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Leafy spurge and Russian knapweed encroachment on Colorado rangeland

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Abstract:

Russian knapweed (ACRRE) and leafy spurge (EPHES) are aggressive, colony-forming perennials. Both reproduce from seed as well as vegetative buds in their extensive root systems. Once established, both Russian knapweed and leafy spurge can completely dominate rangeland and adapt well to poor range conditions. Although these weeds are known to be aggressive and displace native vegetation, few studies have monitored their expansion and dominance.

ACRRE and EPHES cover, density, frequency, and grass cover was monitored from 1994 to 1999. Each study was conducted on a square grid system with permanent transects running perpendicular to each other at 1.5 meter intervals. A 0.1 m^2 quadrat was used at 1.5 meter intervals along each transect to determine EPHES or ACRRE cover, density, and grass cover. ACRRE patch radius was monitored from the center of the grid to permanent markers along the border. The outer-most ACRRE canopy cover distance along a line-intercept was recorded for each grid marker. Outside (X,Y) coordinates were recorded on a graph and ACCRE patch area was calculated each year of the study. The ACCRE and EPHES study sites were located in the same pasture approximately 200 meters apart. Western wheatgrass comprised 90% of the grass composition at the EPHES site, while smooth brome and western wheatgrass contributed 50% each to the grass composition at the ACRRE site. Data collected from individual quadrats were averaged over a transect and cover, density, and frequency of individual species in a patch were determined by averaging data from all transects.

EPHES frequency increased from 27 to 71%, density from 10 to 49 shoots/m^2, and cover from 8 to 34% from 1994 to 1999. EPHES density increased from 284 to 1,413 total shoots in the study site during this time. Grass cover increased from 8 to 47% from 1994 to 1999, however, grass cover decreased as EPHES increased in cover and density. Grass cover was 60% where no EPHES was present compared to a low of 35% with

EPHES at 95% cover and 12 EPHES shoots/m^2. The trend from 1994 to 1999 was an increase in both EPHES and grass cover, and a dramatic increase in EPHES frequency. EPHES patch expansion was considerable throughout the study site over 6 years. The continual increase in EPHES shoots within the study site illustrates EPHES aggressive nature.

ACCRE frequency increased from 31 to 37% from 1994 to 1999. ACCRE cover was static with a high of 23% in 1995 to low of 13% in 1999. ACCRE density decreased from 26 to 18 shoots/m^2 while grass cover increased from 11 to 35% from 1994 to 1999, respectively. Grass cover was 40% where no ACCRE was present compared to 5% grass cover with 80% ACCRE cover and 11 shoots/m^2. The ACCRE patch area increased from 239 m^2 to 279 m^2 from 1994 to 1999. This is an increase of approximately 15% over 6 years. ACCRE cover and density did not increase or decrease substantially from 1994 to 1999, but fluctuated each year. Grass cover increased approximately 3-fold from 1994 to 1999 possibly due to increased precipitation and improved grazing management. Although ACCRE frequency and patch radius slightly increased from 1994 to 1999, ACCRE reduced grass cover within the ACCRE patch. The ACCRE patch seems relatively stable other than minor expansion along the perimeter that provided a 15% increase in surface area over 6 years. Russian knapweed seems to be more dependent upon root than seed propagation. No seedling emergence was noted for the duration of the study and shoot recruitment was confined to the outer boundary of the patch.

The grid system illustrates the increase and decrease in cover, density, and frequency as well as directional shifts in populations. This system has the potential for multiple uses. The grid could provide a valuable tool in monitoring endangered species, soil and vegetation surveys, and shifts in specie's composition. Correlating direction of patch expansion to soil texture and plant community composition may help identify habitats at greatest risk for noxious weed invasion.