4 Environmental characteristics

Spatial information available to represent the different environmental characteristics that can potentially influence the distribution of environmental threats and assets in the region are listed in this section (and summarised in Table 2).

Differentiating the natural physico-chemical attributes of the landscape on spatial and temporal scales is important to developing an understanding of the processes that contribute to the ecological processes and character of the floodplain environment. Current and future patterns in the distribution of exotic weed incursions, native vegetation communities, and freshwater ecosystems can often be explained by the processes limiting their distribution, for example. However, there is a general paucity of information on physico-chemical attributes of tropical floodplain wetlands as they relate to key ecological processes and functions (Finlayson 2005). Information gaps and uncertainties need to be addressed at a local landscape scale in the context of defining natural environmental attributes and physico-chemical processes underpinning floodplain ecology. A more complete understanding of these attributes would be beneficial to refining predictive spatial models for weeds risk assessment and management, for example, and would also assist in the strategic planning and management of natural resources in the region, generally.

Currently, there is insufficient information on spatial and temporal hydrological dynamics and bathymetry of the Magela floodplain in relation to period of inundation, water depth, and flow rate profiles. While these can be modelled from historical gauge records and digital elevation data (DEM), there are notable data quality issues associated with this method- the available DEM is generated from stereo aerial photography where height is determined from surface features (vegetation), and not from actual (and often submerged) ground height. Similarly little or no information outlining spatio-temporal distribution pattern of specific traits exist (pH, nutrients, salinity, redox potential). Although we can generalise that the whole Magela floodplain soils are black-cracking clays, this is inadequate when defining the local regions (and management units) required for strategic risk management. Some information exist on seasonal changes in water quality (in lowland billabongs of the Magela), but this has not been translated at an appropriate spatial scale to the entire floodplain (Walker & Tyler 1982). Information on the spatial change in water salinity, conductivity and pH may also contribute to an understanding of the distribution patterns of vegetation communities. Therefore a longitudinal study of the floodplain defining these traits at an appropriate scale would be beneficial to the management of landscape assets of the Magela floodplain as well as defining spatial units for management of ARR wetlands, generally.

4.1 Topographic elevation data

Topographic elevation information is a key physical factor influencing the ecosystem processes that define different habitats, such as the availability of water, geo-morphological landform, and the dynamic flows of surface and ground water. Elevation data can be used also to delineate the major geomorphic land systems KNP of which there are three: the Arnhem Land plateau; and two lowland systems, the undulating Cainozoic plain, and the sub-coastal/coastal Holocene floodplains, of which the Magela floodplain is a component. A Sub-meter DEM, standardised to ADH and covering the majority of the Magela floodplain has been produced. It is hoped that a detailed history of floodplain inundation patterns can be derived when using these data in conjunction with hydrological data recorded from floodplain gauge-boards (also standardised to ADH).

4.1.1 Digital elevation data of the Magela floodplain downstream of the Ranger uranium mine

The DEM developed for the ecological risk assessment of Magela was produced by merging two data sources standardised to AHD: 1) DIGO Level 2 Digital Terrain Elevation data (provided as ESRI GRID); and 2) a higher-resolution dataset produced by AUSLIG for eriss from aerial photography covering most of the Magela floodplain generated at 30 m horizontal resolution. The resulting dataset has provides continuous coverage over the Magela floodplain, with higher accuracy in low relief areas with surrounding terrestrial woodland and floodplain fringes provided at lower resolution. Vertical accuracy is believed to be in order of ± 0.2 m for the higher resolution component (covering most of the low-relief floodplain area), with the surrounding terrestrial woodland area having an absolute vertical accuracy of ±30 m linear error at 90%.

The full metadata report for this dataset is provided in Appendix 1.12.

4.2 Fire history

Fire histories for the region are an important resource for park managers in determining the success of prescribed burning practises in facilitating conservation of biological diversity, or preventing fire in critical areas such as sites of cultural significance. Fire is also an important disturbance factor influencing establishment or attrition of different plant species. In floodplain environments an absence of fire has been implicated in both reducing the diversity of wetland habitats, as well as in restricting access to traditional hunting areas (Boyden et al 2003). Consequently, it is an important consideration for the management of both threats and assets in the region. Cumulative probability estimates of early and late dry season fires for Kakadu and the Magela floodplain regions are illustrated in Figures 22–25.

4.2.1 Remote sensing fire-scar mapping of annual 'early' and 'late' dry season burning for Kakadu National Park (1980–2004) and adjoining West Arnhemland (1995–2006)

The fire history of Kakadu and adjoining west Arnhem Land provides broad scale annual mapping of both early (April–July) and late dry season (August–end-of-dry-season) fire-scars as derived from satellite remote sensing. The two regions, Kakadu and west Arnhem Land, are kept as separate datasets. The Kakadu dataset provided continuous annual monitoring for the period 1980 to 2006, while the adjacent area in western Arnhem Land provides continuous monitoring for the period 1995 to 2006. The regional monitoring program continues at the time of this publication, and fire-scar mapping is compiled and updated annually by the Fire Research Unit of the Bush Fires Council of the NT. Detailed documentation of the datasets is provided in Russell-Smith and Ryan (1994), Russell-Smith et al (1997), Gill et al (2000) and Turner et al (2002).

Fire-scar history is interpreted from satellite imagery captured at strategic times to determine the frequency and extent of early and late dry season burning. Fire scars were interpreted from Landsat MSS satellite imagery (56x78 m pixel resolution then re-sampled to 100 x 100 m) for the period 1980 to 1995. From 1996 to 2004 data are derived from Landsat TM/ETM (30 m x 30 m re-sampled to 25 m x 25 m). For the west-Arnhem Land component derivation of fire-scars was from Landsat TM, MODIS and AVHRR. Coarser resolution AVHRR (1.09 km2) and MODIS imagery were substituted for the LDS captures for the periods 1995–2001, and

2002–2004, respectively. The resolution of these data is coarser (200 x 200 m pixels), although it can still be used to reliably detect areas where fire has occurred.

For any one year, mapping of 'Early' and 'Late' dry season burning is undertaken. Early fires (EDS) are defined as fires occurring from May to July. For this period imagery is captured at least twice to address the potential problem of under-sampling, where fire-scars can be missed, unless a suitable number image capture times are used (Russell-Smith et al 1997). Late burns (LDS) are defined as fires occurring from August onwards and are derived from a at least one capture time, preferably as late in the dry season as possible (before the onset of cloudy conditions). Cumulative probability estimates of early and late dry season fires for Kakadu and the Magela floodplain regions are illustrated in Figures 22–25.

The full metadata report for this dataset is provided in Appendix 1.13.

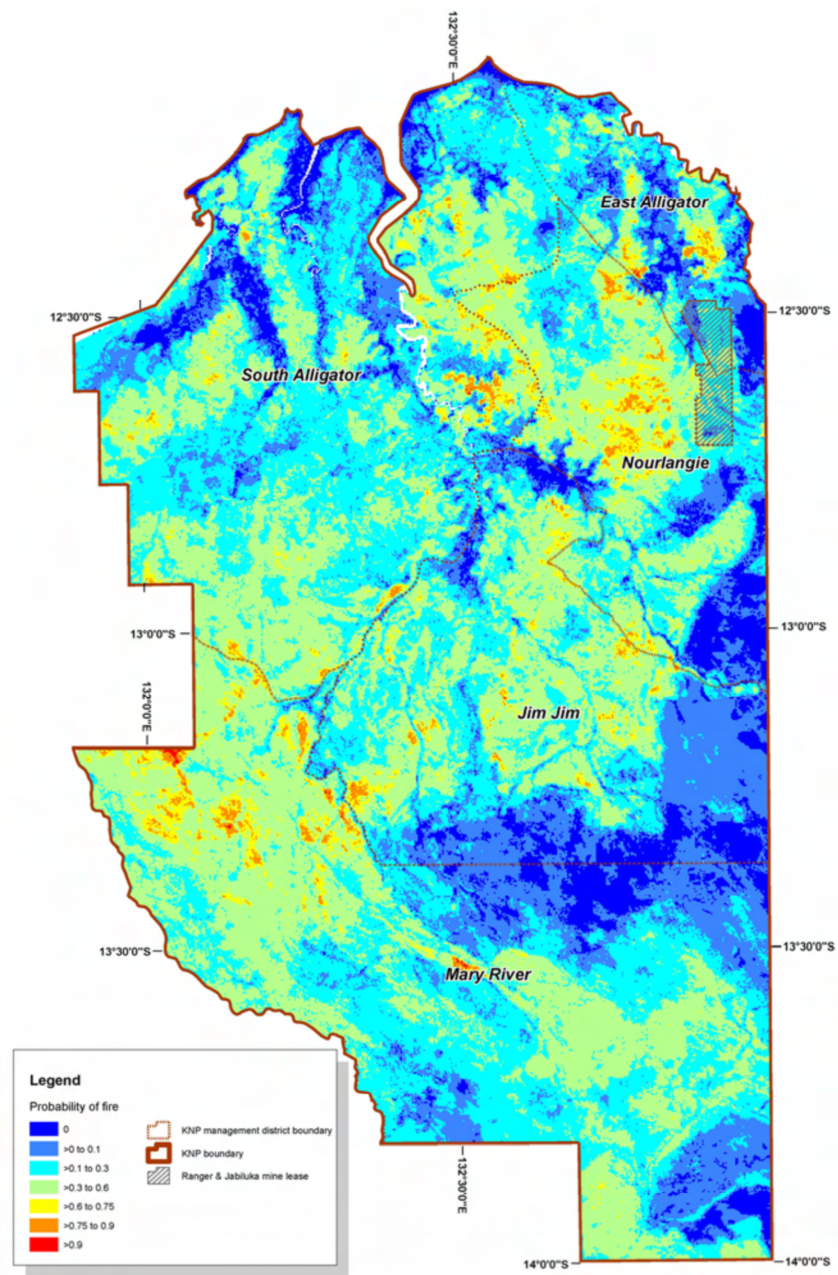

Figure 22 Probability estimates for early dry Season burning across the Kakadu region derived from annual monitoring over a 25-year period (1980–2004) using Landsat fire scar mapping

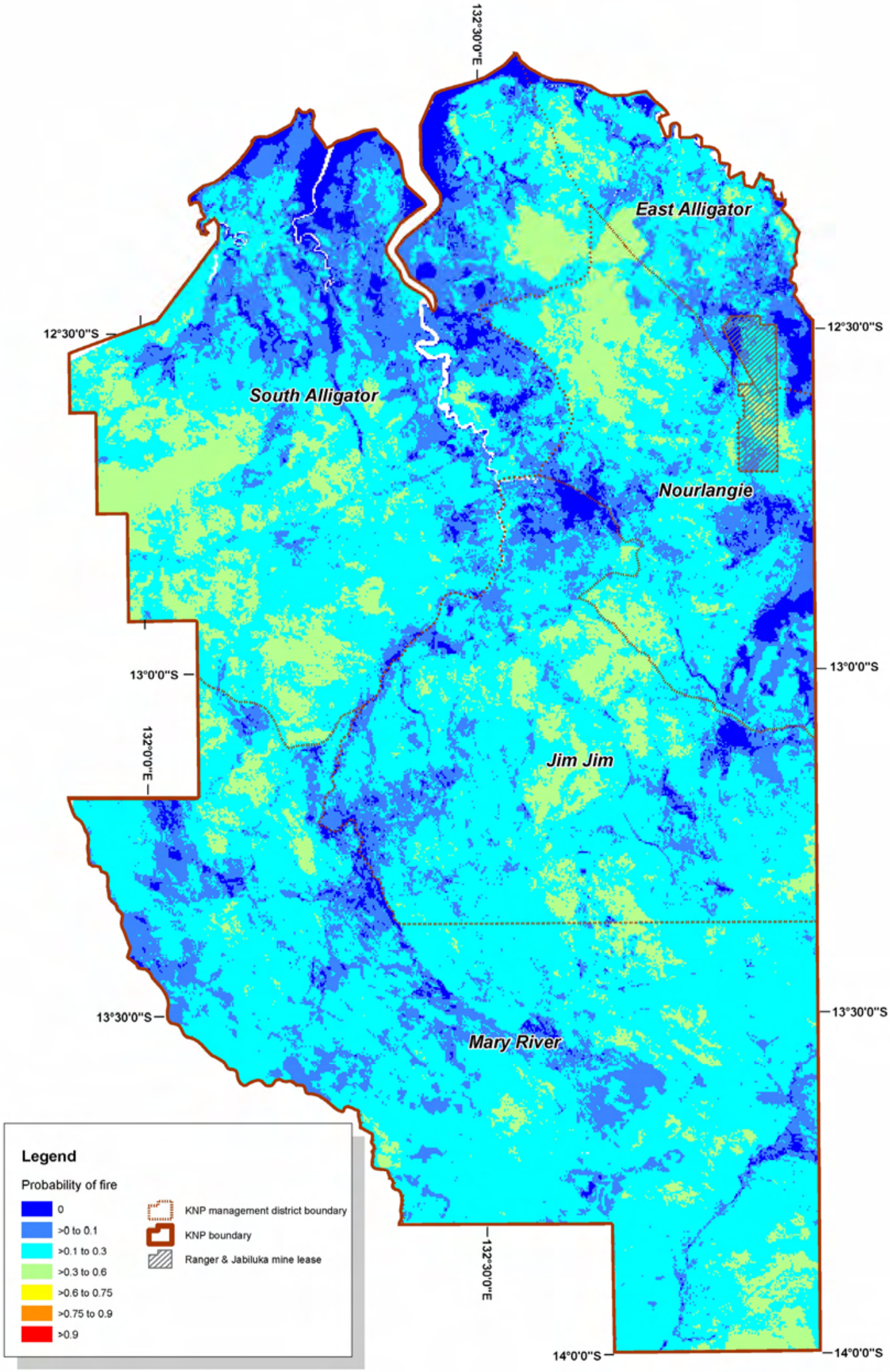

Figure 23 Probability estimates for late dry Season burning across the Kakadu region derived from annual monitoring over a 25-year period (1980–2004) using Landsat fire scar mapping

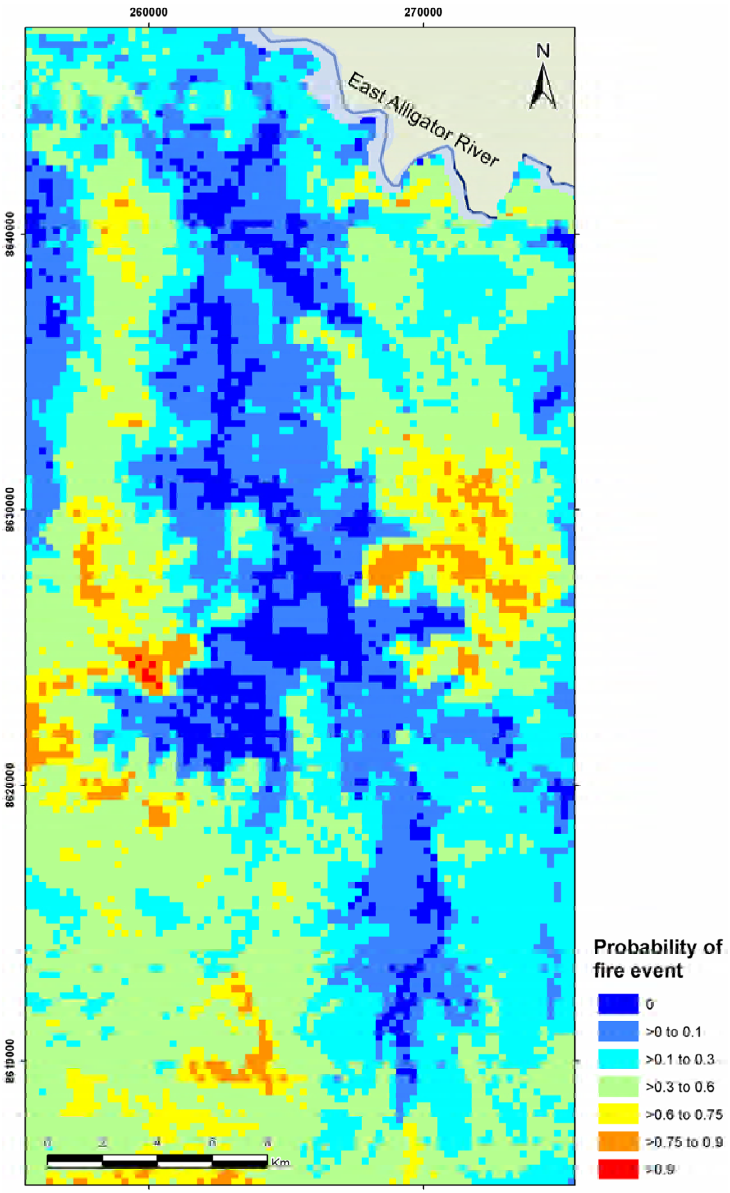

Figure 24 Probability estimates of early dry Season burning across the Magela floodplain region derived from annual monitoring over a 25-year period (1980–2004) using Landsat fire scar mapping

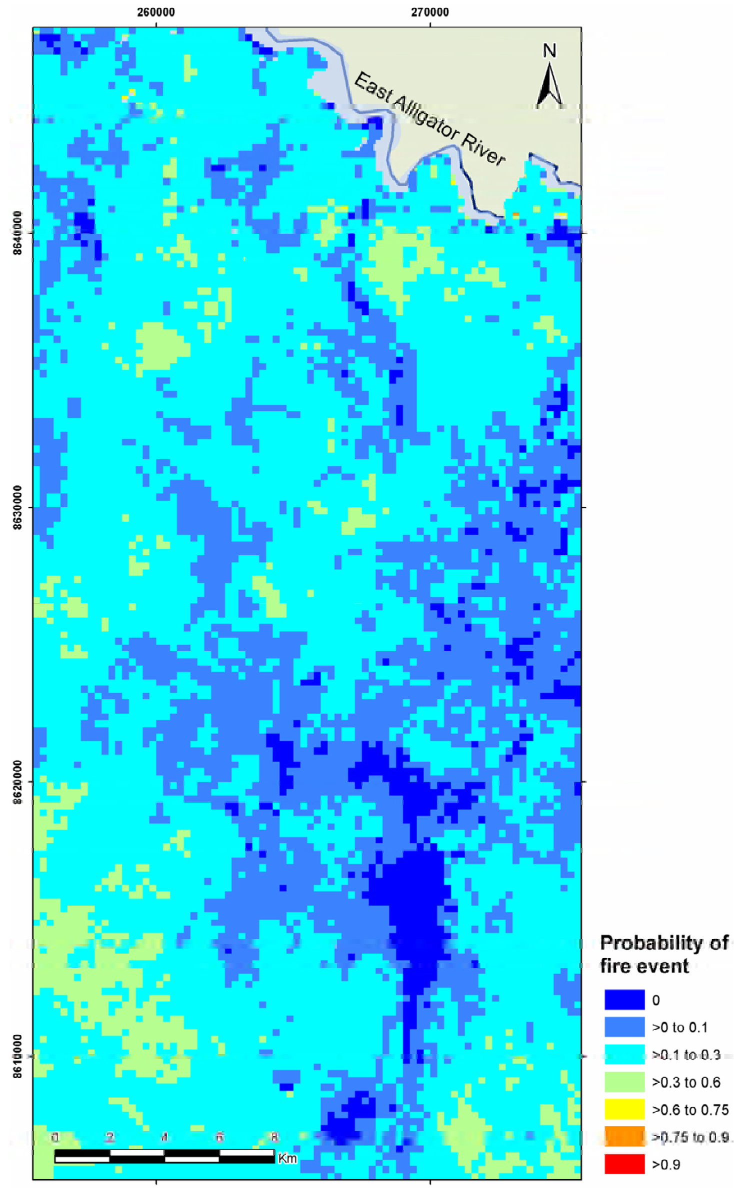

Figure 25 Probability estimates of late dry season burning across the Magela floodplain region derived from annual monitoring over a 25-year period (1980 to 2004) using Landsat fire scar mapping

4.3 Infrastructure

Infrastructure is an important characteristic as it influences accessibility to the environment by land managers, and tourists alike. Unfortunately it can also increase the invasive potential introduced species, such as weeds and feral animals as road vehicles are well known to act as vectors for invasion of both weeds and feral animals. On the other hand roads improve access to implement various management programs, and also provide access for land users.

4.3.1 Infrastructure of the Magela Creek floodplain region (June 2001)

This vector dataset combines data available for roads, tracks, fence lines, and building boundaries from the DIGO 1:50000 topographic map series and linear features digitised from IKONOS satellite imagery captured during June 2001 for the entire Magela floodplain region. The dataset was produced for the ecological risk assessment study of the Magela floodplain and covers this area only (Figure 26).

The full metadata report for this dataset is provided in Appendix 1.14.

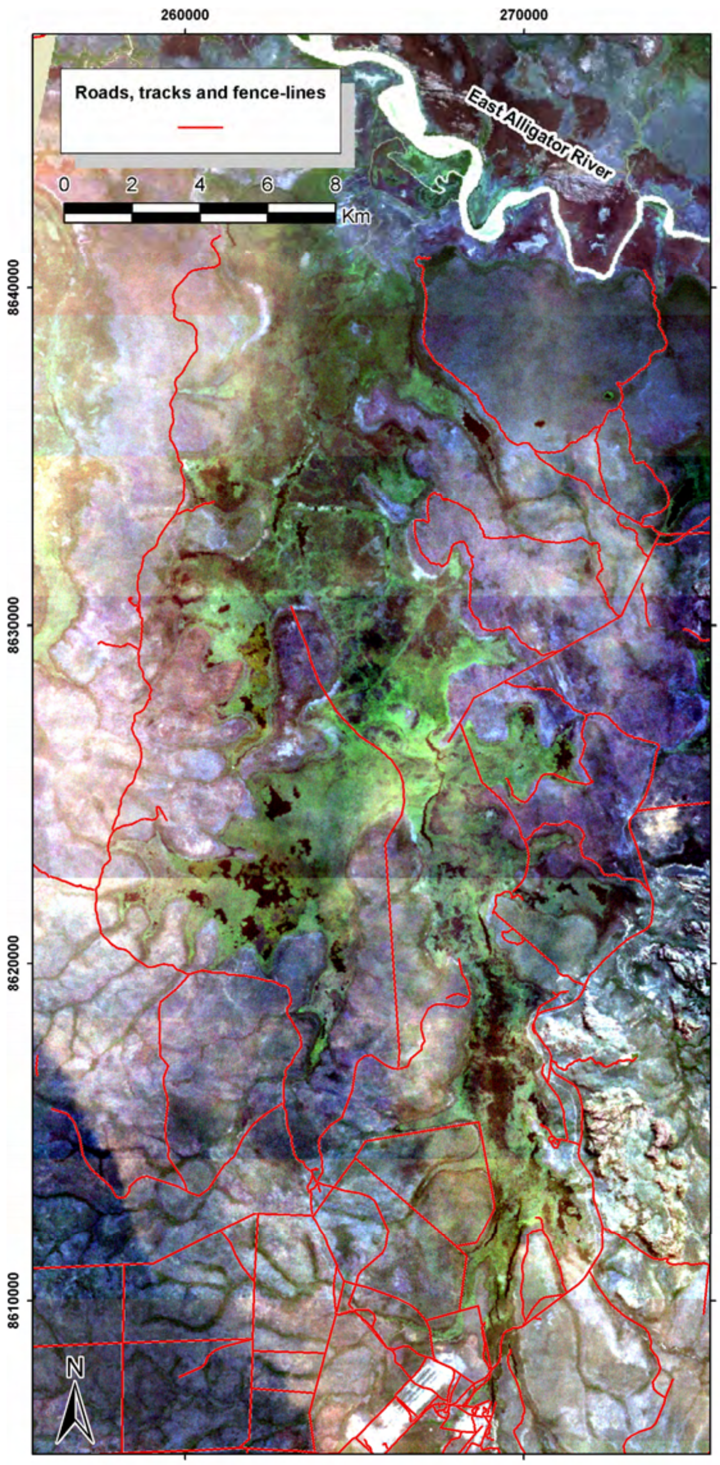

Figure 26 Delineation of roads and tracks of the Magela creek floodplain region derived from 1:250 k AUSLIG topographic map series, 1:50 k topo maps, and IKONOS satellite imagery