5 Discussion

Spatial information technologies such as remote sensing and GIS provide a systematic framework for organising and analysing spatial and temporal information for ecological risk assessment. The use of available knowledge in spatial ecological risk assessment models and GIS can also allow for different management scenarios to be simulated to identify a 'best' solution. GIS is also a powerful visual communication tool.

In context to floodplain landscapes Leuven and Poudevigne (2002, p857) provide a summary of data requirements for GIS-based risk modelling for conservation management. Data requirements are also determined through a participative process including land managers, regulators, scientists, and the general community (Ball 1994, Burgman 2005). Monitoring systems need to be realistic, pragmatic, and defensible. In this context there is potential to further develop and implement more cost-effective and spatially explicit monitoring endpoints for ecological risk assessment. Strategic remote sensing capture and development of more automated processing techniques, for example, can be further integrated into standardised monitoring programs that account for the seasonal variability in the distribution of wetland resources.

However, adherence to an adaptive management system can only eventuate through effective data management based on appropriate integration of GPS, field survey, and database technologies. Implicit is the need also to build and maintain skills capacity among field workers and support staff in rapid assessment techniques for monitoring various environmental indicators. Conversely there is a need to keep field data collection simple as possible and to avoid unnecessary administrative burden on workers involved in hands-on management operations'.

Utility of data for risk assessment studies that represent endpoint elements in an assessment model is enhanced with the progression towards standardised long-term multi-temporal datasets, of appropriate scale (both spatial and temporal) and extent. A sufficient time-series will yield information on spatial change, where detrimental trends can then be examined more closely in context of the risk factors being analysed. It is worth noting that available time-series data were limited for some measurement endpoints of the initial ecological risk assessment for the Magela floodplain. In other cases standardised monitoring information was also not available. Delivery of higher-quality and cost effective products for monitoring and routine analyses is however becoming more practical with technological advances in the spatial information sciences. Remotes sensing, for example, enables synoptic information to be captured over very large areas and at frequent time intervals. This provides the potential to improve detail and accuracy of environmental maps, particularly for dynamic landscapes such as wetlands of the Magela floodplain. Nevertheless the risk remains that inappropriate data processing can produce unreliable results despite the GIS-generated output appearing convincing (Leuven & Poudevigne 2002).

The timely processing of reliable information for ecological risk assessment must consider all aspects of the data management cycle, from existing maps to practical field monitoring exercises. Implicit is the need to embed monitoring in policy frameworks and apply quality control and assurance protocols at every step of data management to ensure successful implementation of ecological risk assessment within a GIS. The provision of metadata libraries that assist data analysts in assessing the fitness for use of data in ecological risk assessment is a critical part of this process (Goodchild 2000). Data quality assessment also

allows for appraisal of the decision making process by natural resource managers' (Mowrer & Congalton 2000).

Implementation of routine landscape-scale monitoring for adaptive management of natural resources is ultimately a decision for all stakeholders. For the value of long-term monitoring information to be realised, ongoing commitment and resources are required. Similarly there is a continual need to adapt and manage IT systems supporting the efficient retrieval and analysis of information for routine risk-assessment reporting. These factors are considered critical to the application of ecological risk assessment as a routine decision support tool.

This report provides a review of currently available spatial information with utility for ecological risk assessment of diffuse, landscape-scale threats to natural assets of wetlands in Magela Creek, Kakadu with application also to the broader ARR. It therefore provides a basis to assess the status of this information in context to the quality and availability of data for ecological risk assessment. However, it is beyond the scope of this report to make recommendations as to how future monitoring programs may be focused to address knowledge gaps or improve this information base. The compendium will, however, provide a initial basis for reviewing monitoring systems for landscape-scale ecological risk assessment as well as providing a valuable reference for data managers.