2nd Conference on Invasive Species in Natural Areas, October 25-29, 2010, Coeur D'Alene, ID.

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Predicting invasion of *Linaria dalmatica* in the Northern Range of Yellowstone National Park

The invasion of the Northern Range of Yellowstone National Park (NRYNP) by *Linaria dalmatica* was documented from initial introduction in a garden in 1946 to three other points in time. In 1968 and 1970 full census maps were created and the region was sampled from 2001 to 2007. We wanted to know how plant invasions proceeded over time so we used *L. dalmatica* as a case study of a species invasion in the NRYNP. Specifically, we were interested in determining if the invasion was a continuous or periodic process, and how different covariates or processes varied in their influence of the invasion. We conducted occupancy modeling on the 1968 and 1970 data and found that the probability of new colonization of *L. dalmatica* populations (patches) was driven by probability of occurrence (+) based on digital elevation map properties (slope, aspect, elevation, annual solar radiation, distance to stream), distance to nearest previously occupied patch (-), distance to road (-) and distance to trail (+). Probability of patch extinction was a function of probability of occurrence (-), distance to road (+) and distance to trails (-). The 1968 to 1970 probabilities of colonization and extinction were used with their covariates to simulate the invasion from 1946 to 1970. Metapopulation number was over-predicted for 1968 and 1970. This result suggests that the invasion was not continuous. The model parameter values were adjusted to determine what set of values assigned over time would produce the most realistic results (i.e. to match the observed number and location of populations in 1968 and 1970). We determined that minimizing dispersal distance by decreasing both of the distance to nearest previous population and the distance to road parameter values for the first 20 years in the colonization model allowed for the most agreement between the predicted and observed invasion data. These results suggest that the lag phase may involve source strength and dispersal limitations early in the invasion of this species. The practical application of these findings is that early detection and a well timed response may provide the best strategy for management of *L. dalmatica*.