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Source: Rangelands, 36(2):37-44. 2014.

Published By: Society for Range Management

DOI: <http://dx.doi.org/10.2111/RANGELANDS-D-13-00074.1>

URL: <http://www.bioone.org/doi/full/10.2111/RANGELANDS-D-13-00074.1>

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# Asymmetric Ecological and Economic Responses for Rangeland Restoration: A Case Study of Tree Thickening in Queensland, Australia

By Neil D. MacLeod, Joe C. Scanlan, and Joel R. Brown

## On the Ground

- Ecological and economic thresholds are important considerations when making decisions about safeguarding or restoring degraded rangelands.
- When degradation levels have passed a threshold, most managers figure it is either time to take action or too late to take action depending on the particular circumstances of the case.
- Considerations of ecological responses and thresholds have largely come from rangeland studies involving perennial vegetation with long-lived cycles of causes and effects, whereas thinking on economic responses to management and thresholds have often been informed by studies of weeds and pests in annual pastures and crops where cycles are fairly short and responses to control are generally fast.
- In many cases of rangeland degradation, an asymmetry may exist between opportunities for taking action on the basis of shorter-term ecological signals and where that action will actually yield an economic response, which is often in the intermediate to longer term.
- In many cases the time for economically warranted action is well past the point at which low-cost ecological control options exist, leaving only scope for higher-cost treatments or capitulation.

**Keywords:** ecological thresholds, economic thresholds, rangeland rehabilitation, prescribed fire, timber thickening, ranching, bio-economic modelling.

*Rangelands* 36(2):37–44

doi: 10.2111/RANGELANDS-D-13-00074.1

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Ecological and economic responses and “thresholds” have considerable relevance to sound rangeland management and monitoring, particularly for preventing soil and vegetation degradation or restoring lost productivity once damage has occurred. Both kinds of thresholds relate to points at which some kind of management intervention is either warranted or might no longer be worthwhile, and this is particularly pertinent to the context of brush or timber management. Ecological thresholds reveal deficiencies in land resource management and are well illustrated by state-and-transition models that describe shifts in range condition states with increasing gradients of management pressure or disturbance.<sup>1</sup> Economic thresholds typically involve the interplay of diminishing benefits and increasing costs and draw heavily on the weed and pests management literature for agricultural crops.<sup>2</sup>

When we are working with rangeland resource degradation or rehabilitation issues, the life cycles of perennial plants, times to impact, and feedback from management interventions are usually much longer than the short-term impact and feedback to treatment cycles of weed and pest outbreaks in annual pastures and crops. In this context an asymmetry may exist between appropriate responses for management action on the basis of ecological signals and where that action might yield an immediate economic response. Due to delayed feedbacks in production responses to resource impairment, the case for economically warranted action may be signaled well past the point at which lower-cost ecological management options might exist, leaving scope only for higher-cost interventions or even capitulation.<sup>3</sup> The environmental and economic context and ecological processes are important for addressing such management opportunity asymmetries. At low levels of apparent harm, the ecological response to treatment may be of limited economic value relative to the immediate cost of taking action. Where the level of resource impairment is already severe there may be a positive, but limited, eco-

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