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Summary

1. The vegetation of semi-arid and arid landscapes is often comprised of mixtures of herbaceous and woody vegetation. Since the early 1900s, shifts from herbaceous to woody plant dominance, termed woody plant encroachment and widely regarded as a state change, have occurred world-wide. This shift presents challenges to the conservation of grassland and savanna ecosystems and to animal production in commercial ranching systems and pastoral societies.

2. Dryland management focused on cattle and sheep grazing has historically attempted to reduce the abundance of encroaching woody vegetation (hereafter, **'**brush management**'**) with the intent of reversing declines in forage production, stream flow or groundwater recharge. Here, we assess the known and potential consequences of brush management actions, both positive and negative, on a broader suite of ecosystem services, the scientific challenges to quantifying these services and the trade-offs among them.

3. Our synthesis suggests that despite considerable investments accompanying the application of brush management practices, the recovery of key ecosystem services may be short-lived or absent. However, in the absence of such interventions, those and other ecosystem services may be compromised, and the persistence of grassland and savanna ecosystem types and their endemic plants and animals threatened.

4. Addressing the challenges posed by woody plant encroachment will require integrated management systems using diverse theoretical principles to design the type, timing and spatial arrangement of initial management actions and follow-up treatments. These management activities will need to balance cultural traditions and preferences, socio-economic constraints and potentially competing land-use objectives.

5. Synthesis. Our ability to predict ecosystem responses to management aimed at recovering ecosystem services where grasslands and savannas have been invaded by native or exotic woody plants is limited for many attributes (e.g. primary production, land surface–atmosphere interactions, biodiversity conservation)
and inconsistent for others (e.g. forage production, herbaceous diversity, water quality/quantity, soil erosion, carbon sequestration). The ecological community is challenged with generating robust information about the response of ecosystem services and their interactions if we are to position land managers and policymakers to make objective, science-based decisions regarding the many trade-offs and competing objectives for the conservation and dynamic management of grasslands and savannas.
Key-words: bush clearing, drylands, ecosystem services, shrub encroachment, state change, vegetation change, woody plant encroachment, woody weeds