

# 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)	$\text{g m}^{-2}$
	$A_{\text{area}}$ or $A_{\text{mass}}$	Photosynthetic rate on a mass or area basis	$\mu\text{mol m}^{-2} \text{ s}^{-1}$ or $\text{nmol g}^{-1} \text{ s}^{-1}$
	$\Psi$	Leaf water potential	MPa
Stem	$k_{\text{stem}}$	Stem hydraulic conductivity	$\text{mmol m}^{-1} \text{ s}^{-1} \text{ MPa}^{-1}$
	[no symbol]	Wood density	$\text{g m}^{-3}$
Root	SRL	Specific root length	$\text{m g}^{-1}$
All	$R_{\text{area}}$ or $R_{\text{mass}}$	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



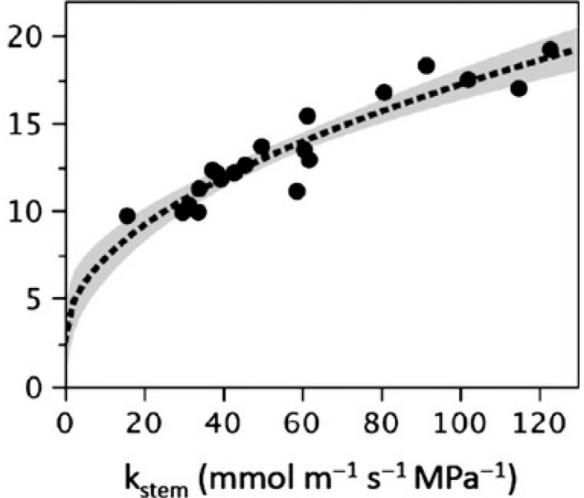
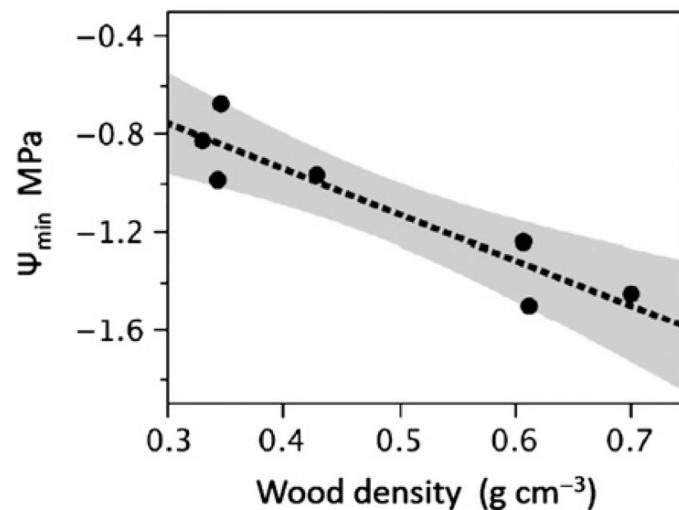
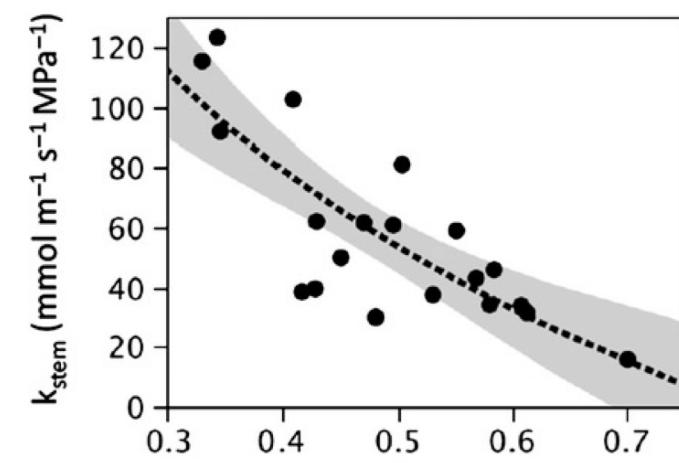
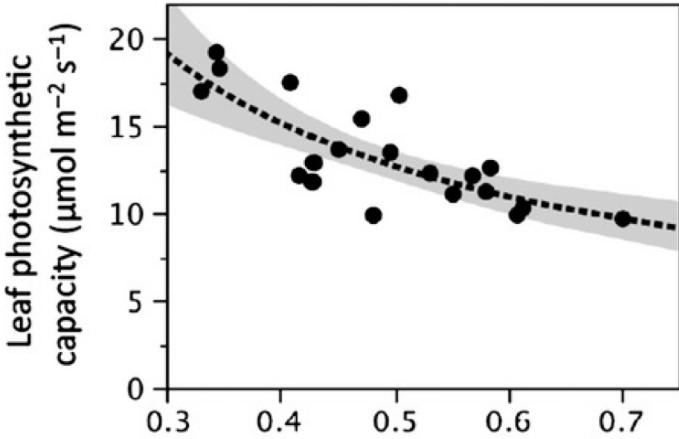
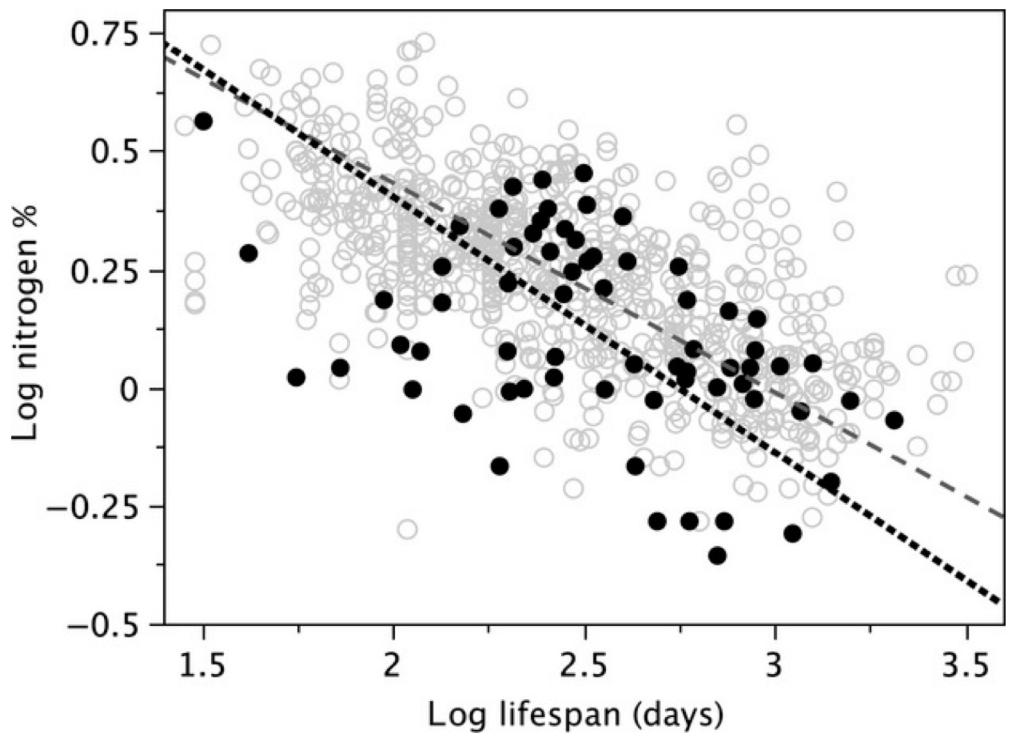
5. Mean community traits  
determine the speed of  
ecosystem-scale processes.



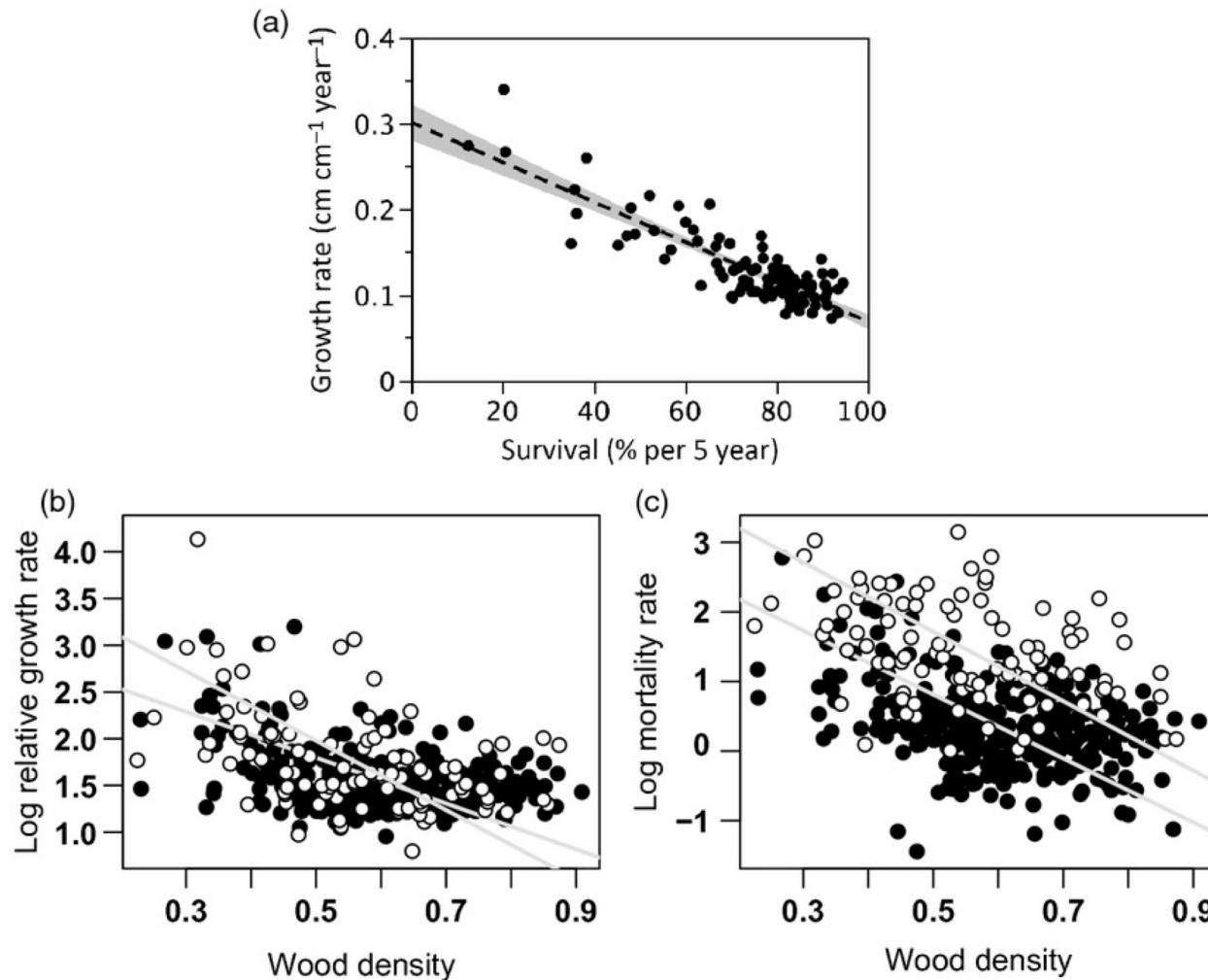
# Plant economics

- 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?

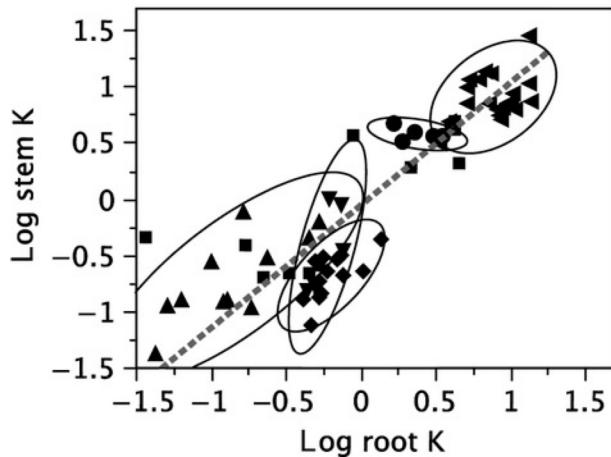
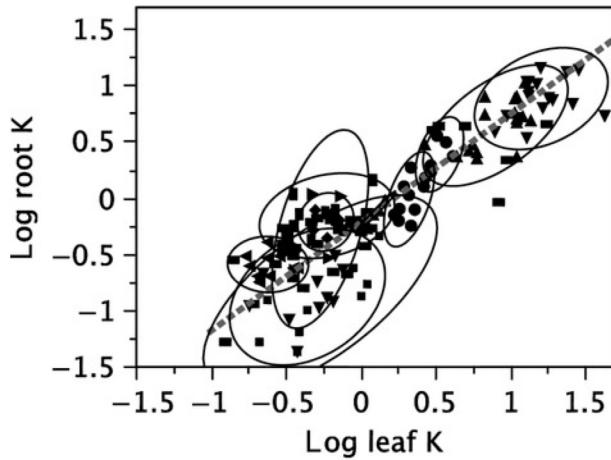
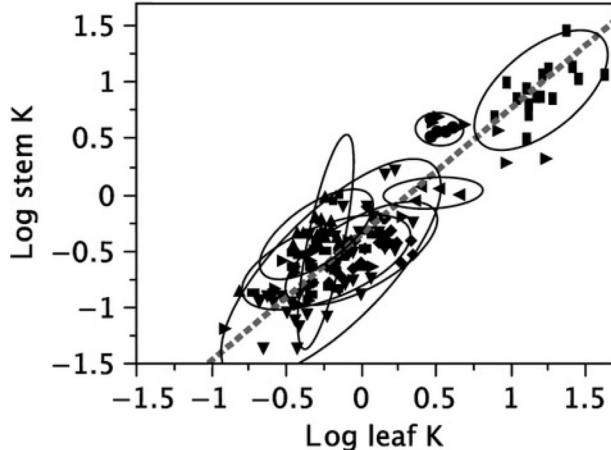
# Q1: Does the spectra exist?



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



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



Do you buy it?