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## Publication

Cellulose ( $\delta^{18}\text{O}$ ) is an index of leaf-to-air vapor pressure difference (VPD) in tropical plants

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Cellulose in plants contains oxygen that derives in most cases from precipitation. Because the stable oxygen isotope composition,  $\delta^{18}\text{O}$ , of precipitation is associated with environmental conditions, cellulose  $\delta^{18}\text{O}$  should be as well. However, plant physiological models using  $\delta^{18}\text{O}$  suggest that cellulose  $\delta^{18}\text{O}$  is influenced by a complex mix of both climatic and physiological drivers. This influence complicates the interpretation of cellulose  $\delta^{18}\text{O}$  values in a paleo-context. Here, we combined empirical data analyses with mechanistic model simulations to i) quantify the impacts that the primary climatic drivers humidity ( $e(a)$ ) and air temperature ( $T(\text{air})$ ) have on cellulose  $\delta^{18}\text{O}$  values in different tropical ecosystems and ii) determine which environmental signal is dominating cellulose  $\delta^{18}\text{O}$  values. Our results revealed that  $e(a)$  and  $T(\text{air})$  equally influence cellulose  $\delta^{18}\text{O}$  values and that distinguishing which of these factors dominates the  $\delta^{18}\text{O}$  values of cellulose cannot be accomplished in the absence of additional environmental information. However, the individual impacts of  $e(a)$  and  $T(\text{air})$  on the  $\delta^{18}\text{O}$  values of cellulose can be integrated into a single index of plant-experienced atmospheric vapor demand: the leaf-to-air vapor pressure difference (VPD). We found a robust relationship between VPD and cellulose  $\delta^{18}\text{O}$  values in both empirical and modeled data in all ecosystems that we investigated. Our analysis revealed therefore that  $\delta^{18}\text{O}$  values in plant cellulose can be used as a proxy for VPD in tropical ecosystems. As VPD is an essential variable that determines the biogeochemical dynamics of ecosystems, our study has applications in ecological-, climate-, or forensic-sciences.

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