INVADERS Weed Tracking and Alert System

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The INVADERS Database <http://invader.dbs.umt.edu> is an interactive web site that tracks the historic spread of approximately 900 exotic plants that have invaded the five Pacific northwest states of United States since 1875. Core data include 80,000 distribution records from herbaria, weed identification laboratories, agency surveys, and other various sources. All distribution records have at least county level spatial resolution. Data can be verified as to source, and most have voucher specimens or originate from experienced weed taxonomists. Online outputs include county level distribution maps, time lapse spread maps, spread rate curve graphics, lists of exotics by user specified state or county groupings, and a database engine with live links to other URL's with species specific descriptions. Point location records can be extracted and imported to GIS for climate matching, determination of habitats at risk to invasion, and other forms of spatial analyses. The site also includes examples of how regulatory agencies, weed program, and land managers have been using INVADERS data for risk assessment, environmental impact statements, selection of target weeds, legal noxious designations, and various on-the-ground projects. Taxonomically qualified users can submit new weed findings directly to the INVADERS web site. The new distribution records are immediately available for inclusion in output graphics and lists. Users can request automatic next morning e-mail notification of new reports of specific weeds. http://invader.dbs.umt.edu is a Java driven web site. It was designed to work best with the Microsoft Internet Explorer 4.01 browser, which allows full delivery of INVADERS web site graphics. The INVADERS team hopes to expand geographic coverage from the current five northwestern US states to at least the 50 US states or continental North America, if not the entire western hemisphere.

Climate Matching between the Western United States and Eurasia to Target Foreign Exploration for Natural Enemies of Spotted Knapweed

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Twelve species of insect natural enemies have been introduced to North America for biological control of spotted knapweed (Centaurea biebersteinii DC. = C. maculosa auct. non Lam). However, only a few of these species have established well in the interior of the continent, suggesting that many of the introduced populations are not well adapted to
the climate. Three climate matching techniques were used to compare areas where spotted knapweed occurs in the western United States with its native range in Eurasia. One approach used 1,292 point location records for spotted knapweed in the western U.S., compiled from several sources, in conjunction with a global 0.5° climate grid. The other two approaches used climate matching functions provided in the CLIMEX system, based on meteorological data for the specific set of locations included with CLIMEX. Analyses focused on the western United States region as a whole, and separately on the core range of spotted knapweed in Montana. There was good agreement among the three approaches used. Areas in the eastern and northern portions of the palearctic range of spotted knapweed appear to be similar in climate to much of the area of spotted knapweed infestation in the western U.S., but particularly to the core range of spotted knapweed in Montana.

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**Patch Size, Herbivore Dispersal, and Spatial Scale: Landscape Effects Promoting Herbivore Outbreaks**

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We examine the effect of patch size on the ability of herbivore populations to reach an outbreak density that results in host-plant defoliation. The intent of this study was to identify whether there were threshold amounts of habitat above which herbivores could outbreak and below which they would not. Theory suggests that when patches are the same size or larger than the typical dispersal distance of the herbivore, populations can build up more readily within those patches. In effect, herbivores would be dispersing within patches. Data were collected from 130 populations of forest tent caterpillar from 1993 through 1999 and the peak density reached at each of those sites was estimated. Around each sample point, the proportion forested vs unforested land was estimated from a classified photo-mosaic; no forest was recorded as zero, and complete forest cover as one. Forest cover estimates were taken from the mosaic at six spatial scales (53m, 106m, 212m, 425m, 850m and 1700m). The relationships between point estimates of tent caterpillar density and forest structure at each of the six spatial scales were examined to identify the [respective] patterns.

At all spatial scales, there were higher densities of tent caterpillar in areas where there was more forest. Among these six spatial scales however, only at the 850 m\(^2\) scale was there evidence of a threshold amount of forest cover above which outbreaks occurred and below which they never occurred, thus producing a distinct ‘step’ in the relationship between cover and population size. With only one exception, all outbreak populations