

The world-wide “fast-slow” plant economics spectrum: a traits manifesto

Reich (2014). *Journal of Ecology* **102**: 275-301.

Functional traits are “morpho-physio-phenological traits traits which impact fitness indirectly via their effects on growth, reproduction, and survival, the three components of individual performance.”

Let's talk about some traits...

Organ	Abbreviation	Definition	Units
Leaf	SLA	Specific leaf area	$\text{m}^2 \text{ g}^{-1}$
	LMA	Leaf mass per area (1/SLA)	g m^{-2}
	A_{area} or A_{mass}	Photosynthetic rate on a mass or area basis	$\mu\text{mol m}^{-2} \text{ s}^{-1}$ or $\text{nmol g}^{-1} \text{ s}^{-1}$
	Ψ	Leaf water potential	MPa
Stem	k_{stem}	Stem hydraulic conductivity	$\text{mmol m}^{-1} \text{ s}^{-1} \text{ MPa}^{-1}$
	[no symbol]	Wood density	g m^{-3}
Root	SRL	Specific root length	m g^{-1}
All	R_{area} or R_{mass}	Respiration rate on a mass or area basis	$\mu\text{mol m}^{-2} \text{ s}^{-1}$ or $\text{nmol g}^{-1} \text{ s}^{-1}$
Whole-plant	RGR	Relative growth rate	$\text{g g}^{-1} \text{ day}^{-1}$

...but characteristics can also be traits

- Photosynthetic pathway (C3 or C4)
- Growth form (tree, shrub, forb, grass)
- Lifespan (annual, perennial)
- Mycorrhizal association (AM, ECM)
- Etc.

The fast-slow spectrum



The fast-slow spectrum: core ideas



The fast-slow spectrum: core ideas



1. Selection is key: being fast in one trait requires being fast in all traits (or else it would be wasteful).



The fast-slow spectrum: core ideas



2. Biophysics: these constrain speed.



The fast-slow spectrum: core ideas



3. Having fast traits is advantageous in high-resource environments: over-investment is wasteful in low resource environments.



The fast-slow spectrum: core ideas



4. Spatio-temporal variation in resources allow multiple trait combinations to exist in a given environment.



The fast-slow spectrum: core ideas



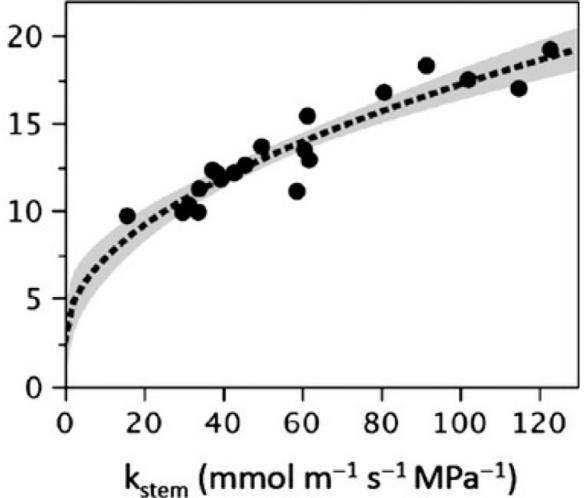
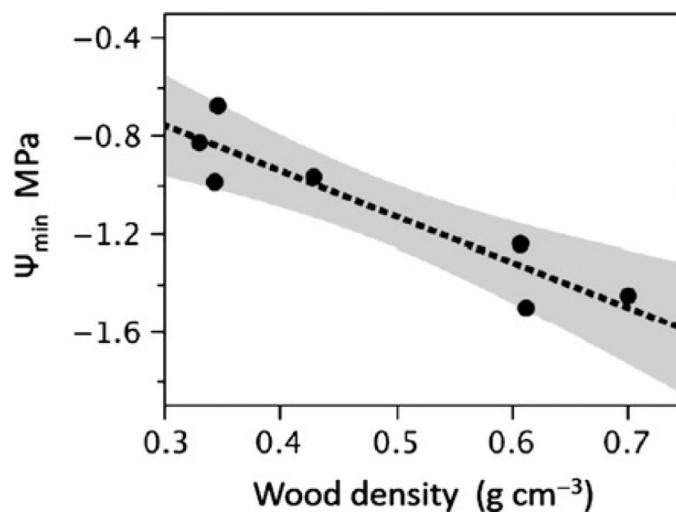
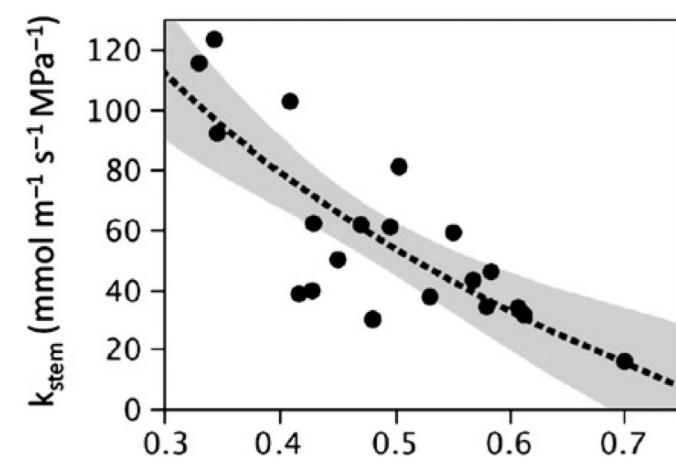
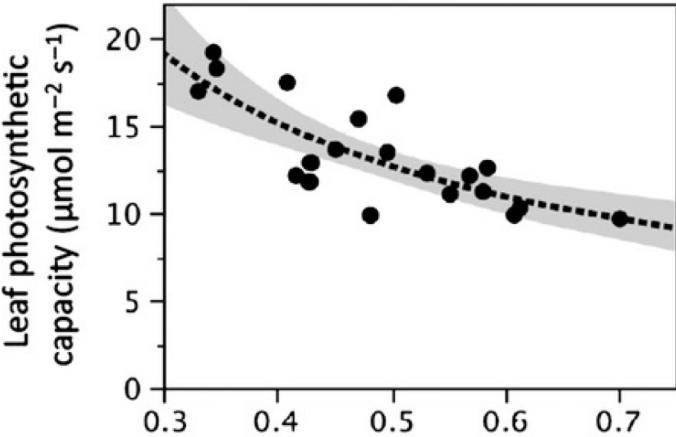
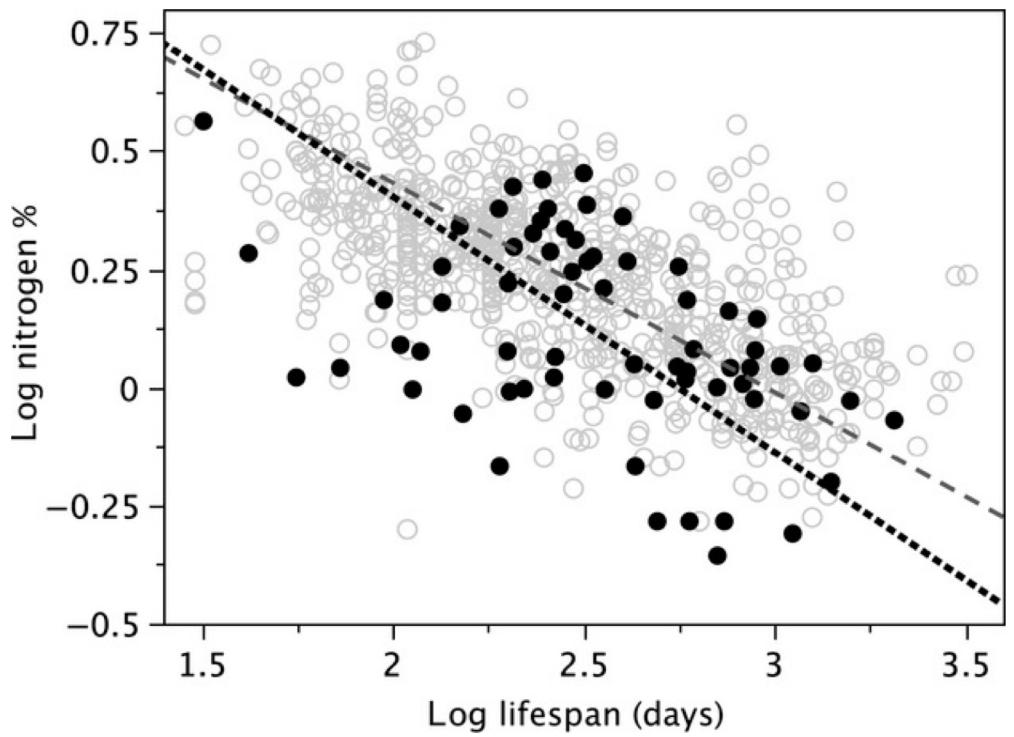
5. Mean community traits
determine the speed of
ecosystem-scale processes.



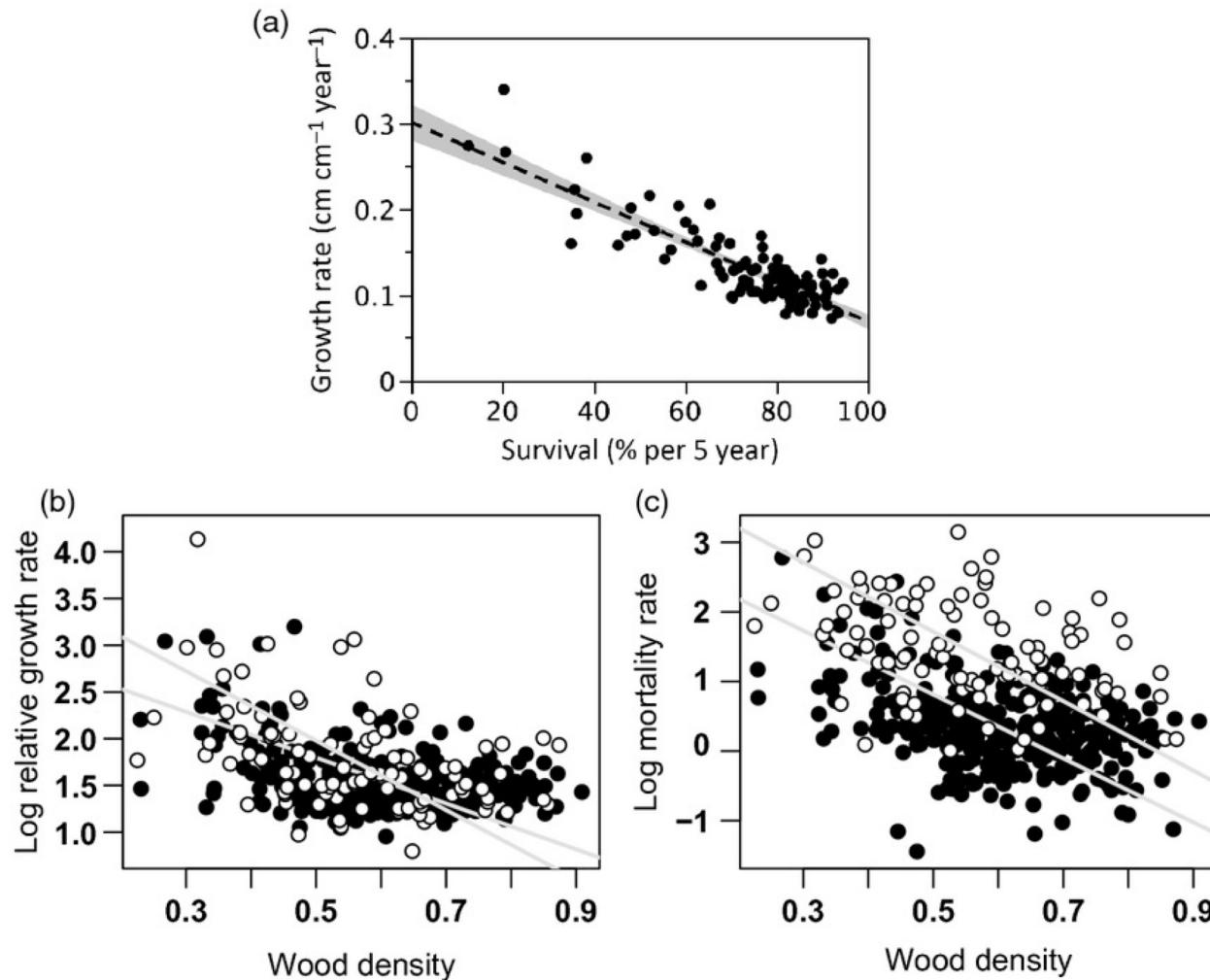
Plant economics

- Idea of costs and benefits
- Cost and benefit to each trait
 - What might these be?
 - How would they differ in fast and slow species?
 - How would they differ with environment?

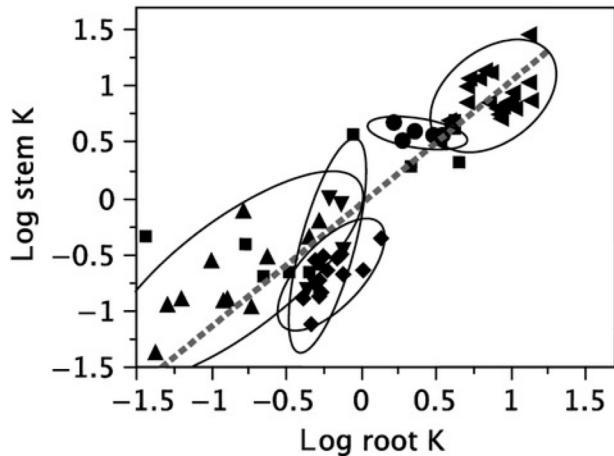
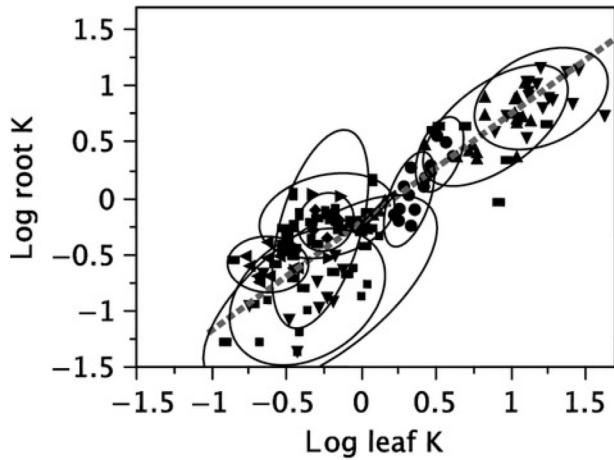
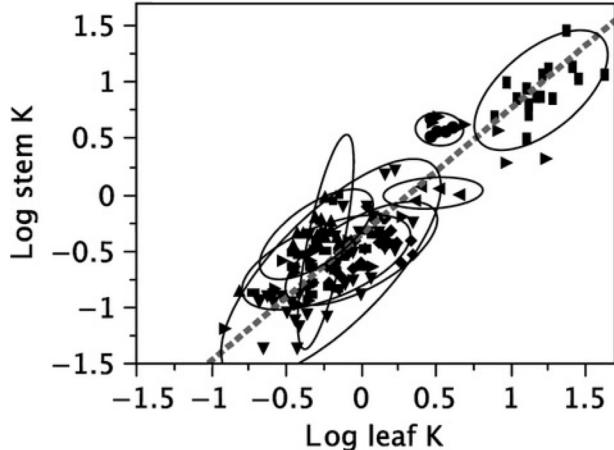
Q1: Does the spectra exist?



Q2: does the spectra predict performance measures related to growth-survival tradeoffs?



Q3: do these “syndromes” predict ecosystem-scale processes?



Do you buy it?