 2018). This approach allows estimate phytomass of the tree (including root phytomass) by easily measured taxation indicators as tree height and trunk diameter. Using model allows to determine the root phytomass without digging out root and using data above-ground fractions of the tree.

The use of this approach greatly simplifies the measurements, but requires a preliminary evaluation of age dynamics equation parameters for individual species in specific climatic zones. To evaluate the effectiveness of the method, the authors used an extensive database of measurements of phytomass (Usoltsev, 2015) for 63 species on the territory of Eurasia.

The calculations of age dynamics equation coefficient show the similarity of the values for trees of the same species that grow under different conditions. This proximity made it possible to estimate the phytomass of the fractions of Scots pine, grown in Switzerland, according to the parameters of equations for Scots pine in the Urals and Siberia.

The proposed approach can also be used to assess the reliability of data on phytomass of tree fractions in the created databases. If there are significant deviations from the Zipf-Pareto distribution, the data should be used with extreme caution.

The study was funded by RFBR (project № 18-04-00119).

Focus of Research

Model for relationships between phytomasses of tree fractions is considered. Phytomass database of tree fractions (6,617 records) in forest stands are used to verify correctness of the proposed model. Method is proposed for estimating the phytomass of fractions from data on the stem phytomass and verifying the reliability of databases.

Key Challenges

Modern methods for assessing forest resources

Suggestion to Address these Challenges

This method simplifies forest stands state estimates and forecasts for forest management in the field conditions.

Local density of live biomass components of Scots pine trunks in SO "Residence "Zalissya" - a case study in Ukrainian Polissya

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Abstract

Research of forests bioproductivity and development of information support for live biomass assessment rest upon knowledge of peculiarities of both its quantitative and quantitative characteristics. Wood density is one of the mentioned qualitative characteristics of live biomass. A research region for this local case study is represented by forest stands of State Organization "Residence "Zalissya" with a total forested area of 14845 hectares, located in Ukrainian Polissya near Kyiv city. This research region was selected due to its regional significance and representativeness of forest ecosystems. The field data was collected on 23 temporary sample plots in the research region and adjacent areas.

To study the dynamics patterns of local density of wood and bark in immature, mature and overmature Scots pine stands, we analyzed these indices distribution along tree trunks. Local natural density of wood and wood over bark is characterized by a U-shaped dependency on relative height, with absolute values for wood 695-871 kg/m3, and for wood over bark - 698-811 kg/m3. Local natural density of bark monotonically increases along a tree trunk from 448 to 871 kg/m3. Local base density of wood and wood over bark monotonically decrease along a tree trunk, with the absolute values of 391-507 kg/m3 for wood and 387-416 kg/m3 for wood over bark. Local base density of bark varied between 299-327 kg/m3, depending on relative height. Compared to Ukrainian Polissya in general, local natural density in the research area is somewhat lower, and local base density is higher. This can be due to site conditions, climatic factors dynamics, peculiarities of mensurational indices in the studied stands, and by trends towards increase of base wood density of conifers with age.

Further steps included developing mathematical models describing dependencies of wood and bark density on tree trunk relative height. Comparison of the modeling results with the data published in scientific literature makes it possible to conclude that there is an insignificant difference in change of local base wood density along tree trunks in the research region and in forests of Ukrainian Polissya. At the same time, nature of dependency of local base density of bark in the research region corresponds to the typical for the tree species, but our results indicate a statistically significant difference in absolute values as compared to the results for Ukrainian Polissya highlighted in scientific publications.

Focus of Research

Our research indicates presence of statistically significant peculiarities of distribution of Scots pine trees live biomass components density along their trunks, compared with the geographically significant region of Ukrainian Polissya. Taking into account these peculiarities will help improve forest bioproductivity assessment in the region.

Key Challenges

Due to presence of the mentioned differences, risk of inaccurate estimates of forest bioproductivity, wrong forest management decisions, economic losses, etc. is increased. The study presents interesting results for comparison of regional and macro-regional bioproductivity-related models with local data, provides opportunities for enhancement of their uncertainty assessment and analysis.

Suggestion to Address these Challenges

In the future, it is necessary to detail the existing models of above-ground live biomass components density for Ukraine, as well as to pay more attention to spot research, case studies and verification of modeling results.

THE EXPERIENCE OF CLEAR-CUTTINGS AND ITS INFLUENCE ON NATURAL REGENERATION IN BOREAL FORESTS ON THE EUROPEAN PART OF THE RUSSIAN FEDERATION

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Abstract

For sustainable forest management in boreal forests, it is necessary to obtain reliable data that characterises their condition, productivity, and resistance to environmental conditions and anthropogenic influences. The studies were carried out in the North of the European part of the Russian Federation. To investigate forest regeneration processes, we surveyed four sites, in 1993, 1994, 1999, and 2012, whereby experimental clear cuttings with a variety of measures to promote natural regeneration of conifers such soil mineralisation, fire soil preparation, and leaving the seed trees were undertaken. To assess the impact of logging on natural regeneration in cutting areas in 2016-2017, the account sites along a linear transect were established. The experimental cuttings were implemented in mature coniferous stands of blueberry forest types, which were formed on the site of the former extensive forest burned area of the last century. At all sites, there was a high variability in the undergrowth number (37-65%), indicating the regeneration uniformity. The greatest number of regenerated trees were noted in the site where soil mineralisation was held (28000±2500 pieces/ha). In four of the five plots, birch predominance was marked (84%), and larch domination was noted (44%) only at the cutting area with the soil mineralization. A minimal thickness of the forest floor was noted on the cutting area of 1999 with mineralised soil, which was 2,75±0,20 cm, what significantly different compared to the thickness of the forest floor in the other cutting areas. We found a high inverse correlation between the forest floor thickness and the undergrowth amount, and the correlation coefficient is statistically significant ($p<0.05$) and equal to -0,85. As a research result, it can be argued that soil mineralisation has a positive effect on coniferous species' natural regeneration, including larch renewal. Conducting science-based forestry practices will increase the efficiency of forest management.

Focus of Research

The general focus of the research is sustainable forest management of boreal forests for the benefit of environmental, socialand economics development. To ensure it, it is necessary to obtain reliable data that characterises condition of forests, productivity, and resistance to environmental conditions and anthropogenic influences.

Key Challenges

We aimed at investigating forest regeneration processes and studying efficiency of soil mineralisation on coniferous species' natural regeneration

Suggestion to Address these Challenges

Conducting science-based forestry practices will increase the efficiency of forest management.

Fitting the Nonlinear Mixed-effects Taper Equation Dependent Variables for Cunninghamia lanceolata (Lamb.) Hook.

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Abstract

There are few parameter equations that are suitable to describe stem profiles. For a specific tree species, the best equation is usually selected and may be improved with nonlinear mixed-effects (NLME) models. In this study, we selected the best taper equations published and modeled them with the NLME model. The results showed that different dependent variables fitting NLME models have different accuracy of diameter estimation and stem volume estimation, and that the dependent variable d/D is the best for diameter estimation and stem volume estimation with 2 random parameters. With the same random parameter but a different dependent variable, the accuracy is not the same, the accuracy rank is d/D > d > d2/D2 > d2. Changing the dependent variable does not destroy the taper equation structure but allows a better equation to be found. In practical forestry, we can change the dependent variable of taper equations fitting the NLME model to find the best taper equation.

Using different dependent variables fitting the taper equation does not destroy the model, but we can find the best dependent variable for the taper equations. Comparing the results we found, the taper equation with different dependent variables has different accuracy for predicting diameter and predicting stem volume. It is verified that selecting the best dependent variables is good for NLME models using in the taper equation, and it is useful for the taper equation to increase the volume estimate accuracy.

Though taper equations are invaluable tools for forest management, it is difficult to select a model suitable across multiple taper types. Developing a variable and segment taper equation necessitates the use of suitable and ample data. These data are not required by taper equations; hence, amending the taper equation is the best method. This observation agrees with the work of researchers who found the same results for taper equations.

Focus of Research

Stand growth and modelling which benefit to volume and biomass estimation accurately.

Key Challenges

Stability of the boreal forests for sustainable forest management.

Suggestion to Address these Challenges

Enhancing forest management for the boreal forests in the world.

The effects of salvage logging after a catastrophic wind disturbance on the wood carbon stock in northern Japan

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Abstract

Windthrow is a common natural disturbance in boreal forests in Northern Europe, North America, and East Asia, and the threat of such events is increasing as a result of climate change (IPCC Working Group I Technical Support Unit 2013). Windthrow disturbances often produce large amount of coarse woody debris (CWD) in a forest; however, post-disturbance conventional salvage logging—the removal of dead or damaged trees to compensate for economic value that would otherwise be lost—greatly reduces the amount of CWD. Salvage logging might have long-term effects on the carbon stocks of disturbed forests, since CWD last many decades in cool climate regions. The importance of live and dead carbon stocks in a forest might change sequentially after the disturbance, which has rarely been measured. We examined the effects of windthrow by a typhoon in 2004 and subsequent salvage logging on the carbon stock of Abies plantation forests 13 years after the disturbance in northern Japan. We targeted wind-disturbed and not salvaged (unsalvaged) stands, wind-disturbed and salvaged stands within four years of the disturbance (salvaged), and undisturbed natural mixed forest stands (undisturbed).

The size and decay class of CWD, and the species and size of standing trees were recorded, and carbon stocks of live and dead wood were estimated. The results revealed the great importance of dead wood carbon stock in the stand initiation stage. We will also show the tentative results of survey in the forests 53 years after the disturbance to discuss the sequential trends of carbon stocks in disturbed forests.

Focus of Research

Wind disturbance and carbon stock in a boreal forest;
Carbon stocks that can be reduced by salvage logging after wind disturbance are critical to mitigate global warming.

Key Challenges

Salvage logging after wind disturbance

Suggestion to Address these Challenges

Change the conventional forest management

A large vegetation-plot database for research and conservation of boreal forest diversity in Europe

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Abstract

Detailed knowledge of habitats, particularly of their species composition, is a precondition for effective nature conservation. However, very little vegetation-plot data from zonal boreal forests of Europe are currently available for assessing e.g. species distribution and diversity, or habitat mapping. We have established a vegetation-plot database of boreal and hemiboreal forests of Europe, aiming to cover the following countries and regions: Iceland, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Belarus, Scotland and north of the 52nd parallel in Poland and in European Russia, west from the Ural Mountains. Vegetation-plot records of all types of forest communities occurring within these zones are collected. For the first time, this database will enable detailed investigation of vegetation patterns of boreal and hemiboreal forests on the European scale.

To assess the data availability, we requested data from the European Vegetation Archive (EVA), which is the largest vegetation-plot data repository in Europe. Only Lithuania, Poland and Scotland were sufficiently covered there. To fill in the gaps, we started a cooperation within an international team of vegetation scientists (now 24 members) to compile the European Boreal Forest Vegetation Database. Currently, we have managed to obtain over 11 000 plots from Belarus, Estonia, Finland, Latvia, Norway and large areas in Russia. We are still looking for potential collaborators, from all of the countries within the study area, to contribute with vegetation-plot data and local expertise. Our ambition is to digitize already published vegetation-plot records from literature, and to encourage complementary field surveys to cover the most apparent gaps.

The European Boreal Forest Vegetation Database can serve a wide range of purposes in vegetation science. One of the intended aims is to create a unified classification system of boreal forest types in accordance with both the EuroVegChecklist (hierarchical floristic classification system of the European Vegetation Survey) and the European Nature Information System (EUNIS) habitat classification. These typologies serve as the basis for the conservation actions of the European Environmental Agency (EEA). Moreover, the database can be used for gradient analyses of species-environment relationships and for studies of species-richness patterns. The database can potentially be useful in addressing biogeographical questions such as sharpening the definition of the border between the hemiboreal and boreal vegetation zones. Once established, the database will enhance the use of these data by a wide range of researchers. In the near future, the whole database, or a subset of it, can be requested via the EVA.

Focus of Research

The focus of the reseach is in compiling and bringing high-quality data accessible for wide range of researches and projects, and to use this database to investigae the species diversity patterns and enhance the conservation of boreal and hemiboreal forest diversity.

Key Challenges

Not yet, it describes a database, which will, in the near future, be used to assess the distribution and conservation status of boreal and hemiboreal forest communities. First, we need to unify the classification system across the study are to identify the conservation needs.

The project is in an early stage, and we have yet no suggestions to address the challenges, which we did not yet investigate.

Novel peatland management practices - key for sustainable bioeconomy and climate change mitigation

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Abstract

Peat soil of croplands and forests is currently the largest emission source in the LULUCF sector and climate-smart peatland management has large potential to mitigate emissions. We aim to develop ecologically and economically sustainable climate change mitigation options for forest and cropland management. The emissions from managed peat soils may be mitigated by limiting depth of actively decomposing peat layer by raising the soil water table closer to soil surface. In managed peatland forests we test continuous cover forestry with elevated water table as an alternative to rotation forestry with clear-cuting and ditch network maintenance. On croplands, other potential means to mitigate emissions are no-till, catch crops and addition of biochar. We will measure GHG exchange on experimental study sites and develop dynamic models for predicting GHG exchange for different management practices. The data will feed economic analyses, i.e., static gross margin and profitability calculations. Microeconomic dynamic models with optimization will be used to quantify the required incentives for a farmer to choose climate-smart management options. For forest sites, cost-efficiency of mitigation options is assessed by comparing net present value - GHG ratios of the management alternatives. We will compile GHG emission scenarios needed for evaluation of the climate policy options in Finland. Our results will have an important impact on the economic optimization of climate change mitigation in the agriculture and LULUCF sectors and they help to meet the agreed emission reduction targets.

Focus of Research

Climate change mitigation

Key Challenges

Emission reduction on managed peatland forests and croplands

Suggestion to Address these Challenges

paludiculture and CCF without ditch network maintenance i.e. elevated ground water table to reduce aerobic decomposition

Development of explanatory model for bark beetle infestations based on a 10-years long outbreak in the High Tatra Mts.

Pavel Mezei[1], Mária Potterf[1], Jaroslav Škvarenina[2], Rastislav Jakuš[1]

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Abstract

Bark beetle outbreaks are one of the main disturbance agents in mountainous forests of Central Europe, affecting ecosystem functions and local economies. The number and intensity of future outbreaks is in question. In recent decades, Norway spruce forests (Picea abies Karst.) of the High Tatra Mts. in the Carpathian have been subject to unprecedented tree mortality caused by infestations of the Eurasian spruce bark beetle (Ips typographus L.). Bark beetle infestations start with infestations of individual trees, than proceed to infestations spots (group of tree is attacked) and at the end, several local or regional outbreaks can affect mountain forest ecosystems on a landscape scale. Therefore, analysis of the spatiotemporal pattern of bark beetle outbreaks across landscape in several consecutive years can reveal new insights into the population dynamics of tree-killing bark-beetles. Bark beetle outbreaks are usually indicted by natural disturbances (wind, drought) and they are affected by forest management, climate (temperature, solar radiation, rainfall), stand characteristics (forest age, diameter of trees) and other environmental variables (altitude, slope etc.).

We analysed a more than 10-years long bark beetle outbreak on the southern slopes of the High Tatra Mts., which occurred after a storm damaging more that 10,000 ha of forests in 2004. To develop an explanatory model for bark beetle outbreak in the High Tatra Mts., we have derived a 10-year long data of forest mortality caused by bark beetles, wind, fires and logging from Landsat satellite images. Climate variables and other environmental variables were acquired for the 10-year long period from forestry databases, digital elevation model and from meteorological data. To explain the spatio-temporal pattern of infestations and to identify main drivers of bark beetle infestations, all above mentioned variables were modelled on a landscape surface (raster analysis). Our results indicate that infested spots (group of trees infested by bark beetles) occurred on sites with higher temperature sums during the seasons as non-infested trees and they have received higher solar radiation loads. Thus, temperature and potential solar radiation can act as a surrogate for identifying future bark beetle infestations

Focus of Research

Focus of our research is on bark beetle outbreaks, which can affect ecosystem functions as well as forest economy and management. They act as one of the main disturbance agents in mountainous and boreal forests and they can be affected in the future by global changes.

Key Challenges

Our research identified bark beetle outbreaks as one of the main risks in mountain forests. Outbreaks can be affected by other disturbances (wind, drought) and by forest management. We identified climate variables such as temperature and solar radiation as the main variables affecting bark beetle infestations on a landscape scale..

Suggestion to Address these Challenges

We are developing a spatio-temporal model for bark beetle outbreak in the High Tatra Mts. We use a 10-year long data of forest mortality, climate variables and other environmental variables to explain the spatio-temporal pattern of infestations. Further, main drivers of infestations are to be identified.

Assessing ecosystem dynamics of East Asian Mid-Latitude Ecotone forests under different management regimes

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Abstract

The Mid-Latitude Ecotone (MLE) – a transition zone between boreal forest and temperate forest along with Northeast Asia around 30°-60° latitudes – has deliver different ecosystem functions depending on different management activities. Temperate forest in South Korea and Japan are well managed and protected, but forest in North Korea suffers from deforestation and forest degradation. In China and Mongolia, temperate forest changes to boreal forest that covers Northern Mongolia and Russia near the Baikal Lake. In this study, we assess forest volume and net primary productivity changes in the MLE under different ecological characteristics as well as various current management activities using the BGC-MAN model. We selected five pilot sites for pine (Pinus sylvestries and P. densiflora), oak (Quercus Spp.) and larch forests (Larix mongolica and L. sibirica), respectively, which cover the transition zone across the MLE form Lake Baikal near Irkutsk, Russia to Kyushu, Japan including Mongolia, Northeast China and the Korean Peninsula. Site information such as species, soil characteristics, and management description were taken from global GIS data and 0.5-degree climate data. We set management characteristics as natural preserved forest, degraded forests, sandy and cold forest stands, and forests exposed to fires. We simulated forest volume (m3) and net primary productivity (Mg C ha-1) during 1951-2005 and compared the results with published literatures. They were in the range of previous studies, with some site level under or over estimation, but unbiased estimates in the mean for pine, oak and larch. Annual change rates of volume and net primary productivity differed by latitude, site conditions and climatic characteristics. For larch, we identified a high mountain ecotype which deserves a separate model parameterisation. We detected changes of forest ecosystems explaining ecological transition in Northeast Asian MLE. Under these transition, we need to resolve expected problems through appropriate forest management and social efforts.

Focus of Research

This study aims to identify forest volume and net primary productivity changes based on literature summary of different forest management in the Northeast Asian MLE. We simulated forest ecosystem functioning under different ecological characteristic as well as various current management activities.

Key Challenges

The challenges of this study is applying BGC-MAN in Northeast Asian MLE where field data are scarce. In addition, the dynamics of the landscape and its ongoing transition create unique ecosystem characteristics.

Suggestion to Address these Challenges

For the future analysis, we need more site-specific data for BGC-MAN validation to assess the accuracy and precision of simulated forest ecosystem changes, especially to assess the impact of future climate scenarios.

Understory vegetation diversity and canopy structure in Abies religiosa dominated forests in central Mexico

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Abstract

Understory vegetation represents the largest component of biodiversity in most forest ecosystems, and holds a key role in forests functioning; however, despite its importance, the influence of canopy structure on understory plant diversity is poorly understood in cool forests of central Mexico. Thus, the aim of this study was to assess the influence of canopy structure on understory light and vegetation diversity in Abies religiosa (Sacred or oyamel-fir) dominated forests in central Mexico. Understory light availability and canopy structure indicators were estimated with hemispherical photos and tree characteristics obtained in sampling units of 500 m2 in pure or almost pure Sacred-fir stands; five quadrats of 1 m2 were also set up on each same sampling unit, where all vegetation was tallied and identified at the species level when possible. We estimated species richness and alpha diversity for each stand using Shannon and Simpson diversity indexes. Relationships between canopy structure and light availability with diversity indexes were evaluated with correlation and simple linear regression. Results indicated a positive influence of canopy gap fraction, cumulative daily

duration of light, and the average duration of luminous events on the understory richness and diversity. Although single stands characteristics, such as basal area and others, were poorly linked to understory vegetation diversity, we believe that these results could be used by forest managers and forests owners; in particular, since multiple values and use diversification is of primary importance in these forests, our results might be helpful in developing strategies for vegetation biodiversity management.

Focus of Research

The focus is on assessing the influence of canopy composition and structure on availability of light and vegetation diversity in Abies religiosa (sacred-fir) forests in central Mexico

Key Challenges

Changes in canopy structure and composition would signify changes in vegetation diversity in these forests, which may impact on the multiple values that are obtained from these stands.

Suggestion to Address these Challenges

Forest managers/owners could use results of our research to develop strategies for vegetation diversity management, giving priority to some of the most important plant species according to their own interests

Forest fires and soil carbon turnover – comparison of permafrost and non-permafrost areas in Canadan cool forests.

Kajar Köster[1], **Egle Köster**[1], **Heidi Aaltonen**[1], **Xuan Zhou**[1], **Frank Berninger**[1], **Jukka Pumpanen**[2]

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Abstract

Boreal forests cover about 15% of the Earth's land area. They are counted as a crucial part of the climate system as they contain approximately 60% of the carbon (C) bound in global forest biomes and approximately 12–13% of the organic C stocks in the world's soils. The presence of permafrost (about 24% of the land in the Northern Hemisphere) makes these high latitude ecosystems especially vulnerable to changing climate.

The soil organic matter (SOM) pool in boreal forests is a particularly important C storage, with a long turnover time ranging from several decades to millennia. Even small changes in the turnover of soil C stocks there may reverse the terrestrial carbon sink into a source with consequent increase in the atmospheric CO2 concentrations.

In this study, we characterize the post-fire C dynamics (CO2 efflux from incubation study, soil C content, soil C turnover times) along a fire chronosequences in northern boreal forests of north-western Canada. Our study areas were located on non-permafrost areas and permafrost areas in Northwest Territories and Yukon, Canada.

In the summer of 2015, four different study areas (each with a different time since the last stand replacing forest fire), were established both in permafrost areas and non-permafrost areas. The fire chronosequence in permafrost areas consisted areas with last forest fire 3 years, 25 years, 46 years, and more than 100 years ago. The fire chronosequence in non-permafrost areas consisted areas with last forest fire 2 years, 46 years, 65 years, and more than 100 years ago.

At each fire chronosequence we established three 150 meter-long-lines with three sample plots along each line at 50 meter intervals. We thus had nine sample plots per age class.

The total C contents in the first 30 cm of the topsoil were lowest in newly burned areas and in general total soil C content was higher in areas with permafrost. Same trends were observed when soil CO2 effluxes from incubation were analyzed. The values were significantly lower in in newly burned areas and when permafrost and non-permafrost areas were compared the areas with permafrost were shoving about 1.5x higher values than non-permafrost areas. Soil C turnover time had no significant difference when permafrost and non-permafrost areas were compared. Soil C turnover time was approximately 2x longer in newly burned areas compared to older areas. The longest C turnover times were found in deeper soil horizons.

Focus of Research

The soil organic matter pool is an important C storage, with a long turnover time ranging from several decades to millennia. Even small changes in the turnover of soil C stocks may reverse the terrestrial carbon sink into a source.

Key Challenges

Generally the boreal ecosystems are C sinks, but due to the climate change the occurrence of forest fires will increase. Permafrost areas are also strongly influenced by fires as combustion removes the insulating organic layer, and evokes changes in permafrost and in thickness of active layer.

Suggestion to Address these Challenges

Both short and long term studies are needed to study the effects of forest fires in boreal regions on the greenhouse gas fluxes and soil organic matter decomposition. Special attention should be on areas with permafrost.

Poster 3: Poster Session - People and nature

The posters will be presented to participants during all coffee breaks and in this dedicated two-hour poster session. During this time we ask all presenters to stay at your poster for questions and discussions.

Seeking microrefugia of Japanese pika: combination of broad-scale species distribution modeling and local-scale habitat measurements

__Tomoki Sakiyama[1]__, Junko Morimoto[1], Osamu Watanabe[2], Nobuyuki Watanabe[2], Futoshi Nakamura[1]
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Abstract

Microrefugia are small sites where isolated populations can survive outside of their main distribution protected by the local favorable environmental conditions. Thermally stable features in micorefugia are thought to facilitate persistence of species that are vulnerable to climate change. However, these sites are often overlooked by species distribution modeling due to lack of fine-scale variables. Therefore, it is essential to clarify the habitat components contributing to species survival in microrefugia by comparing its local features to that of main distribution. In this study, we aimed to unveil the favorable environmental conditions for the Japanese pikas (Ochotona hyperborea yesoensis). Japanese pikas are cold-adapted species inhabited in Hokkaido Island, Japan. While the main population occurs in the rocky patches in alpine regions, the minor populations are found in the lower outskirts as low as 50m in elevation. We first conducted species distribution modeling throughout central Hokkaido (41°55'-44°23' N, 141°58'-144°6' E, 0-2230 m a.s.l., 26,297 km2) using Maxlike algorithm, which predicts occurrence probability from presence-only data (n=551). We then selected multiple potential study sites based on the occurrence probability in the species distribution map to take local-scale measurements. We deployed surface and subsurface temperature sensors in rocky patches and quantified the openness of forest canopy by taking hemispheric photographs. Potential microrefugium sites (minor population) are expected to show cool temperatures like their main distribution sites (main population). The suitable thermal environment in microrefugia should be created by the accumulation of rocks as well as closure of the forest canopy.

Focus of Research

Our research focus is to clarify the habitat components that contribute to the survival of Japanese pikas inhabiting microrefugia. Understanding these local features may help isolated populations to persist under climate change through habitat protection with attention to the favorable environmental condition for the species.

Key Challenges

It remains unknown how the climate change will directly and indirectly affect the local features that provide favorable environmental conditions to the species.

Suggestion to Address these Challenges

Understanding the physiological threshold of cold-adapted species under warm environment is essential. Therefore, experimenting and monitoring the effects of warming on the local features will bring knowledge of how the microrefugia population may react to the change.

Modified Combustion Efficiency and Emission Factors for CO2 and Non-CO2 Emission Gases from Surface fuel beds of P. densiflora and Q. variabilis forest in South Korea.

__Donghyun KIM[1,2]__, Florian KLAXNER[2]
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Abstract

P. densiflora and Q. variabilis are major species for temperate and boreal forests in South Korea. This study analyzed MCE(Modified Combustion Efficiency) and EF(Emission factors) for CO2 and Non-CO2 gases using FTIR (Fourier Transform Infrared spectrometer) and Cone-calorimeter. As a result, MCE was estimated 0.90±0.05 in all of two species. Emission gases was analyzed CO2 and Non-CO2 gases such as CO, NO2, NO, CO2H4O2, C6H12O2, C2H4 CH4, HCl, CH3OH, HBr, SO2, HF, NH3. EF of surface fuel beds for CO2 and Non-CO2 was evaluated 1,661 g/kg, 184 g/kg in P. densiflora and to 366 g/kg and 45 g/kg in Q. variavilis, respectively. MCE and EF of coniferous forests were 2.75% and 3.92% higher than those of previous studies in mixed conifer forests, respectively. In conclusion, the EF value is dependent on MCE, and MCE of the surface fuel beds was shown about 0.9 when completely burned and EF (CO2) of P. densiflora litter has a value of 1,661 g/kg.

Focus of Research

Emission gases assessment from forest fires for Climate and People.

Key Challenges

We studied environment and health hazard for CO2 and Non-CO2 emission gases from forest fires. Each forest land has different EF values for each forest fuels. In additional, In addition, EF value is very important to evaluate CO2 emission from forest fires.

The Protection of Cool Forests, and Diplomacy of Linkage and Interdependence in Kyoto Protocol and Paris Agreement

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Abstract

IPF (The Intergovernmental Panel on Forests), IFF (The Intergovernmental Forum on Forests) and UNFF (The United Nations Forum on Forests) have been very important for protection of cool forests. One of the most important conventions for forests is UNFCC (The United Nations Framework Convention on Climate Change), and Kyoto Protocol is the Convention related to UNFCC. Kyoto Protocol was adopted in the COP3 on December 1997. I have researched the relations between power-dependence of domestic politics and interdependence of foreign policy, linkage diplomacy and bureaucracy. I think that Emission Trading in Kyoto Protocol is Interdependence, Linkage Theory and Linkage Diplomacy. The United Nations and many states cooperate to protect the nature. In the domestic politics, at least in Japan, Central Government, successive Cabinets negotiate and coordinate the Ministry of Agriculture, Forestry and Fisheries which has role of protection of agriculture, the Ministry of Environment which has role of preservation of environment, the Ministry of Economy, Trade and Industry which has role of economic development, the Ministry of Foreign Affairs of Japan which negotiate with countries, and ministries affected by politicians of the National Diet. In bargaining of Kyoto Protocol, Central Government must negotiate and coordinate the ministries, politicians, parties and local government. Because Japan has not converged from the smokestack industry, heavy industry to tertiary industry, Japan central government has difficulty in achieving balance and harmonization of economic development and protection of environment. The Ministry of Agriculture, Forestry and Fisheries, and the Ministry of Environment promoted Kyoto Protocol because of greenhouse gas emission cut, but the Ministry of Economy, Trade and Industry opposed Kyoto Protocol because of the economic growth. Japan central government opposed the extension of Kyoto Protocol in COP16 on 2010. Japan government considers the next election, House of Representatives election and House of Councillors election for the ruling party and politicians, and negotiates with bureaucracy and politicians. But in the principle of international cooperation, Japan central government must also consider global environment. Paris Agreement was adopted in COP21 on December 2015. Japan ratified Paris Agreement on November 2016. This paper investigates Kyoto Protocol, Paris Agreement and Linkage Diplomacy of protection of environment, and researches the balance and harmonization of economic development and protection of environment.

Focus of Research

My research focuses how politics involves and affects the protection of environment. My research also focuses how central government and bureaucracy coordinate politicians and local government. The policy for environmental protection is made by government and bureaucracy. Politics is the important factor of protection of nature.

Key Challenges

I have researched the relations between power-dependence of domestic politics and interdependence of foreign policy, linkage diplomacy and bureaucracy. I also investigate the balance and harmonization of economic development and protection of environment to maintain critical values of boreal and mountain ecosystem.

Suggestion to Address these Challenges

I think that these challenges are historically important and great for protection of cool forests. These challenges will restore cool forests and conserve nature diversity. The protection of cool forests also improves social environment. I hope these challenges will continue for global environment in future.

Forest degradation and carbon mobilization resulting from landslides: A case study from Western Nepal

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Abstract

Degradation of forest ecosystems has been well studied in the context of landslide science, normally from the perspective of linking landslide frequency and occurrence to increasing deforestation. In Nepal for example, it has been recognized that the dramatic increase in landslides since around 1990 was at least partly caused by high rates of deforestation prior and during this time. Conversely however, few studies have taken the other perspective, to explore the role of landslides in the removal and degradation of forests, and the implications of this for carbon storage and mobilization.

In this study we draw upon a unique high resolution (both spatially and temporally) inventory of landslides mapped across the Karnali basin of Western Nepal, to provide a first-order estimation of the contribution of landslide processes to carbon mobilization. In total, some 27,000 landslides have been mapped for the time period from 2003 – 2007, most of which (95%) are shallow earth flows. Using automated procedures with Landsat imagery, standard vegetation indexes have been produced on an annual basis, allowing us to determine activation and reactivation dates for many landslides, and determine the loss of vegetation associated with these events.

Based on known vegetation types and ages in the region, we can then estimate the amount of carbon mobilized by these landslides, considering also the future carbon sequestration potential that is lost.

First results are in preparation and will be presented at the conference, but are expected to reveal that landslide activity is a major agent of carbon mobilization in this region. As the study basin is representative of much of the geologically unstable, monsoon-affected Himalayan region, the results will likely provide a good basis for drawing conclusions on larger-scale processes. Given that some climate projections suggest extreme rainfall will increase in this region over the coming century under a warmer climate, thereby further increasing rainfall-triggered landslide activity, this may represent an important and largely unexplored feedback mechanism as more carbon becomes mobilized.

Focus of Research

Carbon mobilisation linked to landslide activity. Potentially an important climate feedback because increasing rainfall will lead to more frequent or larger landslides.

Key Challenges

Research is ongoing, but it is expected to demonstrate that landsliding is a threat to mountain ecosystems in the Himalaya, with important climate feedbacks.

Suggestion to Address these Challenges

Improved landuse practices to reduce landslide activity bringing dual benefits - decreased risk to mountain communities, while reducing also the mobilization of carbon.

Change in the biodiversity of the north taiga forests under the influence of pollution in the central part of the Murmansk Region

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Abstract

Assessment of changes in composition and spatial organization of forests is particularly important for areas with a high level of anthropogenic impact. The study of the spatial organization of the forest cover is associated with the selection of thematic classes and their cartographic mapping. The possibilities of remote sensing and geo-information technologies require special standards for the classification of vegetation cover. The purpose of this work is to assessment the damage from metallurgical plant to forest ecosystems and to create the map the coenotic diversity of the cool forests.

The modern diversity was assessed by the example of the model region with an area of 8400 km2 in the central part of the Murmansk Region, which includes the territory of the Lapland Nature Reserve and a large part of Khibiny mountains area. The eco-phytocoenotic classification (EPC) for assessing the typological diversity of vegetation cover was used. As a result of classification, 47 typological units at the ranks of groups and association classes that characterize the diversity of vegetation (forests, elfin woodland, marshes, and mountain tundra) were identified. Statistical methods and GIS technologies based on joint processing of geobotanical data, satellite information (Landsat 4, 5 and 7, GeoCover TM and ETM) and digital elevation models (DEM) were used to assess the spatial differentiation of forest cover. The technique of digital mapping was carried out by interpolation of vegetation classes at the upper scale levels by comparing them with remote sensing data and DEM based on the training sample.

Analyses of spatial distribution of plant communities using field data, RSD, DEM, and statistical methods made it possible to consider their composition and structure with consideration of successional status and anthropogenic impacts. Altitudinal gradient of mountain ranges, anthropogenic disturbance, and the natural dynamics of plant communities at different successional stages were the main factors affecting spatial differentiation of vegetation cover in the model area. Fires and air pollution emissions from smelter were among the types of anthropogenic impacts that prevail in this region. Analysis of the physical content of discriminant axes showed that approximately 23% of the study area is covered by anthropogenically-modified vegetation. The overall relative quality of the discriminant analysis was 76%.

Focus of Research

The research is aimed at revealing the diversity of forests and their dynamics in connection with natural and anthropogenic factors (pollution, climate change). Harmonization of the data obtained for the Russian part of eastern Fennoscandia with international data will provide an opportunity to coordinate global changes in the forest cover.

Key Challenges

The methods used made it possible to identify the main factors of differentiation of vegetation cover at the regional level, among which the main ones are climatic altitudinal gradients and anthropogenic disturbances. The change in the diversity of communities is also an indicator of climate change.

Suggestion to Address these Challenges

The presented methods and results of the assessment of various parameters of the state of forests can be integrated into the international network of the National Forest Inventory. There is a principal possibility of harmonization of the obtained data with the data of the Global Earth Observation System of Systems.

FotoQuest Crowdsourcing European Land Cover and Land Use

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Abstract

Citizen science is quickly becoming one of the most effective tools for the rapid and low-cost collection of environmental information, filling a long recognized gap in in-situ data. Incentivizing citizens to participate, however, remains a challenge, with gaming being widely recognized as an effective solution to overcome the participation barrier. Building upon well-known gaming mechanics, games provide the user with a competitive and fun environment. This poster presents the FotoQuest application that employs game mechanics and has generated useful information for environmental science. Furthermore, it describes the lessons learnt from this process to guide future efforts.

Focus of Research

To monitor land use change across Europe, and demonstrate the information that citizens can collect. It allows citizens to become part of the process of recording change.

Key Challenges

The campaign is currently running - will complete in August. In September we will have some preliminary results. Hypothesis is that land use change and soil sealing is on the rise. Furthermore we expect that citizens can gather high quality data.

Suggestion to Address these Challenges

Certainly better centralized landscape planning - and allowing for citizens to monitor.

Calculation boundaries forest damage from large industrial source of air pollution by the phase transitions model

Yulia Ivanova[1], Vlad Soukhovolsky[2]

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Abstract

The present study proposes new approaches to describing changes in the ecosystem caused by exposure to pollutants as dependent on the local concentration of pollutants and duration of exposure. Based on rather simple assumptions about the effects of a pollutant on biota, this process can be considered as an ecological analog of second-order phase transitions. Analysis and verification of the proposed model have been performed using the data on the state of forest ecosystems located close to a powerful source of pollutants – MMC "Nornickel" in Norilsk (the Krasnoyarskii Krai).

The data on time- and distance-dependent damage done to trees by pollutants can be adequately described by an ecological analog of the model of second-order phase transitions. This model can be used to determine critical distances from the source, at which pollutants stop exerting significant effects on biota, and the critical exposure dose, at which the impact of pollutants causes decline of a tree stand. The values of model parameters and critical values can vary in different ecosystems, but the relationship between the selected characteristics of the effect and exposure dose are invariably described by the model of second-order phase transitions.

The model of second-order phase transitions proposed in this study can be used to plan biota monitoring close to point sources of pollutants and to estimate critical distances from the pollution source. This model can be useful in siting of industry. To classify an area by the environmental risk of exposure to pollutants, one can use the model of second-order phase transitions to determine the distance to the reference background region.

The study was funded by RFBR and Russian Geographical Society to support research project No. 17-05-41012.

Focus of Research

The focus of our research is to present new approaches to describing changes in the ecosystem caused by exposure to pollutants as dependent on the local concentration of pollutants and duration of exposure.

Key Challenges

In our studies, we study the key risks of forest pollution by industrial emissions.

Suggestion to Address these Challenges

The model of second-order phase transitions proposed in this study can be used to plan biota monitoring close to point sources of pollutants and to estimate critical distances from the pollution source.

Mapping the historical evolution of Fennoscandic forest cover and structure for application in regional hydrological and climate modeling

Jonathan Rizzi, Clara Antón Fernández, Titta Majasalmi, Ryan M. Bright, Rasmus Astrup

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Abstract

Forests, covering large areas in many regions of the world, play an important role in the hydrological cycle and have a strong influence on climate. Their importance is widely recognized and are now integrated into most hydrological and climate models. The calibration of hydrological models require historical data about the spatial distribution of forest cover and structure. While hydrological time series that span several decades are not uncommon, land cover (and forest) information is usually considered static; that is, it is assumed that the forest remains at the same development stage, i.e. without harvest or growth, for the whole time series. This assumption is unrealistic and can lead to biased models and spurious conclusions. Although land cover data is not widely available before the advent of satellite data on a large scale, it can be estimated through the integration of current land cover data and historic information from national forest inventories (NFIs). Similarly, climate simulations often consider the forest structure as static, while there can be changes due to natural evolution of the forest, to harvesting and other disturbances.

We present a tool to reconstruct historical forest cover and structure based on its present day state. That is, the tool can back-cast the forest structure based on the available present-day information provided by an enhanced forest classification scheme based on national forest inventory data. The tool applies a Matrix model that estimate the changes of each forest pixel based on climate (temperature and precipitation) and soil depth information. Further, by integrating harvesting information for the past, the tool allows the possibility of reconstructing forests that have been clear cut or thinned. The results obtained by the application of this tool are successively applied to calibrate a hydrological model run for several catchments in Norway. The empirically-based method was applied to study the historical impacts of Norwegian forest management on large-scale hydrological cycling and will be applied to future research impacts of historical forest management on climate.

This presentation aims to explain the models, the method used for the definition of the growth rates and the results obtained by the application of the model to the whole Fennoscandic forests.

Focus of Research

Fennoscandic boreal forests play a relevant role in the hydrological cycle and on the climate and have a key role in the (bio)economy of the region. A better knowledge of the past forest structure can help in the definition and implementation of mitigation and adaptation plans/initiatives.

Key Challenges

Current hydrological and climate modelling often do not consider the forest structure, neither in the past nor in the future, therefore their role is not correctly taken into account.

Suggestion to Address these Challenges

Modelling forest structure in the past can improve hydrological and climate modelling, supporting also modelling of future scenarios useful in several contexts, from risk assessment to definition of adaptation plans or mitigation actions.

About the conference
Rationale

Climate:
cool forests store as much carbon
per hectare as tropical forests

Bioeconomy:
they deliver much of the world's
harvested wood products
including timber, pulp, and paper

People:
they are home to unique
landscapes and nature diversity
providing ecosystems crucial
for the livelihoods of millions of
people
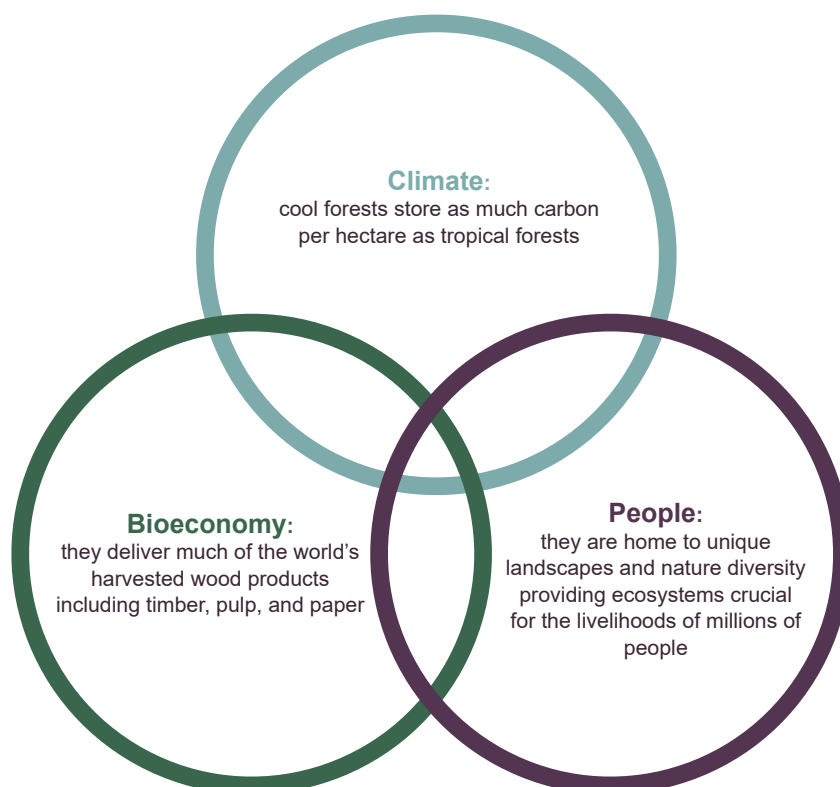
Main goals

The main objective of the Cool Forests Conference (IBFRA18) is to promote the critical role of boreal and mountain ecosystems for the people, bioeconomy, and climate.

TO ACHIEVE THIS GOAL, THE CONFERENCE:

1. facilitates inter-disciplinary discussion and invites scientists, policy-makers, industry and civil society to collaborate in the multi-stakeholder dialogue;

2. strengthens (and revives) the collaboration of scientific work on boreal topics on the one side and mountain research on the other side;

3. provides a set of "scientific key findings" resulting from the scientific sessions that will be brought up and discussed in the science-stakeholder dialogue;

4. facilitates through a science-stakeholder dialogue the discussion of how the scientific key findings can inform strategies and decisions by policy, industry and CSOs;

5. uses the science-stakeholder-dialogue to generate a comprehensive communique/policy brief which includes perspectives from scientists and stakeholders; and

6. increases the visibility of the critical role of boreal and mountain ecosystems in international processes and enhance the status of IBFRA to provide insight and research synthesis.

7. This conference will distill the knowledge and expertise of hundreds of renown and early-career scientists, synthesize and translate these into clear key messages that are relevant for policy makers, the private sector and civil society as a whole.

Our overall goal is to disseminate the key messages of this conference to relevant processes at the global, national and regional levels.

CONFERENCE OUTCOME

We are aiming to develop publications including policy briefs, communiques, and factsheets which will be disseminated among political, public, and private decision makers. Ultimately, we will reach out to relevant international processes such as the SDGs, UN Framework Convention on Climate Change, UN Convention on Biodiversity, UN Convention to Combat Desertification, UN Forum on Forests, and many more.

SPECIAL ISSUE ON COOL FO- RESTS CONFERENCE

Further to individual publications, we are envisaging to organize and collect scientific articles from this conference for peer-review in a special issue of the forests journal by MDPI (Impact Factor: 1.956 (2017)). See upcoming announcement at: http://www.mdpi.com/journal/forests/special_issues

WHAT IS NEW ABOUT THE COOL FORESTS EVENT?

The cool forest event is much more than a conference – it is the start of a collective effort, initiated by scientists from the International Boreal Forest Research Association (IBFRA), the Pan-Eurasian Experiment (PEEX), and IIASA, supported by the International Union of Forest Research Organizations (IUFRO). The event brings together and support the dialogue of academia and decision makers from policy, business and civil society as the start of a collective effort to create solutions for a sustainable future for the earth system.

POSTERS

IBFRA18 provides a permanent exhibition and networking area for scientific posters. The posters will be presented to participants during all coffee breaks and in a dedicated two-hour poster session on Wednesday.

All submitted posters are automatically enrolled in the election for the poster award. Posters will be evaluated for their scientific quality, but also and equally relevant for their way of communicating complex scientific findings to a broader audience.

The forests journal by MDPI - a pioneer in scholarly open access publishing since 1996, based in Basel, Switzerland - generously sponsors the following poster awards.

1st price: 500 EUR and free publication in the forests special issue - *1 winner*

2nd price: 300 EUR and free publication in the forests special issue - *1 winner*

3rd price: free publication in the forests special issue - *1 winner*

STAKEHOLDERS AND DIALO- GUE – PLENARY PANELS

The third day will bring together scientists from all parts of the world with stakeholders from policy, industry and CSOs. We will address the question of how scientific key findings can inform strategies and decisions of these stakeholders. The Science-Stakeholder Dialogue will stimulate exchange of scientific knowledge and the stakeholders' perspective on the three themes – people, bioeconomy, climate. Each of the three panel dialogues will be introduced by a Science Key Note, reporting back from the scientific sessions followed by a discussion with five panelists from policy, industry and CSOs.

The panel discussion will be guided by the following questions:

1. Cool Forests play an important role for our climate, bioeconomy, people and nature. What are your organization's biggest concerns and challenges related to Cool Forests?

2. Where do you see synergies and trade-offs in maintaining the critical ecosystem services of Cool Forests?

3. How can science contribute to tackling those major concerns and challenges? What are the most important knowledge gaps and information requirements of your constituency? (concrete examples)

4. Looking into the future, how can we work together more effectively?
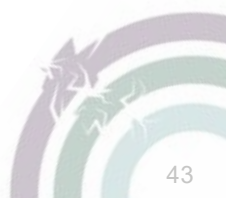
About Cool Forests

WHAT ARE COOL FORESTS?

Boreal and mountain forests developed in the regions of cold climate over many thousands of years. They make up more than one third of global forests, forming the largest terrestrial vegetation ecosystem. They are found from the circumpolar belt in the northern hemisphere to high-elevation forests spread over the entire planet. Forests on permafrost show many similarities in the boreal and high mountain ecozones – especially with respect to species and growth patterns, and in response to climate exposure.

WHY ARE COOL FORESTS SO IMPORTANT?

Cool Forests store as much carbon per hectare as tropical forests and they deliver much of the world's harvested wood products including, timber, pulp, and paper. They are home to unique landscape and nature diversity, providing ecosystem services, crucial for the livelihoods of millions of people.
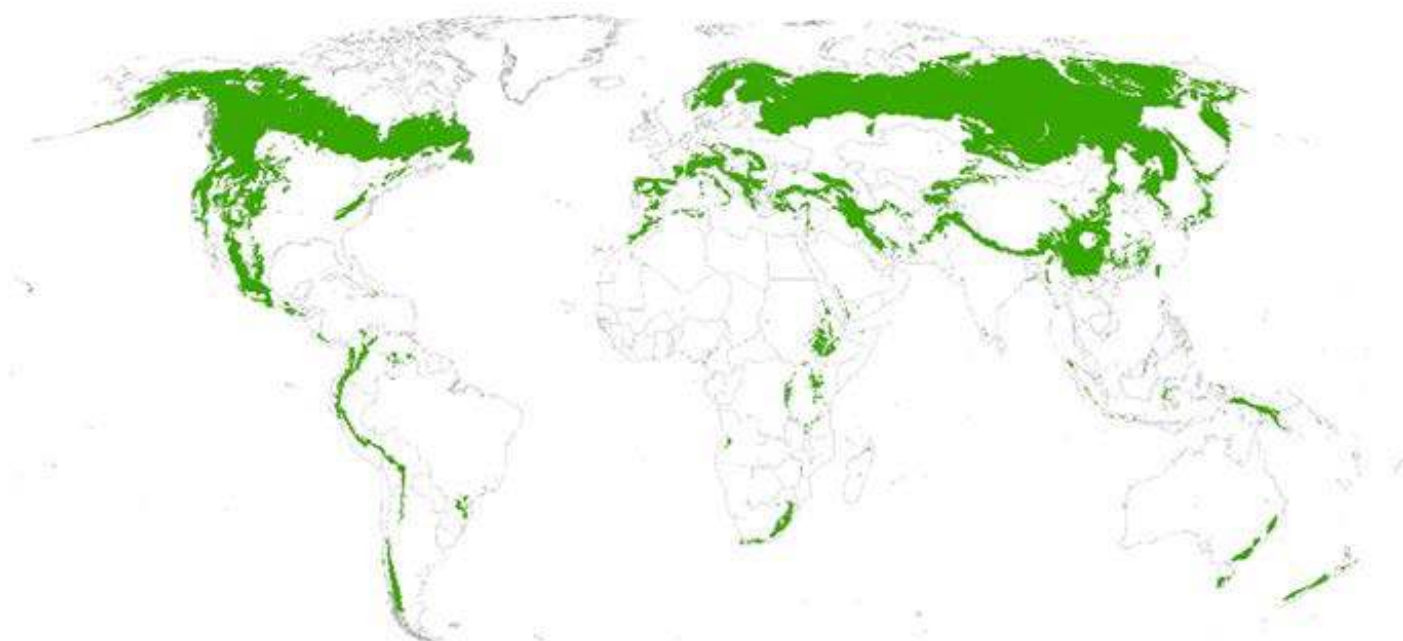
Schepaschenko et al. 2018, IIASA

Cool forest in this map is defined as:

- ■   Boreal zone: all the forest
- ■   Temperate zone: forests at the elevation above 700 m
- ■   Subtropical zone: forests at the elevation above 1000 m
- ■   Tropical zone: forests at the elevation above 2000 m

The colour gradient displays the forest density (% forest/pixel):
- ■   Light green: 0-10%
- ■   Green: 10-50%
- ■   Dark green: 50-100%

Spatial information used:
- ■   Global forest map (Schepaschenko et al., 2015) calibrated to the FAO FRA country statistics for the year 2000
- ■   Global ecological zone map by FAO
- ■   ASTER Global Digital Elevation Model

WHY ARE COOL FORESTS AT RISK?

The full impact of current social, economic, environmental, and technological changes on Cool Forests is uncertain. As climate change bites and temperatures rise, the permafrost could thaw, resulting in a huge release of greenhouse gases which will further accelerate climate change. Permafrost thawing in the mountains has already caused landslides, rock falls, and mudflows i.e. in densely populated areas of the Alps.

If we fail to protect Cool Forests an entire economic sector which depends on its resources and provides the livelihood of many people is at risk of collapse. Additionally, the Sustainable Development Goals (SDGs) and the Paris Agreement will become out of reach.

Cool Forest Ambassadors

WHAT IS THE COOL FOREST AMBASSADORS' CALL FOR ACTION ABOUT?

It is a wake-up call to the world, raising awareness to maintain and promote Boreal and Mountain Forest Ecosystems for people, bioeconomy, and climate. Cool Forest Ambassadors form a coalition initiated by science joined by policy, business and CSOs. Cool Forest Ambassadors are committed to help maintaining and enhancing the multiple, critical values provided by Boreal and Mountain Forest Ecosystems.

WHO OR WHAT ARE THE COOL FOREST AMBASSADORS?

The cool forest ambassadors are individuals from policy, business, and civil society who join the call for action to maintain and promote boreal and mountain forest ecosystems for people, bioeconomy, and climate. By signing up to raise awareness, they commit to help maintain and enhance the multiple values provided by those ecosystems and support further research to identify future pathways. The ambassadors join IIASA, PEEX, IBFRA, and IUFRO to concentrate efforts in this initiative.

WHAT IS THE COOL FOREST AMBASSADORS' CALL FOR ACTION ABOUT?

A: This is a wake-up call to the world, to raise awareness of boreal and mountain forest ecosystems for people, bioeconomy, and climate. Cool Forest Ambassadors form a coalition of scientists, policymakers, and stakeholders from civil society. They are committed to help maintaining and enhancing the multiple, critical values provided by boreal and mountain forest ecosystems by identifying future pathways and strengthening the collaboration between boreal and mountain ecosystem countries. Thereby they support the initiative and join the coalition of IIASA, PEEX, IBFRA, and IUFRO to concentrate efforts.

We are very proud that many Ambassadors signed up.

"Multifunctional boreal forests and mountain forests are among the ecosystems most affected by climate change. They play a key role in tackling climate change and achieving the Paris climate goals. I am therefore supporting the IBFRA18 Cool Forests Conference and I am delighted to be an Ambassador for Cool Forests."

© BMNT/ Paul Gruber

Elisabeth Köstinger
Federal Minister for
Sustainability and Tourism of Austria
Cool Forest Ambassador

AMBASSADOR for COOL FORESTS

Conference location

Laxenburg: This is the place where emperors and kings and queens took a stroll in days gone by, and you can still see the beauty and splendour of the imperial residence with its impressive castles, its historic places, its buildings and renowned landscaped gardens[1].

CONFERENCE ADDRESS
IIASA & Laxenburg Conference Center

Schlossplatz 1
2361 Laxenburg
Austria

Local hosts
IIASA: International Institute for Applied Systems Analysis

Founded in 1972, IIASA is an international scientific institute that conducts policy-oriented research into problems that are too large or complex to be solved by a single country or academic discipline. Problems like climate change that have a global reach and can be resolved only by international cooperative action; or problems of common concern that need to be addressed at both the national and international level, such as energy security, population aging, and sustainable development. Funded by research funding agencies in Africa, the Americas, Asia, and Europe, IIASA is independent and unconstrained by political or national self-interest.

The IIASA mission is to:

Provide insights and guidance to policymakers worldwide by finding solutions to global and universal problems through applied systems analysis in order to improve human and social wellbeing and protect the environment.

See more on: www.iiasa.ac.at

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1   Source: https://www.laxenburg.at/ONLWYSIWYG/IMG/Prospekt_Eng.pdf

NOTES

Logistics

VIENNA UNDERGROUND MAP

© viennamap360.com

Vienna Central Station – Daily pick-up to the conference venue

VIENNA BUS #200 TERMINAL PLAN

Busterminal Wien Hauptbahnhof / *Bus terminal Vienna main station*   Gültig ab 2. September 2017

Linie / Line	ab / from **Wien Hauptbahnhof** 🚆 Ⓤ nach / to:	Steig-Nummer / platform number
120	Eisenstadt – Rust am See – **Mörbisch am See**	N
200	Laxenburg – Ebreichsdorf – **Eisenstadt**	N
261	**IZ NÖ-Süd**	M
552	Hainfeld – Lilienfeld – Türnitz – **Mariazell**	M

Linie / Line	ab / from **Wien Hauptbahnhof** 🚆 Ⓤ nach / to:	Steig-Nummer / platform number
1155	Wiener Neustadt – Mattersburg – Weppersdorf – **Piringsdorf**	L
1158	Eisenstadt – Oberpullendorf – **Lockenhaus**	L
7860	Wiener Neustadt – Kirchschlag – Rechnitz – **Markt Neuhodis**	L
7940 (O2)	Weppersdorf – **Deutschkreutz/Nikitsch**	L
7941	Mattersburg – Forchtenstein – Oberpullendorf – Klostermarienberg – **Langental**	L

Warteraum / *Waiting room*

Hauptbahnhof / *Main station*

Lageplan / *site map*

K Ankunft / *Arrival*   K Ankunft / *Arrival*   K Ankunft / *Arrival*

L
1155 1158 7860 7940 (O2) 7941

M
261 522

Richtung / *direction* Gürtel

N
120 200

P

Sonnwendgasse

Laxenburger Straße

Legend:

M	**Steig** / *platform*
Ⓗ	**Haltestelle** / *Busstop*
261 522	**Liniennummer Regionalbus** / *Line number bus*
🚆	**Schnellbahn** / *Suburban railway*
🚌	**Bus der Wiener Linien** / *Wiener Linien bus*
🚋	**Straßenbahn** / *Tram*
Ⓤ	**U-Bahn** / *Underground*
🚆	**Zugang zum Hauptbahnhof** / *Access to main station*
🚲	**CityBike** / *CityBike*
P	**Fahrrad-Abstellplatz** / *Bike parking area*

www.vor.at   0800 22 23 24   VOR AnachB App   ServiceCenter BahnhofCity Wien Westbahnhof

VOR DER VERKEHRSVERBUND
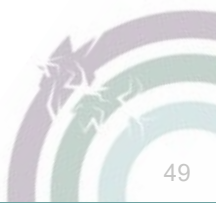
Public Bus Timetable

Direction: **WIEN - LAXENBURG**
Line: **Bus #200**
Departure: **WIEN Hauptbahnhof**

Direction: **LAXENBURG - WIEN**
Line: **Bus #200**
Departure: **LAXENBURG Franz Joseph-Platz**

| Dep	Journey		Arr	Dur.	Servicedays
5:21	Bus	200	5:54	0:33	Mo - Sa
5:58	Bus	200	6:31	0:33	Mo - Fr
6:21	Bus	200	6:54	0:33	daily
6:36	Bus	200	7:09	0:33	Mo - Fr
6:48	Bus	200	7:21	0:33	Mo - Fr
6:58	Bus	200	7:31	0:33	Mo - Fr
7:06	Bus	200	7:39	0:33	Mo - Fr
7:21	Bus	200	7:54	0:33	Mo - Fr, Su
7:36	Bus	200	8:09	0:33	Mo - Fr
7:58	Bus	200	8:31	0:33	Mo - Fr
8:06	Bus	200	8:39	0:33	Mo - Fr
8:21	Bus	200	8:54	0:33	daily
8:36	Bus	200	9:09	0:33	Mo - Fr
8:58	Bus	200	9:31	0:33	Mo - Fr
9:21	Bus	200	9:54	0:33	Mo - Sa
9:28	Bus	200	10:01	0:33	Su
9:51	Bus	200	10:24	0:33	Mo - Fr
10:21	Bus	200	10:54	0:33	daily
10:51	Bus	200	11:24	0:33	Mo - Fr
11:21	Bus	200	11:54	0:33	Mo - Fr, Su
11:51	Bus	200	12:24	0:33	Mo - Fr
12:21	Bus	200	12:54	0:33	daily
12:51	Bus	200	13:24	0:33	Mo - Fr
13:21	Bus	200	13:54	0:33	Mo - Sa
13:28	Bus	200	14:01	0:33	Su
13:58	Bus	200	14:31	0:33	Mo - Fr
14:21	Bus	200	14:54	0:33	daily
14:41	Bus	200	15:14	0:33	Mo - Fr
14:51	Bus	200	15:24	0:33	Mo - Fr
15:21	Bus	200	15:54	0:33	daily
15:58	Bus	200	16:31	0:33	Mo - Fr
16:21	Bus	200	16:54	0:33	daily
16:36	Bus	200	17:09	0:33	Mo - Fr
16:51	Bus	200	17:24	0:33	Mo - Fr
17:06	Bus	200	17:39	0:33	Mo - Fr
17:21	Bus	200	17:54	0:33	Mo - Sa
17:28	Bus	200	18:01	0:33	Su
17:36	Bus	200	18:09	0:33	Mo - Fr
17:58	Bus	200	18:31	0:33	Mo - Fr
18:06	Bus	200	18:39	0:33	Mo - Fr
18:21	Bus	200	18:54	0:33	daily
18:51	Bus	200	19:24	0:33	Mo - Fr
19:21	Bus	200	19:54	0:33	Mo - Fr, Su
19:51	Bus	200	20:24	0:33	Mo - Fr
20:21	Bus	200	20:54	0:33	daily
21:21	Bus	200	21:54	0:33	daily
22:21	Bus	200	22:54	0:33	daily

Dep	Journey		Arr	Dur.	Servicedays	
5:53	Bus	200	6:23	0:30	Mo - Fr	a
6:08	Bus	200	6:38	0:30	Mo - Sa	b
6:38	Bus	200	7:08	0:30	Mo - Fr	a
6:53	Bus	200	7:23	0:30	Mo - Fr	a
7:08	Bus	200	7:38	0:30	daily	
7:23	Bus	200	7:53	0:30	Mo - Fr	a
7:38	Bus	200	8:08	0:30	Mo - Fr	a
7:53	Bus	200	8:23	0:30	Mo - Fr	a
8:08	Bus	200	8:38	0:30	daily	
8:38	Bus	200	9:08	0:30	Mo - Fr	a
9:08	Bus	200	9:38	0:30	daily	
9:38	Bus	200	10:08	0:30	Mo - Fr	a
10:08	Bus	200	10:38	0:30	daily	
10:38	Bus	200	11:08	0:30	Mo - Fr	a
11:08	Bus	200	11:38	0:30	daily	
11:38	Bus	200	12:08	0:30	Mo - Fr	a
12:08	Bus	200	12:38	0:30	daily	
12:38	Bus	200	13:08	0:30	Mo - Fr	a
13:08	Bus	200	13:38	0:30	daily	
13:38	Bus	200	14:08	0:30	Mo - Fr	a
14:08	Bus	200	14:38	0:30	daily	
14:38	Bus	200	15:08	0:30	Mo - Fr	a
15:08	Bus	200	15:38	0:30	daily	
15:38	Bus	200	16:08	0:30	Mo - Fr	a
15:53	Bus	200	16:23	0:30	Mo - Fr	a
16:08	Bus	200	16:38	0:30	daily	
16:23	Bus	200	16:53	0:30	Mo - Fr	a
16:38	Bus	200	17:08	0:30	Mo - Fr	a
16:53	Bus	200	17:23	0:30	Mo - Fr	a
17:08	Bus	200	17:38	0:30	daily	
17:23	Bus	200	17:53	0:30	Mo - Fr	a
17:38	Bus	200	18:08	0:30	Mo - Fr	a
17:53	Bus	200	18:23	0:30	Mo - Fr	a
18:08	Bus	200	18:38	0:30	daily	
18:23	Bus	200	18:53	0:30	Mo - Fr	a
18:38	Bus	200	19:08	0:30	Mo - Fr	a
19:08	Bus	200	19:38	0:30	daily	
19:38	Bus	200	20:08	0:30	Mo - Fr	a
20:08	Bus	200	20:38	0:30	daily	
20:38	Bus	200	21:08	0:30	Mo - Fr	a
21:08	Bus	200	21:38	0:30	daily	
22:08	Bus	200	22:38	0:30	daily	
22:38	Bus	200	23:08	0:30	Mo - Fr	a

Map of the conference venue:
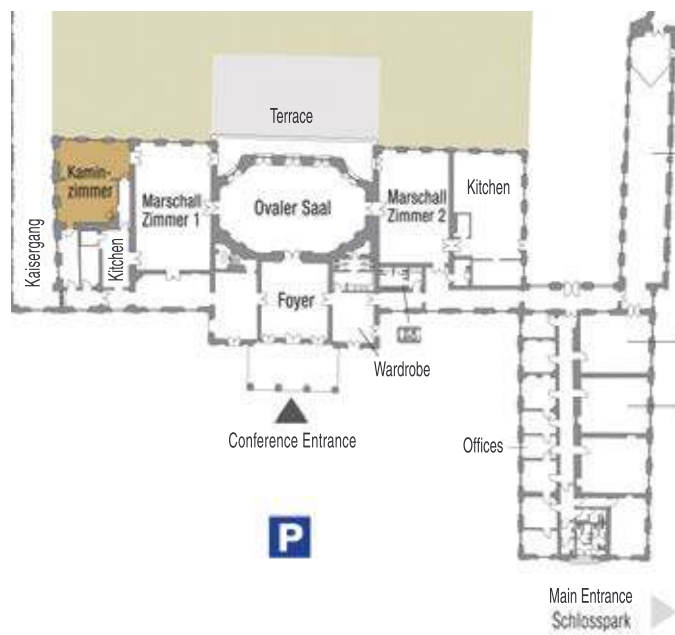
Ovaler Saal/Oval Room: Plenary Room
Marschallzimmer 1 and 2: Room for scientific Sessions
Kaminzimmer: Room for closed meetings
Entrance and Garderobe/Wardrobe: Registration and coffee
Kaisergang: Poster Session
Foyer and corridors: Lunch break and tables
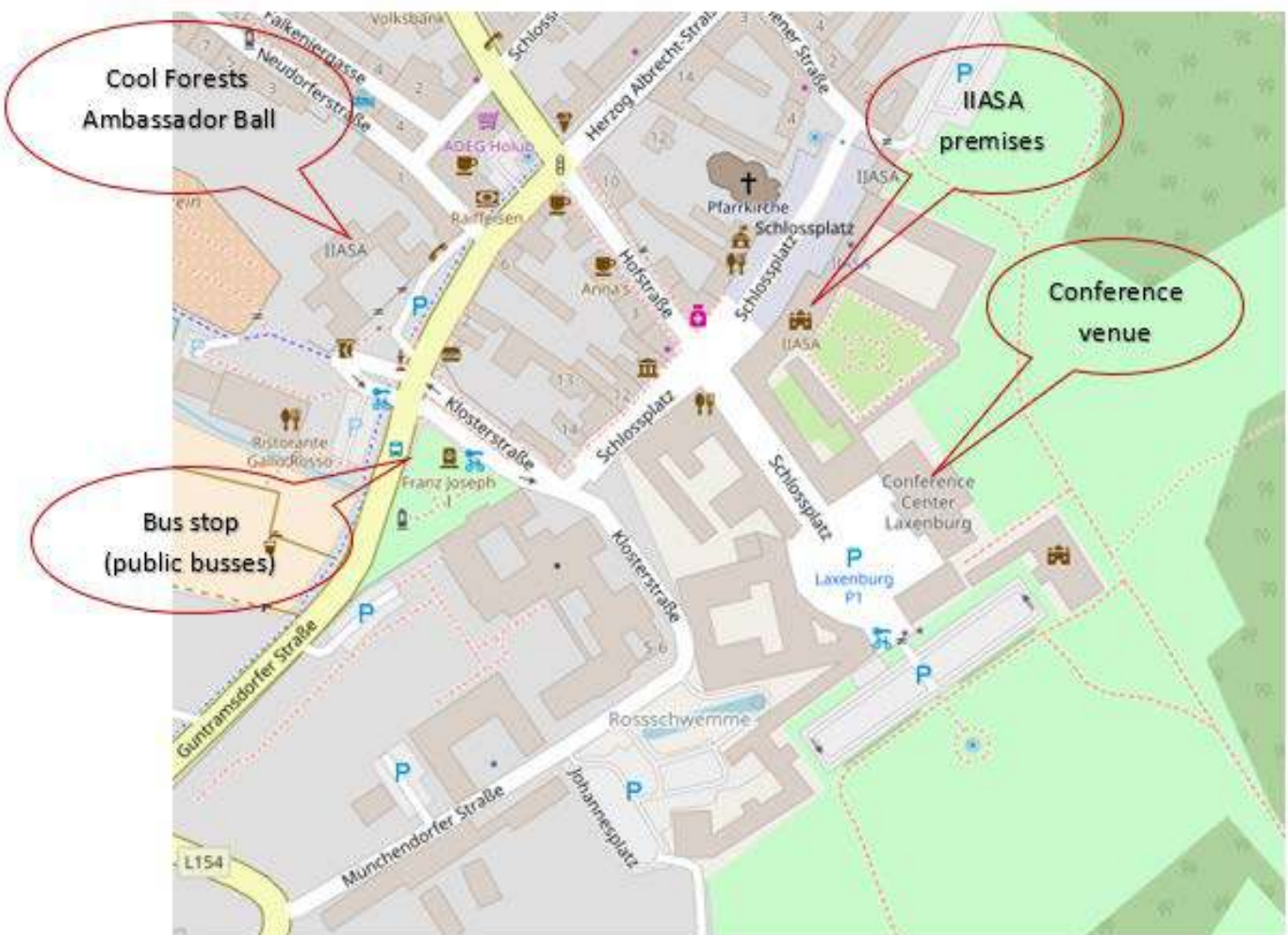
Indicates important places

Program at a glance

	Oval room	Marschallzimmer 1	Marschallzimmer 2	Foyer & Kaisergang	Kaminzimmer
	Day 1, September 17, 2018				
08:00	Pick up (daily)				
08:30	Registration and Coffee (Conference Center Entrance)				
09:00 - 10:00	Opening Ceremony				
10:00 - 10:30				Coffee and Posters	
10:30 - 12:30	**PARALLEL SESSIONS 1**				
	C1	B1	PN1		
12:30 - 13:30	LUNCH				
13:30 - 15:30	**PARALLEL SESSIONS 2**				
	Special Session 1	B2	PN2		
15:30 - 16:00				Coffee and Posters	
16:00 - 18:00	**PARALLEL SESSIONS 3**				
	C3	B3	PN3		
18:00	End of day one				
	Day 2, September 18, 2018				
08:45 - 10:30	**PARALLEL SESSIONS 4**				
	C4	B4	PN4		
10:35 - 11:00				Coffee and Posters	
11:00 - 13:00	**PARALLEL SESSIONS 5**				
	C5a	B5	C5b		
13:00 - 18:00	**Excursion to alpine uplands (Alpines Vorland)**				
18:00	End of day two				
	Day 3, September 19, 2018				
08:45 - 10:30	**PARALLEL SESSIONS 6**				
	C6a	C6b	Special Session 2		
10:35 - 11:00				Coffee and Posters	
11:00 - 13:00			**POSTER SESSION**		Scientific keynote speakers meeting
13:00 - 14:00	LUNCH and Panelists Lunch (closed meeting, Kaminzimmer)				
	STAKEHOLDER DIALOGUE AND KEYNOTES				
14:00 - 14:30	Stakeholder Keynotes				
14:30 - 15:30	Stakeholder Dialogue on Climate				
15:30 - 16:00				Coffee and Posters	
16:00 - 17:00	Stakeholder Dialogue on Bioeconomy				
17:10 - 18:10	Stakeholder Dialogue on People and Nature				
18:15 - 18:30	Summary of key messages from the stakeholder dialogues				
18:45 - 18:50	**Cool Forests Group Picture** (in front of the Conference Center)				
18:00 - 19:30	**Cool Forests Ambassador Signing Ceremony** (Schloss Restaurant)				
19:30 - 23:00	**Conference Dinner & Ball**				
23:00	End of day three				
	Day 4, September 20, 2018				
08:45 - 08:55	Opening: Introduction, rationale, aims, outcome				
09:00 - 09:40	Science Focus Looking into the future Early Career Scientists (ECS)				
09:45 - 10:45	SDG Keynotes				
10:45 - 11:10				Coffee and Posters	
11:10 - 13:00	Science ommunicates: Who is listening? Practical Experiences & Successful Communication				
13:00 - 14:00	LUNCH				
14:00 - 15:15	Science strives for impact: Action & Collaboration				
15:15 - 16:00	Closing of the Cool Forests Conference				

Climate	Bioenergy	People & Nature	Special Sessions	Closed Meetings