



Shrub patches capture tumble plants: potential evidence for a self-reinforcing pattern in a semiarid shrub encroached grassland

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Abstract

Background and aims The development of fertile patches within an infertile matrix is a common phenomenon in drylands. Shrub-centered expansion of fertile islands is generally attributed to processes of sediment erosion and deposition, but there have been fewer stud-

ies of how litter might contribute to the development of fertile islands in semiarid shrub grassland.

Methods We quantified the capture of two tumble plant species (*Cleistogenes squarrosa*, *Salsola collina*; also known as tumble weeds) by shrubs across ten sites across 38,000 km² of a semiarid grassland encroached by *Caragana microphylla*.

Results Tumble plants are plants that blow across the grassland propelled by strong winds. Both tumble plant species were found over extensive areas of semiarid grassland, and their distribution coincides with the distribution of *Caragana microphylla*. Biomass production of both tumble plants averaged 12.2 g m⁻² (range: 1.0 to 25.0 g m⁻²) and litter accumulation (amount accruing from wind-blown plants) of both tumble plants was significantly greater beneath shrubs (94.5 ± 28.9 g m⁻² mean ± SE) than in the interspaces (3.3 ± 1.4 g m⁻²). Most of the material collecting under *Caragana microphylla* comprised tumble plants. Increases in the area of *Caragana microphylla* patches did not correspond to greater tumble plant capture. However, the supply of tumble plants was the strongest predictor of capture within shrub hummocks, suggesting that tumble plant capture is source limited rather than sink limited. Our structural equation model indicates that increases in grass cover and height were indirectly and negatively associated with tumble plant capture by reducing the tumble plant supply. Contrary to prediction, shrub height and shrub patch area had no overall effect on the tumble plant capture.

Conclusions Overall, we maintain that the capture of tumble plants by shrubs is an important self-maintaining

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