Main points and suggested sequence

draft of 2017-6-28

1. Wide coverage, varying almost independently in temp and precip (Fig 1a and b)
2. On average 64% associated with photosynthesis – 36% with Calvin Cycle, 22% with light reactions (Fig 2a)
   1. this is a higher degree of dominance by top few proteins than observed in [comparison]. It obviously reflects that phot is the primary function of leaves plus that phot reactions require large amounts of particular proteins, rubisco and photosystems being the top-ranked
3. Methodology as it was tuned comfortably captured quantification, detected ~2000 individual proteins total (i.e. down to within xx% of total protein) among which top 500 ranked captured 90% of total protein mass (Fig 2c)
4. Because individual proteins can be quantified, pairwise correlations can be calculated between them, and between any given protein and a range of environment-at-site and physiological quantities (Fig 3a currently)
   1. (However, personally I’d be more inclined to let this point emerge from looking at particular substantive relationships, rather than making it in the abstract and having a figure just for it)
5. Absolute amounts of protein per leaf area adjust along physical gradients as follows (lower row of Fig 3b):
   1. Light reactions decline at higher irradiance but calvin cycle doesn’t change (in other words, at lower irradiance there is more light-capture apparatus relative to CC)
   2. All types decline toward higher temp
   3. toward lower rainfall CC increases, no change to light reactions
   4. each of these make sense for reasonably-well-understood reasons
   5. combined effects in lower row of Fig 3d
6. These adjustments are predominantly (though not exclusively) happening via changes in LMA and total protein per area – increases toward lower rainfall, decreases towards higher temp [?]. Absolute protein amounts per leaf area are all intercorrelated with each other and also with Amax and LMA and total N per area (Fig 3a lower quadrant, also Fig 3c) – in other words, variation in total protein per leaf area is the dominant influence on variation in amount of any one protein.
   1. We need to find the best way to explain and quantify this line of argument
   2. No such tidy intercorrelations among fractional amounts (Fig 3a upper quadrant)
7. Because specific components are responding, there are also relative shifts (upper row of Fig 3b)
8. We believe this study is harbinger of widespread use of one-pass protein quantification to study ecological distribution of proteins, both those with well-understood function and those where function uncertain
   1. Potentially some kind of map?
   2. Possibly might choose to point out that strongly divergent ratios of quantity of certain protein pairs probably indicates strongly-divergent activity? – or could reserve that point to make elsewhere

Total protein amounts are strongly driven by temp and to a lesser extent rainfall. Individual protein groups are all correlated positively with total protein to varying extent, implicating: 1.) a general thermodynamic requirement for greater amounts per leaf area of all major protein functional classes at lower temperatures, and 2.) a substitution of water use efficiency for N-use efficiency at low rainfall.s

Per leaf area trends in CC’s are essentially identical to environmental trends in leaf protein abundance (cor = 0.97). No strong effect of environment on proportional allocation of CC’s (although some response to irradiance). Some evidence that carboxylation capacity per leaf area is increased by increasing LMA, although there is substantial variation in the total protein – LMA relationship, indicating that LMA is responding to other requirements than photosynthetic capacity (see last para).

Patterns in per leaf area PS are also similar to patterns in total protein, although more variability is apparent in protein allocation to light harvesting capacity (cor = 0.82). Strong reduction in proportional allocation of protein to photosystems with increasing irradiance, and decreasing precip. Photosystem abundance does not increase on a per leaf area basis as leaves become thicker/denser, and reduces as a proportion of total leaf protein.

The role of LMA vs protein concentration (i.e. as a fraction of leaf dry mass) in determining per leaf area protein abundance depends interactively on MAP and MAT. Low per leaf area protein abundance at warm, wet sites is more closely associated with low LMA than low protein concentration, while high per leaf area protein abundance at cool, dry sites is strongly associated with high protein concentration. (This isn’t anything that couldn’t have been done using LMA, leaf N% and leaf N\_area, but the point to make is that it’s not all just about increasing carboxylation capacity by adding layers of mesophyll).