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A model for plant invasions: the role of distributed generation times.

Méndez V, Campos D, Sheppard AW

Bull Math Biol 2009 Oct **71**(7):1727-44 [abstract on PubMed]
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Selected by | Hao Wang and Mark Lewis NEW
Evaluated 21 Jan 2010
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Hao Wang and **Mark Lewis** University of Alberta, Canada Ecology Confirmation New Finding Tech Advance	**Biological invasions are treated as a key component of global environmental change and appear to occur more frequently worldwide. Although there has been a long history of models for biological invasions, the model in this paper is exceptional because it contains complex plant life-cycle information, and also provides explicit analytical expressions for invasive success.** Most existing models for biological invasions employ partial differential equations, integro-differential equations, or integro-difference equations. They are mostly too simple to capture all life-cycle information or too complicated to provide explicit mathematical expressions for key features of biological invasions. This article provides a novel, stage-structured integral model that contains the whole life-cycle of plants and consists of adult plants and (unripe and mature) seeds. This model is not only biologically mechanistic, to incorporate life-cycle details, but is also mathematically feasible, to generate explicit threshold conditions for invasive success and expressions for invasive speed, both of which can be useful tools for invasion assessment. The authors apply the threshold condition and empirical data from the native and exotic ranges of Echium plantagineum, Cytisus scoparius and Carduus nutans to demonstrate the success of their invasions in Australia. The analytical predictions of invasive speed from the model closely fit recent experimental data for Carduus acanthoides. This model has no derivatives but includes a group of temporal and spatial probability distribution functions (pdfs). The selection of pdfs should be based on underlying mechanisms and experimental data. Appropriately interpreted, this model and its analytical techniques can potentially be modified and applied to a wide range of biological invasions. **Competing interests:** None declared Evaluated 21 Jan 2010 NEW

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