



**Grassland community  
dynamics of a  
freshwater tropical  
floodplain: Invasion of  
*Brachiaria mutica* (Para  
grass) on the Magela  
floodplain, Kakadu  
National Park**

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GRASSLAND COMMUNITY DYNAMICS OF A  
FRESHWATER TROPICAL FLOODPLAIN: Invasion of  
*Brachiaria mutica* (Para Grass) on the Magela Floodplain,  
Kakadu National Park.

By

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### ***Declaration***

I certify that the work described in this thesis has not been submitted for any other award or degree. I certify that any help in the preparation of this thesis and all sources used have been acknowledged.

Nunzio John Alexander Knerr

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I dedicate this thesis to the memory of Dr George E. Hollis, whom I was fortunate enough to meet on his first and last visit to Australia, in respect of his lifetime dedication to the conservation of the world's wetlands, one of our most valuable ecological resources.

## **Abstract**

The Magela floodplain in Kakadu National Park is occupied by several different grassland communities each of which is flooded annually in the tropical wet season. Data collected in this study adds to the understanding of vegetation dynamics on the floodplain and provides essential information for the management of the introduced plant species, *Brachiaria mutica*, in this ecosystem. The species composition and abundance of the extant vegetation in four grassland communities (*Brachiaria*, *Oryza*, *Hymenachne* and *Pseudoraphis* grasslands) were examined in the dry and wet seasons of 1995-96 in order to examine spatial and temporal changes. The area covered by each grassland community in the southern section of the Magela floodplain was mapped. The change in distribution of *Brachiaria mutica* was estimated by detailed mapping of the most heavily infested area in 1996 and by interpreting aerial photographs of the same area taken in 1991. In addition, the spatial variation of seeds in sediments was studied through a sediment germination trial. Data generated from this experiment was compared to a previous sediment germination trial conducted in 1984. The experimental design allowed both within and between study site variations to be detected in germination from the seed banks. The potential seed production of the grass species that dominate the floodplain were estimated (*Brachiaria mutica*, *Oryza meridionalis*, *Hymenachne acutigluma* and *Pseudoraphis spinescens*). Seed germinability and viability of these species was also assessed by a direct germination trial and tetrazolium chloride tests. The density of *Brachiaria mutica* and *Oryza meridionalis* seeds in the sediments was estimated by direct seed counts from soil cores.

Distinct changes in species composition and abundance of the grasslands were found between wet and dry seasons. Species richness and diversity in the extant vegetation was highest in the *Hymenachne* grassland. The *Pseudoraphis* and *Oryza* grasslands had low species richness and diversity in the dry season and this increased significantly in the wet season. *Brachiaria* grassland had the lowest species richness and diversity of all grasslands. *Pseudoraphis* grassland covered the greatest area of the floodplain followed by

*Oryza*, *Brachiaria* and *Hymenachne* grasslands. The *Brachiaria* grassland was found to increase in area by 290ha in the most heavily infested area over 5 years and a corresponding decrease in the *Oryza* grassland was found.

Sediment samples were found to have heterogeneously distributed seeds. Many aquatic taxa emerged from the sediments and low numbers of grass seeds germinated. Distinct differences in the seed banks of each community were found. *Brachiaria* and *Hymenachne* grasslands contained more species rich seed banks than the *Pseudoraphis* and *Oryza* grasslands. This was attributed to the growth form of the species that dominate the former communities. Species composition of the *Brachiaria* grassland seed bank was more similar to that of the *Oryza* grassland than other grasslands, indicating that the latter community is being invaded. Comparisons of seed banks between 1984 and 1996 gave varying results, indicating that the seed banks of these grasslands are dynamic. Differences in the proportions of individual species found to emerge in each year were attributed to differences in methodology between the studies and variation in rainfall in the years leading up to sample collection for each study, as this factor effects seed production.

*Brachiaria mutica* was found to have the greatest potential seed production followed by *Hymenachne acutigluma*, *Pseudoraphis spinescens* and *Oryza meridionalis*. These differences may be due to the growth forms and habit of these species. Seeds of *Hymenachne acutigluma* had the highest germinability compared to other species. No *Pseudoraphis spinescens* seeds germinated and this species had the lowest seed viability (tetrazolium test) of all species. *Oryza meridionalis* and *Brachiaria mutica* were both found to have low germinability but high viability indicating that these species have some seed dormancy mechanism. Seed counts from soil cores indicated that *Brachiaria mutica* contains a considerable seed bank in the sediments below the community in which it occurs. Hence, the eradication of *Brachiaria mutica* from the Magela floodplain may be impossible, therefore, it is suggested that management efforts should be directed toward restricting *Brachiaria mutica* to areas already invaded.

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