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# Expansion of the exotic grass *Bothriochloa pertusa* on the Basalt of the Burdekin catchment

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## Introduction

The basalt is an area of productive grazing country north and west of Charters Towers. Graziers regard it as a resilient land type and pasture community (*Bothriochloa spp.* and *Heterpogon contortus*) that recovers well from grazing and drought. *Bothriochloa pertusa* is an introduced, grazing adapted, stoloniferous, pasture grass that has expanded from initial introductions in the Bowen region in the mid 1900's (Bisset 1980). Graziers and extension staff, who long attributed the *B. pertusa* expansion to overgrazing, are now reporting the species expanding under all grazing regimes in spite of what they believe are sound grazing practices. This is a concern as *B. pertusa* with its shallow root system allows less water infiltration than tussocking native species (Bartley et.al. 2014) and is considered by graziers as a less productive pasture plant. This paper reports the changes in *B. pertusa* over a 19 year period on a suite of long term monitoring sites on the basalt soils in the upper Burdekin catchment.

## Methods

Sixteen QGraze monitoring sites situated on basalt derived soils or soils with similar properties in the basalt country Northwest of Charters Towers were the subject of the study. The QGraze program was initiated in Queensland in 1991 to track changes in pasture condition on grazing lands. In April and May 2014 the QGraze methodology was used to measure species frequency, 3P indicators (*Bothriochloa bladhii*, *Bothriochloa ewartiana*, and *Heterpogon contortus*) frequency, and percent ground cover. In addition *B. pertusa* cover data was collected. Data from the 2014 recordings was compared with the site data collected by QDAFF staff in 1995.

A survey of graziers managing the properties upon which the QGraze sites are situated was also conducted. Questions asked included whether *B. pertusa* occurred on their property, when and where it first appeared, what factors they believed could be facilitating expansion and information on management practices such as stocking rates, grazing systems, pasture resting and fire regimes.

Comparative analysis was undertaken for *B. pertusa*, *H. contortus* and 3P *Bothriochloa* frequencies in 1995 and 2014. Relationships were explored between combined 3P Indicators (*B. bladhii*, *B. ewartiana* and *H. contortus*) frequency (2014) and *B. pertusa* frequency (2014), *B. pertusa* as a proportion (%) of organic groundcover (2014) and *B. pertusa* frequency (2014).

## Results

### Frequency

*B. pertusa* was not recorded at any of the 16 sites in 1995. However in 2014 *B. pertusa* was recorded at all sites with a mean frequency of 74% (Figure 1). The site with the lowest *B. pertusa* frequency is one colonized in the past few years. *H. contortus* was recorded at 15 of the 16 sites in 1995 with a mean frequency of 22%. In 2014, *H. contortus* was recorded at all 16 sites with a mean frequency of 43% (Figure 1).

3P *Bothriochloa* (*B. bladhii* and *B. ewartiana*) was recorded at 15 of the 16 sites in 1995 with a mean frequency of 18% but by 2014 was recorded at only 12 of the sixteen sites with a mean frequency of 23%. Of these 12 sites there was a substantial increase in frequency at four sites, a large decrease at two sites and little change at the remaining six.

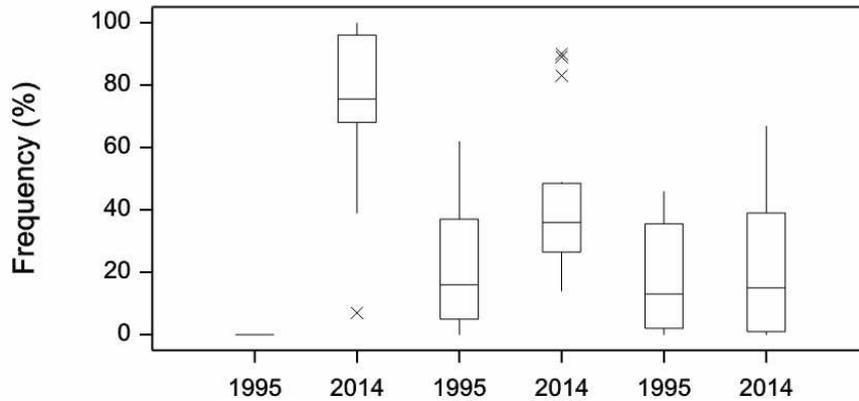


Figure 1. Box and whisker plot of the frequency (%) of *B. pertusa*, *H. contortus* and 3P *Bothriochloa* spp. across sixteen QGraze sites in 1995 and 2014.

#### Cover

Between 1995 and 2014 mean organic ground cover increased from 45% to 73% (Figure 2). *B. pertusa* was not recorded at any of the 16 sites in 1995, but by 2014 *B. pertusa* had increased to an average of 26% with some sites up to 56% (Figure 2). Averaged over all sites *B. pertusa* contributed over 33% of mean organic groundcover.

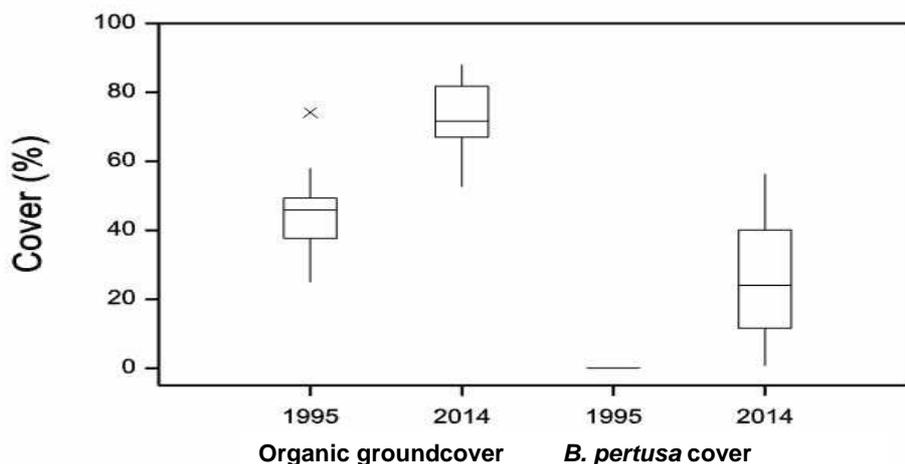


Figure 2. Box and whisker plots of organic groundcover (%) and *B. pertusa* cover (%) across sixteen Q Graze sites in 1995 and 2014.

## Relationships

As *B. pertusa* frequency increased, the indicator species frequency decreased exponentially. The rate of decrease was slow for the lower frequency values of *B. pertusa*, but increased rapidly for *B. pertusa* frequencies above 60% (Figure 3a). Conversely as *B. pertusa* frequency increased the proportion of *B. pertusa* cover increased exponentially (Figure 3b).

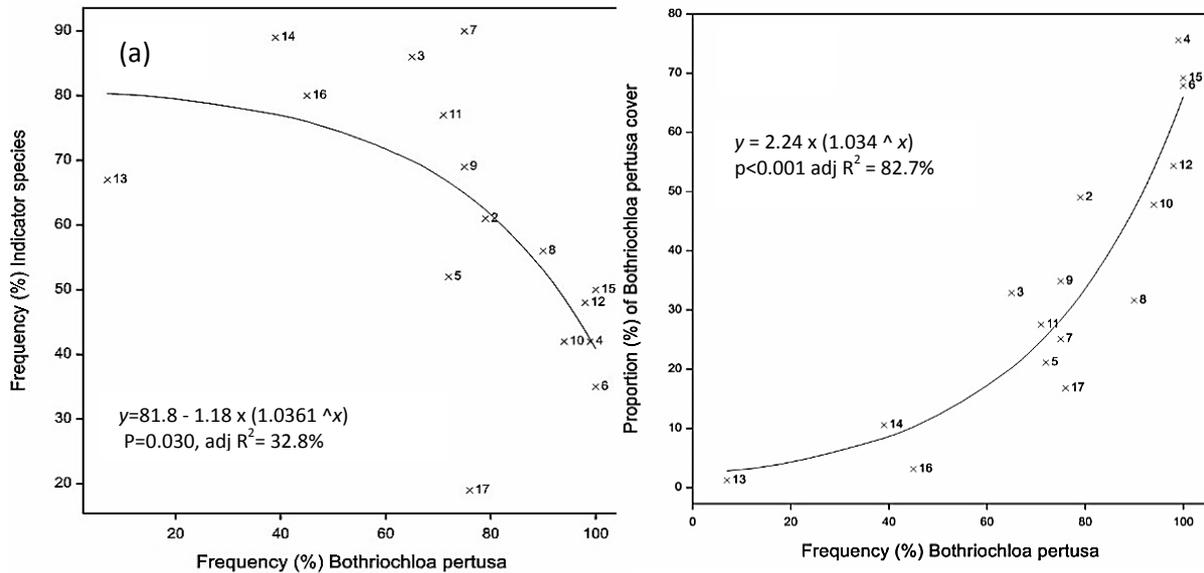


Figure 3. Relationship between (a) the indicator species 3P *Bothriochloa spp.* and *H. contortus* frequencies and the frequency (%) of *B. pertusa* and (b) *B. pertusa* frequency (%) and proportion of groundcover that is *B. pertusa*. All data for 2014.

## Discussion

There was a large increase in *B. pertusa* frequency across all sites from a complete absence in 1995 to a mean frequency of 70% in 2014 with the majority of these sites having very high frequencies of *B. pertusa*. The fact that *B. pertusa* has an average cover of 26% and contributes 33% of organic cover, indicates that the species is well established as a major component of the pasture at these sites.

While *B. pertusa* was not recorded at any sites in 1995, graziers report that it was present on some roadsides earlier than this date. However in a later 1999 survey, *B. pertusa* was present at low frequencies (<13%) at 7 of 12 sites. These low level establishments would have been the source for further expansion when conditions were favourable. Although there is a 15 year gap in QGraze recordings that could have documented the stages of *B. pertusa* expansion, grazer observations go some way to fill this gap.

The earliest grazer report of *B. pertusa* being present on their property is in the early 1980's while the most recent is in the 2000's. It is noteworthy that the site with the highest frequency of *B. pertusa* (100%) is situated on the property with the earliest reporting of *B. pertusa* while the site with the lowest frequency (7%) is on the property with the most recent reporting. Both these sites are on heavily grazed black vertosol plains, suggesting that heavy utilization and time are drivers of *B. pertusa* dominance.

The graziers surveyed describe an expansion “beginning along roads and expanding into disturbed and heavily grazed areas”. While the long term, whole of property, stocking rates reported by graziers are within the range suggested by extension staff, graziers acknowledge that overgrazing events occur. Overgrazed areas were the result of long term preferentially grazed areas, short term over grazing following fires and lack of rainfall. Graziers are now report *B. pertusa* spreading into “naturally bare areas and interplant spaces in seldom grazed areas”.

While there has been a considerable increase in *B. pertusa* frequency at the sites there has also been a large increase in the frequency of *H. contortus* and 3P *Bothriochloa* spp. There may be a combination of reasons for this increase in 3P species;

- The recordings in 1995 occurred in the middle of a significant drought and 3P species were reduced by seasonal conditions and grazing. The above average rainfall in 2007 – 2011 would have been conducive to 3P recruitment and the resultant increase in 2014.
- Many graziers improved management following the degradation that occurred during the 1980’s and 1990’s droughts.

In spite of the increase in frequency of 3P indicators, the data suggests that a threshold exists of 60 – 80% *B. pertusa* frequency, beyond which the decline in 3P indicator species accelerates. This is also the threshold beyond which the *B. pertusa* proportion of organic groundcover increases exponentially. This could indicate a threshold of *B. pertusa* below which it may be possible to retain the benefits of both native 3P’s and *B. pertusa*.

The expansion documented here is consistent with the findings of Howden (1988) who suggested *B. pertusa*, because of its ability to outcompete 3P natives would increase under all grazing regimes, though the biggest expansion would be under the heaviest grazing. Significant increases in *B. pertusa* have occurred over the past 20 years and with an available seed source, disturbed ground, weakened 3P species and seasonal conditions conducive to establishment the continuing increases can be expected. If managers wish to graze in an environment not dominated by *B. pertusa* grazing management that favours the regeneration of native 3P’s will thus be required.

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