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Drought Vulnerability of Neotropical Canopy Trees and Lianas

Louis Santiago, Mark De Guzman, Aleyda Acosta-
Rangel, Christopher Baraloto Damien Bonal

University of California, Riverside
Smithsonian Tropical Research Institute
Florida International University
UMR EEF – INRA



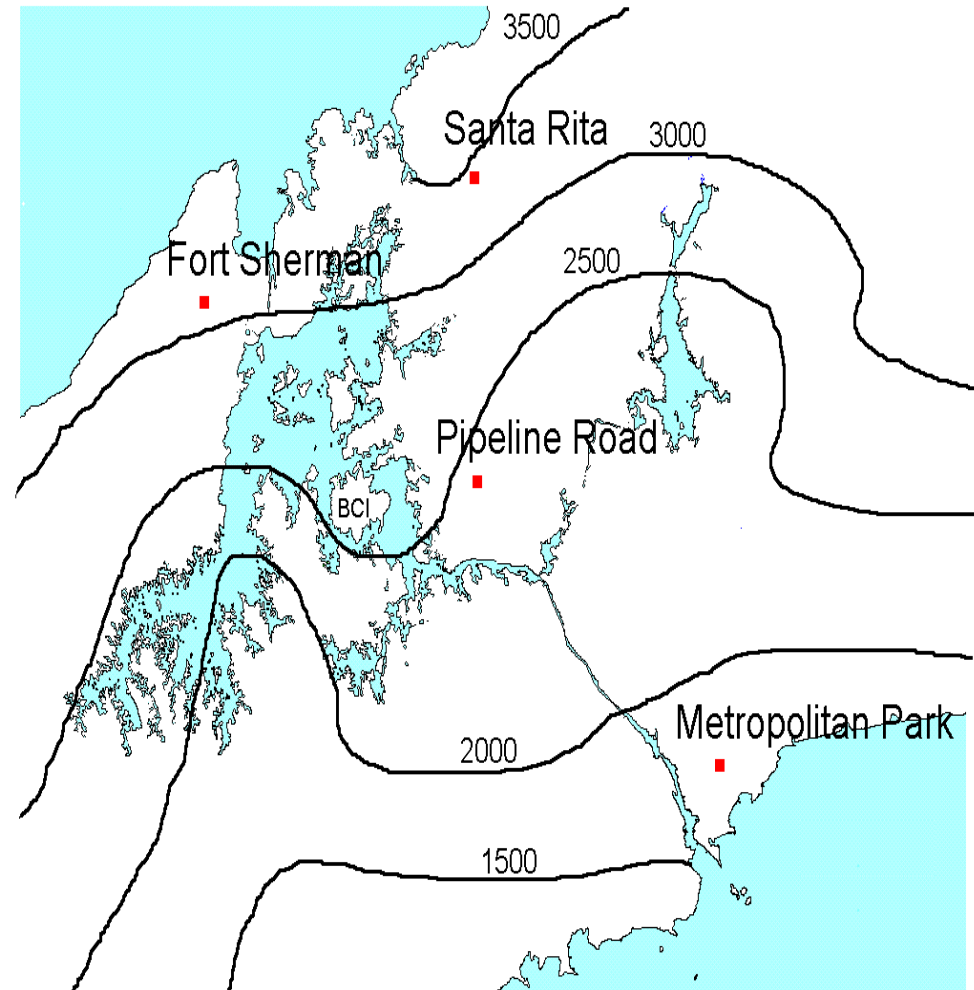
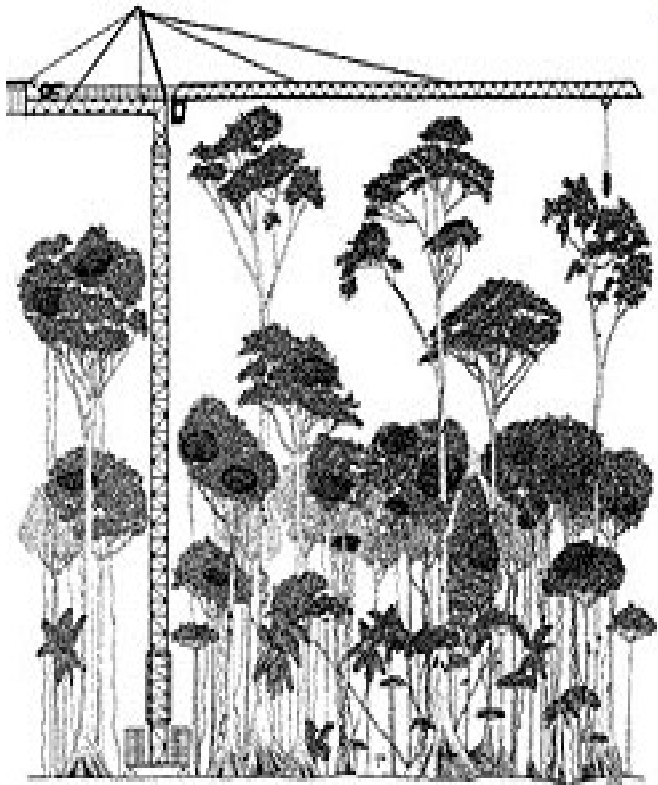
UNIVERSITY OF CALIFORNIA, RIVERSIDE

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

Damien Bonal, Nicolas Angeli, Pascale Maillard, Christian Hossann, Sabrina Coste, Jean-Yves Goret, Benoit Burban, Jocelyn Cazal, Heidy Schimann, Elaine Louisanna, Maricar Aguilos, Patrick Heuret, Bruno Herault, Camille Ziegler, Maguy Dulorme, Celine Leroy, Nathalie Sejalon-Delman, Marc Buee, Cyrille Bach, Melanie Roy, Sophie Manzi, Isabelle Marechaux, Jerome Chave, Elodie Courtois, Clement Stahl, Erik Verbruggen, Ivan Janssens, Hans Verbeeck, Elizabeth Kearsley, Hannes De Deurwaerder, Louis Santiago, Mark De Guzman, Chris Baraloto, Ken Feeley, Oscar Valverde, Lucy Rowland, Patrick Meir, Herve Cochard, Corinne Vacher, Celine LaLanne, Patrick Leger, Sylvain Delzon, Regis Burret, Gaelle CapDeville, Laurant Lamarque, Jose Torres, Nathan McDowell, Charlotte Grossiord, Lawren Sack, Megan Bartlett



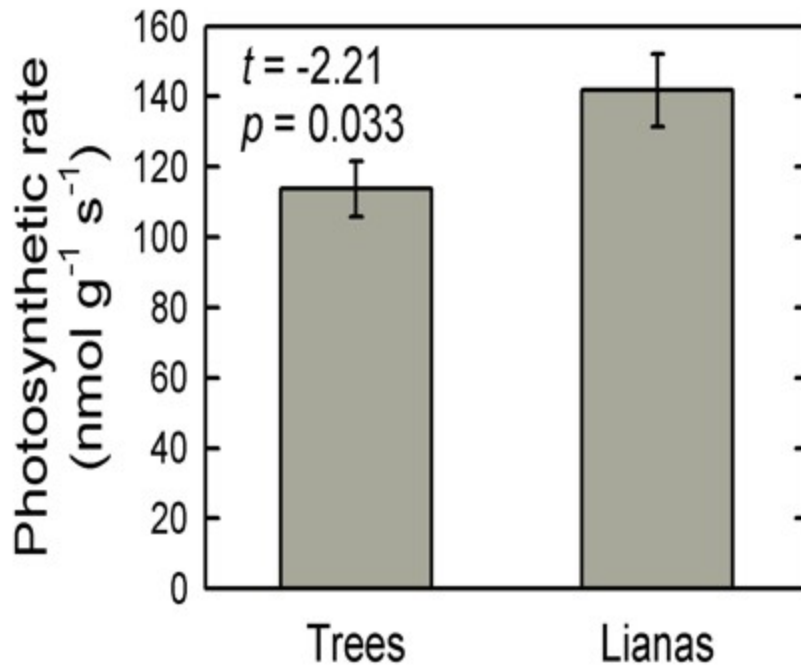
Panama Canopy Cranes



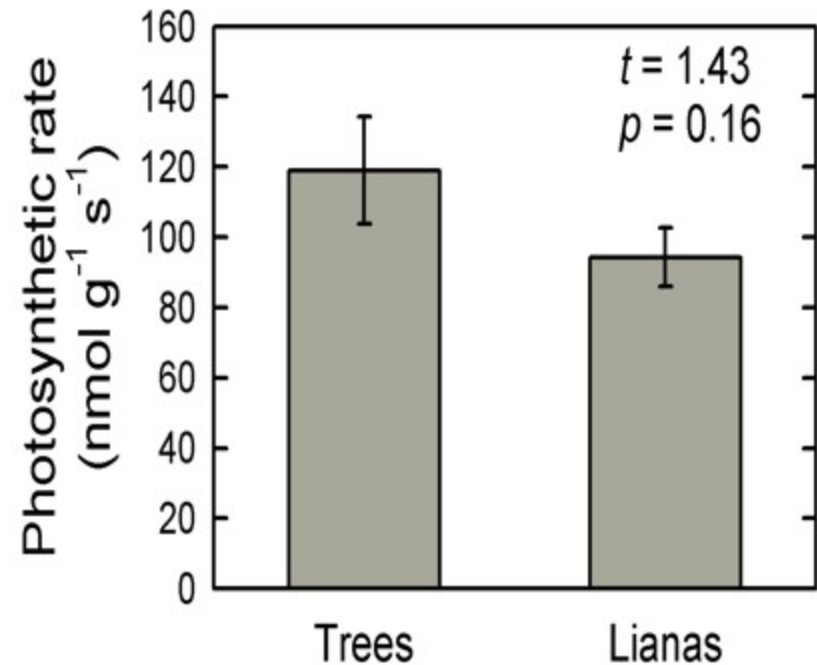
Question 1:

- Does the magnitude of hydraulic trait differences in trees and lianas vary with precipitation?

Lianas appear to lose their advantage as annual precipitation increases

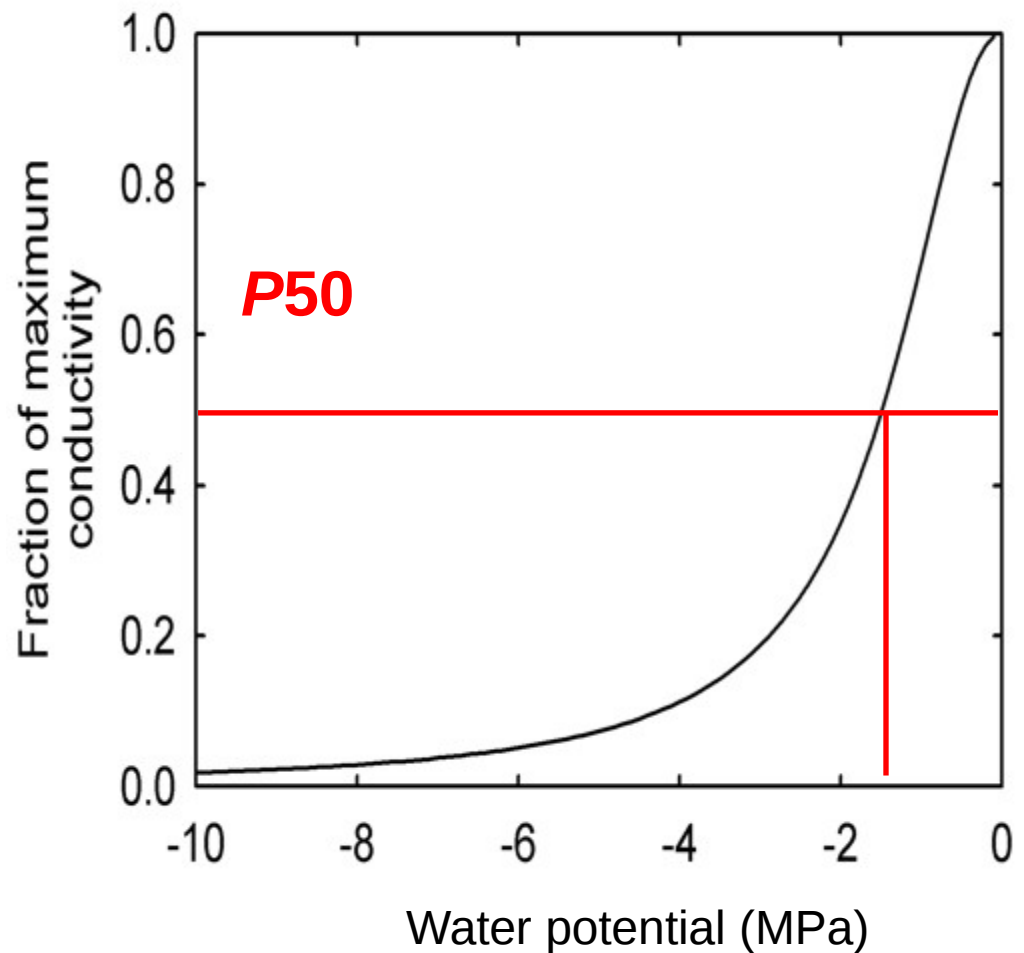
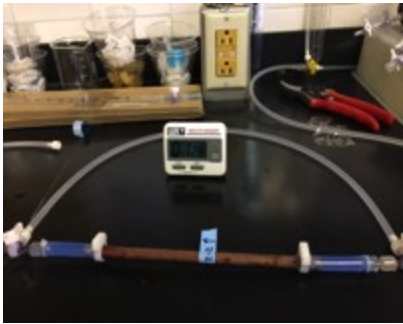


Cai, Schnitzer & Bongers (2009)
1550 mm yr⁻¹ precipitation



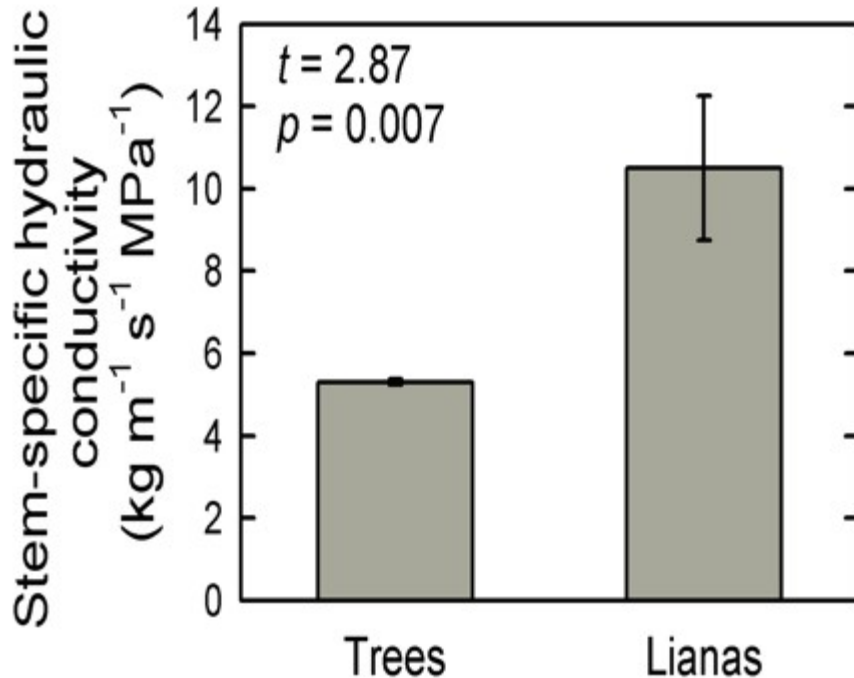
Santiago & Wright (2007)
3100 mm yr⁻¹ precipitation

Vulnerability to drought-induced xylem cavitation “vulnerability curve”



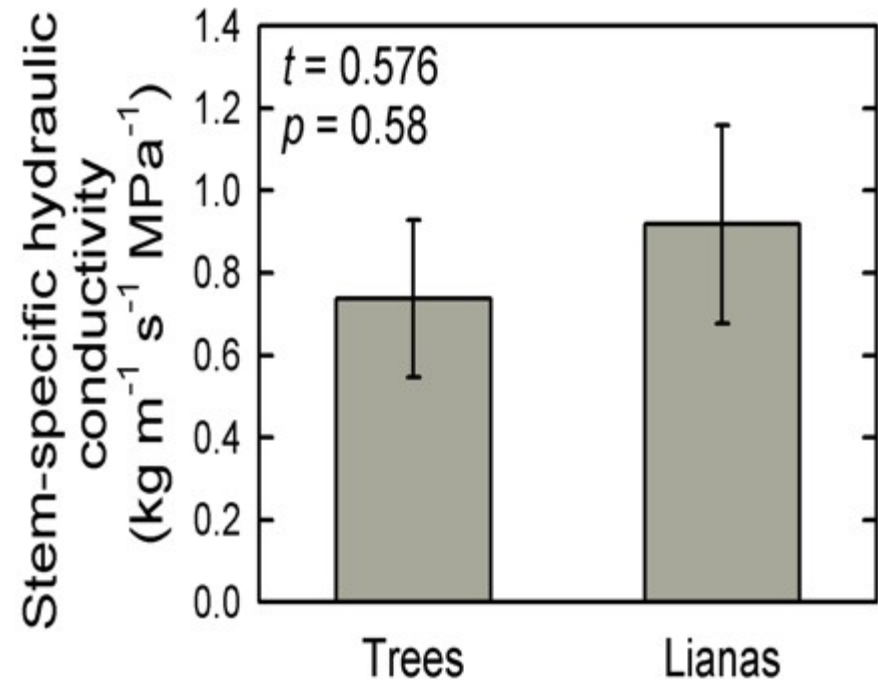
Differences in K_s are greater in drier forests

Parque Metropolitano Crane
1800 mm yr⁻¹



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

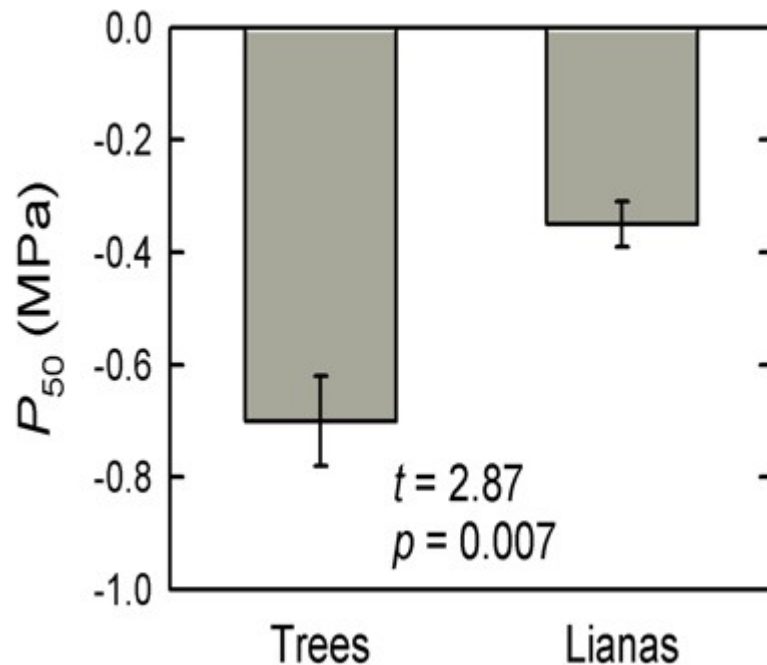
San Lorenzo Crane
3100 mm yr⁻¹



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

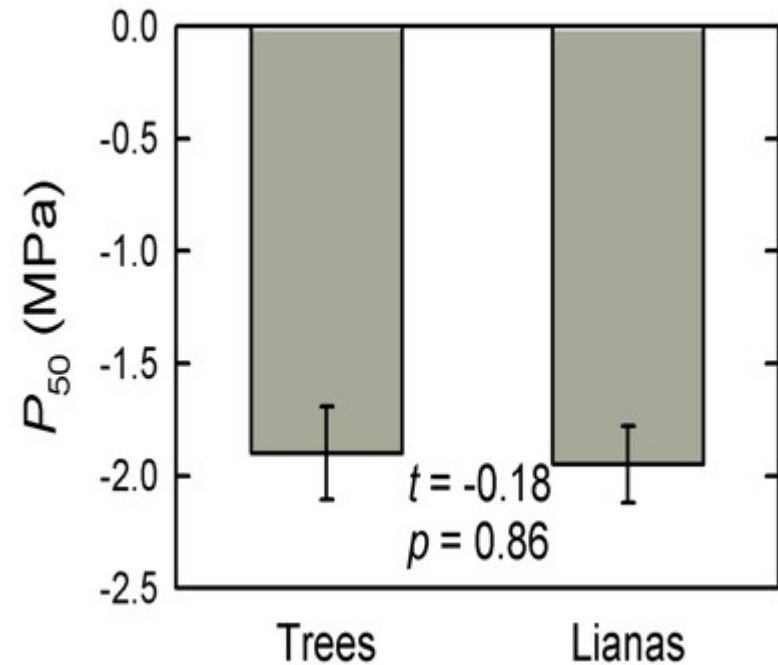
Differences in P_{50} are greater in drier forests

Parque Metropolitano Crane
1800 mm yr⁻¹



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

San Lorenzo Crane
3100 mm yr⁻¹



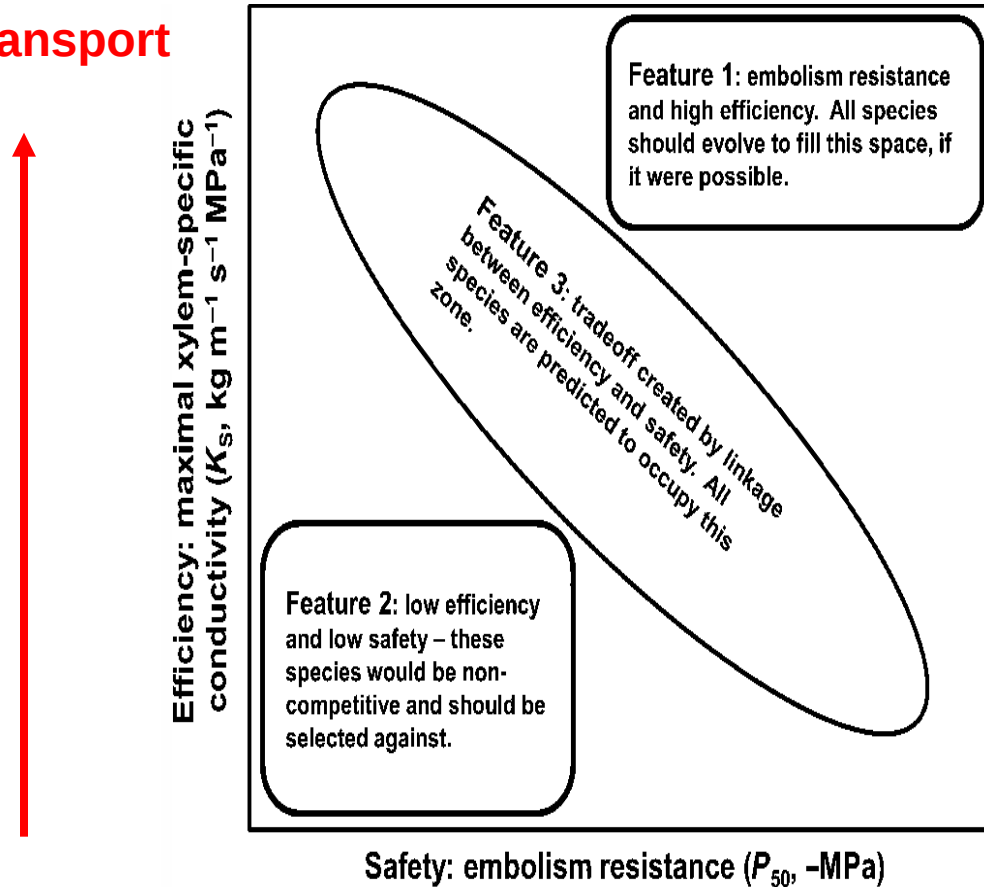
De Guzman, Acosta-Rangel, Winter, Bonal, Santiago (unpublished)

Question 2:

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

The hydraulic safety versus efficiency trade-off

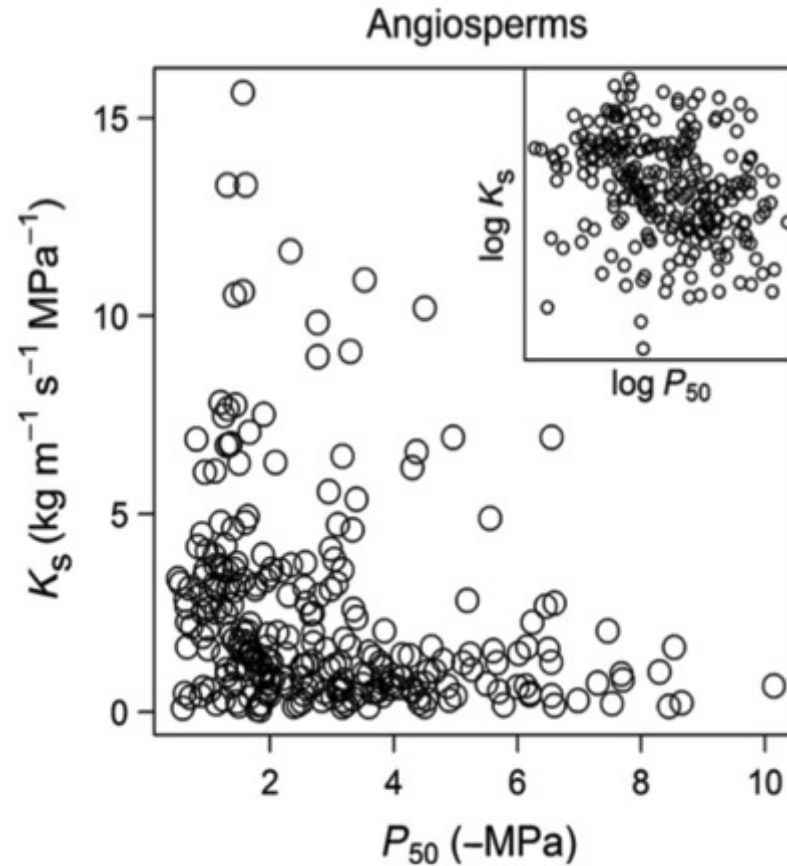
More efficient
water transport



Safer xylem;
more resistant

The hydraulic safety versus efficiency trade-off

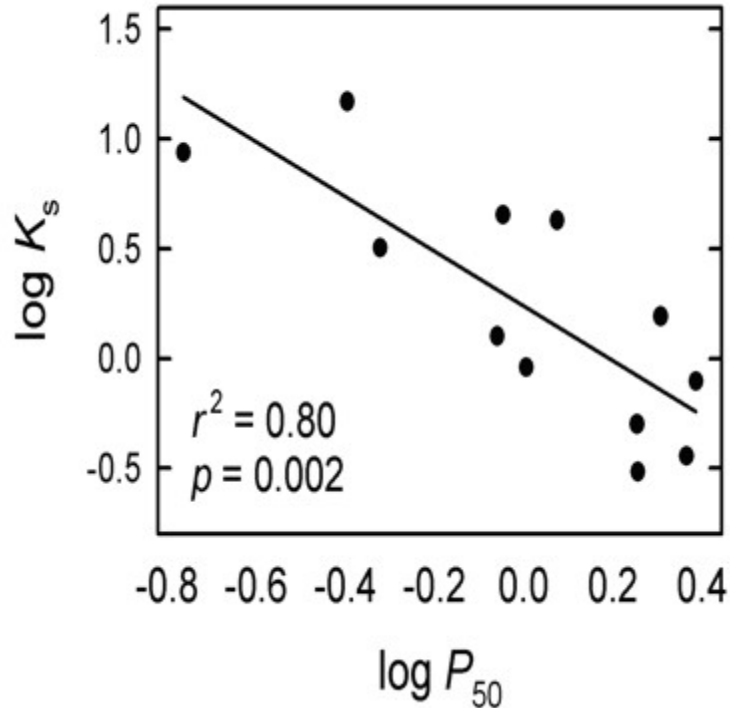
More efficient
water transport



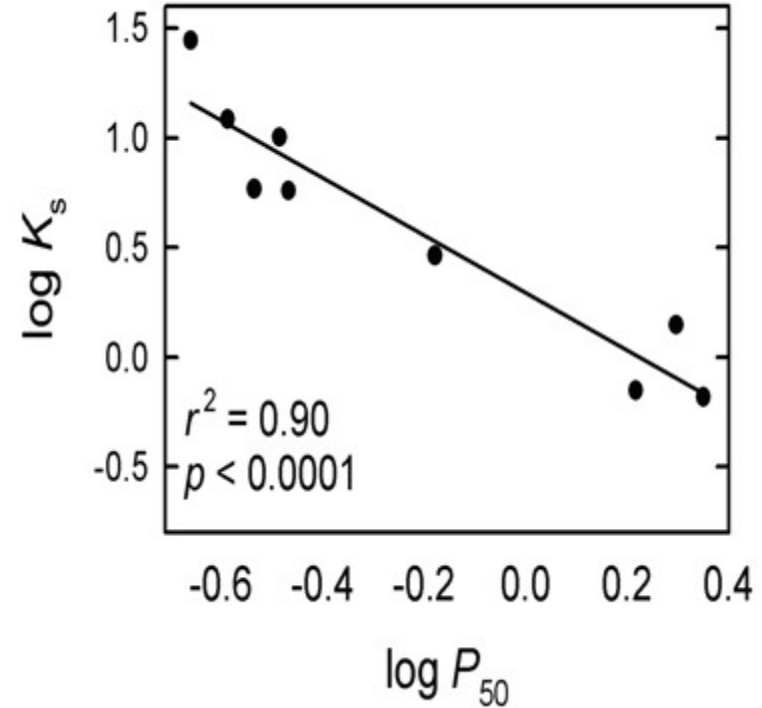
Safer xylem;
more resistant

Lianas show stronger safety-efficiency trade-off than trees

Trees



Lianas

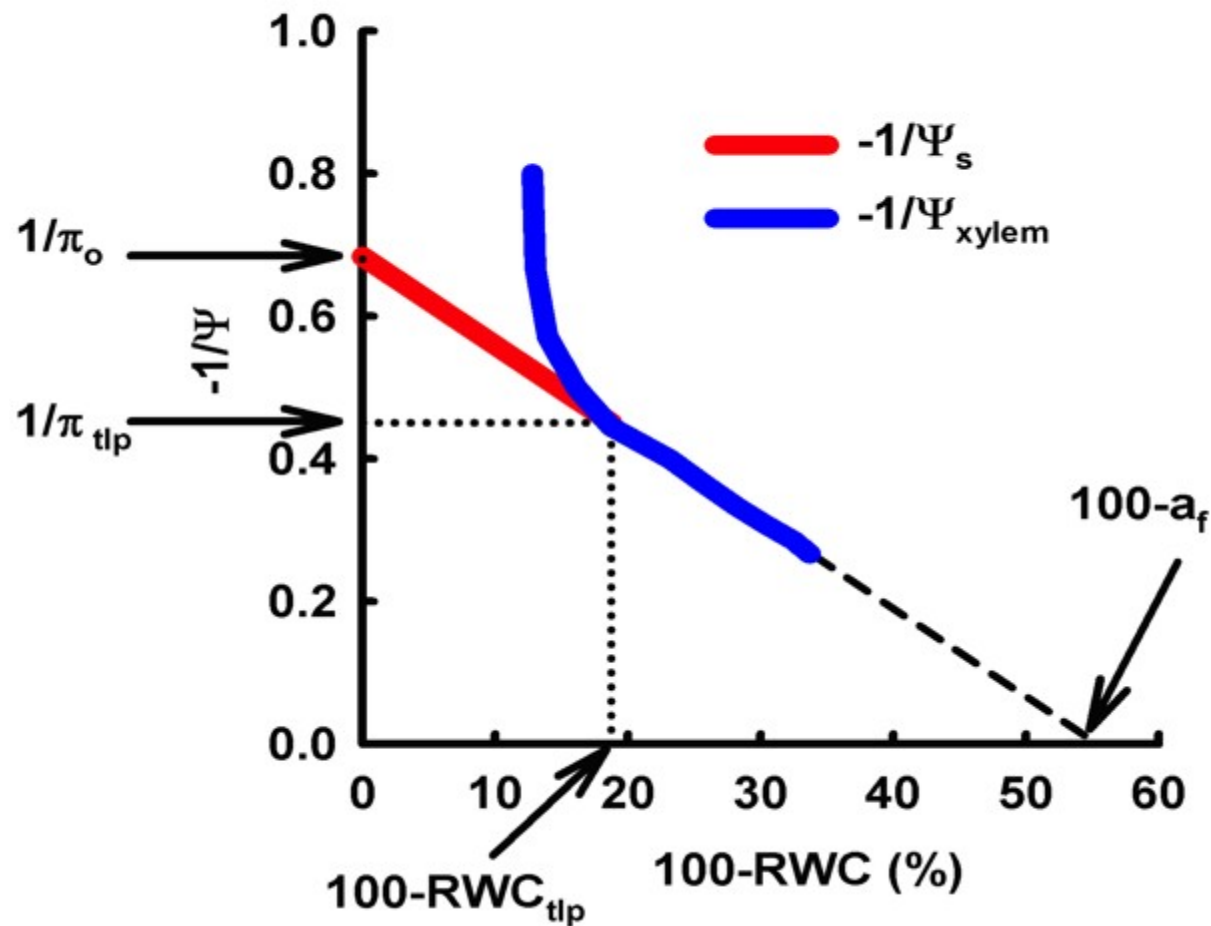


De Guzman, Santiago, Schnitzer, Álvarez-Cansino, Acosta-Rangel, Winter, Bonal, Baraloto, *et al.*
(*Tree Physiology* (2016) and unpublished data)

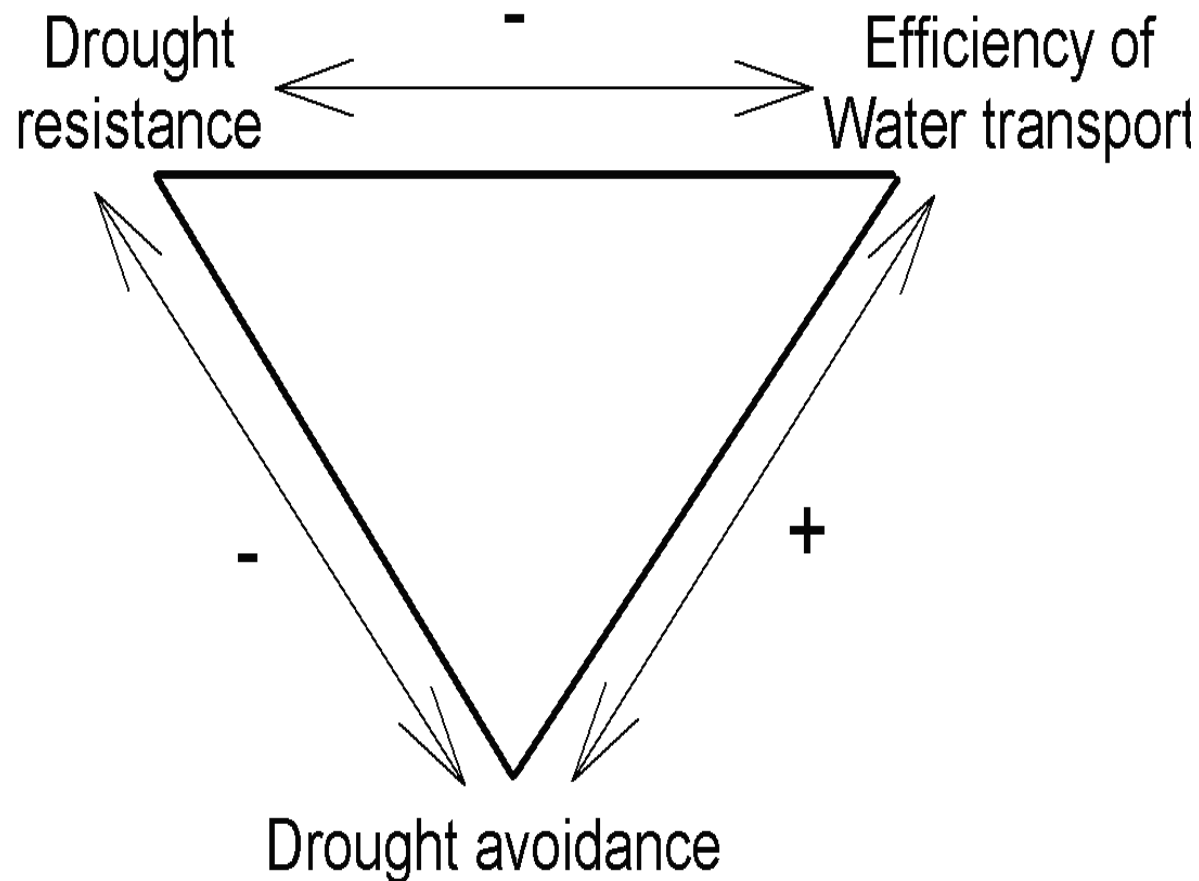
Question 3:

- Coordination with drought avoidance traits?

Stem pressure-volume curve: Drought avoidance traits

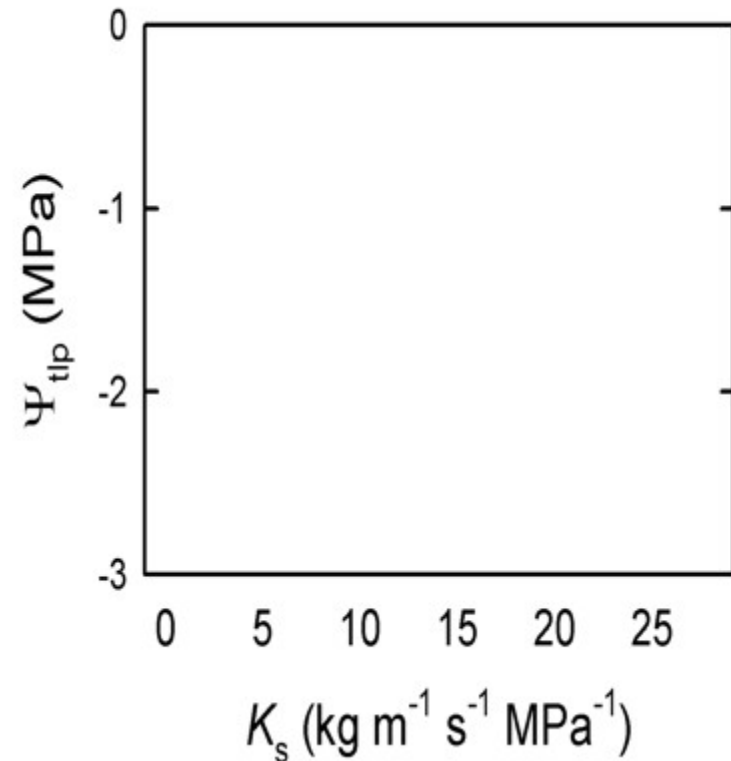
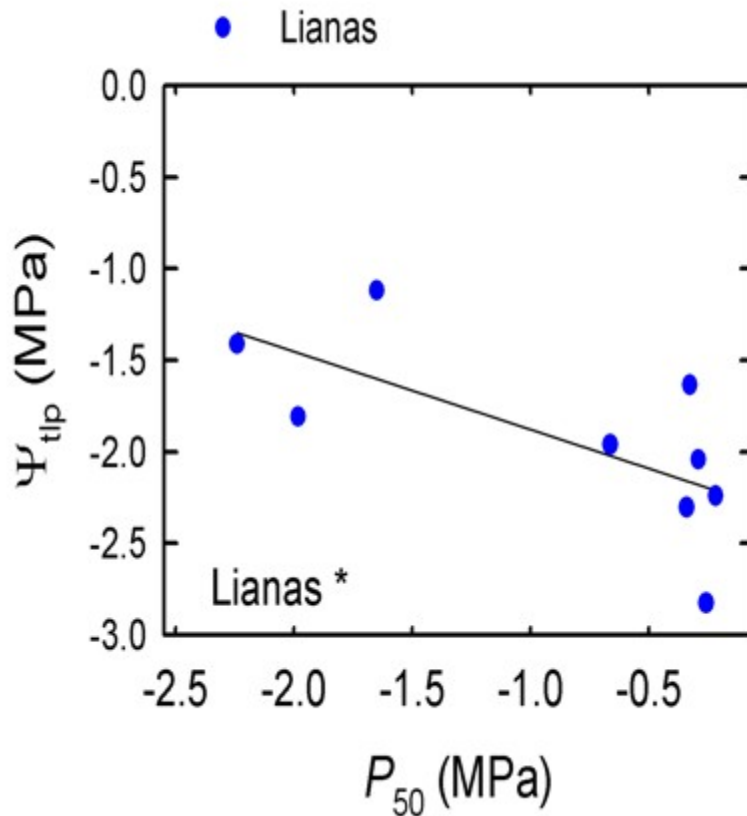


Expected linkages among hydraulic traits



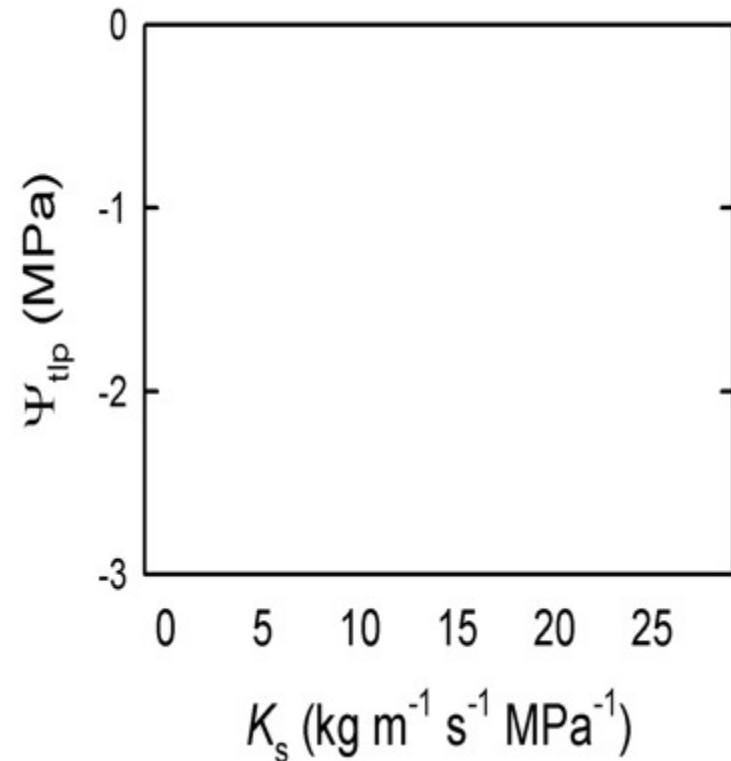
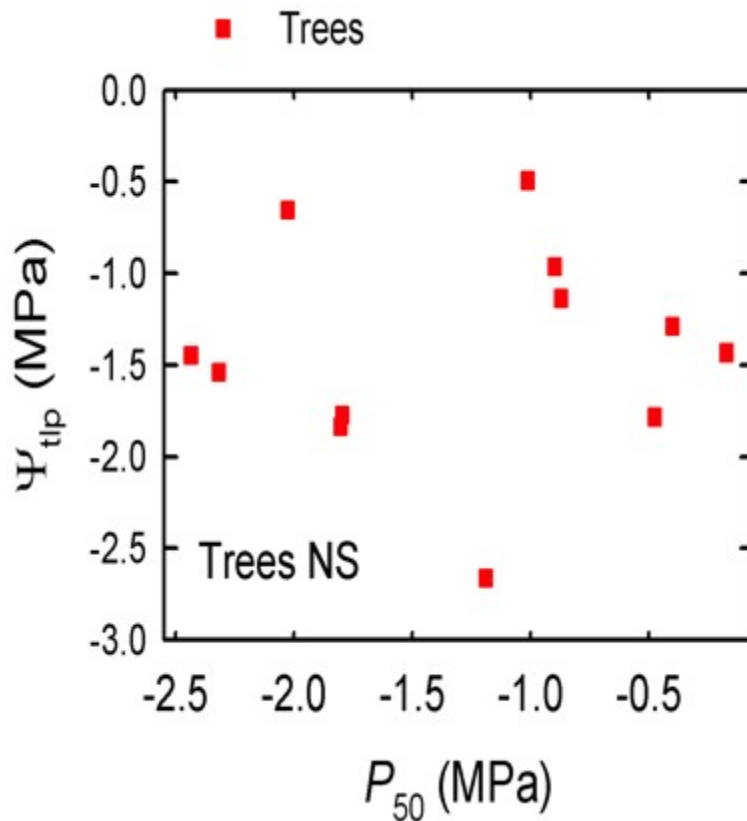
Evidence of safety-avoidance coordination in lianas – trees no

No evidence of efficiency-avoidance trade-off



De Guzman, Santiago, Acosta-Rangel, Winter, Bonal, (*unpublished data*)

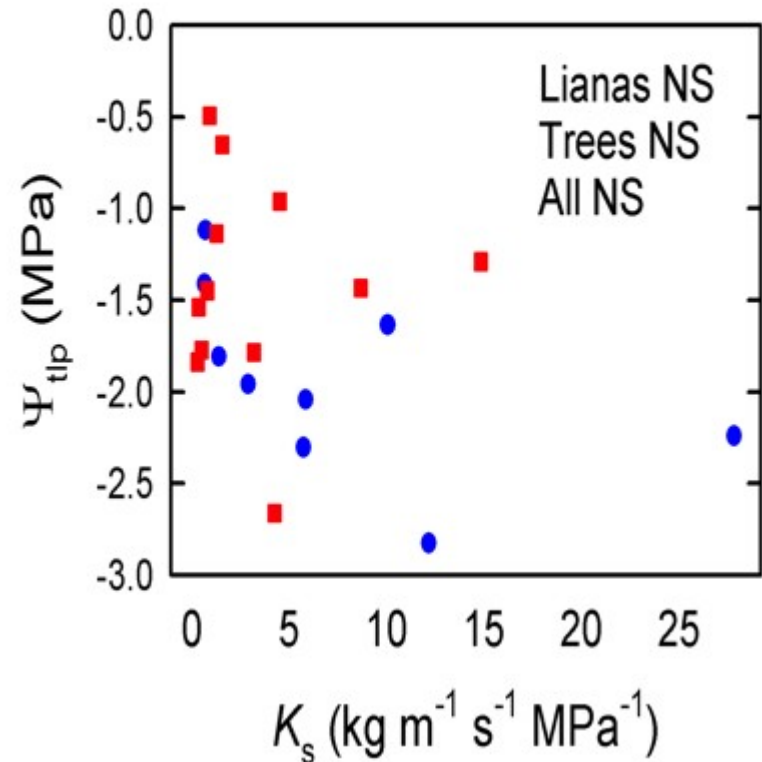
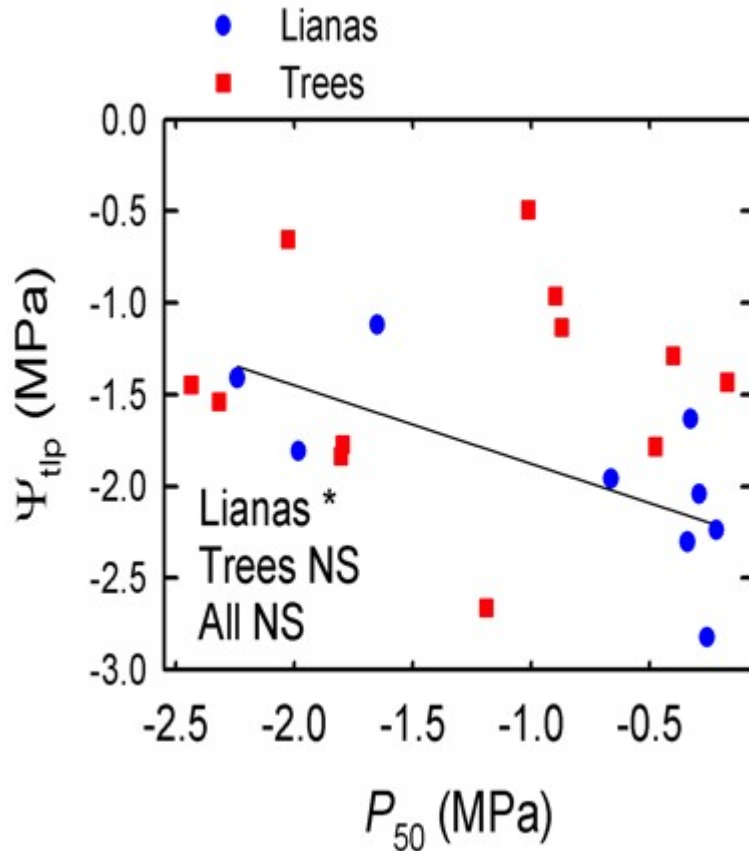
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De Guzman, Santiago, Acosta-Rangel, Winter, Bonal, (*unpublished data*)

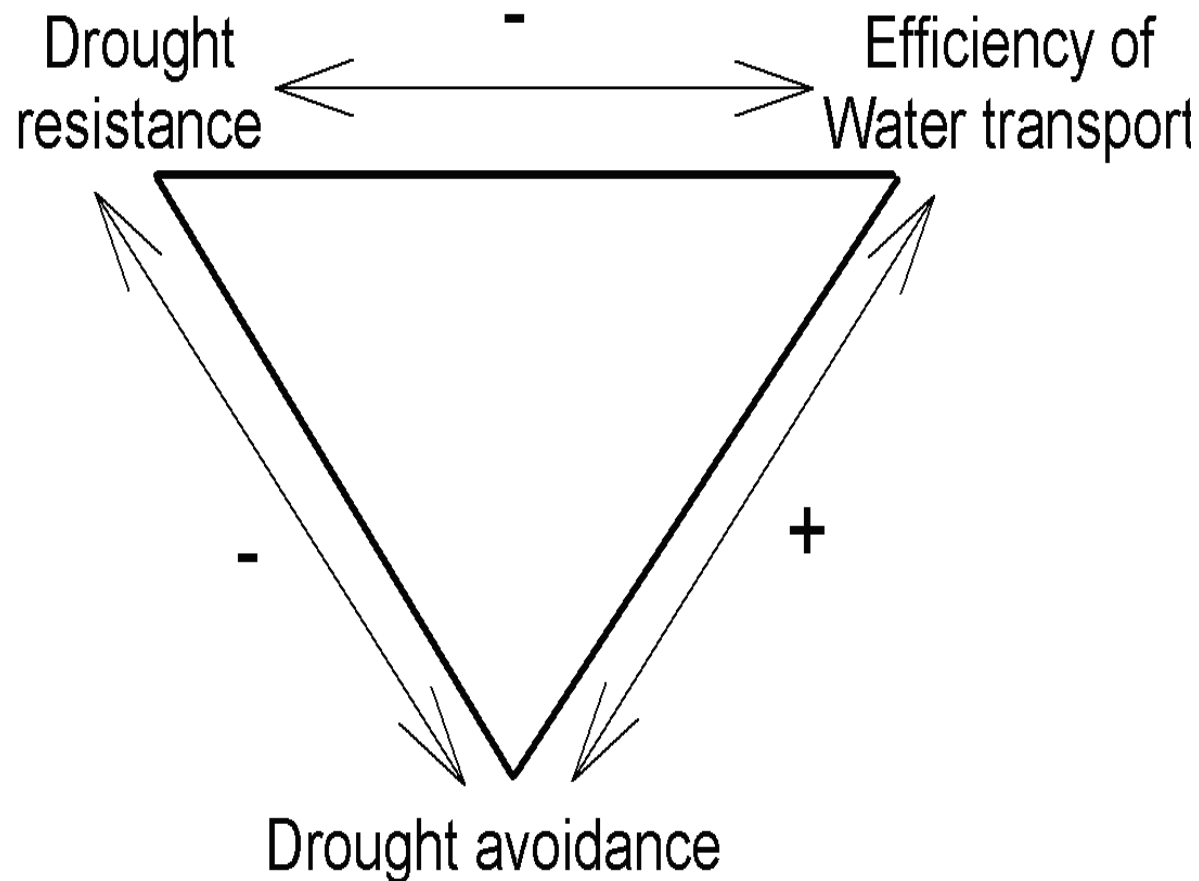
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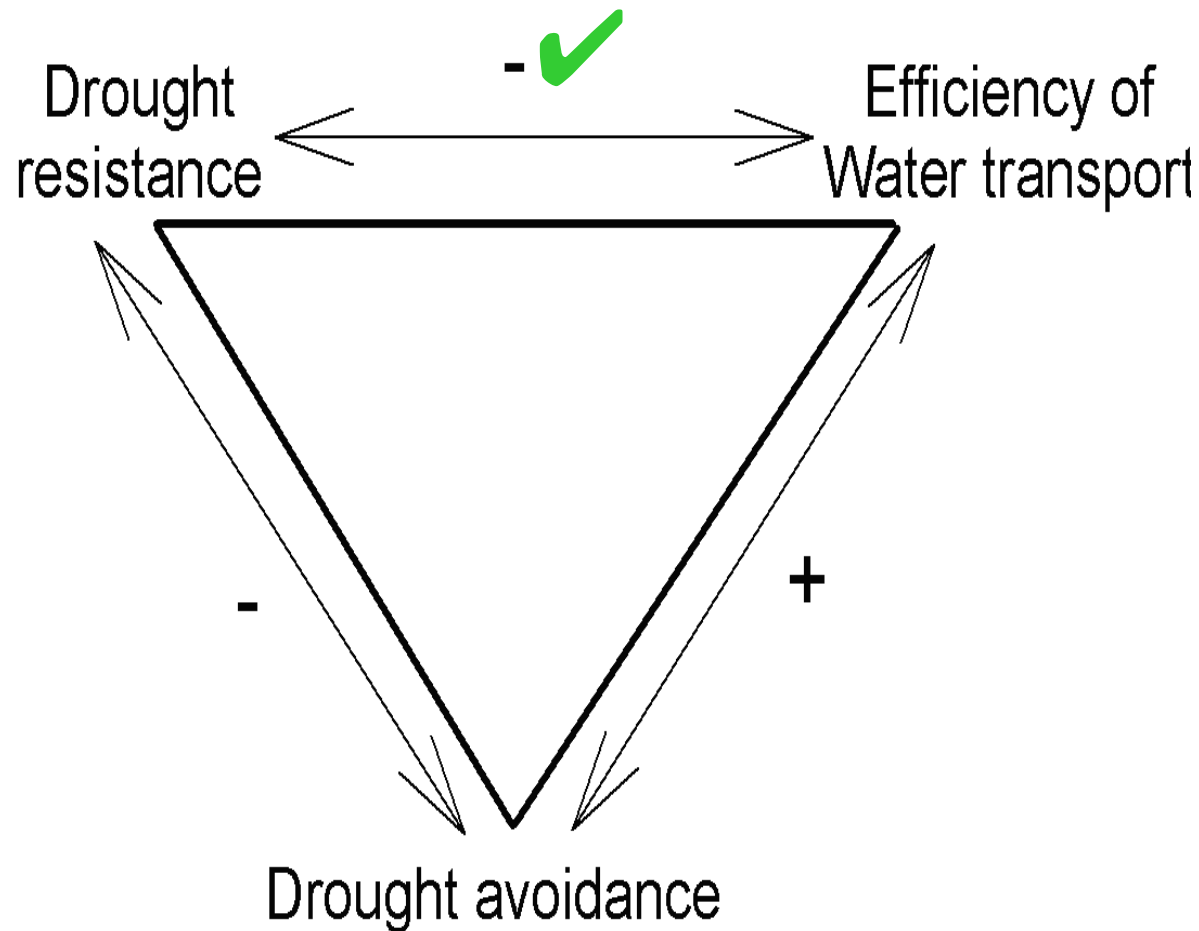


De Guzman, Santiago, Acosta-Rangel, Winter, Bonal, (*unpublished data*)

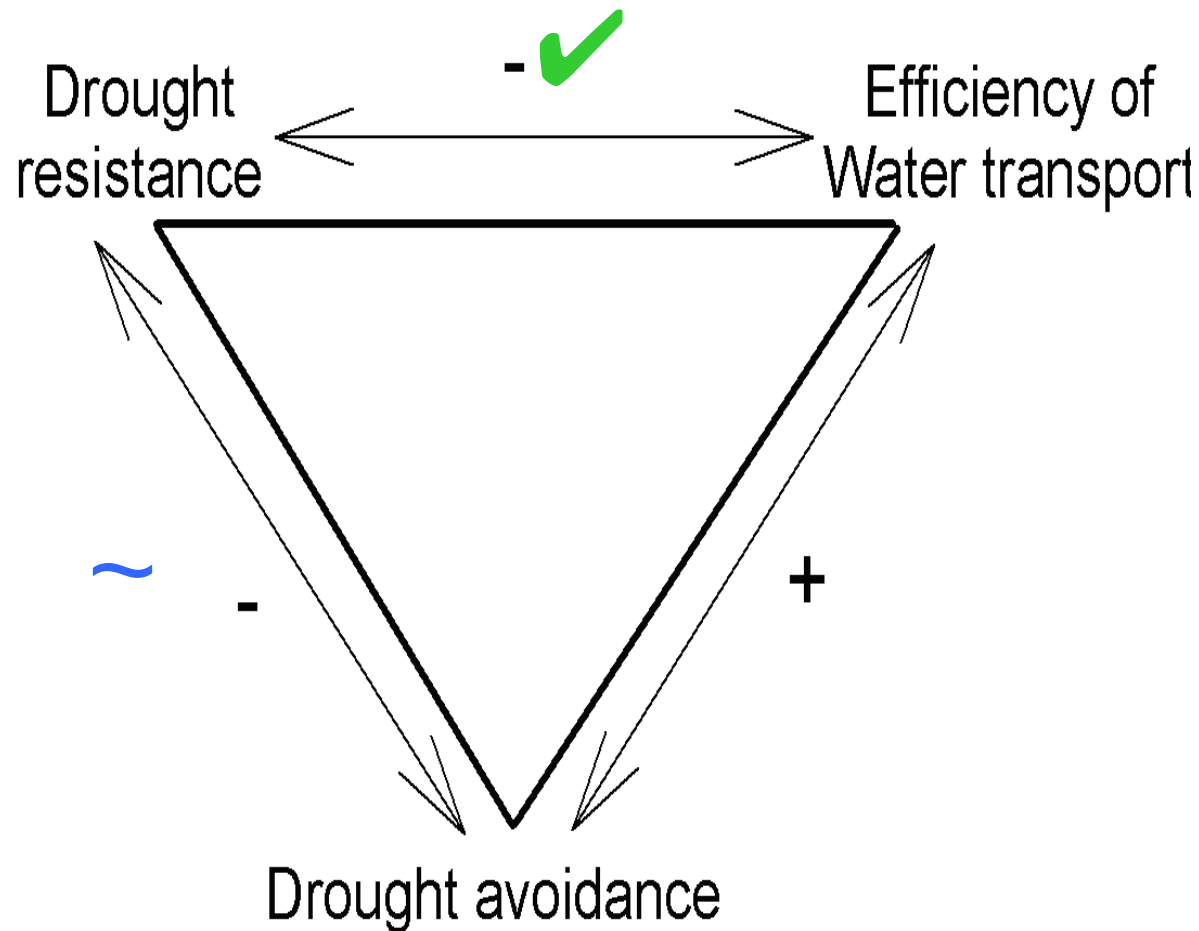
Expected linkages among hydraulic traits



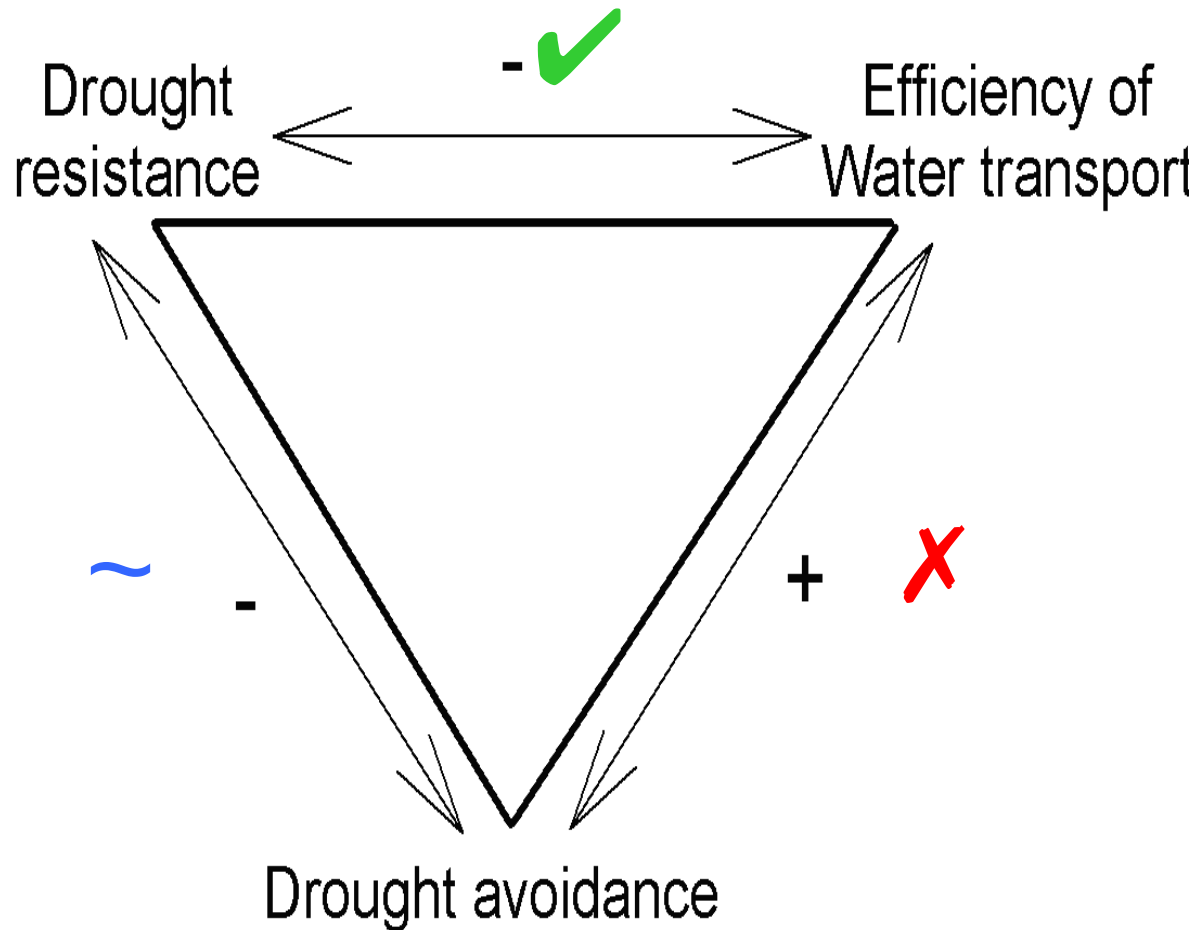
Expected linkages among hydraulic traits



Expected linkages among hydraulic traits



Expected linkages among hydraulic traits



Questions:

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Thank you!

