

RESEARCH ABSTRACT

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Study Title: Investigation of the effects of Mount St. Helens tephra on soil gas composition and subsequent effects on root and mycorrhizal growth of *Abies amabilis*

Key Words: terrestrial plants upland archives
trees soil gas ashfall zone

Abstract: It was hypothesized that tephra from the May 1980 eruption of Mount St. Helens would form an impervious layer, limiting gas exchange (oxygen and carbon dioxide) in the soil. Resulting limited oxygen and excessive carbon dioxide were predicted to affect root and mycorrhizal growth of Pacific silver fir (*Abies amabilis*) causing higher than normal foliage loss.

Experiments were conducted in growth chambers, and observations were made in the field. In growth chambers seedlings were grown under constant light, temperature, and relative humidity approximating mid-growing season. Soil atmosphere and oxygen and carbon dioxide concentrations were controlled. Above ground and root growth were determined after one growing season. Growth was significantly affected by carbon dioxide concentrations in the 10% range and unaffected by oxygen concentrations ranging from 2% to 20%. Observations and measurements in the field at a site with 15 cm of tephra showed premature and extended period of litter fall at three times the normal rate and failed to show soil carbon dioxide concentrations above 5%.

Results achieved in the field did not support the hypothesis. It was concluded that the high rate of foliage loss was not due to inhibition of gas exchange in soil covered by tephra.

Type of Measurement(s): Growth chamber measurements: basal diameter (mm), terminal leader elongation (cm/week), fine root biomass (root diameter in mm, grams dry weight), mycorrhizal biomass (grams dry weight), total leaf area; oxygen and carbon dioxide were injected into soil at determined rates and occasionally gas chromatography was used to test actual gas in soil.

Field measurements: existing regressions to determine biomass of stand, core samples to determine fine root and mycorrhizal condition, litter fall collected in 1/4 meter square screens, gas chromatography used to measure carbon dioxide and oxygen concentrations in soil.

Frequency of Measurement(s): Sampling was performed in 1980-1983.[†]

Data Storage: Hard copies of computer records, field notebooks in personal possession; computer records no longer exist. Data published by Hinckley et al. 1984.

Long-term plans: Data available for collaborative efforts: No future plans for research. The nature of this study called for early investigations and since the hypothesis was not supported by evidence, there would be little purpose to future investigation.

[†]Information concerning the frequency of measurements was unavailable at the time of printing. Contact principal investigator or consult publications for these details.