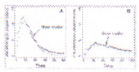
Figures and tables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Thematic Issue on Spatial Agent-Based Models for Socio-Ecological Systems

An agent-based modeling framework for integrated pest management dissemination programs ☆

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Abstract

The study of how people acquire and diffuse information among heterogeneous populations has a rich history in the social sciences. However, few approaches have been developed to better understand how information diffusion patterns and processes affect resource management in complex socio-ecological systems. This is a timely issue for crop protection diffusion programs, which have a larger place than ever on the international policy agenda due to the growing number of challenges related to controlling agricultural pests. To assess the impact of heterogeneous farmer behaviors (receptivity toward IPM practices) and types of information diffusion (either active or passive) on the success of integrated pest management (IPM) programs, we developed a socio-ecological model coupling a pest model (population growth and dispersion) with a farmer behavioral model (pest control and diffusion of pest management practices). The main objective of the model was to provide insights to explore effective IPM information diffusion strategies at the farmer community level. Our simulations revealed 1) that passive IPM information diffusion among agents seemed to be more effective to control pests over the community of agents than active diffusion and 2) that increasing levels of agent heterogeneity would significantly slow down pest control dynamics at the community level, but to a lower extent in the case of passive IPM information diffusion. Our findings therefore suggest that IPM diffusion programs should focus their efforts in developing methods to create purposefully the conditions for social learning as a deliberate pest control mechanism, while taking into account potential limitations related to the commonly reported farmer heterogeneity. Our study further stresses the need to develop a comprehensive and empirically based framework for linking the social and ecological disciplines across space and time in agricultural system management. While we specifically focus on pest infestation levels and IPM information diffusion strategies in this study, our approach to understand information diffusion within heterogeneous human populations in interaction with environmental features would be applicable to a much wider range of both social and resource management issues.

Keywords

Agent-based model; Socio-ecological systems; Pest control; Farmers; Information diffusion; Behavioral heterogeneity

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