

# MINUTES

FORHOT – 5th formal project meeting at University of Antwerp, Belgium

and from a following workshop entitled “*Joint Ecosystem Assessment on the Effects of Natural Soil Warming on Subarctic Grasslands and Forests*” 8-10 March, 2016

## Attending:

Altogether 28 ForHot participants attended the meeting:

Bjarni D. Sigurdsson (Agric. Univ. Icel. / AUI)	Peter van Bodegom (Leiden Univ, NL)
Edda S. Oddsdóttir (Icel. For. Res.)	James Weedon (UA/VU Univ. Amsterdam)
Bryndís Marteinsdóttir (Univ. of Iceland)	Håkan Wallander (Lund Univ., Sweden / LU)
Ivan Janssens (Univ. Antwerpen, Belgium / UA)	Erland Bååth (LU)
Niki Leblans (UA/AUI)	Thomas Kätterer (Swedish Univ. Agric. Sci.)
Steven Dauwe (UA/AUI)	Per Gundersen (Copenhagen Univ. /KU)
Sara Maranon (UA)	Anna Theresa Edlinger (KU)
Sara Vicca (UA)	Martin Holmstrup (Aalborg Univ., Denm.)
Cindy De Jonge (UA)	Ivika Ostonen (Tartu Univ., Estonia)
Hans De Boeck (UA)	Marja Maljanen (Univ. Eastern Finland)
Jennier Soong (UA)	Andreas Richter, Univ. Vienna (UV)
Stephanie Van Look (UA)	Tom Walker (UV)
Wendelien Meynzer (UA)	Krassimira Ilieva-Makulec (Card. St. Wysz. Univ)
Dajana Radujkovic (UA)	Josep Penuelas (Univ. Autonom. Barcelona)

## Agenda

1. ForHot project and participant overview
2. ForHot’s main happenings in the past (2011-2016)
3. „To do“ in the last Minutes revisited
4. Recent project news
5. Next steps in field research at ForHot (ForHot business meeting)
6. Publications planned for 2016-2017 (there is now a competition to win a bottle of red wine!!)
7. List of ForHot-related publication already out
8. Other issues/decisions

## 1. ForHot participant overview (active 2015-2016)

<p><b>Agric. Univ. of Iceland</b></p> <ul style="list-style-type: none"><li>• Prof. Bjarni D. Sigurdsson (coord.)</li><li>• Dr. Úlfur Óskarsson</li><li>• B.Sc. Gunnhildur Eva (technician)</li><li>• M.Sc. Helena M. Stefánsdóttir</li><li>• <b>Elín Guðmundsdóttir (M.Sc. student)</b></li><li>• <b>Damiano Cilio (B.Sc. student)</b></li><li>• <b>Niki Leblands (Ph.D. student – joint w. UA)</b></li><li>• <b>Steven Dauwe (Ph.D. student – joint w. UA)</b></li></ul> <p><b>Icelandic Forest Research – Mogilsa</b></p> <ul style="list-style-type: none"><li>• Dr. Edda S. Oddsdóttir</li></ul> <p><b>Univ. Akureyri, Iceland</b></p> <ul style="list-style-type: none"><li>• Dr. Brynhildur Bjarnadóttir</li></ul> <p><b>Univ. of Iceland</b></p> <ul style="list-style-type: none"><li>• Dr. Bryndís Marteinsdóttir (postdoc)</li></ul> <p><b>Univ. of Antwerp - Belgium</b></p> <ul style="list-style-type: none"><li>• Prof. Ivan Janssens</li><li>• Dr. Jennifer Soong (postdoc)</li><li>• Dr. Erik Verbruggen (postdoc)</li><li>• Dr. Cindy De Jonge (postdoc)</li><li>• Sara Vicca (postdoc)</li><li>• Hans De Boeck (postdoc)</li><li>• <b>Wendelien Meynzer (M.Sc. student)</b></li><li>• <b>Stephanie Van Look (M.Sc. student)</b></li><li>• <b>Dajana Radujkovic (M.Sc. student)</b></li></ul> <p><b>Swedish Univ. Agric. Sci.</b></p> <ul style="list-style-type: none"><li>• Prof. Thomas Kätterer</li><li>• Dr. Christopher Poeplau (postdoc)</li></ul> <p><b>Univ. Autònoma Barcelona - Spain</b></p> <ul style="list-style-type: none"><li>• Prof. Josep Peñuelas</li><li>• Dr. Mireia Bartrons (postdoc)</li><li>• Dr. Albert Gargallo (postdoc)</li></ul> <p><b>Univ. Vienna, Austria</b></p> <ul style="list-style-type: none"><li>• Andreas Richter</li><li>• Tom Walker (postdoc)</li><li>• Anne Daebeler (postdoc)</li></ul>	<p><b>Icelandic Inst. Nat. Hist</b></p> <ul style="list-style-type: none"><li>• M.Sc. Ásrún Elmarsdóttir</li></ul> <p><b>Basel University, Switzerland</b></p> <ul style="list-style-type: none"><li>• Prof. Kristian Körner</li></ul> <p><b>Vrije University, Amsterdam, NL</b></p> <ul style="list-style-type: none"><li>• Dr. James T. Weedon</li></ul> <p><b>Leiden University, NL</b></p> <ul style="list-style-type: none"><li>• Prof. Peter van Bodegom,</li></ul> <p><b>Univ. Eastern Finland</b></p> <ul style="list-style-type: none"><li>• Dr. Marja Maljanen</li><li>• <b>Heli Yli-Moijala (M.Sc. student)</b></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>• Zhanfeng Liu (postdoc)</li></ul> <p><b>METLA, Finland</b></p> <ul style="list-style-type: none"><li>• Prof. Leena Finér</li></ul> <p><b>Copenhagen Univ.</b></p> <ul style="list-style-type: none"><li>• Prof. Per Gundersen</li><li>• <b>Anna Theresa Edlinger (M.Sc. student)</b></li></ul> <p><b>Aarhus Univ.</b></p> <ul style="list-style-type: none"><li>• Prof. Martin Holmstrup</li></ul> <p><b>Cardinal St. Wyszynski Univ., Poland</b></p> <ul style="list-style-type: none"><li>• Krassimira Ilieva-Makulec</li></ul> <p><b>Tartu Univ., Estonia</b></p> <ul style="list-style-type: none"><li>• Dr. Ivika Ostonen</li><li>• <b>Kaarin Parts (Ph.D. student)</b></li></ul> <p><b>In total: 38 participants</b></p> <p><b>19 senior researchers</b></p> <p><b>12 postdocs</b></p> <p><b>3 PhD students</b></p> <p><b>7 M.Sc./B.Sc. students</b></p> <p><b>2 other staff</b></p>
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## 2. ForHot's main happenings 2011-2016

2011. No site manager.	2012. No site manager.	2013. Site manager = Elín
ClimMani conference in Iceland in June 2011 – Bjarni/Edda launch the project idea.	<b>Adding GN.</b> Inventory on vascular and non-vascular plants (Bjarni, Úlfur, Ásrún, Elín)	<b>Adding GO:</b> Grasslands with long-term warming. Ts10 loggers in all plots. (Niki, Ivan, Bjarni)
Temperature mapping of the recently warmed FN (Bjarni, Edda)	N2O/CH4 fluxes in FN and GN (Marja)	75 new permanent plots – 25 in FN, GN and GO (Niki/Elín)
Tree growth (Armando & Bjarni)	Soil respiration in FN (Bjarni)	Soil nematodes (Krassimira)
Fine roots/mycorrhiza (Ella, Kesera & Edda)	Soil bacteria and fungi in FN/GN (James, Håkan, Erland)	More N2O/CH4 in FN, GN, GO (Marja/Heli)
Litter bags (Edda & Helena).	Niki starts her PhD with Ivan/Bjarni	More soil fungi (Håkan/Magnus)
		Tree roots (Ivika /Kaarin)
		Carbon and nutrient stocks, NDVI, plant traits, PRS-probes (Niki/Katherine/Lieven)

2014. Site manager = Niki	2015. Site manager = Niki
Leiden ForHot meeting, NL, Feb 2014	Only local ForHot meeting, April 2015
The ForHot Database created	Winter CO2/N2O/CH4 flux in GN (Hans/Brynhildur)
Niki added „F“ plots and Ts20	Minirrhizotron tubes installed GN/GO/N(T) (Steven)
Per installed lysimeters in all.	Litter bags in GN/GO/NT (Steven)
Bjarni et al. installed 3 scaffolding towers in FN.	Laboratory incubations on GN/GO soils (Sara M)
FN. Growth, photosynth. / Rs in FN (Hanna/Agnes)	TBI from FN, GN, GO, NT (Bjarni)
FN. MSc student from Peter in FN	Lysimeters installed in NT – sampled in all.
FN. Italian BSc. student (litter fall, phenol.)	Vegetation composition in GN/GO (Wendelien).
FN/GN/GO: More N2O/CH4 (Marja+Heli)	NPP in GN/GO/NT (Stephanie)
TBI in FN, GN and GO (Bjarni).	M.Sc. on soil microbes in GN, GO and NT (Dajana)
Three NEE camp. In FN, GN, GO (Bjarni)	PFLAs for soil fungi and microbes (Håkan & Liu)
FN, GN, GO. Soil fungi and microbes (Håkan et al.)	CUE, NUE of soil microbes in GO (Andreas&Tom)
Niki worked hard: C and N stocks, 3 x PRS, NDVI	Anne D. 3 transects at GO for NO3 oxid. bacteria
Soil pH in water/KCl and grain size distribution in all plots of GN, GO, FN (Niki)	Niki, Steven NDVI, NEE of GN/GO/N(T) and sampled lysimeters in FN, GN, GO, N(T)
DNA on fungi in GN and GO (Erik)	Litter bags installed in FN (Edda)
Soil fauna in FN, GN, GO in Oct (Martin).	Martin sampled springtails for genetic studies
First suction of soil water from FN, GN, GO in late Oct (Niki)	Steven put down ingrowth bags, litter bags and root nets in GN, GO, N(T)
Christopher Poeplau (SLU) cored GN in Dec. for OM fractionation.	FN: 3 campaigns of NEE, pheno., growth, C/N in 4 soil layers (2014) (Bjarni)
Steven Dauwe starts his PhD.	Litterfall in FN analysed (2013-2014)
Steven added 30 N-addition plots	FN. Root ingrowth bags in FN (Edda)
Minirrhizotron tubes installed FN (Edda)	Josep & Jordi – Metabolic state biomarkers in GN, GO, NT

### **3. To-do list in the last two minutes (2014/2015) revisited**

- 2015. FN, GN, GO: The ForHot database has not been updated as planned.
- 2015. FN: Root biomass and bulk density not yet analysed on 2014 samples as planned
- 2015. FN: Brynhildur did not do gas exchange measurements as planned due to interment failure.
- 2015. FN, GN: Elín did not finish her M.Sc. thesis as planned
- 2015. FN: Edda did not do repeated measurements on the mini-rhyzotrons as planned (did one)
- 2014. Bjarni has not added keyword-protected page to the ForHot homepage; instead he will make a drop-box.
- 2014. Not yet put gps coordinates of all permanent plots into the ForHot database.
- Everything else was more-or-less done as planned in the 2014 and 2015 minutes.

### **4. Recent project news**

- i) Bryndís Marteinsdóttir (Univ. Iceland) was accepted as a new a ForHot participant
- ii) James has now got an ass. professorship at VU Univ. in Amsterdam
- iii) The application to Icel. Research Council is still pending (1 PhD on the FN + site manager)
- iv) Bjarni/ForHot is participating in a H2020 application (EXPLORES) which is led by Claus Beier.
- v) An application to the Nordic SNS for a Nordic ForHot network was not successful

### **5. The ForHot business meeting (project plan for 2016-2017)**

- Everybody accepted that pdfs of the talks would be made available to all participants in a dropbox folder.
- Niki Leblans will defend her PhD in Iceland in October 2016.
  - will come to Iceland in March – maybe come again later to write
- Wendelien, Stephanie, Dajana and Anna will all finish their M.Sc. thesis in June/July.

#### Field-work related plans/comments:

- No site manager fixed yet for 2016 – but will be hired by Bjarni (summer).
- Steven will come for three or four 6 week stays during 2016 to work on his experiments.
- Intensive field campaign in late July: Steven/Jenny + student + Ivan and Cindy for pulse labelling experiment in NT (3 temps (+0, +5, +10) and up to 5 repl).
- Anna (MSc student) will come for 1-2 weeks in April/May to work on lysimeters
- Marja + NN comes for a week in July to work on gaseous isotopic sampling.
- Ivika will come in September for doing root-work in FN (focussing on root phenology)
- Ivika has in Estonia equipment to measure N<sub>2</sub> emissions from soil cores. She was encouraged to do that on ForHot cores.
- Ivika also has equipment to measure root exudates from living tree roots in the field. She plans to do this in FN in September, with a pilot study in the A and E plots.

- Bryndís will start some pilot studies on plant phenology etc at GN/GO
- Håkan will come in middle of July for sampling ingrowth bags in GN and GO (= 2<sup>nd</sup> uptake of 4)
- Håkan will come in middle of July for sampling geotide bags in GN and FN (=last uptake)
- Thomas will look for a student at SLU to sample GO for a similar fractionation study as done at GN.
- Martin aims to start lab-studies on isolated springtails from the ForHot sites.
- Peter will look for the FN shoot/stem samples taken in 2014 for TNC analysis and get them analysed → Andreas made the comment that what was needed is to do TNC analyses of roots. Peter will look for those also, or Bjarni will take new ones now in the late winter.
- Per is planning to add an incubation study on the FN soil + maybe look at <sup>14</sup>C fractionation. Not fully decided yet.
- Andreas is thinking of measuring CUE in GN, and of measuring gross mineralization processes of N and P. However, no fixed plans have been made yet.
- Andreas will get 12 samples from GO analysed for “total soil DNA” (don’t remember the name of the technique; but it also gives the soil fauna...). Encouraged the other ForHot partners to sponsor doing the same for 12 samples from GN.
- General comment: More winter-process measurements are needed from the sites if we are to fully understand what is happening.
  - Microbial biomass in winter especially needed.
  - Flux measurements
  - Root stocks
- Andreas suggested that we will organize a joint field-campaign where all will be invited to come and do different measurements at the same time.
- The minirhizotron tubes in FN are ready to be sampled. Anyone who has an interested student or time is very welcome to work with them (in cooperation with Edda).
- Steven will measure *in situ* pH of all permanent plots

#### Isotope studies:

- Already done:
  - Marja: <sup>13</sup>C in CO<sub>2</sub>, CH<sub>4</sub> emissions and <sup>15</sup>N of N<sub>2</sub>O of GN and FN
  - Thomas: <sup>13</sup>C in soil fractions of GN
  - Hakan: <sup>13</sup>C in bulk soil of GN and GO
  - Andreas: <sup>13</sup>C and <sup>15</sup>N in bulk soil of GO
- Planned (fixed):
  - Marja: <sup>13</sup>C in CO<sub>2</sub> and CH<sub>4</sub> emissions and <sup>15</sup>N of N<sub>2</sub>O of GN, GO and FN (summer 2016), as well as <sup>13</sup>C and <sup>15</sup>N of a certain plant species (*Agrostis stolonifera?*).
  - Steven: pulse <sup>13</sup>C labelling study in GN (summer 2016)  
!!! Steven will clearly mark the labelled plots, as the label will influence the isotope ratio’s for a long time and as it can spread belowground to the near surroundings !!!
  - Per: <sup>15</sup>N in DON in FN (Summer 2016)

- Steven: Another pulse  $^{13}\text{C}$  labelling study in N-addition plots (summer 2017)  
!!! Steven will clearly mark the labelled plots!!!
- Planed (not fixed yet)
  - Ivan:  $^{15}\text{N}$  in  $\text{NO}_3$  and  $\text{NH}_4$

**Other issues:**

- The ForHot database will be updated now in the spring. Bjarni will send out requests for data inputs.
- It would be helpful to create a database with papers on other geothermal ecosystem studies.
- Discussed that modelling efforts should now be added to the ForHot consortium.
  - Andreas proposes to lead this. For the soil part, he has contacts.
  - Peter has modelling group, but has no people available at this moment.
  - Ivan suggests to involve Bertrand Geunet from the French National Centre for Scientific Research (Paris)
  - The Oak ridge group is doing similar research and could be of help
- How to estimate the temperature data of the old plots (mainly for James, Hakan and Marja):  
As the temperature increase is sufficiently constant throughout the year, the temperature increase of the in situ measurements can be used.
- More information on soil water status should be obtained
  - Moisture measurements should be calibrated for BD and C content
  - Data of conservative ions (e.g. Cl) can be used as a support against drought at high T
  - Stomatal conductance data can be used as a support against drought at high T
- Planned Monolite transplant experiment  
Ivan is planning a monolite transplant experiment (transplanting monoliths from normal soil temperature to increased soil temperature) to study C and N dynamics during the first years after warming.  
(Application for this experiment is submitted)
  - It would be great to measure *everything* in these monoliths. If the project is funded, everyone is very welcome to join in with their own research money.
  - The size of the monoliths, replication, ... will be discussed if the project is funded.
  - Ivan suggest to apply aboveground warming to a part of the monoliths, to disentangle the soil- and air warming effects. This could be done with IR heaters (practically very difficult) or open top chambers.
- Threshold discussion
  - Few measurement points around threshold  $\sim +10^\circ\text{C}$
  - Focus: not on exact location of threshold
  - Focus: likelihood that a process crosses the threshold under current climate predictions
- Warming time in GO:

- Hotspots at least 50 years at the same location (but intensity might have changed)
- Icelandic geologist will check his data from the 1960's
- Cindy will investigate the depth profile (a shift of 15°C will be visible in the lipids)
- Supports for long-term warming in GO:
  - Microbial community seems to shift from GN to GO (based on measurements in 2012 and 2015)
  - Many communities / processes show a stronger response in GN than in GO (→ adaptation?)

#### **Funding plans:**

- Ivan submitted a new PhD application this week to FWO for a new project to close the N-cycle at the GN/GO sites + to do a transplant monolith experiment.
- Bjarni will consider to initiate a COST Action application (Jan 2017)
- Bjarni will consider to re-submit a changed ITN application after new year.
  - All suggestions on how to involve business partners from industry are welcome
- Per and Bjarni will apply again for Nordic Network funding
- Share proposals for PhD and Postdoc fellowships (e.g. Marie Curie)

*It would be appreciated if you could notify Bjarni if there are some additional measurements planned within ForHot in 2016-2017 that are not listed here.*

## **6. The planned ForHot publications in 2016-2017**

We made a list of 12 publications that all will be submitted in 2016. Participants agreed to that at the next ForHot meeting the first three papers/authors that will be published this year will each receive a bottle of good red wine that the other authors will buy.

1. Bjarni D. Sigurdsson et al. (2016). The methodological paper on ForHot
2. Niki Leblans et al. (2016) The SOC paper on GN/GO.
3. Marja Maljanen et al. (2016) The N<sub>2</sub>O/CH<sub>4</sub> fluxes from FN, GN, GO
4. Christopher Poeplau et al. (2016) The
5. Niki Leblans et al. (2016) The phenology and NDVI paper on GN/GO
6. James Weedon, Erland Bååth et al. (2016) The soil bacteria growth and composition at FN/GN
7. Håkan Wallander et al. (2016). The fungi in FN
8. Sara Maranon et al. (2016). Soil incubation study from GN and GO
9. Kaarin Parts et al. (2016). Morphological adaptations in tree roots at FN
10. Josep Peñuelas et al. (2016). RNA/DNA and metabolomics in GN and GO
11. Cindy De Jonge et al. (2016) Soil lipids.
12. Martin Holmstrup, Krassi, et al. (2016). Soil fauna in FN, GN, GO

Papers that will be submitted in early 2017 include:

13. Maljanen et al. (2017). Geothermal sources of <sup>13</sup>C and <sup>16</sup>N fluxes with CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> fluxes from FN, GN and GO.
14. Erland Bååth et al. (2017)
15. Tom Walker et al. (2017) CUE of GO microbes
16. Liu et al. (2017) PFLAs, OM spectroscopy and enzymatic responses in GN and GO
17. Steven Dauwe et al. (2017) Plant community responses to warming in GO and GN
18. Sara Maranon et al. (2017) C, N, P additions to soil incubation experiments in GN GO.
19. Sigurdsson et al. (2017). Tree growth, production and phenology in FN
20. Håkan Wallander et al. (2016). The fungi in GN and GO

## ***7. ForHot related publications already out***

Four papers that address ForHot in some way or give some results

1. O’Gorman, E., Benstead ... Sigurdsson, B. D., Woodward, G. (2014). Climate change and geothermal ecosystems: natural laboratories, sentinel systems, and future refugia. *Global Change Biology*, 20(11), 3291–3299. doi:doi:10.1111/gcb.12602
2. **[linked]** De Boeck, Hans J., Vicca, Sara, . . . Beier, Claus. (2015). Global change experiments: challenges and opportunities. *Bioscience*, 65(9), 922-931. doi:10.1093/biosci/biv099.
3. **[linked]** Kayler, Z.E., De Boeck, Hans J. . . Dukes, Jeffrey S. (2015). Experiments to confront the environmental extremes of climate change. *Frontiers in Ecology and the Environment*, 13(4), 219-225. doi:10.1890/140174
4. Sigurdsson, B. D., Leblans, N., Oddsdottir, E. S., Maljanen, M., & Janssens, I. A. (2014). Effects of geothermal soil warming on soil carbon and nutrient processes in a Sitka spruce plantation. *Working Papers of the Finnish Forest Research Institute*, 316, 11-13 (Extended abstract from a conference).

Five theses have come out of ForHot so far.

1. André, Hanna, & Bondesson, Agnes (2014). Hur en ökad marktemperatur påverkar fotosyntes och markrespiration i en boreal skog [How increased soil temperature affects photosynthesis and soil respiration in a boreal forest]. (Candidate thesis), Swedish University of Agricultural Sciences, Uppsala, Sweden. (Examensarbeten, Institutionen för mark och miljö, SLU, 2014:12)
2. Cilio, Damiano. (2014). Influenza di un gradiente geotermico di recente comparsa su un imboschimento di *Picea sitchensis*. Il singolare caso di Reykir, Islanda. (Corso di Laurea in Scienze Ambientali e Forestali), University of Florence, Italy.
3. Michielsen, Lieven. (2014). Plant communities and global change: adaptation by changes in present species composition or adaptation in plant traits. A case study in Iceland. (M.Sc. thesis), University of Antwerp, Antwerp.



4. Thoen, Ella. (2011). ECM fungi along a geothermal temperature elevation gradient in a *Picea sitchensis* forest stand in Iceland. (B.Sc. thesis), University of Iceland, Reykjavik.
5. Vande Velde, Katherine. (2014). Effects of short-term and long-term natural soil warming gradients on plant productivity, carbon and nitrogen stocks of a sub-arctic grassland. (M.Sc. thesis), Universtiy of Antwerp, Antwerp, Belgium.

Six other publications in Icelandic or publications from other projects in Grændalur (GO).

1. Oddsdóttir, Edda Sigurdís, & Sigurðsson, Bjarni Diðrik. (2012). Jarðhitaskógurinn - ForHot: Nýtt samstarfsverkefni á sviði skógvistfræði. Ársrit Skógræktar ríkisins, 2011, 16-19.
2. Guðmundsdóttir, Elín, Óskarsson, Ú., & Elmarsdóttir, Á. (2014). Áhrif af hlýnun jarðvegs á gróðurfar í skóglendi og graslendi á Reykjum, Ölfusi. [Effects of geothermal warming on forest and grassland flora at Reykir, Ölfus] Rit Mógilsár, 31/2014, 73-80. (in Icelandic).
3. **[linked]** Daebeler, Anne. (2014). Archaeal ammonia oxidation in volcanic grassland soils of Iceland: Effects of temperature and N availability on processes and organisms. (PhD thesis), Utrecht University, Utrecht, the Netherlands.
4. [Linked] Daebeler, Anne, Abell, Guy CJ, ...Hefting, Mariet M, & Laanbroek, Hendrikus J. (2012). Archaeal dominated ammonia-oxidizing communities in Icelandic grassland soils are moderately affected by long-term N fertilization and geothermal heating. *Frontiers in Microbiology*, 3(352). doi: 10.3389/fmicb.2012.00352).
5. [Linked] Daebeler, A., Bodelier, P. L. E., Yan, Z., Hefting, M. M., Jia, Z., & Laanbroek, H. J. (2014). Interactions between Thaumarchaea, Nitrospira and methanotrophs modulate autotrophic nitrification in volcanic grassland soil. *ISME J*, 8(12), 2397-2410. doi:10.1038/ismej.2014.81
6. [Linked] Daebeler, A., Bodelier, P. L. E., Hefting, M. M., & Laanbroek, H. J. (2015). Ammonia-limited conditions cause of Thaumarchaeal dominance in volcanic grassland soil. *FEMS Microbiology Ecology*, 91(3). doi:10.1093/femsec/fiv014

### ***Other issues / decisions***

1. It was discussed during the last day that such ForHot workshops should be repeated annually; no question about how beneficial this one was for all participants.
- 2) Method Article (Bjarni) to introduce geothermal warming studies
  - Use temperature as driver
  - Show primary response variables (pH, BD, WHC, soil structure, ...)

Show secondary response variables (TBI study with k-value, ...), but only findings that can be explained in one paragraph

- Make schematic picture of the mechanism, with focus on the physical responses
- Keep it strictly empirical OR use a simple model to see what happened in the first year
- Presentation temperature data
  - Show 'raw' temperature graph (T data throughout the years)
  - Or graph of temperature increase (T increase throughout the years)  
This shows more clearly the lack of seasonal influence on the T increase
  - Add extra information on table (T extremes, ...)
  - Add depth profile
  - Show lack of air warming
  - share (T) data so people can choose what they want
- Presentation moisture data
  - Search wilting point & WHC of soils  
(Andreas has WHC GO; Sara M. has WHC GN)
  - Add data on conservative ions (e.g. Cl)
- Presentation pH data
  - Use KCl method
- Presentation contamination with geothermal water
  - Per: No increase in  $\text{SO}_4\text{-S}$  in soil water
  - Marja: No increase in S in bulk soil
- Add paragraph 'how to avoid overextrapolation' (What can we do/what can't we do)
  - + natural system
  - - decoupling aboveground & belowground
  - - small climate variation
  - - andosol
- Where to publish?
  - Should be freely available
  - Frontiers in biological sciences?
  - Biogeosciences?
  - Icelandic agricultural sciences?
  - Soils

Meeting ended at 10-03-2016 at 13:00.