

# MINUTES

## FORHOT – 8th formal project meeting 2019

### Hotel Port Sitges, Sitges, Cataluña, Spain

and from a following workshop entitled “Joint Ecosystem Assessment on the Effects of Natural Soil Warming and N-input Manipulation on Subarctic Grasslands and Forests” 12-14 March, 2019



**Attending:** Altogether 52 ForHot and Future Arctic participants attended the meeting.

## Participants

Country	Institute	e-mails
<b>Cataluña / Spain</b>		
Josep Peñuelas	CREAF, UAB	j.penuelas[at]creaf.uab.cat
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<b>Iceland</b>		
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Figure. The ForHot participants in Sitges 2019

## Agenda

1. Last year's minutes revisited
2. Main happenings in 2018-2019
3. 2019 ForHot miniconference and session overview
4. Acceptance of new ForHot partners and partner overview
5. ForHot products (papers / theses) and future paper promises
6. Change in the ForHot MoU
7. Who is coming when?
8. Next steps ((in field research)) within ForHot?
9. Funding possibilities – ideas
10. Other issues
  - a) Next ForHot meeting?
  - b) Comments

## ***1. Last year's minutes***

Our plans in 2018 were mostly lived up to and the status of the ForHot project is generally very good.  
See [www.forhot.is](http://www.forhot.is) / Meetings

## ***2. ForHot's main happenings Mar 2018 – Mar 2019***

- **ForHot meeting**, Sitges, March
- March 9: Tom's 1st database manuscript meeting
- Palli was the Manager
  - Mar-July: Internship student Ben Wisniewski (DE)
- Apr 20: Regular measurement (NDVI, WcV, started)
- Apr-May: TNT and NT (Niel, Khadir, Chao)
- May: FN soil samples for Christopher
- Jun 4-8: Last intensive Seasonal camp (Sara, Albert)
- Jun: Soil samples for Ruud
- Jul 10-12, 2018. The 8th and the last Seasonal sampling.
- Jul 2-5, Ivika did root exudation measurements in FN
- Jun. Gunnhildur et al. installed walking bridges in GN
- July 1 – Aug 7, 2018. Belgian/Austrian army: GN, GO, NT, TNT summer campaign.
- Aug 3-18, 2018. Nia Perron – Sap flow in FN
- Aug. FN soil samples from 2017 processed (C,N, BD)
- Aug. LAI campaign by Palli
- Sep. Chao works on roots.
- Oct. All Ts dataloggers downloaded (GN, GO, TNT, NT)
- Nov 14, 2018. A pre-meeting for the Future Arctic.
- Nov 15-16, 2018. The ForHot Metatranscriptome Workshop, University of Vienna, with 20 participants.

## ***3. The 2019 mini-conference on recent findings in ForHot and sessions***

**Session 1: the ForHot mini-conference.** Different chairs.

Pdfs from all the 26 talks at the mini-conference are available on a closed dropbox folder. The address is <https://www.dropbox.com/sh/q6w5v5ds0q945z2/AABc1Acm1l1sP2YolCpDy0mHa?dl=0>

**Session 2: (Talks 13-17): The wrapping up of the seasonal ForHot experiment.** Chair: Andreas Richter

All field sampling in GN and NT ended in July 2018 – and some people have already sent Andi some data (e.g. Hans Sánden, Martin Holmstrup, Krassimira Ilieva-Maculec). The first results on seasonal changes in microbial biomass are extremely interesting and seem to confirm the potential N loss through soil microbial seasonal dynamics. See pdfs in the dropbox folder.

Notes: One plot (GN5E) has very high and strange Ts10 values – and the Tibit sensor had broken down in 2018. BDS/PS will check if it is really like that a.s.a.p. and also look into manual measurements done in 2017-2018 to see if this was really observed.

- **Deadline:** The previous deadline to have the data from all Seasonal Experiment WPs ready was had been set to **31. Jan 2019**. No official date was set for the extended deadline; but all participants are strongly encouraged to send the data to Andreas as soon as possible!

**Session 3: (Talks 27-30): The TNT experiment.** Chair: Michael Bahn

Very interesting findings and first results on the C-N interaction. The fieldwork will be continued to 2019/2020. See pdfs in the dropbox folder.

**Session 4: (Talks 31-36): The Metatranscriptome study in GN/GO.** Chair: Andreas Richter

GN and GO A and E plots (n=4) = 16 samples. Josep agreed to contribute with 1500 EUR which were lacking to be able to finish all the analyses. Very interesting findings and first results. See pdfs in the dropbox folder.

**Session 5: (Talks 37-38): Joint data synthesis activities.** Chair: Josep Peñuelas

- a) First Tom Walker gave an overview over the first joint (database) synthesis paper that has been produced. See pdfs in the dropbox folder.
- b) Then Daijun Liu explained his planned synthesis on multifunctionality, using the ForHot database (a joint synthesis activity that was accepted last year). See pdfs in the dropbox folder. This activity was accepted by the ForHot group and resulted in a manuscript activity (see list).

Josep reminded us about what we accepted at the last meeting:

- c) i.e. that Jordi would lead a synthesis work with “discriminant functional analysis” or “structural (equation) model analyses” on the variables in soil on one hand and in plants on the other. This will be done on the “updated version” of the database with data for 2017 and 2018 also included.
- d) We had also accepted last year that Josep Peñuelas & Jordi Sardans would lead a synthesis on “biogeochemical niche shifts” in ForHot. For this Josep wants to analyze all macro- and microelements in soil samples + litter, which have not been analysed so far. Bjarni will coordinate that samples will be sent to Josep for this.
- e) Ivika Ostonen reminded us that we already accepted that she and James Weedon et al. will do a FN synthesis paper about linking aboveground and belowground “food-web interactions” in response to warming. E.g. changes of soil microbial communities, links to GHG, ECM, mycelial biomass, fractionation data, stoichiometric shifts linked to shifts in vegetation allocations patterns (aboveground vs. belowground). This activity is just starting, but became a manuscript activity.
- f) Tim/Josep: It would be very interesting to compare results from the metatranscriptome and metabolomics.

- g) Bjarni, Per Gundersen, Alf Ekblad, Ivika Ostonen, Christopher, Edda et al. also reminded that we had accepted to use GN and FN A and B plots to evaluate the effect of land-use change on ecosystem structure and function. This became a manuscript activity (see list).
- h) Christopher reminded us that Håkan Wallander et al. had already submitted a paper on soil hydrophobicity and FTIR data; an joint synthesis analysis decided last year. Fungal biomass produce hydrophobic substances that make aggregates more stable. Hydrophobicity declines with temperature in bulk soil and SC fraction, but not in the SA fraction. This paper will be sent to another journal for publication.
- i) Rose A et al. will do modelling work on SOC dynamics in the GN / GO experiments and use data from the database. This was accepted by the group (see Session 8).

**Session 6: (Talk 39): Are there warming effects on SOM quality in ForHot?** Chair: Christopher Poeplau. Chris reviewed our findings and results from fractionation studies. See pdfs in the dropbox folder. More studies on SOM quality is still an open niche within ForHot. Andi will have pyrolysis results for all the GN A, D and E samples.

**Session 7: (Talks 40a and 40b): How do we initiate a new transplant activity in ForHot?** Chair: Bjarni D. Sigurdsson.

Sara Marañon reviewed a pilot project for a transplant activity using 20 cm monoliths which would be transplanted into the GO gradients (Talk 40b); this application is currently pending if it will be funded or not. Bjarni (Talk 40a) suggested that an application for setting up a soil warming facility with larger monoliths (e.g. 70 cm) at the AUI Reykir campus should be made a top priority of the consortium. This was discussed and few possible funding avenues for such an project were identified (see later). Andi: Take GN and GO (smaller) monoliths and compare with the soil taken from the 3<sup>rd</sup> area for large monoliths.

**Session 8: (Talks 41-42): FutureArctic meets ForHot.** Chair: Josep Peñuelas

Ivan gave an overview for the non-ecologists on what the ForHot study is about (Talk 41) and Steven Latré and Maarten Weyn gave an overview about AI and IoT for the non-technical ecologists (Talk 42)

**Session 9: (Talks 43): Adding modelling to the ForHot and FutureArctic studies.** Chair: Sara Vicca

Rose Abramoff gave a talk (Talk 43) about her modeling framework to incorporate complex data from soil warming experiments into earth-system models. She has already started this work (which had been accepted per capitulum by the ForHot PIs; but this activity was now introduced formally for the whole consortium which accepted it.

- Rose would like to be involved in some field activity in 2019 so she can get a first-hand experience with the field sites. The Antwerp group who are coming to work in the TNT project were positive ;o)
- Rose also showed a list of parameters she could not find in the ForHot database, but which she would be interested to use if anybody has those. Bjarni will coordinate.
- Rose is currently listed in the Berkley Lab; but just started a new post-doc at LSCE in France with Philipp Ciais. She has now three years funding for this project.

Because of time constraints further involvement of modellers was not discussed.

#### 4. ForHot project status overview now (March 2019) + new partners

##### New ForHot participants who were formally accepted at the 2019 ForHot meeting

EMU in Estonia = Ülo Niinemets  
 Univ. Lausanne = Tom Walker (moved to a new institute)  
 Univ. Montreal = Nia Perron / Oliver Sonnentag (sap-flow in FN)  
 Univ. Tromsø = Alex Tveit/Andrea  
 Univ. Greifswald = Tim Urich/Matthilde

##### Future Arctic private sector partners

Microsoft (BE) = Martin Slijkhuis & Lien Deleenheer  
 ILVO (BE) = Greet Ruysschaert  
 IMEC (BE) = Stefen Latré & Weyn Maarten  
 Svarmi (IS) = Tryggvi Stefansson & Victor Madrigal  
 DMR (DK) = Paul Larsen  
 MIRICO (UK) = Doug Millington Smith & Mohammed Belal  
 Vienna Sci. Instrum. (AU) = Boris Rewald & Liaqat Seehra

Bjarni will prepare MoU for new participants, one representative per institution/companies

##### Overview over present and past ForHot partners

The list of participants of the ForHot project during 2012-2020. Researchers active now in 2019/2020 are in **bold/green**, but those not active are in **normal/brown**. Students who are still active in 2019 are in **bold/blue**; students who have finished or otherwise ended their work are in **normal/red**:

<p><b>Agric. Univ. of Iceland</b></p> <ul style="list-style-type: none"> <li>• <b>Prof. Bjarni D. Sigurdsson (coord.)</b></li> <li>• <b>Páll Sigurðsson (Ph.D. student 2016-)</b></li> <li>• <b>Verena Kosel (internship student 2019)</b></li> <li>• <b>Antonia Lindau (internship student 2019)</b></li> <li>• Ben Wisniewski (internship student 2018)</li> <li>• Alice L. Sarolta Cosatti (internship student 2017)</li> <li>• Julia Bischof (internship student 2017)</li> <li>• Paige Guevarra (internship student 2017)</li> <li>• Damiano Cilio (internship student 2014)</li> <li>• Elín Guðmundsdóttir (M.Sc. student 2013-)</li> <li>• M.Sc. Gunnhildur E. G. Gunnarsdóttir</li> <li>• Dr. Úlfur Óskarsson</li> </ul> <p><b>Icelandic Forest Research – Mogilsa</b></p> <ul style="list-style-type: none"> <li>• <b>Dr. Edda S. Oddsdóttir</b></li> </ul> <p><b>Univ. Akureyri</b></p> <ul style="list-style-type: none"> <li>• <b>Dr. Brynhildur Bjarnadóttir</b></li> </ul> <p><b>Soil Conservation Service / Univ. of Iceland</b></p> <ul style="list-style-type: none"> <li>• <b>Dr. Bryndís Marteinsdóttir</b></li> <li>• Nia Perron (M.Sc. student 2016-2017)</li> <li>• Ella Thoen (B.Sc. student 2011-2012)</li> </ul>	<p><b>Univ. of Antwerp - Belgium</b></p> <ul style="list-style-type: none"> <li>• <b>Prof. Ivan Janssens</b></li> <li>• <b>Prof. Erik Verbruggen</b></li> <li>• <b>Dr. Joke Van den Berge (PM for Future Arctic)</b></li> <li>• <b>Dr. Eric Struyf</b></li> <li>• <b>Dr. Lucia Fuchslueger (Post-doc 2017-2019)</b></li> <li>• <b>Dr. Sara Vicca (Post-doc 2017-2019)</b></li> <li>• <b>Dr. Niki Leblans (Post doc 2016-2019)</b></li> <li>• <b>Chao Fang (PhD student 2018-2020)</b></li> <li>• <b>Niel Verbrigghe (PhD student 2017-2020)</b></li> <li>• <b>Johan de Gruyter (PhD student 2017-2019)</b></li> <li>• <b>Leandro Van Langenhove (PhD student)</b></li> <li>• <b>Dr. Cindy De Jonge (Post-doc 2016-2018)</b></li> <li>• Dr. James Weedon (Post-doc)</li> <li>• Dr. Jennifer Soong (Post-doc)</li> <li>• Wendelien Meynzer (M.Sc. student 2014-)</li> <li>• Niki Leblans (PhD student 2012-2016)</li> <li>• Stephanie Van Loock (M.Sc. student 2014-2016)</li> <li>• Katherine Vande Velde (M.Sc. student 2014-2015)</li> <li>• Steven Dauwe (PhD student 2015-)</li> <li>• Lieven Michielsens (M.Sc. student 2014-2015)</li> <li>• Mattias Janssens (job student 2016)</li> <li>• Elien de Schutter (job student 2016)</li> <li>• Dajana Radujkovic (M.Sc. student 2014-2016)</li> </ul>
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<p><b>Univ. of Vienna - Austria</b></p> <p>Group I:</p> <ul style="list-style-type: none"> <li>• Prof. Andreas Richter (PI: Group I)</li> <li>• Prof. Christina Kaiser</li> <li>• Dr. Craig Herbold</li> <li>• Philipp Guendler (M.Sc. student 2018-2019)</li> <li>• Moritz Mohrlok (M.Sc. student 2019-2020)</li> <li>• Joana da Silva (PhD student 2018-2020)</li> <li>• Qingfang Bi (PhD student 2018-2020)</li> <li>• Judith Prommer (PhD student 2017-2018)</li> <li>• Dr. Alexander Tveit (Post-doc 2018-2019)</li> <li>• Dr. Tom Walker (post-doc 2017-2018)</li> </ul> <p>Group II:</p> <ul style="list-style-type: none"> <li>• Prof Michael Wagner (PI: Group II)</li> <li>• Dr. Petra Pjevac</li> <li>• Dr. Anne Daebeleer (post-doc)</li> </ul> <p>Group III:</p> <ul style="list-style-type: none"> <li>• Prof Ulrike Felt (PI: Group II)</li> </ul> <p><b>Univ. Eastern Finland</b></p> <ul style="list-style-type: none"> <li>• Ass. prof. Marja Maljanen</li> <li>• Dr. Christina Biasi</li> <li>• Heli Yli-Moijala (M.Sc. student 2012-)</li> </ul>	<p><b>Lund University</b></p> <ul style="list-style-type: none"> <li>• Prof. Håkan Wallander</li> <li>• Prof. Erland Bååth</li> <li>• Dr. Per Bengtson</li> <li>• Jian Li (PhD student 2018-2019)</li> <li>• Dr. Jing Zang (PhD student 2017-2018)</li> <li>• Dr. Zhanfeng Liu (Postdoc 2016)</li> <li>• Dr. Nicholas Rosenstock (PostDoc)</li> <li>• Dr. Magnus Ellström (Ph.D. student 2012)</li> <li>• Dr. Stephanie Reischke (Ph.D. student 2012)</li> </ul> <p><b>Örebro Univ</b></p> <ul style="list-style-type: none"> <li>• Prof. Alf Ekblad</li> </ul> <p><b>Univ. of Tromsø</b></p> <ul style="list-style-type: none"> <li>• Dr. Alexander Tveit</li> <li>• Andrea Söllinger (Post-doc 2019-2020)</li> </ul> <p><b>Swedish Univ. Agric. Sci. (SLU)</b></p> <ul style="list-style-type: none"> <li>• Prof. Thomas Kätterer</li> <li>• Dr. Monika Strömgren</li> <li>• Dr. Christopher Poeplau (Post-doc)</li> <li>• Hanna André (B.S. student from SLU 2014)</li> <li>• Agnes Bondesson (B.S. student from SLU 2014)</li> </ul>
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<p><b>FUTURE ARCTIC PRIVATE COMPANY PARTNERS:</b></p> <p><b>Microsoft (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Martin Slijkhuis</li> <li>• Lien Deleenheer</li> </ul> <p><b>IMEC – Belgium (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Maarten Weyn</li> <li>• Steven Latré</li> </ul> <p><b>ILVO – Belgium (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Greet.Ruysschaert</li> </ul> <p><b>SVARMI (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Tryggvi Stefansson</li> <li>• Victor Madrigal</li> </ul> <p><b>MIRICO – UK (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Doug Millington Smith</li> <li>• Mohammed Belal</li> </ul> <p><b>DMR - Denmark (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Poul Larsen</li> </ul> <p><b>Vienna Scientific – Austria (Future Arctic company)</b></p> <ul style="list-style-type: none"> <li>• Boris Rewald</li> <li>• Liaqat Seehra</li> </ul>	<p><b>In total active in 2019-2020 (before FutArc PhD students start):</b></p> <p>43 researchers, 14 postdocs 6 MS students 13 PhD students 12 Company representatives</p> <p><b>Total: 87 persons</b></p> <p><b>From:</b> 33 universities/institutes/companies 16 countries</p>
<p><b>Former ForHot partners</b></p> <p><b>Icelandic Inst. Nat. Hist</b></p> <ul style="list-style-type: none"> <li>• M.Sc. Ásrún Elmarsdóttir</li> </ul> <p><b>METLA - Finland</b></p> <ul style="list-style-type: none"> <li>• Prof. Leena Finér</li> </ul> <p><b>Basel University, Switzerland</b></p> <ul style="list-style-type: none"> <li>• Prof. Christian Körner</li> <li>• Dr. Armando Lenz (PhD student 2011-2012)</li> </ul>	

## 5. Project outputs

### Older papers already out before the last meeting:

1. **JOURNAL PAPER:** O’Gorman et al. (2014) Climate change and geothermal ecosystems: natural laboratories, sentinel systems, and future refugia. *Global Change Biology*, 20(11):3291-3299.
2. **JOURNAL PAPER:** Bjarni D. Sigurdsson et al. (2016). Geothermal ecosystems as natural climate change experiments: the ForHot research site in Iceland as a case study. *Icelandic Agricultural Sciences* 29:53-71.
3. **JOURNAL PAPER:** Christopher Poeplau et al. (2017). Sensitivity of soil carbon fractions and their specific stabilisation mechanisms to extreme soil warming in a subarctic grassland. *Global Change Biology* 23: 1316-1327.
4. **JOURNAL PAPER:** Niki Leblans et al. (2017). Phenological responses of Icelandic subarctic grasslands to short-term and long-term natural soil warming. *Global Change Biology* 23(11), 4932-4945.
5. **JOURNAL PAPER:** Marja Maljanen et al. (2017). The emissions of N<sub>2</sub>O and CH<sub>4</sub> from natural soil temperature gradients in a volcanic area in southwest Iceland. *Soil Biology and Biochemistry* 109: 70-80.

6. **JOURNAL PAPER:** Albert Gargallo-Garriga. (2017). Impact of soil warming on the plant metabolome of Icelandic grasslands. *Metabolites* 7(3) 44
7. **JOURNAL PAPER:** Martin Holmstrup et al. (2018). Resilience in functional diversity of Collembola subjected to long-term warming. *Functional Ecology* 32(5): 1304-1316
8. **JOURNAL PAPER:** Dajana Radujkovic et al. (2018). Prolonged exposure does not increase soil microbial community response to warming along geothermal gradients. *FEMS Microbiology Ecology* 94(2): fix174.
9. **JOURNAL PAPER:** Marja Maljanen et al. (2018). The potential effect of elevated soil temperatures on the production of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), nitric oxide (NO) and nitrous acid (HONO) from volcanic soils in southern Iceland. *Icelandic Agricultural Sciences* 31, 11-22

### Published articles since the last meeting

10. **JOURNAL PAPER:** Tom W. N. Walker, Christina Kaiser, Florian Strasser, Niki I. W. Leblans, Dagmar Woebken, Ivan A. Janssens, Bjarni D. Sigurdsson & Andreas Richter (2018). Microbial temperature sensitivity and biomass change explain soil carbon loss with warming. *Nature Climate Change* 8: 885-889.
11. **JOURNAL PAPER:** Marañón-Jiménez S., Soong J.L., Leblans N.I.W., Sigurdsson B.D., Peñuelas J., Richter, A., Asensio D., Fransen E., Janssens I.A. (2018). Geothermally warmed soils reveal persistent increases in the respiratory costs of soil microbes contributing to substantial C losses. *Biogeochemistry* 138: 245–260.
12. **JOURNAL PAPER:** Kaarin Parts, Leho Tedersoo, Andreas Schindlbacher, Bjarni D. Sigurdsson, Niki Leblans, Edda Oddsdottir, Werner Borken, Ivika Ostonen (2018) Acclimation of fine root systems to soil warming: comparison of an experimental setup and a natural soil temperature gradient. *Ecosystsems* (Published on-line).
13. **JOURNAL PAPER:** Nicholas Rosenstock, Magnus Ellström, Edda Oddsdottir, Bjarni D Sigurdsson & Håkan Wallander (2018). Carbon sequestration and community composition of ectomycorrhizal fungi across a geothermal warming gradient in an Icelandic spruce forest. *Fungal Ecology* (published on-line)
14. **JOURNAL PAPER:** Christopher Poeplau, Pierre Barre, Lauric Cecillion, Francois Baudin, Bjarni D. Sigurdsson (2019). Changes in the Rock-Eval signature of soil organic carbon upon extreme soil warming and chemical oxidation - A comparison. *Geoderma* 337 (2019): 181-190.
1. **THESIS:** Lena M. Müller (2019). **Title?** M.Sc. thesis. University of Innsbruck, Austria

## Publication plans 2019-2020



We have had a fairly good year publication-wise! We now have 13 papers that give data from the ForHot sites, whereof 5 appeared since the ForHot meeting in 2018 (see above) and 8 have been submitted (see below). That is a success rate of 65%, but we had pledged that we would publish/submit 20 papers before this meeting :o)

**The following papers have been submitted or are just to be re-submitted and should appear soon:**

1. **JOURNAL PAPER:** Dmitry Kutcherov, Stine Slotsbo, Bjarni D. Sigurdsson, Niki Leblans, Matty Berg, Jacintha Eilers, Janine Mariën, and Martin Holmstrup (201X). Thermal reaction norm evolution in a subarctic springtail in response to habitat type and geothermal warming. (to be resubmitted).
2. **JOURNAL PAPER:** Johan De Gruyter et al. (201X). Patterns of local, intercontinental and intra-annual variability in soil bacterial and eukaryotic microbial communities. (submitted)
3. **JOURNAL PAPER:** Tom W. N. Walker, Ivan A. Janssens, Bjarni D. Sigurdsson, Andreas Richter, Josep Peñuelas, Niki I. W. Leblans, Michael Bahn, Mireia Bartrons, Cindy De Jonge, Lucia Fuchslueger, Albert Gargallo-Garigga, Gunnhildur E. G. Gunnarsdottir, Sara Marañón-Jiménez, Edda S. Oddsdóttir, Ivika Ostonen, Christopher Poeplau, Judith Prommer, Dajana Radujkovic, Jordi Sardans, Páll Sigurðsson, Jenny Soong, Sara Vicca, Hakan Wallander, James T. Weedon & Erik Verbruggen (201X). A systemic decadal-scale overreaction to soil warming in a grassland ecosystem. (to be resubmitted).
4. **JOURNAL PAPER:** Jing Zhang, Alf Ekblad, Bjarni D. Sigurðsson, Håkan Wallander (201X). The influence of arbuscular mycorrhizal fungi on soil organic carbon sequestration under geothermal warming in Iceland. (submitted).
5. **JOURNAL PAPER:** Sara Marañón-Jiménez, Josep Peñuelas, Andreas Richter, Bjarni D Sigurdsson, Lucia Fuchslueger, Niki I Leblans, Ivan A Janssens (201X). Coupled carbon and nitrogen losses in response to seven years of chronic warming in subarctic soils. Soil Biology and Biochemistry (Accepted).
6. **JOURNAL PAPER:** Cindy De Jonge, Dajana Radujković, Bjarni D Sigurdsson, James T. Weedon, Ivan Janssens, Francien Peterse (201X). Lipid biomarker temperature proxy controlled by abrupt shift in the bacterial community composition. (to be resubmitted)
7. **JOURNAL PAPER:** Wallander H, Zhang J, Kätterer T, Persson P, Sigurdson BD, Poeplau C (201X). Soil macroaggregates disintegrate when hydrophobicity is lost at elevated temperatures in a sub-Arctic grassland. (to be resubmitted)

The participants pledged to submit and published the following papers before before the next ForHot meeting (July 2020). **Those on the list below list that will not have done so, promised that at the next meeting they would bring a bottle of wine and give to another person on the list who had succeeded to keep his/her promise!**

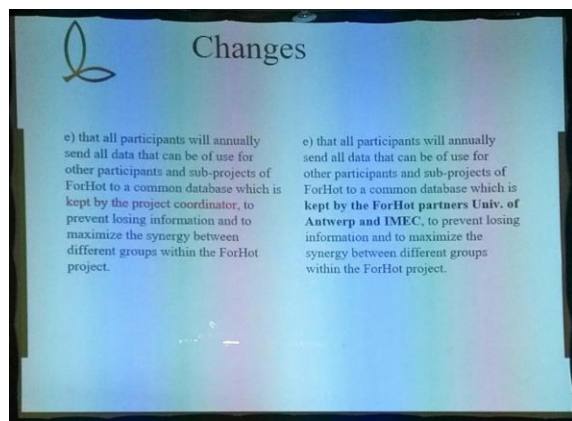
1. **James Weedon & Erland Bååth** The soil bacteria growth and composition at FN/GN in 2012 (was presented)
2. **Marja Maljanen, Christina Biasi et al.** Geothermal sources of  $^{13}\text{C}$   $\text{CO}_2$  fluxes from FN (was presented)
3. **Pall Sigurdsson et al.** Fine-root turnover in FN (was presented)
4. **Chao Fang et al.** Fine-root turnover in GN, GO and NT (was presented)
5. **Per Gundersen et al** Leachates in FN, GN, and GO 2015-2018 (was presented)
6. **Krassimira et al.** Nematodes in FN, GN and GO in 2014 (was presented)
7. **Tom Walker's et al.** synthesis paper on GN and GO (was presented)
8. **Christopher Poeplau et al.** FN new fractionation data (was presented)
9. **Kathiravan M. Meeran et al.** Pulse-labelling study 2018 in TNT – a (presented)
10. **Kathiravan M. Meeran et al.** Pulse-labelling study 2018 in TNT – b (presented)
11. **Albert Gargallo et al.** The next metabolomics paper (GN GO soil from 2015; presented).
12. **Andrea Söllinger et al.** MetaTranscriptome data form GN/GO on functional diversity (presented)
13. **Matthilde Dahl et al.** MetaTranscriptome data form GN/GO on functional diversity (presented)
14. **Joana da Silva et al.** Org-N cycl MetaTranscriptome data form GN/GO (presented)
15. **Niki Leblans/Ivan Janssens et al.** Effect of short- and long-term soil warming on plant and soil stoichiometry in GN and GO
16. **Ivan Janssens/Niki Leblans/NN, et al.** The updated Niki's SOC paper with the 2018 results included that show that the changes in GN have stabilized.
17. **Chao Fang et al.** Fine-root phenology in GN, GO and NT
18. **Niel Verbrigghe et al.** First paper from TNT
19. **Jenny Soong/Niel Verbrigghe + Wallander, Poeplau & Richter et al.** Fractionations of GN/GO soil with different methods.
20. **Pall Sigurdsson et al.** Aboveground and belowground phenology in FN
21. **Martin Maddison et al.**  $\text{N}_2$ ,  $\text{NO}_x$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}_2$  incubations from GN, GO and FN
22. **Bang-Xiao Zheng et al.** Multi-gen chip for ForHot
23. **Jordi Sardans et al.** SEM of GN and GO
24. **Sara Marañón Jiménez et al.** N-cycle from Seasonal Experiment in GN/NT a
25. **Sara Marañón Jiménez et al.** N-cycle from Seasonal Experiment in GN/NT b
26. **Mireia Bartrons et al.** POPs and organic pollutants from Seasonal Exp.
27. **Bjarni D. Sigurdsson et al.** Effects of Land Use Change synthesis paper
28. **Philipp Guendler et al.** Seasonal Experiment I
29. **Tom Walker, Erik V et al.** Synthesis on plant and soil community changes due to warming
30. **Oh Mann** Carbon chicken & N eggs

**The following 14 papers will be submitted in 2020/2021 (After the ForHot meeting in July 2020).**

1. **Andreas Richter et al.** Seasonal experiment paper(s)
2. **Ivika Ostonen, James Weedon, et al.** FN synthesis paper
3. **Ruud Ts** Threshold in microbial community compositions in different soils
4. **Páll Sigurdsson et al.** Tree growth and forest productivity in FN
5. **Páll Sigurdsson et al.** C-balance changes in FN during 2013-2018
6. **Hans Sandén et al.** (2018/2019) FN enz responses
7. **Bryndís Marteinsdottir, Nia Perron, et al.** (2017). Plant phenology and fitness at Hengill, GN and GO
8. **Niki Leblans et al.** (2019) Effect of short-term and long-term soil warming on vegetation composition and traits, GO and GN.
9. **Niki Leblans et al.** (2019) NDVI and aboveground biomass stocks in GN and GO
10. **Erland Bååth & Liu.** The fungi PFLAs, OM spectroscopy and enzymatic responses in GN and GO
11. **Lucia Fuchslueger et al.** Decomposition results from TNT
12. **Guille Peguero et al.** Soil invertebrates and environmental DNA from GN/GO
13. **Daijun Liu et al.** Multi-functionality synthesis paper from GN/GO/FN
14. **Josep Peñuelas & Jordi Sardans.** Biogeochemical niche shifts in ForHot (pending more nutrient analyses!)

## **6. Change in the ForHot MoU**

The following changes were accepted in the text of article e) of the present MoU, regarding the ForHot database:



This change is necessary because from now on IMEC and University of Antwerp are going to develop and host the ForHot database, in connection to the Future Arctic project. This was accepted. Articles f) and g) in the MoU about data ownership and data sharing/co-authorships and the amendments to those accepted at the 2016 Antwerp meeting will remain unchanged and confirm with the Future Arctic data policy.

### **Future changes in the data/database policy were discussed:**

Currently the ForHot database is closed, except for the ForHot consortium participants themselves.

Agreed to keep this in mind for the development of the new **IMEC/UA ForHot database**, and it means that new data-sharing rules need to be formulated in a new and updated MoU at latest at next business meeting (2020).

Points:

- a. We should aim for more "Open access" policy. At minimum all basic data already used in publications should be made publically available through the database.
- b. Question when other (unpublished) data should be made open for people outside the ForHot consortium - 3 years after they are put in the database?
- c. Discussed that the new ForHot database should also be able to handle large datasets (raw data repository).
- d. Discussed that it would be beneficial if the database included "sample ID" system – so it was clear when multiple analyses are done on shared samples that they are indeed "shared".
- e. We should make a database about available DNA and other soil/plant/animal samples archived at different institutes.

At the FutureArctic meeting on 15/3 Steven Latré showed the database solution he was thinking about using for the new ForHot database = INVENiQ

### **Exchange the ForHot MoU with more formal ForHot Consortium Agreement (Accepted by institution heads)?**

A participant asked the question if this was something that we would like to aim for. It could e.g. facilitate applications to large funding bodies, etc. This is now already done for the 7 + 7 partners' in the Future Arctic spin-off project; but does not exist for the ForHot project as a whole.

There was not a full consensus if this should be done or not. It was decided that this discussion should be revisited at the next ForHot business meeting – but in the meantime this should be considered as a possible way forward.

## ***7. Who is coming when to the ForHot field sites in 2019?***

The field activity will not be very active during summer of 2019.

- a) Palli will be the site manager Mar 2019 – Sept 2019.
- b) One internship student Mar-Aug 2019 (Verena Kosel) and we will try to find another one.
  - Fertilization of NT (April, June, July)
  - NDVI and Theta-Probe every 2-3 weeks in GN/GO (NT/TNT – check with Antwerp?)
  - Lysimeters in GN/GO/NT (Per suggests 3 sessions; but needs to be cleared with Antwerp if this is funded or not).
  - Max LAI in August

- c) **May/June:** Future Arctic (Maarten Weyn) plans to come in spring to set up a fieldgate and some sensors to test if automated cloud-connections are working well. Bjarni will coordinate.
- d) **June:** TNT (2 people). Fertilization and sampling. Lucia will coordinate.
- e) **July:** FN (1 person) Christina Biasi interested in doing root-respiration by trenching; maybe in GN/GO also in collaboration with Michael Bahn.
- f) **August:** TNT. 2-3 people for sampling litter-bags, etc. Lucia will coordinate.
- g) **Oct/Nov:** Future Arctic (Ivika Ostonen) plans to come in to install new mini-rhizotron tubes in GN/GO.
- h) **Oct/Nov:** Erik Verbruggen + ESR1 will initiate the ingrowth core study at GN / GO
- i) When?: GO-seasonal (Matthilde): pending if funded)
- j) When? Transplant pilot project (Sara M: pending if funded)

### ***8. Next steps in field research at ForHot (new activities)***

- a) Future Arctic will officially start on June 1, 2019, and in total 15 PhD students will be hired who are going to start different measurements activities.
- b) Transplant pilot study (Sara M, BDS)
- c) Seasonal GO (Mathilde) - start in this summer and continue 2020 - closely related to FutureArctic - if this goes through then plan an intensive sampling for the seasonal GO experiment
- d) Root quality + food web in the FN (Ivika) - addition to Future Arctic project with national funding (pending).
- e) Christina Biasi - radioactive waste disposal -> apply to company in FI - get better understanding of the respiration - deadline in October, either PhD or half a PhD - partly overlapping with FutureArctic.
- f) Petra is interested in intestinal bacterial communities of soil fauna; Josep/CREAF are already working on this and will collaborate. Bjarni will take nematode samples for Krassi in Oct.
- g) Margaret/Bjarni would like to measure albedo changes of the warming plots in GN/GO. Drones?
- h) Ivan would like to see somebody measure entrophy/energy content of different SOM/DOC fractions.

### ***9. ForHot funding (plans) for 2019-2020***

Now we have (research) funding from:

1. The Icelandic ForHot-Forest project (ends 2019)
2. The post-doc project of Sara Maranon (ends 2019)
3. The TNT project of Lucia, Sara V. and Michael
4. Some inputs through Imbalance-P
5. Some inputs from Univ. Antwerp ForHot project
6. The Future Arctic ITN/ETN (starts June 2019-May 2023)



Some applications have been submitted or will be submitted.

- Transplant activity:
  - a. Bjarni will check with his national representative if it would be feasible to send a large application to the Belmond Forum for starting a transplant experiment. Other potential collaborators Margaret (US), Andi (AU), Josep (ES), Per (DK), Alex (NO)....
  - b. Petra will check if it would be feasible to send a large application to CA-Life.
  - c. Sara M has a pending application in Spain to start a transplant pilot. Sara got full support for this initiative.
  - d. Bjarni will send application to Icel. Res. Council in June 2019 for starting the transplant pilot
  - e. Ivika Ostonen will apply for national funding in Estonia to add to the root studies in Future Arctic (FN) + some contribution towards starting a transplant pilot.
  - f. Josep Peñuelas will send Bjarni some fellowships where applications can be sent to.
  - g. Ivan, Andi et al. discussed if it was possible to submit an ERC grant application for this.
- Mathilde Dahl is sending an application of DFG for her post-doc project (seasonal GO).
- Christina Biasi is going to send an application in Oct to a Finnish nuclear funding (deep transport of C) for measurements in FN (geological CO<sub>2</sub> transport and root respiration), in collaboration with Michael and possibly adding measurements in GN/GO.
- Jaak Truu and Ivika plan to send in a joint application with AUI for teaching interaction.
- All participants are encouraged to seek national funding for ForHot projects!! Only remember to coordinate with the ForHot coordinator (Bjarni) – who distributes the info and gets support.

## 10. Other issues / decisions / comments

- **NEXT ForHot meeting will be in Iceland Wed-Fri 1-3 July 2020. FutureArctic Supervisory Board meeting will take place on 3 July and then there will be a joint field-excursion on Sat 4.** “Local organiser” will be Bjarni, together with Edda and Joke.
- **Talks from 2019 meeting.** Everybody accepted that pdfs of the talks would be made available to all participants in a dropbox folder.
- **Andi:** the lack of warming response on SOC in subsoil in GO is a very interesting issue.
- **Andi:** We should maybe prioritize which plots we want to continue into the future (and should not be disturbed).
- **Chris/Andi:** Important to establish a soil archive from the ForHot experiments + -80°C freezer.
- **Andi:** We should agree on soil sampling protocols
- **Andi:** We should always advertise our sampling plans in the whole consortium to stimulate collaboration (e.g. within the Future Arctic).
- **Andi:** We should set up -80 °C freezer at Reykir
- **Mathilde/Andi:** Important to study what happens during thawing episodes during winter. Winter sampling equipment needs to be available at the sites.
- **Erik:** Microbial ecology ESRs in Future Arctic aim to have 2020 as intensive sampling season.