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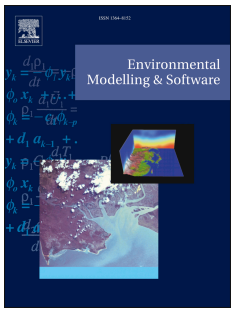

Managing ecological disturbances: Learning and the structure of social-ecological networks

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Managing ecological disturbances: Learning and the structure of social-ecological networks

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Abstract:
Ecological disturbances (i.e. pests, fires, floods, biological invasions, etc.) are a critical challenge for natural resource managers. Land managers play a key role in altering the rate and extent of disturbance propagation. Ecological disturbances propagate across the landscape, while management strategies propagate across social networks of managers. Often, these related processes of diffusion are studied separately. Here we use an agent-based model to examine the simultaneous diffusion of ecological disturbances and management strategies across a multiplex, social-ecological network, that allows us to account for the fundamental role of social-ecological feedbacks. We examine the management of a generic ecological disturbance as a function of different learning strategies and social-ecological network structure. Our results show that managers who imitate other successful managers and have access to accurate information are most effective at controlling disturbances. The structural properties of the social-ecological network also play an important role: an increase in inter-layer assortativity and average multiplex degree reduce the expected disturbance prevalence, while an increase in local clustering increases it. The results presented here highlight the potential for local, close-knit communities to impede the learning and coordination required to accurately transmit information for disturbance management, as well as the importance of social structures that match ecological processes on the landscape. Our approach, integrating coupled social-ecological models with network analysis, provides a general scaffold that can be modified to examine a variety of more specific processes in which both social and ecological flows diffuse across a multiplex network.

Ecological disturbances (i.e. pests, fires, floods, biological invasions, etc.) are a critical challenge for natural resource managers. Land managers play a key role in altering the rate and extent of disturbance propagation. Ecological disturbances propagate across the landscape, while management strategies propagate across social networks of managers. Here we use an agent-based model to examine the joint diffusion of ecological disturbances and management strategies across a social-ecological network, accounting for the fundamental role of social-ecological feedbacks. We examine the management of a generic ecological disturbance as a function of different learning strategies and the social-ecological network. Our approach provides a general scaffold that can be modified to examine a variety of processes in which both social and ecological flows propagate across a social-ecological network. Our findings highlight the importance of full and accurate information to assess successful strategy, limited clustering and alignment between the social and the ecological system.

Keywords: