

## Stochastic models in seed dispersals: random walks and birth-death processes

### ABSTRACT

Seed dispersals deal with complex systems through which the data collected using advanced seed tracking facilities pose challenges to conventional approaches, such as empirical and deterministic models. The use of stochastic models in current seed dispersal studies is encouraged. This review describes three existing stochastic models: the birth–death process (BDP), a 2 dimensional (2D) symmetric random walks and a 2D intermittent walks. The three models possess Markovian property, which make them flexible for studying natural phenomena. Only a few of applications in ecology are found in seed dispersals. The review illustrates how the models are to be used in seed dispersals context. Using the nonlinear BDP, we formulate the individual-based models for two competing plant species while the cover time model is formulated by the symmetric and intermittent random walks. We also show that these three stochastic models can be formulated using the Gillespie algorithm. The full cover time obtained by the symmetric random walks can approximate the Gumbel distribution pattern as the other searching strategies do. We suggest that the applications of these models in seed dispersals may lead to understanding of many complex systems, such as the seed removal experiments and behaviour of foraging agents, among others.

**Keyword :** Birth–death process; Cover time; Individual-based model; Random walk; Seed dispersa