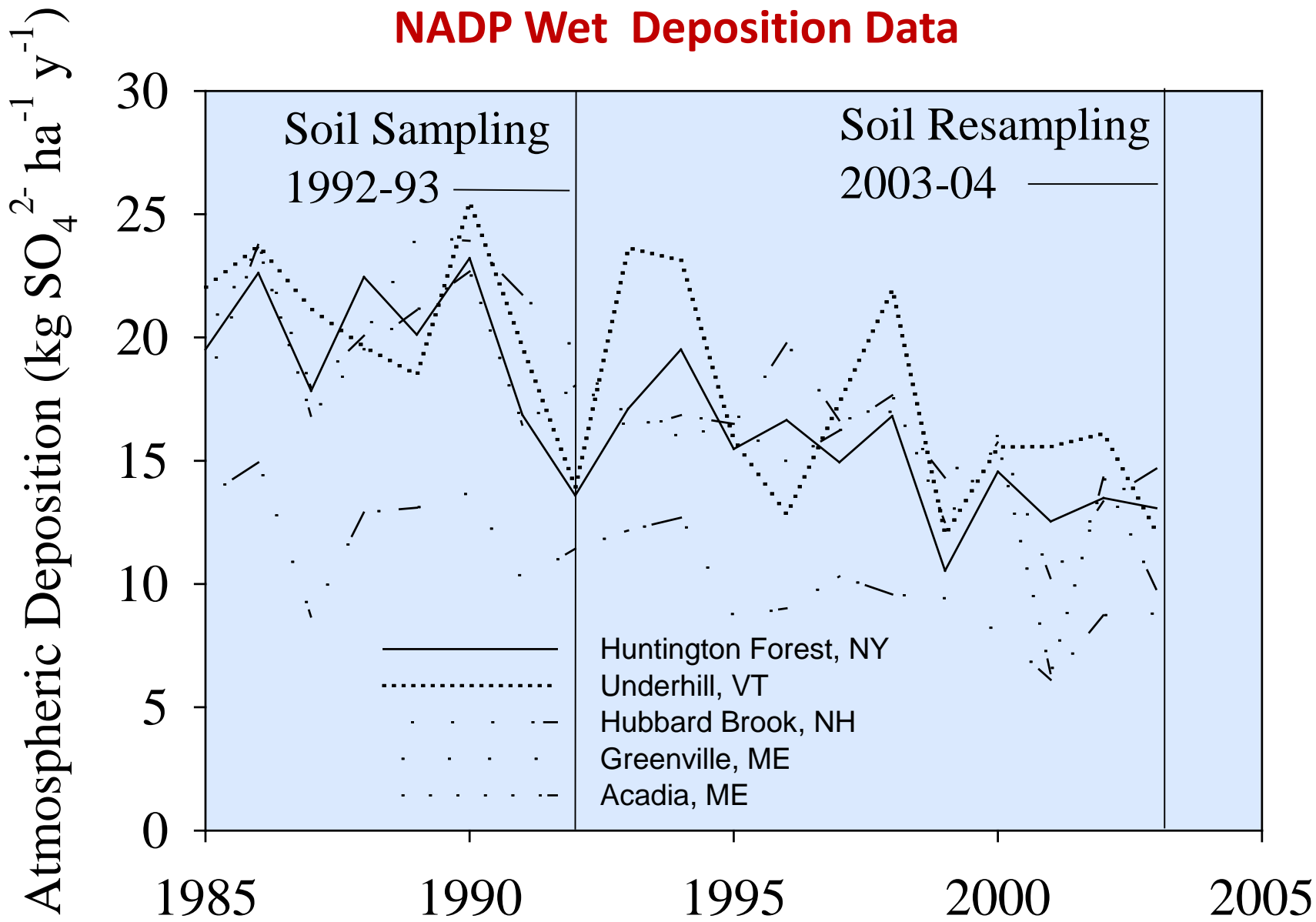


Early Recovery of Soils from Acidic Deposition Tied to Carbon Dynamics in U.S. Spruce Forests

Lawrence, G.B.
Shortle, W.C.
David, M.B.
Smith, K.T.
Warby, R.A.F.
Lapenis, A.G.



NADP Wet Deposition Data



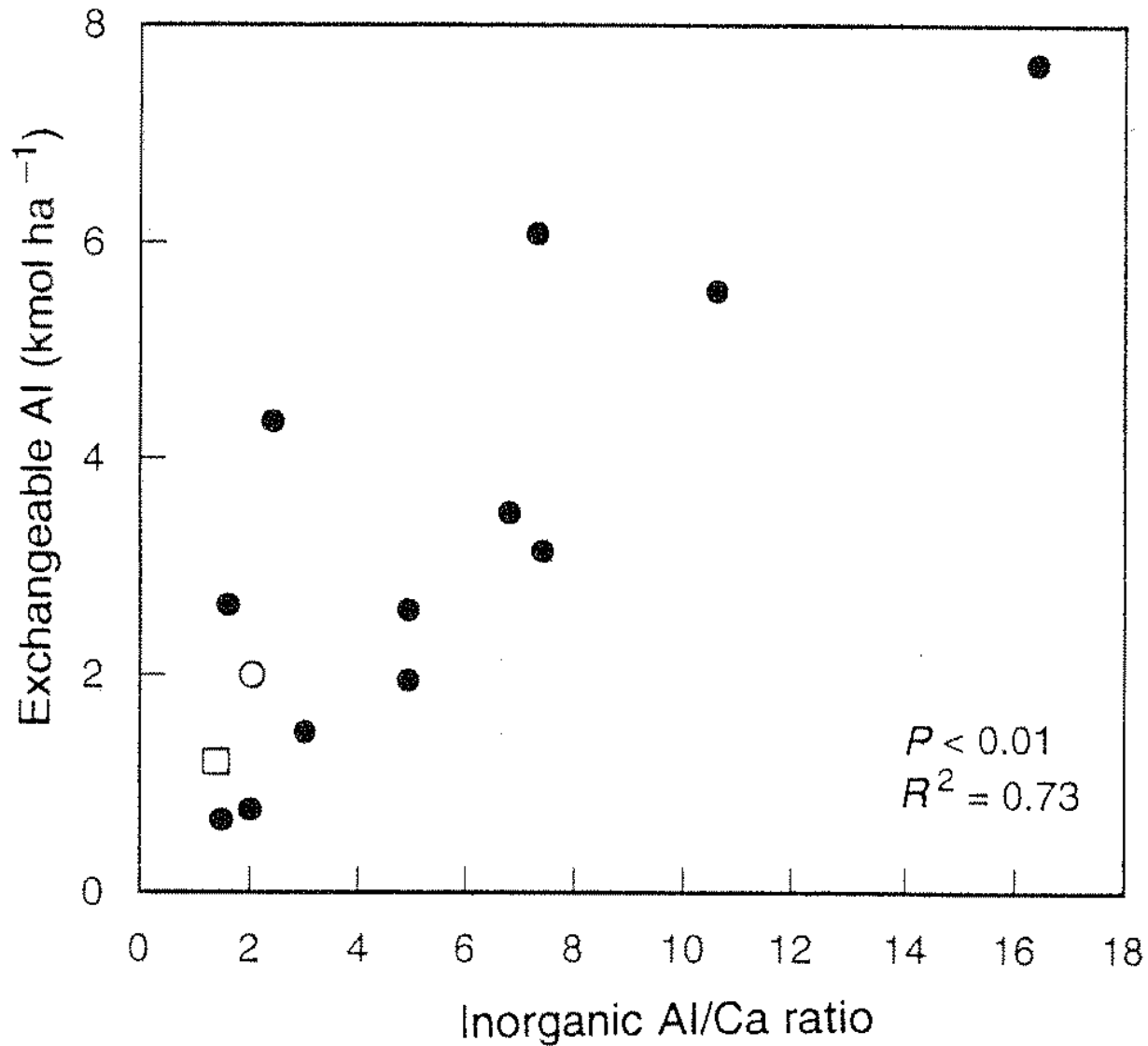
Spruce Stands, Hubbard Brook Experimental Forest, NH

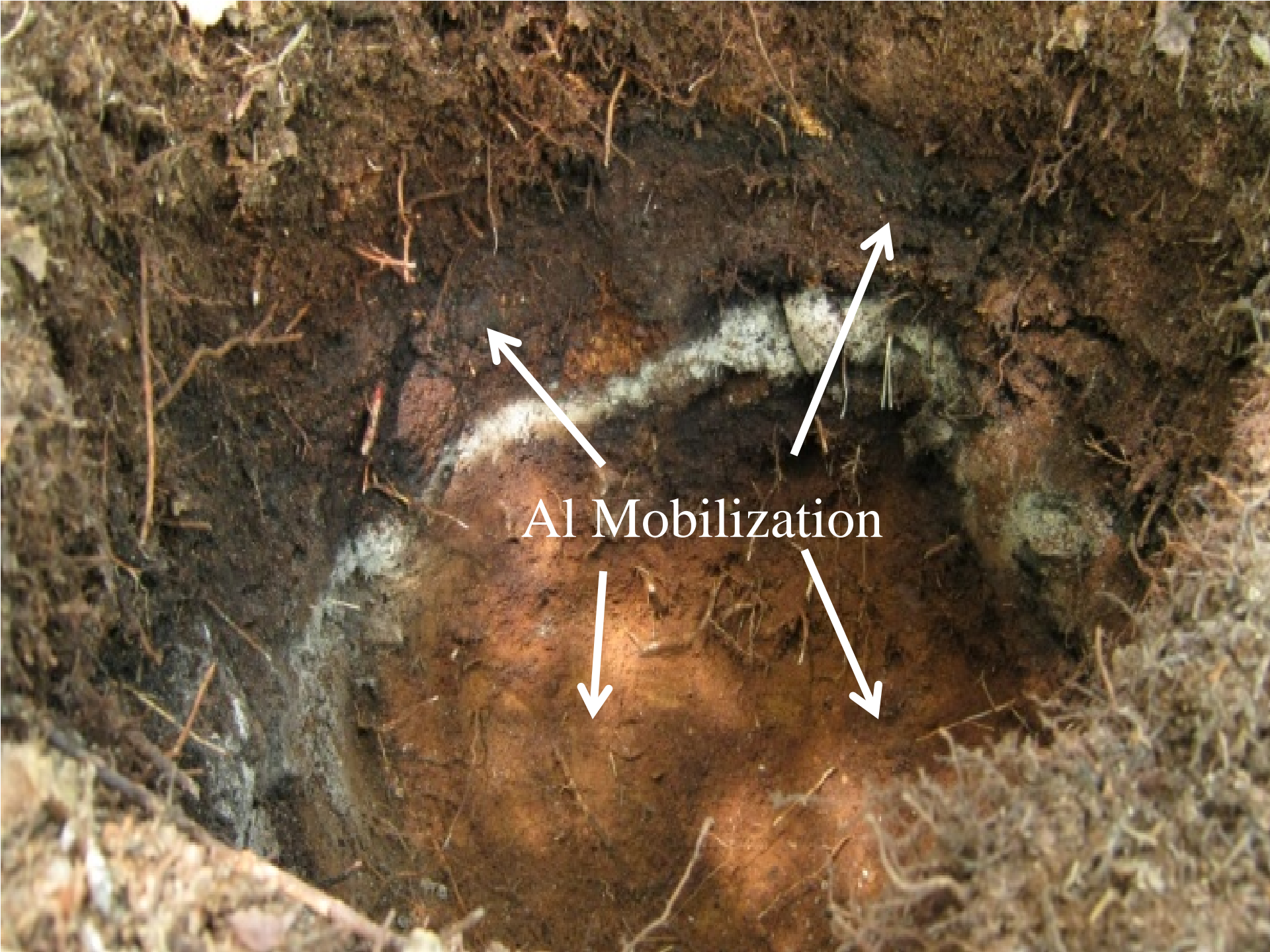
From Lawrence et al., 1995

Sampling Period	Exchangeable ($\text{cmol}_c \text{ kg}^{-1}$)		Extractable ($\text{cmol}_c \text{ kg}^{-1}$)	
	Al	Ca	Al	Ca
1969-1970	2.5 ^a (1.1)	8.3 ^a (4.4)	19.3 ^a (10.2)	9.9 ^a (6.4)
1987,1992	3.7 ^a (2.9)	3.5 ^b (2.1)	37.0 ^b (21.6)	4.6 ^b (2.9)

****Warby et al. 2009 --- Loss of Ca and increase in Al in the O horizon between 1984 and 2001***

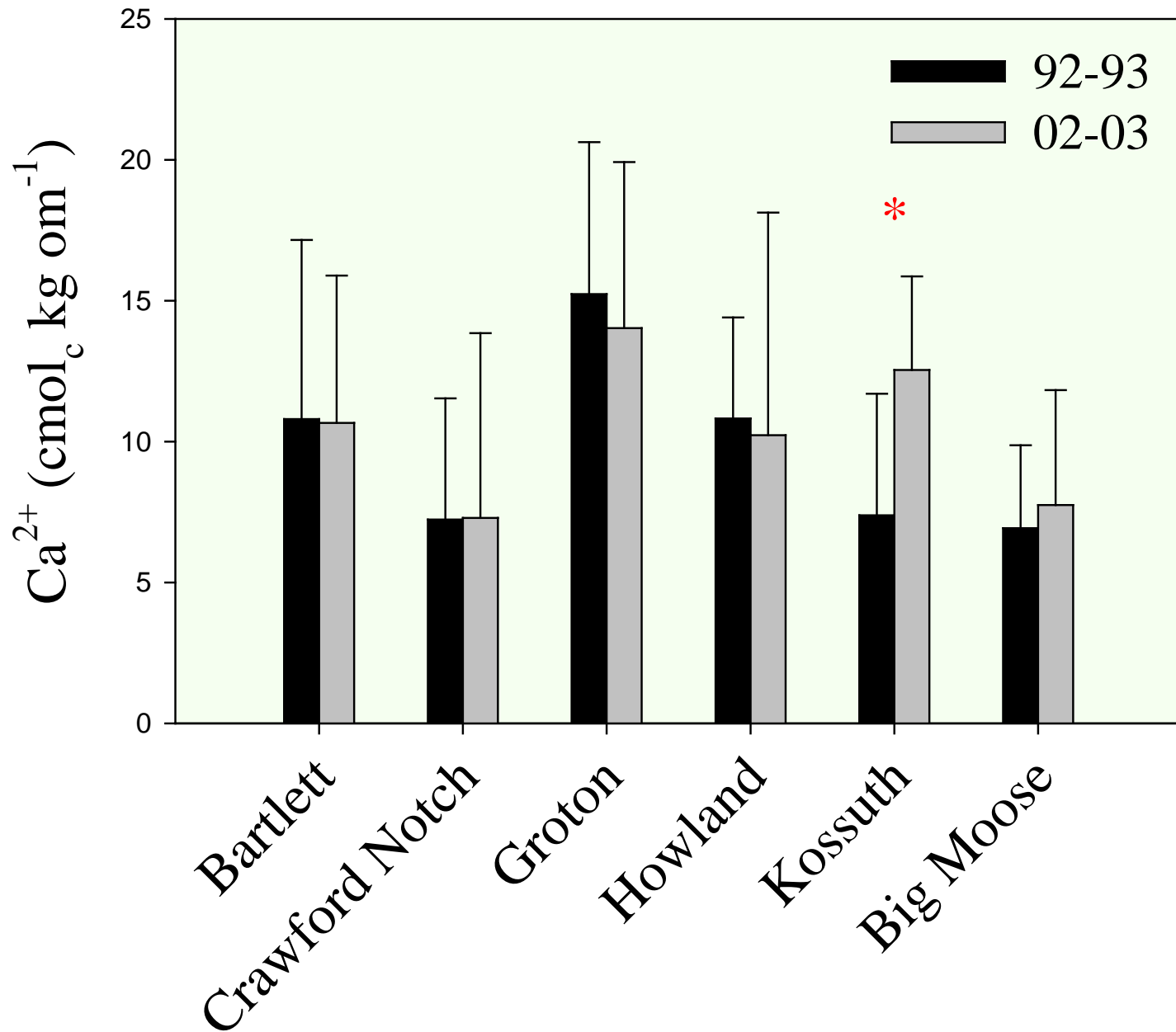
Mobilization of Al in the upper B Horizon



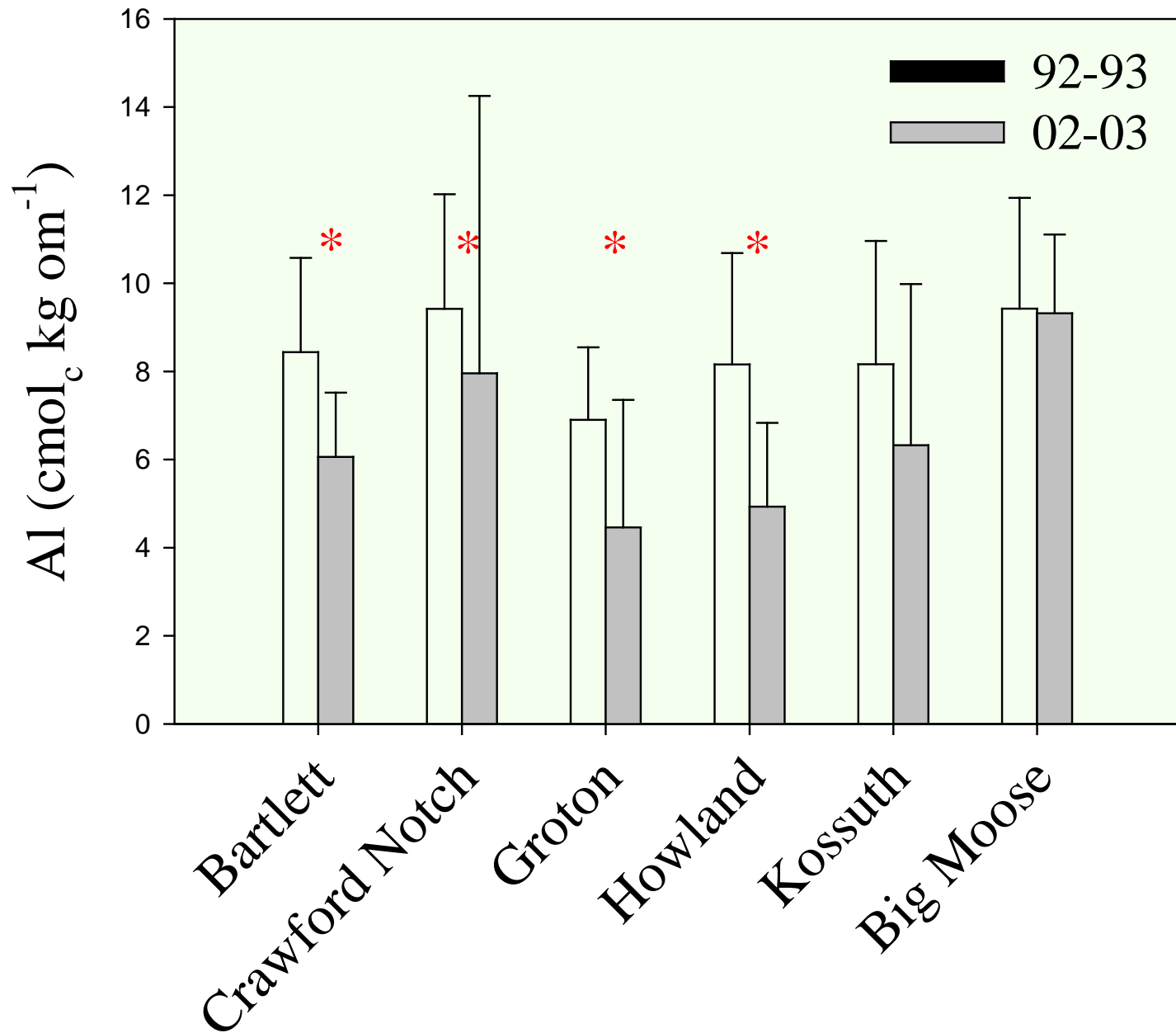


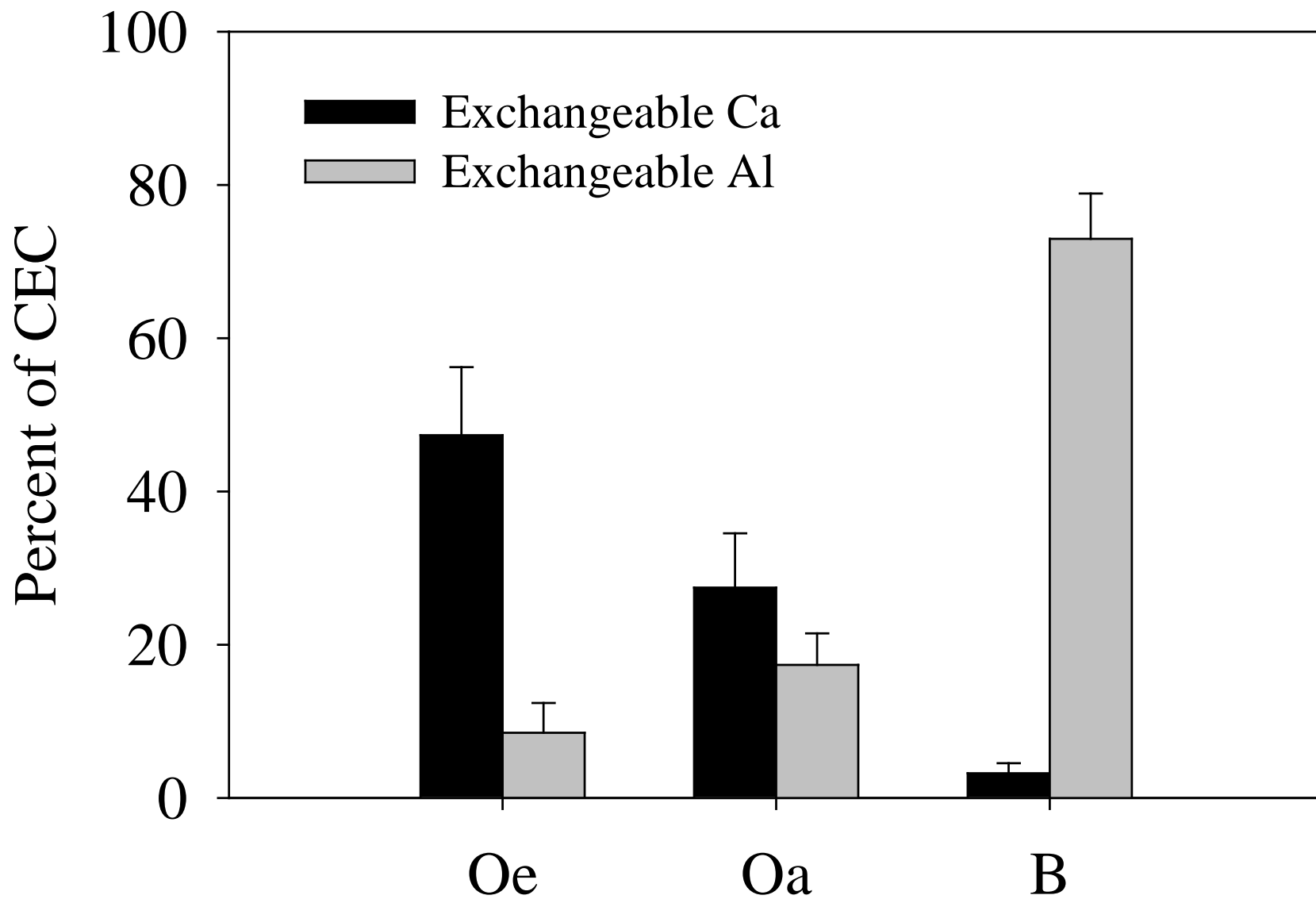
Al Mobilization

Oa Horizon Exchangeable Ca

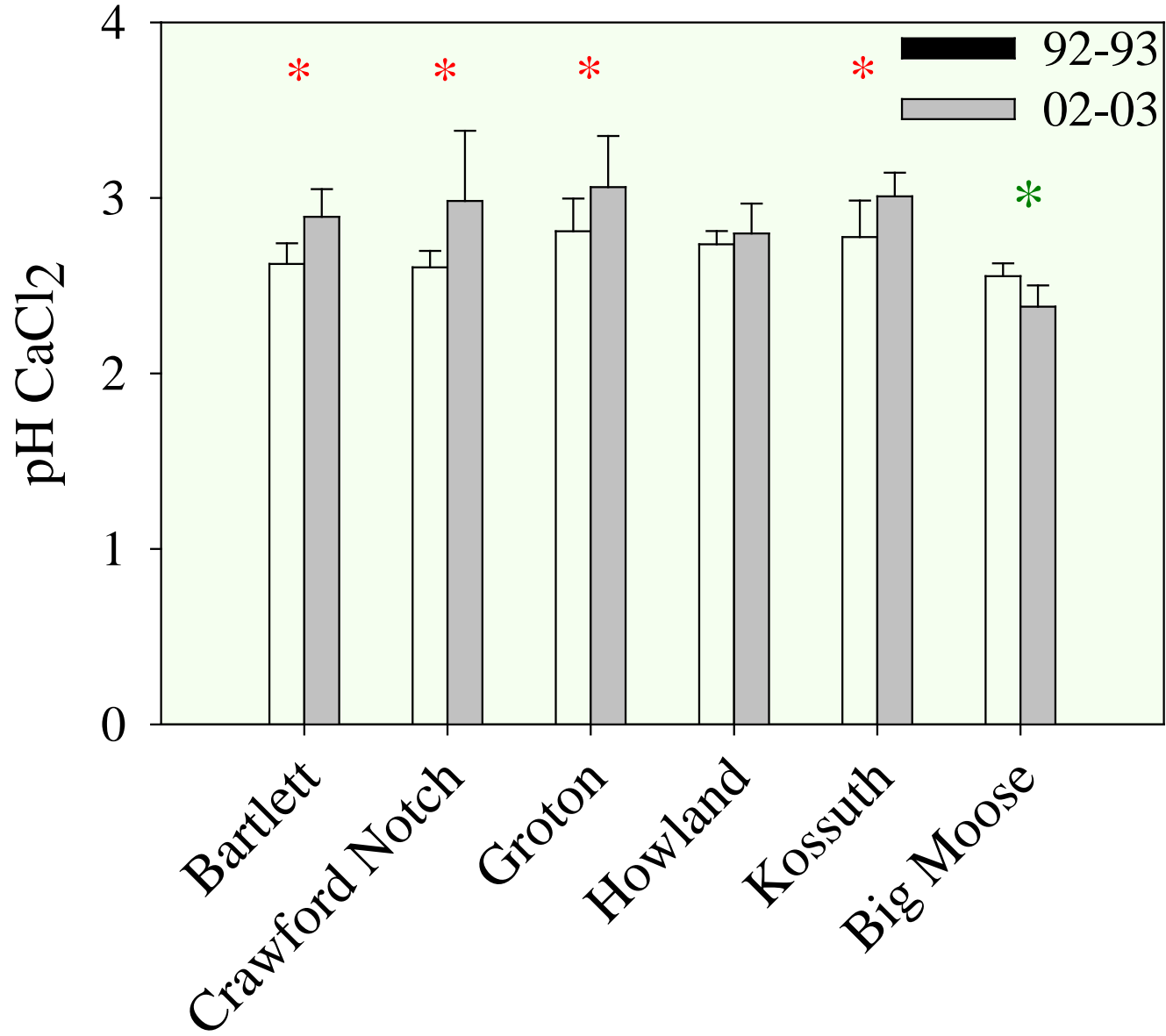


Oa Horizon Exchangeable Al

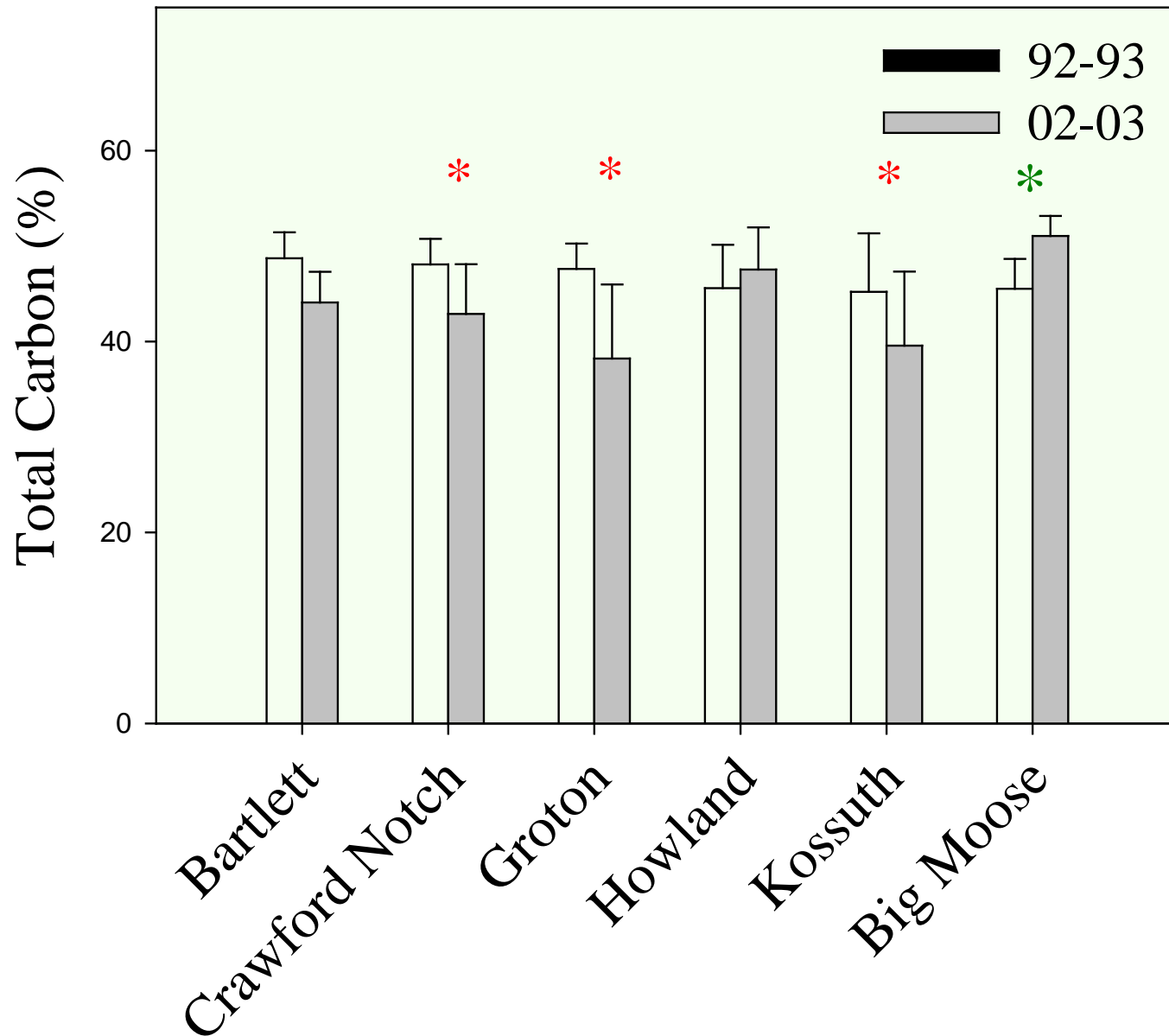


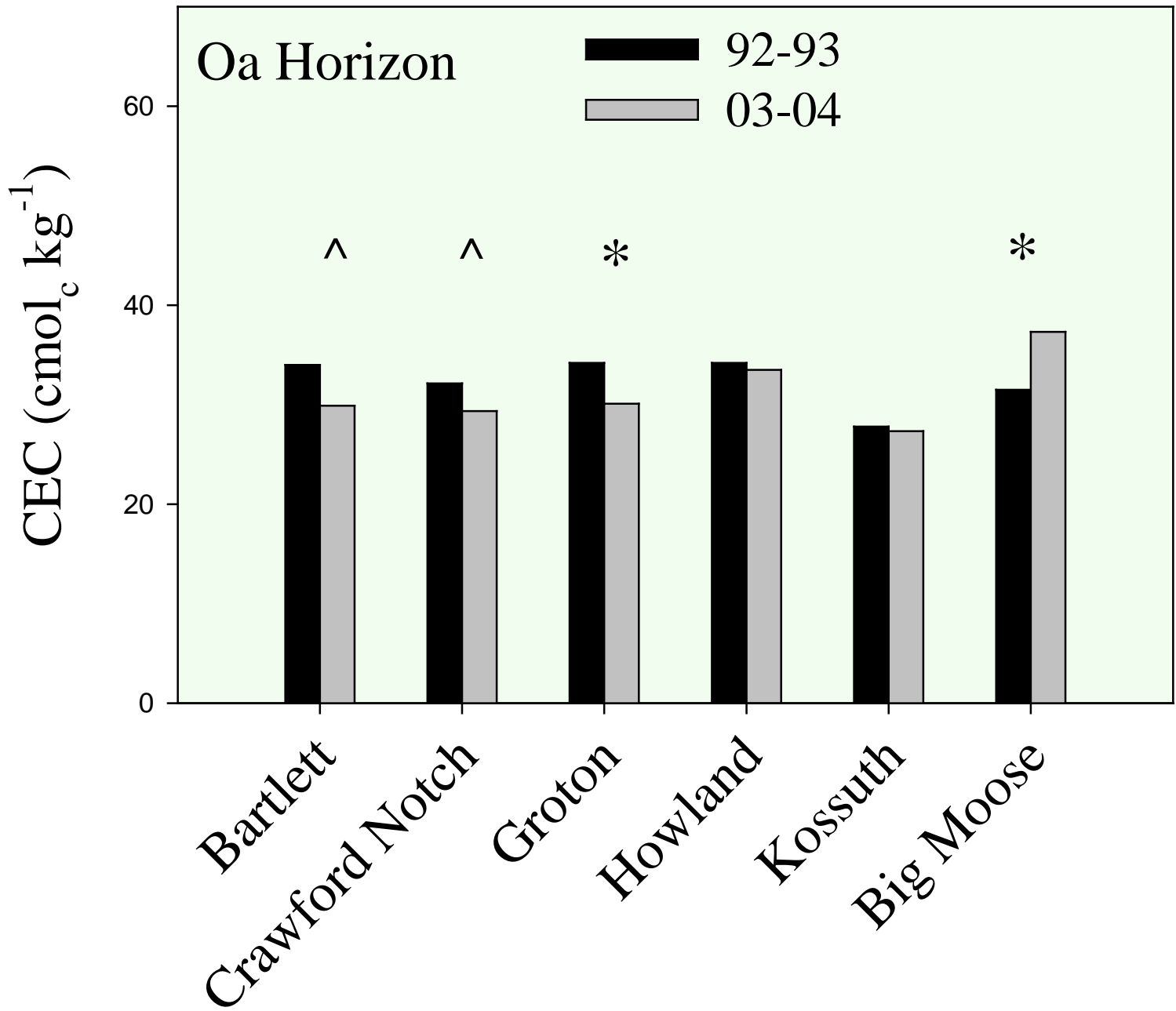


Oa Horizon pH



Oa Horizon Total Organic Carbon





Changes in Oa horizon Organic Matter Mass

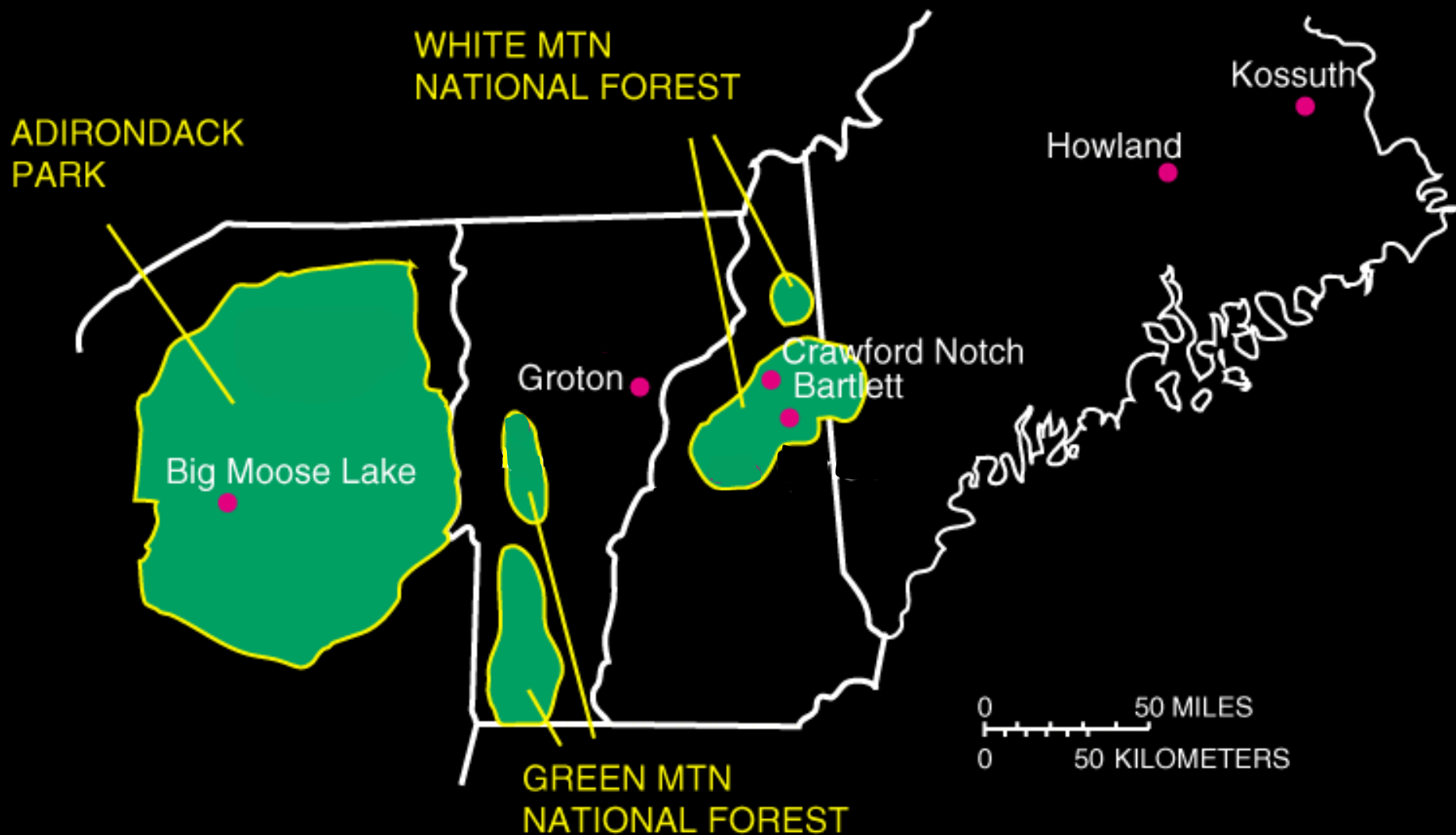
Site	Mg ha ⁻¹		Difference
	1992-93	2003-04	Mg ha ⁻¹ y ⁻¹
Big Moose Lake	175.0	161.7	-1.2
Groton	42.8	17.6	-2.3
Crawford Notch	79.0	45.7	-3.0
Bartlett	86.2	66.3	-1.8
Howland	67.3	56.6	-1.0
Kossuth	21.6	30.6	0.8
Czech Republic			-4.6

**11-year inputs of litter, roots and wood ~ 57 Mg ha⁻¹*

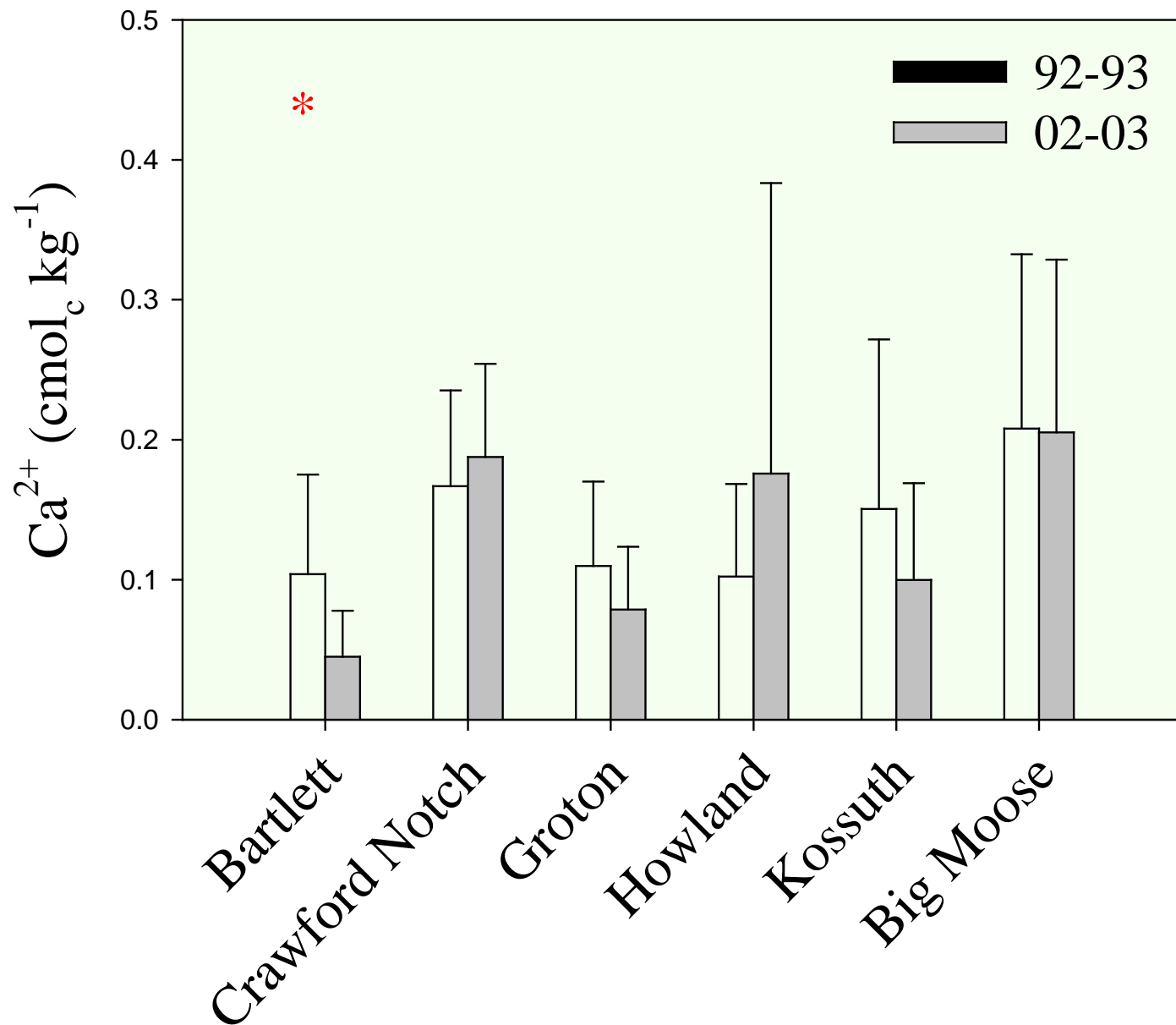
Conclusions

- Accumulation of Al in the Oa horizon is reversing.
- pH is decreasing in the Oa as a result of decreased organic carbon concentrations.
- Further work is needed to understand the cause of decreased organic carbon concentrations.
- To date no improvement in Ca availability in the mineral soil

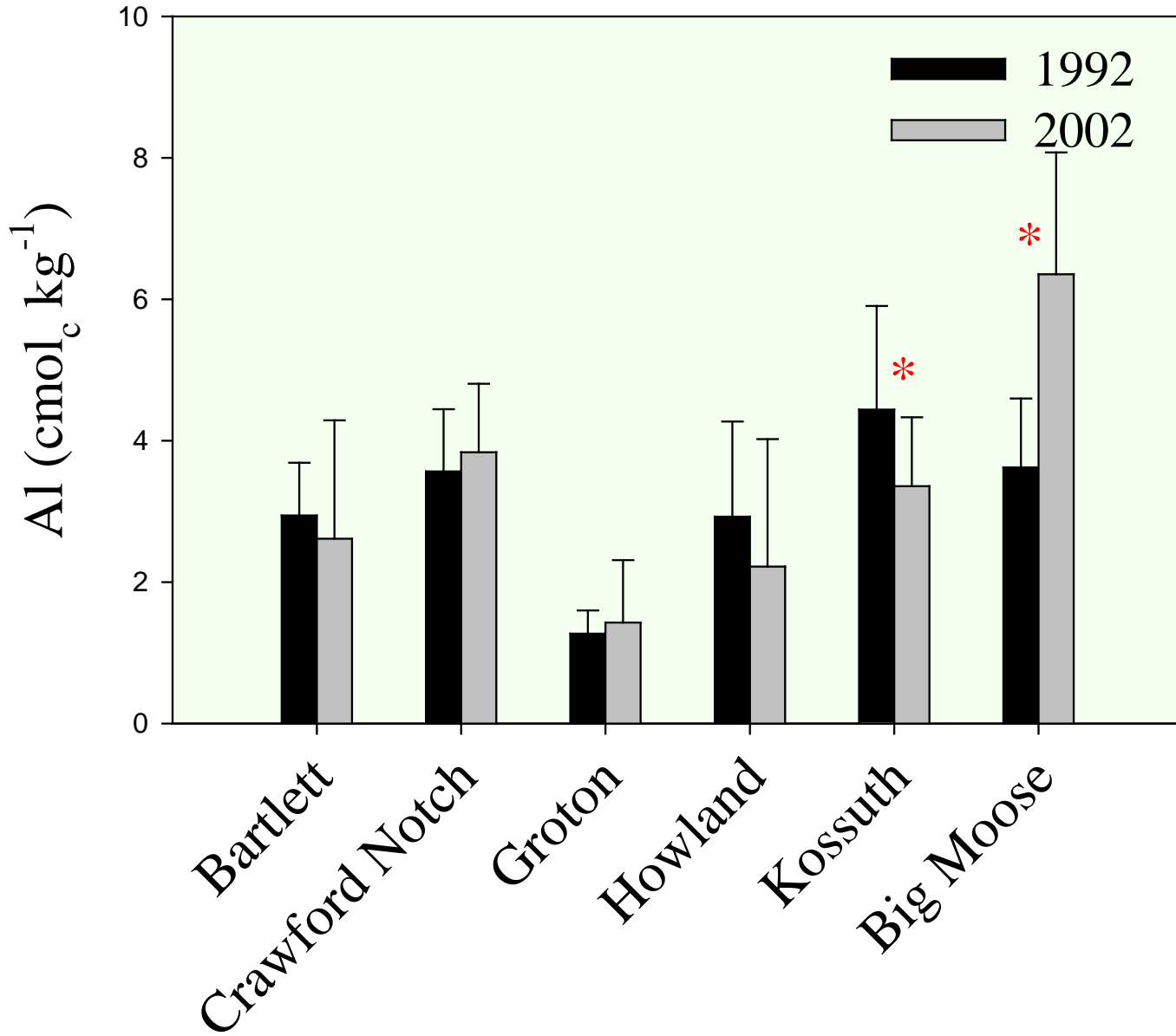
Spruce Stands Sampled in 1992-93 and 2002-03

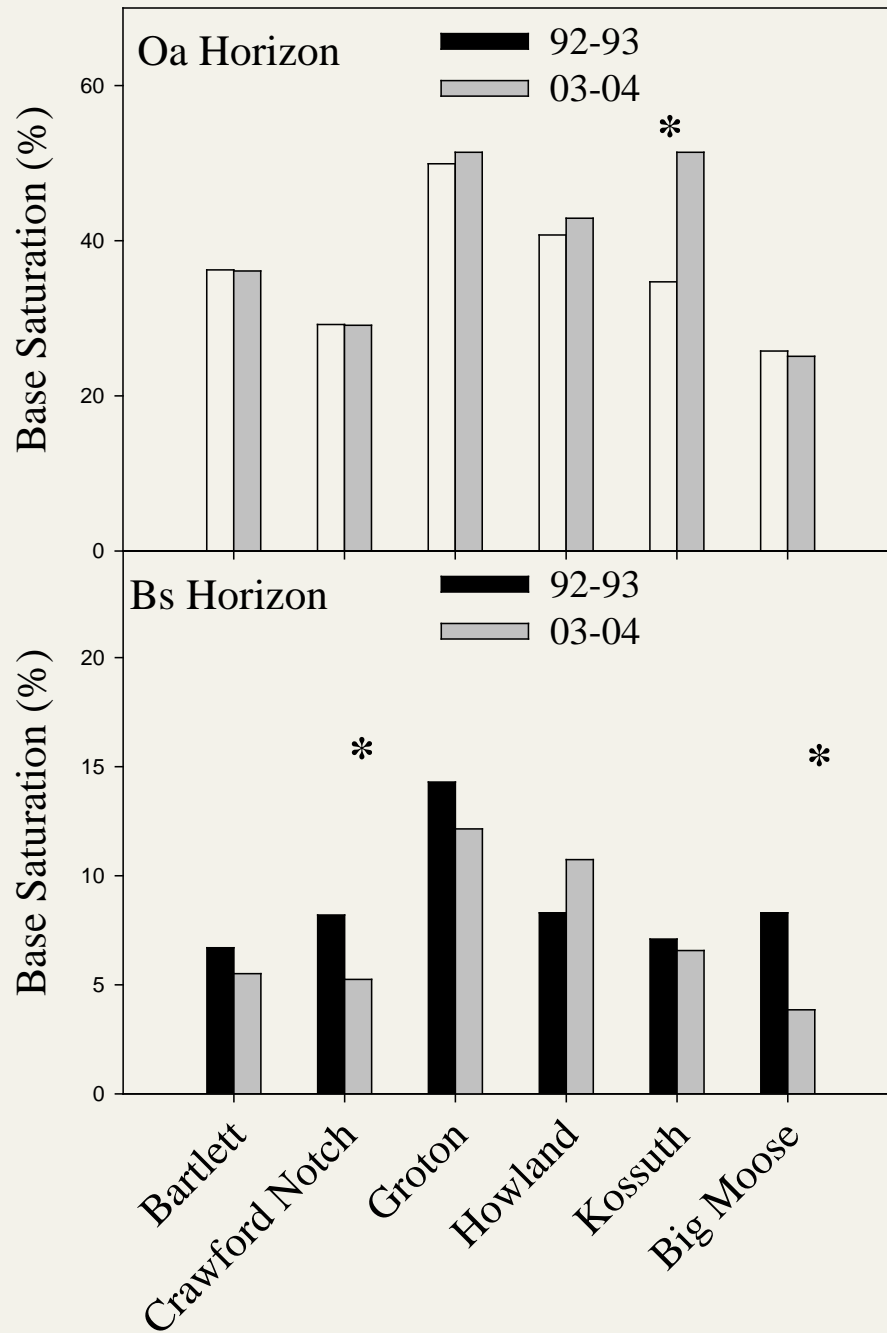


Upper B Horizon Exchangeable Ca



Upper B Horizon Exchangeable Al





Bs Horizon Total Carbon

