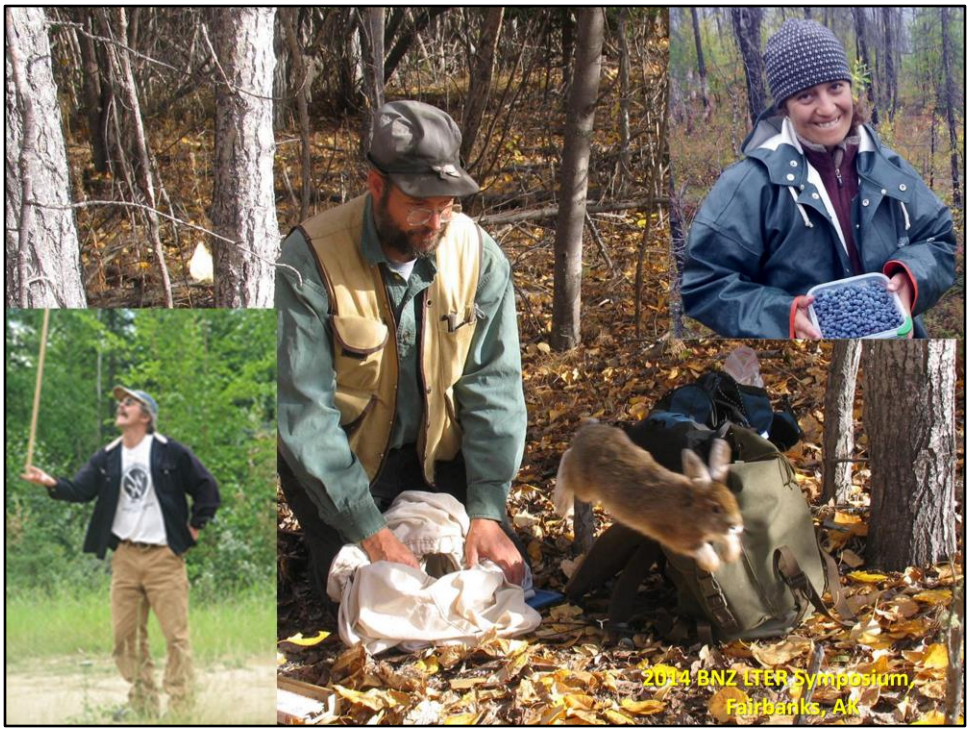
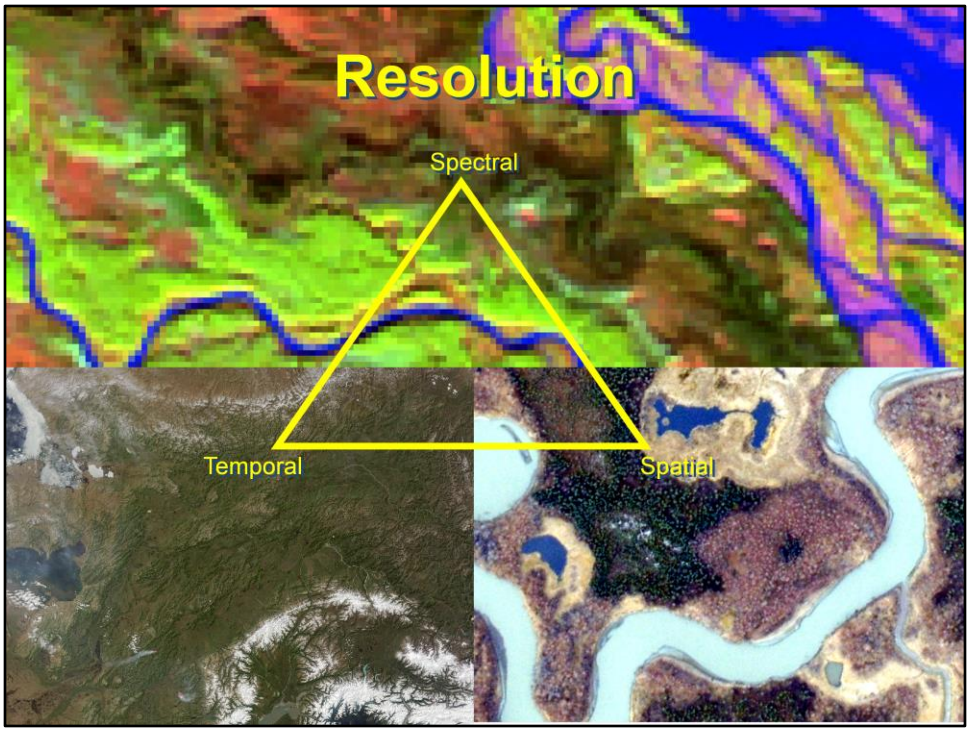
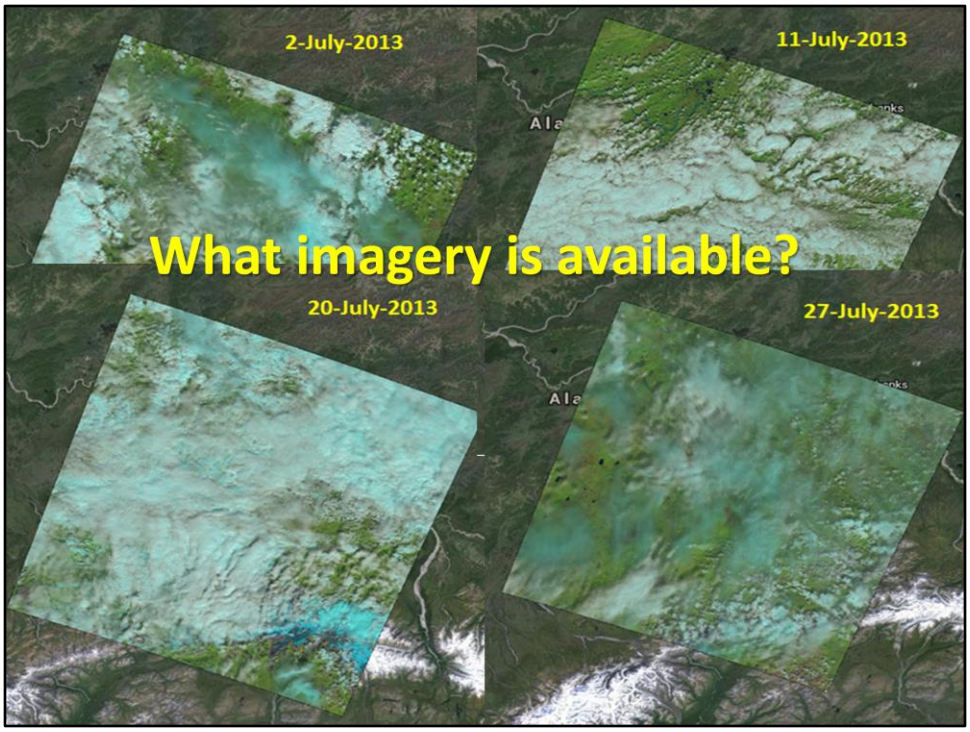


Monitoring plant-herbivore interactions from space
2014 BNZ LTER Symposium, Fairbanks Alaska
emai: dlverbyla@alaska.edu

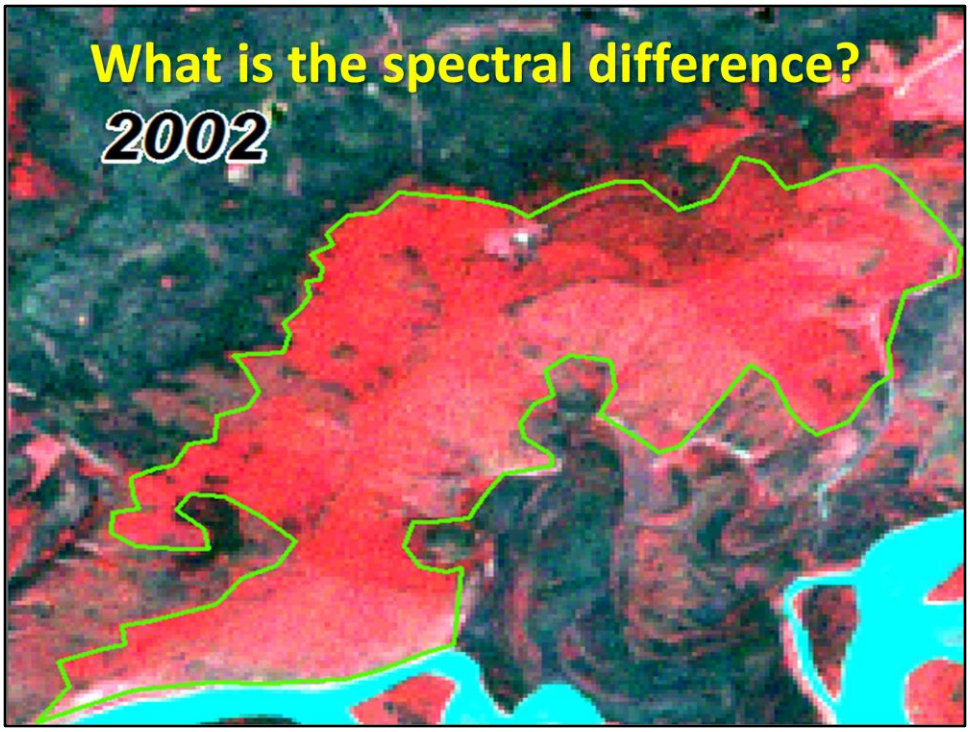
In this talk, I focus on factors to consider in remote sensing of change…the change may be land cover change, vegetation productivity change, expansion or drying of lakes, change in fire severity over time, or change associated with insect infestations



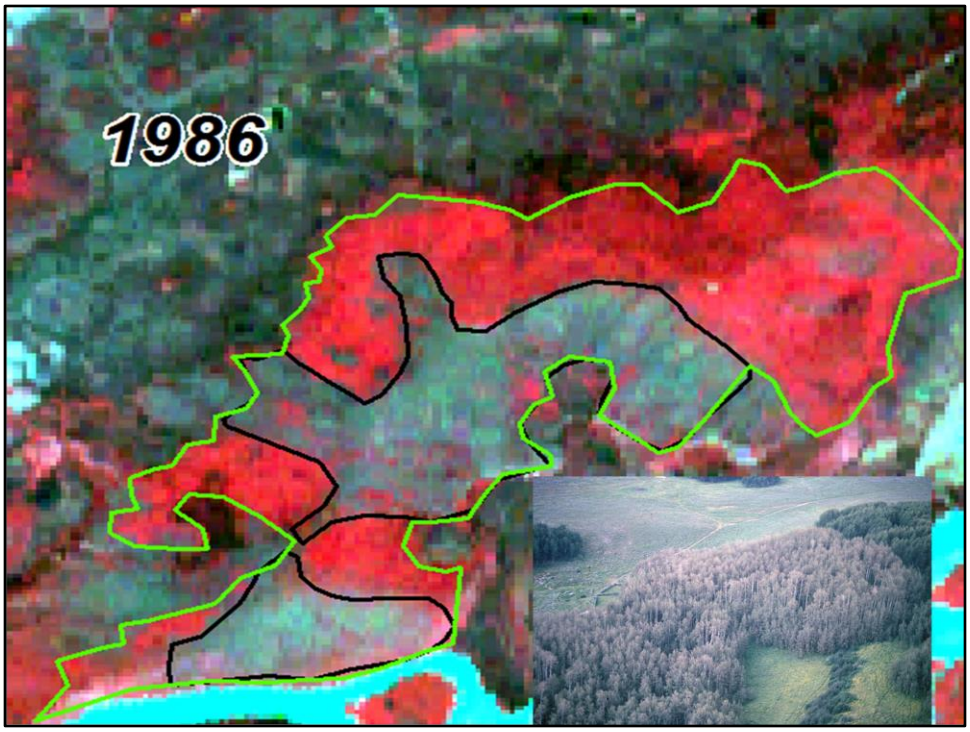
There is always a tradeoff between spectral/tempora/spatial resolution in remote sensing systems.
Want regional coverage of Alaska's boreal forest? Not a problem and its free, but the finest resolution will be 250 meter pixels.
Want imagery where you can see the tree crowns? Not a problem, but you may have to wait years and pay $thousands.
Want imagery with narrow spectral bands? Not a problem, but you will have 30-meter pixels and it may not be available for your area, or you may have to wait years and pay $thousands.



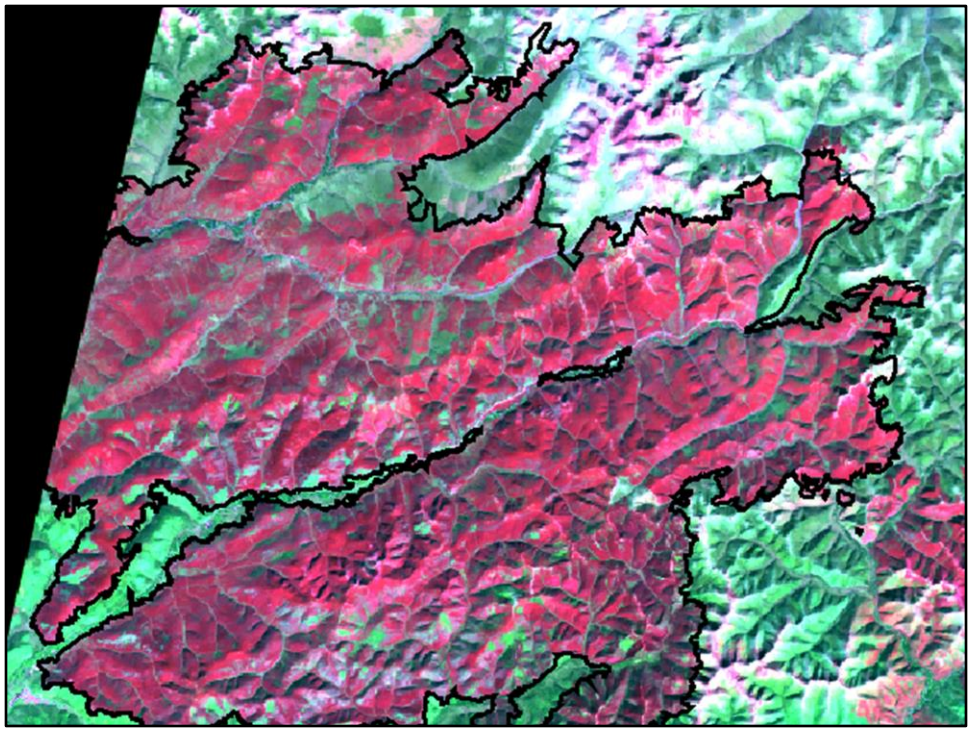
In general, the finer the detail (smaller pixels) the less imagery available both temporally and spatially.
Want daily coverage of boreal Alaska with 1km pixels? Not a problem (but you still have to deal with clouds)
Want 0.5 meter pixels of BNZ site from midJuly 2013…likely a problem
At high latitudes such as boreal Alaska, cloud shadow can also be a limitation…25 percent cloud cover means greater than 50 percent unusable image due to cloud shadows.
Another problem with a Landsat time series is a scarcity of Landsat images during the time period of privatization when each scene cost $4900 compared to free today.



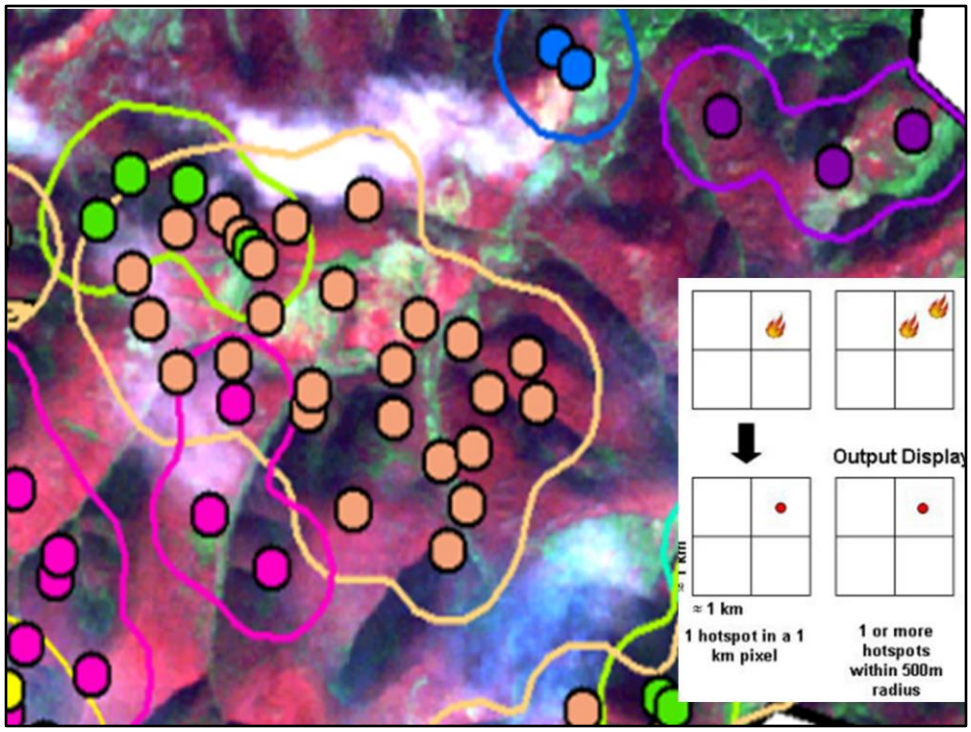
Most of the spectral difference between birch and aspen in this Landsat image is due to topography..there is little spectral response due to leaf miner infestation in aspen because the miners are not damaging the cellular structure of the leaf (pallasade cells and spongy mesophyll)



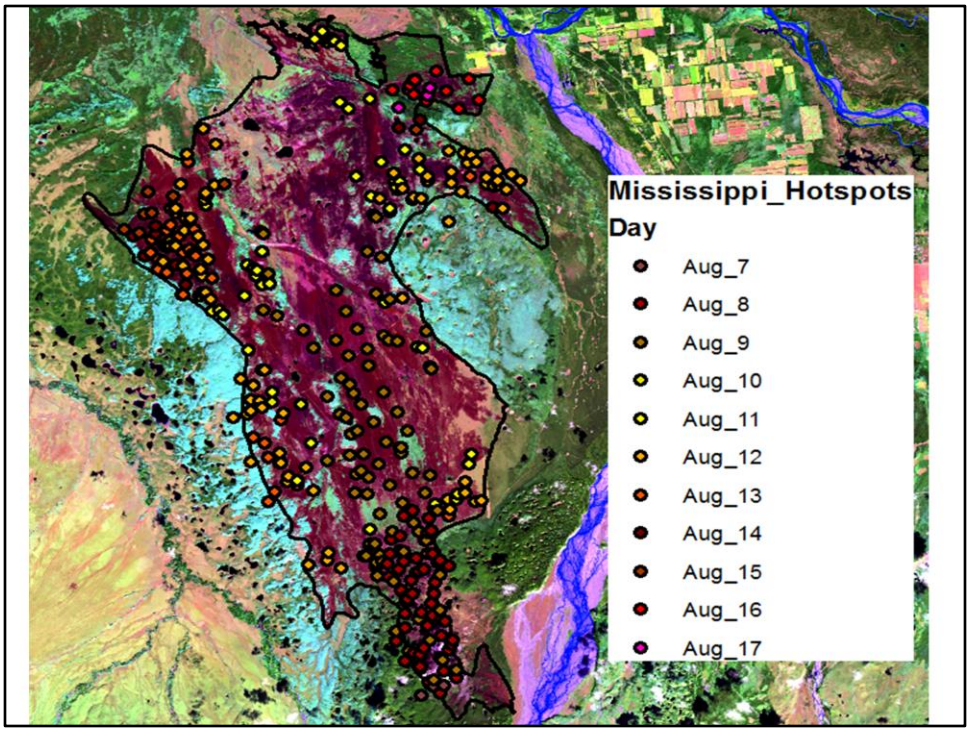
Here in 1986 aspen was hammered by large aspen tortrix resulting in defoliation and a large spectral difference.



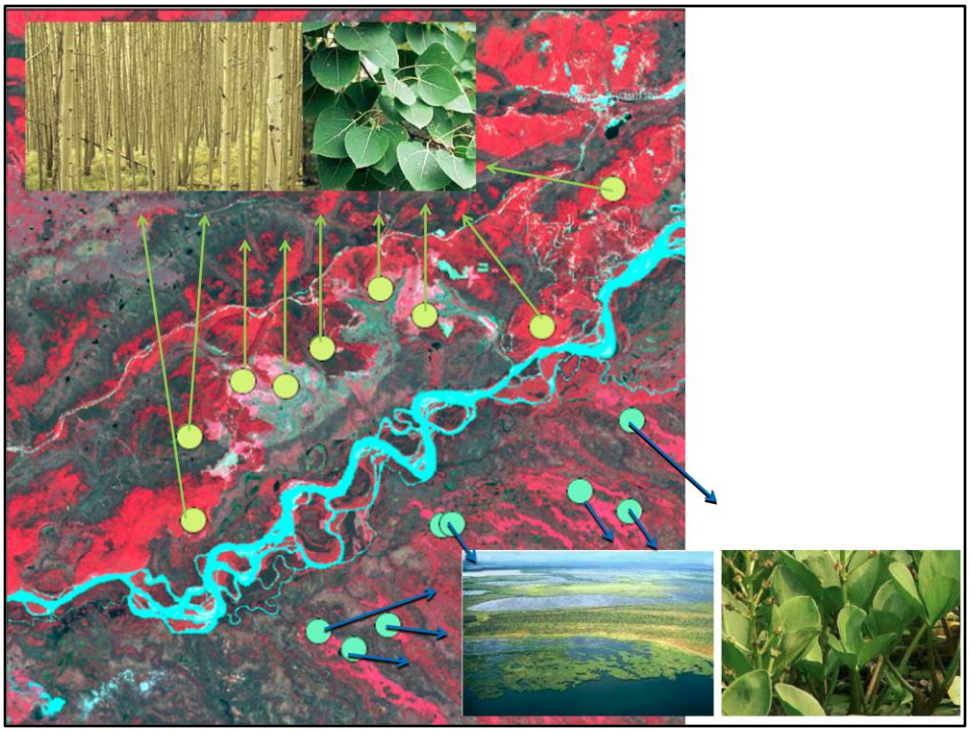
Typically it is easy to map wildfire at great detail because of the large spectral difference between undamaged canopy and burned areas.



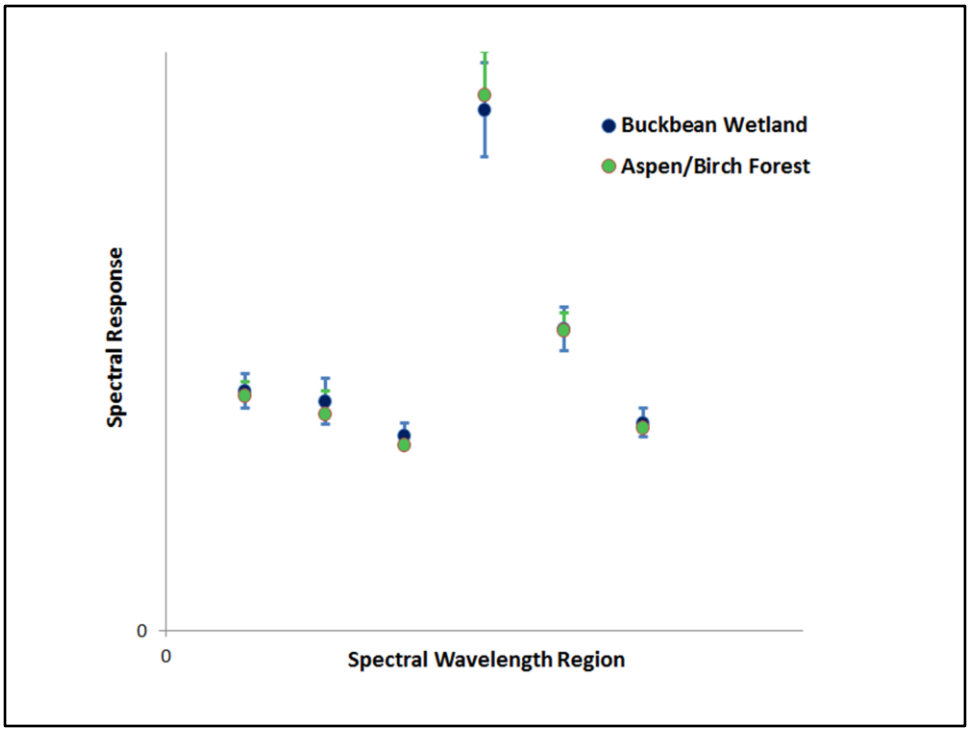
MODIS Hotspots are like presence absence data in animal location research….we know about presence but not about absence…



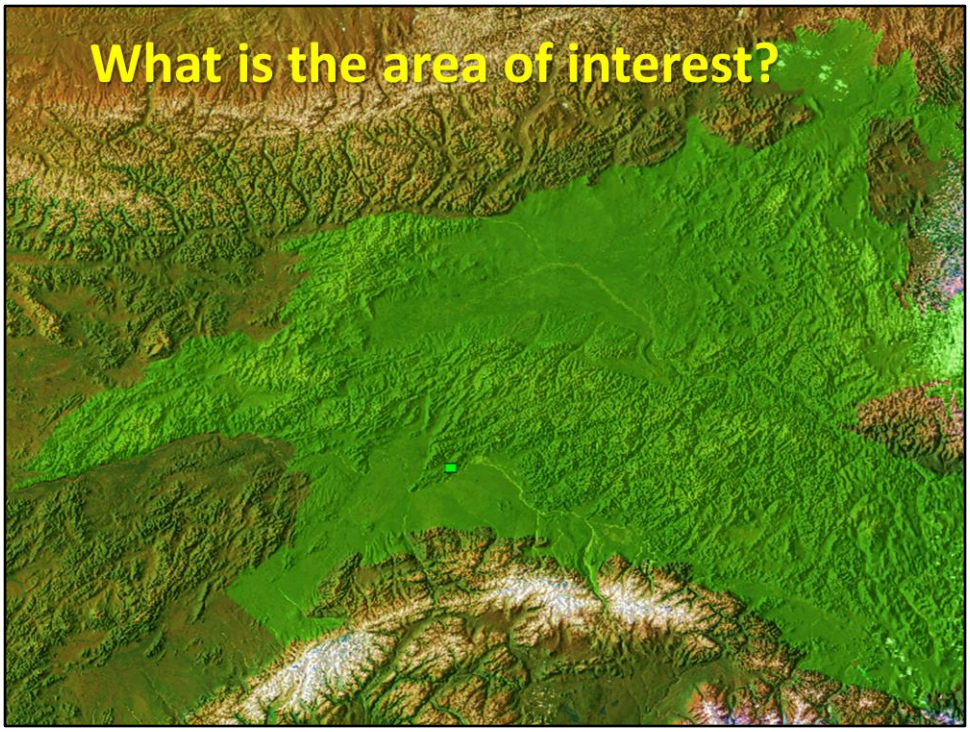
The Mississippi Fire started in May 2013 and burned through October. The MODIS Hotspot data tell a different story…some days may have been cloudy when burning occurred or the thermal signal was not strong during cold October days.



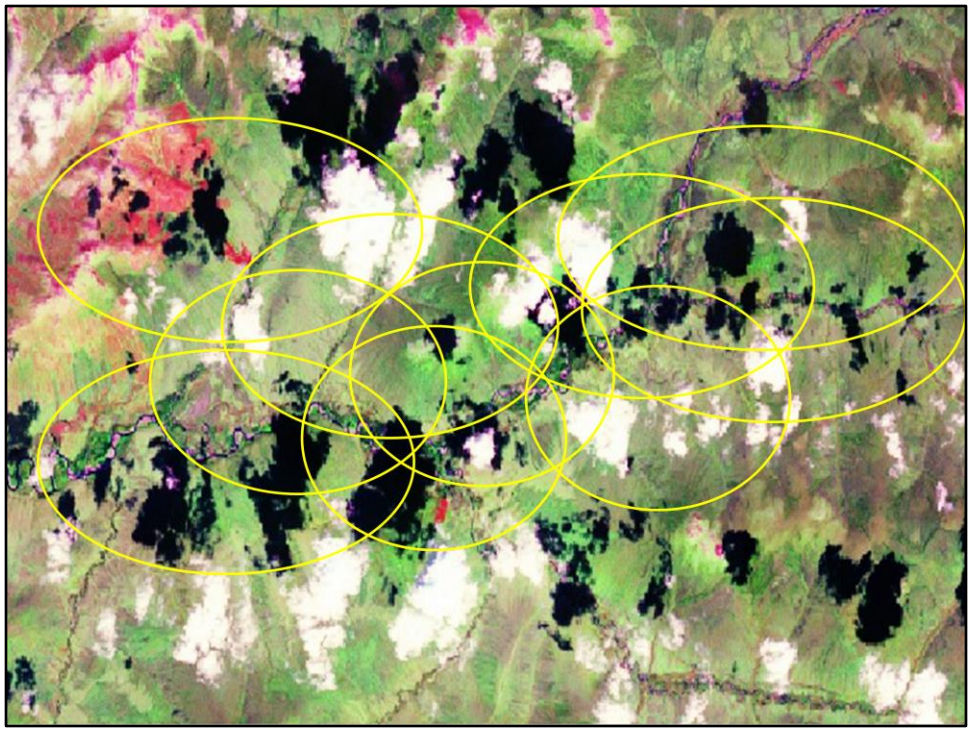
Here is an example of ten sample areas from aspen/birch forest versus ten sample areas of broadleaf wetland (Menyanthes) in the Tanana Flats.



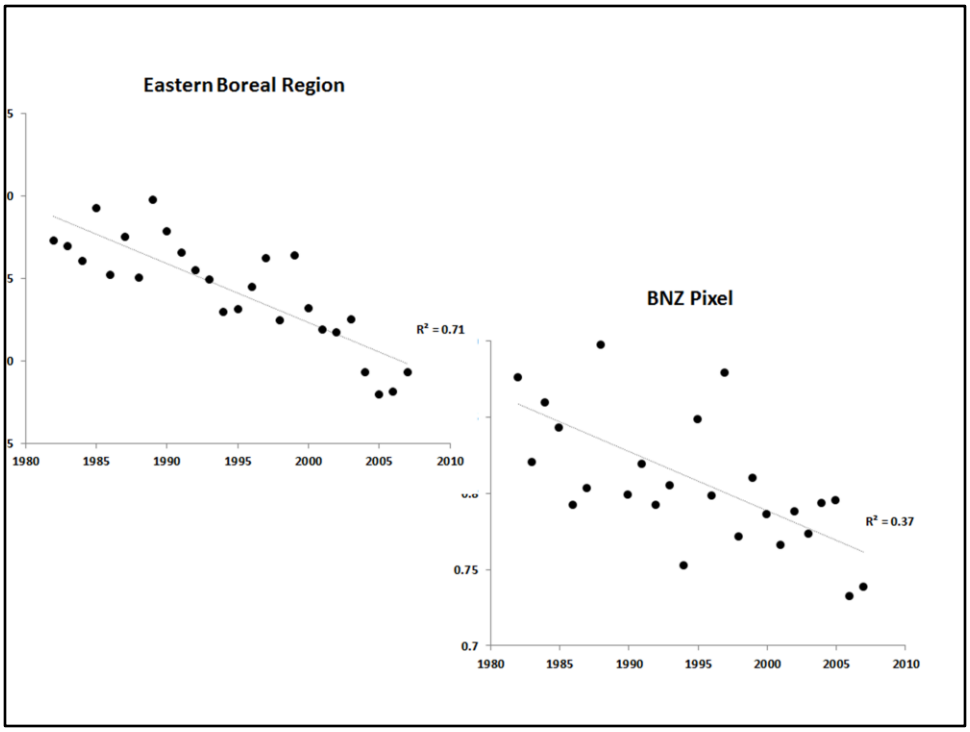
There is no significant difference in spectral response at the 6 Landsat sensor bands between buckbean wetland and aspen/birch forest. This is likely due to confounding factors such as variation in percent cover, and spectral variation from topography, etc.



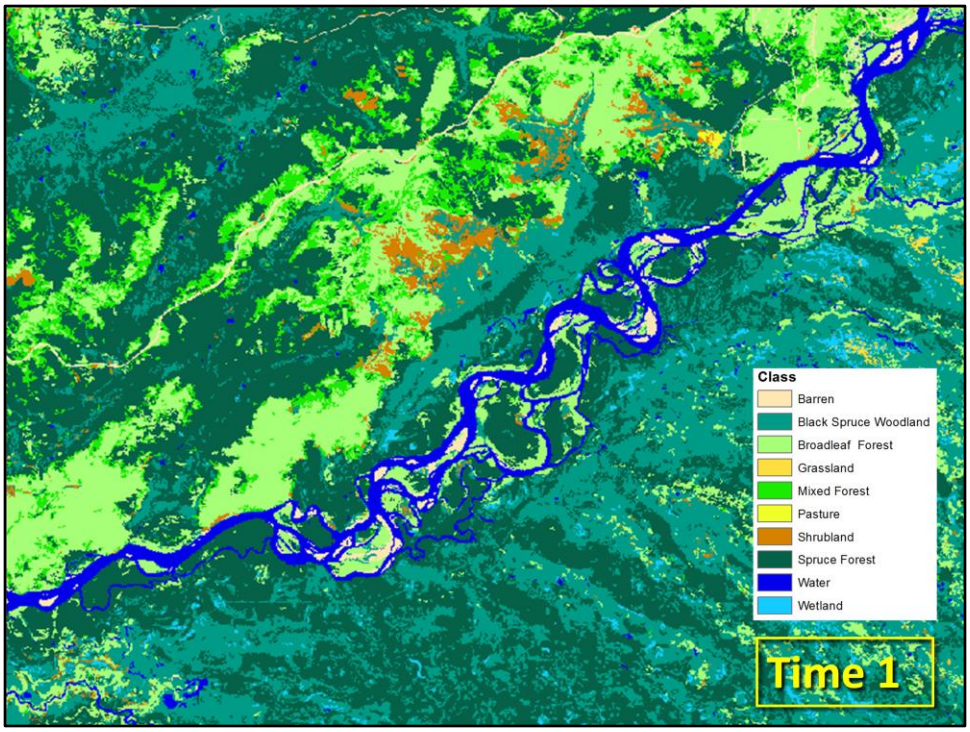
In general, there is more noise in a time series at the single pixel relative to a regional mean.
In this example, we will compare the browning trend son pixel at BNZ compared to an eastern boreal Alaska region.



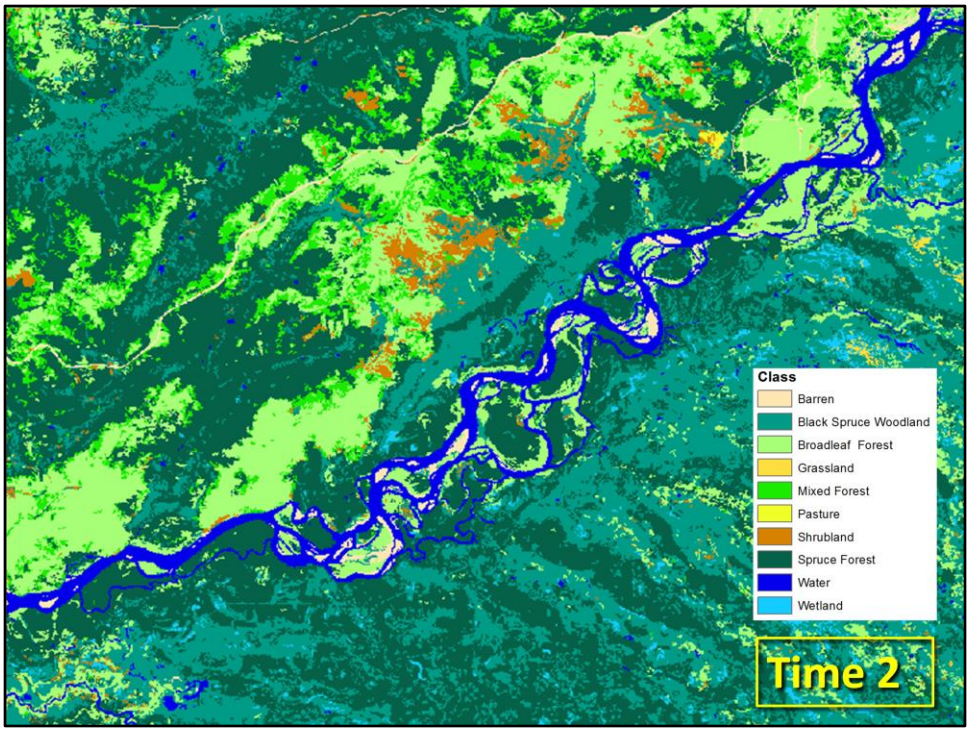
Imagery such as MODIS or AVHRR NDVI time series has an oblong instantaneaous field of view which becomes a pixel…we take the maximum NDVI from hundreds of samples during the growning season…but some pixels will have deflated NDVI due to cloud or cloud shadow within the instantaneous field of view.



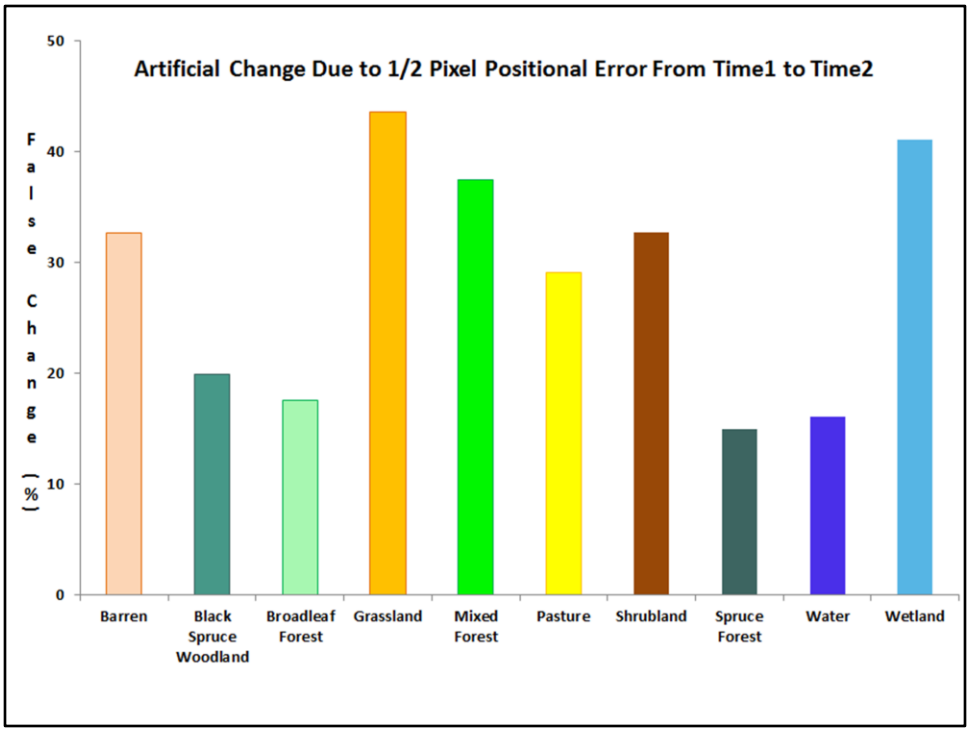
Note the higher variation for the single pixel…one reason is that the location of the "pixel" varies spatially with every observation.
This is anlagous to trying to take the same photograph today of the same area from a photo from yesterday..they will not perfectly co-register…
The area may be only half a pixel, but there is always some inherent positional error.
When we are using regional means, the effect of positional error in a time
Series is negligle.



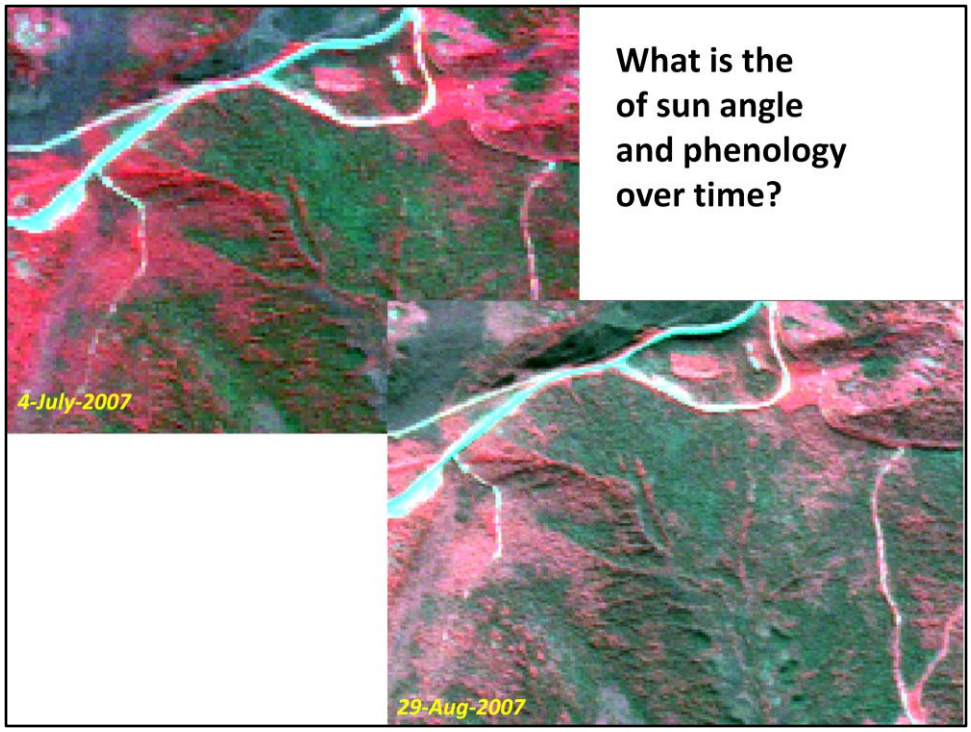
Here is a land cover map from the BNZ area.



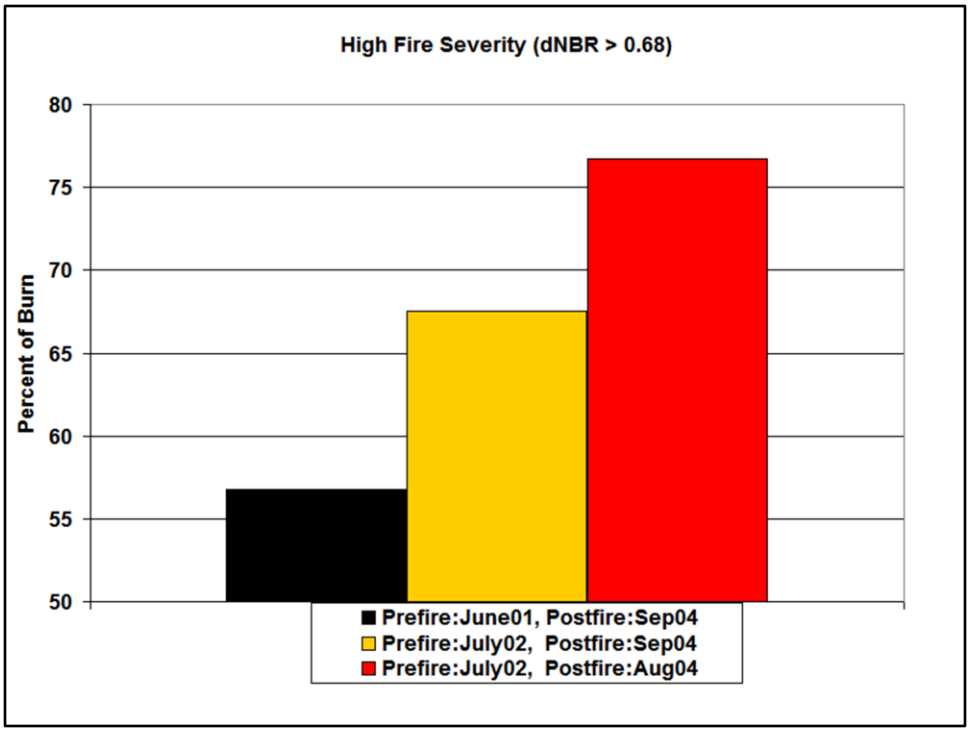
Here is the same map with each pixel having a positional error of a half pixel shift…lets say this is time 2.
If we subtract time 1 from time2, we will have some false change due to this positional error.



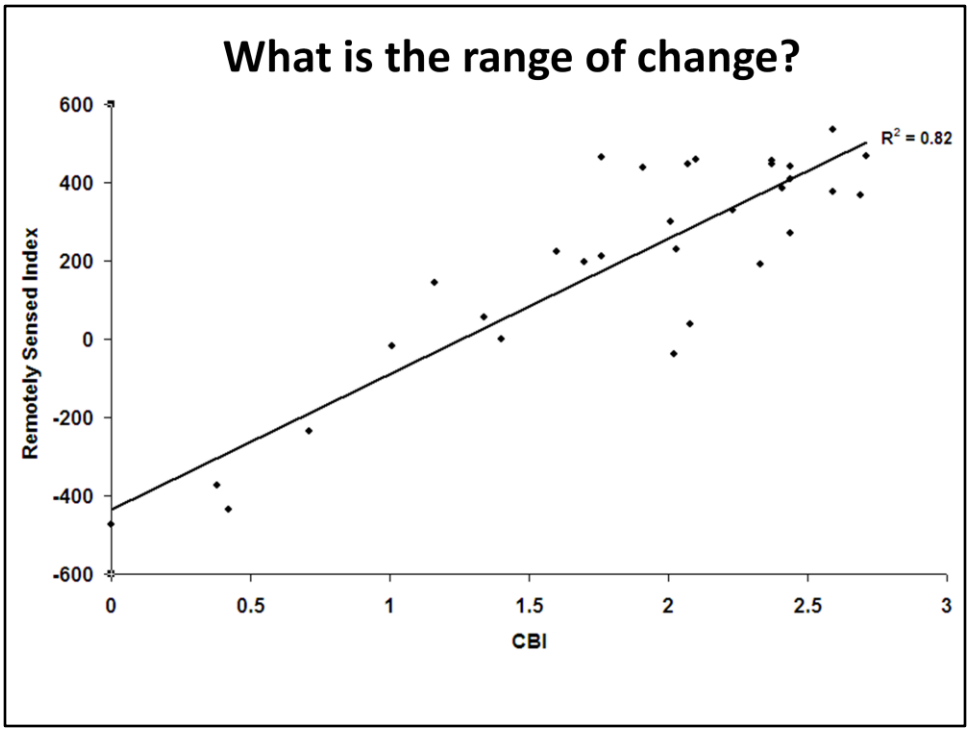
The more homogenous cover types such as broadleaf or spruce forest have less false change, but for every class there is false change due to positional error in the time series.



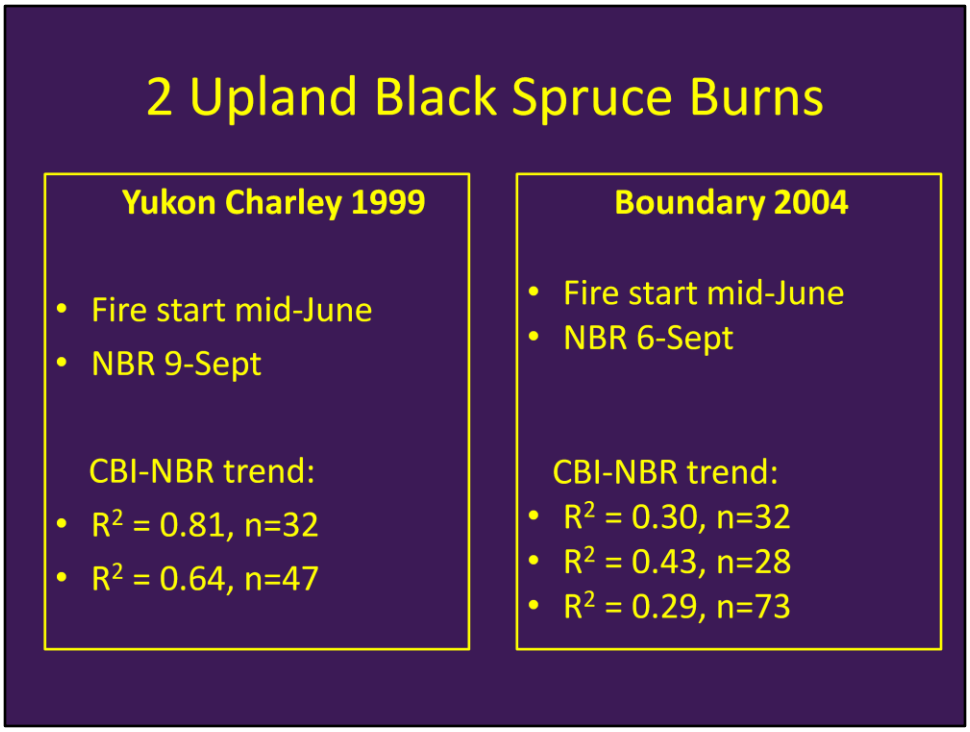
At high latitudes, the effect of variable sun angle and plant phenology in a time series can be important.



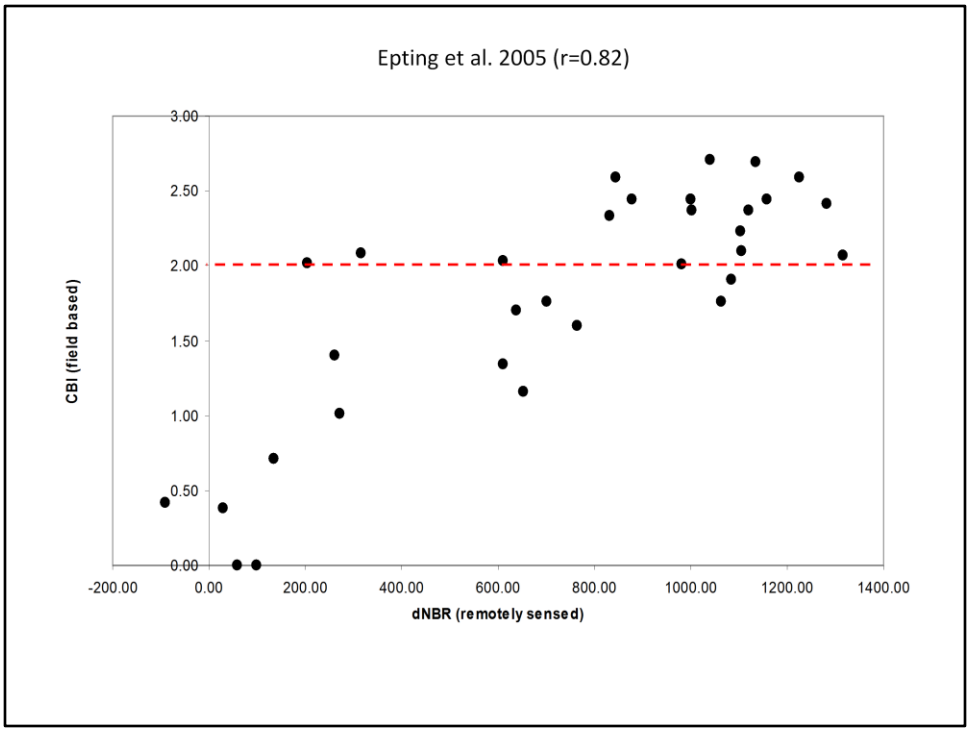
Fire severity was the same for the pixels in the Boundary Burn since these pixels burned before Aug04. The dNBR values were influenced by phenology and solar elevation with different pre-fire and post-fire image dates used to compute dNBR



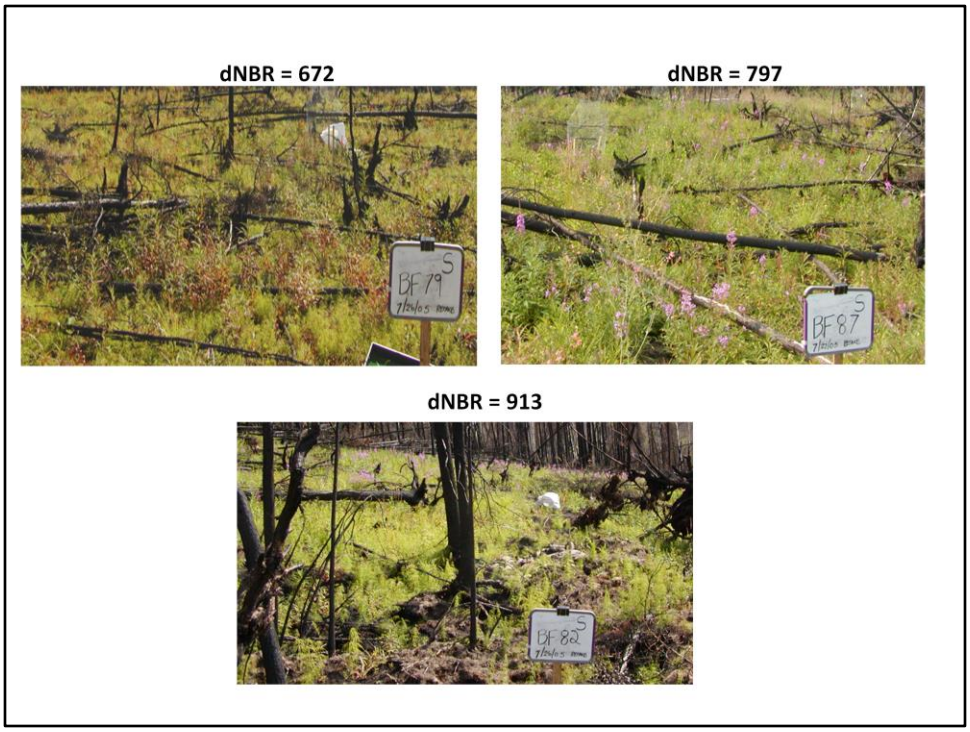
We found a strong correlation from field based CBI and the remotely sensed severity index for an uplands burn in 1999



Despite these sources of noise, the Park Service has found some strong correlations (Yukon Charley 1999)
Between NBR and CBI. Why did the three teams all find weak correlations from Boundary 2004?



We published this in Remote Sensing of Environment. The correlation between dNBR and CBI was weak above a CBI of 2.0.



Here is an example of three severity burned sites, with high variability of the remotely sensed dNBR.

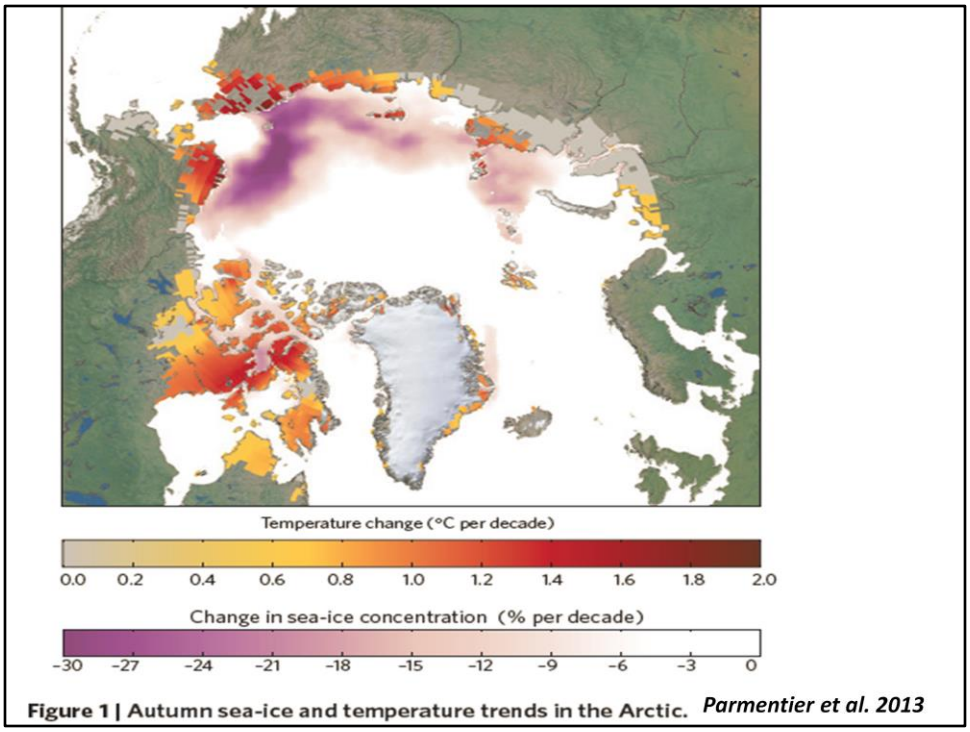
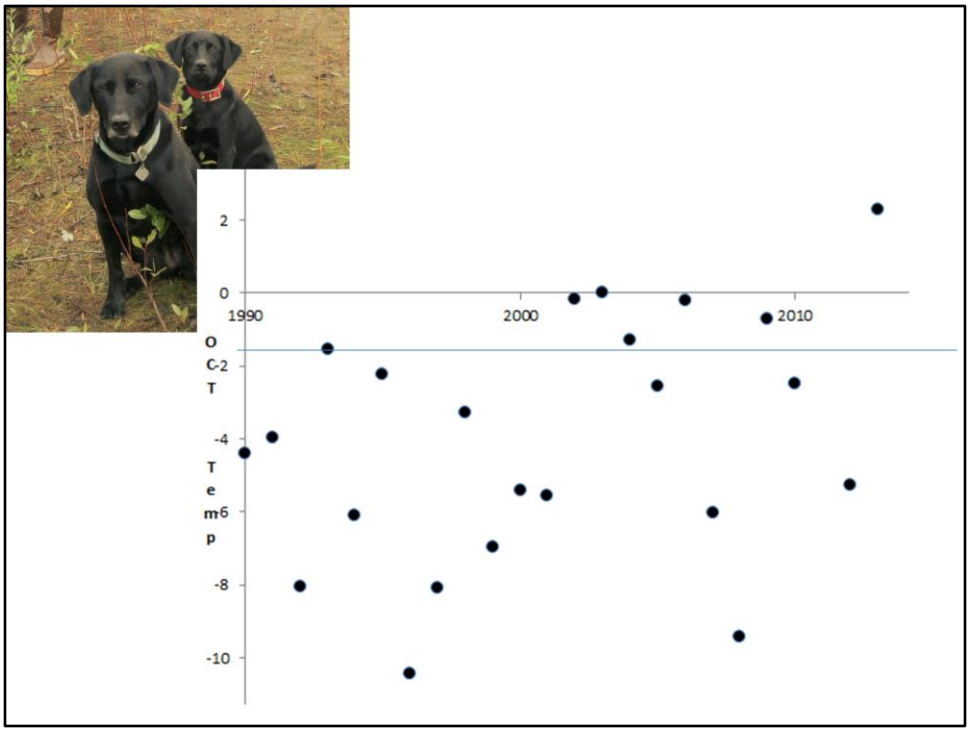


Figure 1 | Autumn sea-ice and temperature trends in the Arctic. ***Parmentier et al. 2013***

Parmentier et al. 2013 Nature Climate Change.
Linear trends in tundra mean air-temperature and sea-ice concentration (September and October, 1979 to 2011). Linear trends in tundra mean air-temperature and sea-ice concentration (September and October, 1979 to 2011).



The cooling trend has now shifted to a warming trend in recent autumns.
Duck hunters are happy with freeze-up typically in late Sept in the 1990s, since 2002 freeze-up has typically been in mid-Oct ,
some moose hunters complain about the hot weather…

Warmer autumns may change predator-prey relationships …species like snowshore hare and willow ptarmigan are highly visible in snowless October/November

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Mississippi Fire near Delta Junction flares up

Story Comments Print Font Size:

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Posted: Wednesday, October 30, 2013 12:05 am | *Updated: 7:25 am, Tue Nov 5, 2013.*

Temperatures reached a record high of 62 degrees Monday in Delta Junction, surpassing a daily record of 43 degrees, according to the National Weather Service. The area saw wind gusts of up to 63 mph Sunday and Monday.

The fire showed this weekend it's not going out without at least one final hurrah. It crossed bulldozer lines and expanded its perimeter along its northern side by about 300 acres, said Alaska Fire Service Manager Kent Slaughter. It's burning in low grassland that previously burned in the 1998 Carla Lake Fire.

If warmer autumns become the norm, wildfires burning in September and October may become more common…what will be the consequences?
Other studies have shown that with warmer autumns, black spruce stands have switched from a net carbon to a net carbon source due to fresh litter and increased respiration during warmer autumns.