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Abstracts

1. **Anderson-Smith, Andy**
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Shrub abundance, NDVI and CO2 exchange in moist acidic tundra in northern Alaska.
Andy Anderson-Smith, Andrew DuComb, Paddy Sullivan, Jeffrey M. Welker. Department of Biological Sciences, University of Alaska, Anchorage.*

Evidence has accumulated during the last decade that shrub communities are expanding in the Arctic and Normalized Difference Vegetation Index (NDVI) values which measure surface greenness are rising. Several studies have suggested that NDVI increases are being driven by increases in shrub abundance. While it is clear that NDVI varies across vegetation types, it is not clear that increasing NDVI values in moist acidic tundra (MAT), the most extensive vegetation type in arctic Alaska, are driven by increasing shrub abundance. The focus of this research is to determine what rising NDVI values actually mean in the MAT. In order to clarify the role of shrub encroachment per se as opposed to other functional groups in driving increases in NDVI, we measured functional group composition in moist acidic tundra in conjunction with =and-held measures of NDVI and direct CO_2 exchange measurements to explicitly link spectral properties, shrub, graminoid, and bryophyte density and trace gas feedbacks to atmospheric chemistry. Point frame data show a deciduous shrub coverage (mostly *Betula nana* (Dwarf Birch) and *Salix pulchra* (Diamond Leaf Willow) of 5% to 60% (median = 26%) in MAT. Our results indicate that high shrub density (>30%) corresponds to peak season NDVI values greater than 0.70 (R^2=.64) whereas low shrub density correspond to values below 0.65. Furthermore, NDVI is closely correlated with net ecosystem CO_2 uptake.

2. **Andresen, Christian, G.**
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Assessing Arctic Aquatic Plants Using Novel Remote Sensing Tools. Christian G. Andresen and Vanessa Lougheed. University of Texas at El Paso, Department of Biological Sciences, El Paso, TX, 79968.*

The extreme arctic environment often limits our ability to take repeat observations using most airborne and satellite systems and thus makes it difficult to track seasonal changes over large temporal and spatial scales. In addition, plot-level measurements are often time consuming and logistically difficult in these harsh environments. To overcome these constraints, this study evaluated the effectiveness of two new cost-effective methods of remotely assessing seasonal phenological and biomass changes of aquatic plants: (1) oblique repeat photography and (2) kite aerial photography (KAP). We validated the effectiveness of these near-surface methods by determining relationships between remotely sensed greening and round-based spectral measurements and plant biomass for both *Carex aquatilis* and *Arctophila fulva*, important mediators of carbon fluxes and energy balance in the Arctic. The green excess index (2G/R+B), calculated using both methods, was a good predictor of NDVI and aboveground biomass. The vertical approach of KAP was able to track variability in Carex greening and senescing, while the emergence and flowering of Arctophila was best captured by the oblique photography. Our data support the effectiveness of oblique repeat photography and KAP to assess spatial and seasonal changes in plant phenology and biomass. These methodological advances will lead to high-resolution descriptions of intra- and inter-annual variation in aquatic plant productivity and provide the ridge between plot level measurements and higher level remote sensing platforms such as aerial and satellite imagery

3. **Björk, Robert**
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Long-term warming effects on carbon and nitrogen dynamics in tundra soils. Robert G. Björk, Mats P. Björkman, Alf Ekblad, Sarah Elmendorf, Gregory H.R. Henry, Leif Klemedtsson, Sofie Sjögersten, and Ulf Molau. Department of Biological and Environmental Sciences, University of Gothenburg, Sweden.*

During IPY 2008 we used the ITEX experiment in Latnjajaure (northern Sweden), established during the early years of the program, to investigate long-term warming effects on ecosystem respiration (ER), carbon (C) and nitrogen (N) pool (including camp $\delta^{13}C$ and $\delta^{15}N$), soil organic C (SOC) chemical composition, and N mineralization among plant communities. After 12 to 15 years of open top chamber (OTC) treatment no statistical effect was found on the soil temperature (10 cm soil depth), although there was an overall increase in all OTC by +0.2 °C. However, the soil moisture decreased significantly by 3-14%, depending on plant community, in the OTCs compared to ambient conditions. Preliminary, there was a 19-61% non-significant increase in annual growing season ER in the OTC compared to the ambient plots over the growing season. The were distinct differences in the SOM functional composition among plant communities with *ca.* 10% more O-alkyls stored in tussock tundra than in dry meadow. The OTCs did not consistently alter the SOM composition among the vegetation types but clearly showed a trend for reduced aliphatic and O-alkyl C in the OTCs suggesting increased decomposition (or reduced inputs) of these compounds. Thus, the non-significantly higher ER may in some communities be of plant origin linked to greater plant biomass in the OTCs, and in other (e.g. tussock tundra) from increased decomposition rates. In conclusion, this study showed that 12-15 years of OTC treatment had a modest effects impact C and N dynamics in tundra soils specific to distinct plant communities.

4. **Botting, Timothy, F**
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A Comparison of Growth Patterns of (Carex aquatilis-stans) Between Two Sites in Northern Alaska. Timothy Botting, Robert D. Hollister. Grand Valley State University, Allendale, Michigan.*

Global climate change will affect many areas of the world in differing degrees of magnitude. High latitude regions have shown the impact of climate change the most. In 1996, two study sites were established in Barrow and Atqasuk, Alaska. Atqasuk is approximately 60 miles south of Barrow. The ongoing study uses open-top chambers to examine the response of vegetation to experimental warming. The change of numerous arctic species has been documented. The growth of the dominant sedge, (*Carex aquatilis-stans*), was compared between two sites and patterns of change have become apparent. Generally, the study has shown that in the Atqasuk wet meadow, (*Carex aquatilis-stans*) has grown taller, has more leaves per individual, and has greater average leaf lengths compared to those in the Barrow wet meadow. These effects of experimental warming suggest that *Carex aquatilis-stans* will become an even more dominant sedge in the arctic community since experimental warming may have contributed to greater growth.

5. **Contreras, Gabriela**

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Changes in Dissolved Organic Carbon (DOC) in Arctic tundra ponds over the past 40 years. Gabriela Contreras and Vanessa L. Lougheed. University of Texas at El Paso, Department of Biological Sciences, El Paso, TX, 79968.*

With a warming Arctic, degradation of permafrost is expected to release organic and inorganic materials into aquatic ecosystems; however, there are few long-term datasets with which to test this prediction. The Arctic tundra ponds at the International Biological Program (IBP) site in Barrow, Alaska, studied for the first time in the 1970s, represent one of the very few locations in the Arctic where long-term data are available on freshwater ecosystem structure and function.

Dissolved Organic Carbon (DOC) is used to describe the thousands of dissolved compounds found in water that derive from organic materials, DOC can impact both heterotrophic and autotrophic production and thus has important implications for carbon flux in the Arctic. The objective of this study was to determine whether DOC concentrations had changed over time in the IBP ponds. Over the summer of 2010, we collected DOC samples from 5 IBP ponds, as well as several ponds in more isolated locations (BEO) and urban locations. We observed higher DOC concentrations in the IBP ponds in 2010, compared to the 1970's, when temperatures were lower. Urban sites tended to have higher DOC than non-impacted sites. A preliminary incubation experiment indicated that more DOC is released when permafrost is incubated at warmer temperatures. This study will add to our understanding of DOC release into Arctic aquatic environments, and will increase our understanding of the impacts of Arctic warming and development on global carbon cycles.

6. **Edwards, Marc**
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How does experimental warming affect the structure and function of three Arctic plant communities? Marc Edwards and Greg H.R. Henry. UBC Geography.*

Arctic regions are experiencing faster rates of atmospheric warming than any other biome. Increasing temperatures will affect the biomass, phenology, and composition of Arctic vegetation, which in turn will alter ecosystem functions such as greenhouse gas flux and nutrient cycling. Responses are expected to occur at a range of scales and are likely to show close coupling to environmental conditions. This work compares ecosystem response in three plant communities after 18 years of experimental warming on Ellesmere Island, Canada. Warming response was measured at peak season in a dry, mesic and wet community. Biomass, height and composition were measured using a point-intercept method and CO_2 flux was measured using an infrared gas analyzer and a custom made chamber. Environmental and NDVI data were collected from all three communities. All three plant communities showed structural responses to warming. Total above-ground biomass and height did not show significant changes but growth form composition shifted in all cases. Increases were observed for graminoids and forbs at the dry site; graminoids, deciduous shrubs and bryophytes at the mesic site; and deciduous shrubs and bryophytes at the wet site. Lichen abundance decreased at all sites. CO_2 flux responses were largely explained by compositional changes. All sites were CO_2 sinks at peak season and the dry and wet sites became stronger sinks as a result of warming. NDVI showed potential as a predictor of CO_2 flux. These results support the prediction that climate change response will be ecosystem specific. While some general trends exist across multiple communities, each community had a unique response to warming.

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Home site advantage in two long-lived arctic plant species: Results from two thirty-year reciprocal transplant studies. *Ned Fetcher[1]*, James B. McGraw[2], Cynthia C.Bennington[3], Milan C. Avrek[4], Sara Souther[2], Marjan van Weg[5] and Gaius R. Shaver[5]. 1. Wilkes University, 2.West Virginia University, 3. Stetson University, 4. Glenville State University, 5. Marine Biological Laboratory*

In 2010 we revisited two reciprocal transplant experiments established thirty years previously to determine if the population differences observed in the early 1980's have persisted. We wished to test the hypothesis that populations from warmer environments would respond more as the climate warmed in the interval since they were planted. We measured flowering and plant survival for *Dryas octopetala* growing in three transplant gardens along a snowbank gradient as well as for six gardens of *Eriophorum vaginatum* growing along a latitudinal gradient. For *E. vaginatum* we also measured maximum assimilation rate and dark respiration.

Plant survival and flowering of both species showed a significant home-team advantage whereby plants from a given site that were transplanted back into that site had higher survival and flowering than plants from other sites. In the case of *D. octopetala*, the originally observed patterns of local adaptation appeared even stronger after three decades, with the complete elimination of foreign ecotypes in two of the three gardens. For *E. vaginatum* assimilation showed significant home-team advantage, whereas respiration did not. Although our original hypothesis does not appear to be supported, future projections of arctic ecosystems will have to consider the role of ecotypic variation in conditioning the response of communities and ecosystems to climate.

8. Jónsdóttir, Ingibjörg Svala
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Effect of long term simulated warming on reproductive effort and success in different plant growth forms. Gudlaug K. Hákonardóttir, Ingibjörg S. Jónsdóttir. University of Iceland.*

In tundra ecosystems increased reproductive effort and success is a common short-term response of most vascular plant species to simulated warming by OTCs, which can be interpreted as a direct response to enhanced temperature. In the long term, however, changes in vegetation composition, ecosystem processes and, consequently, changes in plant interactions may offset the direct warming effect. In this study we investigate the reproductive effort and success in four plant species representing different growth forms in subarctic-alpine heath vegetation after 14 years of warming. For the deciduous dwarf shrub (*Betula nana*), which increased significantly in abundance in response to the warming, there was no difference between treatments in reproductive effort, while reproductive success was significantly higher in the OTC plots. The abundance of the other three species, a low-growing evergreen dwarf shrub (*Empetrum nigrum*), a small-leaved dicot herb (Bistorta vivipara) and a graminoid (sedge, *Carex bigelowii*), did not change in response to warming and neither reproductive effort nor success differed between treatments after 14 years. It is concluded that the responsive *B. nana* maintains high reproductive success under warmer condition in the long term, while potentially positive effects of warming on reproduction in low growing species is offset in the long term by increased shading by the dominating deciduous dwarf shrub.

9. Jónsdóttir, Ingibjörg Svala
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10. Kremers, Kelseyann, S.
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Response of Graminoids to Increased Temperature in the Arctic. Kelseyann S. Kremers and Robert D. Hollister. Grand Valley State University.

The objective of this study was to determine the consistency of the response of graminoids to warming. The study examined the impact of experimental warming and natural temperature variation at ITEX sites at Barrow and Atqasuk, Alaska. Correlation with TDD_{sm} and the response to warming were used to classify graminoid species into temperature response types, as in Hollister et al. (2005). If the trait was significantly correlated with TDD_{sm}, then temperature was considered to control the response and was a dominant factor, and if the trait responded to the warming treatment but was not significantly correlated with TDD_{sm}, then temperature was considered a subordinate factor (Hollister et al., 2005). The response of leaf length, inflorescence height, and number of inflorescences for 13 graminoid species from 1994-2010 is included. Plants responded to temperature in 45 of 62 measured traits of a species in a site (73%). The traits of leaf length and inflorescence height had a higher percentage of measured traits that responded to temperature (38/42 traits, 90%). Most of the traits that were responsive were considered to be dominantly controlled by temperature (35/45 traits, 78%). Overall, the response of graminoids to warming was considered a dominant positive response, and only 1 of 45 traits was classified as a negative response type. The high abundance of responses that were dominantly controlled by temperature indicates that warming due to climate change may drastically impact graminoid populations.

11. Liebig, Jennifer A
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Exploring for Traits that Predict Plant Response to Warming. Jennifer A. Liebig and Robert D. Hollister. Grand Valley State University.*

At the Barrow and Atqasuk ITEX sites in Alaska we have documented changes in the plant community in response to warming. Plant cover was estimated using a point frame method and cover of species in control plots was compared to cover of species in warmed plots. Although generalizations may be made about the response of plants of certain growth forms, (i.e., that shrubs increase in cover in response to warming) not all species within a growth form responded with the same direction or magnitude of cover change. In this study we used other ways of categorizing species too determine which traits can be used to predict response to warming.

We tested 21 different grouping schemes using a two-way ANOVA to determine if the different groups within a grouping scheme showed different responses to warming. These grouping schemes varied widely: some were based on distribution, some on morphology, and some on flowering phenology. Each ANOVA was run for each of the four sites separately, as well as for all sites combined. Out of the 21 grouping schemes, 11 returned a significant result ($p < 0.05$), with an additional seven groups showing trends ($p < 0.10$).

The results do not indicate that any one of the grouping schemes can be used universally, since a grouping scheme may be significant at one site but not another. Our ultimate goal is to determine a suite of traits that can be used together to predict vegetation change.

12. May, Jeremy L.
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Heterogeneous response to warming of tundra vegetation in Northern Alaska. Jeremy May, Robert Hollister. Grand Valley State University*

Warming in the Arctic and its effects on plant communities has been documented and is expected to continue. This study documents changes occurring naturally and due to experimental warming over 15 years at four plant communities in northern Alaska with emphasis on the consistency of the response over time and across locations. The response to warming observed in earlier years of the study was also used to predict plant community composition in later years of the study. Vegetation surveys were done using a point frame method. Changes between years were generally larger than responses to warming, however changes between years were mostly in different directions and the changes were not consistent across locations. Warming responses were generally larger initially and diminished over time across all sites. Most taxa and growth forms either did not respond (6 taxa) or responded inconsistently to warming (54 taxa). The number of taxa that responded consistently over time, although relatively few, was greater in response to warming (22 taxa) than that observed in the control plots (8 taxa). Of the plants that were consistently changing, graminoids and shrubs increased in cover while nonvascular plants decreased. The warming response in early years of the experiment was a poor predictor of later years and was only able to accurately predict less than one -third (24 out of 83) of taxa covers at sampling 3 to within 1% of cover. The inability to use present trends to predict future tundra plant community dynamics make long term monitoring necessary, this is because the response to warming is heterogeneous across time and locations.

13. Oberbauer, Steven F.
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The effects of arthropod galling on the physiological function of arctic willows. Rajit Patankar, Gregory Starr, Behzad Mortazavi, Steven F. Oberbauer, and Alyssa Rosenblum. Department of Biological Sciences, Florida International University.*

1. Arctic deciduous plants are increasing in abundance coincident with warming trends and this increase will likely contribute to changes in regional carbon dynamics.

2. One of the dominant deciduous-shrub genera, *Salix*, is highly susceptible to leaf galls, but the influence of galling arthropod herbivores on plant-level carbon uptake in the Arctic remains poorly studied.

3. We examined the impacts of galling by two eriophyoid mites on a suite of ecophysiological traits in leaves of two willows (*Salix pulchra* Cham. and *Salix glauca* L.) in Alaskan arctic tundra.

4. Galled leaves showed significant declines in maximum photosynthetic capacity [Amax], photosystem II efficiency [FV/FM], stomatal conductance [gs] and instantaneous water-use efficiency [WUE] in *S. pulchra* leaves and in Amax and FV/FM of *S. glauca* leaves. Neighboring gall-free leaves on the same shoot as galled leaves had higher Amax and gs than nearby controls suggesting compensatory responses. Mite gall-infested tissue had significantly higher concentrations of glucose and fructose compared to gall-free leaves, suggesting a preference for these over other soluble metabolites (sucrose and starch). Increased anthocyanin and decreased chlorophyll concentrations were seen in galls of both species, and likely contributed, at least in part, to the observed decreases in photosynthesis.

5. Based on our findings, we suggest that galling mites - ubiquitous but poorly examined in the tundra - have significant impacts on photosynthetic processes and are likely to affect whole-plant functioning in arctic willows.

14. Olivas, Paulo

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Contrasting responses of CO_2 flux components from coastal and inland tundra in northern Alaskan to long-term passive warming. Paulo C Olivas, Steven F Oberbauer, Craig E Tweedie, Robert D Hollister, Andrea Kuchy, Jose Luciani. Department of Biological Sciences Florida International University*

Arctic ecosystems hold close to 1672 Gt of carbon, of which 190 Gt are in a labile state in the uppermost layer of the permafrost. Vegetation cover strongly influences stability of the uppermost permafrost and organic matter decomposition. Changes in climate can affect the hydrological and thermal regimes that can affect primary productivity as well as thaw and organic matter decomposition. The Arctic is undergoing an increase in the mean annual temperature. Warming is very likely to positively affect organic matter decomposition, shifting the net carbon balance of the Arctic from sink to source. We evaluated the long-term effects of warming on the CO2 balance of tundra at the ends of a hydrological gradient (wet and dry) in a coastal and an inland location. We used open top chambers (OTC) for passive warming and static chamber techniques to measure the CO2 exchange. The study sites were a coastal location near Barrow and an inland location near Atqasuk, Alaska. The two locations were established in the mid 1990,s as part of the International Tundra Experiment (ITEX) network. The time series of CO2 measurements spans from 2000 through 2011, with measurements at peak season during most years. After 15 years of warming, the tundra CO2 exchange still presented a significant response; however, the response to warming was not the same at each site and location. The magnitude of the CO2 flux components presented high interannual variability. GPP (gross primary productivity) was higher at the coastal than at the inland location. GPP rates of OTC and temperature control (T_CTL) plots in the wet sites were higher than those of the dry sites, and the OTC plots presented higher GPP than the T_CTL especially in the dry sites. In general the net ecosystem exchange (NEE) did not differ between the coastal and inland locations. At each location, dry sites presented lower NEE than the wet sites, and the OTC plots presented lower NEE than the T_CTL plots. Ecosystem respiration (ER) rates were higher at the coastal location than those inland. On average the ER rates of the wet sites were higher than the dry sites. At both locations OTC plots presented higher ER rates than T_CTL in the dry sites, but the difference was not significant for the wet sites. ER of the OTC and T_CTL plots presented a positive significant response to peak season air temperature, but we did not see an increase in ER rates with time. Our results revealed that coastal locations can respond differently than inland locations to warming. After a period of aboveground biomass increase, wet sites presented no significant response to warming after several years of warming, in particular the inland location. Conversely, OTC plots compared to T_CTL plots in dry areas especially near the arctic coast presented higher losses of CO2 even after more than a decade of warming.

15. Olsen Siri Lie

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What determines species richness in an alpine Dryas heath? Siri Lie Olsen and Kari Klanderud. Norwegian University of Life Sciences.*

Despite decades of research, there is a continuing debate within ecology concerning what determines species richness in local plant communities, a process which is especially important to understand in light of the ongoing climate warming. Seed addition experiments are commonly used to examine whether local species richness is limited by dispersal or microsite availability. However, most seed addition experiments are short-term studies, and little is known about the factors controlling plant establishment following the seedling stage. We examined the long-term effect of seed addition on species richness, and how the change in species richness was related to different biotic and abiotic factors, in an alpine *Dryas* heath subjected to experimental warming (OTCs). Seed addition increased species richness four years after growing, but after eleven years this positive effect had disappeared, indicating that while species richness appeared to be seed limited on the short term, the relative importance of seed availability decreased on the long term. The subsequent decrease in species richness was related to different biotic factors, with more significant relationships in the OTCs than in the control plots. These results suggest that biotic interactions are a major determining factor for community species richness beyond seedling establishment, especially under climate warming. Our study shows that the alpine plant community is relatively resistant to establishment of new species, and experimental warming does not seem to facilitate long-term establishment following seed addition. Further analyses remain to be done on how single species respond to manipulation of seed availability and warming.

16. Reyes, Frankie
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A Model to Predict Nutrient Release from Permafrost Thaw. F.R. Reyes & V.L. Lougheed. University of Texas at El Paso.*

Continued warming of the Arctic tundra in northern Alaska can have important ecological implications for freshwater ecosystems. An increased active layer depth can lead to nutrient release from permafrost. Comparisons of water quality parameters from the 1970s and 2008-09 from tundra ponds in Barrow, Alaska indicated an increase in water column Total Phosphorus (TP), Soluble Reactive phosphorus (SRP), Total Dissolved Phosphorus (TDP) and algal biomass (phytoplankton) over time.

We designed an incubation experiment to look at nutrient release rates from permafrost cores under different warming scenarios. Permafrost core incubations showed an increase in phosphorus and nitrogen species; nitrogen being the dominant nutrient release with warmer conditions. Data suggest that increasing temperature indirectly impacts phosphorus release by inducing less oxic conditions. understanding the temperature dependent release of nutrients will further support nutrient addition via permafrost degradation and create a predictive model for future temporal additions of nutrients into the Arctic tundra pond ecosystems with warming.

17. Robinson, Samuel, V.J.
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Observed Insect Visitations Rates in the High Arctic: Preliminary results. Samuel V.J. Robinson and Greg H.R. Henry. University of British Columbia.*

Our understanding of pollination networks and their sensitivity to climate change is very poor in high arctic tundra communities. Using a variety of techniques, this study examined insect pollinators and tundra vegetation communities in experimental and control plots over the complete June-August 2011 flowering season at Alexandra Fiord, Ellesmere Island, Canada. We used standard ITEX (International Tundra Experiment) Open Topped Chamber (OTCs) to artificially warm ~1m2 experimental plots containing *Salix arctica*, *Dryas integrifolia*, and *Papaver radicatum*. Using both direct observation and automated digital cameras we observed insect visitation over the hourly to seasonal timescale, comparing OTC and non-OTC control plots. The visual and camera record of insect visits was complemented by bowl traps to measure ambient numbers of pollinating insects. Thirdly, we gauged the role of selfing and anemophily using netted cages to exclude insects from subplots of the three plant species. Coupled to the OTC and control plot design, the three kinds of observation allow us to gauge the effect of the OTC (and presumably, a warmer microsite environment) with visitation rates, seed set, and insect community composition over the flowering season.

18. Thorhallsdottir, Thora, E
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Rapid colonization of deglaciated areas in South Iceland. Thóra Ellen Thórhallsdóttir, Ólöf Birna Magnúsdóttir, Kristín Svavarsdóttir & Jóna Björk Jónsdóttir. Institute of Life and Environmental Science, University of Iceland*

About 11% of Iceland is presently covered by glaciers. On the south slopes of Vatnajökull glacier, over a dozen outlet glaciers descend into relatively warm and moist lowland plains. These glaciers had reached maximum Holocene size by the late 19th century. They retreated 2-4 km during the 20th century, with greatly escalating rates in the last 15 yrs, even exceeding 100 m/yr. The physical environment of all the proglacial fields is similar but the available species pool differs in composition, richness and distance to seed sources.

We have studied ecosystem development by six of these outlet glaciers and noted rapid colonization of the most recently exposed land (2001-2005), which in 2010 had a median vascular species cover ranging from 2-8% among glaciers. Sites deglaciated 65 yrs ago (AD 1945) had 15-30% median cover and the oldest sites (deglaciated after 1890) 18-40%. Colonization rates are very rapid compared with the huge AD 1783 Laki lava field, which lies in a comparable climate 100 km distance from the westernmost outlet glacier. In less than a decade, vascular species density immediately in front of the glacier margin (10~27 spp/2.5 m^2) exceeded that of the Laki lava after 225 yrs (median 7.8 spp/2.5 m^2), although the vascular aboveground cover was slightly lower (2-8% for the proglacial fields vs 9.7% in Laki lava). Up to 4,000 km^2) may be exposed by retreating glaciers in Iceland this century and we predict that much of this land will be rapidly colonized by vegetation.

19. Tweedie Craig

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Decadal Time Scale change in arctic terrestrial plant communities: An overview of the International Polar Year Back to the Future Project (IPY-BTF). Craig E. Tweedie[1], David R. Johnson[1], Mark Lara[1], Sandra Villarreal[1], Robert Hollister[2] Patrick Webber[3]. [1]. Systems Ecology Lab, University of Texas at El Paso; [2]. Grand Valley State University; [3]. Michigan State University*

In the absence of long-term monitoring, revisiting, re-sampling and assessing environmental change at Arctic terrestrial research sites established several decades ago represent one of the few means by which decade-time scale change in these systems can be assessed. Rescuing old research sites and/or data collected at these sites in combination with transfer of knowledge from older to younger generation scientists also builds a new capacity for future observation and change detection. As a contribution to the fourth International Polar Year (IPY 2007-2009), the Back to the Future project (BTF) comprised an international multidisciplinary collaborative to investigate decade-time scale change in arctic ecosystem structure and function. BTF researchers rescued, resampled, and assessed change at historic research sites 15 to 60 years around the arctic. Most studies included students, mid-career researchers and senior or recently retired investigators to maximize cross-generation transfer of data and information. The overarching goal of IPY-BTF is to determine how key structural and functional characteristics of high latitude/altitude terrestrial ecosystems have changed over the past 15 or more years and assess if such trajectories of change are likely to continue in the future. Resampling of sites established by Patrick J. Webber between 1964 and 1975 in northern Baffin Island, Northern Alaska and in the Rocky Mountains form a key contribution to the BTF project. Here we report on resampling efforts at each of these locations. Results suggest that although shifts in plant community composition are detectable at each location, the magnitude and direction of change differ among locations. Vegetation shifts along soil moisture gradients is apparent at most of the sites resampled. Interestingly, however, wet vegetation types seem to have changed more than dry vegetation types. Ecosystem function studies performed in conjunction with plant community change suggest that there has been an increase in plant productivity at most sites resampled, especially in wet and mesic land cover types. Results will also be compared to key findings from other IPY-BTF studies that were compiled in a special issue of the journal AMBIO in Fall 2011.

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Algal changes in tundra aquatic ecosystems over the last 40 years. Mariana Vargas M., and Vanessa L. Lougheed. University of Texas at El Paso*

Algal communities in the Arctic are highly sensitive to environmental change, such as longer growing seasons and changes in ice cover. On the north slope of Alaska, ponds and lakes cover large portions of the total land area. We surveyed the periphytic algal communities in tundra ponds from Barrow, Alaska to assess environmental effects on their populations. Samples were collected in August 2008-10 from two main study areas: the IBP (the International Biological Program), which was also studied in 1970-71 but now is located near to human settlements, and the BEO (Barrow Environmental Observatory), which is within a protected area. The algal community composition in the IBP ponds has changed dramatically over the last 40 years, with many new taxa observed in the recent samples. However, gross taxonomic composition in IBP Pond B was somewhat similar between 2010 and 1972. The dominant algal groups in 2008-10 were Cyanophyta and Bacillariophyceae. Cyanophyta tended to dominate under low nutrient, high light conditions in the spring and early summer, whereas, Bacillariophyceae dominated when nutrient levels were highest in late summer. Moreover, these two algal groups fluctuated in relative abundance twice during the growing season. We also found some algal taxa at some sites that were bioindicators of nutrient-rich conditions, but they were rather low in relative abundance. It is important to understand algal processes in aquatic ecosystems in the Arctic, since any change in the primary producers can cause a cascading effect on the whole ecosystem and have impacts for global carbon balances.