5th International Weed Science Congress, Vancouver, Canada. 20-25 June, 2008.

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Characterizing invasion of *Linaria dalmatica* at a patch and metapopulation scale

Understanding the pattern and rate of non-indigenous species invasion are important for prioritizing populations for management. Ages of individual *Linaria dalmatica* plants across patches and among patches were determined using herb-chronology methods. Age patterns were used to identify plant spread as phalanx, guerrilla, or infiltration. Individual plant roots were collected and mapped along two axes, 1 meter in width, of an established patch of *L. dalmatica* in Yellowstone National Park, USA. Satellite patches were also mapped and roots collected. The roots were cross-sectioned with a rotary microtome, dyed with phloroglucinol/HCl, and the annual growth rings identified for each root. Spatial locations of each root were recorded. The age frequency distribution of the main patch was positively isn't this negative – ie left side of the mean skewed with a mean age of 3.54 years and a median age of 3 years. Ages ranged from 1 to 10 years old. Spatial analyses of the age and density structure showed that the patch can be best characterized as infiltration invasion which can be described as micro-invasions coalescing into a patch. The distribution of young plants between older plants on each of the axes was also indicative of this pattern of spread. There were significant ($p = 0.0472$) linear density aggregations along the long axis of the patch. Repeating patterns in the cross-sectional age distributions were seen at a scale of 3.0 meters using a Three-Term Local Quadrat Variance test of mean age along both axes ?also supporting infiltration as the spread pattern?. The satellite population age distributions were analyzed to assess the rate of spread into the surrounding area. An individual based population dynamics spatial automaton model was used to evaluate the role of demographic and dispersal processes on the age structure within the population as well as the creation of new satellite populations.