The landscape ecology of para grass (*Urochloa mutica*) on a monsoonal wetland of Kakadu National Park, NT Australia

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Summary This study applied remote sensing, ground data and historical maps to monitor and understand the dynamics of para grass (*Urochloa mutica* (Forssk.) T.Q.Nguyen) spread in relation to key habitat features (water depth, fire history and native vegetation) on the 225 km^2 Magela Creek Floodplain within Kakadu National Park. Maps of these features were produced from Medium- and High-Spatial-Resolution (HSR) satellite images (Landsat 5 TM; and Ikonos, Quickbird or Worldview 2).

A trend of increasing para grass cover and patch connectivity was apparent from maps produced from HSR images for a selected 42 km^2 area, captured biennially from 2001 to 2010. Yet spatial variability, between-years, was high. An uncharacteristic net decline in para grass was also measured for 2004. The average annual increase in para grass was estimated by linear regression to be 55.4 ha when data were included with historical para grass maps for 1992 and 1998, with the exception of the 2004 outlier (R^2 0.96, $p = 0.0003$, $n = 6$). Para grass occupied 1308 ha of the total floodplain area as mapped by Landsat in 2006 and, compared to a map of the floodplain for 1986, had primarily displaced native *Oryza* and *Hymenachne* grassland.

As determined by two-way analysis of variance, the spatial dynamics of para grass was strongly associated with water-depth (i.e. shallow, moderate and deep categories: ≥1.15 m, >1.15 to <1.45 m, and ≥1.45 m) and fire in the previous dry season ($F_2 = 370$, $p < 0.0001$). For example, in flood-years following fire, para grass cover declined in the 'shallow' and 'moderate' depth habitats, but increased in 'deep' habitat compared to unburnt areas.

Medium- and HSR remote sensing provide essential information for applied research and adaptive management of site- and time-specific management strategies for para grass. This information is also likely to improve the sensitivity of spread prediction models for para grass as defined by vegetation type, ecohydrology and fire; and be useful for development of weed management strategies on monsoonal wetlands, generally.

Keywords *Urochloa mutica*, para grass, remote sensing, monsoonal wetlands, ecohydrology, habitat mapping, conservation management.