Timber Tracking: Multi-isotope analysis for provenancing Bigleaf maple wood in the Pacific Northwest

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ABSTRACT

Tracking timber back to its point of origin is crucial in order to prevent illegal logging and preserve our natural forests. Stable isotope ratios can provide useful information on the geographic origin of trees due to differences based on surrounding environmental, climatic and geological conditions in which the plant grew. Thus isotope ratios of wood can provide a screening tool to assist in ruling whether timber comes from a legal or illegal source. In this study we analysed three light stable isotopes and one heavy stable isotope in order to develop a model able to propose a zone of geographic origin of Bigleaf maple (*Acer macrophyllum*) in the Pacific Northwest of North America. Oxygen (δ\(^{18}\)O), carbon (δ\(^{13}\)C) and nitrogen (δ\(^{15}\)N) isotope ratios were measured in α-cellulose and whole-wood of Bigleaf maple sampled in 73 trees from four different states (California, Oregon, Washington and British Columbia). In addition strontium (\(^{87}\)Sr/\(^{86}\)Sr) ratios of 10 trees were measured across this range. The relationships between these isotope ratios were examined based on geographic, climatic and geologic information in order to attempt to distinguish trees from different locations. To test the method, five blind samples were analysed to yield a proposed zone of origin.

Carbon and nitrogen ratios did not show coherent geographic trends in this species across the sampled region. However, oxygen and strontium ratios revealed spatial patterns with distance from the coast and latitude. Using oxygen, blind test samples were able to be distinguished in some cases at a state level. We conclude that δ\(^{18}\)O and \(^{87}\)Sr/\(^{86}\)Sr ratios provide the most promising methods for identifying latitudinal and longitudinal origin, respectively.

KEYWORDS

Isotope, geochemistry, timber tracking, wood provenance, geographic origin, illegal logging, Pacific Northwest
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