

Disturbance is required for CO₂-dependent promotion of woody plant growth in grasslands - DTU Orbit (16/08/13)

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The relative effects of disturbance (here defined as bare soil), competition for edaphic resources, thermal interference and elevated [CO₂] on growth of tree seedlings in grasslands were studied under field conditions. Snow gum (*Eucalyptus pauciflora* Sieb. ex Spreng.) seedlings were grown in open-top chambers flushed with either ambient or elevated [CO₂] from March 2004 to January 2005 (autumn to summer). These seedlings were planted into three treatments (i.e. bare soil, soil covered with straw or soil supporting a sward of live pasture grass) to separate effects of grass on seedling growth into those due to competition with grass for soil resources or to alteration of the thermal environment caused by a grassy surface (Ball et al. 2002). After the first major autumn frost, seedlings growing in competition with grass lost 59% of their canopy area, whereas those growing in bare soil or straw suffered negligible damage. These results reveal the complexity of competitive inhibition of plant growth in which ineffective competition for resources such as soil water enhances the vulnerability of the plant to abiotic stress, in this case frost. Tree seedlings growing in bare soil and straw commenced growth earlier in spring than those growing in competition with grass, where soil moisture was consistently lowest. Under ambient [CO₂], growth was greater in bare soil than in straw, consistent with thermal interference, but these differences disappeared under elevated [CO₂]. Elevated [CO₂] significantly increased biomass accumulation for seedlings growing in bare soil and straw treatments, but not in grass. Thus, elevated [CO₂] alleviated apparent thermal interference of seedling growth in spring but did not overcome adverse effects on seedling growth of either competitive reduction in soil resources or competitive enhancement of environmental stress. Nevertheless, elevated [CO₂] could promote invasion of grasslands due to enhancement of woody plant growth in bare soil created by disturbances.

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