SUPPLEMENTAL MATERIAL

Appendix A

Fitted equations for relationships between each parameter and adult density and climate (Table 1), and details of the matrix population model (Fig. 1).

Vital rates

Germination rate (Figure 2b)

$$Germ = Germ_{max} \, (t^n / (t^n + K^n)) \qquad \text{Eq. A.1}$$

with $Germ_{max} = 1$, $n = 4$, $K = 3$, and t the number of times per year when soil moisture is above field capacity (> 130mm) for three consecutive days.

Seedling survival rate (Figure 2c)

$$S_{sg}, = S_{sgmax} \, (t^n / (t^n + K^n)), \qquad \text{Eq. A.2}$$

with $S_{sgmax} = 0.5$, $n = 8$, $K = 4.1$, and t the number of times per year when soil moisture is above field capacity (> 130mm) for seven consecutive days.

Sapling survival rate for isolated to sparse density populations (Fig. 2d)

$$S_{sap} = 0.025t + 0.02 \qquad \text{Eq. A.3}$$

with t the number of days per year where soil moisture is above field capacity (> 130mm).

Sapling growth rate (Fig. 2e)

$$G_{sap,t} = G_{max,sap,t} \, e^{(-cd)}, \qquad \text{Eq. A.4}$$

with $G_{max,sap} = 1$, $c = 0.003$ and d is the summed density of small and large adult trees.

Growth rates of small juveniles (SJ), large juveniles (LJ) and small adults (SA) (Fig. 2e)

$$G_{i,t} = G_{max,i,t}\,(1 - d^n / (d^n + K^n)) \qquad \text{Eq. A.5}$$

with $n = 4$, $K = 1500$, $i \in [SJ, LJ, SA]$, with $G_{max,SJ} = 0.55$ or $G_{max,LJ} = G_{max,SA} = 0.06$, and d is the summed density of small and large adult trees.

Retrogression rates of large juveniles (LA), small adults (SA) and large adults (LA) (Fig. 2e)

$$R_{i,t} = R_{min,t} + R_{max,t}\,(1 - e^{(-cd)}) \qquad \text{Eq. A.6}$$

with $R_{LJ,t} = R_{SA,t} = R_{LA,t}$, the minimum and maximum retrogression rate observed $R_{min} = 0.02$, $R_{max} = 0.12$, $c = 0.003$, and d is the summed density of small and large adult trees.

Fertility rate of small adults (SA) and large adults (LA) (Fig. 2f)

$$f_{d,i} = p_{max,i}\, m(1 - d^n / (d^n + K^n)) \qquad \text{Eq. A.7}$$

with $i \in [SA, LA]$, $n = 3$, $K = 1500$, pre-dispersal mortality rate $m = 0.25$, the maximum fertility rate of small adults $p_{max,SA} = 20.75$ or large adults $p_{max,LA} = 63.6$, and d is the summed density of small and large adult trees.

Detail of the matrix population model

The model projects at an annual-time step the population dynamics at different life-stages through a (6 × 6) transition matrix ***A*** (Pichancourt et al., 2012):

$$\vec{N}_{t+1}^{a,d} = A.\vec{N}_t \Leftrightarrow \begin{pmatrix} n^{SB} \\ n^{Sap} \\ n^{SJ} \\ n^{LJ} \\ n^{SA} \\ n^{LA} \end{pmatrix}_{t+1} = A.\begin{pmatrix} n^{SB} \\ n^{Sap} \\ n^{SJ} \\ n^{LJ} \\ n^{SA} \\ n^{LA} \end{pmatrix}_{t} \quad \text{Eq. A.8}$$

where ***A*** contains the vital rates (Table 1) at the different life-stages and size-classes:

$$A = \begin{pmatrix} S_{SB}(1-Germ) & 0 & 0 & 0 & \sqrt{S_{SA}} f_{SA} \sqrt{S_{SB}}(1-d)(1-Germ) & \sqrt{S_{LA}} f_{LA} \sqrt{S_{SB}}(1-d)(1-Germ) \\ S_{SB} Germ.S_{Sg} & S_{Sap}(1-G_{Sap}) & 0 & 0 & \sqrt{S_{SA}} f_{SA} \sqrt{S_{SB}}(1-d) Germ.S_{Sg} & \sqrt{S_{LA}} f_{LA} \sqrt{S_{SB}}(1-d) Germ.S_{Sg} \\ 0 & S_{Sap} G_{Sap} & S_{SJ}(1-G_{SJ}) & S_{LJ}(1-G_{LJ}) R_{LJ} & 0 & 0 \\ 0 & 0 & S_{SJ} G_{SJ} & S_{LJ}(1-G_{LJ})(1-R_{LJ}) & S_{SA}(1-G_{SA}) R_{SA} & 0 \\ 0 & 0 & 0 & S_{LJ} G_{LJ} & S_{SA}(1-G_{SA})(1-R_{SA}) & S_{LA} R_{LA} \\ 0 & 0 & 0 & 0 & S_{SA} G_{SA} & S_{LA}(1-R_{LA}) \end{pmatrix}$$

Eq. A.9

LITERATURE CITED

Pichancourt, J. B., I. Chades, J. Firn, R. D. van Klinken, and T. G. Martin. 2012. Simple rules to contain an invasive species with a complex life cycle and high dispersal capacity. Journal of Applied Ecology **49**:52-62.