Impacts of dwarf mistletoe on the physiology of host Tsuga heterophylla trees as recorded in tree ring C and O stable isotopes

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• Dwarf mistletoes, obligate, parasitic plants with diminutive aerial shoots, have long-term effects on host tree water relations, hydraulic architecture, and photosynthetic gas exchange and can eventually induce tree death.

• To investigate long-term impacts of dwarf mistletoe on growth and gas exchange characteristics of host western hemlock, we compared diameter growth and tree-ring cellulose stable carbon and oxygen isotope ratios (δ13Ccell, δ18Ocell) of heavily infected and uninfected trees.

• Relative basal area growth was initially greater, but declined more rapidly in infected than uninfected trees. δ13Ccell and δ18Ocell were significantly lower in infected trees. Lower δ18Ocell in infected trees was unexpected given that stomatal conductance and external variables expected to influence δ18O values of leaf water were similar for both groups. Estimates of mesophyll conductance (gm) were significantly lower and effective path length for water movement (L) significantly higher in leaves of infected trees, consistent with their lower values of δ18Ocell.

• This study reconstructs long-term physiological responses of western hemlock to dwarf mistletoe infection. It further points to limitations of the dual isotope approach for identifying sources of variation in δ13Ccell and indicates that changes in leaf internal properties such as gm and L that affect δ18Ocell must be considered.