



Ecophysiological and phenological strategies in seasonally-dry ecosystems: an ecohydrological approach

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Seasonally-dry climates are particularly challenging for vegetation, as they are characterized by prolonged dry periods and often marked inter-annual variability. During the dry season plants face predictable physiological stress due to lack of water, whereas the inter-annual variability in rainfall timing and amounts requires plants to develop flexible adaptation strategies. The variety of strategies observed across seasonally-dry (Mediterranean and tropical) ecosystems is indeed wide – ranging from near-isohydric species that adjust stomatal conductance to avoid drought, to anisohydric species that maintain gas exchange during the dry season. A suite of phenological strategies are hypothesized to be associated to ecophysiological strategies. Here we synthesize current knowledge on ecophysiological and phenological adaptations through a comprehensive ecohydrological model linking a soil water balance to a vegetation carbon balance. Climatic regimes are found to select for different phenological strategies that maximize the long-term plant carbon uptake. Inter-annual variability of the duration of the wet season allows coexistence of different drought-deciduous strategies. In contrast, short dry seasons or access to groundwater favour evergreen species. Climatic changes causing more intermittent rainfall and/or shorter wet seasons are predicted to favour drought-deciduous species with opportunistic water use.