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Drought Vulnerability of Neotropical Canopy Trees and Lianas

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Functional diversity and responses to drought in tropical forests (DROUGHT)

Panama Canopy Cranes
Question 1:

Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation?
Lianas appear to lose their advantage as annual precipitation increases.

Cai, Schnitzer & Bongers (2009) 1550 mm yr⁻¹ precipitation

Santiago & Wright (2007) 3100 mm yr⁻¹ precipitation
Vulnerability to drought-induced xylem cavitation
“vulnerability curve”

Fraction of maximum conductivity

\[ P50 \]

Water potential (MPa)
Differences in $K_s$ are greater in drier forests

Parque Metropolitano Crane
1800 mm yr$^{-1}$

San Lorenzo Crane
3100 mm yr$^{-1}$

De Guzman, Santiago, Schnitzer, Álvarez-Cansino (2016) Tree Physiology

De Guzman, Acosta-Rangel, Winter, Bonal, Santiago (unpublished)
Differences in $P_{50}$ are greater in drier forests

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De Guzman, Acosta-Rangel, Winter, Bonal, Santiago (unpublished)
Question 2:

Does the hydraulic safety versus efficiency trade-off apply to lianas?
The hydraulic safety versus efficiency trade-off

Gleason et al. (2016) *New Phytologist*
The hydraulic safety versus efficiency trade-off

Gleason et al. (2016) *New Phytologist*

More efficient water transport

Safer xylem; more resistant
Lianas show stronger safety-efficiency trade-off than trees

(Tree Physiology (2016) and unpublished data)
Question 3:

Coordination with drought avoidance traits?
Stem pressure-volume curve: Drought avoidance traits
Expected linkages among hydraulic traits

- Drought resistance
- Efficiency of water transport
- Drought avoidance
Evidence of safety-avoidance coordination in lianas – trees no
No evidence of efficiency-avoidance trade-off

De Guzman, Santiago, Acosta-Rangel, Winter, Bonal, (unpublished data)
Evidence of safety-avoidance coordination in lianas – trees no
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De Guzman, Santiago, Acosta-Rangel, Winter, Bonal, (unpublished data)
Expected linkages among hydraulic traits

Drought resistance

-  

Efficiency of Water transport

-  

Drought avoidance

+  

-
Expected linkages among hydraulic traits

Drought resistance

- ✔ -

Efficiency of Water transport

Drought avoidance

- + -
Expected linkages among hydraulic traits

Drought resistance

Efficiency of Water transport

Drought avoidance
Expected linkages among hydraulic traits

Drought resistance ➖ Efficiency of Water transport

Drought avoidance
Questions:

- Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation?
- Does the hydraulic safety versus efficiency trade-off apply to lianas?
- Coordination with drought avoidance traits?
Questions:

❯ Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation?
❯ Does the hydraulic safety versus efficiency trade-off apply to lianas?
❯ Coordination with drought avoidance traits?
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➢ Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation? ✔

➢ Does the hydraulic safety versus efficiency trade-off apply to lianas? ✔

➢ Coordination with drought avoidance traits?
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➢ Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation? ✔

➢ Does the hydraulic safety versus efficiency trade-off apply to lianas? ✔

➢ Coordination with drought avoidance traits? ✗
Thank you!