Rangeland Ecology & Management xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Rangeland Ecology & Management

journal homepage: http://www.elsevier.com/locate/rama

Original Research

The Soil Seedbank of Pasture Communities in Central Queensland Invaded by *Parthenium hysterophorus* L.☆

Thi L.T. Nguyen [a,b], Ali A. Bajwa [a,*], Sheldon C. Navie [c], Chris O'Donnell [a], Steve W. Adkins [a]

[a] School of Agriculture and Food Sciences, University of Queensland, Queensland, Australia
[b] Faculty of Biology, Department of Ecology and Evolutionary Biology, University of Sciences, Ho Chi Minh City, Vietnam
[c] IVM Group Pty., Varsity Lakes, 4227, Queensland, Australia

ARTICLE INFO

Article history:
Received 11 May 2016
Received in revised form 13 July 2016
Accepted 18 July 2016
Available online xxxx

Key words:
biological invasion
grasslands
parthenium weed
plant diversity

ABSTRACT

A study examining the composition and dynamics of the soil seedbank was conducted at two locations in central Queensland between December 2007 and May 2009. These two grassland communities were infested with parthenium weed (*Parthenium hysterophorus* L.), which had been present at both sites for at least 25 years. During the period of study, the seedbank varied between 5 962 and 16 206 seeds/m^2 at the Clermont site and between 6 795 and 24 862 seeds/m^2 at the Moolayember Creek site. Parthenium weed exhibited a very abundant and persistent seedbank, accounting for 80 − 87% of the seedbank at the Clermont site and 3 − 26% of the seedbank at the Moolayember Creek site. The species richness and species diversity of the seedbank, as well as the seed abundance of several native and introduced species, were higher at the Moolayember Creek site than at the Clermont site. The domination of the seedbanks by parthenium weed, especially at Clermont, suggests that the weed is having a substantial negative impact on seedbanks of native plant communities. The diversity of the seedbank at the Clermont site was found to be lower in comparison with that observed during an earlier study in 1995 − 1996, while the diversity at Moolayember Creek was found to have increased. Hence, the prolonged presence of parthenium weed may have substantially reduced the diversity of the seedbank at the Clermont site, while improved management practices may have increased diversity at the Moolayember Creek site.

© 2016 The Society for Range Management. Published by Elsevier Inc. All rights reserved.

Introduction

The existing vegetation at a site governs the constituents and dimensions of the soil seedbank, which, in turn, significantly affects the structure of the future community at that site (Coffin and Lauenroth, 1989). Moreover, anthropogenic manipulation, environmental factors, and animals also play an important role in reshaping the soil seedbanks (Bajwa et al., 2016). Soil seedbanks are particularly important to the recruitment of species, which reproduce mainly by seeds (Bajwa, 2014; Bajwa et al., 2015a). The weed seedbank ecology plays an important role in weed interference with agro-ecosystems and weed management (Chauhan and Johnson, 2010; Bajwa et al., 2015b). A decline in the density of perennial grasses in pastures often results from overgrazing and, hence, the density of weeds and annual species increases in the community (O'Connor and Pickett, 1992). Such inclinations have been observed in the seedbank of communities subject to overgrazing (Navie et al., 1996, 1998). The studies of annual weed species seedbanks are important in this regard to devise suitable management strategies.

Parthenium weed (*Parthenium hysterophorus* L.), a member of the Asteraceae, is an aggressive herbaceous weed of tropical and subtropical environments that is spreading rapidly around the world (Adkins and Shabbir, 2014; Bajwa et al., 2016). This annual weed has the ability to dramatically reduce the productivity of pastures (Haseler, 1976), affect the well-being of livestock (Narasimhan et al., 1980; Navie et al., 1996), cause serious human health problems (McFadyen, 1992), and be a significant weed of crops (Safdar et al., 2015). In Australia, and especially in Queensland, parthenium weed is currently one of the most important invasive weeds. As parthenium weed reproduces only by seed, its seedbank is an important factor for predicting how its populations will change over time and at what rate (Navie et al., 1996).

Competitive ability enables parthenium weed to become the most abundant species in native ecosystems. In Ethiopia, it was the second most frequent (63%) weed among 102 weed species across 240 crop fields, while 90% farmers ranked it as the most important weed in their region (Tamado and Milberg, 2000). Moreover, it was assessed that parthenium weed had become the most problematic weed in eastern Ethiopia within a very short period of time. In Pakistan, Javaid et al. (2006) found that parthenium weed had become the second most frequent (70%) weed out of 31 local weed species within just 2 years after

☆ Operational funding for this research was provided by the Vietnamese Government (Project 322), Queensland Murray Darling Committee, and University of Queensland.
* Correspondence: Ali Ahsan Bajwa, School of Agriculture and Food Sciences, The University of Queensland, Australia. Tel.: +61 431 194 862.
E-mail address: a.bajwa@uq.edu.au (A.A. Bajwa).

http://dx.doi.org/10.1016/j.rama.2016.07.010
1550-7424/© 2016 The Society for Range Management. Published by Elsevier Inc. All rights reserved.

Please cite this article as: Nguyen, T.LT., et al., The Soil Seedbank of Pasture Communities in Central Queensland Invaded by *Parthenium hysterophorus* L., Rangeland Ecology & Management (2016), http://dx.doi.org/10.1016/j.rama.2016.07.010

its introduction into a fallow landscape. The success was attributed to its fast-growing habit, adaptive and competitive nature, and superior reproduction mechanism (Bajwa et al., 2016). Due to competitive displacement of native species, the overall ecosystem function was negatively affected by parthenium weed. Although there are only a few detailed studies on parthenium weed on the soil seedbank and its interference with other species, the impact on vegetative landscape is vivid. One of the earliest reports was a brief statement by Joshi (1991), indicating that a seed density of approximately 200 000 seeds/m^2 could be found within abandoned agricultural fields in India. More recently, studies have been undertaken in sorghum (*Sorghum bicolor* [L.] Moench.) fields (Hassen et al., 2008) and in grazing lands (Nigatu et al., 2010) in eastern Ethiopia. Parthenium weed affected soil seedbanks' diversity by reducing the native species density (Hassen et al., 2008). In the latter study, the species diversity and evenness of the soil seedbank declined as parthenium weed infestation levels increased. Parthenium weed accounted for 87—91% of the total seedlings that germinated from the soil seedbank of heavily infested sites, 65—70% of seedlings from moderately infested sites, and 25—31% of seedlings from lightly infested sites (Nigatu et al., 2010).

In central Queensland, the parthenium weed seedbank was shown to vary from 3 282 to 5 094 seeds/m^2 (accounting for 47%—73% of the total seedbank) at a site near Clermont, and from 20 599 to 44 639/seeds m^2 (accounting for 65%—87% of the total seedbank) at a site near Moolayember Creek, when assessed on four separate occasions from 1995 to 1996 (Navie et al., 2004). Soil seedbank studies were also conducted at the same sites in 2000 and 2001 (Navie and Adkins, 2001). However, no work on the soil seedbank and the recovery of native species has occurred at these two sites in recent years (i.e., from 2001 to 2009). Therefore, it was deemed necessary to discover what changes had occurred in the soil seedbank in the intervening 10-yr period since the last study, especially after implementation of a long-term management plan at the Moolayember Creek and Clermont sites.

The present study aims to determine the dynamics of soil seedbanks of parthenium weed in two grazed pastures in central Queensland, which have also been studied in this regard previously. The assessment of native community structure and its interaction with parthenium weed was done to estimate the impact and interference magnitude of parthenium weed on pasture communities that will help to devise suitable management strategies.

Materials and Methods

Study Locations

The two locations used in this study were long-standing beef pastures that had been infested with parthenium weed for at least 25 years. For experimental purposes, certain areas were specified and

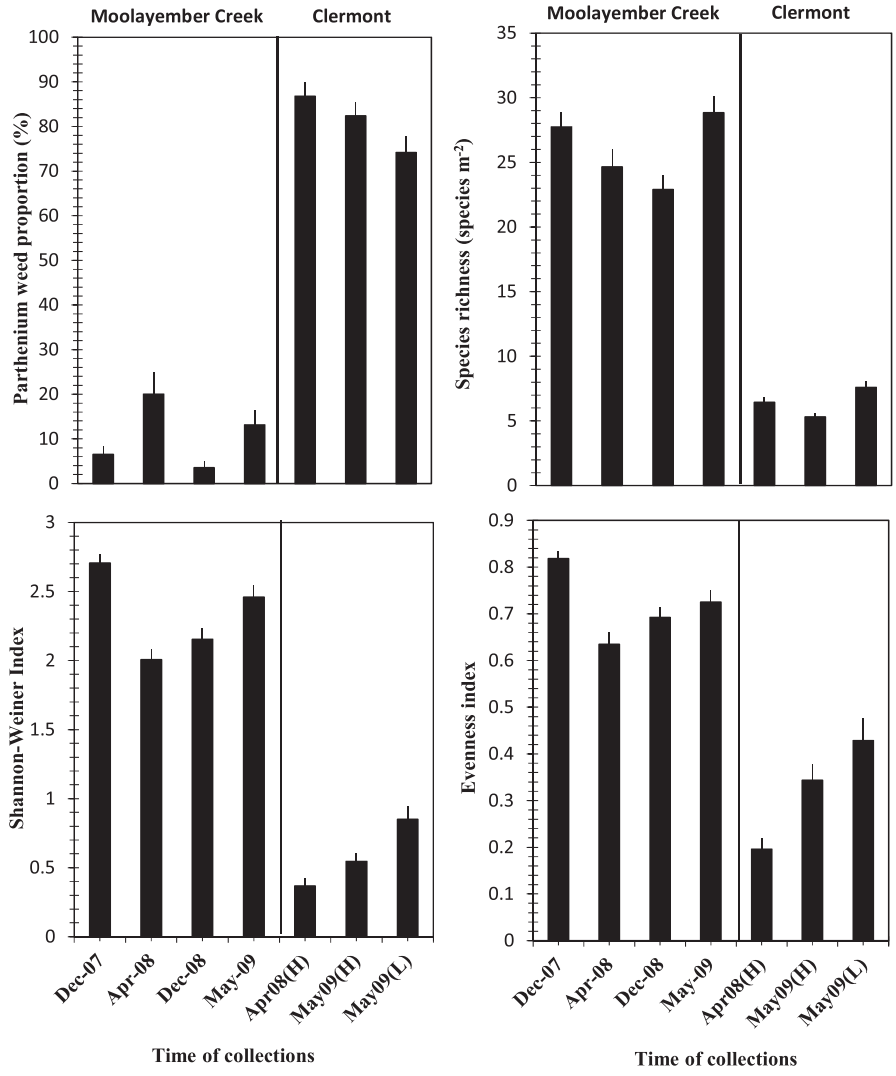

Figure 1. Characteristics of the soil seed bank at Moolayember Creek in December 2007, April 2008, December 2008, and May 2009 and at Clermont in April 2008 and May 2009 (where H = site with high density of parthenium weed and L = site with low density of parthenium weed). Error bars represent the standard error of the mean.

Please cite this article as: Nguyen, T.LT., et al., The Soil Seedbank of Pasture Communities in Central Queensland Invaded by *Parthenium hysterophorus* L., Rangeland Ecology & Management (2016), http://dx.doi.org/10.1016/j.rama.2016.07.010

Download English Version:

https://daneshyari.com/en/article/5745249

Download Persian Version:

https://daneshyari.com/article/5745249

Daneshyari.com