German Centre
for Integrative
Biodiversity Research (iDiv),
Halle-Jena-Leipzig
Deutscher Platz 5e
04103 Leipzig, Germany
phone +49 (0)341 97-33103
info@idiv-biodiversity.de
**www.idiv-biodiversity.de**

# sDiv Workshop Summary
## ” sTUNDRA II: Scaling tundra vegetation change from site to biome”
## May 2015

**Summary**

The sTUNDRA II workshop brought the five main sTUNDRA-related project teams together for finalization of analyses and manuscript preparation. Each project focuses on a different aspect of understanding tundra vegetation change at multiple scales in a warming world:

1. Correspondence between satellite and on-the-ground observations of climate-driven tundra greening across the tundra biome
2. Biome-scale patterns in tundra plant traits correspond with warming-induced trait change
3. Linking tundra shrub expansion to carbon storage using decomposition rates and leaf traits
4. Convergence and divergence of flowering times across the Arctic in response to warmer temperatures
5. Spatial modelling of future changes in plant functional traits across the tundra biome

We made substantial progress toward the finalization of these projects, particularly in the core sTUNDRA projects, #1 and #2.

**Contact persons**

Isla H. Myers-Smith
Crew Building, The King’s Buildings
School of GeoSciences, University of Edinburgh
Edinburgh, UK EH9 377
Isla.Myers-Smith@ed.ac.uk

Anne D. Bjorkman
Crew Building, The King’s Buildings
School of GeoSciences, University of Edinburgh
Edinburgh, UK EH9 377
annebj@gmail.com

**Participant List**

| Name | Affiliation | Field of expertise | Professional status |
|---|---|---|---|
| 1. Anne Bjorkman | iDiv (now U of Edinburgh) | Tundra plant ecology | Post-Doc |
| 2. Isla Myers-Smith | University of Edinburgh | Tundra plant ecology | Chancellor's Fellow (Professor, Assistant) |
| 3. Sarah Elmendorf | University of Colorado Boulder & NEON | Tundra plant ecology, Bayesian analysis | Research scientist |
| 4. Pieter Beck | European Commission - Joint Research Centre | High-latitude remote sensing | Research scientist |
| 5. Nadja Rüger | iDiv | Plant ecology, Bayesian analysis | Research scientist |
| 6. Anne Blach Overgaard | Aarhus University | Tundra ecology, Species distribution modelling | Post-Doc |
| 7. Janet Prevéy | SLF, WSL, Switzerland | Tundra ecology, Plant phenology | Post-Doc |
| 8. Signe Normand | Aarhus University | Tundra ecology, Species distribution modelling | Professor, Assistant |
| 9. Christian Rixen | SLF, WSL, Switzerland | Tundra ecology, Plant phenology | Senior research scientist |
| 10. Haydn Thomas | University of Edinburgh | Tundra ecology | PhD-student |
| 11. Sonja Wipf | SLF, WSL, Switzerland | Tundra ecology | Research scientist |
| 12. Damien Georges | University of Edinburgh | Ecoinformatics | Scientific programmer |

**Workshop agenda**

| ***May 2015*** | |
|---|---|
| Day 1 | – Welcome, progress update presentations from project teams 1 & 2 + discussion |
| Day 2 | – Progress update presentation for project teams 3, 4 and 5 + discussion |
| Day 3 | – Model finalization for project teams 1-4, seminar given by S. Elmendorf |
| Day 4 | – Breakout groups, manuscripts drafted or updated for project teams 1 & 2 |
| Day 5 | – Finalization of manuscripts, discussed future plans and assigned concrete tasks to each participant |

**Feedback of applicants**

The following specific progress was made on the two core sTundra manuscripts:

**1. Scaling tundra greening**

*Title:* Inconsistent correspondence between satellite and on-the-ground observations of climate-driven tundra greening across the tundra biome

*Research question:* Is there correspondence between cover change of shrubs, graminoids and forbs and climate sensitivity of shrub growth on the ground with greening patterns observed by satellites?

*Since the first sTUNDRA meeting we have:*

- Accessed GIMMS and MODIS data for all of our sites.
- Compared trends and interannual variability in tundra greening and shrub growth and cover change of different functional groups over time.
- Conducted a break point analysis on the GIMMS data and found that break points in the data correspond better with sensor shifts/satellite changes rather than any break points in shrub growth.

- Conducted a pixel to plot scale analysis demonstrating low correspondence between tundra shrubs and NDVI greening (Figure 1).
- Drafted a manuscript explaining how our findings relates to the regional scale analyses already presented in the literature, and what this might mean for future analyses with these tundra greening datasets.

*During the workshop, we finalized the following analyses:*

- Predicting change in cover over time by site and functional group and/or species.
- Proportion of shrub individuals at each site that have a significant correlation with NDVI data (GIMMS and MODIS).
- Correspondence of the ITEX cover change over time model outputs with the greening trends (GIMMS and MODIS).

*After the workshop, we are working on the following analyses:*

- Regional evaluation of NDVI~growth covariation.
- Pan Arctic analysis of climate sensitivity of NDVI.
- Break-point comparison of rings and NDVI.
- Trend Comparison ITEX and NDVI.

A preliminary draft of the manuscript was compiled at the sTUNDRA II workshop and manuscript finalization is currently underway.

*The preliminary results of this work were presented at the following conferences:*

- AGU meeting. San Francisco. December 2015 (**Pieter Beck**)


*Figure 1. Tundra shrubs show variable correspondence with satellite-observed greening trends. Maps of the proportion of individuals at a given*

*site that show positive significant correspondence between NDVI and shrub growth time series. Sites with an "x" indicate sites where the proportion was below that which could be picked up by random chance using sampled data.*

**2. Tundra Trait Biogeography**

*Title:* Biome-scale patterns in tundra plant traits correspond with warming-induced trait change

*Research question:* Do the patterns of community-weighted traits across climate space in the tundra biome match changes being observed over time?

*Since the first sTUNDRA meeting:*
The trait biogeography manuscript has seen the most progress since the last meeting. We ask whether we see the same patterns of plant traits across biogeographic gradients as we do trait change over time, a slight variation on the question discussed at the first sTUNDRA meeting. This manuscript uses Bayesian hierarchical models to test the variation in tundra plant traits across climate space (both among and within species) and the change in community-weighted plant traits over time. We have found strong patterns of community-weighted plant traits across the tundra biome from warmer to colder sites, and we have found a tendency for increasing SLA, Leaf N and decreasing wood density over time. We have also collected ~24,000 new trait observations from the tundra ecology research community (the "Tundra Trait Team") that will supplement the data previously extracted from TRY (Figure 2).

*During the workshop, we finalized the following analyses:*

- Patterns of community weighted mean traits over climate space (including uncertainty in trait means per estimate).
- Intraspecies trait – climate covariation.
- Change in community weighted mean traits over 25 years of warming at tundra sites around the world.

*After the workshop, we are working on the following analyses:*

- Implementation of intraspecific climate-trait covariance to the overall model predicting trait change over time.

A preliminary draft of the manuscript was compiled at the sTUNDRA II workshop and manuscript finalization is currently underway.

*The preliminary results of this work were presented at the following conferences:*

- British Ecological Society. Edinburgh. December 2015 (**Anne Bjorkman**)
- US Department of Environment Meeting. Maryland. November 2015 (**Isla Myers-Smith**)
- Mountains of our Future Earth. Perth, Scotland. October 2015 (**Anne**

**Bjorkman**)

- International Tundra Experiment (ITEX) 21st Meeting, Swedish University of Agricultural Sciences, Uppsala, Sweden. September 2015. Invited keynote presentation. (**Anne Bjorkman**)

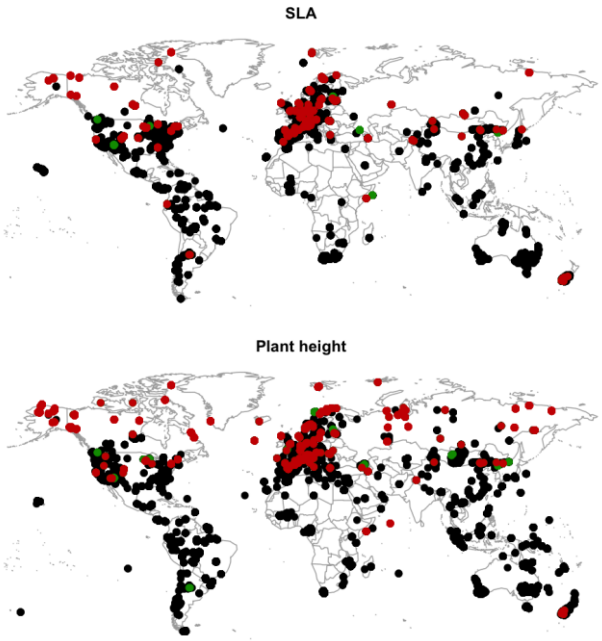


*Figure 2. The sTUNDRA working group has compiled additional trait records from sites around the tundra biome (red) to add to the TRY database (green –TRY tundra species records, black – all species).*

**Overall**

As this was the 2nd sTUNDRA meeting, we focused largely on finalizing outputs rather than general ideas/brainstorming. One day (in total) was reserved for updating each other about progress on each of the five sTUNDRA projects since the first meeting, and discussion about the future direction of these projects. The remainder of the meeting was focused on actively progressing on the projects, either in terms of finalizing the models used for the analysis (most involve Bayesian modeling approaches) or for drafting or updating manuscripts.

**Feedback on sDiv support**

Support from sDiv for a weeklong workshop allowed for face-to-face discussion research progress since the last meeting and concrete planning for the finalization of these projects, and was enormously helpful to allow the efficient completion of these research efforts. The sDiv team facilitated our progress throughout the workshop and will continue to contribute to advancing our work plans through providing access to computing facilities

(iDiv server space has been crucial in allowing us to remotely work with the assembled dataset and run computer-intensive analyses).

In case of questions, please contact Marten Winter marten.winter@idiv.de
or tel. +49 (0)341 97 33129.