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Above ground response of rainforest functional groups to experimental drought and subsequent rewetting

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Experimental design

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Project Water, Atmosphere, and Life Dynamics in Biosphere 2 (WALD)

- At Biosphere 2: controlled tropical rainforest ecosystem

- Extended drought period of 10 weeks
- Subsequent rewetting in 2 steps:
  1) deep water pulse (from Dec 3), enriched in ^{2}H (~ 1000 ‰)
  2) rain events (Dec 8, from Dec 18 on every 2-3 days), isotopic range: natural abundance

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Experimental setup

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Measurements

- Gas leaf chambers coupled to water & carbon laser spectroscope, measured alternately for 5 minutes
- Chambers continuously flushed, supplied air continuously monitored

Studied species: canopy trees and understory species

- Canopy: *Clitoria fairchildiana* CF, *Ceiba pentandra* CP, *Hibiscus tiliaceous* HE, *Hura crepitans* HC, PA: *Pachira aquatic* PA
- Understory: *Hibiscus rosa-sinensis* HR, *Pterocarpus indicus* PI

Above ground response

Analysis

1) Transpiration *E* and net assimilaton rate *A* (von Caemmerer & Farquhar 1981), leaf water use efficiency *A/E*
2) Isotopic signature of transpiration by mass balance (Simonin et al. 2013, Dubbert et al. 2017)

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First results: above ground response

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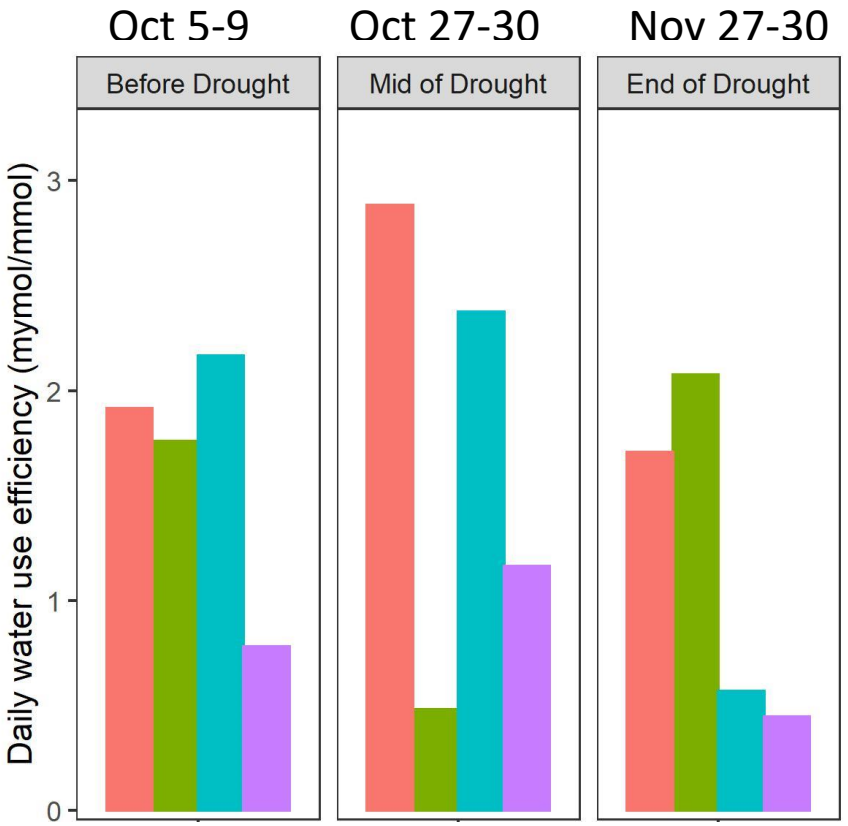
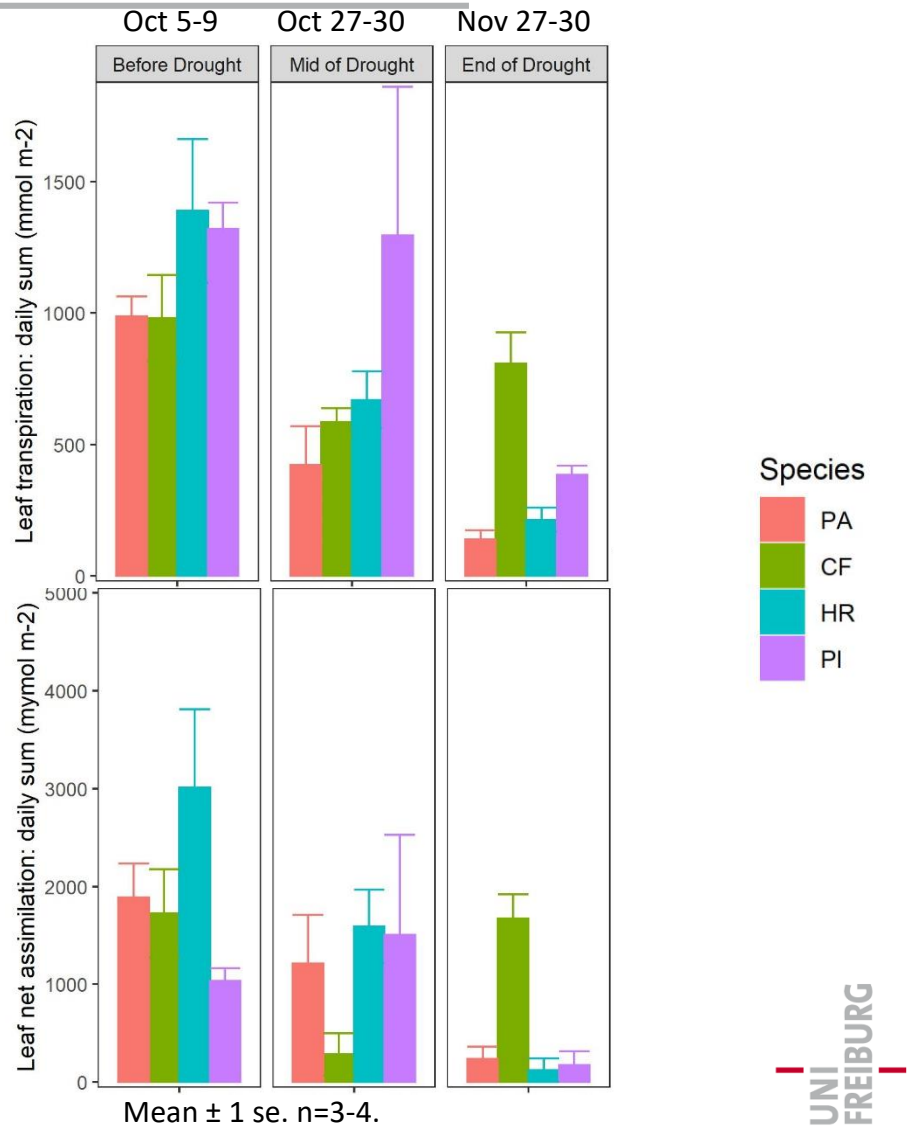
Leaf water use during drought

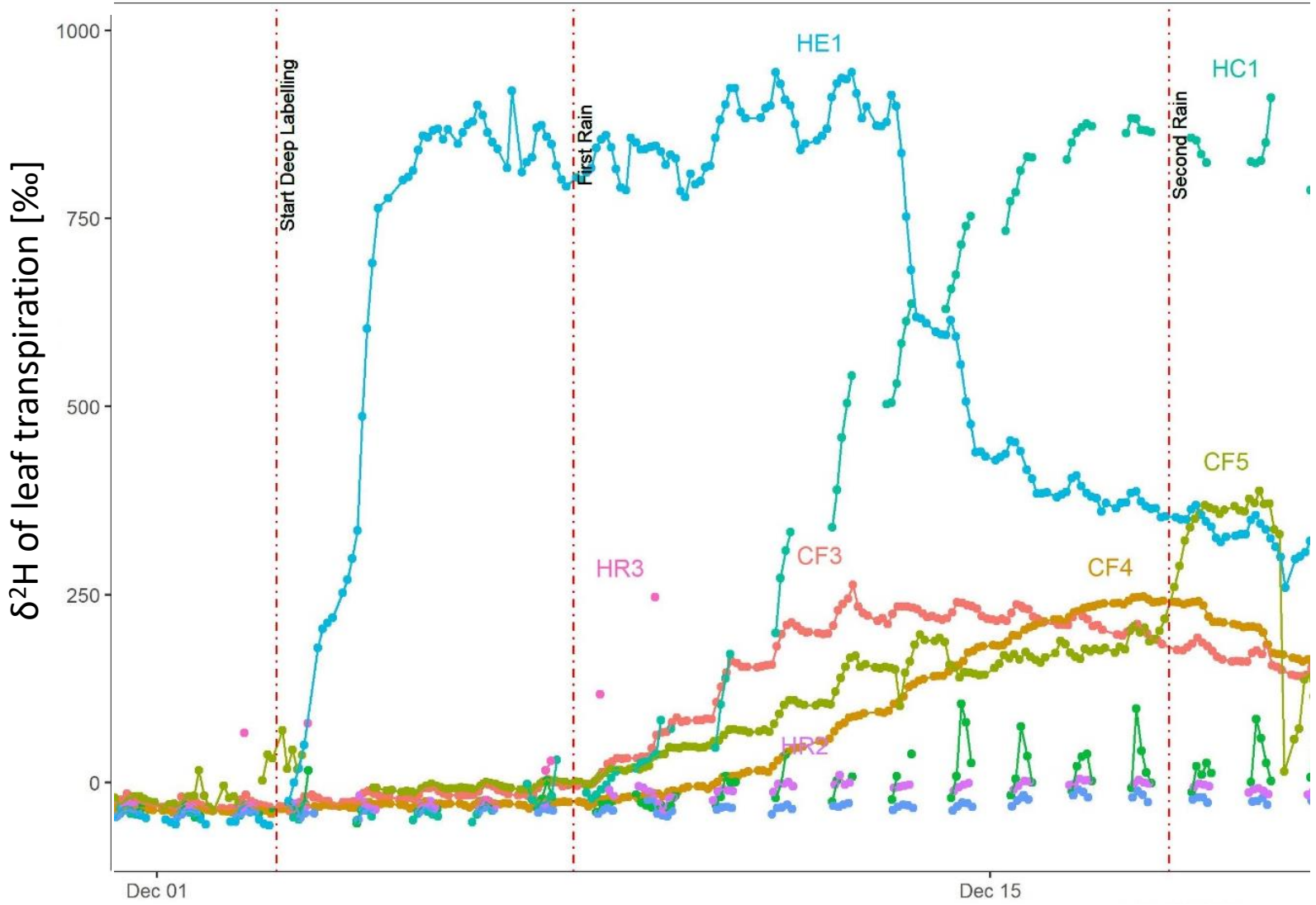


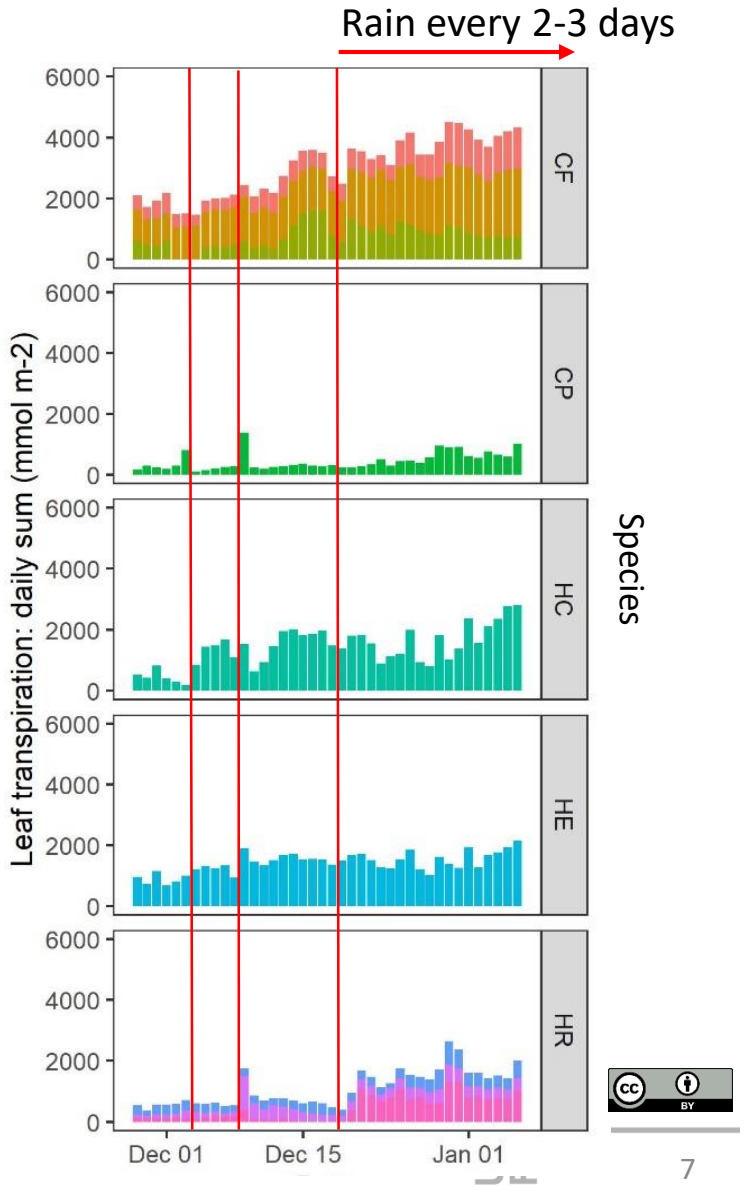
Mean A / mean E. n=3-4.



Mean ± 1 se. n=3-4.

Recovery after drought: deep water uptake





Outlook

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Species-specific water use strategies in response to drought and rewetting:

Study of above and below-ground water use before, during and after drought, i.e.:

plant physiological responses such as leaf water use efficiency, leaf water potential, root water uptake dynamics

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