LONG-TERM ASSESSMENT OF TROPICAL ARID GRASSLAND IN THE FORTESCUE VALLEY FLOODPLAIN, PILBARA, WESTERN AUSTRALIA

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ABSTRACT

Perennial and annual grass densities and cover (more so) have fluctuated with rainfall since 1993 but have generally increased. Low mean density and cover values have eventuated in years with low summer rainfall. Flooding also plays a role in determining pasture condition. Some perennial grass species have the ability to form butts and appear to be capable of regrowth from apparently moribund butts after flooding. Areas that have experienced flooded conditions have shown increases in perennial and annual grass density and cover. This study has demonstrated that grass cover is mainly determined by rainfall.

INTRODUCTION

Generally, prolonged periods of low rainfall and localised overgrazing can result in a decline in annual and perennial species on floodplains. Many perennial and annual grass species are thought to be reliant on certain levels of minimum rainfall and (or) flooding for germination, establishment and growth. The Pilbara climate is arid, with high summer temperatures and low mean annual rainfall. Long-term means (1981-2003) for summer (Dec-Apr) and annual rainfalls are 246.3 and 313.2 mm for Ethel Creek station and 333.3 and 389.9 mm for Marillana station. A study was conducted by the Mulga Research Centre (1993-2003) to assess seasonal vegetation changes downstream of the Ophthalmia Dam along the Fortescue River floodplain on Ethel Creek, Roy Hill and Marillana stations.

MATERIALS AND METHODS

Sixty permanent plots were established, covering the floodplain of the upper Fortescue River north of Newman in the Pilbara and adjacent areas as controls. Land use is cattle ranching, most plots are on Ethel Creek, Marillana (100 km north-west of Ethel Creek) and Roy Hill (north of, and adjacent to, Ethel Creek) stations. Data from four representative regions of the 11 sampled in the area have been used in this paper. These are Jackson's Bore (8 plots); Grasslands (7 plots, 2 plots from 1996); Roy Hill Junction (4 plots), and Marillana (6 plots). Ground cover vegetation assessment involved recording the density (number of live individuals rooted within the quadrat) and percentage cover (the sum of projective foliage) of all species within continuous 1 sq m quadrats along two 25 m transects at each plot. For Ethel Creek and Roy Hill plots, long-term summer rainfall means were calculated using Ethel Creek rainfall data; the means for Marillana plots were calculated using Marillana rainfall data.

RESULTS

Over the period 1993-2003, summer rainfall was lowest in 1993, 1994 and 1998, and was slightly higher than the long-term summer mean (1981-2003) between 1995 and 1997; summer rainfall in 1998 was very low (<70 mm). During 1999 and 2000, summer rainfall levels were the highest in more than 50 years at Ethel Creek (648.5 and 670.2 mm respectively) and Marillana (747.7 and 790.8 mm respectively). Since 2001, summer rainfall has continued to be above the long-term summer mean, although substantially less than that recorded in the previous two years.

Perennial grass densities and cover have varied among regions. Substantial declines in density and cover values were observed in the lower rainfall years, especially in 1998. Increased summer rainfall in 1999 produced substantial increases in perennial grass cover at all regions in that year. In 2000, cover increased at Jackson's Bore and Roy Hill Junction but decreased at Grasslands and Marillana. Mean perennial grass cover was lower in 2001-2003. Mean perennial grass density peaked in 2003 at

Grasslands and Jackson's Bore despite lower mean summer rainfall than in 1999-2002. Density values were lower at Marillana and Roy Hill in 2003. Dominant perennial grass species observed were *Eriochloa pseudoacrotricha* (Jackson's Bore), *Leptochloa digitata* (Jackson's Bore), *Eriachne benthamii* (Grasslands), *E. flaccida* (Grasslands), *Astrebla pectinata* (Grasslands), *Eulalia aurea* (Marillana) and *Panicum decompositum* (Jackson's Bore).

Annual grass density and cover were better correlated with rainfall than perennial grasses. Mean density remained low in the low summer rainfall years 1993-1994, 1996 and 1998, and higher densities were noticeable in 1995 and 1997 after slightly higher rainfall. In 1999, annual grass cover increased substantially at all regions and remained high in 2000 following continued high summer rainfall. Mean cover declined in 2001, coinciding with lower rainfall, and remained low to 2003. Dominant annual grass species observed at various regions were *Dichanthium sericeum* (Jackson's Bore; Roy Hill Junction), *Eragrostis tenellula* (Jackson's Bore; Roy Hill Junction; Marillana), *Panicum laevinode* (Jackson's Bore), *Iseilema membranaceum* (Jackson's Bore) and *Chloris pectinata* (Roy Hill Junction).

DISCUSSION

Perennial and annual densities have fluctuated with rainfall but values have generally increased since 1993. Low mean density and cover values prevailed prior to 1999, especially in years experiencing below mean summer rainfall. Australian native grasses generally require a high water potential in order for germination to occur (Maze *et al.*, 1993). Very high summer rainfall levels in 1999-2000 increased density, and cover more so, compared with other years. Since 2001, summer rainfall has continued to exceed the long-term summer mean, although at substantially lower values to those experienced in 1999-2000. Grasses generally respond rapidly to favourable rain and deep-rooted tussock grasses can retain green foliage for up to ten weeks (Hunter and Melville, 1994). Annual grasses demonstrate seasonal sequences and are more opportunistic, while perennial grasses can persist through the year as green plants pending moisture availability (Xin *et al.*, 1996).

Rainfall *per se* is not the only factor involved in the variation in grass density, cover and health. Rainfall intensity and resultant flooding also affect grass growth, survival and renewal. Observations following prolonged flooding in 1995 suggest that flooding can result in negative effects on the health of longer-lived perennial grass species. However, flooding can be beneficial. In 1995 and 1997, several areas experienced short-term flooding following rainfall above the long-term summer mean. As a result, density and cover increased slightly at most regions. Some species of perennial grass (e.g. *Chrysopogon fallax, Eriachne benthamii* and *Panicum decompositum*) form butts in low rainfall years and appear to be capable of regrowth from apparently moribund butts in favourable conditions (such as after flooding). Areas on Ethel Creek, Roy Hill and Marillana have been overgrazed (high stocking rates) in the past (Payne and Mitchell, 1992). Effects have been compounded with low rainfall years and lack of flooding. More recently, lower stocking rates and higher rainfall have coincided with improved pasture growth. The study has demonstrated that grass cover is determined by seasonal rainfall patterns.

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