

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 ($\delta^{18}\text{O}$), carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) 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 ($^{87}\text{Sr}/^{86}\text{Sr}$) 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 $\delta^{18}\text{O}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ 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

Contents

Abstract.....	i
Keywords	i
List of Figures and Tables.....	3
Introduction.....	4
Stable isotope background	7
Study species.....	9
Study Area	9
Aims.....	10
Methods.....	11
Sample collection and preparation.....	11
Light Isotope Analysis	12
α-cellulose extraction.....	12
Heavy Isotope Analysis	12
Blind tests.....	13
Statistical analysis.....	14
Geographic Information System	15
Variables	15
Observations and Results.....	15
δ ¹⁸ O.....	16
δ ¹³ C & δ ¹⁵ N.....	16
⁸⁷ Sr/ ⁸⁶ Sr.....	16
Spatial isotope patterns	18
Blind tests.....	24
Ordination approach.....	24
.....	25
.....	25
oxygen isotope determination of blinds.....	26
Blind test 1	26
Blind test 2	28
Blind test 3	29
Blind test 4	31
Blind test 5	33
Discussion.....	34

Conclusions..... 38
Acknowledgments..... 39
References..... 40

LIST OF FIGURES AND TABLES

Figure 1 Bingleaf maple sites within the Pacific Northwest of North America.....	10
Figure 2 Sample preparation flow chart.....	13
Figure 3 $\delta^{18}\text{O}_{\text{cell}}$ ratios measured from Bingleaf maple samples with latitude.....	18
Figure 4 Mean $\delta^{18}\text{O}_{\text{cell}}$ ratios grouped by state with latitude.....	19
Figure 5 $\delta^{18}\text{O}_{\text{cell}}$ ratios measured from Bingleaf maple samples with longitude..	19
Figure 6 Auto-correlation based on 10 variables relating to 73 Bingleaf maple reference sites..	21
Figure 7 $^{87}\text{Sr}/^{86}\text{Sr}$ Bingleaf maple ratios with distance to the coast (km).....	22
Figure 8 Two end member mixing model showing the relationship between Sr derived modern seawater (%) versus Sr derived basalt bedrock (%) in Bingleaf maple wood.....	23
Figure 9 The relationship between the influence of Sr derived basalt bedrock (%) as a source for Bingleaf maple with distance from the coast (km).....	23
Figure 10 The relationship between the influence of Sr derived modern seawater (%) as a source for Bingleaf maple with distance from the coast (km).....	24
Figure 11 NMDS ordination for Bingleaf maple dataset (n=78) coloured by state.....	25
Figure 12 NMDS ordination for Bingleaf maple dataset (n=78) coloured by distance from the coast (km).....	25
Figure 13 Blind sample #1 claim location test.....	26
Figure 14 Blind sample #2 claim location test.....	28
Figure 15 Blind sample #3 claim location test.....	29
Figure 16 Blind sample #4 claim location test.....	31
Figure 17 Blind sample #5 claim location test.....	33
Table. 1 Isotopic analyses for Bingleaf maple wood and corresponding international reference standards.....	13
Table 2 Results of least squared regression.....	17
Table 3 Blind test #1.....	27
Table 4 Blind test #2.....	29
Table 5 Blind test #3.....	27
Table 6 Blind test #4.....	32
Table 7 Blind test #5.....	34