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12.6?Concluding remarks

Sunlight is free to humankind, and is certainly an all-pervasive source of energy for our continuing existence. However, optimum utilisation does not come free to either plants or humans.

Vascular plants have evolved over millennia with features that now enable utilisation of light climates that differ by orders of magnitude in photon irradiance. Their adaptation to sun and shade is a marvel of nature's biological engineering, with a wide range of adaptive features at all levels of organisation from chloroplast to community. These features are a continuing source of wonder to ecophysiologists. Moreover, the nature of selection pressures imposed by sunlight has also changed. The blistering UV radiation of a prebiotic world has been attenuated thanks to oxygenic photosynthesis, and vascular plants still carry adaptive features that may again ?nd strong expression if global change does result in a substantially greater UV-B irradiance.

The central signi?cance of sunlight as an energy source for natural and managed ecosystems is unarguable, and quantitative relationships between forest productivity and sunlight interception provide just one example that underscores human reliance on intrinsic properties of photo-energetics. More subtle, and especially costly in terms of gaining necessary research experience, is plant response to light quality.

Optimising interception of sunlight by managed communities of plants in horticulture calls for application of solid geometry, and some highly sophisticated canopy systems have been developed. However, a knowledge of growth and developmental response to changes in spectral composition of sunlight transmitted by plant canopies provides crucial insight into reproductive physiology. Concord grapevines were cited as an example of a species with features that make them especially amenable to canopy manipulation. Having evolved in North America as forest vines, vegetative extension rather than reproductive development would have conferred a selective advantage for reaching exposed crowns in forested habitats. Accordingly, the far-red-enriched sunlight trans-mitted by their own canopy in a managed vineyard encourages shoot extension, rather than differentiation of flower buds and subsequent cropping. That predisposition to vegetative vigour was successfully countered by shrewd management of vine canopies via pruning, trellising and shoot positioning.

Overall, sunlight is pervasive by driving genotype × environment interactions for both evolution of adaptive features and day to day physiology of vascular plants. Our growing appreciation of photobiology in managed communities, and of nature's adaptations in natural communities, has already paid huge dividends in understanding plant function. What is even more compelling is that such knowledge will shape our future options for plant utilisation.