Decision Analysis to Evaluate Control Strategies for Crested Wheatgrass in Grasslands National Park of Canada

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Introduction One of the most persistent threats to native grasslands worldwide is invasion by exotic species . On the North American Great Plains , land managers protecting native prairie struggle to prevent exotic invasion with limited resources for monitoring and control . On the Canadian mixedgrass prairie , crested wheatgrass (*Agropyron cristatum*) is widely planted for fodder and roadside reclamation . However , it is capable of invading and forming monocultures on undisturbed native grasslands either through contagion of existing patches or long-distance seed dispersal . Controlling this species requires thorough understanding of treatment effectiveness , rates of new patch emergence and rates of spread of existing patches (Perrings et al . , 2005) . Yet , quantifying these factors is difficult and they remain uncertain at large spatial and temporal scales .

Methods Using a spatially explicit computer simulation model parameterized for Grasslands National Park of Canada and formal decision analysis (Alexander et al . , 2006) , we evaluated the effectiveness of alternative management approaches to controlling crested wheatgrass in the face of uncertainty . We simulated three landscape conditions (uninvaded , invaded and established) and modeled the effect of treating large vs . small patches with a large vs . small initial effort all under conditions in which treatment effectiveness , spread rates and long distance dispersal rates were uncertain . We measured both the area invaded by crested wheatgrass and the cost of treatment over a fifty-year period .

Results In general , treating small patches is a better strategy to both manage spread and minimize costs in our simulations . Only under conditions of high (> 80%) control effectiveness is it beneficial to prioritize large patches over small . Decision analysis highlighted the role of uncertainty in designing a control program . If it cannot be demonstrated that crested wheatgrass can be controlled effectively , then focusing treatments on small patches is the most prudent action .

Conclusions Our model highlights the acknowledgement of uncertainty in managing native grasslands . Results of such an analysis could be incorporated into a broader adaptive management framework that aims to identify and reduce critical uncertainties in an invasive management problem (Shea et al . , 2002) .

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