Supplementary Information

Estimation of boundary conditions

To find acceptable boundary conditions and, in turn, be able to estimate the parameters of interest in Eq. 9, our approach was to choose the boundary values that produce the best match between the observed and predicted number of infested trees in the domain. We optimized the boundary conditions outside the infested border using the function optim of the R package stats. The optimization algorithm used the Nelder-Mead method with initial parameter values $b_x^{2005 \text{ to } 2010} = \{0, 0, ..., 0\}$. The function maximized the coefficient of determination r^2 between the observed and predicted number of infested trees once Eq. 9 was fitted to data. Finally, we checked that the chosen boundary conditions were consistent with the known levels and patterns.

900 MAP OF THE YEARLY RATE OF INCREASE R_x^{2012}

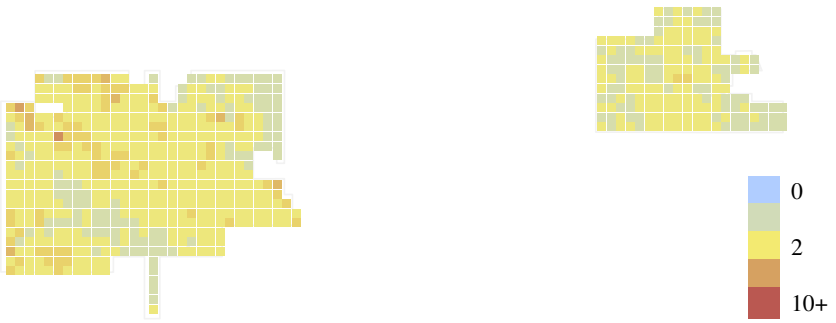

Fig. S.1 Yearly rate of increase R_x^{2012} per 500×500-meters cell on a log scale estimated using a non-linear regression to obtain the number of infested trees I_x^{2013} for the year 2013.

901 OBSERVED CONTROL EFFICIENCY

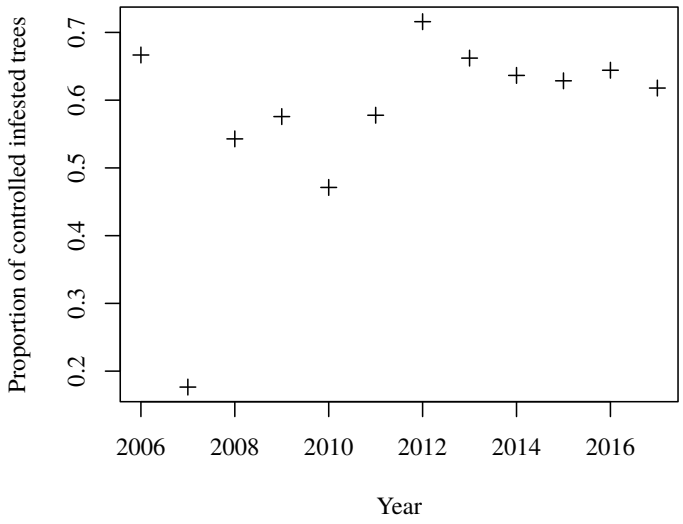

Fig. S.2 Observed control efficiency in Cypress Hills, Saskatchewan, Canada.