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Using water-use efficiency to interpret tree-line dynamics

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At high latitudes and altitudes trees give way to shrub vegetation. It has been hypothesized that in a warmer world the extent of forests will shift, dramatically altering ecosystem carbon balance as well as influencing biophysical properties such as albedo. However, recent observations show a range of tree line responses to climate change including forest retreat as well as expansion. The response of these trees to warming may well be mediated by soil moisture. At a local scale Arctic tree productivity is highly dependent on soil moisture status suggesting that future forest distributions will be determined by water availability as well a temperature. We present observational data from a mountain birch (*Betula pubescens* ssp. *czerepanovii*) forest at the tree line in Abisko, northern Sweden. We used an *in-situ* automated chamber system to measure hourly carbon and water fluxes from whole branches through a growing season. These data were used to derive water-use efficiencies which were then analyzed in relation to seasonal variation in soil moisture.