Influence of liquid water and geospatial dependency on biological activity and greenhouse gas emissions in Arctic soils

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Project Locations: Alexandra Fiord (78°53’ 75°55’) Eastwind Lake (80°08’ 86°10’) and Truelove Lowland (75°33’ 84°40’)

Timeframe: Alexandra Fiord (July 7-17, 2008) Eastwind Lake (July 17-27, 2008) and Truelove Lowland (July 27-August 7, 2008)

Project Description

Purpose: Liquid water and not temperature likely controls a wide variety of biological processes in frozen soil. These processes include the conversion of nitrogen, release of greenhouse gases and the transformation of contaminants. Geospatial dependency is a measure of how natural processes vary from one location to another. Understanding geospatial dependency is crucial for understanding how large an area a particular measurement can be applied.

Goals: The first goal of this year’s research is to collect a variety of Arctic soils and monitor their release of greenhouse gases and conversions of nitrogen during the summer. We will use these data to identify and characterize the spatial dependency of summer greenhouse gas emissions from Arctic soils. The second goal is to investigate these processes under winter conditions by returning samples of these soils to the laboratory where we will study the biological and chemical properties of these soils when frozen.

Transportation: We will fly to and from our research sites. We will conduct all work at those sites on foot.

Structures: We will live in temporary tent camps while on site. No permanent structures will be built.

Restoration / Abandonment: We will remove all equipment and waste when we leave each site.

Methodology: We will be bringing a custom built FTIR analyzer of trace gasses to directly assess greenhouse gas fluxes in the field. After we measure the greenhouse gas flux, we will collect small soil samples from these locations for analysis of the soil bacterial community and soil chemical properties. Analysis of the soil biology and chemistry will allow us to determine the biological processes that determine greenhouse gas fluxes. Because the majority of nitrous oxide release may be occurring from Arctic soils in the winter, we will also take disturbed and undisturbed cores from these sites and return these cores to the laboratory. By experimentally modifying the amount of liquid

water present at -5C we will be able to determine the rates of greenhouse gas production from these soils across a range of liquid water contents in frozen soil.

Data / Reporting: The data collected will be used in the writing of peer-reviewed scientific papers. We expect that at least 2-3 publications will result from this research.

ᐊᓯᔾᔨᕐᓂᖅᑎᑦᑎᒍᓐᓇᕐᓂᖓᑦ ᐃᒪᑉ ᐊᒻᒪᓗ ᓄᓇᒥ ᐊᖏᑎᒋᓂᖓᑦ ᐆᒪᔪᖃᕐᓂᖓᓂᒃ ᐊᒻᒪᓗ ᐊᓂᕐᓂᓘᖅᑲᐃᓂᖓᓂᒃ ᐆᓇᖅᓯᕙᓪᓕᐊᓂᖃᕐᓂᖓᑦ ᓯᓚᒥᒃ ᐅᑭᐅᖅᑕᖅᑐᑉ ᐃᔾᔨᖏᑦ

ᑖᒃᑕ ᓯᑏᕙᓐ ᓯᓯᓕᐊᓄ, ᓄᓇᒥ ᐃᔾᔪᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᐱᖓᑦ, ᓯᓚᑦᑐᓴᕐᐱᕐᔪᐊᖓᑦ ᓴᔅᑳᑦᓱᕙᓐ

ᐱᓕᕆᐊᑉ ᐃᓂᖅᑲᕐᐱᖏᑦ: ᓴᓇᙳᐊᕐᕕᒃ (78°53’ 75°55’) Eastwind Lake (80°08’ 86°10’) ᐊᒻᒪᓗ Truelove Lowland (75°33’ 84°40’)

ᐊᑯᓂᐅᓂᖓᑦ ᐱᓕᕆᐊᑉ: ᓴᓇᙳᐊᕐᕕᒃ (ᔪᓚᐃ 7-17, 2008) Eastwind Lake (ᔪᓚᐃ 17-27, 2008) ᐊᒻᒪᓗ Truelove Lowland (ᔪᓚᐃ 27-ᐋᒡᒌᓯ 7, 2008)

ᐱᓕᕆᐊᑉ ᓇᓗᓇᐃᔭᖅᓯᒪᓂᖓᑦ

ᐱᔾᔪᑎᖓᑦ: ᐃᒪᖅ ᐊᒻᒪᓗ ᐊᓯᖏᓪᓗ ᐊᐅᓚᑦᑎᓂᖅᑐᒃᓴᐅᒪᒪᑕ ᐊᔾᔨᒌᙱᑦᑐᓂᒃ ᐆᒪᔪᐃᑦ ᐊᐅᓚᓂᖏᓐᓂᒃ ᖁᐊᕐᒥ ᐃᔾᔪᒥ ᓄᓇᒥ. ᑕᒪᒃᑯᐊ ᐊᐅᓚᓂᕆᔭᖏᑦ ᐱᖁᓯᐅᔾᔨᕗᑦ ᐊᓯᔾᔨᖅᑕᐅᓂᖏᑦ ᐳᓪᓚ ᓇᐃᑐᕈᔭᓐ ᑎᐱᖃᓐᖏᑦᑐᖅ, ᓴᒃᑯᑕᐅᓂᖏᑦ ᐳᓪᓚᑦ ᐊᓂᕐᓂᕐᓘᖅᐸᓪᓕᓪᓚᐊᓂᖏᑦ ᐅᖅᑰᓇᖅᓯᑎᑦᑎᓂᖅᐸᑦᑐᑦ ᐊᒻᒪᓗ ᓴᖅᑭᕐᓂᖏᑦ ᓱᕋᕐᓇᖅᑐᐃᑦ. ᓄᓇᓕᕆᓂᕐᒧᑦ ᑐᙵᕕᖅᑲᕐᓂᖓᑦ ᑐᑭᖃᖅᐳᖅ ᖃᓄᖅ ᐊᐅᓚᓂᕆᕙᑦᑕᖏᑦ ᐊᑕᐅᓯᕐᒥᒃ ᐊᓯᐊᓄᑦ. ᑐᑭᓯᐅᒪᓗᓂ ᓄᓇᒥᐊᖏᓂᑎᒋᓂᖓᑦ ᑐᙵᕕᖅᑲᕐᐱᐅᓂᖓᑦ ᐱᓪᓚᕆᐅᖑᖅ ᑐᑭᓯᔭᐅᒍᓐᓇᕐᓂᕐᒧᒍ ᐃᓂᖅᑲᕐᐱᐅᔪᖅ ᖃᐅᓴᖅᑕᐅᓂᖓᑕ ᐊᖏᑎᒋᓂᖓᓂᒃ ᐊᑐᓕᖅᑎᑕᐅᒍᓐᓇᕐᒪᖔᑦ.

ᑎᑭᑕᐅᓇᓱᐊᖅᑐᑦ: ᓯᕗᓪᓕᖅᐹᖅ ᑎᑭᑕᐅᓇᓱᐊᖅᑐᖅ ᐱᔭᕇᖅᑕᐅᓇᓱᐊᖅᑐᖅ ᑕᒫᓂ ᐊᕌᒍᑉ ᖃᐅᔨᓴᕐᓂᖏᓐᓂᒃ ᓄᐊᑦᑎᓗᑎᑦ ᐊᔾᔨᒌᙱᑦᑐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᔨᖏᓐᓂ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕐᓗᒋᑦ ᓴᒃᑯᐃᓂᖅᑲᕐᓂᖏᑦ ᐊᓂᕐᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᓂᖏᑦ ᐳᓪᓚ ᓇᐃᑐᕈᔭᓐ ᑎᐱᖃᓐᖏᑦᑐᖅ ᐊᐳᔭᐅᑎᓪᓗᒍ. ᐊᑐᖃᔭᖅᑕᐳᑦ ᑖᒃᑯᐊ ᑐᑭᓯᒋᐊᕈᑎᐅᔪᑦ ᓇᓗᓇᐃᖅᑕᐅᖁᓪᓗᒋᑦ ᐊᒻᒪᓗ ᖃᓄᐃᑦᑑᓂᖏᑦ ᓱᖅᑯᐃᖅᑕᐅᖁᓪᓗᒋᑦ ᐊᖏᑎᒋᓂᖏᓐᓂᒃ ᑐᙵᕕᖅᑲᕐᓂᖓᑦ ᐊᐳᔭᒃᑯᑦ ᐊᓂᕐᓂᕐᓘᖅᑲᐃᓂᖏᓐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᑉ ᐃᔨᖏᓐᓃᙳᙳᓕᑦ. ᑭᖑᓪᓕᖅ ᐱᓕᕆᐊᓇᔭᐅᓇᓱᐊᖅᑐᖅ ᖃᐅᔨᓴᕐᓗᑕ ᑕᒪᒃᑯᐊ ᐊᐅᓚᓂᓇᔭᖏᑦ ᐅᑭᐅᖑᑎᓪᓗᒍ ᐅᑎᖅᑎᓪᓗᒋᑦ ᓄᐊᑕᒥᓂᐅᔪᑦ ᖃᐅᔨᒃᓴᑦ ᐃᔨᐃᑦ ᖃᐅᔨᓴᕐᐱᑦᑎᓐᓄᑦ ᖃᐅᔨᓴᔭᕐᑎᒍ ᐆᒪᔪᖃᕐᓂᖏᑦ ᐊᒻᒪᓗ ᓱᕋᕐᓇᖅᑐᖃᕐᒪᖔᑦ ᑖᒃᑯᐊ ᐃᔨᐃᑦ ᖁᐊᖑᑎᓪᓗᒋᑦ.

ᐊᐅᓪᓚᕈᑎᒋᔭᒃᓴᐅᓚᐅᖅᑐᑦ: ᖃᖓᑕᓲᖅᑐᒃᑯᑦ ᑕᐅᕗᖓ ᐊᐅᓪᓚᕝᕕᒋᓚᕿᑦᑎᒍᓗ ᖃᐅᔨᓴᕝᕕᑦᑎᓐᓄᑦ. ᐱᓕᕆᐊᓇᔭᖅᑎᓐᓂ ᐱᓱᒃᑕᐃᓐᓇᓛᖅᑐᑦ ᖃᐅᔨᓴᕝᕕᑦᑎᓐᓂ.

ᐋᖅᑭᒃᓯᒪᓂᖏᑦ: ᑐᐱᖅᓯᒪᑲᐃᓐᓇᔭᖅᑐᑦ ᖃᐅᔨᓴᕝᕕᑦᑎᓐᓃᑦᑎᓪᓗᑕ. ᓴᓇᔪᖅᑲᔭᖕᖏᑦᑐᖅ ᓇᔪᒃᓴᓂᖅᑐᐃᖏᓐᓇᕈᓇᖅᑐᒥᒃ.

ᐅᑎᖅᑎᑕᐅᓂᖏᑦ ᖃᓄᐃᑦᑑᓂᒥᓂᖓᓐᓂ / ᕿᒪᒃᑕᐅᓂᖏᑦ: ᑕᒪᐃᓐᓂᓕᒫᖅ ᓱᓇᒃᑖᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐅᑎᖅᑎᑕᐃᓐᓇᓂᓚᐅᖅᑐᑦ ᓇᒃᓴᕐᓗᒋᑦ ᑕᐅᕙᙵᑦ ᖃᐅᔨᓴᕝᕕᓕᒫᑦᑎᓐᓂ ᐊᐅᓪᓚᓕᕈᑦᑕ ᐊᒻᒪᓗ ᓴᓂᕗᑦ ᓇᒃᓴᔭᖅᑐᒋᑦ.

ᖃᐅᔨᓴᕈᑎᒃᓴᐃᑦ ᐊᑐᖅᑕᐅᔭᖅᑐᑦ: ᓇᒃᓴᔭᖅᑐᒍᑦ ᓴᓇᔭᒥᓂᐅᔪᖅ ᖃᐅᔨᓴᕈᑎᒥᒃ FTIR ᐳᓪᓚᑕᖅᑲᕐᓕᖅᑰᑦ ᖃᐅᔨᓴᕈᑎᐅᓪᓗᓂ ᖃᐅᔨᓴᔭᖅᑐᑎᒍ ᐊᓂᕐᓂᕐᓘᖅᑲᖅᐸᓪᓕᐊᔪᑦ ᐳᓪᓚᐃᑦ ᖃᐅᔨᓴᕐᐱᑦᑎᓐᓂ. ᖃᐅᔨᓴᓚᐅᕐᓗᑎᒍᑦ ᐳᓪᓚᐃᑦ ᓴᒃᑯᐸᓪᓕᐊᓂᖏᑦ, ᓄᐊᑦᑎᓚᐅᖅᑐᒍᑦ ᐃᔨᓂ ᑕᐃᑲᓐᖓᑦ ᖃᐅᔨᓴᕐᐱᑦᑎᓐᓂ ᖃᐅᔨᓴᖅᑕᐅᔭᖅᑐᒍ ᖃᓄᐃᑦᑑᓪᓚᕆᖕᖑᑦ ᑯᐱᕐᔪᕐᒥᑦ ᐊᒻᒪᓗ ᐃᔨᒥ ᐃᓚᐅᕈᑎᒃᓴᖅᑕᖅᑲᖅᑰᑦ. ᖃᐅᔨᓴᖅᑕᐅᓂᖏᑦ ᐃᔨᑎᑉ ᑯᐱᕐᔪᖏᑦ ᐆᒪᔪᑰᖏᑦ ᐊᒻᒪᓗ ᐃᓚᐅᕈᑎᒃᓴᐃᑦ ᐱᔪᓐᓇᕐᓂᖅᑎᑦᑎᓂᖅᐸᖅᑐᑦ ᐅ ᕙᑎᓐᓂ ᓇᓗᓇᐃᖅᓯᓗᑕ ᑯᐱᕐᔪᐃᑦ ᐆᒪᔪᐃᑦ ᐊᐅᓚᔫᖅᐸᓐᓂᖏᓐᓂᒃ ᐳᓪᓚᖅᑲᕐᑎᑦᑎᓂᖅᐸᖅᑐᑦ ᓴᒃᑯᐃᓗᑎᑦ. ᐊᖏᓂᖏᑦ ᐳᓪᓚᐃᑦ ᓴᒃᑯᖅᑕᖅᐸᖅᑐᐃᓐᓇᓇᐊᖅᑲᕐᓂᖏᓐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᑉ ᐃᔨᖏᓐᓂ ᐅᑭᐅᒃᑯᑦ,

ᐃᓂᒋᔭᐅᖃᑦᑕᕐᓂᑯᒥᓂᕐᓂᒃ ᖃᓄᐃᓕᐅᖅᑕᐅᕚᖕᒋᑦᑐᒥᓂᕐᓂᓪᓗ ᓄᐊᑦᑎᒐᔭᖅᑐᒍᑦ ᖃᐅᔨᓵᓇᒐᔭᖅᑕᑦᑎᓐᓂ ᑕᐃᑲᖕᖓᑦ ᖃᐅᔨᓴᕐᕕᑦᑎᓐᓂ ᐊᒻᒪᓗ ᐅᑎᖅᑎᓪᓗᒋᑦ ᖃᐅᔨᓵᒃᓴᐅᔪᑦ ᖃᐅᔨᓴᕐᕕᑦᑎᓐᓄᑦ. ᐊᓯᔾᔨᕐᓗᒋᑦ ᐊᖏᓂᖓᑦ ᐃᒪᖏᑦ -5C -ᒥ ᓇᓗᓇᐃᖅᓯᒐᔭᖅᑐᒍᑦ ᓱᑲᓐᓂᖏᑦ ᐳᓪᓚᐃᑦ ᐊᓂᕐᓂᕐᒨᖅᐸᓪᓕᐊᓂᖓᑦ ᑕᐃᒃᑯᓇᖕᖓᑦ ᐃᔾᔪᓂᒃ ᐃᒪᓕᓐᓂᒃ ᕹᐊᖅᓯᒪᔪᓂᒃ ᐃᔾᔪᒥ.

ᑐᑭᓯᒋᐊᕈᑎᖏᑦ / ᐅᓂᒃᑳᓕᐅᕐᓂᕗᑦ: ᓄᐊᑕᐅᓯᒪᔪᑦ ᑐᑭᓯᒋᐊᕈᑏᑦ ᐊᑐᖅᑕᐅᒐᔭᖅᑐᑦ ᑎᑎᕋᖅᑎᓪᓗᑕ ᖃᐅᔨᓴᖅᑎᐅᔪᓄᓪᓗ ᑫᒥᕿᔭᐅᒐᔭᖅᑐᑎᑦ ᖃᐅᔨᓵᓂᒃ ᑎᑎᖅᑲᓕᐅᕐᓗᑕ. 2-3-ᓄᑦ ᓴᖅᑭᖅᑐᖃᕋᔭᖅᑐᑦ ᑎᑎᕋᖅᑕᒥᓂᑦᑎᓐᓂ ᑐᓐᖓᕕᒋᓗᒍ ᑕᒪᓐᓇ ᖃᐅᔨᓴᕐᓂᐅᔪᖅ.