

Monitoring soil carbon and emissions: natural and anthropogenic influences

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Abstract

Some of the better-known effects of climate change on vegetation include potential for increased growth, improved water use efficiency and changed allocation of carbon above and below ground. Much of the research behind these potential impacts has been done in Europe and the USA, with Australian contributions from mostly controlled environment and laboratory studies. However most natural (forests) and semi-natural (much of the rangelands) Australian ecosystems are characterized by old, often poorly structured soils; by limitations imposed by the poor availability of elements such as P; and by periodic disturbance by fire that results in wholesale changes in phenology and even in species composition. Here I explore how these non-climatic influences are likely to modify, or even dictate, ecosystem responses to climate. Fire in particular has already been shown to be crucial to expression of the growth-promoting influence of increases in CO₂, for some grassland ecosystems. Our research has highlighted that soil carbon content and turnover (e.g. rates of respiration and its temperature dependence) are frequently species- and thus fire-regime dependent. Modelling suggests that changes in phenology and species composition will play major roles in the carbon and hydrological consequences of changing climates and that predicting and monitoring of impacts must take into account ecosystem-scale interactions and stochastic events..