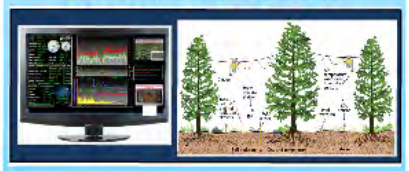
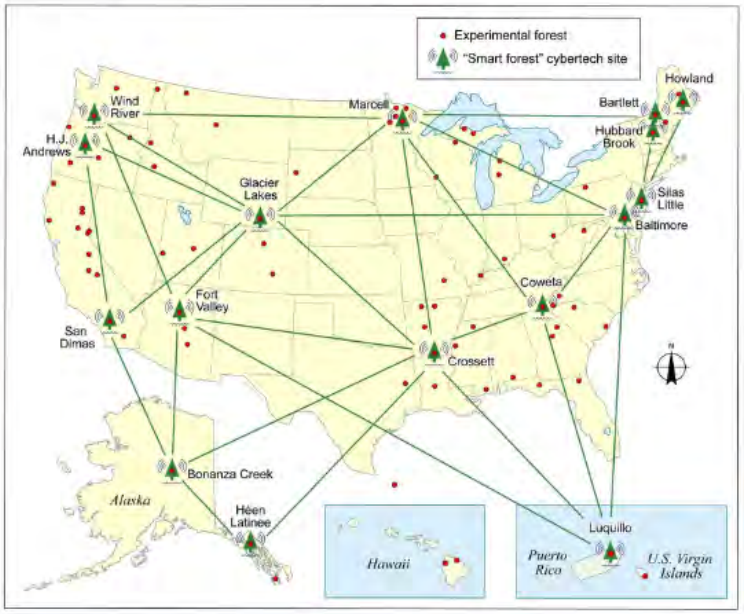
Smart Forests for the 21st Century:

How Cyber Technology and Big Data are Changing Environmental Sciences

NRS Smart Forests

The New "Business as Usual"

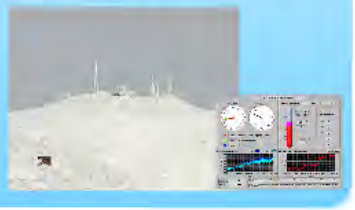




New Opportunities for Education and Outreach

RealTime Data Access

Access to Data From Difficult Locations



Access to Data From Difficult Times

New Scientific Insights

Smart Forests for the 21st Century:

How Cyber Technology and Big Data are Changing Environmental Sciences

Lindsey Rustad, Northern Research Station, December 2013

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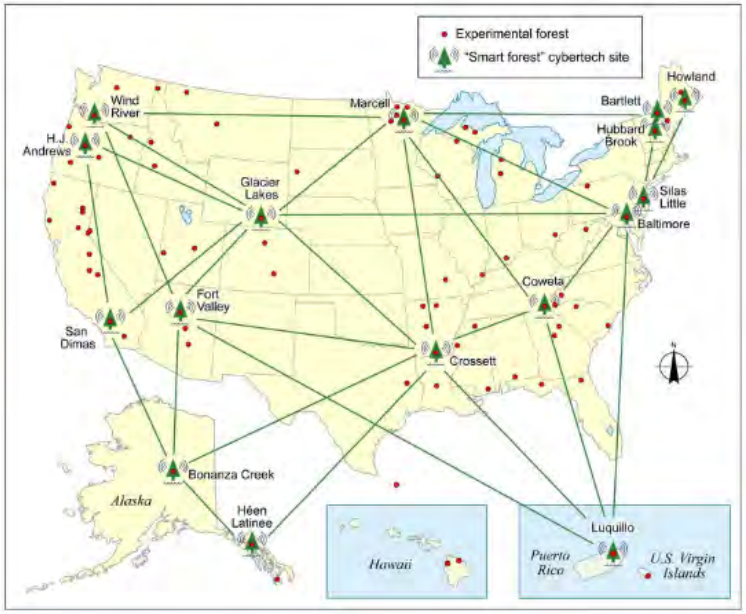

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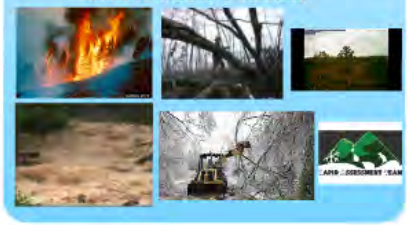

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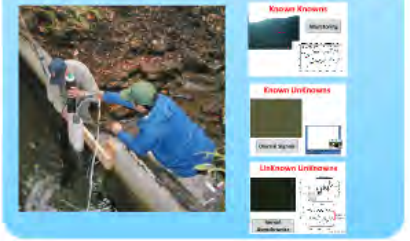

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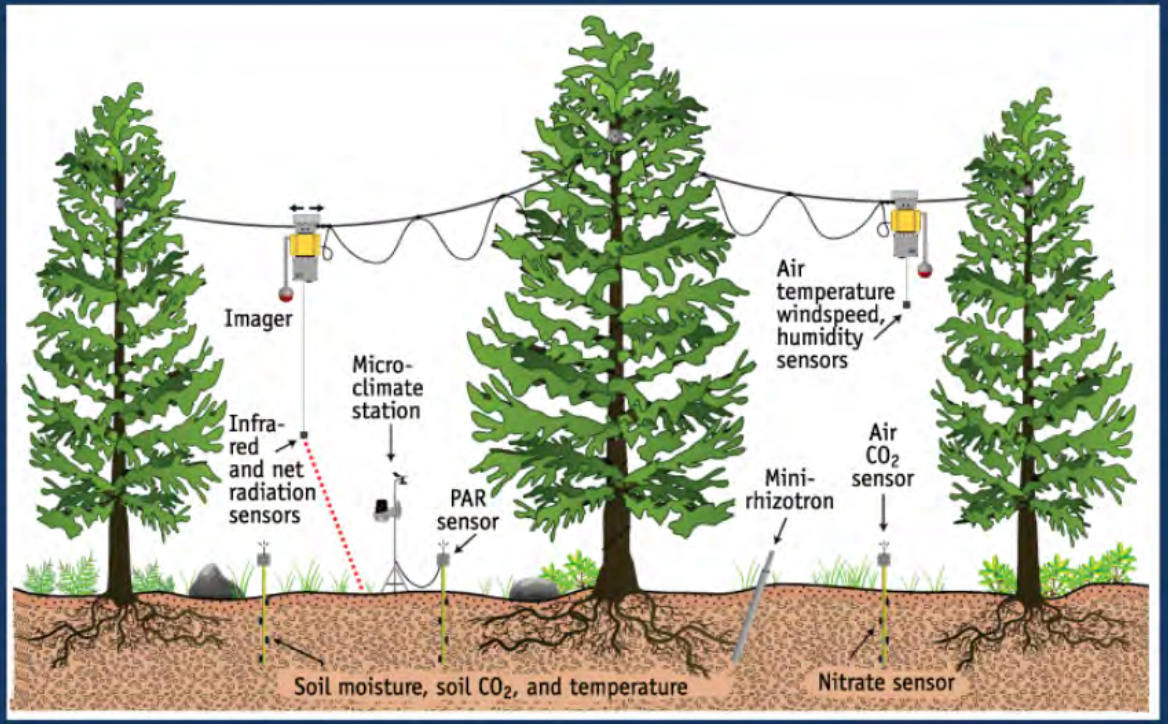
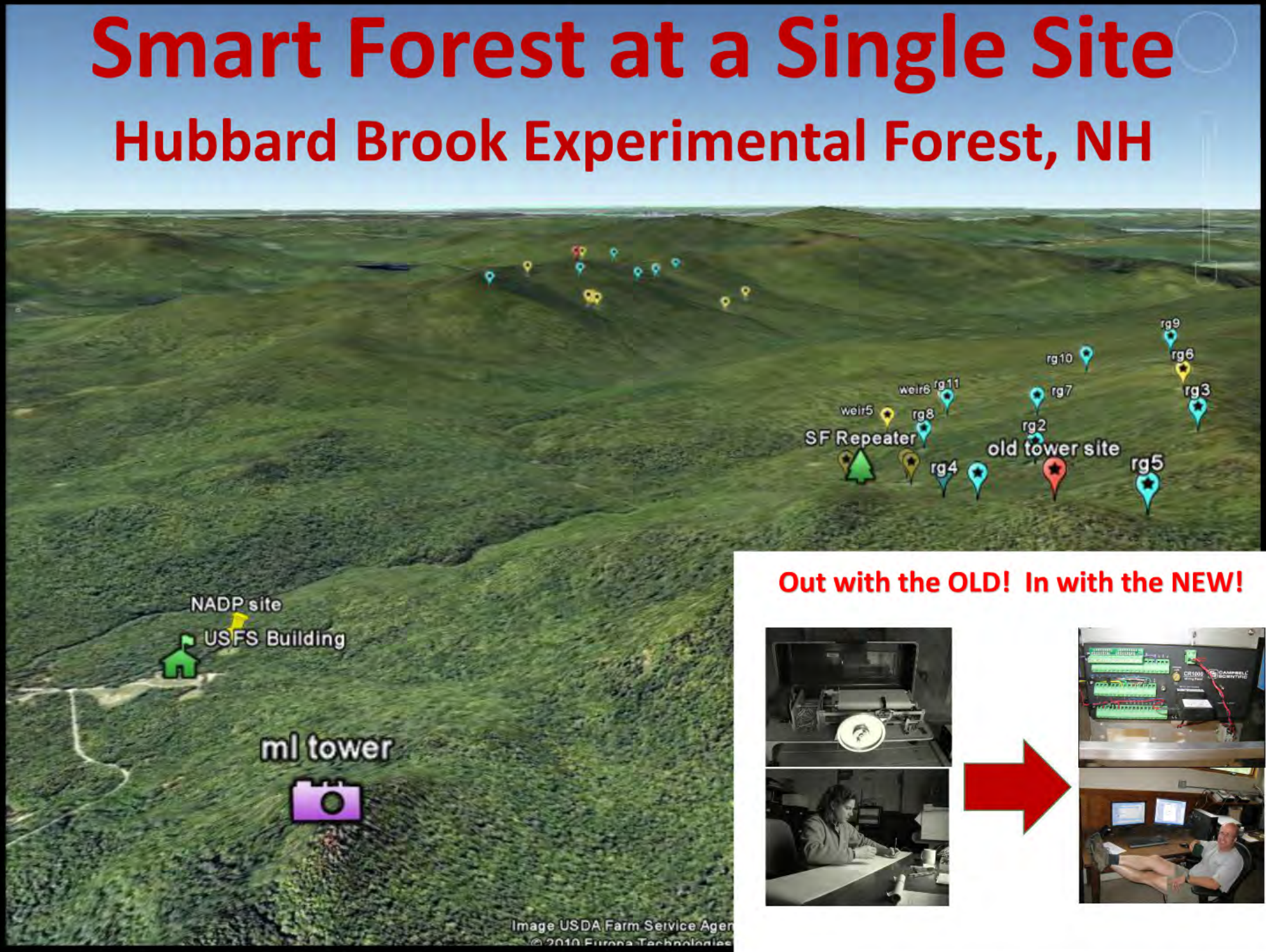


Smart Forest at a Single Site

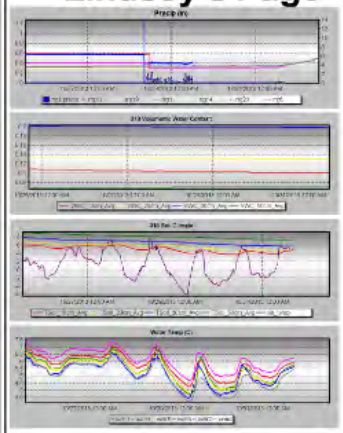
Hubbard Brook Experimental Forest, NH



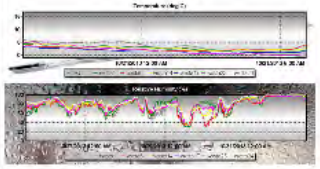
Out with the OLD! In with the NEW!

Realtime Loggernet Quicklooks

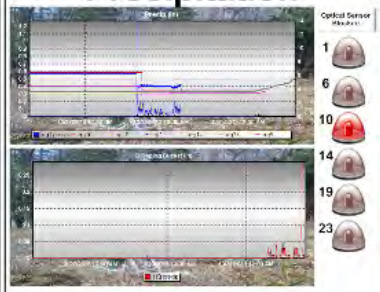
Lindsey's Page



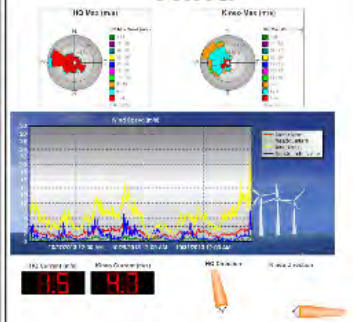
Temperature and RH



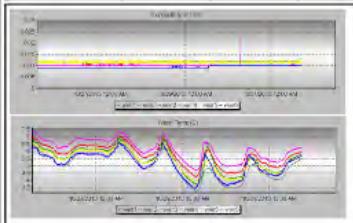
Precipitation

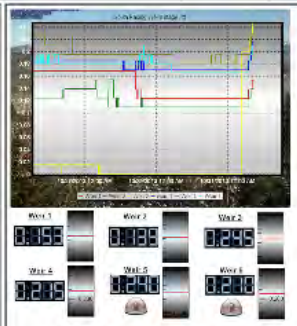


Wind

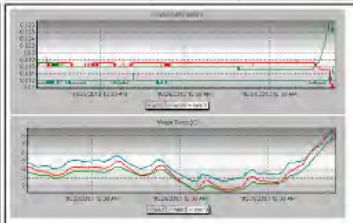


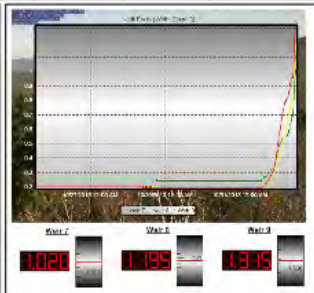
South Facing Watersheds



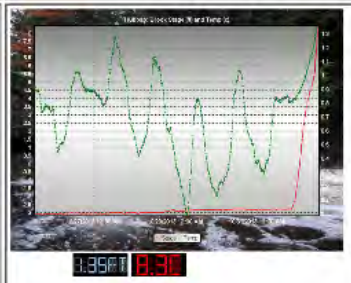


North Facing Watersheds

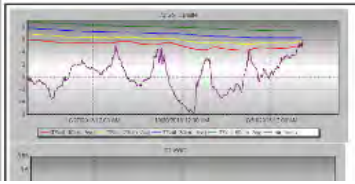


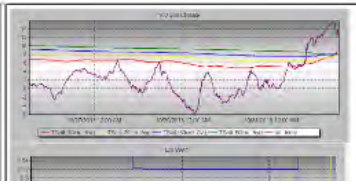


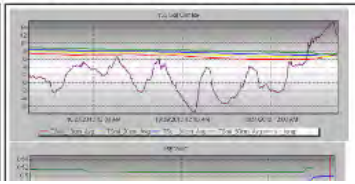
Hubbard Main Branch

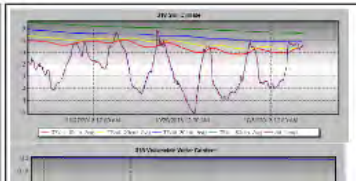


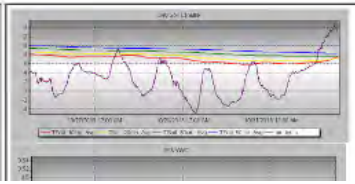
Soil Temperature Plots









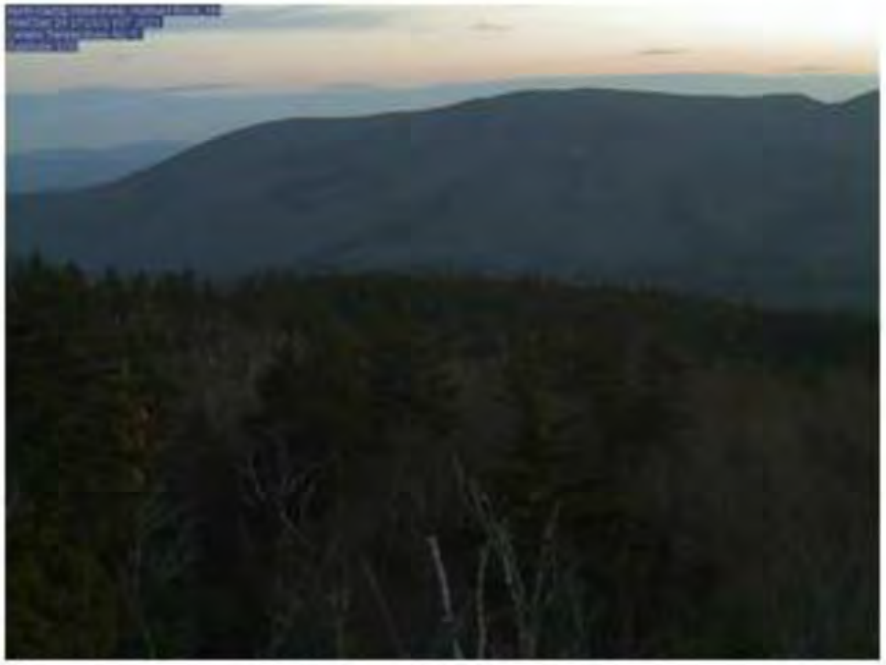


Smart Forests Provide a *Virtual* Window on Our Watersheds

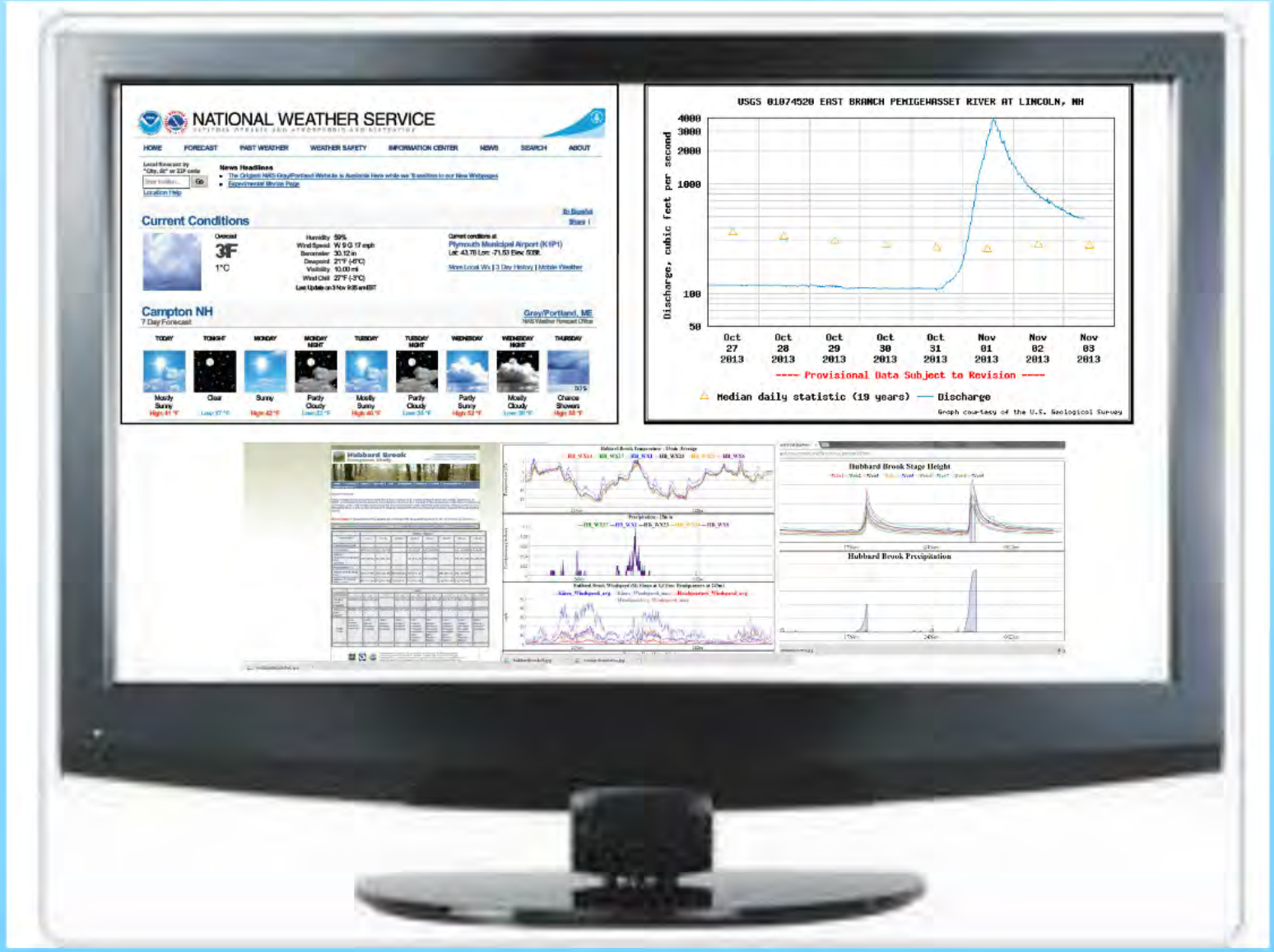
org/data/webcams.shtml

Webcams

Click on thumbnails below to go to the Phenocam site for more information on these images and to access the image archive.



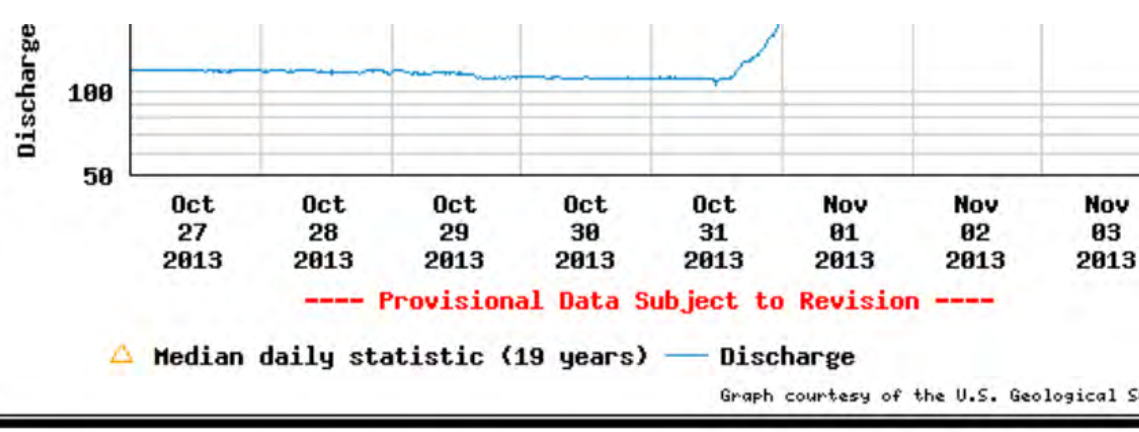
RealTime Data Access

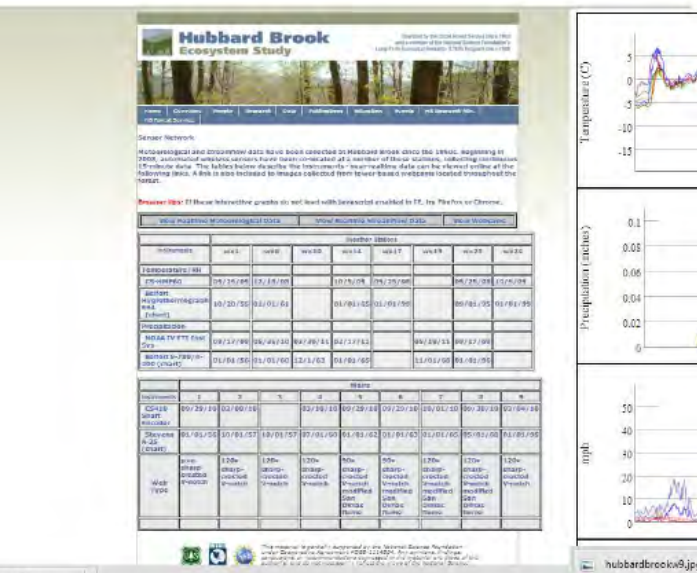


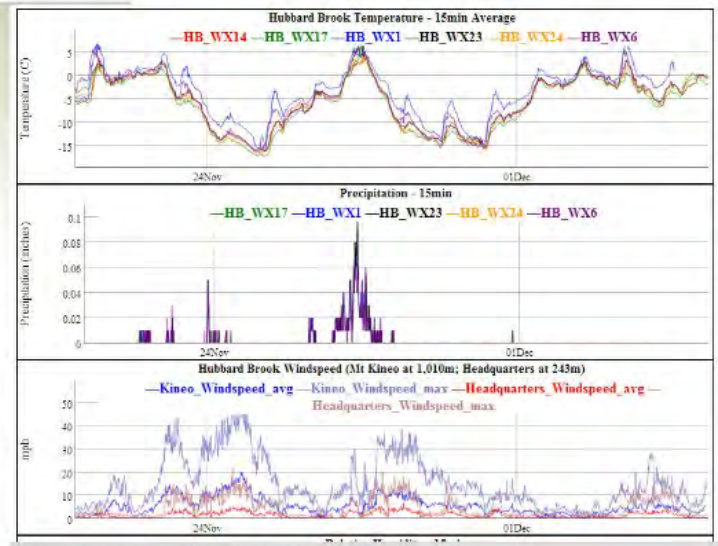
Visibility 10.00 mi
Wind Chill 27°F (-3°C)
Last Update on 3 Nov 9:35 am EST

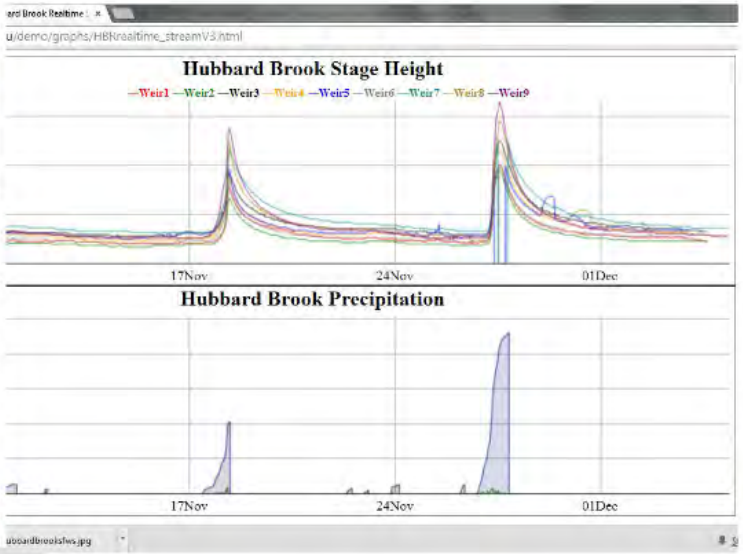
Gray/Portland, ME
NWS Weather Forecast Office

MONDAY NIGHT	TUESDAY	TUESDAY NIGHT	WEDNESDAY	WEDNESDAY NIGHT	THURSDAY
Partly Cloudy	Mostly Sunny	Partly Cloudy	Partly Sunny	Mostly Cloudy	Chance Showers
Low: 22 °F	High: 46 °F	Low: 30 °F	High: 52 °F	Low: 38 °F	High: 58 °F









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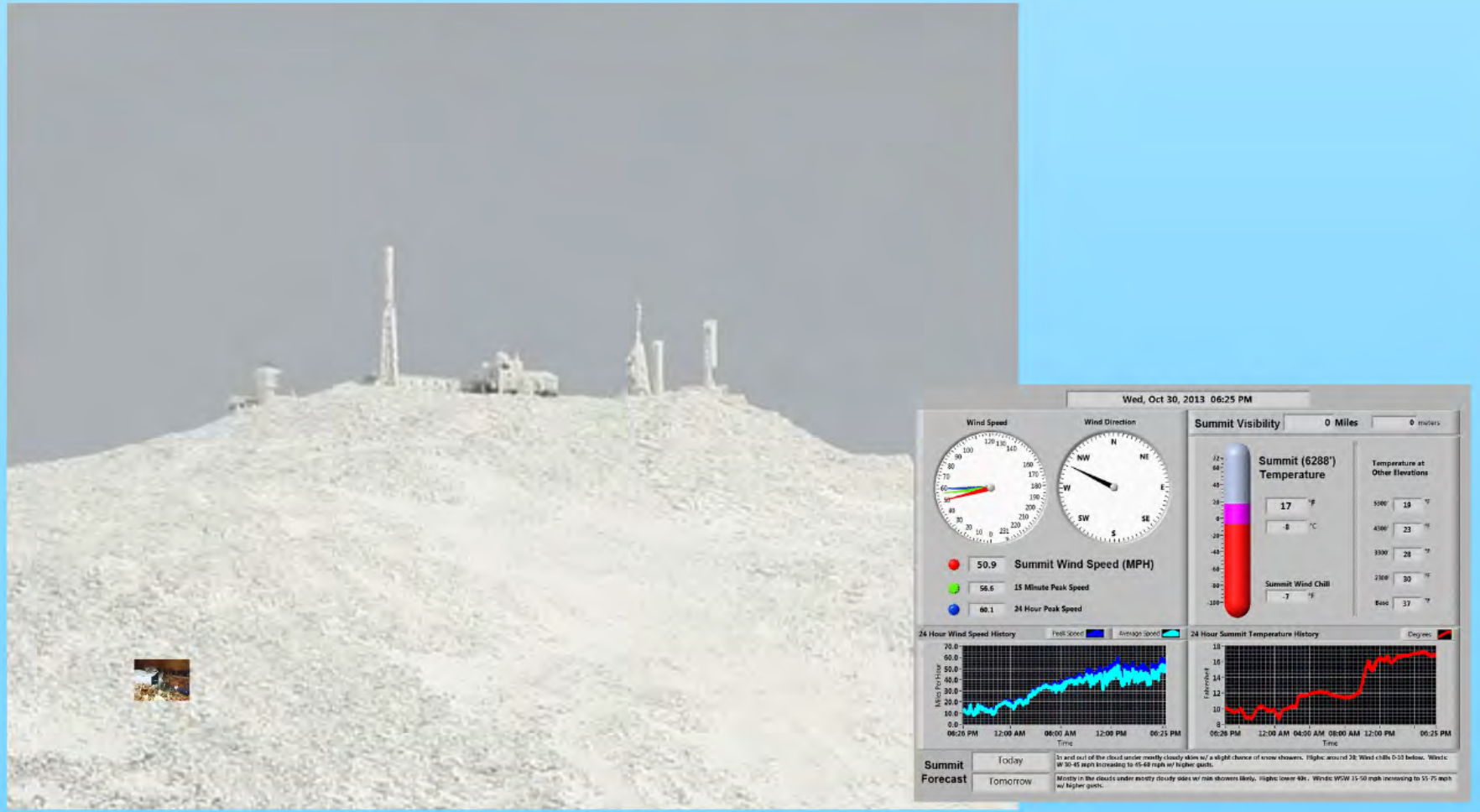

Access to Data From Difficult Times

RAPID ASSESSMENT TEAM

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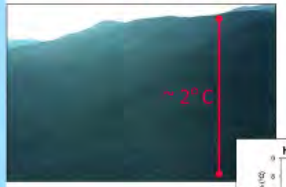
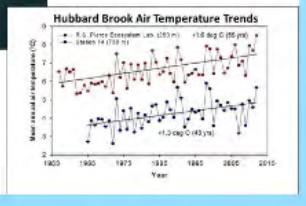
New Scientific Insights

Known Knowns

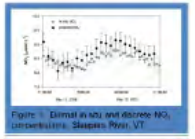


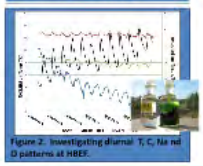
Monitoring



Known UnKnowns

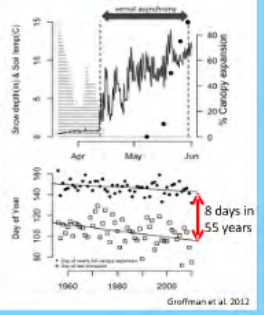
Diurnal Signals





UnKnown UnKnowns

Vernal Asynchronies



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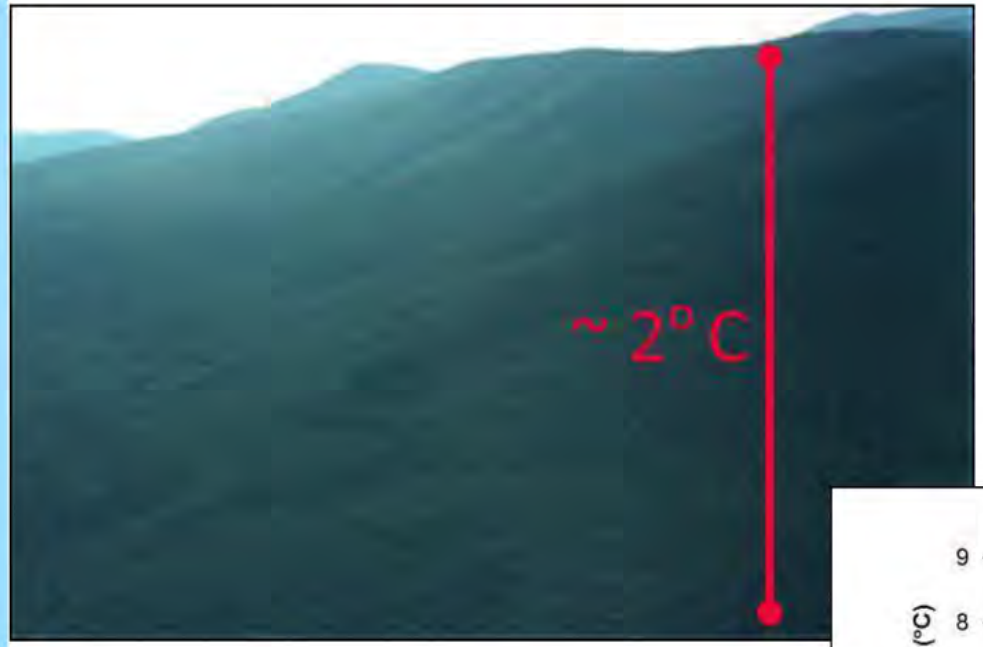

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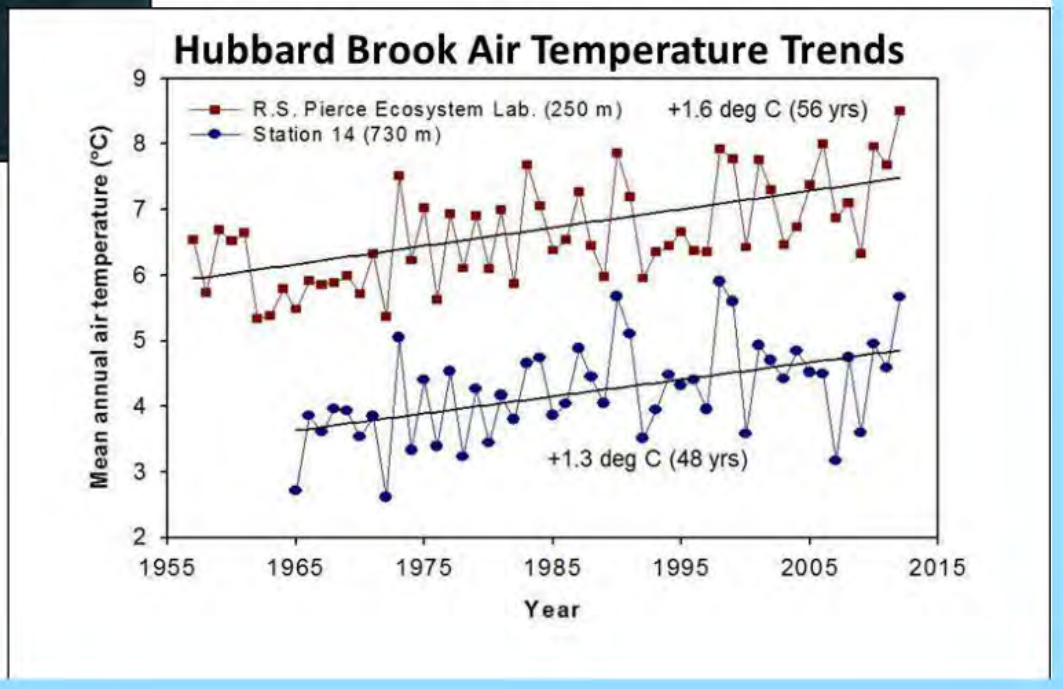

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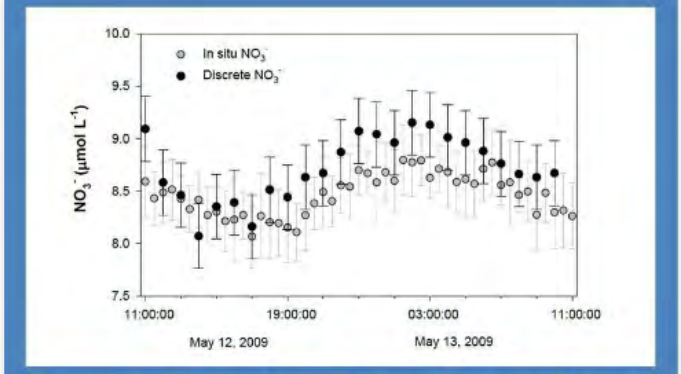


Figure 1. Diurnal in situ and discrete NO_3 concentrations, Sleepers River, VT

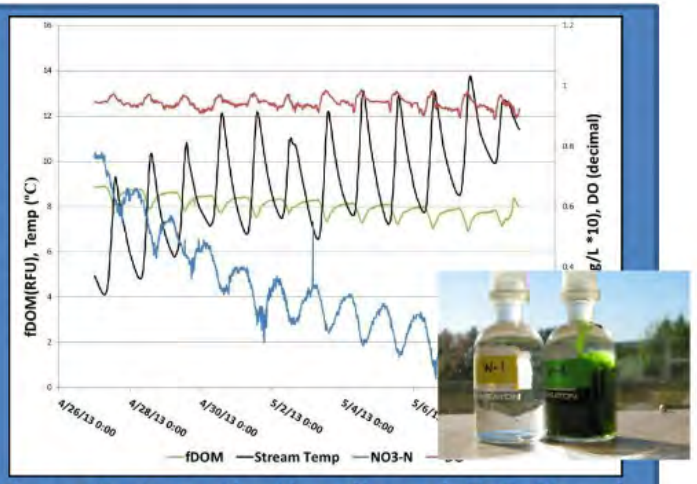
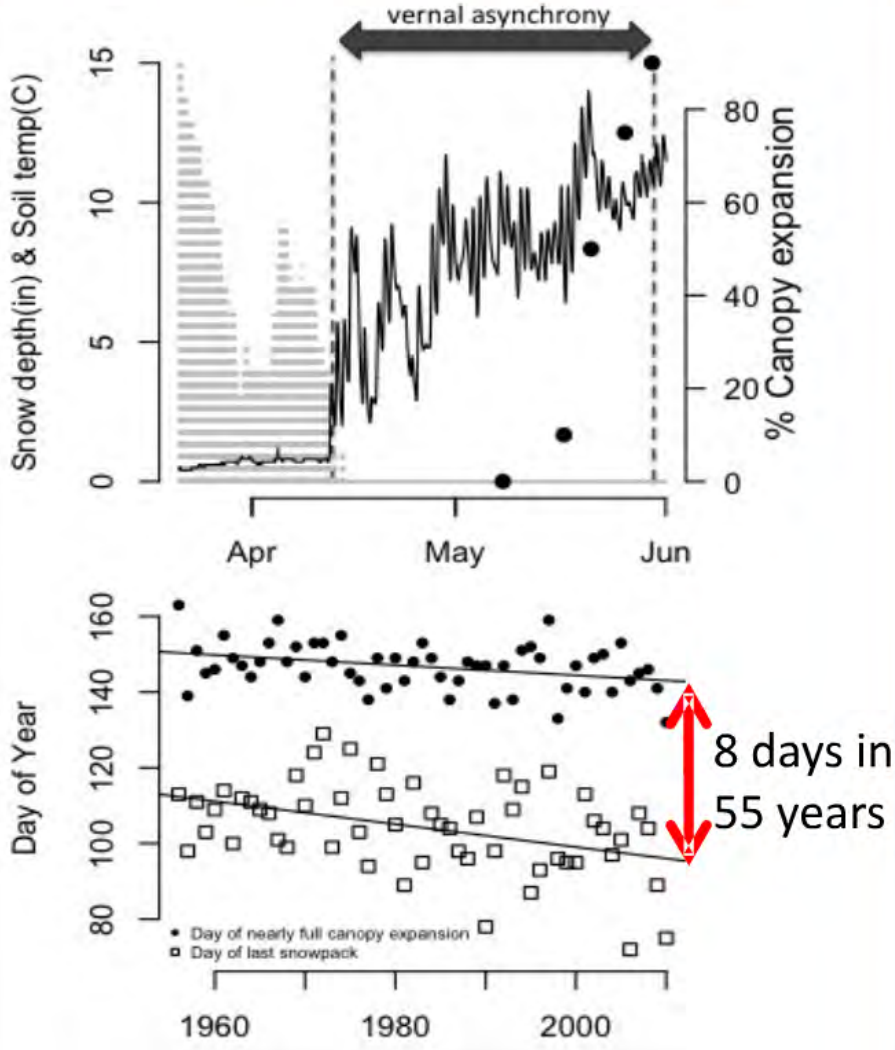


Figure 2. Investigating diurnal T, C, Na nd O patterns at HBEF.

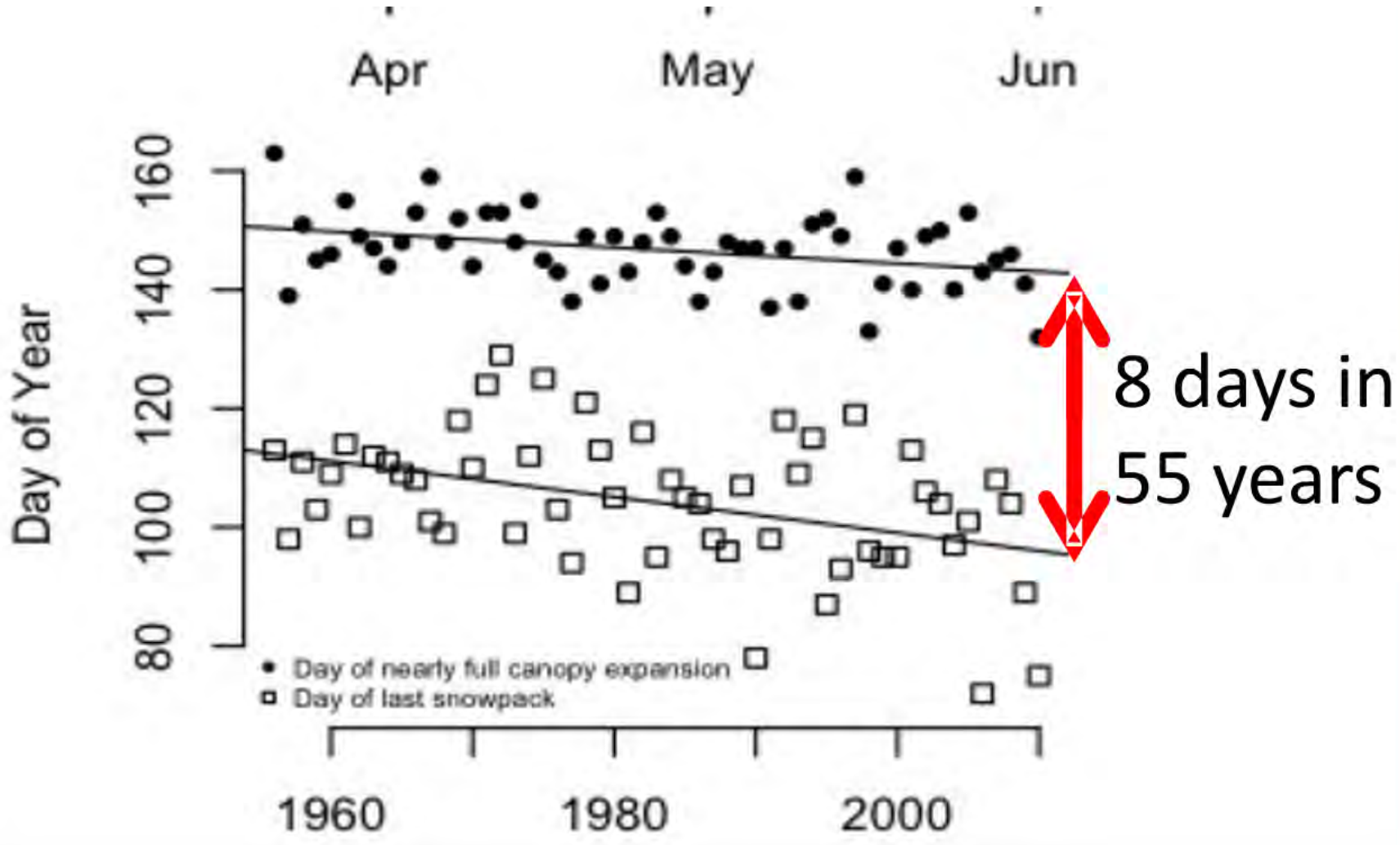
UnKnown UnKnowns

Vernal Asynchronies



Groffman et al. 2012

vernal asynchrony
Snow depth(in) & Soil temp(C)
0
5
10
15
% Canopy expansion
0
20
40
60
80
Apr
May
Jun
160



Groffman et al. 2012

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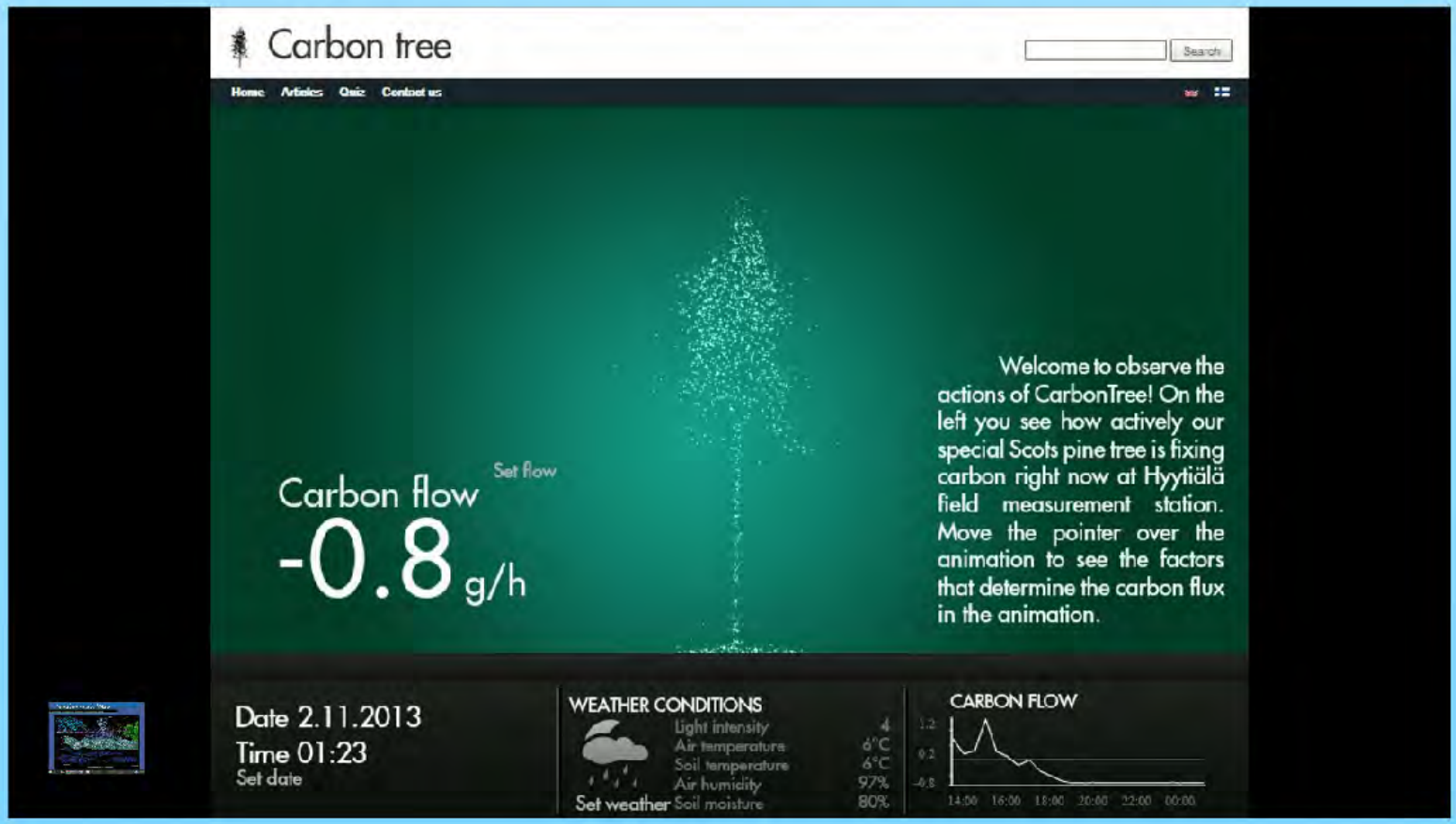
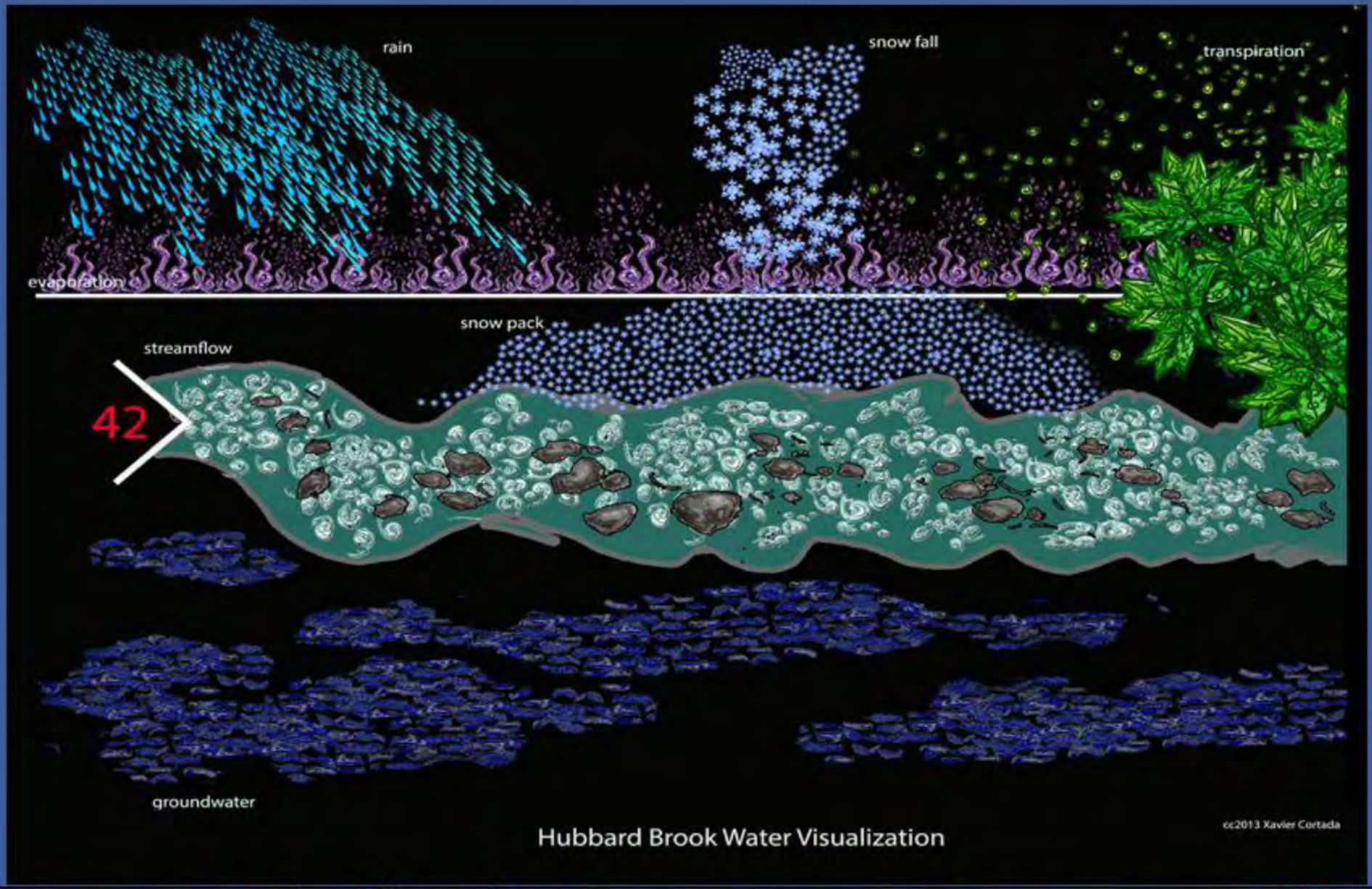


Hubbard Brook Water Cycle Viewer



NRS Smart Forests

Vision for Smart Forests

"…a network of long-term research sites that are equipped with an integrated technological platform, combining high frequency, real-time sensor-based measurements with traditional ecological field-scale studies, designed to monitor and respond rapidly to environmental change at the local to continental scales."

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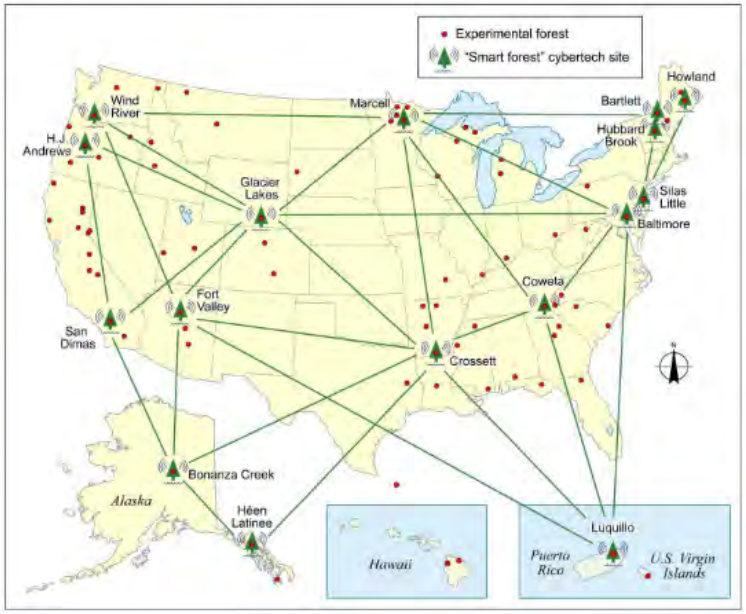

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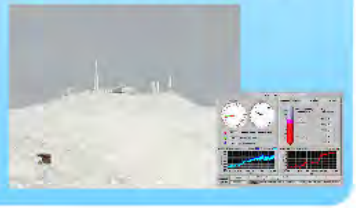

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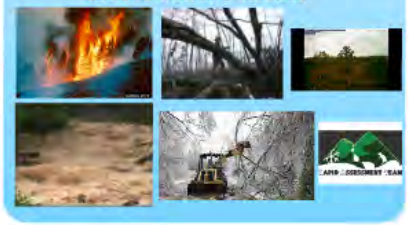
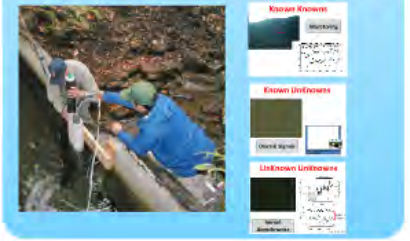
New Scientific Insights