Supplementary file S1: Dispersal kernels

Model fitting with the Gene Shadow Model requires the definition of a dispersal kernel in order to obtain good estimates of the dispersal parameters. There are four commonly used two parameter-kernels in dispersal modelling, which differ in their shapes of the very near and far tail: lognormal kernel (Stoyan and Wagner 2001), 2Dt kernel (Clark et al. 1999), Weibull kernel (Ribbens et al. 1994) and generalized exponential kernel (Gupta and Kundu 1997). The properties of these kernels make them suitable for dispersal studies. The four distributions have one scale and one shape parameter that define the kernel (see below). The mathematical definition of the three kernels in the form of kernel generating functions is given by equations A1-A4.

Lognormal distribution

The lognormal distribution is a continuous probability distribution of a random variable whose logarithm is normally distributed. The kernel for the lognormal distribution is:

[A1] $$k(r,\mu,\sigma) = \frac{1}{(2\pi)^{1.5}\mu r^2}\exp\left(-\frac{(\ln r-\sigma)^2}{2\mu^2}\right)$$

where μ and σ are the mean and standard deviation of the logarithm of the variable. The lognormal kernel shows zero seed abscission at the tree, which is supported by empirical and theoretical work showing that seed density is often higher at some distance from the seed tree (Stoyan and Wagner, 2001).

Weibull distribution

The Weibull distribution (also called exponential power) is a continuous probability distribution from the exponential family widely used in seed and pollen dispersal modeling (Ribbens et al. 1994). The kernel for Weibull distribution is:

[A2] $$k(r,\lambda_w,k) = \frac{1}{2\pi\frac{\lambda_w^{-\frac{2}{k}}}{k}\Gamma\left(\frac{2}{k}\right)}\exp\left(-\lambda_w r^k\right)$$

where λ_w is the shape parameter and k is the scale parameter.

Supplementary file to the article "High seed dispersal ability of Pinus canariensis in stands of contrasting density inferred from genotypic data", by Unai López de Heredia, Nikos Nanos, Eduardo García-del-Rey, Paula Guzmán, Rosana López, Martin Venturas, Pascual Gil Muñoz and Luis Gil. Forest Systems Vol. 24 No. 1, March 2015. (http://dx.doi.org/10.5424/fs/2014241-06351)

Generalized exponential

The generalized exponential function is an exponentiation of the 2-parameter Weibull distribution (assuming that location parameter is zero) that may be an alternative to the gamma model and the Weibull model in many situations (Gupta and Kundu 1997). The kernel expression is as follows:

[A3] $$k(r,\lambda_{eg},\alpha) = 1 - \exp\left(-\frac{r}{\lambda_{eg}}\right)^{\alpha}$$

where α is the shape parameter and λ_{eg} is a scale parameter.

Clark's 2Dt distribution

The Clark's 2Dt distribution is an optimal kernel for data with both short and long distance dispersal events and it has been previously used in pine species (Clark et al. 1999). It is a bivariate Student's t distribution whose kernel has the following expression:

[A4] $$k(r,p,u) = \frac{p}{\pi u\left[1+\frac{r^2}{u}\right]^{p+1}}$$

where *p* is the shape parameter and *u* the scale parameter. Lack of convergence was obtained when trying to fit *u* and *p* parameters simultaneously. After several runs using different values for *p*, we fixed the shape parameter *p* to 1. Fixing *p* = 1 provides the best convergence when the actual p parameter is <1 (Jones and Müller-Landau 2008).

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