Update on Red Spruce Research

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Genecology

The study on the relationships between seed sources and their source environment

Zonificación climática/altitudinal de *Abies religiosa* (oyamel) para reforestar la Reserva de la Biósfera de la Mariposa Monarca, basada en la diferenciación genética entre poblaciones y considerando cambio climático poblaciones y considerando cambio climático

Cuauhtémoc Sáenz-Romero[1], Marisol A. Ortiz-Bibian[1], Arnulfo Blanco-García[2], Roberto A. Lindig-Cisneros[3], Mariela Gómez-Romero[2], Dante Castellanos-Acuña[4]

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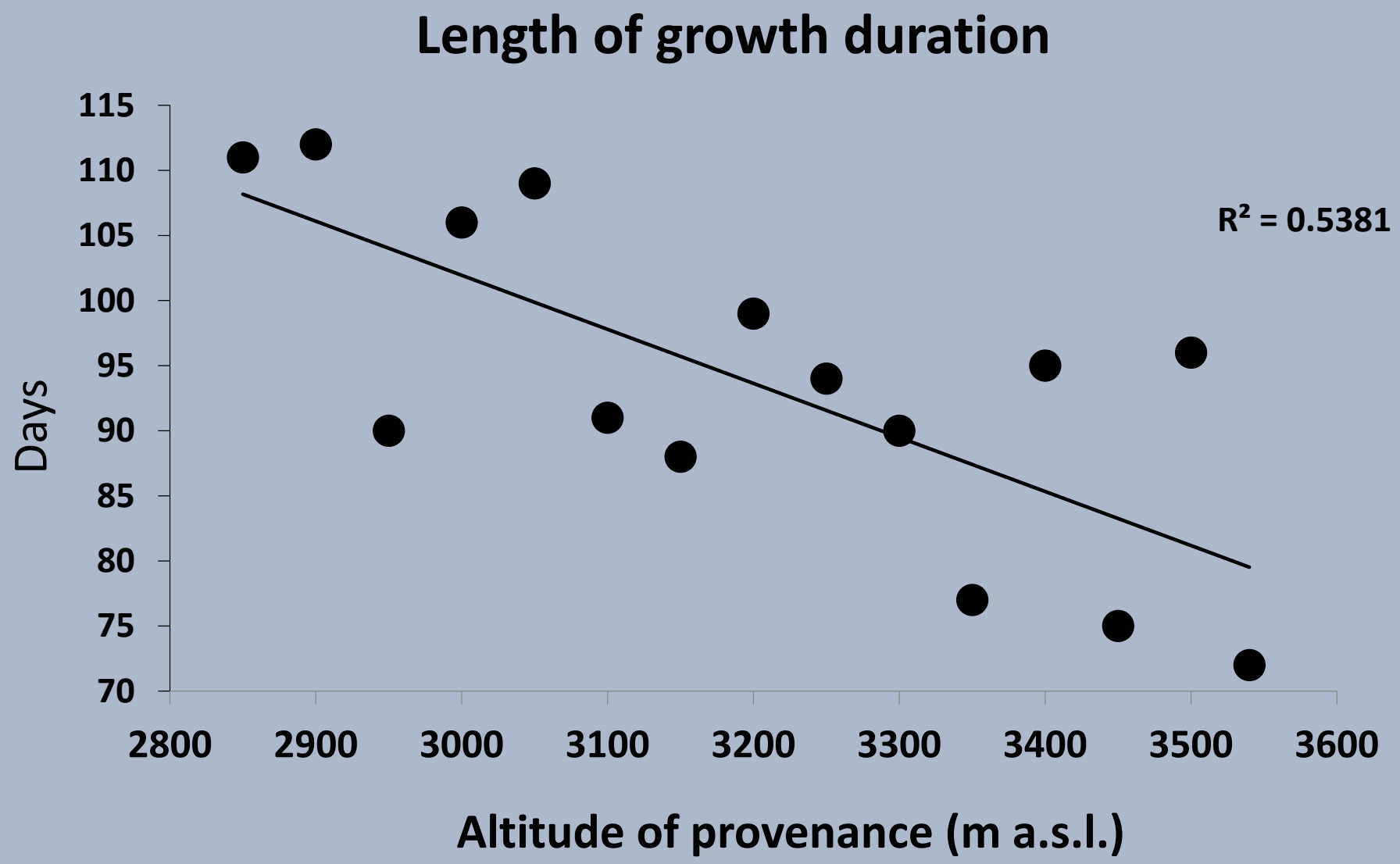
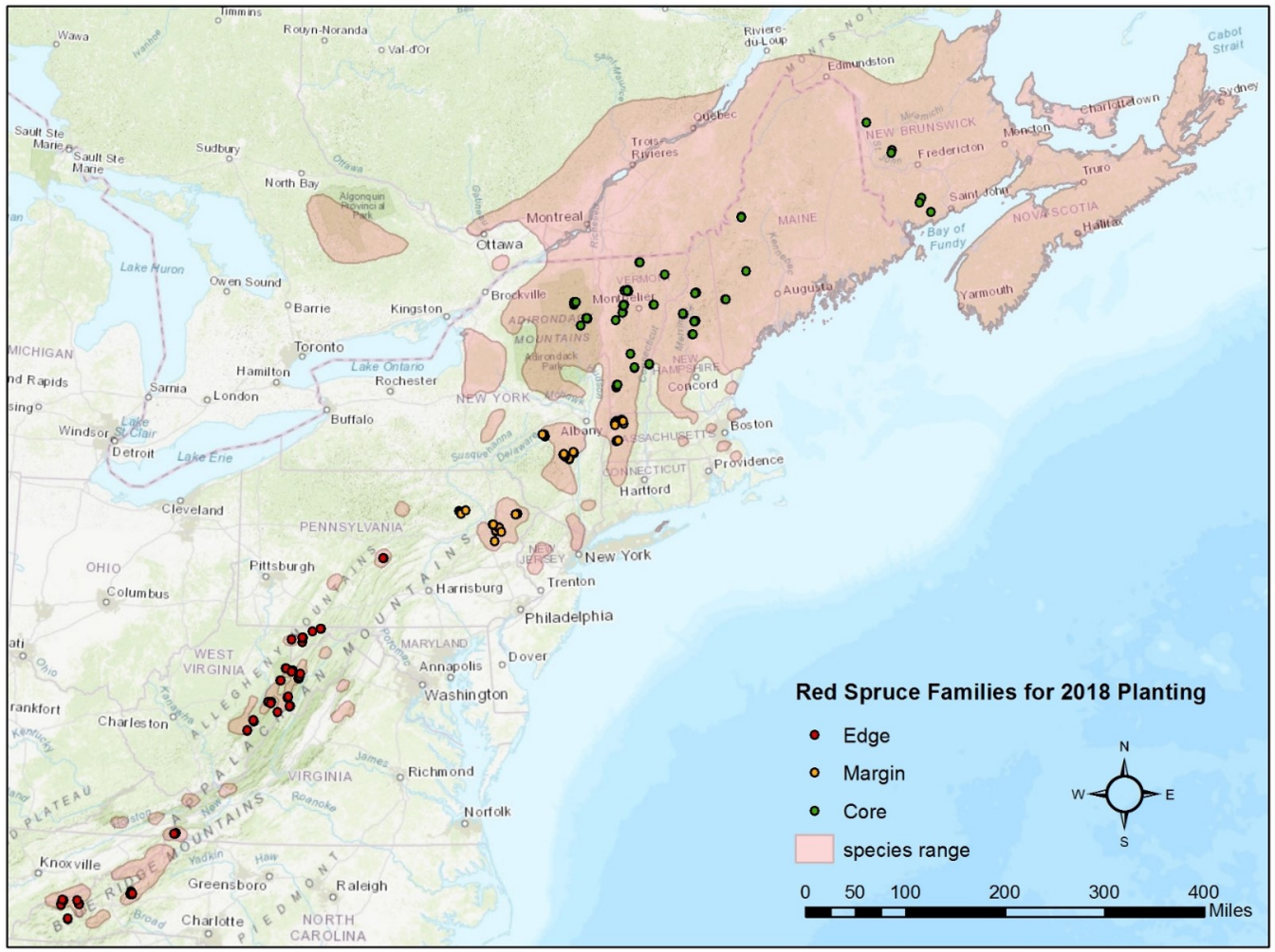
Simposio Monarca, Morelia, Mich. 7 marzo 2018

Diferenciación genética altitudinal entre poblaciones de *Abies religiosa*

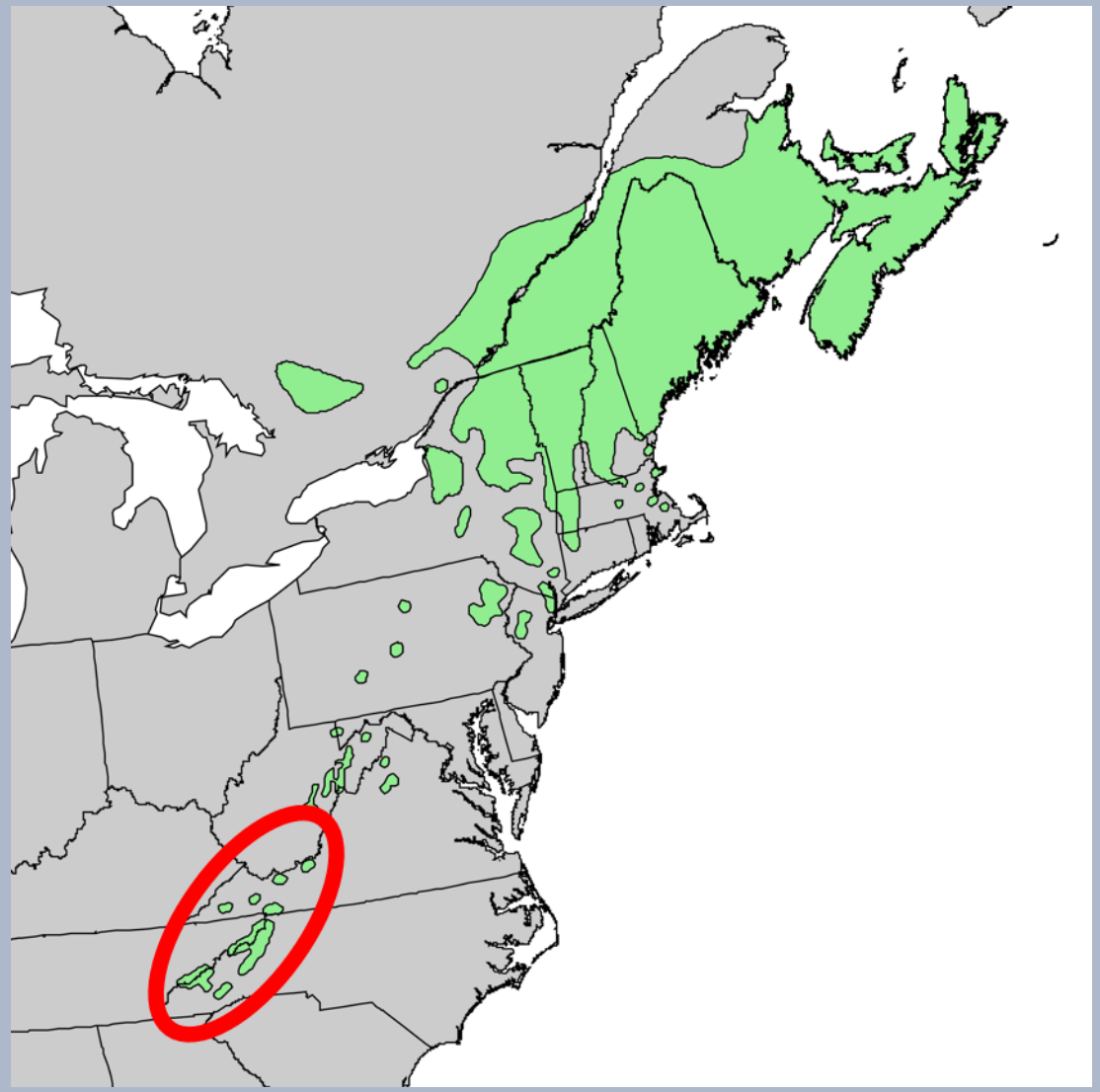


Ortiz-Bibián *et al* 2017. Silvae Genetica

Red Spruce Range-wide Study



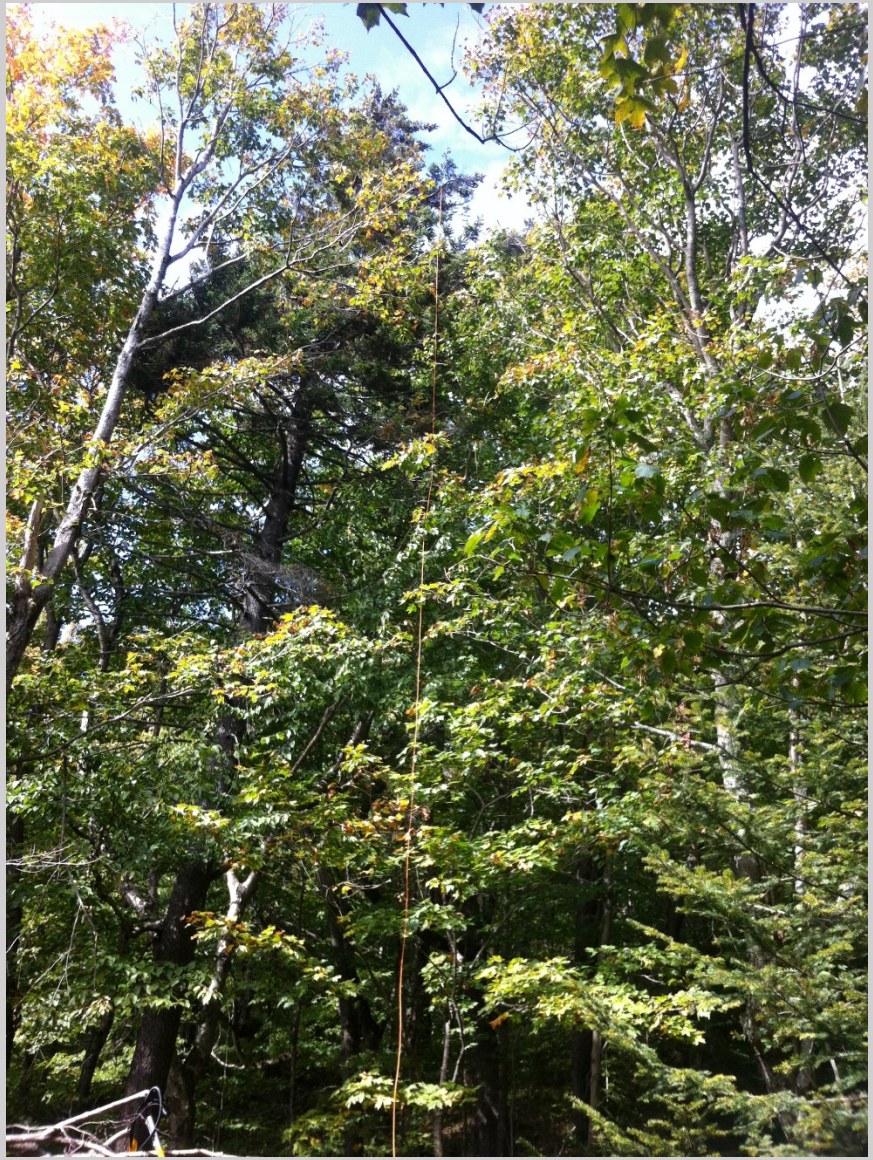
Nested in this is more intensive study of seed sources from Southern Appalachians



Approximately 50 trees each from each Mt. Mitchell and Clingmans Dome were collected from 1036 to 1988 Meters elevation.

Seed were collected using a modified pole pruner
or with a sling shot and a saw attached to the rope (shown here)

Some trees took more than 2 hours to collect seed!



John Butnor,
seed collector extraordinaire
(among many other things)

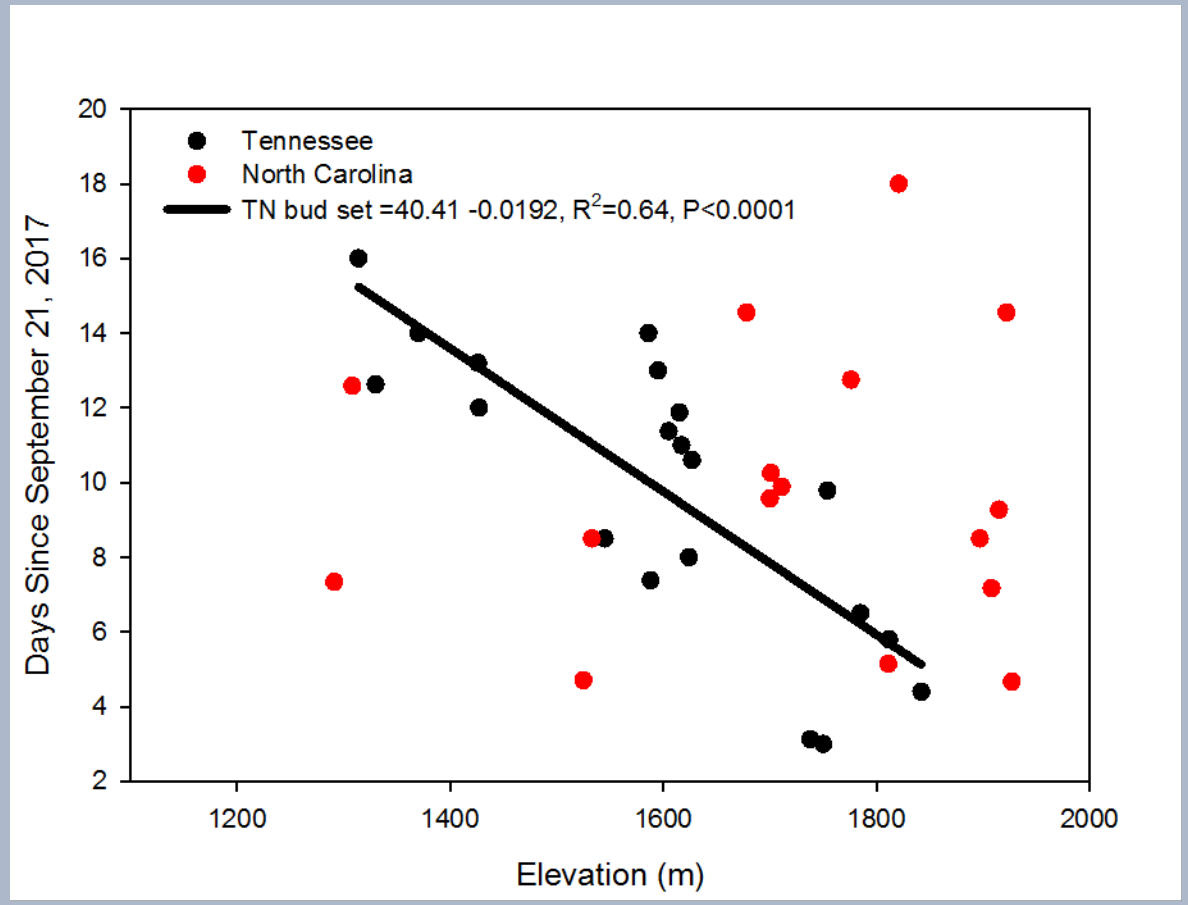
Initial work was conducted to develop protocol for germinating seed

Results are from sub-set of greenhouse grown seedlings

Transplanted outside under shade cloth mid-summer

Mt. Mitchell – extensively planted in 1920's with unknown seed sources

Clingmans Dome – pristine forest

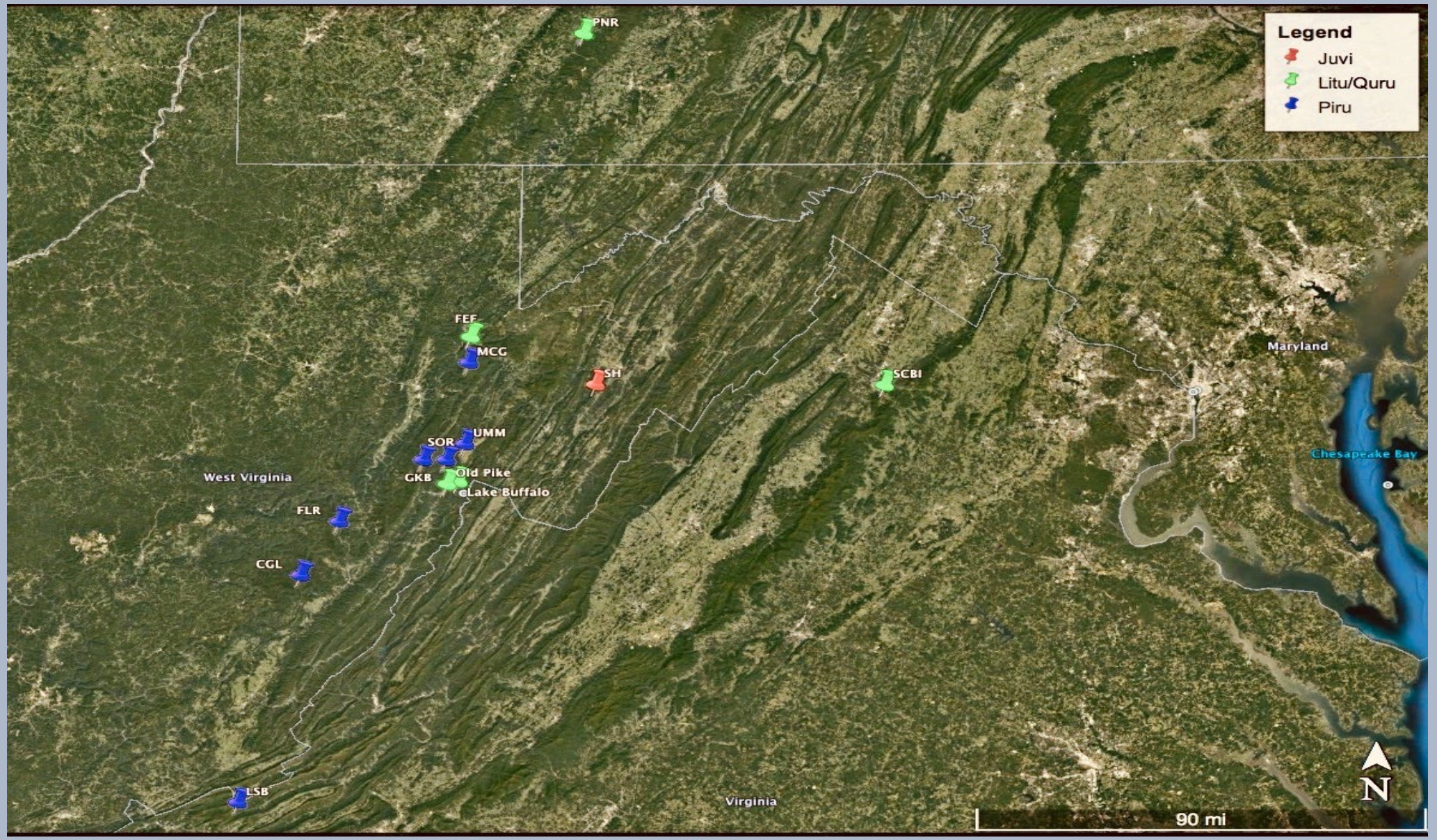


Same Soil delivered to each location

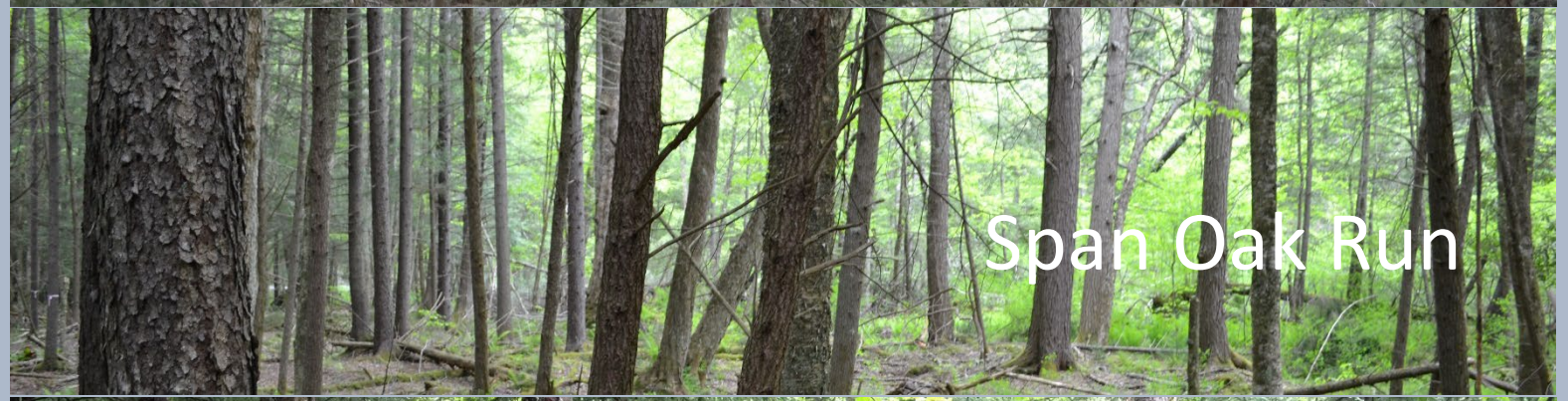
Seedlings are being grown and hardened over at the University of Vermont and will be shipped here in the spring for planting

(molecular genetics will be examined on all seedlings, Steve Keller's lab)

Rebound of Red Spruce Growth

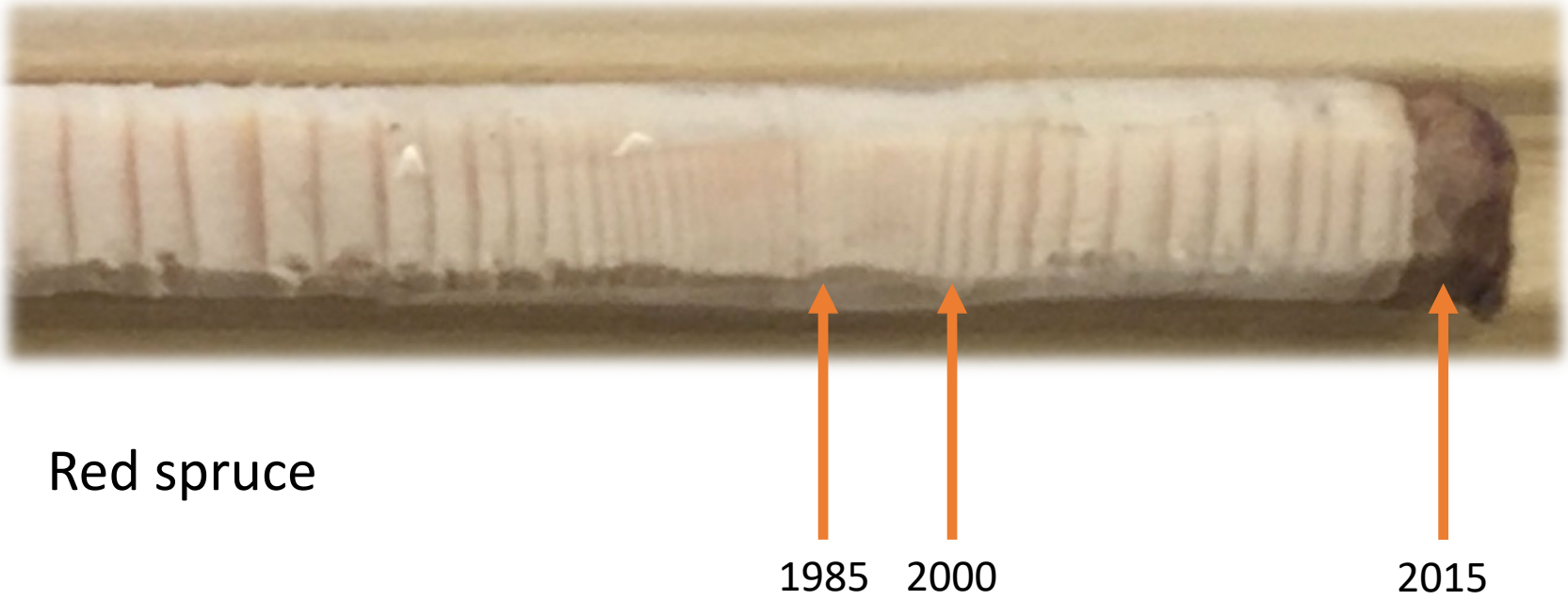

Legend
Juvi
Litu/Quru
Piru
PNR
FEF
MCG
SH
SCBI
UMM
SOR
GKB
Old Pike
Lake Buffalo
FLR
CGL
LSB
West Virginia
Virginia
Maryland
Chesapeake Bay
N
90 mi


McGowan Mountain

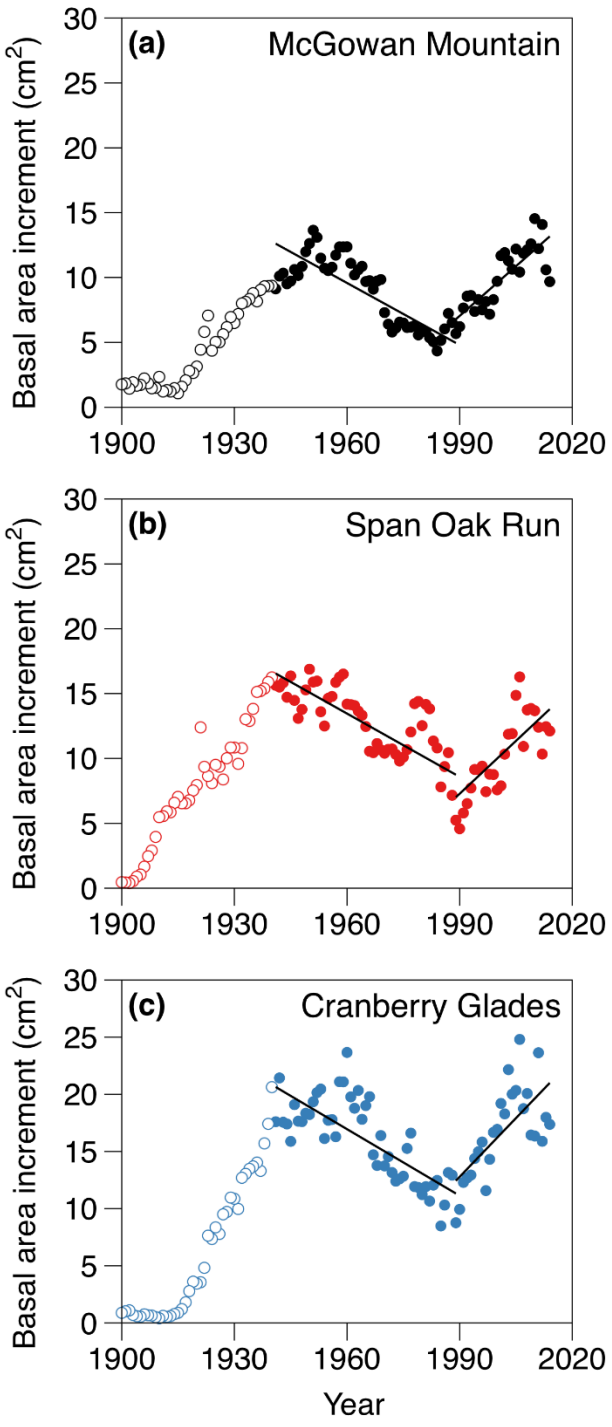

Span Oak Run


Cranberry Glades

1. Basal area increment (BAI) = proxy for tree growth



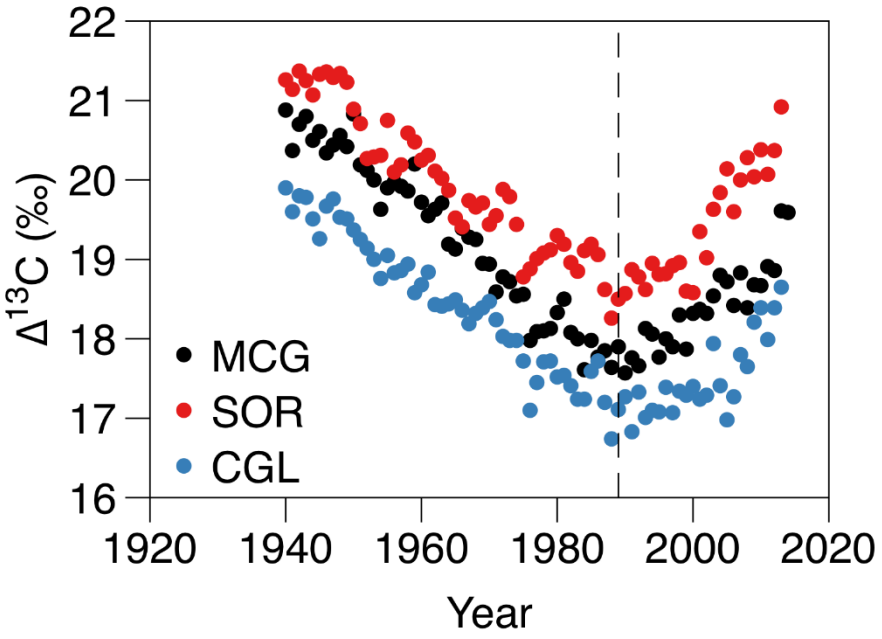
Red spruce



Red spruce trees (*Picea rubens*)

- Trees cored at 3 locations in WV.
- N = 20-25 trees per site.
- Crossdated tree cores with WinDendro and dplR.

Leaf-corrected $\Delta^{13}C$ from red spruce tree rings

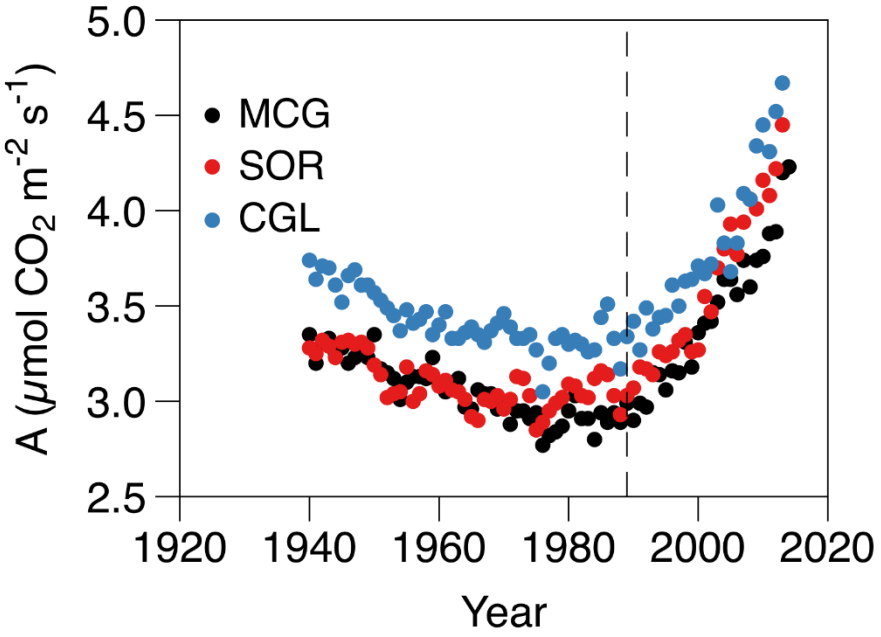


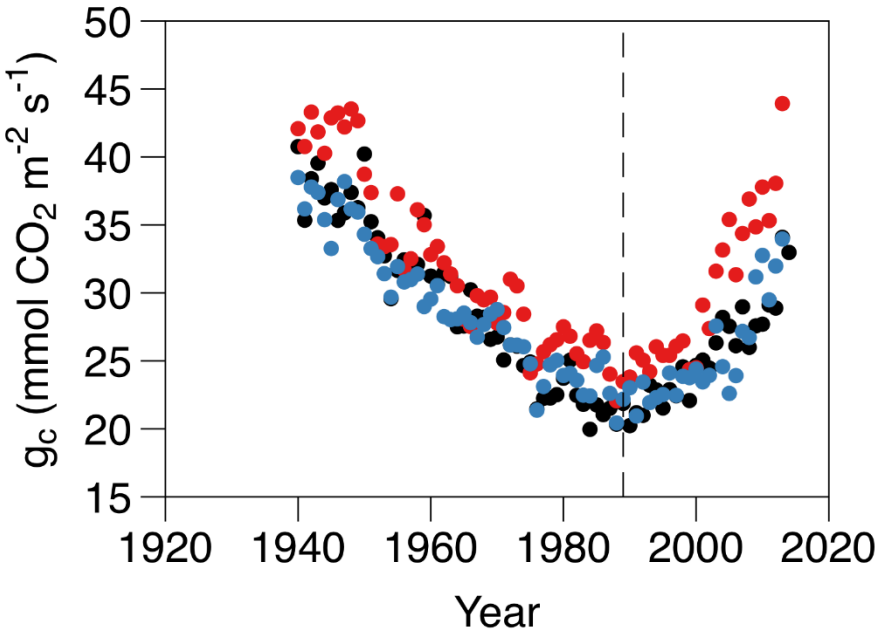
Critical year

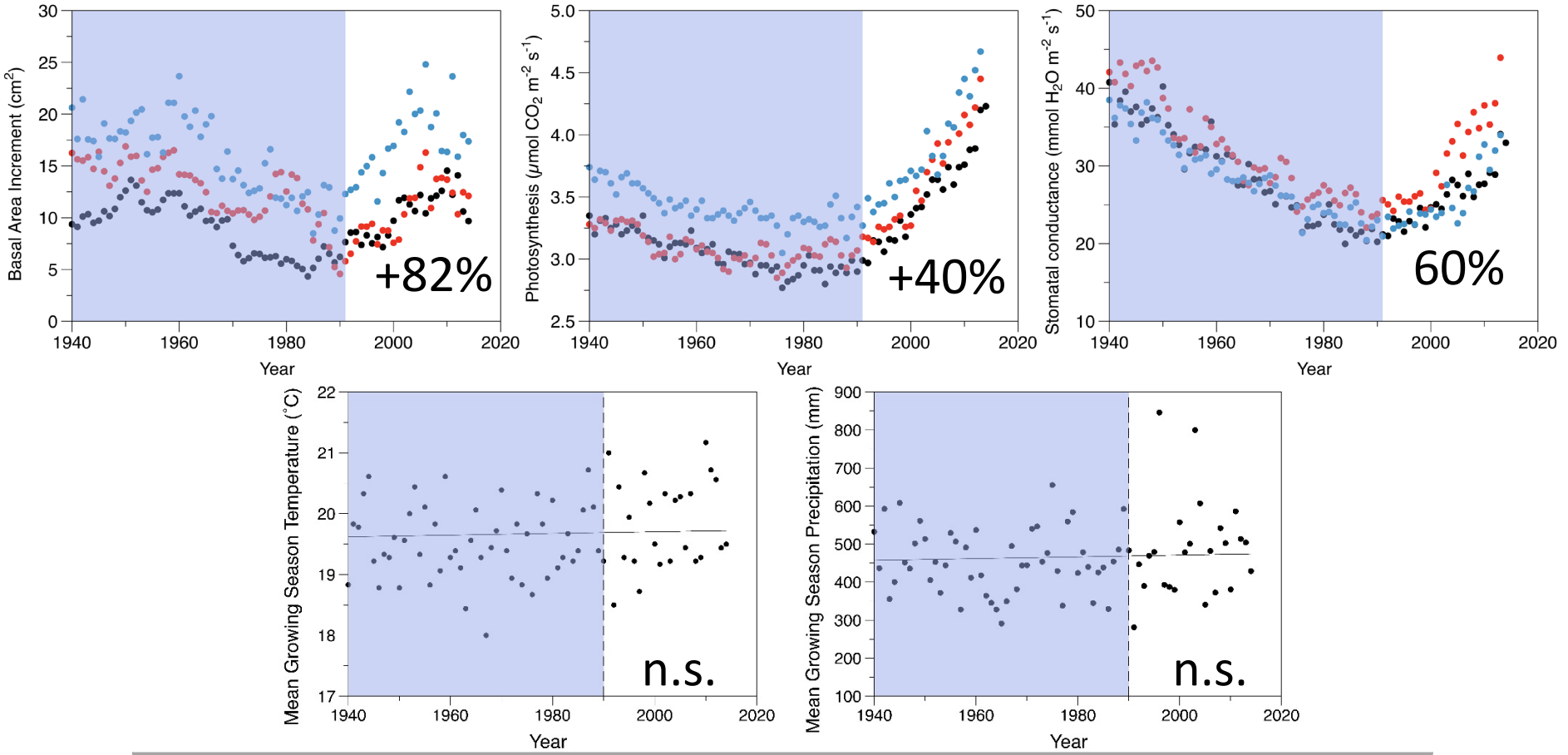
MCG: 1990

SOR: 1992

CGL: 1993







Environmental Parameter	BAI	$\Delta^{13}C$	A	g_c
January temperature			-0.203	-0.215*
February temperature			-0.175	-0.171
April temperature	0.263**		0.233*	0.210*
May temperature			0.190	0.211*
February precipitation	-0.154		-0.186	
March precipitation			-0.165	
December precipitation			0.167	0.157

Question: Does growth, photosynthesis and stomatal conductance change with elevation?

Hypothesis: Growth decreases at lower elevation due to warmer temperature