Supplementary Information

In order to determine if there is a general relationship between overall photosynthetic capacity and the magnitude of within-canopy gradients we surveyed the literature to determine values of the capacity of ribulose-1,5-bisphopshate-carloxylase/oxygenase (Rubisco) for upper canopy leaves, $V_{max(0)}$, and an extinction coefficient describing the exponential decline with depth in the canopy (expressed as the cumulative leaf area index, L, from the top down) with the Rubisco extinction coefficient being denoted k_V. For some studies, e.g. Carswell et al. (2000), these parameters were directly estimable, but in many cases some assumptions had to be made; for example to deduce either the Rubisco activity from measurement of the light saturated photosynthetic rate - this requiring an estimate of the intercellular partial pressure of CO_2 (c_i) or to estimate L from the given light profile. For the former case, we also used the standard equations of Rubisco limited photosynthesis (Farquhar et al. 1980) with Rubisco kinetic constants as given by Bernacchi *et al.* (2001). For converting radiation interception values to L, we took where I/I_0 represents the incident flux density, I, relative to that at the top of the canopy, I_0, as given in several of the studies (eg. Hollinger, 1996; Kull and Niinemets, 1998; Meir *et al.*, 2002) taking a general value for the light extinction coefficient, k_I, of 0.6 except where as noted in Table S1.

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Species	Reference	$V_{max(0)}$ (μmol m^{-2} s^{-1})	k_v	Notes
Acer saccharum	Ellsworth and Reich (1993)	32	0.11	$V_{max(0)}$ and k_v estimated directly from Fig. 4b and Fig. 5a assuming c_i = 22 Pa.
Acer saccharum	Raulier *et al. (*1999)	63	0.18	$V_{max(0)}$ and k_v estimated from Fig. 6 with k_I = 0.5 (as stated in the text) with c_i = 22 Pa (Fig 2)
Betula grossa	Uemura *et al.* (2006)	39	0.13	By matching profiles of A_{max} at high [CO_2] (their A_{sat}) and L with height with $V_{max(0)}$ estimated from $A_{maa((0)}$ at high [CO_2] assuming c_i = 100 Pa.
Betula pendula	Meir *et al.* (2002)	114	0.25	$V_{max(0)}$ directly from the authors, k_v estimated from Fig. 5 assuming k_I = 0.6
Castilla elastica	Poseda *et al.* (2009)	84	0.36	$V_{max(0)}$ estimated from profiles of A_{max} in Fig. 1 assuming c_i = 22 Pa and with k_I = 0.7 (Wirth *et al.*, 2001).
Eucalyptus globules	Turnbull *et al.* (2007)	50	0.17	$V_{max(0)}$ and k_v estimated from Fig. 6 using a low k_I of 0.3 due to near vertical leaf orientation (Goudriann, 1977).
*Fagus crentana**	Uemura *et al.* (2006)	54	0.14	By matching profiles of A_{max} (high [CO_2]) and L with height with $V_{max(0)}$ estimated from $A_{maa((0)}$ (high [CO_2]) assuming c_i = 100 Pa.
Fagus sylvatica	Meir *et al.* (2002)	64	0.19	$V_{max(0)}$ directly from the authors, k_v estimated from Fig. 5 assuming k_I = 0.6
Ficus insipid	Poseda *et al.* (2009)	111	0.43	$V_{max(0)}$ estimated from profile of A_{max} in Fig. 1 (upper curve) assuming c_i = 22 Pa and with k_I = 0.7 (Wirth *et al.*, 2001).
Luhea seemannii	Poseda *et al.* (2009)	95	0.22	$V_{max(0)}$ estimated from profile of A_{max} in Fig. 1 (upper curve) assuming c_i = 22 Pa and with k_I = 0.7 (Wirth *et al.*, 2001).
Nothofagus fusca	Hollinger (1996)	40	0.11	$V_{max(0)}$ from Table 1, k_v estimated from Fig. 4 assuming k_I = 0.6 with two outliers omitted from the analysis.
Populus tremula	Kull and Niinemets (1998)	113	0.24	$V_{max(0)}$ from initial slope of A;c_i curve, with k_v also estimated from Fig. 2a assuming k_I = 0.7 (Green *et al.* 2001)
Prunus persica	Walcroft *et al.*(2002)	80	0.16	$V_{max(0)}$ and k_v from Fig 3c (May 1999) using relationship of Fig. 6 and assuming k_I = 0.6
Quercus glauca	Miyazawa *et al.* (2004)	98	0.10	Gradient in V_{max} estimated from gradient in $[N]_A$ (Fig. 2) and relationships between $[N]_A$ and both A_{max} and c_i (Fig. 3) assuming k_I = 0.6.
Quercus petraea	Meir *et al.* (2002)	104	0.20	$V_{max(0)}$ directly from the authors, k_v estimated from Fig. 5 assuming k_I = 0.6
Tilia cordata	Kull and Niinemets (1998)	78	0.17	$V_{max(0)}$ from initial slope of A;c_C curve, with k_v also estimated from Fig. 2a assuming k_I = 0.7 (Green *et al.* 2001)
Miscellaneous tropical forest species (Manaus)	Carswell et al. (2000)	58	0.18	As independently estimated by Mercado *et al.* (2006).
Miscellaneous tropical forest species (Tapajos)	Domingues et al. (2005)	64	0.15	With k_v as estimated in the main text, with $V_{max(0)}$ directly from equations in Tables 3 and 4.

Table S1. Values for Rubisco activity of uppermost canopy leaves, $V_{max(0)}$, and the Rubisco extinction coefficient k_v used for Figure 10 in the main text.
**Fagus japonioca* was not analysed as its profiles appear very similar to *F. crenata.*