MINUTES

FORHOT – 6th formal project meeting at University of Vienna, Austria

and from a following workshop entitled "Joint Ecosystem Assessment on the Effects of Natural Soil Warming on Subarctic Grasslands and Forests"" 12-15 March, 2017

				
Austria	Belgium	Finland	Sweden	Iceland
1. Andreas Richter	7. Ivan Janssens	13. Marja Maljanen	16. Håkan	22. Bjarni
			Wallander	Sigurdsson
2. Michael Bahn	8. Erik Verbruggen	Germany	17 Alf Ekblad	23. Edda
				Oddsdottir
3. Hans Sandén	9. Niki Leblans	14. Christopher	18. Thomas	24. Bryndis
		Poeplau	Kätterer	Marteinsdottir
4. Anne Daebeler	10. Dajana		19. Jing Zhang	25. Pall Sigurdsson
	Radujkovic			
Denmark	Estonia	Switzerland	Spain	26. Alice Liana
5. Martin	11. lvika Ostonen	15. Tom Walker	20. Josep Penuelas	27. Gunnhildur
Holmstrup				Gunnarsdottir
6. Per Gundersen	12. Martin		21. Sara Marañón	28. Nia Perron
	Maddison		Jiménez	

Attending: Altogether 28 ForHot participants attended the meeting:



Figure. Some of the ForHot participants in Vienna

Agenda

- 1. ForHot project and participant overview
- 2. ForHot's main happenings in the past year (Mar 2016 Mar 2017)
- 3. Project outputs since the Antwerp ForHot meeting: Theses, papers and new funding.
- 4. The mini-conference on recent findings in ForHot
- 5. Next steps in field research at ForHot (ForHot business meeting)
 - i. Infrastructure/measurements needed
 - ii. New measurements decided now.
 - iii. Action plan for 2017 season
- 6. Publications planned for 2017-2018
- 7. The ForHot database
- 8. Ivan's session about potential overview articles(s) from ForHot
- 9. Michael Bahn's and Sara Maranon's new projects
- 10. Andreas Richter's session about microbial ecology
- 11. New experiment on seasonal changes at GN 2017-2018
- 12. Other issues/decisions

1. ForHot project status overview 2016-2017

The list of participants of the ForHot project during 2012-2017. Researchers active in 2016/2017 are in **bold/black**, but those not active are in normal/black. Students who are still active in 2017 are in **bold/BLUE**; students who have finished are in normal/RED:

Agric. Univ. of Iceland	Lund University		
 Prof. Bjarni D. Sigurdsson (coord.) 	Prof. Håkan Wallander		
Gunnhildur E. G. Gunnarsdottir (research ass.)	Prof. Erland Bååth		
Páll Sigurðsson (Ph.D. student / Site manager)	• Jing Zang (PhD student 2017)		
• Alice L. Sarolta Cosatti (internship student 2017)	Dr. Zhanfeng Liu (Postdoc 2016)		
Julia Bischof (internship student 2017)	Dr. Magnus Ellström (Ph.D. student 2012)		
Elín Guðmundsdóttir (M.Sc. student 2013-)	Dr. Stephanie Reischke (Ph.D. student 2012)		
• Damiano Cilio (B.S. student from Italy 2014).	Swedish Univ. Agric. Sci. (SLU)		
Dr. Úlfur Óskarsson	Prof. Thomas Kätterer		
Icelandic Forest Research – Mogilsa	Dr. Christopher Poeplau (Post-doc)		
Dr. Edda S. Oddsdóttir	Dr. Monika Strömgren		
Icelandic Inst. Nat. Hist	Hanna André (B.S. student from SLU 2014)		
M.Sc. Ásrún Elmarsdóttir	• Agnes Bondesson (B.S. student from SLU 2014)		
Univ. Akureyri	Örebro Univ		
Dr. Brynhildur Bjarnadóttir	Prof. Alf Ekblad		

Univ.of Iceland	Univ. of Tartu, Estonia		
Dr. Bryndís Marteinsdóttir	Prof. Ivika Ostonen		
Nia Perron (M.Sc. student 2016-)	Dr. Martin Maddison		
Ella Thoen (B.Sc. student 2011-2012)	Kaarin Parts (Ph.D. student 2014-)		
Univ. of Antwerp - Belgium	Copenhagen Univ Denmark		
Prof. Ivan Janssens	Prof. Per Gundersen		
Prof. Erik Verbruggen	Anna Theresa Edlinger (M.Sc. student 2016)		
Dr. Niki Leblans (Post doc)	Aarhus Univ Denmark		
Dr. Sara Vicca (Post-doc)	Prof. Martin Holmstrup		
Dr. Jennifer Soong (Post-doc)	Univ. of Vienna - Austria		
Dr. Cindy De Jonge (Post-doc)	Prof. Andreas Richter		
Mattias Janssens (job student 2016)	Dr. Tom Walker (post-doc)		
Elien de Schutter (job student 2016)	Judith Prommer (PhD student 2017)		
Niki Leblans (PhD student 2012-2016)	Dr. Anne Daebeleer (post-doc)		
Steven Dauwe (PhD student 2015-2016)	Univ. of Innsbruck - Austria		
Wendelien Meynzer (M.Sc. student 2014-)	Prof. Michael Bahn (2016)		
Dajana Radujkovic (M.Sc. student 2014-2016)	BOKU - Austria		
Stephanie Van Loock (M.Sc. student 2014-2016)	Dr. Hans Sandén		
Katherine Vande Velde (M.Sc. student 2014-2015)	Christoph Rosinger (PhD student 2016-2017)		
Lieven Michielsen (M.Sc. student 2014-2015)	METLA - Finland		
Thünen Institute - Germany	Prof. Leena Finér		
Dr. Christopher Poeplau	Universitat Autònom a de Barcelona (UAB), Spain		
Basel University, Switzerland	Prof. Josep Peñuelas		
Prof. Christian Körner	Dr. Jordi Sardans		
 Dr. Armando Lenz (PhD student 2011-2012) 	Albert Gargallo (post-doc)		
Cardinal Stefan Wyszynski Univ., Poland	Dr. Mireia Bartrons (post-doc)		
Dr. Krassimira Ilieva-Makulec	 Dr. Sara Marañón Jiménez (Post-doc 2018) 		
Vrije Univerity, Amsterdam, NL	Marta Ayala Roque (M.Sc. student 2016)		
Ass. prof. James T. Weedon			
Benjamin Hearn (M.Sc. student 2014-2015)	In total active in 2016-2017:		
Leiden Univ., NL	30 researchers or postdocs		
Prof. Peter van Bodegom	18 graduate, MS and PhD students		
Univ. Eastern Finland			
Dr. Marja Maljanen			
Prof. Christina Biasi			
Heli Yli-Moijala (M.Sc. student 2012-)			

2. ForHot's main happenings Mar 2016 - Mar 2017

- ForHot meeting, Antwerp, March
- We got funding from the Icel. Res. Council, starting 1st of June 2016 to start "a new" 3-year project Forhot-Forest (2016-2019). So finally we have some real budget for the ForHot project in Iceland! The budget includes 50% research assistant (Gunnhildur) and 100% PhD student (Páll).

Fieldwork: May-Sep 2016

- Gunnhildur, site man. / Sep-Dec Pall, site man.
 - NDVI biweekly (+ThetaProbe) (FN, GN, GO, NT)
 - Soil leachates monthly (FN, GN, GO, NT)
 - Tree phenology + dendromeeters weekly
 - LAImax campaign in Aug: GN, GO, NT, FN
 - C/N soil inventory 2013 analysed and finished (from Niki)
- Steven: April July Oct: NT + GN/GO fertilization, litter bags, ingrowth babs...
- April: Anna Theresa Edlinger (DK) MSc.
- June...: Bryndis Marteinsdottir initiated a M.Sc. Project (Nia Perron) on the ForHot grasslands (GN and GO)
- July 10-17. Marja Maljanen from Univ. of Eastern Finland came and did CO2 flux measurements and 13C isotope sampling from air at FN.
- July 13-17. Håkan Wallander, Alf Ekblad, et al. retrived mesh-bags after one year incubation at the ForHot Forest (FN) and Grassland sites (GN, GO).
- July 14-16. Prof. Andreas Richter and Judith Prommer came and sampled soil in GN and GO for a metatranscriptome study.
- July 20 Aug 5, Steven Dauwe, Jennifer Soong, Cindy De Jonge, Mattias Janssens and Elien de Schutter did a 13C pulse-labelling campaign in the GN experiment. Cindy also took soil samples at GO and GN for soil lipid analysis.
- Aug 11-14. Martin Maddison from Univ. of Tartu, (STMS). Soil samples from FN, GN and GO for N2 emission measurements.
- Andreas
- Sept 12-16. Ivika Ostonen from Univ. of Tartu made in situ measurements of root exudation at A and D plots in FN.
- Oct 12, Krassimira Ilieva-Makulec sampled FN, GN and GO again for further studies on changes in soil microfauna.
- Nov 14. Project meeting at AUI between BE and IS participants.
- Nov 14. Niki defended a PhD thesis at AUI/UA => ½ from ForHot
- Dec 31. Steven terminates his PhD Niki starts a post doc.

2017

- Jan 2017. Pall makes his first mini-rhyzotron campaign at FN
- Feb 2017. Pall took root cores at A and D plots at FN and went to Estonia on an STSM
- March 2017. Pall/Bjarni sampled FN shoots for chemical analysis.
- 13-15 March 2017 = the 6th General Project meeting at Univ. Vienna.

3. Project outputs since the Antwerp ForHot meeting in 2016

Papers:

2016

1. **JOURNAL PAPER:** Sigurdsson, Leblans, et al. (2016). Geothermal ecosystems as natural climate change experiments: the ForHot research site in Iceland as a case study. *Icelandic Agricultural Sciences*. Link:

http://www.ias.is/landbunadur/wgsamvef.nsf/Attachment/IAS%202016%205%20Sigurdsson%20et%20al%2053-71/\$file/IAS%202016%205%20Sigurdsson%20et%20al%2053-71.pdf

2017

- JOURNAL PAPER: Marja Maljanen, Heli Yli-Moijala, Christina Biasi, Niki I. W. Leblans, Hans J. De Boeck, Brynhildur Bjarnadóttir, Bjarni D. Sigurdsson. The emissions of nitrous oxide and methane from natural soil temperature gradients in a volcanic area in southwest Iceland. Soil Biology and Biochemistry. Link: <u>http://ac.els-cdn.com/S003807171730130X/1-s2.0-</u> <u>S003807171730130X-main.pdf? tid=8250730e-0c7f-11e7-8651-</u> <u>00000aacb35f&acdnat=1489912924 1bb36d76fdf70075a19686935a2fea42</u>
- JOURNAL PAPER: Poeplau, Christopher, Kätterer, Thomas, Leblans, Niki I. W., & Sigurdsson, Bjarni D. (2016). Sensitivity of soil carbon fractions and their specific stabilisation mechanisms to extreme soil warming in a subarctic grassland. *Global Change Biology*, Link: <u>http://onlinelibrary.wiley.com/doi/10.1111/gcb.13491/epdf</u>

Theses

2016

- THESIS: Leblans, Niki I. W. (2016). <u>Natural gradients in temperature and nitrogen: Iceland</u> represents a unique environment to clarify longterm global change effects on carbon dynamics. Joint PhD thesis between Agricultural University of Iceland and University of Antwerp. Defended on Novemer 14, 2016, Agric. Univ. Iceland, Reykjavik, Iceland.
- THESIS: Roque, Marta Ayala. (2016). <u>Impact of soil warming on the plant metabolome of</u> <u>Icelandic grassland</u>. (M.Sc. thesis), Master in Industrial Chemistry and Introduction to Chemical Research). UAB - Universitat Autonoma de Barcelona, Barcelona, Spain.
- 3. THESIS: Edlinger, Anna Theresa. (2016). <u>Changes of belowground processes of the carbon and nitrogen cycle in response to soil warming. Will global warming increase the turnover of soil C and N above plant demands and lead to increased leaching losses (M.Sc. thesis), Copenhagen University, Denmark & University of Natural Resources and Applied Sciences (BOKU), Austria. Defended on September 4, 2016, Univ. Copenhagen, Copenhagen, Denmark.</u>
- THESIS: Dajana Radujkovic. (2016). <u>Structure of soil microbial communities along a geothermal</u> <u>gradient in Iceland</u>. (M.Sc. thesis). Defended in June 2016. Faculty of Science, Department of Biology, Unviersity of Antwerp, Belgium.

2017

 THESIS: Van Loock, Stephanie. (2017). Short-trem and long-term changes in vegetation and biomass in response to natural soil warming and nitrogen availability in a subarctic grassland. (M.Sc. thesis). Unviersity of Antwerp, Belgium. 49 p.

New ForHot-related projects:

- i. **Dec 2016.** A new ForHot-related project got funded! Univ. of Antwerp (PI: Ivan Janssens) and Univ. of Innsbruck (PI: Micael Bahn) got a new 3-year project funded, where part of the field research will take place at the ForHot Grasslands (GN and GO) in Iceland. The name of the project is: "*Plant-soil carbon responses to warming and nitrogen: Plant carbon allocation as a mediator of soil carbon dynamics under warming and increasing nitrogen availability*".
- ii. Jan 2017. A new ForHot-related Marie-Curie post-doc (Sara Maranon)"StoiCa Resilience of Soil Stoichiometry in subartic soils under Temperature Induced Soil Carbon Losses: Where does the N go?"

4. The mini-conference on recent findings in ForHot

Pdfs from all the talks is available on a closed dropbox folder (address sent to participants by e-mail)

5. Next steps in field research at ForHot (ForHot business meeting)

i) Points about improvements of the ForHot infrastructure or data – basic knowledge

- More modelling needed.
- More information about the geothermal effect (different gases + 13C)
 - Bjarni will try to involve geologists from IS with geogases + get better info about geological CO2 emissions (and 13CO2)
- Andreas Richter would like that we would arrange a ForHot workshop(s) in Iceland where the group could come together and make measurements on a reduced design of plots.
- Ivan Janssens, Michael Bahn, Andreas Richter et al. Aboveground warming would be a very interesting addition to ForHot! Even if it was only done in A (control). IR-lamps would be needed to reach +3 or +6 °C.
 - **NOTE:** This should be a new research funding applications
- Martin Holmstrup, Michael Bahn et al. Automatic Ts measurements at 5 cm depth would be very good for some surface processes
 - **NOTE:** This should be added to any new research funding applications
- Michael Bahn: Automatic soil humidity loggers (at least few in each experiment) would also be very helpful.

- NOTE: This should be added to any new research funding applications
- Andreas Richter: Having soil CO2 concentrations at different depths would be good.
 - **NOTE:** This should be added to any new research funding applications
- Michael Bahn: Some automatic CO2 exchange measurements would be very helpful to understand the systems.
 - **NOTE:** This should be added to any new research funding applications
- Check if 15N analysis is still missing for soil in GO
 - **Per Gundersen** could get that analysed if we would send samples to him
- Ivan Janssens and all participants during his discussion session:

Data we need	GO	GN	FN
CEC	х	х	х
BS	x	х	х
Mineralogy	x	х	x
FTIR	x		х
Pyr.GCMS	x	x	х
Hydrology	x	х	x

- **Ivan Janssens** pointed out that better knowledge in soil physical properties is needed. Involve Icelandic soil scientist?
 - o pF curves
- Alf Ekblad, Bryndís et al.: How important is the grazing for ecosystem responses at GN/GO do an artificial (clipping) grazing experiment.
 - 0
- **Per Gundersen** wants to do something about the hydrology.
- Christopher Poeplau wants to resample GN after ca. 5 years to follow the changes.

ii) Additional measurements decided now

- **Bjarni** will take air samples a.s.a.p. this winter from nearby geothermal CO2 efflux spots for 13C analysis and send to **Andi**.
- Alf Ekblad could come and do one campaign on 12CO2 and 13CO2 with his Picarro to check on geothermal CO2 mixing.
 - **Bjarni** will try to find funding for this activity for spring 2017.
- **Niki** will send plant samples from GN and GO to Andi, who will get 13C and 15N analysed. This will help with determining if the geothermal CO2 outgassing is a problem or not!
- Andreas will ask Christina Kaiser if the microbial model used in his and Tom's manuscript can be rerun with gradual warming instead of stepwise-warming.

iii) Action plan for the 2017 summer field season

AUI (Iceland):

- Pall Sigurdsson will be site manager Mar 2016-Mar 2017.
- Jun-Aug/Sept: Alice Liana Sarolta Cosatti and Julia Bischof internships

• Gunnhildur ca. 40%

Field mesurements

- Every 3 weeks: March-March: Pall/NN minirhyzotron campaign FN
- March/April: Pall/Bjarni make 4th forest inventory at FN
- Weekly April-Sept: FN dendro/pheno (Pall/NN)
- Every 3 weeks April-Oct: NDVI-Theta probe (Gunnhildur/Pall/NN)
- June/July: Fertilization 2 and 3 of 3 of NT (Pall/NN)
- Edda et al. will finish the FN root ingrowth-bag study + the needle/root litter study.
- **Bryndís** will submit a post-doc application to Icel. Res. Council to continue and extend the plant phenology and fitness project in 2018-2019 at GO and Hengill.
- Bryndís will study plant phenology and fitness in Hengill and GO from May –August 2017
- **Bryndís** is interested to continue with the monitoring of the vegetation inside and outside the grazing enclosures at GO, that Vendelin started with in her M.Sc. thesis work.

Belgium:

- April: Niki comes and works on NT project: Fertilzation (1 of 3 of NT); Litter bags taken up...
- June 13-16 Ivan, Jennifer, Michael Bahn, Sara V., Sara M. come to start the new project (see later).
- Harvest of NT plots in late July/early August (Ivan/BE team)
- **Ivan** will get a new PhD student this autumn who can work on minirhyzotron images from GN **Sweden:**

• Jing and Håkan will come during summer to take the last ingrowth bags in FN, GN and GO. Estonia:

- **Ivika** want to make more exudation measurements in FN and get Bjarni to make photosynthesis measurements at the same time.
- Martin Maddeson wants to come again to Iceland and take another batch of samples for incubation measurements. Add NOx measurements in the lab.

Denmark:

- Martin Holmstrup is interested to add sampling and analysis on the Enchytraeids in ForHot.
- Martin Holmstrup will do PFLA/NFLA on his samples.
- **Per Gundersen** has now advertised for a M.Sc. student to work on hydrology of the ForHot experiments in summer 2017.

Germany:

• **Christopher Poeplau** would be interested to get Palli to his lab in Germany with soil samples from FN – and train him in doing a physical fractionation.

It would be appreciated if <u>you</u> could notify Bjarni if there are some additional measurements planned within ForHot in 2017-2018 that are not listed here.

6. Publication plans 2017-2018



We made a list of 21 publications that all will be submitted in 2017.

The following papers have been submitted and should appear before Sept. 2017

- Leblans, Niki, Bjarni D Sigurdsson, Sara Vicca, Yongshuo Fu, Josep Penuelas, Ivan Janssens (2017). Phenological responses of Icelandic subarctic grasslands to short-term and long-term natural soil warming. Global Change Biology (submitted in Mar 2017).
- Martin Holmstrup, Bodil Ehlers, Stine Slotsbo, Krassimira Ilieva-Makulec, Bjarni D. Sigurdsson, Niki Leblans, Jacintha Ellers and Matty Berg (2017). Resilience in functional diversity of Collembola subjected to long-term warming. Functional Ecology (submitted Jan 2017)
- Gargallo-Garriga, Albert, Marta Ayala-Roque, Jordi Sardans, Mireia Bartrons, Bjarni D. Sigurdsson, Niki Leblans, Michal Oravec, Otmar Urban, Josep Peñuelas. (2017). Impact of soil warming on the plant metabolome of Icelandic grasslands. Environmental and Experimental Botany (submitted in Dec 2016)

The following papers will be submitted and published before the next ForHot meeting (March 2018).

- Dajana Radujković, Erik Verbruggen, Bjarni D. Sigurdsson, Niki I. W. Leblans, Ivan Janssens, Steven Dauwe, Sara Vicca, James T. Weedon (2017). Prolonged exposure does not increase soil microbial community response to warming along geothermal gradients. XXXXXXX (need to be resubmitted)
- 5. **Niki Leblans** et al. (2017) Large, fast and permanent SOC-losses in naturally warmed Icelandic grasslands. Nature Climate Change (needs to be resubmitted).
- 6. Niki Leblans, et al. (2017) Brief communication in GCB
- 7. **Niki Leblans et al.** (2017) Effect of short-term and long-term soil warming on vegetation composition and traits, GO and GN
- 8. **Marañón-Jiménez S.**, Soong J.L., Leblans N., Sigurdsson B.D., Peñuelas J., Asensio D., Fransen E., Janssens I. A. (2017). Soil warming increases metabolic quotients of soil microorganisms without changes in temperature sensitivity of soil respiration. Soil Biology and Biochemistry (in preb.)
- 9. **Tom Walker, Andreas Richter et al.** Microbial biomass and CUE at GO and in short term incubation study (almost ready)
- 10. James Weedon, Erland Bååth et al. (2017) The soil bacteria growth and composition at FN/GN
- 11. Erland Bååth et al. (2017)
- 12. Håkan Wallander, Edda S. Oddsdottir, et al. (2017). The fungi in FN
- 13. Jing Zang, Håkan Wallander, Liu et al. (2017). The fungi PFLAs, OM spectroscopy and enzymatic responses in GN and GO

- 14. Cindy De Jonge et al. (2017) Soil lipids.
- 15. Kaarin Parts et al. (2017). Morphological adaptations in tree roots at FN
- 16. Marja Maljanen et al. (2017). Geothermal sources of 13C CO2 fluxes from FN.
- 17. Marja Maljanen et al. (2017). Field and Lab fluxes of N-gases (HONO, NO, N2O...) from FN.
- 18. Pall Sigurdsson et al. (2017). Tree growth, production and phenology in FN
- 19. Krassimira (2017) Nematodes in FN, GN and GO in 2014
- 20. Bryndís Marteinsdottir, Nia Perron, et al. (2017). Plant phenology and fitness at Hengill, GN and GO
- 21. Per Gundersen et al. (2017) Leachates from FN, GN and GO 2014-2016

The following papers will be submitted in 2018 (After the ForHot meeting in 2018).

- 1. Tom Walker et al. (2018/2019) ForHot synthesis paper on GN, GO and FN
- 2. Håkan Wallander et al. (2018/2019) FTIR + Pyro fractionation in GN
- 3. Hans Sandén et al. (2018/2019) FN enz responses
- 4. Judith Prommer et al. (2018/2019). Gross N-P mineralization in GN and GO
- 5. Martin Maddison et al. (2018/2019) N2, NOX, CH4, N2O, CO2 incubations from GN, GO and FN
- 6. Niki Leblans et al. (2018) NDVI and aboveground biomass stocks in GN and GO
- 7. Niki Leblans et al. (2018). Effect of short- and long-term soil warming on plant stoichiometry in GN and GO

7. The ForHot Database

The database format was discussed. The ForHot database in almost complete for 2011-2013 – but it has only been partly updated with Icel. + Antwerp data for 2014-2016 data. Bjarni will <u>soon</u> send out requests to all other ForHot participants to send us all missing data.

Line for units - specify how to write the unit

Line for Analytical method

Large datasets, f.ex. data on community composition - normally huge data, just put in

metadata or descriptive parameters so that people know that the data exist and who to contact to get the data.

Clear instructions on how to format: date, decimal, points,

Make a metadatabase of the data we have (not the data itself) available for public.

8. Ivan's session about potential overview articles(s) from ForHot

System integration + year?

Sales point for an overview paper: Resilience & tipping points in ecosystem state and function in response to geothermal warming!

Who :Tom (will lead), Bjarni, Erik, Josep, Ivika, Niki, Ivan, Andreas, Dajana, Edda and Sara M. First try joint analysis + split up between FN and GX

RR / Abs / Relative to mean

Data available at Forhot si	te				
State 1		GO	GN	FN	
Plant community		х	x	x	
	Nematodes	x	x	x	
Invortobrato	Mites	x	x	x	
Invertebrate	Collembola	x	x	x	
	Earthworms	x	x	x	not in all temp
Bacteria / Fungi	NGS	x	x	x	
	PLFA	x	x	x	
Archea		x	-	-	not in all temp
Plant biomass		х	x	x	
Microbial biomass		x	x	x	
Protists		-	-	-	
Metatrans		x	x	-	not in all temp

State 2		GO	GN	FN
Aboveground biomass /				
Stochiometry		х	x	x
Belowground biomass /				
Stochiometry		х	x	x
Microbial biomass /				
Stochiometry		х	x	x
Soil Stochiometry		х	x	x
рН		х	x	x
Bulk Density		х	x	x
Soil fraction		х	x	x
Water holding capacity		х	x	x
Texture analysis		х	x	x
MAT		х	x	x
elements	Base cations	х	x	x
	Mn	х	x	x
Functional metrics		х	x	-

Function		GO	GN	FN	
ANPP		х	x	x	
	Exudates	-	-	x	
BNPP	Roots	-	-	x	
	Mycorrhizal fungi	х	x	x	
Above Ground Dhenelogy	NDVi	x	x	x	
Above Ground Phenology	Cci/Pri	x	x	x	
Metabolomic		x	x	-	
ACI		-	-	x	
RNA/DNA		x	x	-	
A-Herbiv		x	x	-	
Enzyme		x	x	-	
PRS probes / Lysim		х	x	x	
From soil extraction mineral	DOC, N, P	х	x	-	
	green tea	x	x	x	
Decomposition	red tea	x	x	x	
Decomposition	litter	х	x	x	
	Cellulose	х	x	x	old plots
GHG conc		-	-	x	old plots
Micr. Physilogy		x	-	-	
W transform / P		x	x	-	
GPP *		x	x	-	

Other analyses:

Ivika and Erik would also like to analyse how food-webs changed with soil warming in GN, GO and FN

9. Michael Bahn's and Sara Maranon's new projects

Both Micael Bahn and Sara Maranon presented their new projects (see overheads on the Dropbox folder).

Michael Bahn: A new experiment where Ts and N interaction is studied.

New plots? +0, +5, +10 °C, +100 N, +150 N, +100 N/+5C, +150N+10C

WP1: Photosynthesis & exudation

WP2: Labelled litter (Jenny)

WP3: SOM fractions & age (14C)

WP4: Priming effects

WP5: Modelling N:C interactions

Two new PhD students will be hired + Ivan has a new postdoc who will start in Arpil and can do labelling work, etc.

Sara Maranaon (StoiCa): Where did the N go?

WP1: N cycle measurements in the field

WP2: Transplant experiment (transient warming effects)

WP3: Symbiosis (N fix and mycorrhiza)

In a discussion afterwards the following three types of transplant experiments were discussed:



Figure. Three types of transplant experiments: i) Main monolith experiment at GO. ii) Move monolith between GO and GN. iii) Transplant small plant/soil between temperatures to mainly study changes in the microbial community.

Transplant experiment i) Move A soils +1 °C each year for six years or + one set to +3 (D) and leave for 6 years + one set to +6 (E). At the same time move +3 and +6 back to A. Most people were interested in this experiment. It will be developed further in June.

Transplant experiment iii) Erik was interested – collaboration with Håkan and Sara M?

10. Andreas Richter's session about microbial ecology

The participants discussed what is already known for a) C-cycling and b) nutrient cycling (over line)

Plant - microbe N20/N2 produc Microb. biomars microb. commity a ensighe ROTIVI birnses, bect. prez +ep us hour Crayne kinetics N2-fixetion plax

Figure: Known (over the line) and missing info (below the line) about microbial ecology. The missing info includes:

C-cycle:	Nutrient cycles	Plant-microbe interaction
Viruses	N-fixation	E.g. in plant school trials (AD/BM)
Soil fauna/microb	Soil fauna/microb	
Bacterial grazing	Bacterial grazing	
Protozoa	Protozoa	
Food webs	Food webs	
	Gross and net N, P mineralization	ation
	Soil enzymes	
	Functional links (CH4/N2O)	

11. New experiment on seasonal changes at GN and NT in 2017-2018

The participants decided to make a new study on the seasonal changes of microbial biomass and other variables at ForHot.



Figure: Set-up of the experiment. Four intensive sampling occasions (bars) and up to eight standard ones (lines). Black lines indicate microbial biomass in unwarmed conditions. Red lines indicate microbial biomass in +10 °C treatment.

Where:

- A, D and E plots of GN (n=5; total 15 plots each time)
- +0 and +150 kg N plots of NT (n=2; total 10 plots each time)
- Total number of samples
 - Intensive campaigns (4) = 100 samples.
 - Extensive campaigns (up to 12) = up to 300 samples.
- Ca. 25 g DM of soil needed for these analyses.

No of samples	Measurements	Who will analyse	Samples
Up to 12	Sample microbial biomass / stochiometry	Andreas Richter	AUI
Up to 12	Fine-root growth - minirhyzotrons	Ivan's new PhD	AUI
Up to 12	PRS probes – 7 days after	Ivan	AUI
Up to 12	DNA/RNA and other biomarkers	Josep	AUI
Up to 12	Soil humidity, NDVI, LAI	Pall	AUI
4	PFLAs of soil	Håkan	AUI
4	Microbial CUE / growth	Andreas Ricter	AUI
4	Soil enzymatic assays	Hans Sandén	AUI
4	Grazer activity	Martin	AUI
4	15N labelling 3 days before sampling*	Sara M.	AUI
1	13C labelling 3 days before sampling*	Alf Ekblad	AUI

Table. Overview for sampling frequency, parameters measured, who will analyse and who will sample.

* Not possible to do in the FN and NT permanent plots.

- Andreas Richter will come to ForHot in summer of 2017 to start these measurements with the AUI crew. It will probably be initiated in July 2017 (first intensive campaign).
- It will also be discussed/prepared during the June visit of Ivan, Sara et al.

12. Other issues / decisions

- **NEXT ForHot meeting.** Participants wanted to repeat such a meeting next year. Time was decided from afternoon of 5 March to early afternoon of 8 March, 2018. Venue will be fixed by Bjarni who will then be in Barcelona. Location: "a hotel by the beach". Participants wanted the same format; i.e. mini-conference (10+5) and longer discussion sessions.
- New funding applications in 2017-2018
 - Jun 2017. Bryndís Marteinsdóttir will submit a post-doc application to Icel. Res. Council to continue to study plant phenology GO, GN and Hengill
 - Jun 2017. Bryndís Marteinsdóttir will submit an research project application with Bjarni to Icel. Res. Council to add Hengill to the studies of plant communities in ForHot (GO at high elevation to the ForHot project).
 - January 2018: New ITN application for the ForHot project led by Antwerp (Erik Struyf eric.struyf@uantwerpen.be). Topic rather "Soil-microb-plant interaction than CC.
 Private sector involvement crucial.
 - 2018. Alf Ekblad & Håkan Wallander plan to submit application for estimating the turnover time of mycorrhiza (EM, ERM AM) at FN, GN, GO and NT to FORMAS and other Swedish research funds – maybe to turn this into European H2020 application?
- Talks from 2017 meeting. Everybody accepted that pdfs of the talks would be made available to all participants in a dropbox folder.
- **ForHot Meta-database.** Bjarni will continue to update the ClimMani meta-database and notify the ForHot participants about its existence.

- **Contact Marja/Christina.** At the end of the meeting it was discussed that we would contact Marja and Christina and ask them to wait with the submission of the 13C geothermal efflux manuscript from FN until the new samples for background 13C have been analysed (and the results sent to Christina), so they can get better "end members" for geothermal CO2 analysis.
- ForHot in New Zealand? Bjarni has been asked to evaluate a PhD thesis at Auckland University of Technology in NZ about vegetation changes along geothermal temperature gradients.
- **Marja**: wants to add studies on HONO, NO, N2O, CO2 and CH4 from Bjarni's poplar nutrient optimization experiment in S-Iceland.
- **Niki:** Minirhyzotron tubes were inserted into GN and GO in 2015 by Steven Dauwe: Good if somebody could find a student to use them.