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Introduction and Study Region

Although dendrochronological studies in Ecuador's tropical dry forests have advanced in recent years, there is still a pressing need to understand how climate influences tree growth (Volland-Voigt et al., 2011). Species such as *Handroanthus chrysanthus* and *Bursera graveolens* show high dendroclimatic potential, offering insights crucial for climate-informed forest management. This study proposes an amendment to the **Organic Code of the Environment (COA, 2024)**, specifically Chapter II, Article 27, to enhance mandates for the sustainable management and conservation of climate-sensitive species based on dendrochronological evidence.

This research was carried out in the "Laipuna" Nature Reserve", in the tropical dry forest, region of southern Ecuador (Gebauer et al., 2020)

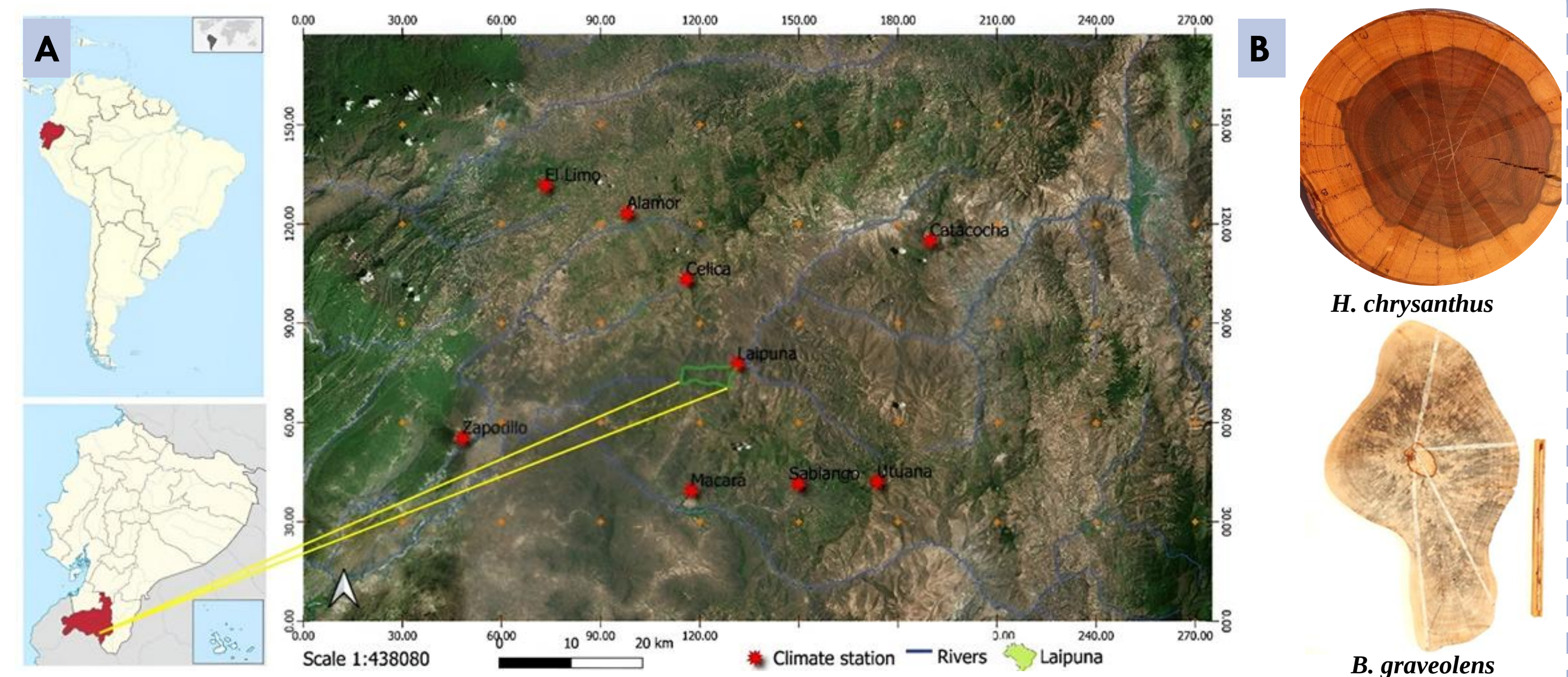


Figure 1 : A. Meteorological climatic station and green map is Laipuna Natural Reserve. B. Wood samples

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Methods

B. graveolens and *H. chrysanthus* chronologies were developed using the DplR package in R (Figure 4A:4B). Their dendroclimatic potential was correlated with regional precipitation from the INAMHI station and CRU TS 4.08, using the TreeClim package. Spatial correlation analyses were applied to explore relationships with Sea surface temperature (SST) anomalies, while El Niño land precipitation data (CRU TS 4.03) was used to identify climate signals linked to ENSO-related rainfall variability (Figure 3A: 3B).

A proposal was made to amend Article 27 of the **Organic Code of the Environment** (COA, 2024) in Ecuador, promoting the sustainable management of climate-sensitive species.

Table 1. A) *H. chrysanthus* (B) *B. graveolens* chronology

Parameter	<i>H. chrysanthus</i>	<i>B. graveolens</i>
No. of trees/ radii	39/77	53/70
Chronology length (years)	246	199
Chronology time span	1777-2023 CE	1824-2023 CE
Mean sensitivity: Glk: EPS	0.70 : 0.55: 0.91	0.69 : 0.54: 0.90

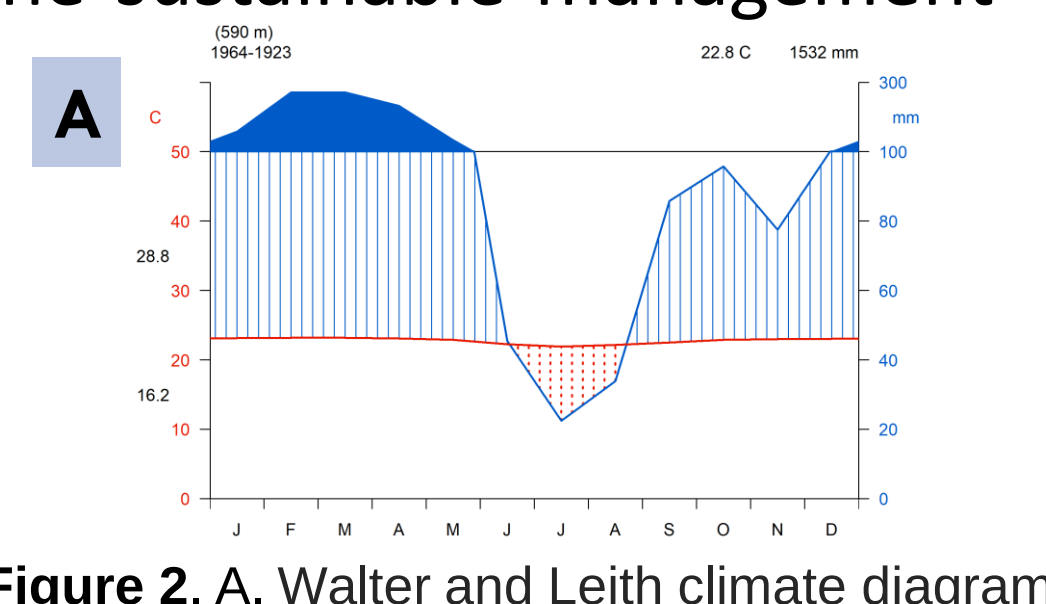


Figure 2. A. Walter and Leith climate diagram

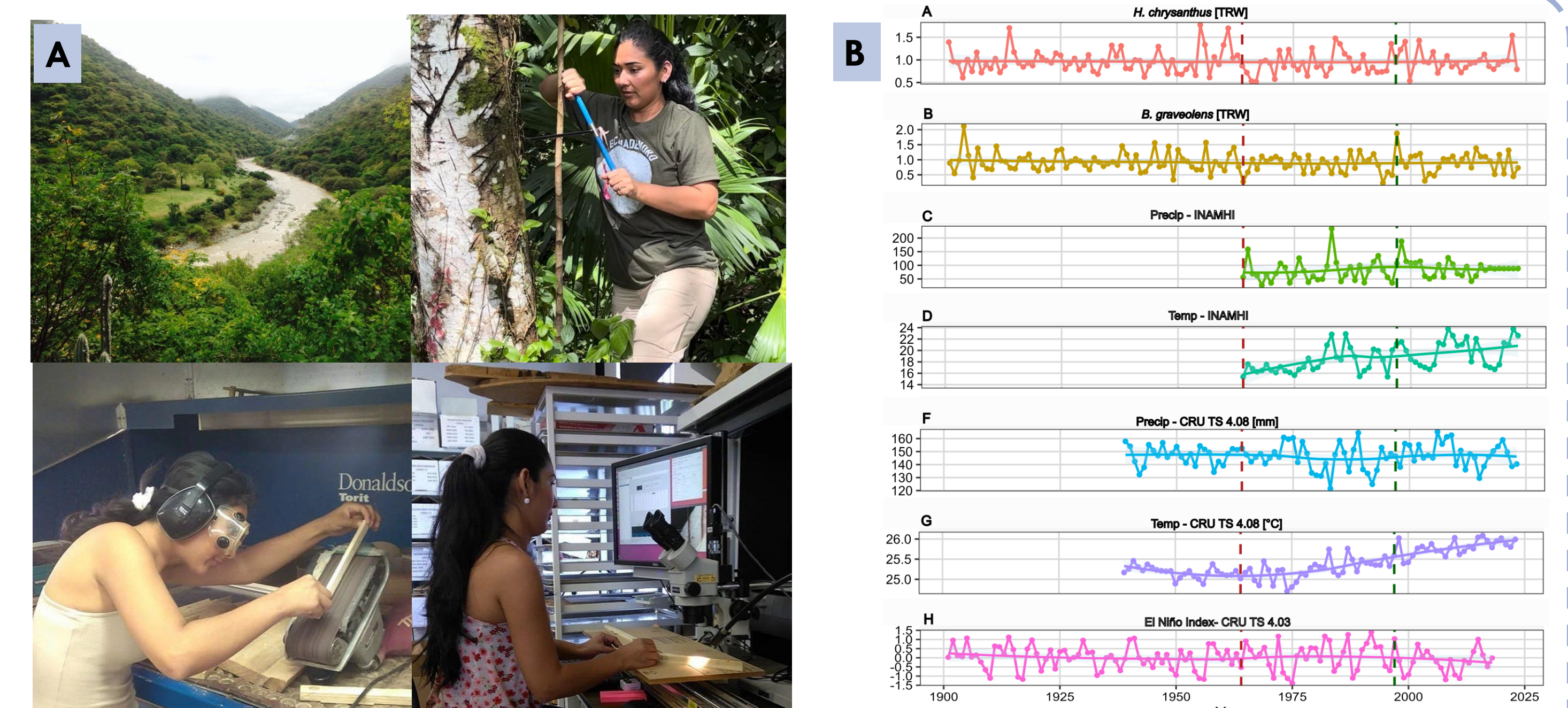


Figure 3. A. Dendrochronological Methods. B. Tree-Ring Width (TRW) and Climate Time Series

(Speer, 2010; Zang & Biondi, 2015)

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Results

Our results showed that tree growth in both species were positively correlated with precipitation data from INAMHI. However, when using CRU TS 4.08 data, only *B. graveolens* showed a negative correlation (Table 2; Figure 4A:4B).

Table 2. A) *H. chrysanthus* (B) *B. graveolens* response

Species	Relationship	Period	r	P-value
<i>H. chrysanthus</i>	Precip INAMHI-TRW	1964-2023	0.35	0.03
	P-CRU TS4-TRW	1939-2002	0.32	0.04
<i>B. graveolens</i>	Precip INAMHI-TRW	1964-2023	0.58	0.01
	T-CRU TS4-TRW	1939-2023	-0.34	0.02

El Niño index in *H. chrysanthus* were evident during the rainy season, unlike *B. graveolens*. In both species, El Niño index was minimal in the dry season (Figure 5A:5B).

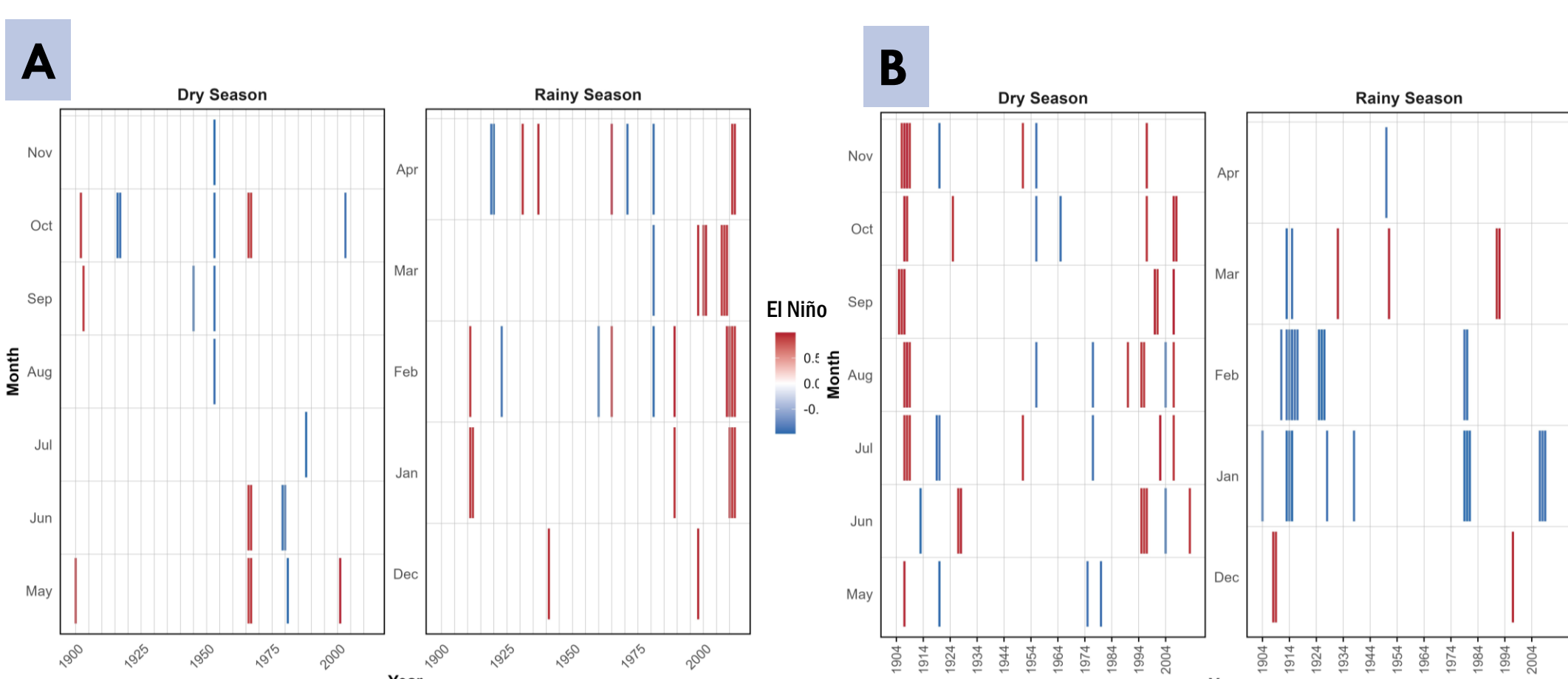


Figure 5. (A) *H. chrysanthus* (B) *B. graveolens* - El Niño Index relationship.

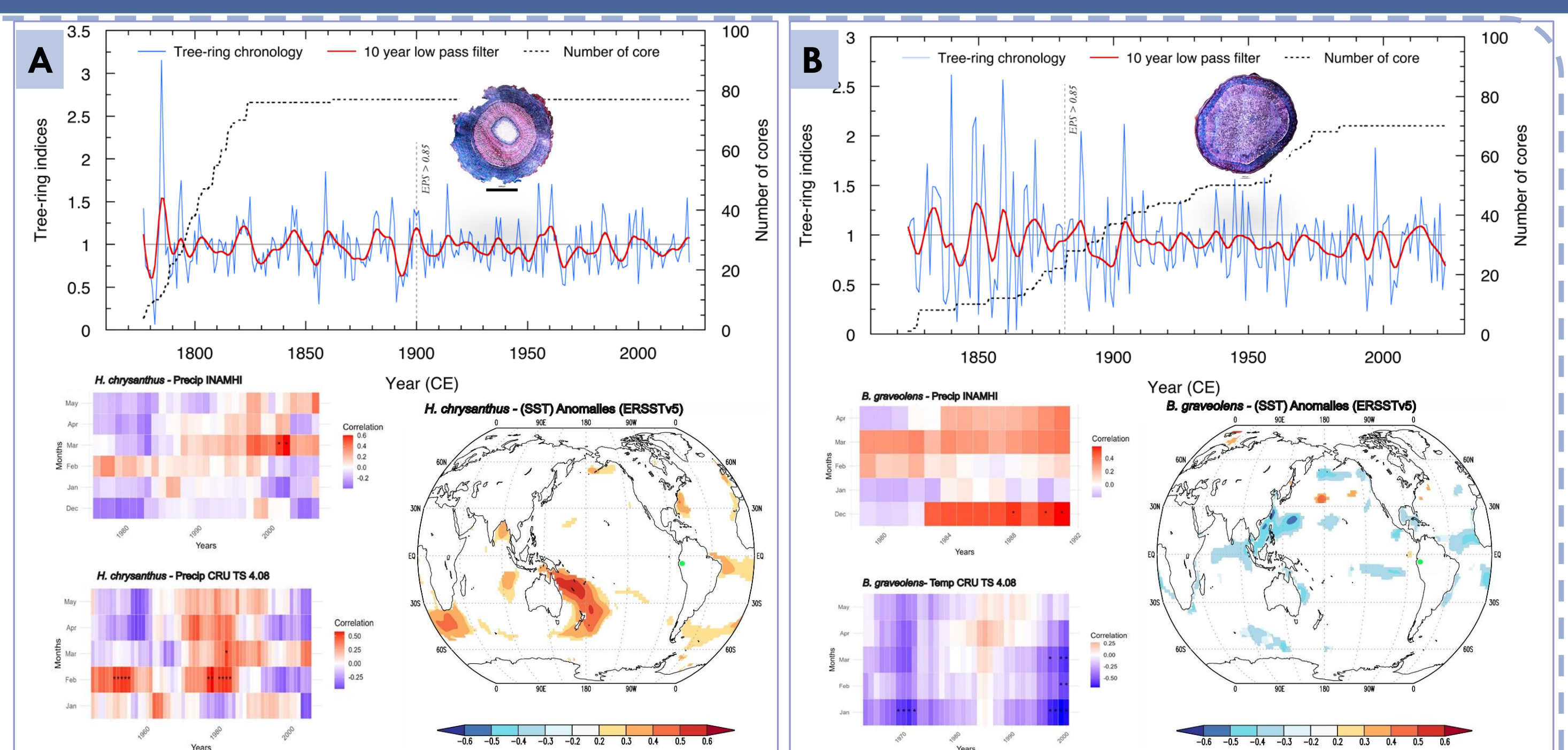


Figure 4. (A) *H. chrysanthus* (B) *B. graveolens* chronologies and climate using INAMHI, CRU TS 4.08 and SST dataset.

Spatial correlation on *H. chrysanthus* showed a positive SST correlation in the rainy season, while *B. graveolens* showed a negative one in the dry season, highlighting their dendroclimatic value for COA regulation support (Figure 4A:4B).

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Conclusions

The developed chronologies for *B. graveolens* and *H. chrysanthus* confirm their dendroclimatic potential, with growth positively associated with rainy season precipitation, as captured by both regional and CRU TS4 data. *B. graveolens* also showed a negative response to higher temperatures. EL Niño anomalies influenced *H. chrysanthus* during the rainy season but were less evident in *B. graveolens*. Spatial correlation with SST revealed that *H. chrysanthus* responded positively during the rainy season, while *B. graveolens* showed a negative response in the dry season. These findings support the proposal to expand Article 27 of the COA (2024), **advocating the protection of climate-sensitive species with dendroclimatological value.**

The work was funded by DFG (project no. PAK 823/1 A2: TRENCH (Tree - Ring Environmental Network for Climate Change Monitoring))

DFG Deutsche Forschungsgemeinschaft
German Research Foundation

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