

BOSQUE

SECO

DRY

FOREST



Will Seasonally Dry
Tropical Forests Be
Resistant or
Vulnerable to
Changes in
Climate?

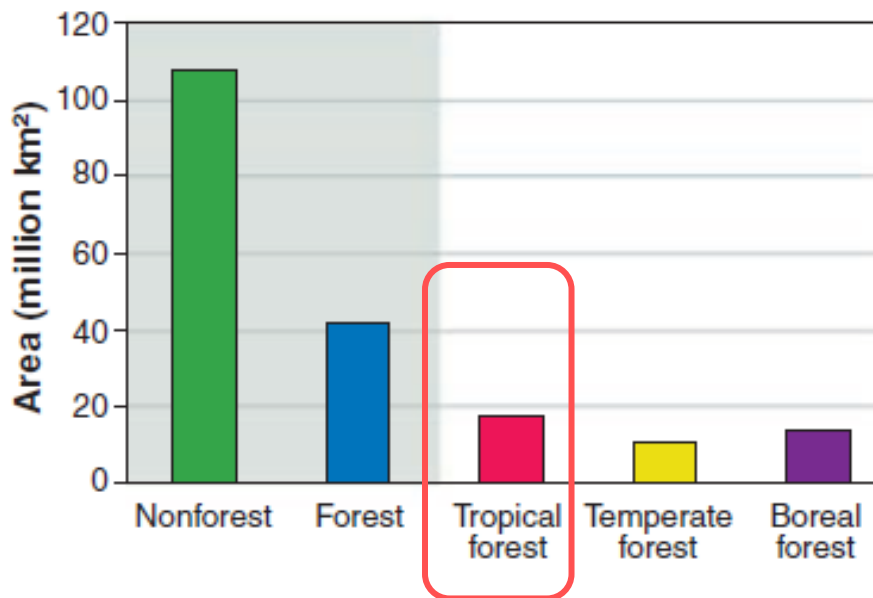
Dr. Jennifer Powers

- Tropical forests and drought
- Hydraulic traits and vulnerability
- Generalizing across dry forests
- Implications for restoration
- Interdisciplinary collaborations

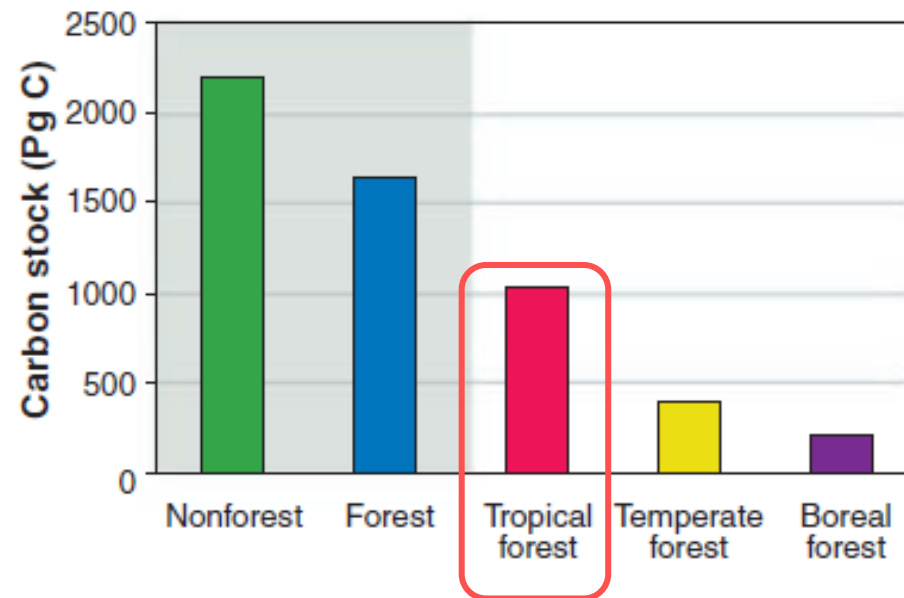
Why tropical forests?

They account for $\sim 2/3$ global forest C stock

Area

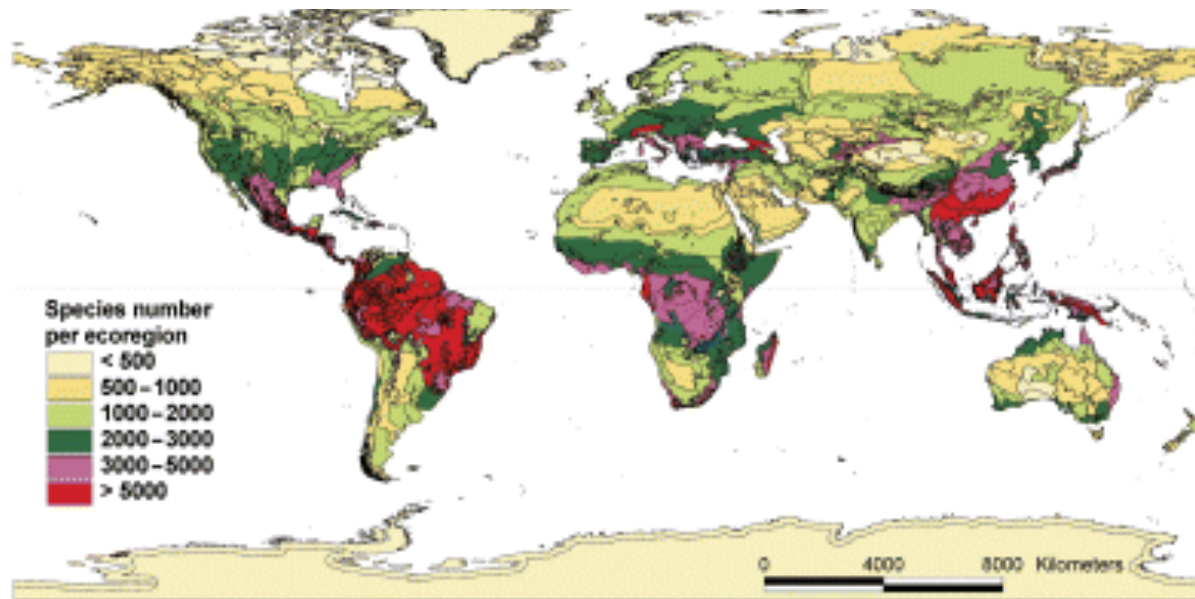


Global carbon



Why tropical forests?

It is where terrestrial biodiversity lives



*vascular
plant species
richness by
ecoregion*

Seasonally Dry Tropical Forest: Unique and critically endangered



Guanacaste, Costa Rica

DRY FORESTS & DROUGHT

Environ. Res. Lett. 12 (2017) 023001

<https://doi.org/10.1088/1748-9326/aa5968>

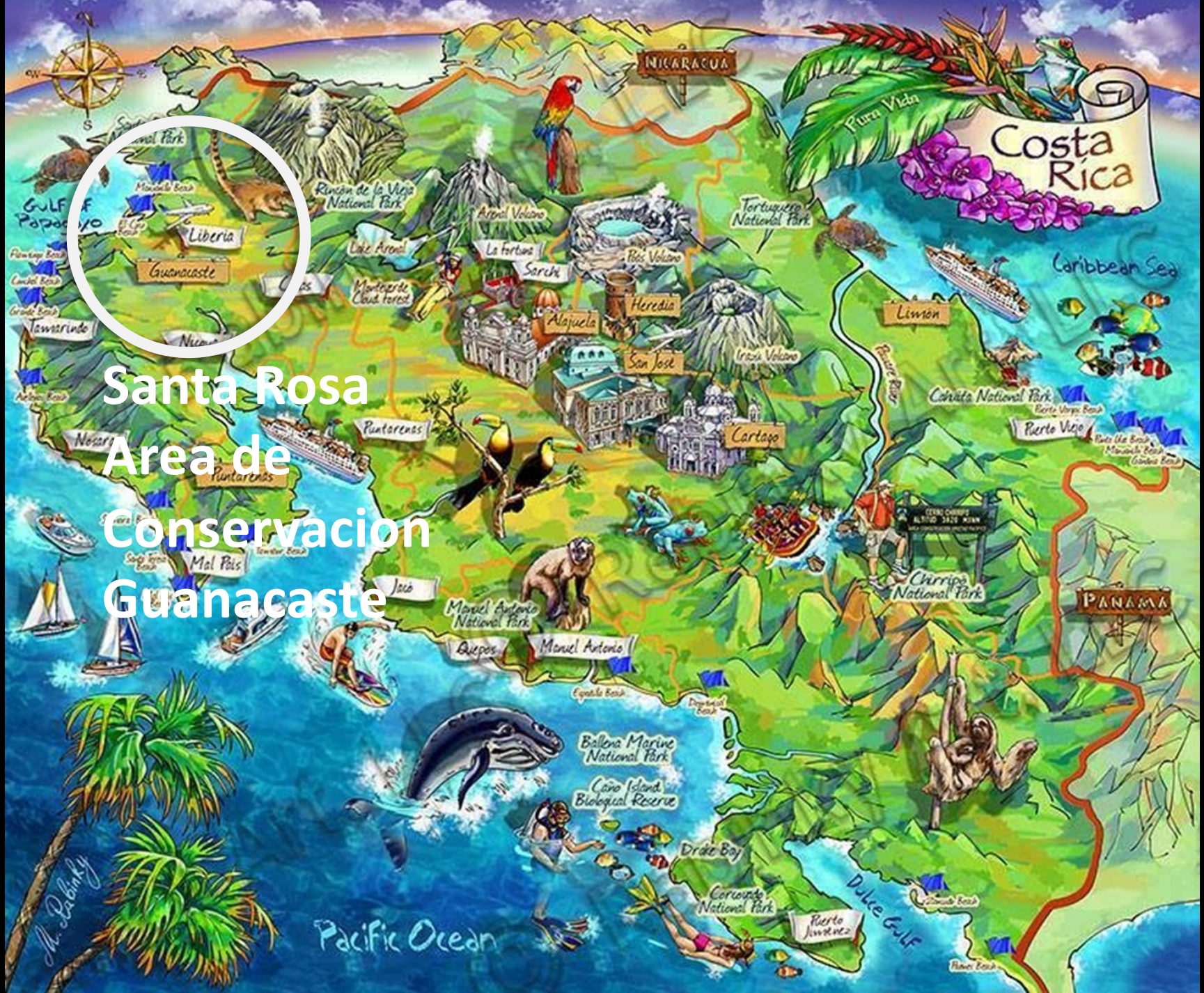
Environmental Research Letters

TOPICAL REVIEW

Will seasonally dry tropical forests be **sensitive** or **resistant** to future changes in rainfall regimes?

Kara Allen¹, Juan Manuel Dupuy², Maria G Gei¹, Catherine Hulshof³, David Medvigy^{4,5}, Camila Pizano⁶, Beatriz Salgado-Negret⁷, Christina M Smith⁸, Annette Trierweiler^{4,9}, Skip J Van Bloem¹⁰, Bonnie G Waring¹, Xiangtao Xu⁴ and Jennifer S Powers^{1,8,11}

Tree Mortality Observations



Santa Rosa
Area de
Conservacion
Guanacaste

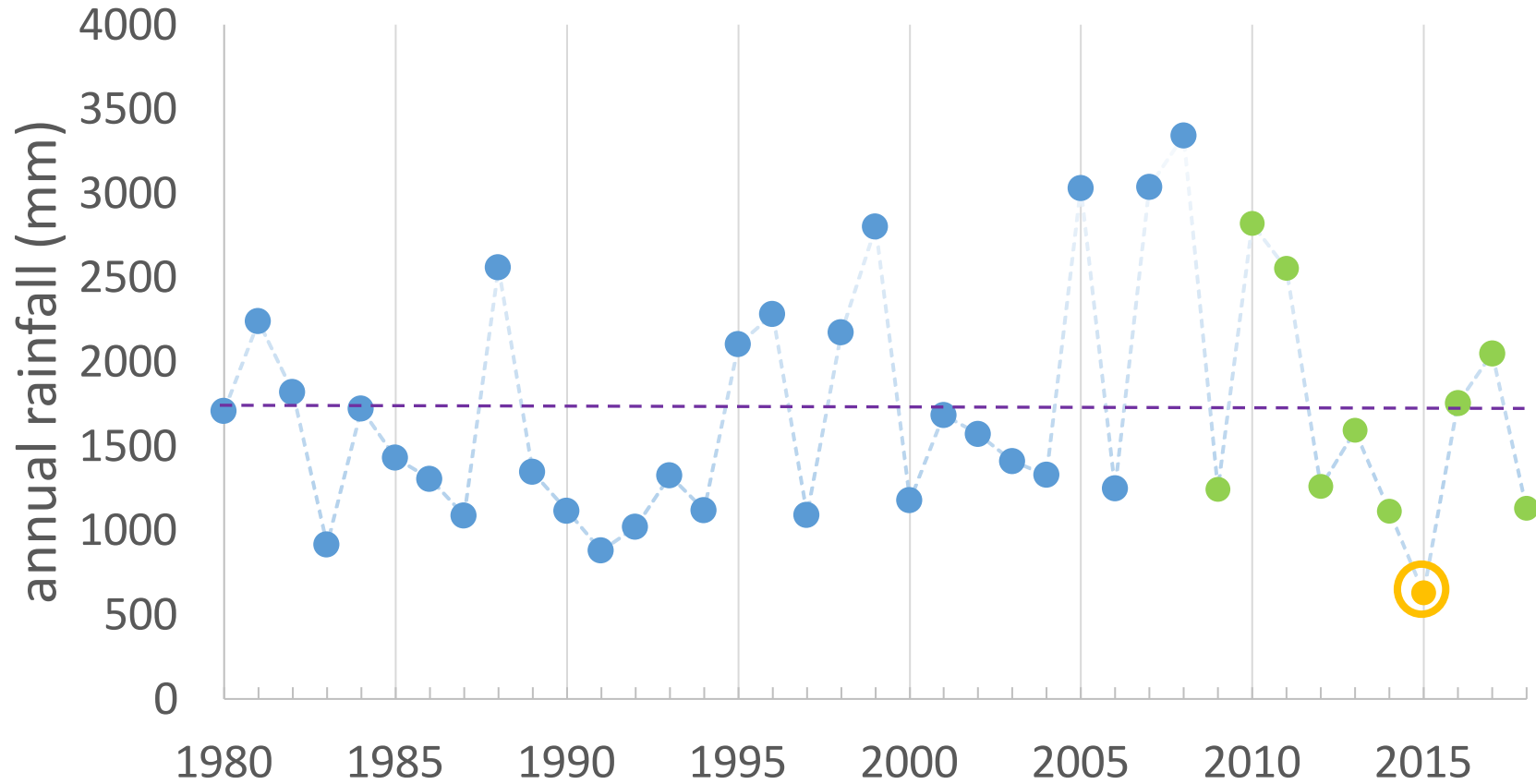
A photograph of a forest scene. The sky is a clear, bright blue. In the foreground and middle ground, there are many trees with bare, thin branches, suggesting a dormant or winter state. Some trees have green leaves, particularly on the right side and in the lower part of the frame. The overall scene is a mix of bare and leafy trees, set against a clear sky.

Is drought linked to mortality?

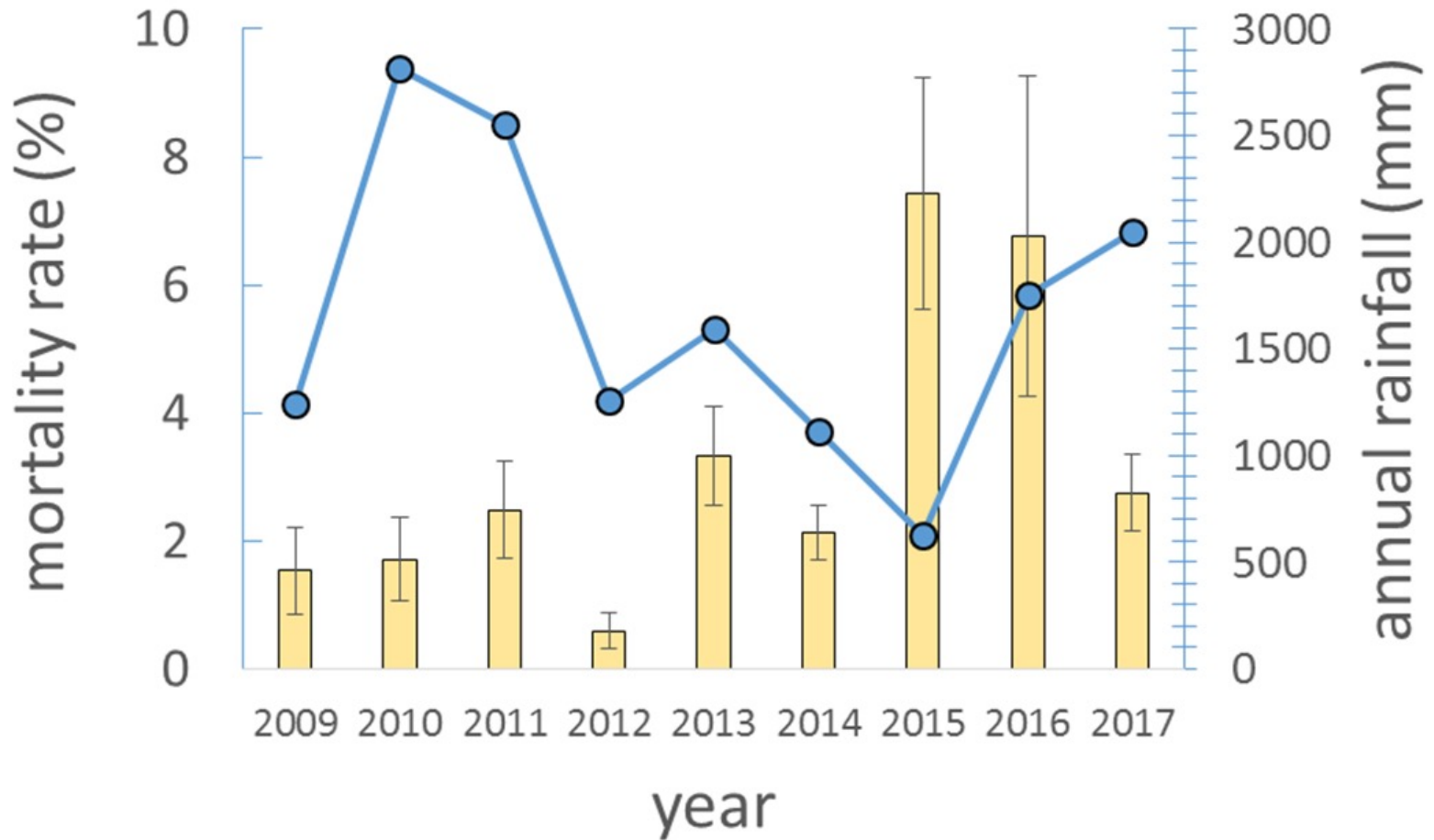
Which species are vulnerable?

Do traits help explain
vulnerability to drought?

2015 was a strong el Niño, with lowest rainfall on record



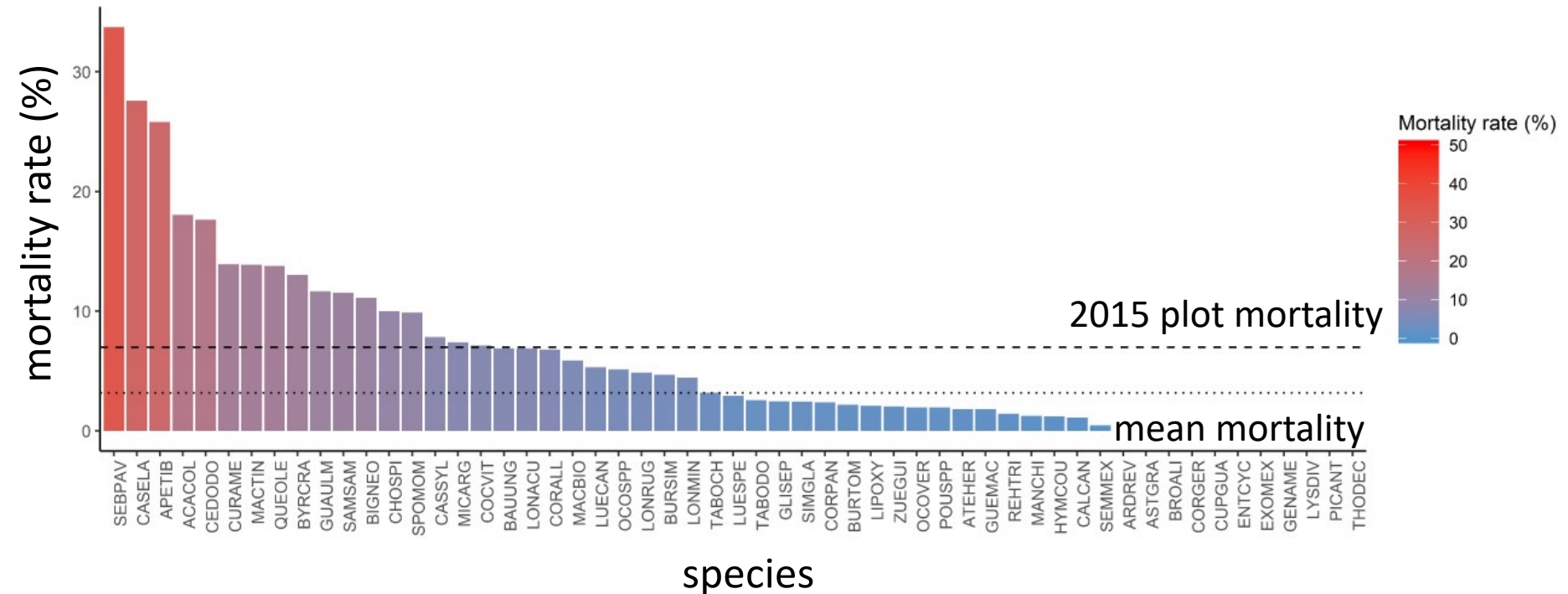
Plot-level mortality rates increased during drought



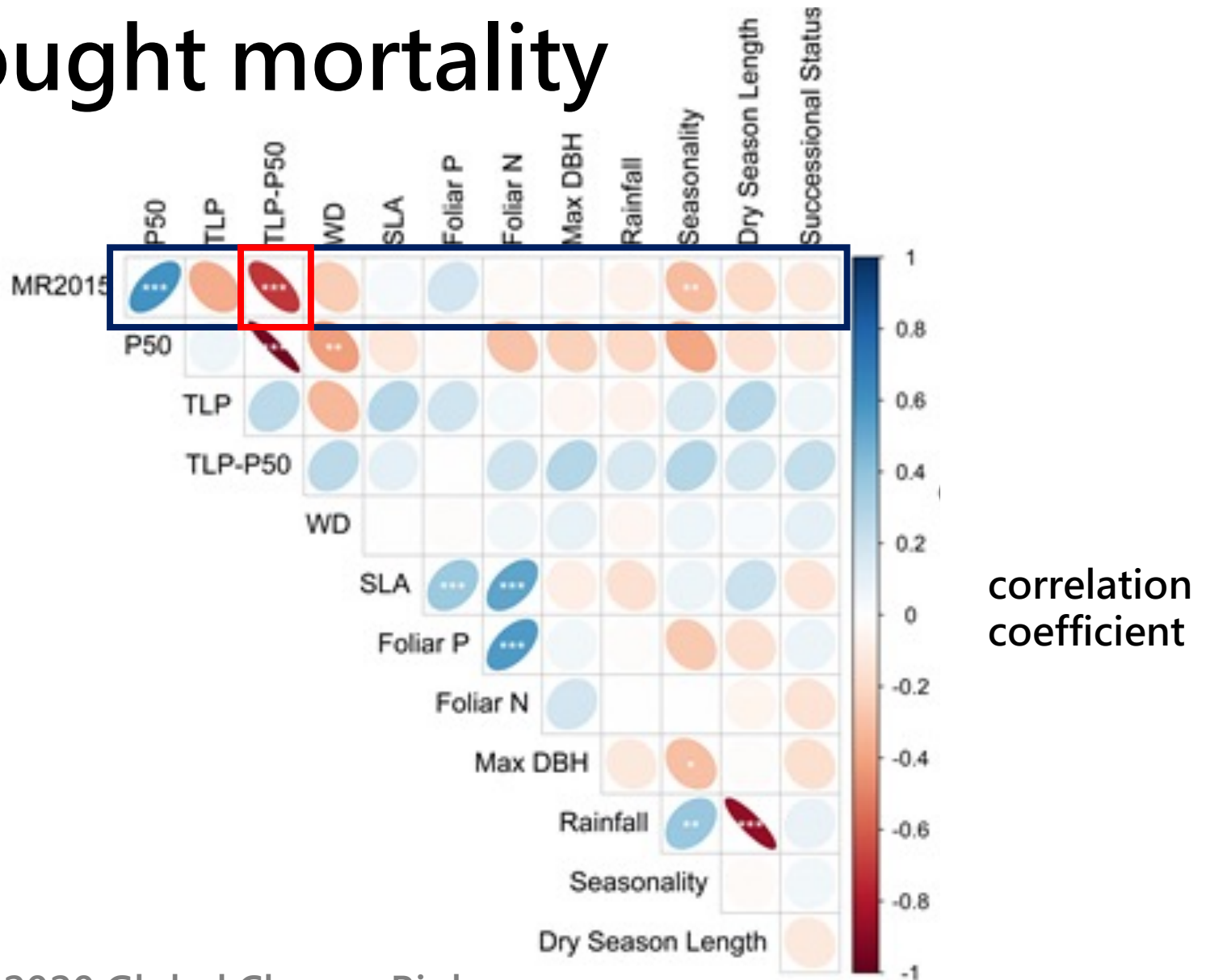
Powers et al, 2020 Global Change Biology



Species vary in susceptibility to extreme drought



Hydraulic traits correlate with drought mortality



Can we generalize to other dry forests?





Secco Tropical
Reserva Biológica

M
Reserva Biológica



Dry forests vary in rainfall regime and vulnerability to drought

COLOMBIA



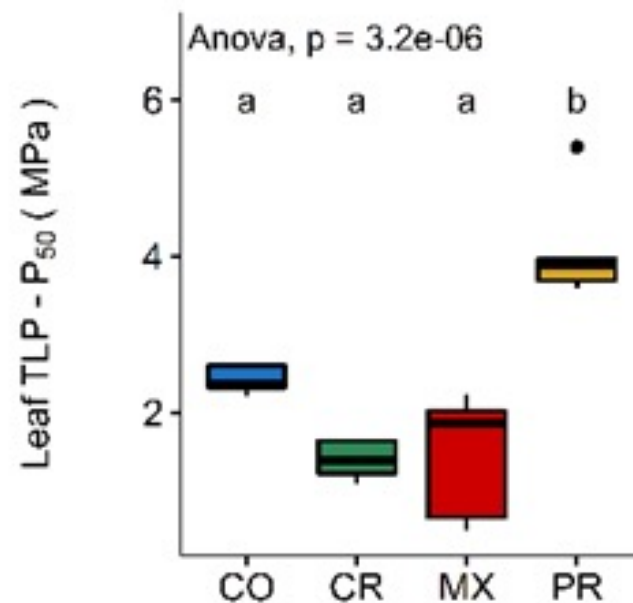
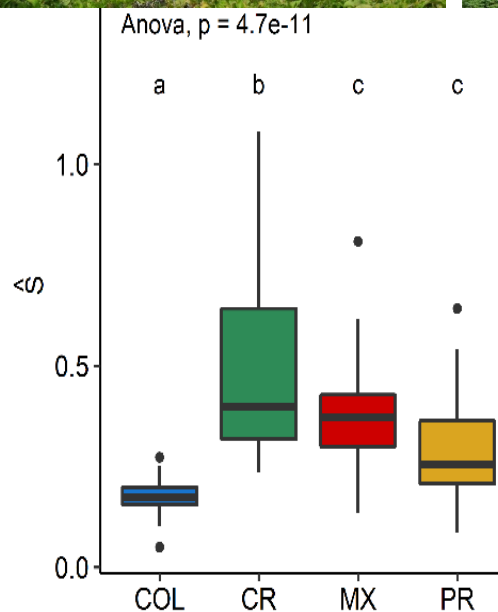
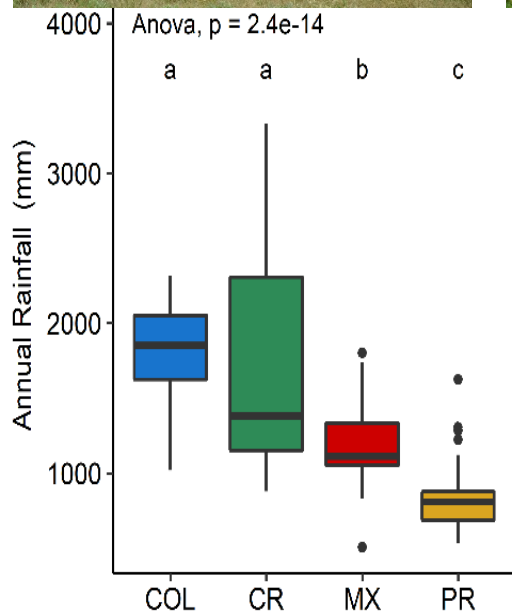
COSTA RICA



MEXICO



PUERTO RICO



annual rainfall


seasonality

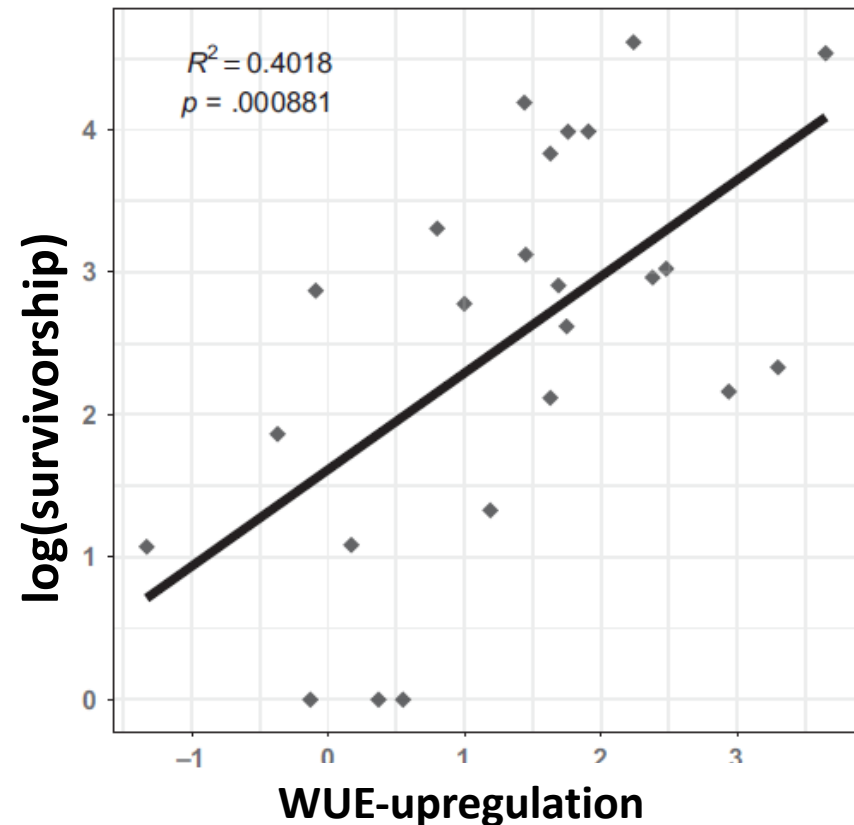
community weighted
mean hydraulic safety
margin

RESTORATION



Using soil amendments and plant functional traits to select native tropical dry forest species for the restoration of degraded Vertisols

Leland K. Werden¹  | Pedro Alvarado J.² | Sebastian Zarges³ | Erick Calderón M.⁴ | Erik M. Schilling⁴ | Milena Gutiérrez L.² | Jennifer S. Powers^{1,4}



Review

Opportunities for Integrating Social Science into Research on Dry Forest Restoration: A Mini-Review

Jennifer S. Powers

- People-centric restoration
- Cost-effectiveness analyses
- Mapping restoration potential

RESTORATION NEEDS COLLABORATION



TAKE HOME MESSAGES

- Dry forest responses to drought depend on hydraulic traits and rainfall regime
- Physiological studies can assist restoration efforts
- Restoring dry forests will depend on interdisciplinary collaborations



Muchas gracias

Collaborators: Justin Becknell, Bonnie Waring, Milena Gutierrez, Kara Allen, Juan Dupuy, Skip Van Bloem, Cathy Hulshof, Camila Pizano, Beatriz Salgado, German Vargas, Laura Toro, Leland Werden, Christina Smith-Martin, Ariadna Mondragon, Tim Brodribb, Mikey O'Brien, Xiangtao Xu, Naomi Schwartz, Julian Tijerin, Damaris Pereira, Dan Du, Silvia Secchi, Forrest Fleischman and **Daniel Perez-Aviles** and the Area de Conservacion Guanacaste