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Guidelines for improved management of riparian zones invaded by alien plants in South Africa

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Abstract

This paper reviews the results of recent research on riparian vegetation recovery following the clearance of invasive alien plants. In Fynbos, Grassland and Savanna Biomes, riparian ecosystems were found to have relatively-high ecological resilience to invasion by alien plants, except in some situations of closed alien stands (75–100% aerial cover). Where alien invasion is the primary disturbance at a site, and invasion intensity is low (<75% cover, with some indigenous species present), the recovery of riparian vegetation structure and functioning is a realistic goal through alien clearance alone. Careful clearance of the aliens to avoid damage to indigenous species, while ensuring a high kill rate for resprouting alien species, is sufficient action to ensure ecosystem recovery. However, it is important that alien follow-up control is maintained at a sufficient frequency and that adaptive management is exercised to deal with unplanned events, such as fire or a high rainfall year, that may stimulate renewed alien recruitment. In closed alien stands, clearance may be sufficient to restore ecosystem structure and functioning in some situations, but not in others. To be realistic, restoration goals must take into account the planned future use of the riparian zone and the current ecological condition of the surrounding catchment area. Where ecological integrity of the catchment is low (highly transformed, fragmented), restoration of natural riparian vegetation structure or composition is untenable in most cases. A more realistic goal will be to restore basic ecosystem functions through providing a vegetation cover, comprising non-invasive (preferably indigenous) species, that is resilient to flood events and re-invasion by alien plants. The functions restored should include the buffering of the aquatic ecosystem through erosion control, and a return to more natural hydrological flows. In less-transformed catchments, restoring riparian ecosystem structure and composition is a realistic goal where closed alien stands are cleared by the "Fell & Remove" treatment. Seed banks provide indigenous herb and shrub species, but where recruitment is poor, especially after fire, active restoration is beneficial in facilitating vegetation recovery and suppressing alien recruitment. However, the costs and benefits of active restoration need to be further investigated. Simple decision trees with accompanying information boxes and species lists are presented to assist managers. Because of the complexity of the decision process, it is recommended that specialists assist project managers in drawing up site-specific restoration plans that dovetail with alien-clearing plans. This synthesis of research findings, on riparian restoration in alien-invaded riparian zones, provides guidelines for improved management, drawing mainly on papers in this Special Issue.

Keywords: Alien vegetation control; Fire; Fynbos; Grassland, Biological Invasions; Restoration; Riparian ecosystems; Savanna; Seed banks

1. Introduction

Worldwide, riparian zones have been degraded on a large scale. In many areas, catchment-scale hydrological modifications and invasive alien plants are among the most influential agents of degradation (Jansson et al., 2000; Holmes et al., 2005; Richardson et al., 2007). Many restoration projects are underway to correct changes to ecosystem structure and functioning caused by alien plant invasions. In South Africa, the primary motivation is to restore hydrological flows in rivers and deliver water benefits to humans, as the major invaders of riparian zones are trees which use more water than indigenous riparian plants and thus reduce water yields from catchments (Prinsloo

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and Scott, 1999; Le Maitre et al., 2002; Dye and Jarmain, 2004). Fig. 1 illustrates different riparian invasion scenarios in South Africa.

A review of the impacts of alien invasion and restoration potential in South African riparian ecosystems, identified both abiotic and biotic constraints to restoration at scales of local reaches to catchments (Holmes et al., 2005). It was concluded that in highly-transformed catchments, interventions at the reach scale (i.e. along short river lengths) may fail if important constraints at the catchment scale are not addressed (see Richardson et al., 2007). Such constraints include altered flow regimes and land-uses in the catchment, which lead to excessive

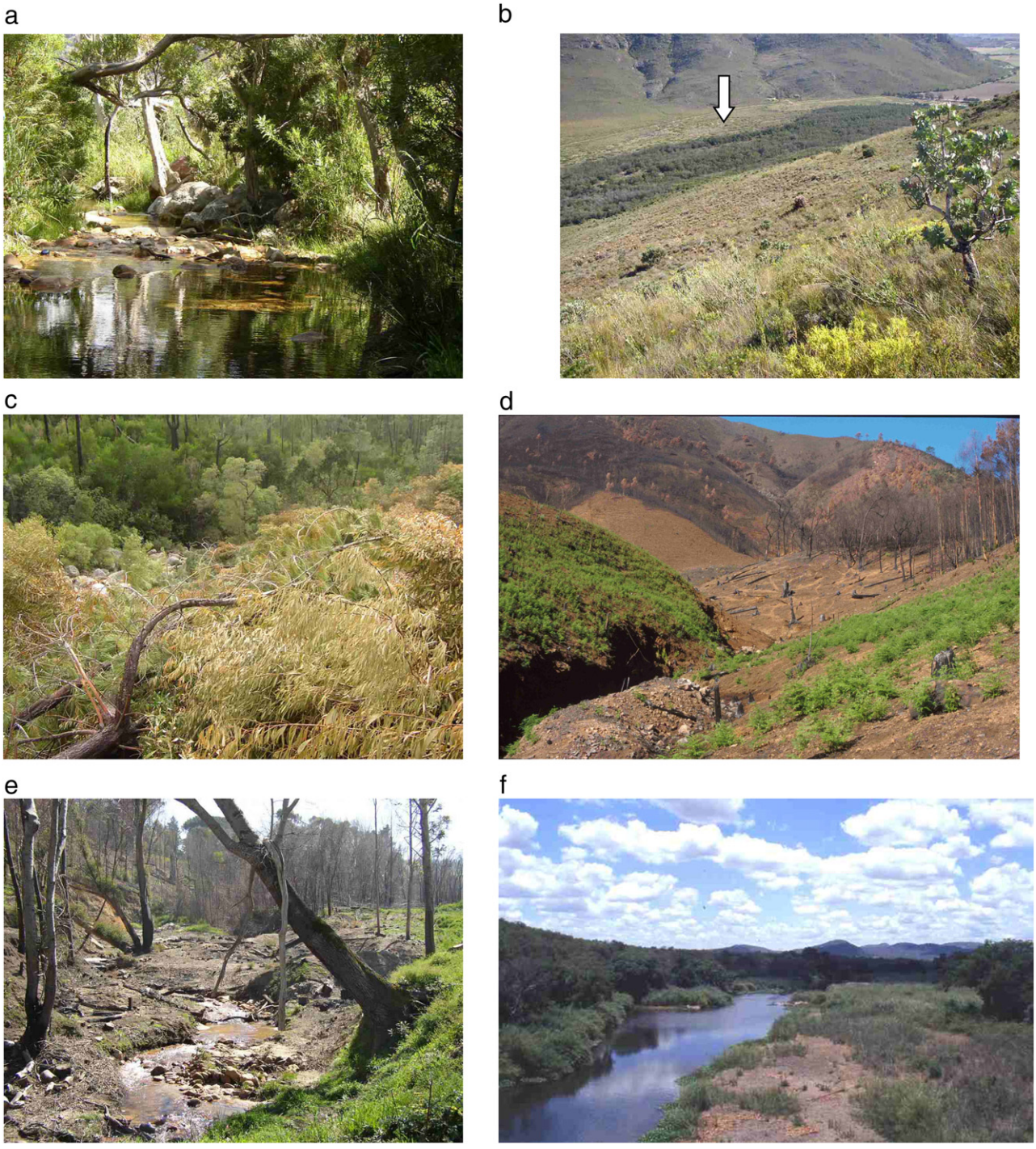

Fig. 1. Fynbos Biome (Western Cape; photo credits P. M. Holmes): (a) native riparian scrub with some forest elements; (b) aerial view of closed-canopy invasion by *Acacia mearnsii* in a foothill riparian area — indicated by white arrow; (c) "Fell Only" clearing treatment of a closed-canopy stand of mixed aliens (near side of stream); (d) riparian zone following a "Fell & Burn" treatment; (e) degraded stream supporting mainly *Eucalyptus* species invasion, after fire; Savanna Biome (Mpumalanga): riparian zone encompassing native riparian herbaceous and woodland vegetation (E.T.F. Witkowski); (g) invasion by *Xanthium strumarium* (T. Morris); Grassland Biome (Mpumalanga); (h) stand of mature *Eucalyptus grandis* adjacent to riparian zone (M. Beater).