Supplementary Material – Model Description

We developed a grid-based spatial model to represent boundary dynamics at a forest – savanna interface (similar in spirit to those described by Murphy and Bowman, 2012 and Hoffmann et al., 2012). The model was implemented in NetLogo 6.0.1 (Wilensky 1999). Each cell in the landscape can be in either a forest or grassland state, with grassland cells more flammable than forest (as per Marsden-Smedley et al. 2001). At the start of each simulation there is a sharp transition from forest to savanna in the mid-point of the grid (200 × 50 cells). Fire occurs at a given frequency (average recurrence of 15 y) and after ignition spreads as a percolation process (O'Sullivan and Perry 2013) with the probability of fire spreading from a burning cell into its unignited neighbour varying depending on the vegetation of the cell being spread into (default of 0.3 vs. 0.035 for forest and grassland, respectively). All fires start at a randomly selected cell in the grassland state, or if there is no grassland in a randomly selected cell in the forest state. We do not represent inter-annual variability in climate on fire nor the effects of topography. Forest cells transition into the grassland state on burning and grassland cells convert into the forest state after a sufficient period of time has elapsed since they were colonised by a juvenile tree; this elapsed period represents the time required for a juvenile to develop traits that enable it to escape the fire-trap (by default 15 time-steps). Each forest cell disperses one propagule per year in a random direction with distance as a random deviate from a negative exponential distribution (mean = one by default). When soil gradients are represented we start with an abrupt transition at the forest-savanna edge, with grassland having a user-defined level of (relative) infertility. Infertility acts to multiplicatively increase the time it takes a colonising tree to escape the fire-trap (e.g., if infertility in grassland is 5.0 (the default) then it will take 5.0 × 15 y = 75 y for an individual to escape the fire-trap). If fire-soil feedbacks are represented then each time that a grassland cell is burned then its infertility increases by 0.2 and each year that a forest cell is unburned its infertility decreases by 0.001 to a minimum of 1.0.

References

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