Spatial evaluation of weed infestation and bioagent efficacy: an evolution in monitoring technique

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Traditional invasive weed and insect biological control agent monitoring can be time consuming, costly and labour-intensive. Practices involving linear transect sampling provide relatively low return on a monitoring investment, particularly when trying to understand target plant and bioagent spread and establishment. Global positioning system and geographical information system (GIS) are tools that are rapidly replacing tape measures and topographic maps. Over the past decade, electronic data collection and analysis techniques have evolved along with the widespread availability of such technologies. Information is now gathered in a spatially relevant manner to identify key environmental attributes contributing to the efficacy of our biocontrol efforts. This presentation will contrast information typically obtained from traditional transect vegetation sampling methods against data collected and evaluated using GIS. Weed and insect population patterns that are readily apparent using a spatial approach, such as ‘hotspots’ and patchiness, edge effects and directional trends, are generally unseen using traditional data collection techniques. GIS analysis allows for an improved statistically sound method of analysing biocontrol efficacy. It also facilitates a much more predictive approach to biocontrol agent release by utilizing spatial modelling techniques. These concepts will be discussed using field-collected data on the biological control of knapweeds, leafy spurge and Dalmatian toadflax.

Influence of release size on the establishment and impact of a biocontrol root weevil

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A strategic approach to classical weed biocontrol implementation is emerging through recent efforts to predict success in agent population establishment and persistence based on initial release size. However, there has been little formal investigation of whether release size can also predict agent efficacy. A root-boring weevil, Mogulones cruciger, which was introduced in Canada to control houndstongue (Cynoglossum officinale), was used to test this relationship. Numbers of 0, 100, 200, 300 or 400 weevils were field-released within discrete, isolated houndstongue patches (five replicates per treatment). Patches were monitored over 2 years for weevil establishment, host attack and changes in houndstongue populations. The weevil established successfully in all treatment patches, regardless of release size. Release size was positively correlated with weevil numbers and damage to host plants. In contrast, the different release sizes reduced houndstongue populations by the same amount and at the same rate relative to control patches during the 2-year study. Thus, all release sizes tested could predictably achieve patch-level control of houndstongue despite differences in the level of feeding. The measurable and predictable impact of the agent on weed populations in this system are mainly attributed to reliable agent establishment and rapid kill of host individuals.