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Research Application Summary

Distribution and potential invasion of *Opuntia* spp. on selected Namibian sites

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Abstract

The distribution, density and size attributes of an alien invasive species, *Opuntia* spp., were assessed on each of north, west, south and eastern communal and commercial farming sites in Namibia. A chemical control trial on this species was carried out with two chemicals, Monosodium Methyl Arsenate (MSMA) and Glyphosate. The density of *Opuntia* in Namibia was found to be sparse. Most populations had a significantly higher juvenile proportion, indicating potential for aggressive invasion of the species. MSMA treatment yielded the best results. Landowners are advised to treat *Opuntia* spp. chemically while densities are still low.

Key words: Monosodium Methyl Arsenate, Namibia, *Opuntia ficus-indica*

Résumé

La distribution, la densité et les caractéristiques de taille d'une espèce envahissante étrangère, appelée " *Opuntia* spp." ont été évaluées sur chacun des sites agricoles commerciaux et communaux du nord, de l'ouest, du sud et de l'est de la Namibie. Une épreuve de contrôle chimique sur cette espèce a été effectuée avec deux produits chimiques, arséniate méthylique monosodique (MSMA) et glyphosate. Il s'est avéré que la densité d' *Opuntia* en Namibie est dispersée. La plupart des populations ont eu une proportion juvénile sensiblement plus élevée, indiquant la possibilité d'une invasion agressive de l'espèce. Le traitement avec MSMA a donné les meilleurs résultats. Des propriétaires fonciers sont avertis de traiter cette espèce chimiquement pendant que les densités sont encore basses.

Mots clés: Arséniate méthylique monosodique, Namibie, *Opuntia ficus-indica*

Background

The arid zones of the world, under which Namibia falls, are geared towards producing sustainable agricultural crops that are tolerant of water shortage, high temperatures and poor soils, as well as easy management to provide food and animal forage for subsistence farming (CACTUSNET-FAO, 2000). *Opuntia* spp., in particular *Opuntia ficus-indica*, fits most of these requirements. Currently, there is on-going research at the Agricultural Research Division in Namibia focusing on the potential of this species as a fodder supplement (Shiningavamwe, 2009).

With this increasing interest in the cultivation of *Opuntia* spp., its impact on the environment, should proper management strategies not be employed, should be of concern. The control and monitoring of *Opuntia* spp. in Namibia is essential in avoiding a similar scenario as that which occurred in neighbouring South Africa's Kruger National Park, where more than 35 000 ha are invaded by *Opuntia stricta* (Foxcroft *et al.*, 2006).

Mapping and density assessments of an alien invasive species are fundamental towards the development of an effective management programme to restrict the spread and negative impacts of such a species (Jacobi and Warshauer, 1992). In Namibia, the invasive species have been observed (Strobach *pers. comm.)* to be growing in areas other than where they have been cultivated. Moreover, no control measures over the spread of alien species in both privately-owned and communal areas exist (Barnard, 1998). This warranted an investigation into the extent to which *Opuntia* spp. are encroaching on especially grazing areas in Namibia. The current study assessed the distribution, density and size attributes of *Opuntia* spp. plants on Namibian farming sites.

Literature Summary

Opuntia species are a massive threat to the ecological functioning of natural systems and the productive use of land (Henderson *et al.*, 2001), as they compete aggressively with indigenous plants for water and nutrients (Venter, 2002). The spines and acidic succulence of the cladodes mutilate wild and domestic animals, while the fruits' covering of fine hairs may scour out the digestive system of healthy animals, rendering a diarrhoeic effect (van Sittert, 2002).

The invasion of *Opuntia* spp. can also have the effect of reducing carrying capacity and land values. Large parts of Namibia still have natural or semi-natural vegetation where

ecosystems continue to provide 'goods and services', thereby improving human lives. The presence of these invasive species may ultimately affect the capacity of these systems to provide these goods and services by altering the ecological functioning (Richardson and Van Wilgen, 2004). As approximately 70% of Namibia's population is involved in subsistence agriculture and livestock husbandry (Smit, 2005), any form of land degradation poses an acute challenge to rural livelihoods, undermining ecosystem integrity.

Study Description

The distribution, density and plant size attributes of *Opuntia* spp. was assessed on communal and commercial farming sites in Otjozondjupa (north), Erongo (west), Hardap (south) and Omaheke (east) regions. *Opuntia* spp. populations were obtained through road drives, field searches, and questionnaires to farmers. In each designated study area, $100m^2$ plots were demarcated around clumps of *Opuntia* species. Each individual plant or cluster was scored according to height class (1 being shortest >1m and 4 the tallest <4m), as well as cochineal infestation (1 being the least infestation of 0% and 4 the highest infestation of >75%). Density (D) was calculated for each site as D= [number of plants/ area (m^2)] x 10 000.

Distribution maps were generated in ARCGIS from the GPS recordings obtained at the various sites. Density patterns were compared with rainfall data from the various sites. For chemical treatments three replications were employed with three treatment factors: no treatment, glyphosate and MSMA. The stems of plants, and cladodes on the ground, were sprayed with a solution made up of three different concentrations of MSMA and Glyphosate. Height class and density data were run in SPSS, to test for significance.

Research Application

The distribution of *Opuntia* spp. in Namibia is sparse, since 85% of the sites studied had D<10 000 plants/ha and only 15% had D>10 000 plants/ ha. Most populations occur either as isolated plants or scattered small satellite infestations. Of all populations studied, 75% had high proportions of juveniles compared to adults, with more than 75% of plants less than 1m. This is an indication that these populations are expanding and hence pose a potential for aggressive invasion. Density did not significantly increase ($p>0.05$) with increasing rainfall patterns as predicted. MSMA at 0.05% concentration yielded 100% mortality by 8 weeks, while the same concentration of Glyphosate at 8 weeks yielded only 60% mortality.

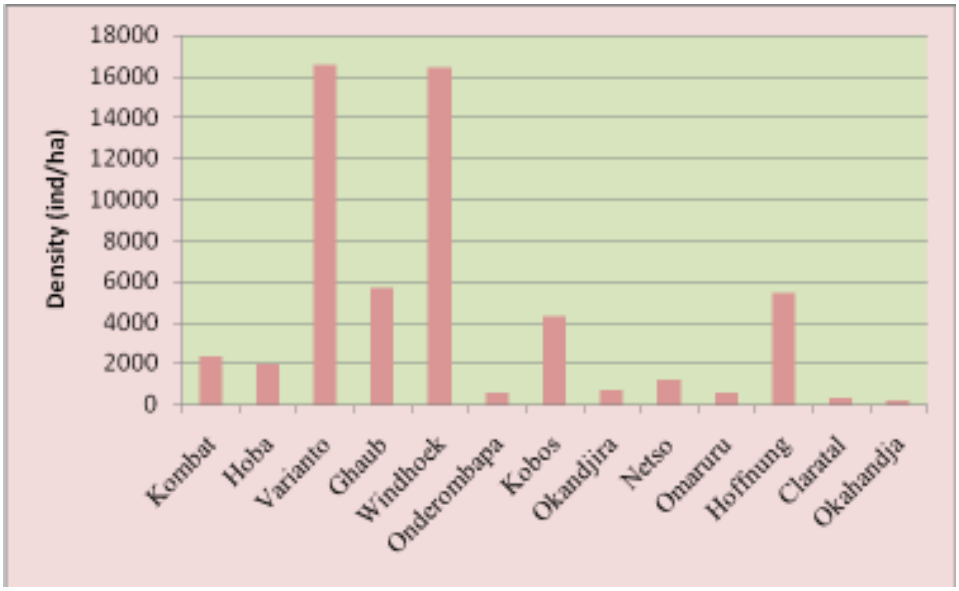

Figure 1. The density (/ha) of Opuntia plants in the selected study sites.

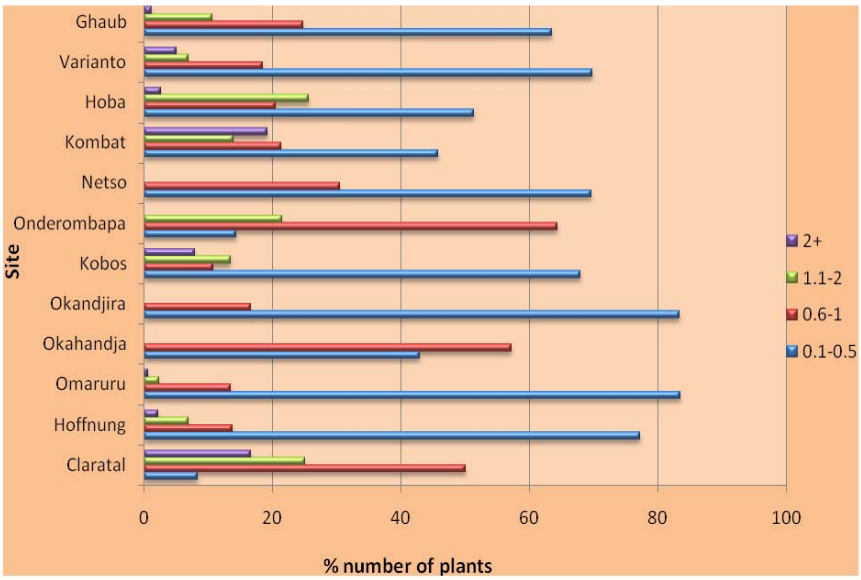

Figure 2. The percentage number of *Opuntia* plants in each height class in the different.

Recommendations

Even though the densities of *Opuntia* spp. are low, the species might transform from being less to aggressively invasive if proper measures are not implemented to control their distribution. Landowners should acquire MSMA and treat these *Opuntia* spp. populations while densities are low and chemical control is still viable.

Acknowledgement

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