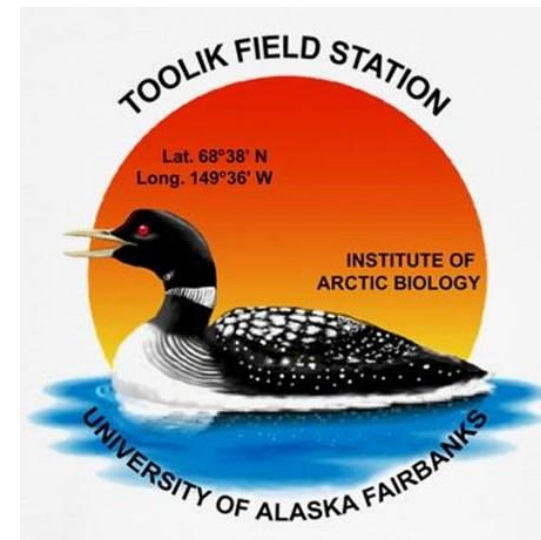
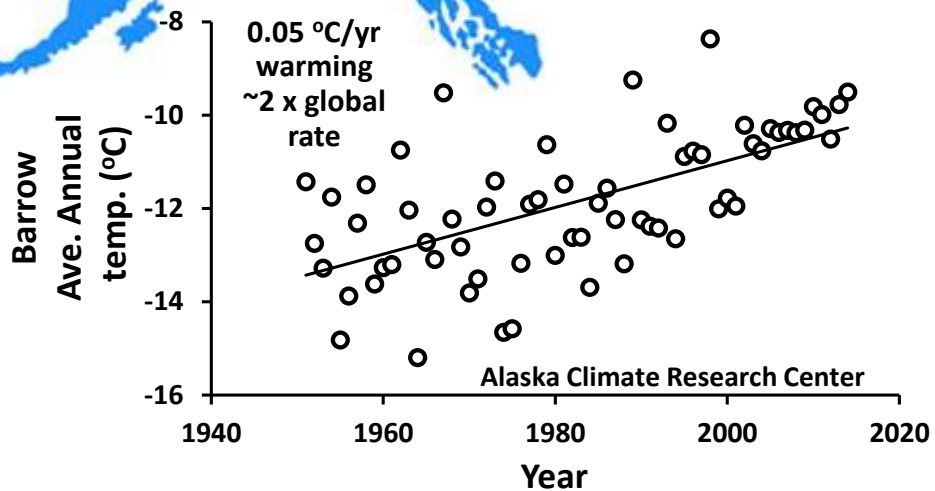
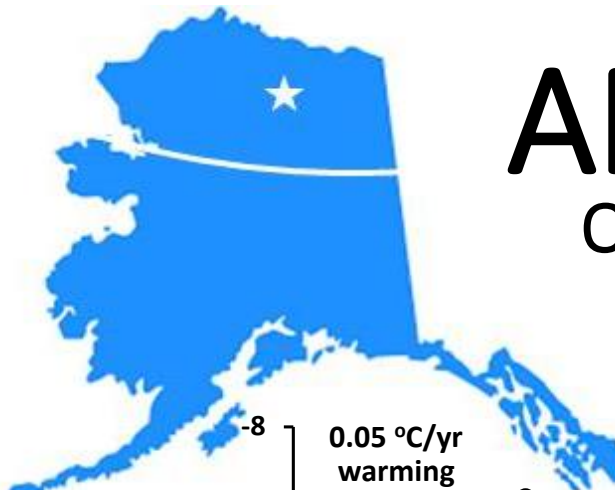


ARC LTER: The Role of Biogeochemical and Community Openness in Governing Arctic Ecosystem Response to Climate Change and Disturbance



Ed Rastetter

TFS Annual Meeting 2019



NATIONAL SCIENCE FOUNDATION

LTER NETWORK

LONG TERM ECOLOGICAL RESEARCH



ARC LTER Site Review 2019:

Review team drives up from Fairbanks on 23 June

Site review: 24 – 26 June

Review team flies out of Deadhorse 27 June

Tentative schedule yet to be approved by review team

New Green houses

Drone flights over our experimental plots

Fish trackers on I1 & I2 lakes (assess weir to close system next summer)

Explore Oksrukuyik (Oks) for closed v. open lakes

eDNA to ID fish distributions

Jade “disappearing lake” monitoring (with TFS) need for long-term perspective

Stopped fertilization on Kuparuk, begin recovery monitoring (also Oks & Trevor)

MEL application to 4 tundra types and other biomes (Rastetter et al)

Team Vole (Boelman et al) AniMEL model

Stream network-sentinels of connectivity & change (Abbott & Zarnetske)

Fishscapes migration in changing Arctic (Deegan, Urban, & Golden)

Aufeis hydro-ecology “Arctic Oases” (Huryn & Gooseff)

Lake warming (Budy et al)

Photo-biodegradation of DOM (Cory & Kling)

Soil freeze-thaw soil hydrology (Chen, Cardenas, & Kling) (Thanx for help TFS)

Iron oxidizing bacteria and methane generation (Emmerson, Bowden)

All-LTERs All-Scientists Meeting

1-6 October 2018

Asilomar, Pacific Grove, CA

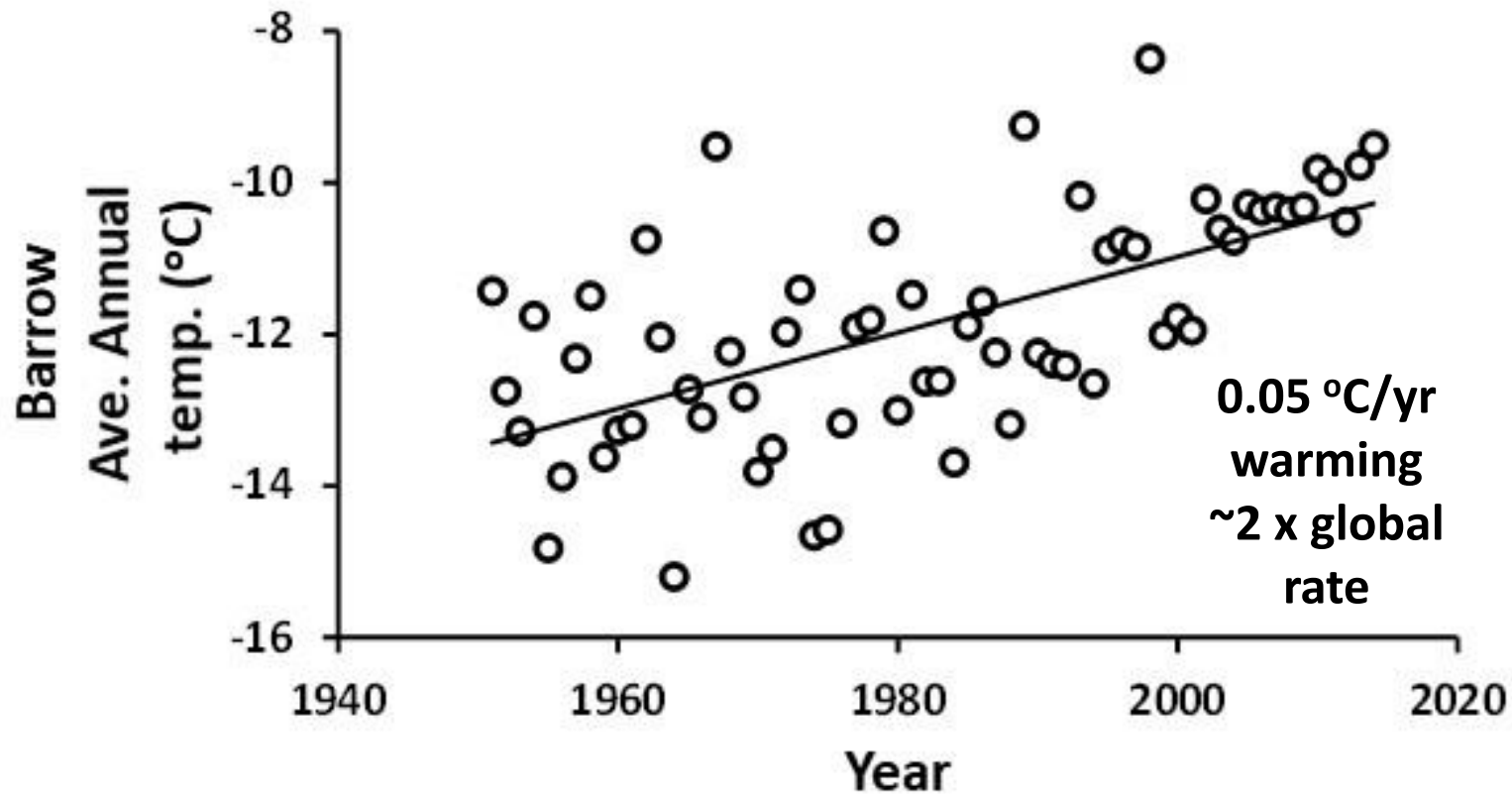
ARC LTER report to the LTER Science Council

16-18 May 2018

Madison WI

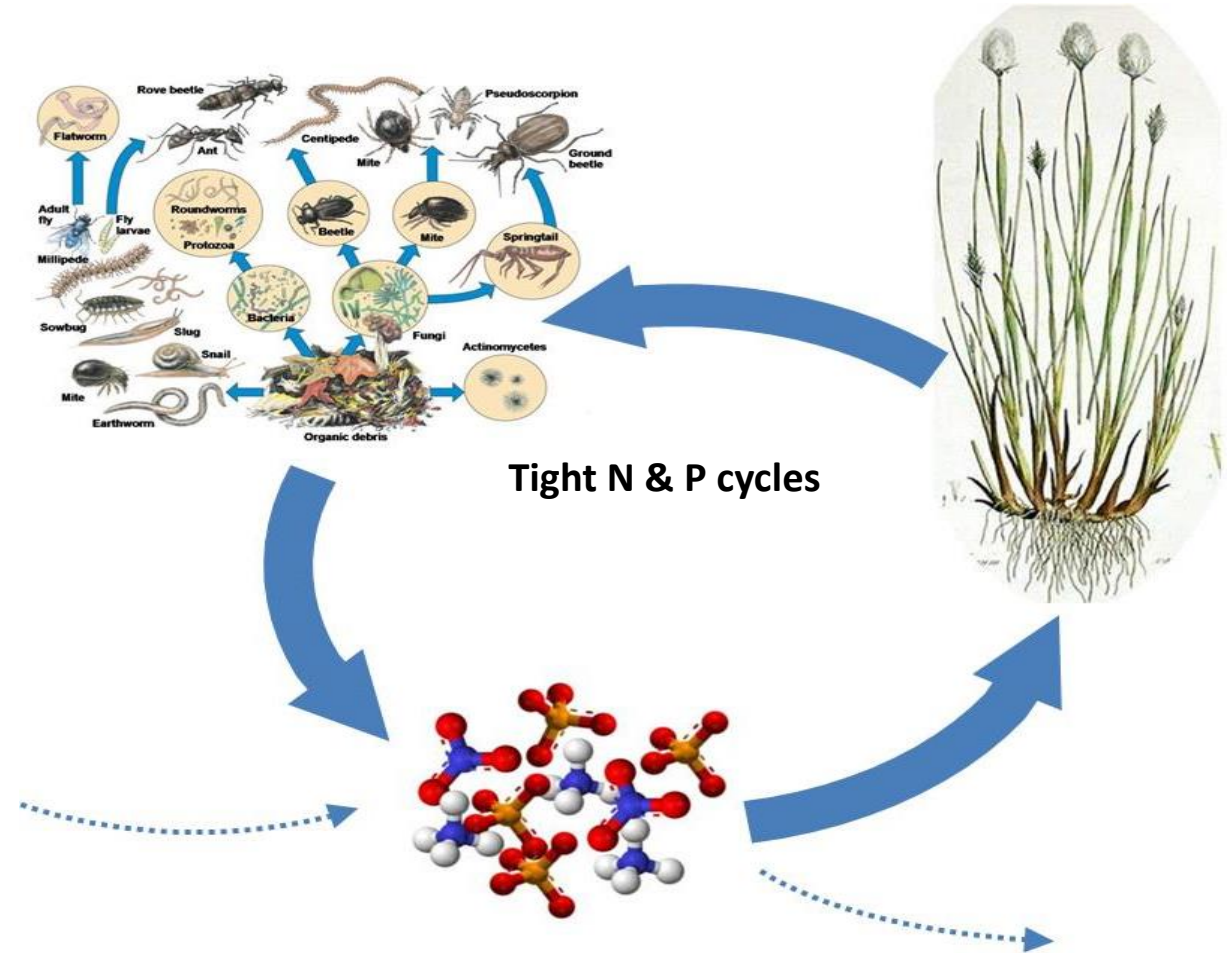
**There are strange things done
in the midnight sun
By them that strive to know
How the North will fare,
in the warming air
And less time covered in snow**





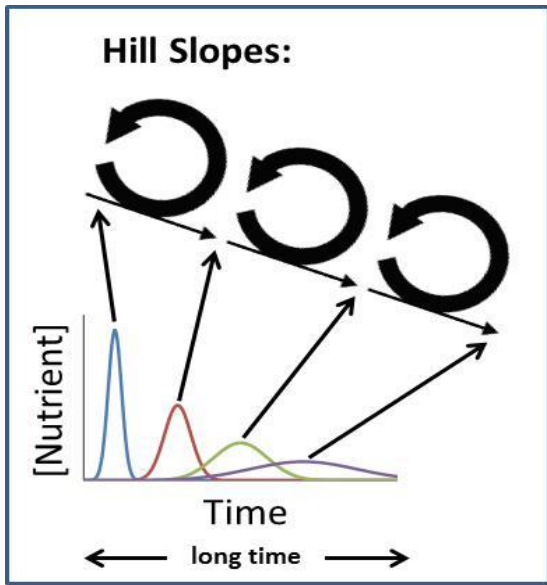
**The tundra's warming fast, and will not last
But for another century, no more
It's for us to assess the extent of the mess
And what we yet have in store**

Now to understand
the issues at hand
A biogeochemical view's required
Recycling's the way
to keep limitation at bay
For nutrients are hard acquired
There are nutrients at hand
to fill plant demand
Nearly all released by the soil
A millennia to accrue
and hard to renew
A treasure to protect and not spoil

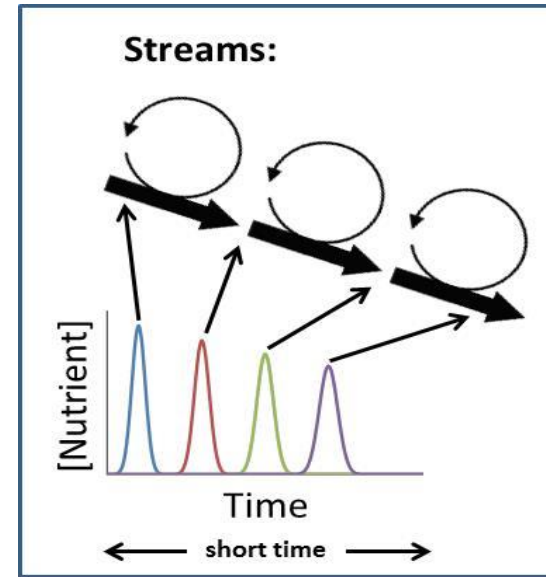


**But warming will feed
the cycling speed
Nourishing the vegetation
Causing disunity
in the plant community
And leaving an aberration**



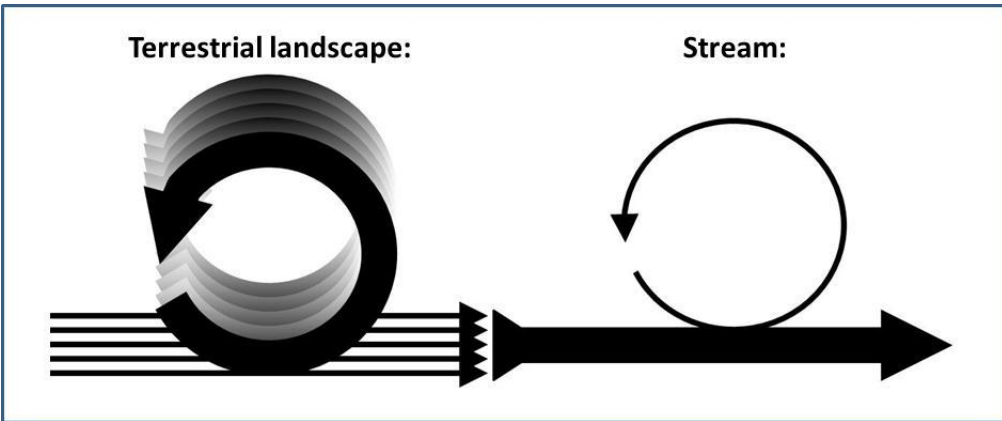


Nearly closed ecosystems on hills are poorly connected; delay and attenuate nutrient pulses moving down slope



More open stream ecosystems are well connected; propagate nutrient pulses moving downstream

**On land cycling's tight
and N losses slight
But in streams it spirals and spills
Relying instead
on the small amounts shed
And amassed from the surrounding hills**

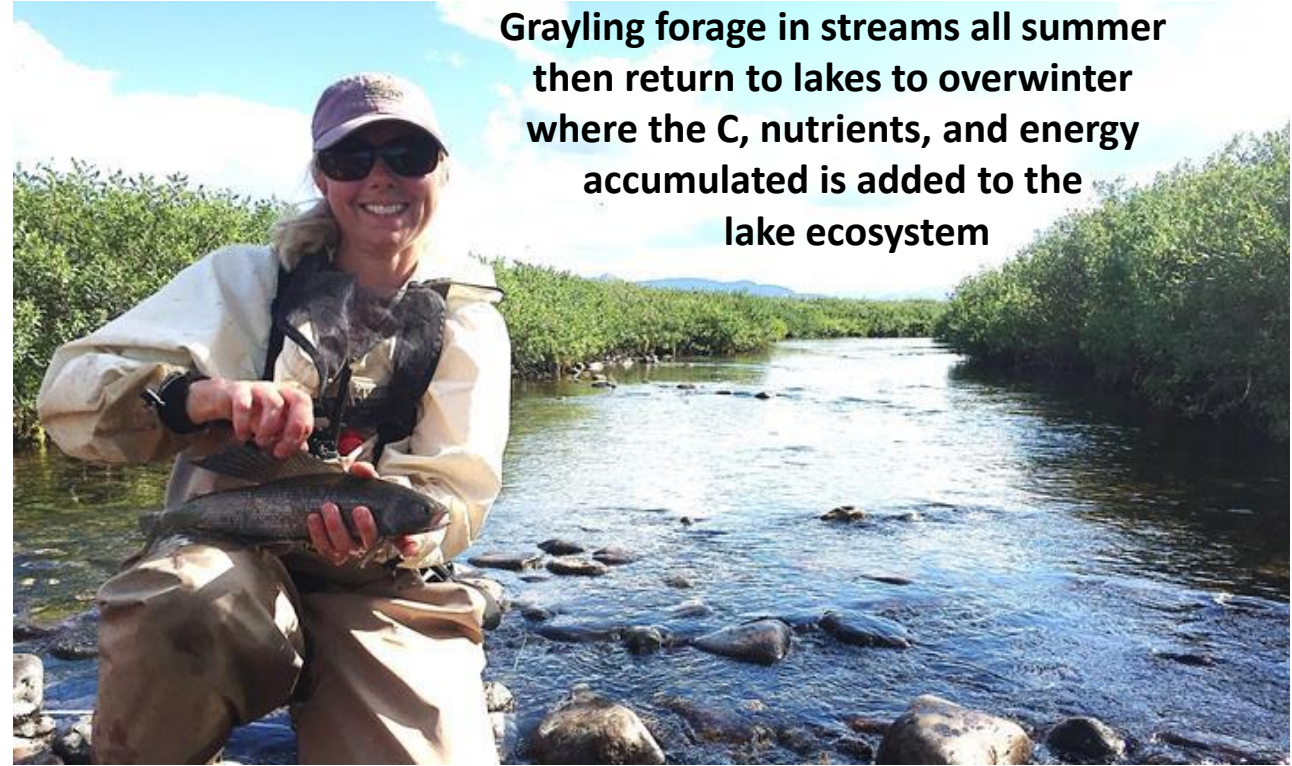


Recycled nutrients accumulated over millennia

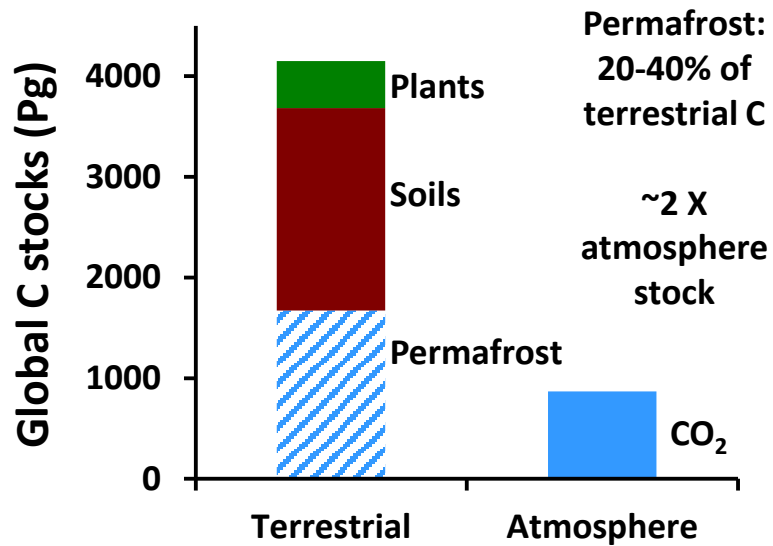
Throughput of nutrients accumulated over catchment area

**The lakes have a means
of filling their needs
For resources that are running low
The grayling move out
to forage about
Into streams when they start to flow**

**There they proceed
to disperse and feed
Until the summer banquet runs out
Then they return to the lake,
their bodies to make
A winter feast for char, burbot, and trout**



**Grayling forage in streams all summer
then return to lakes to overwinter
where the C, nutrients, and energy
accumulated is added to the
lake ecosystem**



**The impending loss
of the permafrost
Should strike you all with shock
For the carbon it holds,
in its deep-freeze cold,
Is twice the atmosphere's stock**



**As the thawing proceeds,
the landscape recedes
Until the hills are sagged and slumped
The surface sheet,
with its plants and peat,
Into streams and lakes are dumped**

And with the warming air,
there's another care
Convective storms abound
Although once rare,
lightning now fills the air
Setting fire to the ground

More than six thousand years
and *then* fire appears
Burning 400 square miles of land
With the peat decreased
by the carbon released
Leaving a dark scar like a brand

2007 Anaktuvuk
River Fire



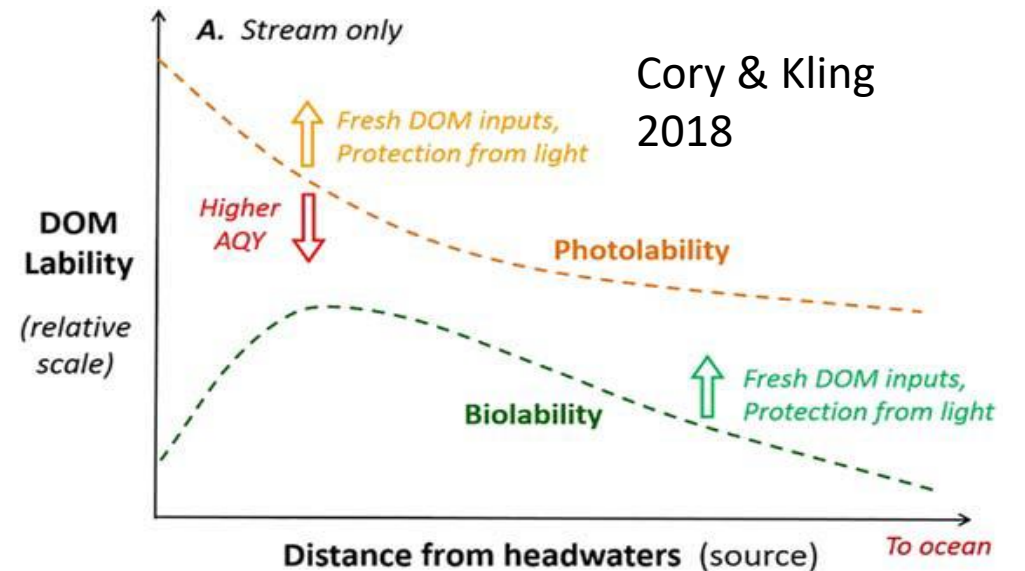
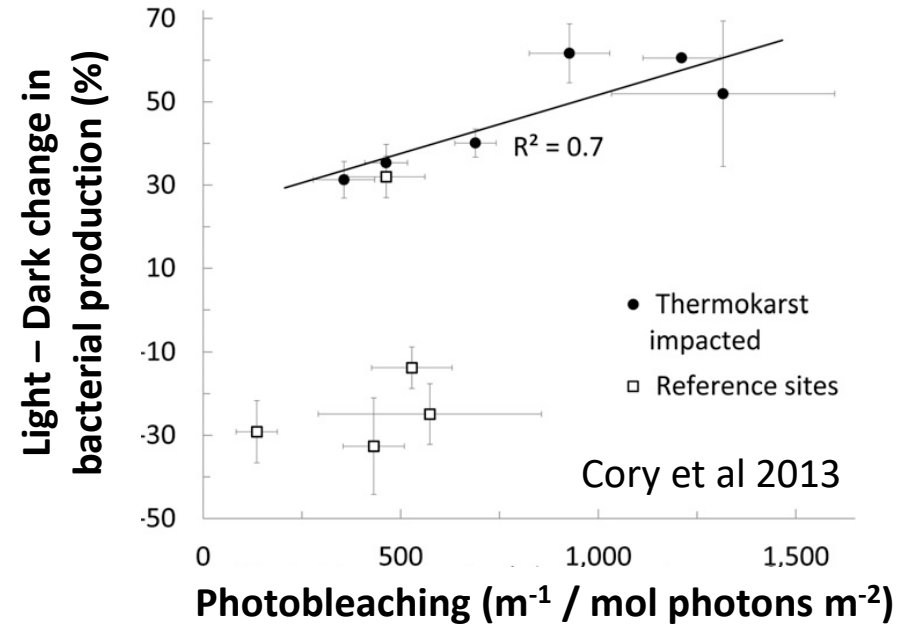
Fire
form
space

1000 km² fire
scar

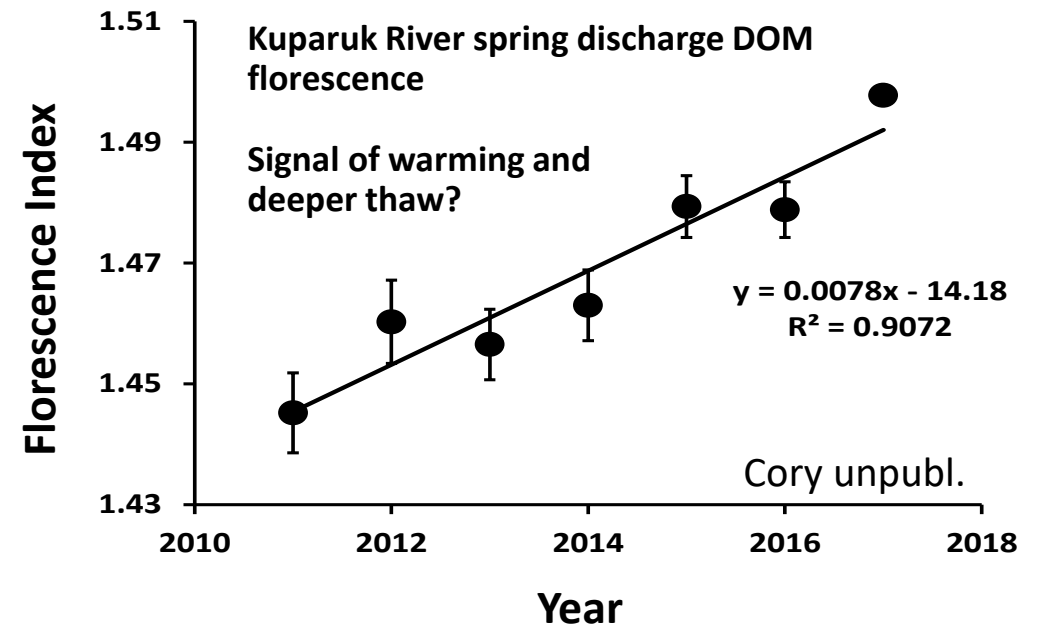
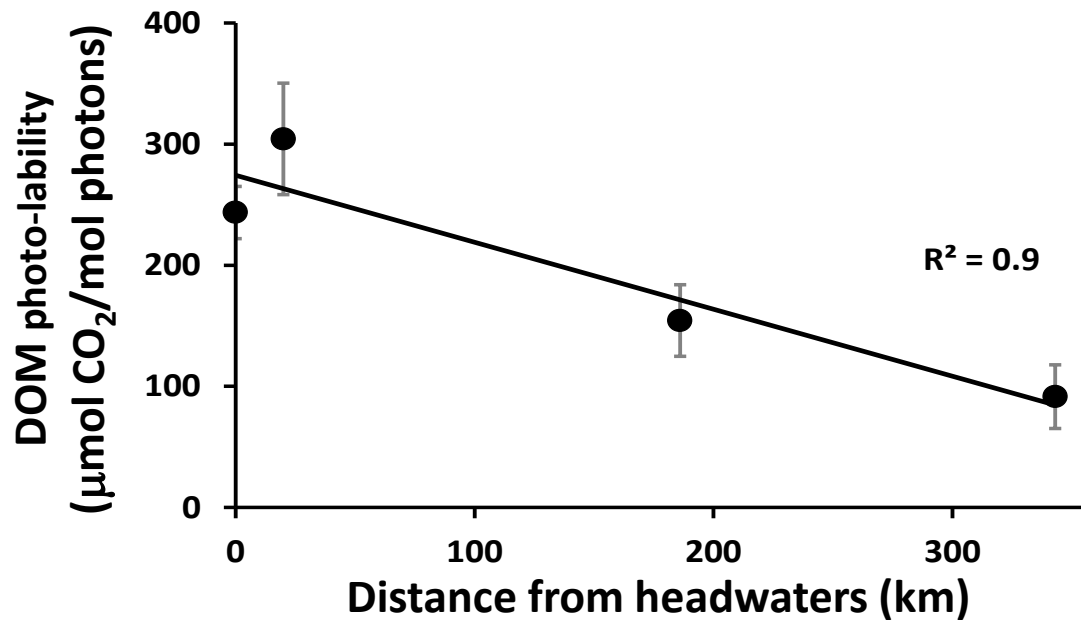
2.1 Tg C
release to
atmosphere

The soil's replete
 with DOM from the peat
 But permafrost has an unusual stash
 That just goes to waste
 'cause it ain't to the taste
 Of the microbes there in its path

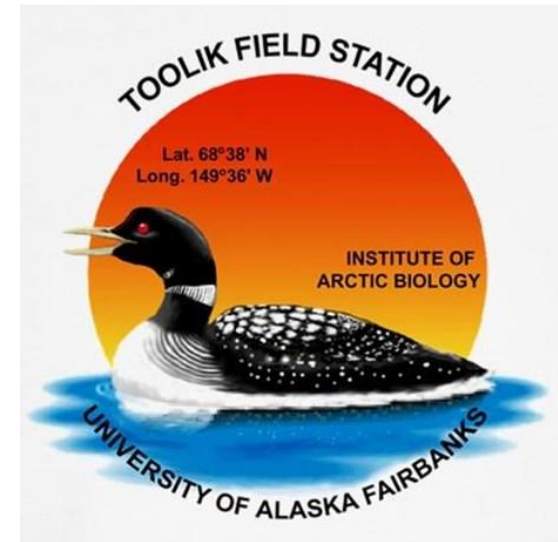
It remains neglected
 and largely unaffected
 As it flows from tussock to stream
 Until its reanimation
 by photo activation
 Its lability there to redeem



**But what happens then to the DON
Flowing attached to the carbon?
Does limitation decrease with N release?
Is it all part of the bargain?**



**Although unique, the Arctic can speak
Of changes yet to come
A harbinger perhaps, of climatic collapse
For ecosystems yet to succumb**



**Yes there *are* strange things done in the midnight sun
By them that that strive to know
How the North will fare, in the warming air
Under the climate's persistent blow**