Integrated ecosystem assessment of wetlands in the in the Northern Territory: a tool for NRM

A pilot case study in the Daly River, Mary River and East Alligator River catchments

Olga Ypma and Matthew Zylstra (eds)

WAGENINGEN UNIVERSITY
ENVIRONMENTAL SCIENCES

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Summary for Stakeholders

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September 2006

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Supervisors: Dr. Max Finlayson, Dr. Rudolf de Groot, Dr. Peter Bayliss and Emma Woodward

Editors' Note:

This report contains information on the ecological, sociocultural and economic values of the Daly and Mary River wetlands. It should be kept in mind that, as a pilot project, there were clear limitations in data, analysis and time. Therefore, the values estimated and described in the report must be considered as an indication of the total value of relevant ecosystem services provided by the wetland areas assessed in northern Australia. We would like readers to bear in mind that as this document is a synthesis of student work (i.e. a non-peer reviewed document), full guarantee cannot be given that the report is 'error-free' despite best efforts made to ensure otherwise. The analysis presented was accurate as of January 2005; this summary report has not accounted for possible changes in management or legislation which have since occurred. Finally, the results reported and views expressed in this document do not necessarily reflect those held by the listed collaborating organisations.

This research behind this publication has been made possible in part by funding from Land & Water Australia and in kind support from the Environmental Research Institute (ERISS) and Wageningen University and Research Centre (WUR).

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Designed by: Olga Ypma and Matthew Zylstra

Cover photos: Background: Billabong in the Daly River catchment by Clement Mabire. Bottom (L to R): Ooloo Crossing on the Daly River by Bas Verschuuren; Mary River at Cousins Lookout by Matthew Zylstra; Aerial view of East Alligator River and floodplains by Clement Mabire.

Photos in report: All unreferenced photos contained in the report were taken by one of the contributing authors: i.e. Sophie Bachet, Clement Mabire, Pujan Shrestha, Bas Verschuuren, Olga Ypma or Matthew Zylstra. Photos referenced with a footnote acknowledge respective sources accordingly.

Acknowledgement: Special thanks to Bas Verschuuren for reviewing content and providing useful comments on earlier drafts.

Preface

This project was initiated in 2004 by Max Finlayson (International Water Management Institute (IWMI) – formerly with *ERISS &* NCTWR) and Rudolf de Groot (Wageningen University & Research Centre (WUR)), based upon their input into the Millennium Ecosystem Assessment (www.MAweb.org) and as a component of the Tropical Rivers Inventory and Assessment Program (TRIAP) - an initiative of Land & Water Australia.

The research was carried out between May 2004 and May 2005 by six MSc-students from the Environmental Systems Analysis Group, Wageningen University, The Netherlands: Sophie Bachet (from France), Clement Mabire (France), Pujan Shrestha (Nepal), Bas Verschuuren (The Netherlands), Olga Ypma (The Netherlands), and Matt Zylstra (Australia).

The research was supported by the Tropical Rivers Inventory and Assessment Program (TRIAP), a project funded by the Australian Government through Land & Water Australia and the National Heritage Trust as part of the National Rivers Consortium (Tropical Rivers)[1]. The primary project partner for the two-year program is the National Centre for Tropical Wetlands Research (NCTWR) which incorporates researchers from the Environmental Research Institute of the Supervising Scientist (*ERISS*), Australian Department of the Environment and Heritage (DEH); and the Australian Centre for Tropical Freshwater Research (ACTFR), and James Cook University (JCU).

Logistics and personnel support for the fieldwork in the Northern Territory was provided by *ERISS* in Darwin and Jabiru. We would like to gratefully acknowledge the

valuable assistance provided by Peter Bayliss, Maria Grazia Bellio, Caroline Camilleri, Rick van Dam, Don Elphick, John Lowry and Joan Mount. We would also like to extend our thanks to *ERISS* staff members who regularly and willingly assisted in various capacities and welcomed the research group into the organisation. We are especially grateful to Emma Woodward (formerly NCTWR/*ERISS*) for her supervision and support during the fieldwork period between July and October 2004.

Finally, we would like to sincerely thank the 50 or more interviewees (or 'stakeholders') including Government employees, academics, community members and landholders who selflessly gave their time and patience in assisting our understanding of the issues and the values individuals attach to the wetland areas in the Northern Territory. Their input was essential to the outcomes of this research and to the successful completion of our respective MSc theses.

Olga Ypma and Matt Zylstra on behalf of Sophie Bachet, Clement Mabire, Pujan Shrestha and Bas Verschuuren.

Wageningen, September 2006

Mary River

Note on Stakeholder Quotes:
Unless otherwise stated, all references to personal communication throughout the report were received during interviews undertaken between July-October 2004. Many interviewees expressed a desire for their comments to remain as anonymous statements, unless permission was sought in advance to use them otherwise. Therefore, due to limitations in recontacting interviewees, all quotes used respect these wishes and have been kept anonymous for this report and are referred to as "Stakeholder personal (pers.) communication (comm.)" or, alternatively, boxed separately in *italics* (as shown below). A database of all interviews is retained on a confidential basis by the author(s); therefore, queries regarding the use of statements or the accuracy of statements themselves should be directed to the authors via the correspondence addresses provided.

"We [as Government] have got a lot of demands on the public purse…and having the ability to allocate the resources more objectively would be useful."

[1] The National Rivers Consortium is a strategic collaboration between policy makers, river managers and scientists.

Table of Contents

1 Introduction

1.1 The purpose of this booklet

This booklet provides an overview of the main research results from six individual MSc theses as components of an integrated ecosystem assessment on ecological, social and economic values of wetlands in northern Australia. These values fed into an analysis of competing interests, relevant policy and institutional aspects and management implications and options. The study areas used for this pilot study were key wetland areas in the catchments of the Daly River, Mary River and, to a lesser extent, the East Alligator River.


Brolgas in the Mary River

The information provided in this booklet has been written predominantly for stakeholders (i.e. community members, pastoralists, fishers, managers, research scientists and decision-makers in governmental agencies etc.) in the catchments and who hold the responsibility for the future of these wetland resources as valuable natural capital.

Numerous stakeholders were interviewed as a basis for this research. Through this booklet, we wish to maintain our prior commitment of informing the stakeholders and interviewees about key outcomes of the research such as the types of values attached to wetlands in the NT and potential implications for management and policy.

The basic approach used for this integrated ecosystem assessment was a 'function analysis'. A function analysis can be defined as "the capacity of natural processes and components to provide services that satisfy human needs, directly or indirectly" (de Groot *et al,* 2002).

True to its name, a function analysis puts the functions of ecosystems at the basis for understanding and deriving the goods and services that people obtain from the natural environment. The 2005 Millennium Ecosystem Assessment (MA) terms these benefits that humans obtain from ecosystems (e.g. forests, mangroves) and their interactions as '**ecosystem services**'. The MA classifies ecosystem services into four groupings (see figure, pg. 9): provisioning services (e.g. food, raw materials, fresh water, and genetic resources); regulating services (e.g. climate, pest, erosion regulation, pollination); cultural services (e.g. spiritual and religious values, recreation, education) and supporting services (e.g. those that maintain all other services such as provision of habitat and nutrient and water cycling). So as not to confuse the reader with approaches and terminology, efforts have been made in this document to conform to the MA classification even though it is acknowledged that other conceptual classifications are in use which may offer greater clarity than the MA typology.

The wetlands of northern Australia are utilised by different groups of people, with different perceptions and values and different needs and demands on these natural resources. Ultimately, these differences - in one way or another - come into conflict and, if such interactions are not properly understood and then managed, the severity of current issues will not only hasten, but are likely to compromise the future quality of Territory life. To prevent such outcomes, the diverse wetland ecosystem services need to be understood in the context of the management, policy and legislative environment and how they may be affected across different models of land use.

This study therefore investigated if an integrated ecosystem assessment (i.e. ecosystem function and services analysis) could inform current management and planning regimes in the NT based on the underlying and perceived wetland values. The integrated ecosystem assessment and valuation framework used to guide this research is located in the Appendix (pg. 35).

After perusing this document, it is hoped that the reader will gain an understanding of how an integrated ecosystem assessment can help to assess the value of the wetlands in the Daly River, Mary River and East Alligator River catchments. We anticipate that these summarized research results also contain beneficial input for ongoing strategic and operational management in each of the catchments.

If you wish to read more about the methodology adopted during the research, we suggest reading the synthesis report or the respective MSc theses. These can be obtained by sending an email to dolf.degroot@wur.nl or, alternatively, copies of the original MSc theses can be obtained from the corresponding authors; or hardcopies can be found in the library of ERISS, Darwin, NT.


East Alligator River catchment

1.2 What is a wetland?

Wetlands are areas of land that are either temporarily or permanently covered by water (Westlake & Pratt, 2006)[2]. This means that a wetland is neither truly aquatic nor terrestrial; it is possible that wetlands can be both at the same time depending on seasonal variability (Stuip *et al.,* 2002). Given these characteristics, wetlands support a large variety of plant and animal species adapted to

[2] http://www.wetlandcare.com.au/Content/articlefiles/403-wetlands%20general%20A4.pdf

fluctuating water levels. For the purposes of this report, the relatively broad definition of wetlands under the Ramsar Convention was used.

Wetlands are defined during the Ramsar Convention on Wetlands of International Importance:

"Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters."

In addition, the Ramsar Convention text Resolution IV (Section 2.1) provides that wetlands:

"May incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands."

This study identified six different types of wetlands within the Top-End of the Northern Territory (see below). Each supports unique plant and tree communities, and provides habitat for a rich diversity of wildlife, such as 'flagship' and culturally important NT species like the barramundi, pig-nosed turtle, magpie-goose and freshwater sawfish.

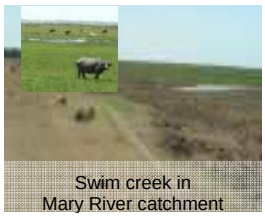
Mary River at Shady Camp

Waterways
River channels where fish and aquatic plants can be found;

Mangroves / saline tidal flats / saline mudflats (coastal and riverine riparian zones)
Habitats that are periodically inundated by tides. The soil is more or less permanently waterlogged;

Riverine floodplain / woodland
Swamp forest and woodland. *Eucalyptus* is the dominant overstorey species. This habitat receives a relatively rich supply of nutrients and often also sediment via surface run-off and groundwater from adjacent land;

Riverine floodplain/ mixed grass-sedge-herbland floodplain/ mixed sedgeland/ grassland
In contrast to riverine woodlands, the habitat consists of grassy landscapes;



Swim creek in Mary River catchment

Open water floodplains (billabongs)
Freshwater sources;

Freshwater riparian zones/ forest
Includes *Melaleuca*, Bamboo, *Bombax* etc. along the rivers. This habitat is further upstream than other wetland types.

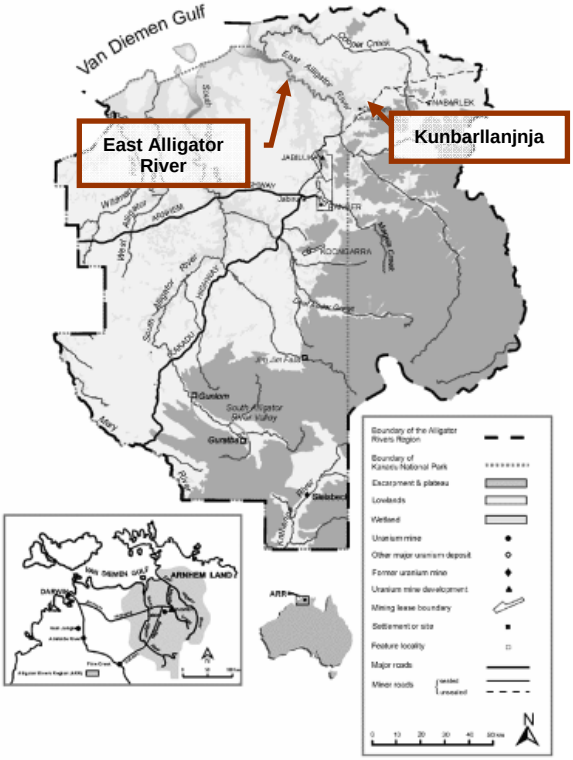
1.3 Daly River, Mary River and East Alligator River wetlands

The Daly River catchment covers an area of 52 600 km^2. (Kennedy, 2004) and includes 1243 wetlands (Australian Wetlands Database; CFC Unit, 2004). The maps of Daly and Mary River catchment are included on page 10.

The Mary River catchment covers an area of 8 062 km^2 (McInnes, 2003). The Mary River contains lakes which are indicated in dark blue, the original map is illustrated in Armstrong *et al* (2002). In the northern part of the catchment area, there are several swamps located (indicated as light blue in the map) and all differ in size.

The wetlands of the East Alligator River catchment surround the Aboriginal township of Oenpelli (hereafter referred to by its local name 'Kunbarllanjnja') and are subjected to Indigenous Land Management (ALRA, 1976). In this respect, the wetlands of the East Alligator River traditionally deliver specific services to the local community. These services provide the commodities for a largely customary economy. This customary economy is partly dependant on external sources such as the welfare system and mining royalties (from the nearby located Ranger uranium mine) but due to remoteness and inherent logistical difficulties is largely dependant on core resources derived from the nearby wetlands (Howitt, 2001; Stakeholder pers comm, 2004).

Alligator Rivers Region[3]



[3] Photo: http://www.deh.gov.au/about/publications/annual-report/01-02/ss-introduction.html (accessed: 07/09/05)

1.4 Why are these wetlands important?

Planet

Wetlands are some of the planet's most diverse ecosystems providing not only many resources and services but holding high ecological importance through their ability to provide life sustaining services.

The wetlands in the NT are Australia's largest seasonal wetlands relatively 'intact' and unaffected by river regulation or other substantial structural or hydrological modification (Finlayson *et al.*, 1997). The wetlands of northern Australia are essential to the maintenance of viable populations of many aquatic flora and fauna species such as lilies, pandanus, birds, fish[4] and reptiles. Many of these wetlands have become icons of the 'Northern Territory experience'. A number of wetlands are registered Ramsar sites or as wetland areas of national significance (PWCNT, 2000).

Red Lily

Barramundi

People

Wetlands provide many different resources and services and are of great socio-cultural importance. As one of earth's most productive ecosystems, wetlands directly and indirectly support millions of people in providing services such as food, fibre and raw materials, storm and flood control, clean water supply, scenic beauty and educational and recreational benefits (Stuip *et al.,* 2002).

Sunrise on the Daly River

Fishing on the Mary River

Plant and animal species play an important role in the nutrition and culture of Aboriginal people as well as supporting regionally important recreational fisheries, tourism and pastoralism.

Profit

The Millennium Ecosystem Assessment (MA) estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services of which the benefits are (arguably) estimated at A$20 trillion a year. Nevertheless, as a result of the failure to fully account for ecosystem values, 50% of the earth's wetlands is estimated to already have disappeared worldwide over the last hundred years. In addition to biodiversity values, such ecosystem degradation has profound implications for the future viability of many industries and enterprises which rely on a continued supply of natural resources or intact landscapes to generate profit. Declines in natural capital can have serious consequences for the economy at local, regional, national and even global scales.

Pastoralism in the catchments

Mango farm at Daly River

Examples of important land uses contributing to the NT economy; the chapter 'Economic value' will further elaborate on the economic value of Daly River and Mary River wetlands to the regional economy.

Despite these benefits - and in a time when the ecosystem services provided by wetlands are better understood - degradation and conversion of wetlands continues (Whitten *et al.*, 2002). This is largely due to the fact that the 'full value' of ecosystem functions is often ignored in policy-making, NRM plans and corporate evaluations of development projects. This often leads to unnecessary ecological damage, social problems and a waste of financial resources, which is now belatedly recognised through expensive wetland restoration actions (de Groot & Finlayson, 2003).

In Australia, there are now positive indications that previous damaging approaches and attitudes towards wetlands are changing. Efforts are being made by landowners, community-based groups, and government agencies at all levels to ensure that wetlands are suitably protected, rehabilitated and even reinstated (Whitten *et al.*, 2002) However, a greater urgency is still required.

Wetlands provide different services.

The Millennium Assessment (MA) uses the following typology to categorise ecosystem services:

Provisioning services: The resources or products provided by ecosystems, such as food, raw materials (wood), genetic resources (biotechnology), medicinal resources, ornamental resources (skin, shells, flowers).

Regulating services: Ecosystems maintain the essential ecological processes and life support systems, like gas and climate regulation, water supply and regulation, waste treatment, pollination, etc.

Cultural and Amenity services: Ecosystems are a source of inspiration to human culture and education throughout recreation, cultural, artistic, spiritual and historic information, science and education.

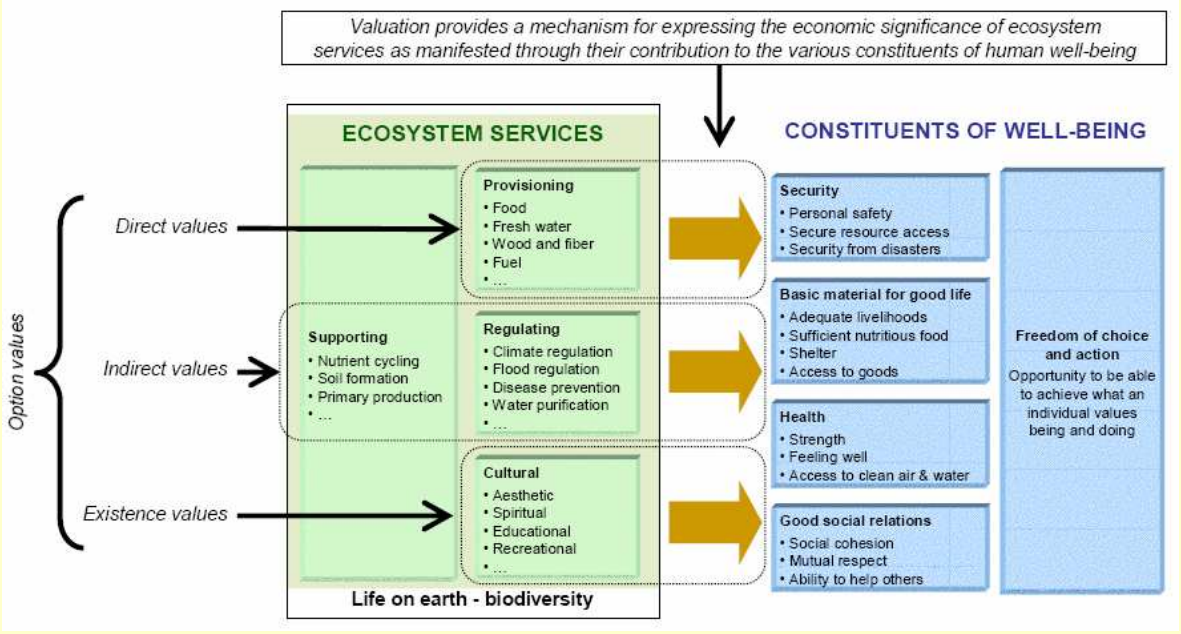
Supporting services: Ecosystems provide habitat for flora and fauna in order to maintain biological and genetic diversity.

In addition to the MA, de Groot (1992) also defines the:

Carrier function: As a subset of provisioning services, ecosystems provide a suitable substrate or medium for human activities and infrastructure, such as agriculture and mining.

[4] Photo: http://burarra.questacon.edu.au/pages/barramundi.html (accessed 23/06/06)

Figure - Conceptual overview: Linking ecosystem valuation to the Millennium Assessment framework



Source: Emerton, 2006: adapted from MA 2005.

1.5 Threats to wetlands in NT catchments

With an estimated half of pre-European settlement wetlands in Australia destroyed - through conversion for urban expansions and rural development (Whitten *et al*, 2002) – there is increased interest in finding opportunities to productively develop or harvest the NT's land and water resources (Land & Water Australia, 2004).

There are a number of significant 'natural' threats facing almost all wetland areas in the NT. Whilst not exclusively limited to wetlands, the oft-repeated phrase of "fire, ferals, weeds" (i.e. the impacts from changing fire regimes and wildfires; feral animal disturbances and severe weed infestations) would best summarise the major threats facing NT landscapes and biodiversity.

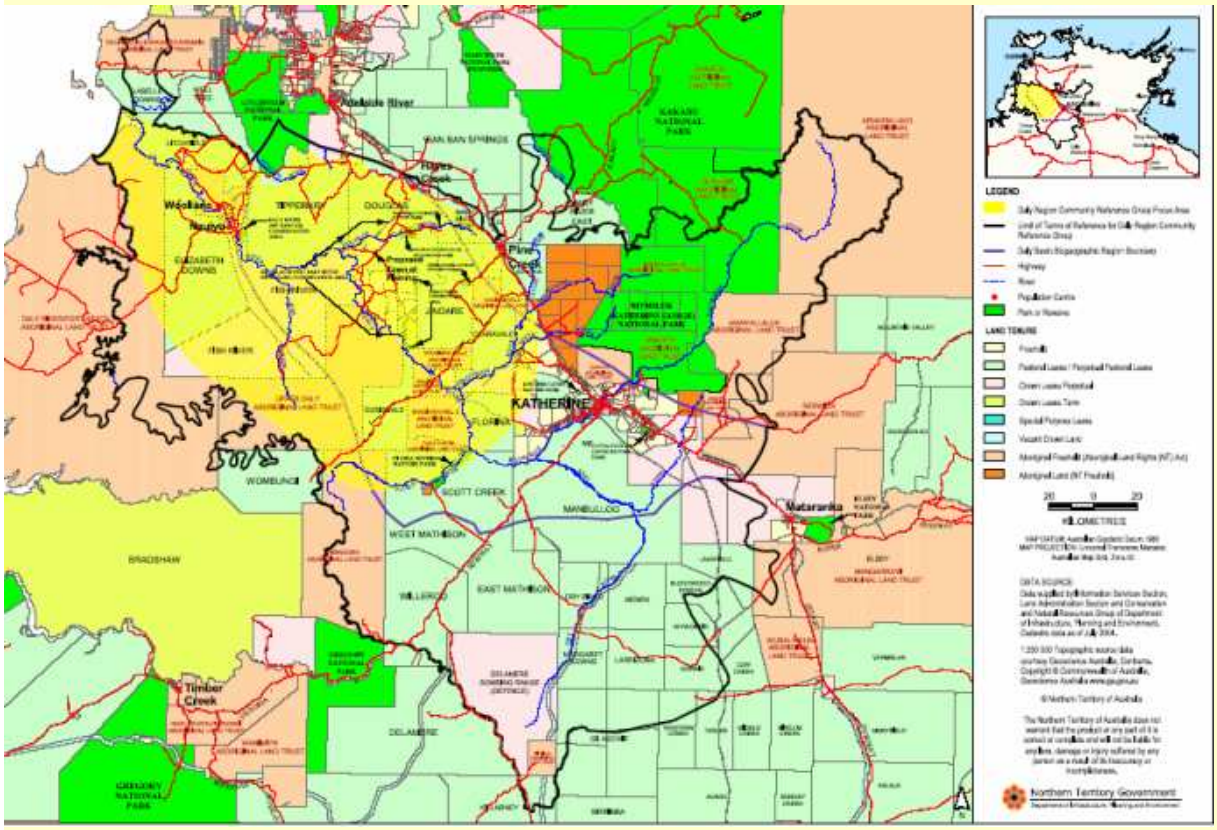
Despite the fact that these threats have been recognised in NRM to date, it cannot be said that the stakeholders involved in land and resource management are really making the progress required in tackling these issues. There are complex factors that make managing such threats difficult. Firstly, each issue is not a stand-alone issue: feral animals accelerate the spread of weeds; weeds can in turn change fire regimes, and fire can be both effective in controlling the spread of certain weeds or assist the ability for weeds to take hold on severely burned native areas. And naturally, other 'separate' issues tied to land-use and activities (e.g. spread of weeds by recreational vehicles or pastoral activity) can accelerate any one of these priority issues. Secondly, addressing these issues requires an ongoing commitment from large sections of the NT population (LCNT, 2004) who must be effectively resourced (i.e. with sufficient expertise and financial capacity). Finally, many of these issues are most severe in remote, unpopulated or under-resourced landscapes such as on Aboriginal lands where additional issues such as the erosion of Traditional Ecological Knowledge and related management practices also come into play. In addition to the obvious cultural implications, this also provides additional challenges to conservation and NRM.

"I mean there are large areas of the Northern Territory [where] there is nobody, not a person, not anyone...the biggest problem that [the NT] Government faces is to get the [management] programs implemented on the ground where there are no people to implement them."

Other pertinent management issues for wetlands in the NT include emerging issues such as the potential impacts of climate change (including increased saltwater intrusion into vulnerable freshwater ecosystems; Bayliss *et al*., 1998; Finlayson *et al*., 2001) or mitigating the impact of soil erosion on wetlands values as a result of, for example, recreational access to sensitive areas or increasing grazing pressure at natural water holes (Storrs & Finlayson 1997; LCNT, 2004).

Finally, the ability to respond effectively to such pressures requires sufficient baseline knowledge to enable informed decision-making. Critical knowledge gaps exist within many management regimes across the NT. In particular, the dynamics of many aquatic ecosystems are not well understood and, as a result, their deterioration has already contributed to growing threats in water quality and availability for NT communities. Therefore, the need to apply an adaptive management approach where knowledge gaps can be filled with management experience as well as new information is recognised as being of critical importance to natural resource management in the NT (LCNT, 2004).

Map of the Daly River catchment –
Including boundaries for the Daly basin, the 'Daly Region' and land tenure.



Source: DIPE, url. Accessed 20/04/2005 http://www.ipe.nt.gov.au/whatwedo/dalyregion/about/pdf/TenureWeb04.pdf

Map of the Mary River catchment –
including indication of wetland areas

Source: Base data sourced from AUSLIG 250k Geodata; Produced by the Bioregional Assessment Unit, PWCNT as illustrated in Armstrong *et al* (2002)

2 Ecological values

Original Author: Sophie Bachet

2.1 What are ecological values?

Wetlands provide habitat for a range of flora and fauna, maintaining biodiversity values and a genetic resource base. 'Supporting services' are the focus of the ecological valuation of the Daly and Mary River wetlands.

However, it is difficult to calculate the "value" of a wetland, especially for ecologists (Farber *et al.*, 2002). This is due to the fact that flora and fauna in the wild can, in economic terms, be only attributed a potential monetary value, or an approximate market price. However, ecological criteria, such as species diversity and uniqueness, can provide valuable information on the ecological importance of wetlands. Balancing different perspectives through ecological valuation can help quantify the value of "the causal relationship between different parts of a wetland ecosystem" or the "survival value" (Farber *et al.*, 2002).

The ecological value might be in discordance with the economical value or the socio-cultural value. The reason is that a service may have a certain economic value for people, whereas it may hold a completely different ecological value in terms of species survival or ecosystem integrity. Economic valuation cannot place a value on species survival or on the ecosystem ecological value, except from the human benefit perspective. Sometimes, the economic value can even be negative when the ecological value is positive, for example when nature conservation costs are implemented to protect an endangered species (MA, 2005).

2.2 Method for valuation

The simplest method to determine the relative value of different habitats is to rank them according to different criteria. Criteria can be intrinsic like floral and fauna diversity, or extrinsic like cost for acquisition (Margules *et al.*, 1991). Intrinsic values are defined here as the value of something in and for itself, irrespective of its utility for someone else (MA, 2005). The following criteria were used to value the ecological importance of the Daly and Mary River wetlands:

Criteria 1. Rare and endemic species

These vulnerable and unique species usually warrant the greatest need for protection and conservation, and sometimes rely completely on the wetlands.

Criteria 2. Integrity of the wetland ecosystem

When the wetland habitats are kept 'intact' and 'pure' there are fewer threats than when flora and fauna are 'imported' or introduced into the wetland ecosystem.

Criteria 3. Diversity

Wetland habitats may contain rare and endemic species but have poor species diversity. Diversity is important ecologically, because the more diverse an ecosystem is, the better it can withstand 'shocks' e.g. drought, flooding etc (Mussared, 1997).

Number of wetland types listed for national importance[5]

Daly River catchment	Mary River catchment
13 wetland types	9 wetland types

2.3 Rare and endemic species

The Daly and Mary River wetlands provide habitat for several rare and endemic species of which the following are examples.

Fish

Some fish species are already considered vulnerable or in danger of becoming extinct. In an effort to ensure their protection, they are listed in the national Environmental Protection and Biodiversity Conservation Act 1999 (EPBC) and on the "red-list" of the International Union for the Conservation of Nature (IUCN).

The freshwater sawfish is listed as endangered (IUCN 2002 for Australia) and vulnerable (EPBC 1999). Along with the threatened whipray, it occurs in the Daly River[6] and possible other major rivers of the NT.

Freshwater Sawfish

(7)

Birds

Numerous bird species use wetlands for gathering food, refuge or as breeding and nursery area. The magpie goose is a well-known example; it is a unique migrating bird which breeds in wetland areas during the wet season. Approximately 95% of the Top-End population of magpie geese (including the population of the Daly River catchment) breed on eight major coastal rivers between Cobourg Peninsula and the Western Australia border.

Magpie Goose

The spatial distribution of the wet season breeding population fluctuates greatly between the years, depending on the variability of rainfall events. The surveys demonstrate that the population concentrations shift between the major river systems from one year to another (Whitehead *et al.*, 1992).

[5] http://www.deh.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW (accessed 25/09/2006)
[6] Under Species Profile and Threats Database: http://www.deh.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66182 (accessed 15/082006)
[7] Photo: http://www.fishbase.org/Photos/PicturesSummary.cfm?ID=2546&what=species

It has been recognised that the potential loss of wetlands in, for example, the Daly River catchment will have significant negative effects on the populations of magpie geese elsewhere in the NT, for example in Kakadu National Park (Kennedy, 2004).

2.4 Ecosystem integrity

There are several (exotic) plant and animal species threatening the 'naturalness' and integrity of the wetland ecosystems in the Daly and Mary River catchment. A well-known example is the cane toad (*Bufo marinus*) (see photo[8]) which in recent times has rapidly invaded Australia's sensitive northern landscapes. Besides the cane toad, there are other pest animals like feral pigs which contribute to the spread of (exotic) weeds.

Cane toad

Cane toads are potentially a threat to freshwater crocodiles (*Crocodylus johnstoni*). Experts have reported that some freshwater crocodiles are able to feed on cane toads without any impact on their survival, whilst some other freshwater crocodiles can be killed by eating the same cane toad.[9] Additional expert opinion notes that, there have been studies concerning the survival of freshwater crocodiles facing cane toads and they now forecast a 40% decline in the freshwater population (Stakeholder, 2004 pers. comm.).


Cane toad

Cane toads are also considered a large threat to dwindling populations of the water monitor, goanna, snakes, quoll, and other would-be predators. Species such as goannas could face local extinction in the coming years (Stakeholder, 2004 pers. comm.). At the time of writing, no major eradication research was underway in specifically in the Daly or in the Mary River catchments; however, CSIRO has initiated genetic research.

Feral pigs


Feral pigs

Feral pigs, which were introduced during the last century, exacerbate the spread of (exotic) weeds like *Mimosa pigra* (see below). In addition, feral pigs often degrade or destroy the plants that species such as magpie geese rely on, subsequently reducing the available feeding and breeding habitat of the geese.

To control spiralling numbers, 80% of the feral pig population would need to be destroyed by; for example, aerial shooting in order to control numbers (Stakeholder, 2004 pers. comm.). However, feral pigs are not only culled for ecological purposes. Recreational hunters or Aboriginal communities also kill feral pigs for recreational and/or economic purposes respectively. However, because of their relatively small scale operations, their activities do not have a large influence on feral pig populations.

Mimosa pigra

Mimosa pigra, a perennial thorny shrub, was first established on the Oenpelli floodplains, in west Arnhem Land in the late 1970s. In just ten years, the infestation increased from a few hectares to nearly 6000 hectares (CTWM and CINCRM, 1998).

Mimosa is considered to be a Weed of National Significance and one of the worst weeds in Australia because of its invasiveness, potential for spread and economic and environmental impacts. It forms thick dense pockets which limit access wetland areas (see photo[9]).


Mimosa pigra

These weeds affect vegetation integrity by competing and 'crowding out' native vegetation and reducing available habitat for native species[10]. It also impedes human activities in wetlands areas such as the gathering of bush food by indigenous people. Pastoralists also have an aversion to the weed as it smothers and replaces grazing pasture, blocks access to stock watering points and hinders mustering. Unchecked, this can lead to significant economic losses.

The *Mimosa pigra* seeds break up individually and float on the water, using waterways to spread in the wetlands and colonise new areas. The seeds are very strong and can remain dormant for up to 20 years in the soil before germinating (Stakeholder, 2004 pers. comm.; CTWM and CINCRM, 1998).

Mimosa pigra can be eradicated by, for example, herbicide tablets. It is systemic, so it dissolves in the ground when it rains and is absorbed through the plant's roots and then into its system.

[8] Photo: http://www.deh.gov.au/biodiversity/invasive/publications/cane-toad/pubs/cane-toad.pdf (accessed 01/07/2006)

[9] Gary Lindner. "NT News" (22/10/04).

[10] Photo: http://www.weeds.crc.org.au/documents/wmg_mimosa.pdf#search=%22mimosa%20pigra%22 (accessed 03/07/2006)

However, since infestation areas are usually very large, a lot of time and expense is needed to target all wetland areas affected by Mimosa and can also raise other issues such as loss of native vegetation due to the incidental effects of widespread (aerial) application of herbicides.

"It is easy killing a weed but it is bloody hard to get everyone to see things in a similar sort of a light to manage it"

2.5 Ecosystem diversity

The NT's vertebrate fauna includes about 400 species of birds, 150 species of mammals, 300 species of reptiles, 50 species of frogs, 60 species of freshwater fish and several hundred species of marine fish[11].

Armstrong *et al* (2002), provide a description of wetlands in the lower Mary River catchment which are listed as sites of national importance. This includes the north of the 'Bark hut' to the 'van Diemen Gulf', an area of 127600 hectares. This part of the Mary River catchment is one of the most important breeding grounds for the magpie goose in Australia, as well as an important dry season refuge for waterbirds and also saltwater crocodiles.

From Chatto (2003), at least 75 species of waterbirds are found and no less than 11 waterbird species are found breeding in the catchment. There are also 33 waterbird species that are listed under treaties (CAMBA, JAMBA).

There is enormous diversity in the Daly and Mary River catchments though there are no major differences in the types of species found within those catchments.

2.6 Ecological importance

For this part of the research, the purpose was not to compare the Daly and Mary River catchments but rather to study them as two separate case studies. However, there are some differences and similarities between the two catchments.

The Mary River catchment is unique in its status as a "nursery area" for many species found in Kakadu National Park. They breed in the wetlands and return to other habitats in Kakadu National Park afterwards.

The Daly and Mary River catchments are both of great importance for migratory shorebirds. However, since the Mary River catchment is located near Kakadu National

Park, its shoreline is part of the Network Sites in Australia designated under the International Site Networks for migratory waterbirds in the East Asian-Australasian region, which is not the case in the Daly River catchment.

In Chatto 2003, it is said that the coastline of the Daly River catchment and other areas of the NT "would qualify for nomination to the East Asian-Australasian Shorebird Site Network and/or as Ramsar sites". This shows therefore the equal importance of the Daly River coastal wetlands for these birds, even though it is not registered as such.

The Daly River catchment has less designated nature conservation areas, which could over time inhibit ecological values, in the sense that the wetlands ecosystems might not be suitably protected. However, there are ongoing plans and for conservation areas to be established in the catchment (DIPE, 2003).

Douglas-Daly Hot Springs (Daly River catchment)

Mary River

"...at the moment there are large areas where we don't know what is going on with them...we don't know what the native species are;...[they still go in and] find new species. So we don't even know what we are losing let alone to know how to best manage that."

"... there are areas elsewhere in the Territory where there's just [been] no scientists...to look at what is actually there and what is known. And they haven't tapped into the indigenous knowledge to find out about what they know about it either."

11 http://www.nt.gov.au/nreta/wildlife/animals/animalsnt/index.html (e.g The Daly River contains an 48 species of freshwater fish and the largest number of freshwater turtle species of any Australian river) WWF, 2005 http://www.wwf.org.au/news/n241/

3 Sociocultural values

Original Author: Bas Verschuuren

3.1 What are sociocultural values?

For many people, wetland ecosystems are a crucial source of non-material well-being by influencing physical and mental health, and historical, ethical, religious, cultural and spiritual values. A particular mountain, forest, or watershed may, for example, have been the site of an important event in people's past, the home or shrine of a deity, the place of a moment of moral transformation, or the embodiment of national ideals.

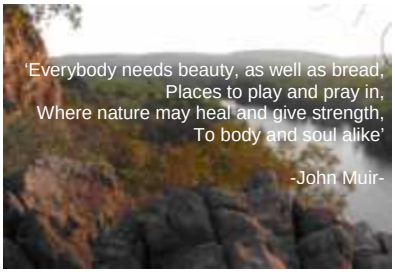
People make diverse use of the wetlands and hold different social and cultural values. The interrelationships between nature, culture and society are inextricably linked and investigating and understanding links is crucial in developing effective and successful management and policies for wetlands in the Northern Territory. Consequently, sociocultural values are increasingly recognised as underlying drivers for steering debate in NRM policy and planning issues.

3.2 Need for an assessment framework

"There's no framework for them to say how to go about it but they [development projects] are still being established. There could be a value assessment framework but how to come up with one is a different thing. Easy package things saying "this is the basis of what you want" with boxes and tasks so it is a blueprint to be used across the Top End".

Although wetlands provide many goods and services to people, their sociocultural importance is often ignored and difficult to capture with traditional economic valuation methods; there is currently no real framework for assessing and valuing the cultural services of wetlands (Verschuuren, 2005). This study focused on developing a typology of cultural services and subdivides sociocultural values into the categories below.

Importance to human health
Increased health and well-being due to the restorative effects of experience with nature: e.g. water, flora and fauna.



(Cultural) heritage
All the qualities, traditions or features of life passed on from one generation to another, that have had a strong influence on society and its history.

Spiritual
Qualities of nature inspire humans to relate with reverence to the sacredness of nature and differentiate cosmologies.

Existence
The importance people attach to nature for ethical reasons and intergenerational equity and knowing that outstanding natural and cultural landscapes have been protected.

Recreation and tourism
Leisure values. Diversity in landscapes with (potential) recreational uses including natural and cultural heritage.

Inspiration and expression
Source of inspiration for art, national symbols, architecture and advertising. The qualities of nature inspire human imagination in creative expression.

Aboriginal Artist at Injalak Community Arts and Crafts Centre in Oenpelli. He is painting a saltwater crocodile which inhabits the surrounding wetlands and plays a role in ancestral creation stories as well as being a source of food and artistic inspiration.

Knowledge
Source of traditional knowledge, scientific information, education and monitoring.

Sense of place
Natural sites link people to their landscape through myth, legend or history and form an integral part of their identity.

Aesthetic
Preference for nature and natural elements related to the beauty of nature.

Peace and reconciliation
Fostering peace and stability through cooperative management across (international) land or sea boundaries.

3.3 Sociocultural importance of Daly and Mary River wetlands for stakeholders

The sociocultural importance of wetlands is related to the values held by society (social values) or groups defined by a distinct culture. The study found that collective importance often exceeds the sum of the individual value attributed to particular ecosystem benefits. For example, a collective benefit such as improved social and community cohesion can stem from a change of psychological health found in individuals who started taking fishing trips in wetland areas. Stakeholders also attribute sociocultural importance to tangible ecosystem services that have direct use value; e.g. the non-use values associated with ornamental resources such as the spiritual significance of artwork.

Four groups of stakeholders in the respective catchment areas were consulted to elicit their perceptions on sociocultural values: landholders, fishers, Aboriginal

people and tourists. It is acknowledged that other stakeholder groups also hold their own sets of values but they could not be properly assessed within the scope of this research.

Landholders

This is a generic name applicable to owners of large private lands which are primarily utilised for pastoralism, agriculture and horticulture. The history of the Northern Territory regarding those activities is one that is characterised by a predominantly colonial and pioneering spirit. The early settlers view to the land is well illustrated in the poem by 'Banjo' Peterson, 1898.

'A man who once goes to the Territory
always has a hankering to go back.
Someday it may be civilised and spoilt
but up to the present it has triumphantly
overthrown all who have tried to improve it,
It is still the Territory'

Some of the spirit found within this poem is still present in everyday life, however development did take place. Under the colonial period, landscapes were filled with new elements: new property titles, new pastoral and agricultural species; new people. This colonialism, including the continuing confrontation with what was perceived as harsh alien environmental conditions, remains embedded or implicit in current disciplinary structures (Howitt, 2003).

"I am proud of my pastoral background. I am a reformed pastoralist; I don't reap, plunder and pillage the land. That still exists around here. I used to manage a station like that - [commercial station] my annual spending on weed eradication was about two thousand dollars so you tell me they care?!"

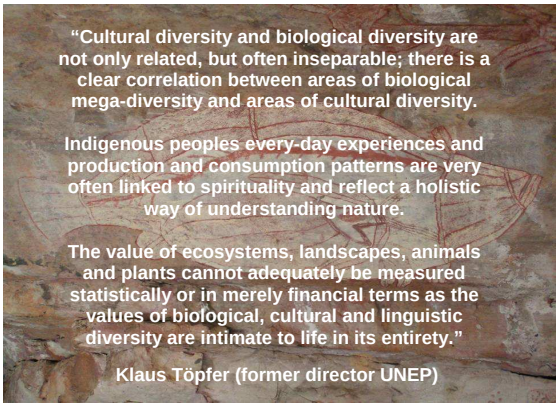
Fishers

For many people in the NT, fishing is an integral part of their lifestyles. Three groups of fishers have been distinguished: indigenous fishers; commercial fishers; and recreational fishers.

Indigenous fishers

Aboriginal fishers have used wetland resources in the NT since wetlands became a feature of the landscape approximately 100-500 years BC. Evidence suggests that coastal habitation extends back to at least 40 000 years hence indigenous fishing practices in coastal areas developed over a longer time span (Stakeholder pers. comm., 2004). Mangrove communities, as well as the shallow shores are fished, and further out to sea dugong (*Dugong dugong*) and turtles are caught (Memmot, 2004). In many coastal communities around the world, cultural traditions have developed in synergy with the coastal zone as a form of co-evolution and are therefore important in stabilising social and institutional structures that underlie cooperative fishing activities (Moberg and Folke, 1999).

In the NT, many creation or dreamtime stories passed on over generations through stories, dance, song, art and ceremony confirm to the ancestral bounds that spiritually connect Aboriginal people to the land, sea as well as to the inherent (aquatic) resources. Hence, the dreaming tracks link social groups and geographical areas (Jackson, 2004). Many of the marine and freshwater species also hold significance as totemic symbols.



Commercial fishers

The sociocultural values of commercial fishers were not thoroughly covered in this study. However, the values expressed by respondents related to the 'good old days' when a 'coexistence approach' permitted fishing on the rivers or the unique lifestyle inherent to the commercial fishing profession was recalled:

"The fishermen were actually fishing the [Daly] River those days from the crossing to the mouth of the river. I was a researcher those days measuring barramundi. It was a hell of an experience for me because I came from South Australia and had never seen a crocodile before in my life. It is a bloody beautiful river, the Daly River, she's a beauty".

Recreational fishers

Sport and recreational fishing on the Daly and Mary Rivers - primarily for the 'mighty barramundi' - is a cherished pastime for many NT residents. The NT's tropical rivers also attract fishers from interstate and overseas particularly to high-profile tournaments such as the Barra-Classic and the Barra-Nationals. The barramundi has become an iconic species and an embodiment of the NT fishing lifestyle and hence represents sociocultural value.

Fishing in the NT appeals to people for a number of reasons: remoteness; pristine nature; sense of adventure and excitement; 'frontierism'; romantic appeal; unique barramundi fishing; interacting with friends; and well-being of peoples' minds (Stakeholder 2004 pers. comm.). These reasons are expressions of the non-use value attributed to wetland ecosystems as experienced through

fishing. The value of "well being of peoples' minds" clearly relates to the importance of nature to human health and psyche; whereas other listed reasons mostly relate to amenity values such as the aesthetic quality of the landscape and recreational uses. Reference is also made to heritage value – such as feeling of 'frontierism' - which can be traced to the cultural traditions of the early settlers and pioneers.

"It is extremely difficult to value the recreational fishing industry – can't just look at it in terms of what dollar value people spend. What is the social value of people being able to go fishing? What does that mean for society? For the well-being of people's minds? And, I don't think anybody has got a grip on that yet..."[12]

(13)

Aboriginal people

Aboriginal people have been custodians of the land for over one thousand generations (Roberts *et al.*, 1994). Their use and management of natural resources over that time is reflected in the landscape. The cultural identity of the Aboriginal people is apparent in their connection with the land. This connection can be described as a mutual interdependence, which has shaped Aboriginal culture as much as it has shaped the landscape and is present throughout Aboriginal cultural memory, traditional knowledge, spiritual transcendence, customary law and traditional systems of land tenure.

Such values are being increasingly recognised through programmes such as "Caring for Country" - which is revitalising the traditional relationship between cultural values and approaches for land (and wetland) management by Aboriginal people on Aboriginal owned lands (Storrs *et al.*, 2001). However, in many cases indigenous community and traditional knowledge remains largely untapped or, worse still, is being irretrievably lost.

Tourists

Tourists at Kunbarllanjnja (Oenpelli) Open Day 2004

"…There is a large potential for Aboriginal people to embark on tourism, there is a large demand for cultural tourism experiences".

Tourism in the NT is a rapidly growing sector. Tourism activities are regulated by the NTTC and Tourism Top and currently operate through a guideline-based strategy called "Destination Development" but has no code of practice for individual operators, only guidelines. There is growing demand for 'authentic' cultural tourism experiences in the NT – both indigenous and non-indigenous.

From a non-indigenous perspective, the tourism industry also draws on the wilderness and adventure experience as well as the values tied to regional heritage which may capitalise on the NT's 'frontier' imagery. The latter has been described by Howitt (2003) as something which simultaneously contains the familiar and excludes the alien incomprehensible other. However, this 'alien incomprehensible other' is now a major reason for the growth of Australia's international tourism industry. In 1997, it was that the indigenous arts and crafts market was worth A$200 million per year with half of the present sales attributed to tourist demand (ATSIC, 1997).

3.4 Facilitating sociocultural valuation of wetlands

Various stakeholders in the NT have expressed their desire to see more open and participatory forms of planning and ultimately guidelines for the incorporation of sociocultural values and cultural services in regional planning processes.

Including sociocultural values in NRM poses the need for 're-tooling' and creating an innovative assessment approaches that ultimately support sustainable development through equitable decision making. The emergence of 'cultural flow' - i.e. amount of water needed to satisfy cultural demands – is a positive step in facilitating a working relationship between Aboriginal people, communities and integrated catchment management.

There are a number of remaining challenges for sociocultural valuation including: the selection of appropriate indicators and valuation processes; the need for the application of appropriate guidelines and methodologies to assess the sociocultural importance of wetlands; the setting in place management methods and policy instruments that facilitate integration of sociocultural importance; and, finally, the need to facilitate equitable trade-offs and compensation mechanisms between intangible values and development, conservation and poverty alleviation.

"One culture is dominating and telling all the others what is or isn't important...or even if we have a right to be doing that. I certainly don't see us [as non-indigenous] being in a box or anyone else's framework and Aboriginal people coming to us and saying 'Well, this is the most important set of values and you fit here within that framework and there you shall stay...and we'll run the whole show'. No one conceives of that at all."

[12] The Ministry for Fisheries Forestry and Conservation recently announced a new recreational fishing clinic project launched in Perth to encourage young Western Australians to become "Addicted to Fishing, not Drugs". The Australian Government is providing $65,000 for the Recfishwest project under its Recreational Fishing Community Grants Programme (MFFC, 2006). See: http://www.mffc.gov.au/releases/2006/06103a.html

[13] Photo: http://www.icfish.com.au/photo5.htm accessed 20/09/06

4 Economic values

Original Author: Clement Mabire

4.1 What are economic values?

Wetlands have long been perceived by decision-makers as having little economic value. In recent times, economic valuation has been used to highlight the values of wetland services in economic and policy decision making (Farber & Costanza, 1987; Costanza *et al.*, 1997; Emerton, 1999). Such information can contribute in making more relevant choices on how resources can be used, managed or allocated and it allows for wetland values to be considered in economic decision-making.

People earn money by utilising wetland resources; e.g. making art crafts and selling these on a local market. Conversely, money is also invested in conserving wetlands services to ensure their future use values.

Economic valuation is a very powerful tool which must be integrated in larger processes of decision-making or simply as a means of improving our knowledge concerning the values of the wetlands. The primary aim of total economic valuation is to develop arguments to support the wise-use of wetlands (Barbier *et al.*, 1997).

4.2 Valuation methods

The economic importance of ecosystem services can be measured by their contribution to production, consumption and employment, e.g. in terms of the number of people whose jobs are related to the use or conservation of wetland services, or the number of production units which depend on wetland services. Since both employment and productivity can be relatively easily measured through the market, this is usually quantified in monetary terms.

The basic aim of economic valuation is to determine people's behaviour and preference:

- How much do they pay for using a wetland service?
- How much are they willing to pay for using/conserving wetland services?
- What are the benefits or the cost for the consumer as a result of changes in their supply?

The (relative) importance people attach to many of the ecological, sociocultural and economic values, and the associated wetland services, can, partly, be measured using money as a common denominator. Monetary valuation methods fall into four basic types, each with its own repertoire of associated measurement issues.

[14] Photo : http://www.fotosearch.com/SIX007/ala-058/

Direct Market valuation

The direct market value is the exchange value that ecosystem services have in the market. This value mainly applies to provisioning services, some cultural (e.g. recreation) and regulating services (e.g. water).

The value of a service can also be derived by *'Factor Income'* (many ecosystem services enhance incomes) and *'Public Investments'*. For example, New York City decided to use natural water regulation services of largely undeveloped catchments, through the purchase or easements of A$133 million per year, to deliver safe drinking water. This avoided the construction of an A$8 billion water filtration plant implies that the conservation and restoration of the watersheds saved the city considerable outlay (Powicki, 1998).

Indirect Market valuation

When no explicit or proxy market for ecosystem services exist, indirect valuation can be applied. A variety of methods can be used to establish the (revealed) Willingness to Pay (WTP) - or Accept (WTA) compensation - for the availability or loss of services. Methods include *'Avoided Cost'*, *'Travel Cost'* and *'Hedonic Pricing'* e.g. prices for houses overlooking beaches usually exceed that of identical homes with less valued scenery.

Survey-based valuation

There are two methods in survey-based valuation. Firstly, *'Contingent Valuation'* where the service demand may be elicited by posing hypothetical scenarios that involves the description of alternatives in a social survey questionnaire (Wilson & Carpenter, 1999). Secondly, *'Group Valuation'* 'where small groups of citizens are brought together in a moderated forum to deliberate about the economic (monetary) value of ecosystem services through group discussions and consensus building (Blamey & James, 1999; Coote & Lenaghan, 1997; MA, 2005; Sagoff, 1998; Wilson & Howarth, 2002).

Benefit transfer

In many cases, constraints on human or financial resources prevent the possibility of a full site-specific economic valuation from being performed. Subsequently, the values of previous completed studies – but which focus on a different region or time period - can sometimes be used (Stuip *et al.*, 2002).

4.3 Economic value of wetlands in the Daly River and Mary River catchments

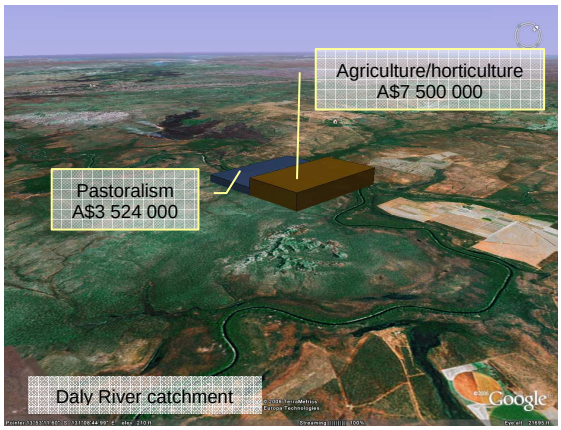
The objective here in the short timeframe available was not to provide an exact economic value of the wetlands but, rather, to provide an estimate of the total economic benefits given the data available. Different methods have been used to estimate the current value of a few selected wetland services.

The relevance of the results is assured by the fact that the methodology using extrapolation and an average margin rate of 20% has been established by economists in order to be used in different studies. This method is not specific for each service and is based on a conservative approach and implies that the global benefit derived has most likely been undervalued.

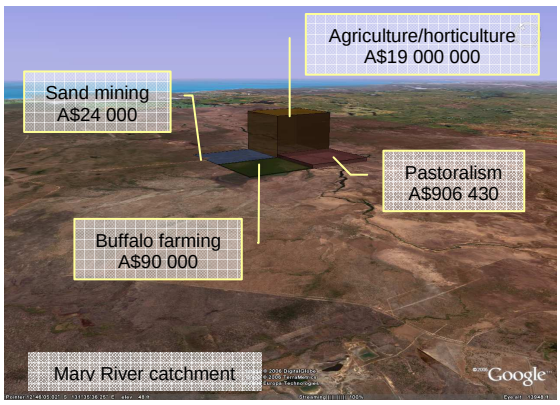
Carrier function

Whilst not formally defined within the MA ecosystem services typology, the 'carrier function' is used here to refer to the value ecosystems have in supporting primary production. By using the direct market valuation method, the economic value of services derived from this function can be estimated by taking the net benefit from the production, for example, of mango production. Given the data available, the valuation focused on four activities:

The valuation calculated the current value of the carrier function of Daly River wetlands to be estimated at approximately A$11 million. Given available data the valuation focused on two activities supported by wetland services in the Daly River catchment, see figure below.



The contribution of wetland services to the value of 'Agriculture/horticulture' and 'Pastoralism' is significant and serves as the major inputs to the total current value of the carrier function for the Mary River wetlands, with estimated value of A$20 million (see below).



Supporting services (nature conservation)

Preserving, improving or studying wetland habitats costs money. Conservation zones in both catchments are recognised for their exceptional characteristics by international, national and regional institutions. Some conservation programs are funded in order to assist in tackling key issues (see photos below) that threaten the supporting services provided by wetlands. Another example is to promote sustainability in development zones.

Daly River catchment	Mary River catchment
A$238 922	A$1 560 410

The importance of supporting services is valued using the different programs included in the management plans. Assessing their financial contributions for environmental conservation, this study provides the partial amount invested in both catchments. This benefit is considered as being the revealed institutional willingness to pay based on the real values attributed to the conservation zones by policy makers by direct or indirect contributions.

Regulating services

The total value of selected regulating services is based on the monetary values of the wetland services 'water supply' and 'carbon dioxide (CO_2) sequestration'.

Water

Water is the essential element to human life (drinking water) and socioeconomic development (irrigation water). For the valuation, only the water under licence has been considered. At the time of writing, no licence was required for water extraction rates under 15L/sec.

To appreciate the dependence on water, the total water consumption per catchment was calculated. The water consumption is linked to population size and extent of socio-economic development such as type and size of industries present as well as residential use water use.

The value of the 'water supply' service can also be estimated by focusing on the contribution of water to consumptive industries such as agriculture.

Irrigation represents 80% of the water consumed in Australia and is crucial for hydrophilic crops, like peanuts. The approach concentrates on calculating the benefits generated for the industry based on the contribution of water; and estimates the economic importance of water for industry and indirectly for social-economic purposes.

Estimated water consumption for irrigation attributable to all wetland types

Daly River catchment
27 099 million litres
(in period 1996/97)

Mary River catchment
3 794 million litres

(15)

Applying both valuation approaches to the wetland service 'water supply' in the Daly and Mary River catchments delivers an estimate of A$40 650 000 and A$ 5 700 000 respectively.

	Daly River (A$)	Mary River (A$)
Water supply	40 650 000	5 700 000
CO2 sequestration	66 260 000	21 112 500

Carbon dioxide (CO_2) sequestration

Carbon dioxide is one of the greenhouse gases listed under the Kyoto Protocol which traps the suns energy within earth's atmosphere. Increased concentrations of CO_2 (largely due to human activity) in the atmosphere are forecasted to change climate on earth; e.g. increased temperatures are likely to alter ecosystems (services), frequency and intensity of storm events and sea level.

Wetlands play a crucial role in the CO_2 cycle: trees and plants absorb large amounts of CO_2 storing it as carbon while oxygen is released back into the atmosphere.

The value of 'CO_2 sequestration' as a wetland service was estimated by an indirect valuation method. One approach focused on the quantity of dry matter produced in wetlands which ranges between 10-15 tons per hectare per year (Begg, 2001). The study used a conservative value of 10 tons/ha/annum (note: natural habitat is probably more productive) and that the production of 1g of dry matter requires 1.62g of CO_2 and 1.2g of O_2 (Guo *et al.,* 2001). Thus, 16.3 tons of CO_2 is absorbed/ha /annum. The marginal damage costs of CO_2 emissions has a median value of A$18.6 (based on 28 studies (Li *et al,* 2004)) and the recommended value after a statistical analysis was around A$66.4/ton of C fixed.

Cultural and Amenity services

Tourism, recreational fishing, hunting and other associated activities are not directly provided by wetlands but are based on their use. Visitors and residents pay to enjoy the experience and not necessarily for what they can physically obtain from the experience.

Tourist boat in Mary River and Hunting Safaris in Daly River

(16)

This valuation is based on tourist expenditure. A part of this amount is directly attributable to the organisation of the different activities including different stakeholders, such as facilities suppliers, furniture and technical material suppliers, food & fuel suppliers, tourism agencies (car renting, tour booking, accommodation). Based on these data, the economic importance can be extracted for the different activities using an assumption of the margin indicated by stakeholders.

	Daly River (A$)	Mary River (A$)
Tourism	20 400 000	1 732 346
Recreational fishing	43 000	269 500
Recreational hunting	No data	160 000

Additional economic values for tourists are derived when fishers and hunters can use also their 'trophy' as a supplement to food income and saving on usual food expenditure. Even if it cannot be considered as a way of subsistence as such, markets exist for animals hunted or caught. According to the quantity; the economic benefits for tourists can be extrapolated.

Total economic value of services

The monetary values of all the services previously mentioned were added to provide an estimated total economic current value of the wetlands.

Daly River catchment
A$ 82 400 000

Mary River catchment
A$ 50 700 000

The values of the Daly and Mary River wetlands are susceptible to change according to the methodology used for the valuation, the human pressure on the ecosystem services and the trade-offs which follow policy and management decision-making.

[15] Amount of litres are counted by using data from: http://audit.deh.gov.au/ANRA/water/water_frame.cfm?region_type=AUS&region_code=AUS&info=allocation

[16] http://www.icfish.com.au/hunting.htm accessed: 28/08/06

5 Competing interests

Original Author: Olga Ypma

5.1 What are competing interests?

Diverse groups of people utilise wetlands and wetland resources such as the fauna and flora, and water. People may compete over wetlands in terms of material resources but wetlands also play an immaterial role in people's lives (Buckles, 1999). There are potentially crucial differences in perspectives regarding the use of wetland services, for example, with water allocation in the Daly River catchment (Grimble & Wellard, 1996).

Competing interests are situations of competition and potential disagreement between two or more individuals or organisations over the use of one or more wetland service(s) (Grimble & Wellard, 1996).

5.2 Method for identifying competing interests

It is important to identify the people who have most at stake or are most vulnerable to changes in the availability or integrity of wetland services; for example, when a service is suffering degradation or is exposed to development and other land-use changes. Therefore, in order to identify such interests and 'stakes', one can apply a stakeholder analysis.

Stakeholders are both the people with power to control the use of wetland services as well as those with no influence, but whose livelihoods are affected by changing use of wetland services (adapted from Brown *et al.*, 2001).

There are basically four steps involved in stakeholder analysis: identification and selection, analysis of interactions (type of relationships) between stakeholders, and analysis of opinions (based on judgement, perception, attitude, and/or well-being); and interpreting the results of the analysis to assess management options and trade-offs (Grimble & Wellard, 1996; AusAid, 2000).

5.3 Potential competing interests in Daly and Mary River wetlands

The disagreements occur between individuals, organisations representing, e.g. conservation or fishers, and governmental agencies. Besides competition over resources, disagreements arise over specific activities affecting the wetlands or corresponding belief systems.

Agriculture development and land clearing

It is well-known that the pastoral and nature conservation sectors (represented primarily by the Northern Territory Cattlemen's Association (NTCA) and the Environment Centre of the Northern Territory (ECNT) respectively) do not always share the same views on the broad effects of agricultural development in the Daly River catchment and land clearing.

According to sentiments expressed from the pastoral sector, the land clearing and related decision-making which has been ongoing for the past twenty years now has not been conducted sustainably within the Daly River catchment as large pieces of land were cleared (Stakeholder, 2004 pers. comm.). However, nowadays, only small amounts of land are being cleared and this allows for more mosaic pastoralism and clearing where, due to the type of land forms, it is sometimes impossible to clear extensively (Stakeholder, 2004 pers. comm.). Furthermore, the opinion is that an established economic base is necessary before attention and resources can be devoted to the environmental and social aspects (Stakeholder, 2004 pers. comm.).

"You need to have an economic base before you do something for the environment and social side of things – you can't pull out the main industry… Neither of those two groups [the 'greenies' and 'indigenous'] provide a lot of financial income. You need culture, and you need your environment but you have also got to have a balance of it. You can't have them in charge of the total economy because they are not a producer and in a lot of ways they restrict a lot of viable production".

Changes in patterns of water run-off, or increasing rates and types of sedimentation are an effect (PWCNT, 2000). This has an impact on distribution patterns and abundance of wetland vegetation and animal communities (PWCNT, 2000).

(17)

In contrast, the conservation sector has stated (e.g. Kennedy, 2004) their opinion on potential threats of land clearing and agricultural development in the Daly Basin: 'Approximately 10-50 percent of wetlands would be affected by the agricultural development proposal, but the implications of these losses would reach far beyond these wetlands. Wetland loss in the Daly could have negative effects on Magpie Geese populations in other parts of the Top End including large protected areas such as Kakadu National Park' (Kennedy, 2004).

"The Daly River is symbolic for a lot of people. The local residents are really keen on the Daly River which they consider as still kind of Territorian and as their own backyard"

[17] Photo: http://www.nt.gov.au/nreta/naturalresources/nativevegetation/clearing/index.html accessed: 28/08/06

Fishing

Discussion with stakeholders indicated that local residents do not wish to see the Daly River being visited by hundreds of tourists and occupying the river all the time. A suggested reason was that there is a feeling that tourists are taking away (favourite and traditional) fishing spots (Stakeholder, 2004 pers. comm.).

The frustration that some local communities have with incoming tourists is partly expressed in a written submission to the DRCRG: "More tourists come with boats on the Daly River causing several impacts on the ecology and eroding of the river banks. The traditional fishing and prawning areas of the Aboriginal community (Malak Malak land trust area) are now being used by tourists. The result is that the Aboriginal people avoid the Daly River during the tourist season. During this season, they have to find other areas for their fishing and hunting" (Lindsay, 2004).

Fishers on the Daly River

Some Traditional Owners are of the opinion that the boats are taking over the river (DRCRG, 2004a). Others are of the opinion that these boats[18] are "roaring through sacred sites on the Daly River and that a sign has been pulled out which warned tourists and other people that they were not allowed to access the Kangaroo Rock – an Aboriginal sacred site" (DRCRG, 2004a). The result is, according to a Traditional Owner, that visitors were standing fishing on the rock at low tide. Another concern was that "anchors are being put into the river bed, which is Malak Malak ground" (DRCRG, 2004a). The response of a fisher during an interview was that they do not use anchors but tie the boat to a tree and therefore do not see the concern.

"We are talking about water, but these people are sitting on my ancestors under the river, that river is really alive. You can knock them about. And when you come back it will walk away to another place" (DRCRG, 2004a).

"On top the land may be white fella country, but underneath it is black fella country" (DRCRG, 2004a).

Introduced pasture species and fire management

Pastoralists in the Mary River catchment and Parks and Wildlife Commission of the Northern Territory (PWCNT) have contrasting views on managing pastoral land and introduced pasture species. According to Parks and Wildlife, introduced pasture species need to be managed in order to prevent them from spreading. 'If spreading occurs, it is possible that one pasture species excludes other vegetation leading to a one species-culture in the Mary River wetlands (Stakeholder, 2004 pers. comm.).

[18] Photo: http://www.krta.com.au/Daly_River_Region.htm accessed: 28/08/06

A controlled fire in Mary River catchment

Fire is a natural occurrence across the Mary River catchment and is a method for controlling introduced pasture species (Armstrong *et al.*, 2002). The differences of opinion between pastoralists and PWCNT relate to the frequency and timing of controlled burning. In many cases, PWCNT believes that pastoral land should be burned more frequently while pastoralists tend to voice disapproval over a higher burning frequency in the Mary River reserve. This leads to competing interests over the way in which ecosystem services are used and managed. In this case, one concern lies with the conservation of supporting services such as biodiversity and habitat while the other places higher importance on landscape conversion with introduced pasture species aiding increased economic returns from ecosystem provisioning and carrier functions.

The history of fire begins within the Aboriginal culture. Aboriginal people have burnt their country in order to control the buildup of fuel and thereby reducing the incidence of large uncontrolled fires (DIPE, 2004a). This resulted in a mosaic of growth in stages and types of vegetation development, providing a range of food sources and habitats for animals (DIPE, 2004b).

Occasionally, land degradation issues are occurring on pastoral land with pastoralists unaware of the cause (Stakeholder, 2004 pers. comm.). In these cases, PWCNT investigates the cause of impact, benefiting both the organization and the pastoralists. The pastoralist has an opportunity to learn of the cause so that measures can be taken to improve the pastoral land and PWCNT is satisfied when these measures benefit conservation in the area (Stakeholder, 2004 pers. comm.).

Water

Particularly within the Daly River catchment, water is a 'hot issue' largely related to the proposed agriculture development in the Daly Region. The discussion is mainly on water allocation, because this will determine potential land use (DRCRG, 2004b). The Daly Region Community Reference Group was formed with the aim of developing a draft Integrated Regional Land Use Plan to ensure that any future development is considered ecologically sustainable (Clare Martin MLA, 2003).

Western view versus Traditional view

The prevailing Western way of thinking is that land is more or less fixed while water exists as a fluid element. Therefore, many people in NT believe that water should not be owned by anyone; however, in the Water Act it is stated that the water is owned by the NT Government (DRCRG, 2004b).

In contrast, Aboriginal people hold the view that water resources are not isolated from other inter-related elements and potentially see it as part of 'country' (Jackson, 2004; Authority of the Senate, 2003).

'Aboriginal people have never drawn a distinction between the land and the water that flow over, rest upon or flow beneath it. The land and waters are equal components of 'country', all that require care and nurturing, and for which there are ongoing responsibilities' (Jackson, 2004).

The origins of water, its features and appropriate use are highly significant to Aboriginal people as it determines their way of life, sense of identity, economy and cosmology – understanding of how the world was formed (Jackson, 2004; DRCRG, 2004c). There are diverse traditional stories associated with water (Jackson, 2004). The stories can express the antics and activities of ancestral beings and spirits and show that there is a value placed on the equitable sharing of water amongst all Aboriginal groups in the Daly River catchment and of the wise use of water (DRCRG, 2004c).

"…There needs to be more Aboriginal representation [in DRCRG group] and in particular greater representation from the Wagiman people, who hold the land in the area subject to recent controversy over land clearing issues"

Water allocation

The Murray-Darling Basin is one of Australia's largest drainage systems (DEH, 2004). The development of the Basin's water resources has brought many benefits but also pitfalls. It supports approximately 75% of Australia's irrigation agriculture. The demands for the amount of water grew leading to low flows and changes in the seasonal flow patterns. As a result, most of the rivers in the Basin are in various states of degradation (MDBC, 2004). Based on this experience, many people fear the same will happen with the Daly River.


(19)

However, equitable water allocation poses many potential conflicts as exemplified by a statement during a public DRCRG meeting: "Currently people have land that they are developing but may not be using all of the water they need for the total area. If the final stages of the development are implemented these people would be disappointed to find that the water had already been allocated' (DRCRG, 2004d). "The resource must be appropriately shared. It is unfair to say that user x will have 100% of their entitlement, and another will have less. All licence holders needed to be treated equally" (DRCRG, 2004d).

[19] Photo: http://www.sitnews.us/FrontPage/WaterTap/water_tap.html (accessed: 08/09/06)

"The total use of water is unknown in the NT…"

The conservation sector is concerned about the effects of water extraction for agricultural development on the Daly River's ecosystem: "During the dry season areas such as the Daly Region and other rivers in the Northern Territory rely on groundwater – so if we go down the path of allocating water up front, just because we want irrigated agriculture that will potentially lead to serious problems with our river systems'"(Authority of the Senate, 2003).

"There is a significant under pricing of water resources in the NT. The fact it is free is probably misleading advertising, but that also highlights the fact that is how it is perceived by agricultural growers in the Northern Territory, and maybe that is how it is being seen by other sectors around the country. It is actually portraying the NT as having free or very low-priced water" (Authority of the Senate, 2003). Conservation groups argue that they are not against large-scale irrigated agriculture but fear that it will be a significant threat to values of the Daly River catchment and that the NT Government is repeating the same development mistakes that lead to the collapse of the Murray-Darling River system (Authority of the Senate, 2003; ECNT, 2003).

Traditional knowledge and science

Aboriginal people learn from nature (wetlands) throughout their lives and share their knowledge with the next generation through, for example, (verbal) stories; on the contrary, science is essentially a process of learning about nature (Storrs *et al.*, 2001).

'The information from scientific research is often treated with more respect and authority than traditional knowledge from Aboriginal and non-Aboriginal people for whom it might be complicated to demonstrate that their knowledge was derived from rigorous processes of dissection and analysis of facts' (Storrs et al., 2001).

Aboriginal people have unique and valuable knowledge about the wetlands biodiversity and uses (Christie, 1996). Occasionally, researchers involve Aboriginal people to gain deeper understanding of wetland biodiversity; 'This ecological knowledge should not be melded with contemporary, science-based knowledge into a new single hybrid. Aboriginal people do not feel any obligation to have their knowledge 'validated' against relevant western science'. In general, it is perceived that it is difficult to extract cultural information from Aboriginal people. In the Aboriginal culture it is not obliged to make all cultural information public (DRCRG, 2004c).


Conducting research while assisting the Ardjumarllarl Rangers with land management

6 Policy analysis

Original Author: Pujan Shrestha

Sound and balanced decision-making requires improved information on policy and institutional contexts and how these affect the way ecosystems are utilised.

Analysis of policy processes and management objectives is essential in setting the stage for a discussion on why ecosystem valuation is necessary, and what kind of valuation is needed (e.g. to assess the impact of past or ongoing interventions, to assess relative importance and analyse trade-offs of planned wetland uses (= partial valuation) or to determine the Total Value of the intact wetland). During the valuation process, it should also be determined how generated values can be relevant to policy and management decisions.

6.1 Why is policy analysis necessary?

Policies, institutions and governance involve 'higher level' actions that can alter the ways wetlands are utilised; various aspects influence the kind of values that are accounted for in relevant decision-making processes.

The ways in which policy and institutional aspects influence the availability of the ecosystem services provided by wetlands in the Daly and Mary River catchments is the focus of this policy analysis.

The analysis examined institutional arrangements for the management of wetlands in the Daly and Mary River catchments; identifying the specific policy interactions associated with key wetland services; and understanding stakeholder perspectives on their involvement in policy decisions related to wetlands at a catchment level.

The purpose of the policy analysis is to identify possible bottlenecks in institutional processes - e.g. policies working at 'cross-purposes' - and subsequently identify priorities that enable effective wetland management.

6.2 Policies & organisations

Institutions depicted as		
Rules-oriented (policy)	or	**Roles-oriented** (roles or organizations with special legal status)
Analysis focuses on relationship between policies and ecosystem services		Analysis focuses on organization's role and importance in wetland management

Lists of policies (especially legislation) and strategies were identified and associated with individual ecosystem services provided by wetlands. Identified policies were first categorized into two types:

Primary policy: the policy directly associated with a given ecosystem service and is a promoter or regulator for that particular service (e.g. The Mining Act is a primary policy for the provisioning service: 'raw materials'; or (carrier) function/activity: 'mining').

Secondary policy: many other policies that are not directly a promoter or regulator of a given ecosystem service but, nevertheless, have substantial power and capacity to define the ways in which the given service is utilized (e.g. the Aboriginal Land Rights Act, which is the secondary policy for mining, would determine if mining is allowed on Aboriginal Land or not).

Influence of policies on ecosystem services

Both primary and secondary policies exert positive and negative influences on the status of ecosystem services.

+ A positive influence is present when policies promote the use of the services and also safeguard their over-exploitation. The mechanisms are basically provided through the provisions prescribed in the Act, such as by:

- granting of title (e.g. Aboriginal freehold, pastoral lease, mining lease);
- giving consent to the conversion of land for a given use (e.g. mining, agriculture purposes);
- declaring the control district and management plans (e.g. water control district, pastoral district);
- prescribing mechanisms to monitor change and/or;
- issuing a moratorium (e.g. Interim Development Control Order in the Daly River catchment to halt land clearing) to control resource degradation.

Primary policies such as the Fisheries Act, Pastoral Lands Act, Mining Act, and Water Act are examples of policies that have a positive influence on respective activities utilising ecosystem services (i.e. fishing, pastoralism, mining and irrigation).

- The negative influence of policies exists when the conduct of a given activity or use of a given service is not consistent with the use of another service. The result is that additional procedures might be required for the:

- use of a given function (e.g. difference in the application procedure for mining on Crown land and Aboriginal land);
- additional time (e.g. the extra negotiation period needed for the consent of all the authorities);
- additional cost (e.g. the compensation or the extra royalties to be paid).

The negative influences do not prevent the use of a given service; nevertheless, it discourages its use due to the extra requirements. For example, secondary policies such as Aboriginal Sacred Sites Act, the Pastoral Lands Act, and Mining Act have negative influences on certain ecosystem services; e.g. the Mining Act often has a negative influence on supporting and regulating services.

It is important to note that positive and negative influences are only based on the smooth continuity of the use of the wetland service by the primary user supported by the policy. However, from the perspective of the entire system - especially in terms of conservation values and socio-cultural values and tradition - it is hard to justify the influence as being overall positive or negative. For example, the impact of elements of the Weeds Management Act can be perceived as negative for the pastoral productivity; however, from the perspective of nature conservation related to the issue of improved pasture species becoming potential environmental weeds, the impact of the Weeds Management Act on most ecosystem services is positive.

Organisations

For roles-oriented institutions, governmental departments and institutions are present in various hierarchies: at regional, national and intergovernmental levels.

The institutions at higher levels (the federal Department of the Environment and Heritage (DEH) and intergovernmental organizations) are more active in the fields of regulation and funding. Their roles are more oriented towards development of specific policies and regulations, monitoring and enforcement. They also play a vital role in motivating the local institutions through provision of funding.

For example, the Natural Heritage Trust (NHT)[20] has been an important source of funding in aiding the development of various management programmes to conserve and protect wetlands in the Daly and Mary River catchments.

The institutions at lower levels, such as the Northern Territory Government and various authorities at a regional level, play a larger role in the implementation of such higher-level regulations. These institutions generally have more contact with the local community by including them in planning and resource use decisions.

Example: DIPE formed the DRCRG consisting of landholders, industry, conservation groups and other stakeholders to discuss future development in the region.

At the catchment level, the local groups essentially consist of the resource users and appear to be more effective and influential in managing the local resources, provided that there was a proper consultative forum and appropriate support from government.

Example: the role of the Mary River Catchment Advisory Committee in overseeing implementation of the ICMP; however, the 'success' of this forum and plan is debated.

[20] Photo: http://www.nht.gov.au/ (accessed: 09/09/06)

There were also other institutions difficult to categorize under any level (perhaps 'cross level') such as research units and special group representative institutions (e.g. the Northern Land Council (NLC), Aboriginal Areas Protection Authority (AAPA) and Key Centre for Tropical Wildlife Management (CDU) which play a major role in research and education, and in representing concerns of special interest groups such as Traditional Owners.

Relative importance of roles-oriented institutions

Institutions	Category (Level)	Field of interest affecting the management of wetlands				
		Funding	Education & awareness	Community Consultation	Research	Regulation
DEH	National	****	***	*	***	***
COAG	Inter-governmental	**	**	*	**	***
DIPE/ DBIRD	Territory	***	***	**	**	****
MRCAC, CRG	Local	**	***	****	*	**
NLC/ APPA	Aboriginal interest	**	***	****	*	***
SSD/ CSIRO/ NAILSMA/ AIMS/ CDU	Research/ Academic	'	***	**	****	'

6.3 Policy interactions

Policies interact with each other in active, passive and 'mixed' ways. Active interaction, when the policies are consistent with each other, promotes the intended activity to proceed smoothly and also foster the multi-functional use of the ecosystem (and its benefits) at the same time.

Active interaction

For example, active interaction between the Strategy for Conservation of Biological Diversity of Wetland of NT (SCBDWNT) and Territory Parks and Wildlife Conservation Act (TPWCA) simultaneously promote supporting services (provision of habitat) and cultural services (recreation & aesthetic values).

"It is a more a policy intent of the current Government to recognise that they see wetlands as being important and they wish to manage them in a sustainable way – it is jargon, but that's all Government can do in policy....there was a wetland strategy [A Strategy for Conservation of the Biological Diversity of Wetlands in the Northern Territory of Australia] which was high level "we love wetlands", "we shouldn't hurt them", "be nice to wetlands"..[but]..in terms of more pragmatic operational type things, in the Government we only have limited resources to throw around in terms of management so we tend to target those things which are under perceived threat."

Passive interaction

Passive interaction - when the policies are inconsistent with each other - disturbs the intended activity and limits even the use of one service to the fullest. For example, the passive interaction between the Pastoral Lands Act and Weeds Management Act neither supports the pastoral activity fully nor safeguards ecosystem services, especially when improved pasture species become potential weeds.

Mixed interaction

The majority of interactions between policies are of a 'mixed' nature, which exists when there are incomplete and unclear mechanisms to address an issue or a problem in both policies. For example, the Fisheries Act recognizes traditional Aboriginal fishing but also grants licenses to fish in areas under Aboriginal claim but limits the issue of commercial Aboriginal coastal licenses to Aboriginal people. Hence, the Fisheries Act has a 'mixed' interaction with ALRA/Native Title.

Passive interaction between policies

Water Supply	Mining Act	Planning Act	Pastoral Lands Act
Water Act	Neither Act clearly specifies how much water is allocated for mining purposes	Neither Act specifies the measures needed to protect the water flow and water supply that – given development activities - can lead to changes in flooding regimes, water flow and degradation of water quality	Neither Act clearly specifies the quantity of water resources to be supplied for pastoral (agriculture) activity

6.4 Stakeholder involvement

There are two approaches for assessing the views and involvement of stakeholders in policy-making. The first approach deals with assessing the existing state of stakeholders' involvement in the decisions made for the Daly and Mary River catchments. The second approach deals with linking the stakeholder group with the policy and the use of ecosystem services through the perspective of representation and organization.

First approach

The existing situation and the present mechanisms for community involvement in both the catchments have been explored. In the case of the Daly River catchment, there was not any statutory community group and the catchment-wide management plan was absent (as of January 2005). However, the existence of the ongoing consultative forum, the Daly River Community Reference Group (DRCRG), brought together different stakeholder groups responsible for developing a Regional Land Use Plan for a defined area. Problems such as limited group representation; limited timeframe and lack of scientific information to underpin decision-making were identified as obstacles for the consultation group.

In the case of Mary River catchment, the existence of the statutory group - the Mary River Catchment Advisory Committee - could oversee the catchment-wide management plan (Integrated Catchment Management Plan of the Mary River Catchment). However, issues such as the structure of the committee and the limited government support afforded to the stakeholder groups were found to be some of the key factors restricting further stakeholder involvement in catchment planning.

Second approach

The identification of the linkages between stakeholders, ecosystem services and policy was explored from two perspectives: 1. from stakeholders' representation and; 2. from stakeholders' organization. In the case of stakeholders' representation, a comparison was made to check if all the stakeholder groups linked to a given ecosystem service or activity were represented in policy.

In most cases, the same stakeholder groups utilizing a given wetland service are also addressed in the policy, but their concerns are not equally reflected in the same policy. For example, the Pastoral Lands Act favours the interests of pastoralists but it has no sufficient provision to address the concerns of other stakeholders who are affected by pastoralism but whom, at the same time, are interested in the diversification of pastoral land for purposes such as mixed farming, eco-tourism and biodiversity conservation.

In the case of stakeholders' organizations, it was observed that stakeholders organize themselves in various groups and their organization reflects their interest on different types of ecosystem services; for example, organized interest groups are more interested in the 'carrier' functions/activities supported by the ecosystem (e.g. mining, horticulture etc.), or, in other words, optimising those ecosystem provisioning services which are economically valuable to those groups (e.g. minerals, water for crops). In contrast, 'community collective activity groups' are more concerned with the maintenance of regulating and supporting services – such as those that are important for their area and are under threat such as reductions in significant habitat, erosion control, flood prevention, and or necessary water to maintain environmental and cultural flows.

In both Daly and Mary River catchments and at regional and national scales, there are many different types and levels of institutions: but not a single policy or authority explicitly governing the management of wetlands. Whilst policies have both positive and negative influences, this is only from the viewpoint of continuity of use of wetland services, and not for the "whole system".

7 Management implications

Original Author: Matthew Zylstra

The wetlands of northern Australia remain relatively undeveloped and intact compared to those of other regions. However, the ecosystem services wetlands provide are subject to increasing pressures from potential expansion of economic activity, development of land and water resources, land-use changes and threats from natural processes. These trends are likely to compromise the ability of wetlands to sustain the benefits that underpin quality of life in the Territory. This will deliver continued management challenges in the coming years.

East Alligator River

Therefore, ecologically sustainable management of these areas requires a multi-disciplinary and integrated approach; one which optimises the potential for the multi-functional use of wetland areas but, at the same time, provides decision-makers with options to protect the values of these rich ecosystems for future generations.

In line with outcomes of the Millennium Ecosystem Assessment (2005a), the results of this study vindicate the message that an integrated, cross-sectoral and ecosystem-based approach to management is needed to secure the benefits that wetlands provide to support human well-being, from local to international scales.

The primary aim of the *Integrated Assessment of Wetlands in Northern Australia* pilot project (i.e. applying the ecosystem function analysis framework) for the Daly, Mary and East Alligator River catchments was to provide an initial overview of how ecosystem service analysis could be applied across different catchment areas – each with their own distinct forms of land-use, values, management and objectives.

Existing management plans and activities across the research catchments were reviewed to learn to what extent wetland ecosystem services were being addressed in management – both explicitly and implicitly.

7.1 Management across the catchments

There are contrasting management structures, activities and land-use objectives across the Daly River, Mary River and East Alligator River catchments. However, wetlands in all catchments face similar management issues such as the spread of weeds, uncontrolled fire and associated threats from current land-use activities or potential intensification of development. Stakeholders identified as being involved in management processes in the respective research areas manage (strategically and operationally) at various spatial scales; however, small community groups or individual landholders (often resourced by either Territory or Commonwealth Government) are most closely involved with wetland management through weed control activities. Across the catchment research areas, there are differing perspectives on why identified management issues are important and should be considered a priority over others. These differences are related to the values stakeholders attach to services provided by wetlands - expressed or implied - and is reflected in how these ecosystem services are currently addressed in management plans.

Generally, current management approaches at a regional and catchment level and for indigenous and non-indigenous management are *issue-based*. That is, a number of wetland services are being addressed indirectly in management plans[21] as a result of actions that focus efforts on mitigating a perceived priority issue. For example, tackling weeds infestations due to concerns of impacts on: agricultural productivity and biodiversity (e.g. in the Mary River catchment and areas of the Daly River catchment) or to retain culturally important activities such as the customary harvest of wetland resources (e.g. in the East Alligator River and areas of the Daly River catchments).

Mimosa pigra seedlings are often found in or near pig wallows. Magpie geese are popular 'bush tucker' for Aboriginal people in the East Alligator River catchment

Management actions across all research areas were, when taking an issue-based approach, generally seen as positive in their potential to address key wetland services. However, the study indicates that stated management actions are often not carried out effectively or even at all. Given the severity of some issues and the presence of 'function-conflicting' land-use activities, there is a need for a larger systematic program for addressing wetlands in management in terms of linking issues and ecosystem services in order to facilitate effective ecosystem-based management (e.g. monitoring the ability of wetlands to sustain current benefits for regional well-being).[22]

[21] A limiting factor in the analysis is that what a management plan says is not always what a management plan does. Therefore, whilst the analysis can provide indications as to *how* management plans are addressing ecosystem services, it does not necessarily provide a true reflection of whether on-ground management *is* addressing them.

[22] As of January 2005; it is acknowledged that the subsequent release of the NT INRM Plan intended to address such 'gaps'.

The existing approaches for wetland management across the research catchments have not explicitly recognized the ecosystem services provided by wetlands. There is a growing recognition in the NT of the diverse benefits and services provided by wetland ecosystems to broader society. There is also an increased understanding of the need to recognise the values derived from wetlands and incorporate them into management and planning frameworks. Whilst this is now being recognized in terms of 'higher-level' strategies for wetland and natural resource management in the NT (e.g. 2005 NT Integrated Natural Resource Management Plan), it has not yet been effectively translated into operational management at catchment or local level.

As an overarching strategy containing specific resource condition and management action targets for the managing the Territory's resources, the implementation of the INRM Plan will have implications for future wetland management in the Daly River, Mary River and East Alligator River catchments.


Katherine Gorge


Mary River


East Alligator River floodplains

7.2 Applying integrated ecosystem assessments in NRM & planning

"Management and planning of any area should attempt to reconcile competing interests, by identifying priorities for the allocation of resources, strategies to manage ecosystem resources and by facilitating public understanding of and involvement in the planning process" (Lawrence, 2000).

An ecosystem services approach to integrated assessment is a tool that can potentially contribute to effective management and planning by offering greater accountability in actions and therefore assisting in reconciling competing interests to allow for the equitable allocation of resources. Before competing interests can effectively be reconciled, it is necessary for decision-makers to have a clear understanding on the nature of the interests at stake – what is driving them and why are they are important to the stakeholders concerned.

The perceived importance of specific wetland services will vary between stakeholder groups within and across the research areas (over space and time); however, these differing stakeholder views are not always adequately captured in management plans or policy.

The potential for ecosystem service analysis approach to be incorporated into wetland management in the NT is dependent on its ability to be perceived to address the grievances stakeholders and decision-makers have with current resource management and decision-making processes. Integrated ecosystem assessments can be applied to address certain bottlenecks in management and decision-making; however, the NT offers a complex management reality and inevitably the application of any conceptual framework will be challenged in its ability to adapt and deliver under circumstances shaped by powerful historical, political and cultural factors in NRM.

7.2.1 Ecosystem assessment in strategic management

"...it's such a big area and there's so little money coming in that we need to have a strategic approach or we're just never going to tackle anything. We need to make sure what we are doing is hitting the ground."

There is clear potential for integrated ecosystem assessment to be used for strategic level management and planning in the Northern Territory. A key implication for management is that by explicitly stating the ecological, sociocultural and economic values of wetland services and where those benefits are likely to accrue, it provides justification for adopting a specific management action. By highlighting potential trade-offs, the decision-making process is more transparent and therefore encourages consensus and effective communication between stakeholders and Government.

In addition to offering transparency in decision-making, there lies practical potential in being able to target resource management priorities and 'at-risk' ecosystem services and habitats. However, the approach must be seen as not only being relevant but compatible with approaches to resource management currently being implemented in the NT. This is particularly important at the present time in the NT where a new strategic approach to natural resource management is being implemented through the INRM Plan.[23]

Since INRM targets have already been established through an extensive consultation process, an integrated ecosystem assessment will have greatest potential when utilised to determine target priorities for wetland management (i.e. Inland Waters and Coastal & Marine) as well as being valuable in future monitoring and evaluation of management targets and actions. The concept of ecosystem services can also be applied in defining the role of indicators in monitoring, i.e. why a certain indicator is useful for measuring ecosystem health or if indicators adequately address a representative cross-section of key ecosystem services.

[23] The MSc thesis on which this summary is based provides a practical example of how ecosystem service analysis can be applied to the NT INRM Plan in terms of 'cross-checking' management action targets and related indicators.

Finally, and as is being witnessed in southern States, ecosystem services can provide a basis for developing market-based instruments (MBIs) which aim to safeguard the integrity of ecosystems by financially compensating (rewarding) sustainable NRM.

7.2.2 Ecosystem assessment in operational management

"What I want to know is how is this going to help me? ...You know, every day when I am out there [doing land management] with the boys."

On-ground land and fire management

For on-ground wetland management, integrated ecosystem assessment has benefits in focusing management on priority issues when only limited resources are available. It can put management actions in a broader context in terms of understanding the benefits of current actions. Highlighting the bundle of ecosystem services addressed by on-ground management actions can add extra support to (NHT) funding applications as well as providing a basis on which to communicate the real value of on-ground actions for wetland management and conservation. An understanding of the wetland services being addressed may assist land managers in entering possible future discussions on establishing markets/payments for their continued maintenance of wetland services.

7.2.3 Increased transparency and accountability

At a broader level, the implications for management and planning relate to the potential for an assessment to increase transparency, objectivity[24] and accountability in decision-making.

Fundamentally, the approach illustrates the value and importance of wetland ecosystems to human well-being – in both economic and social terms. Whilst the importance of wetland ecosystems services to sustainable management are mostly well-known and described, a *justification* that encourages consensus for required management actions is often missing or, at least, not effectively communicated. Therefore, integrated ecosystem assessment has potential in: facilitating a more objective justification for 'trade-offs' which may be required; levelling the playing field in decision-making; and in engaging stakeholders in constructive dialogue by facilitating use of a 'common language' (i.e. benefits received from ecosystems).

[24] Objectivity is difficult to achieve in any form of decision-making process and, more often than not, such (multi-stakeholder) processes are prone to subjectivity or a tendency to conform to the prevailing discourse ('business-as-usual'). However, in many cases, poor decisions are simply made due to a lack of understanding, communication or information.

7.2.4 Prioritisation of stated INRM targets

Integrated ecosystem assessment will realise greater potential for wetland management in the NT when it can be applied or integrated within current strategic approaches to management at both a regional and catchment-scale. Understanding the value and importance of relevant ecosystem services can assist in the prioritisation of stated management targets in the INRM Plan by identifying 'at-risk' services – in terms of vulnerability and future availability under different land-use change scenarios. In addition, it has potential in defining future management by fostering awareness (at an ecosystem level) of what actually *makes* a certain issue an issue for stakeholders (as part of a broader value assessment framework).

7.2.5 Increased awareness and communication of ecosystem values and benefits

It is acknowledged that the uniqueness of NT situation presents many challenges to ecologically sustainable management. In this regard, substantial political will is required to translate the valuable elements of ecosystem-based approaches such as those advocated by the Ramsar Convention on Wetlands, Convention on Biological Diversity and the Millennium Ecosystem Assessment into tangible and practical management outcomes which balance the objectives of economic development, ecosystem integrity, and human well-being.

There is no 'silver bullet' to solve the many issues that threaten wetland ecosystems in the NT; however, more can be done to ensure sustainable outcomes through the effective implementation of ecosystem-based approaches. This requires 'whole-of-government' support and a need to build greater awareness and appreciation for the many critical services that healthy ecosystems provide for human well-being. The challenge is therefore to communicate ecosystem values and benefits in a clear language that engages Government and society. Based on this emerging knowledge, the challenge then is for *both* society and Government to listen – and then to act.

The principles of ecosystem-based approaches should be adopted within current management frameworks to assist in developing value assessment frameworks, and understanding trade-off options for multi-functional land use scenarios. Opportunities through the Ramsar Convention - both in technical guidance and for listing of wetlands - should be investigated for potential benefits for management. Finally, wetland management would benefit from a program that increases education and awareness of the value that healthy ecosystems deliver to broader society. Once ecosystem benefits are known and their values clearly communicated, then it should facilitate a greater acceptance of decisions which assist in the sustainable management of wetland resources.

8 Recommendations

There are a few important caveats to be considered when offering recommendations for management and policy in the NT. Some of these have been described and relate to the considerable constraints that are faced in effectively managing extensive wetland areas with limited resources. Many of these constraints are well-known and have been articulated through research reports and current planning processes such as in the *NT INRM Plan*.

Lessons from nature: Adaptive management

Given the sensitive nature of resource management in the NT, it is also not advised to make far-reaching and sometimes unqualified 'throwaway' statements of 'how things should be' when one is considered to have an 'outsider' status; that is, not being resident or a participant to the everyday realities and challenges experienced by resource managers and stakeholders in the NT.

Therefore, it will not be the intention of this section to reemphasise well-known recommendations[25]; however, at the same time, the existence of challenges for effective resource management should not be seen as a mandate for continuing along the familiar 'business as usual' path. Whilst there are significant structural impediments to forging a more effective, integrated and comprehensive approach, there are a number of steps can be taken to yield positive results for natural resource and wetland management in the NT. These steps have been summarised as recommendations below with an emphasis on the opportunities for integrated ecosystem assessment to assist in ecologically sustainable wetland management.

8.1 Methodology for ecosystem valuation assessments

Recommendations related to improvements in methodology have been described in detail in the individual contributing MSc theses (copies held at *ERISS*) which provide the basis for this summary document. Readers interested in recommendations related to methodology should refer to these reports or alternatively contact the corresponding authors.

However, a few aspects on methodology will be briefly described. Firstly, consideration needs to be given to all ecosystem goods and services and not only those easily identified, economically important or which most technically valuable in terms of available data. Using values derived from other studies can be a viable alternative in this case and may assist in acknowledging the importance of values that stakeholders attach to various ecosystem functions.[26]

Secondly, a truly integrated approach requires multidisciplinary and innovative forms of information exchange and an understanding *a-priori* of realistic limitations (e.g. time, data, distance), Future studies would benefit from more clearly focused and defined research areas which, when applying the framework (see Appendix) would assess ideally assess the following:

- relevant management and policy objectives and the purpose for applying the framework; [27]
- ecosystem services to be identified for a defined area (e.g. catchment) and ranked in importance;
- values (ecological, economic and socio-cultural valuation) of services to identify possible trade-offs;
- trade-offs (or magnitude of) related to wetland use options and selected services[28];
- constraints within the existing policy framework for options/outcomes to guide policy measures;
- strategic management objectives to assist implementation of actions at an operational level;
- suitable indicators to be used as a benchmark for ecosystem services' assessment and monitoring;
- potential for representative stakeholder and expert involvement throughout the process.

Finally, the importance of preparing sound methodology should not be underestimated. Well-prepared methodology can improve research efficiency and avoid costly losses in both time and available research funding. It is anticipated that ecosystem valuations - of the form described in this report – will be gain growing importance and prominence in the coming years. With this mind, it is

[25] For example, recommendations include: addressing knowledge gaps in baseline information; building community capacity; providing incentives for best-practice land management regimes in wetland areas; improved monitoring and evaluation of sensitive aquatic ecosystems; implementing ICMPs which include assessments of ecological, economic and socio-cultural values relating to wetlands; incorporating indigenous and western-based/scientific knowledge and values in wetland management and planning; and, critically, providing the necessary support to assist Aboriginal people in 'getting back on country' by building capacity to allow for more active involvement and independence in NRM (see also LCNT, 2004; Storrs *et al*, 2003; Scott, 2004; Armstrong *et al*, 2002; PWCNT, 2003). Further recommendations include adopting - with the purpose to implement – principles contained within *A Strategy for Conservation of the Biological Diversity of Wetlands in the Northern Territory of Australia* (see PWCNT, 2000).

[26] Known by ecological economists as "benefit transfer", this method is becoming increasingly important where the costs of undertaken a specific valuation exercise are too high. A number of databases are being created to help economists and policy-makers in accessing this information. For example see: ESD (http://esd.uvm.edu/); EcoValue (http://ecovalue.uvm.edu/) EnValue (http://www.epa.nsw.gov.au/envalue/) Databases.

[27] For example, to assess: multi-functional use options; total economic value (regional); environmental impacts (EIA).

[28] What are the cost and benefits of different scenarios? How is the availability of ecosystem services affected? How do stakeholders rank/rate the importance of various scenarios?

critical that researchers embarking on assessments in this field familiarise themselves with past and present studies in terms of obstacles faced, challenges overcome, best practice and overall 'lessons learned'. This becomes a call for improved communication and dissemination in the exchange of related information and processes to facilitate practical knowledge sharing.

Drawing on past and present experiences in the field can provide invaluable guidance. Initiatives such as the Nature Valuation & Financing Network (www.naturevaluation.org) - in addition to acting as a platform for the development of practical tools for ecosystem valuation - are facilitating information exchange by building a database of case studies which use ecosystem-based approaches (including valuation and market-based instruments) to achieve sustainable and equitable outcomes for NRM and related policy.[29] Alternatively, a short search on Google or an academic search engine will return an abundance of related information wherein one can find tips and lessons learned from valuation assessments[30].

Whilst considerable attention has been paid to the ecological and economic valuation of ecosystems, less progress has been made or articulated in terms of developing sound methodology for cultural valuation. Valuing the cultural importance of ecosystem services is a critical element in providing information to decision-makers. (31)

Whether we are aware of it or not, most of us attach what is known as "intangible values" to our natural environment. The sociocultural importance of ecosystem services is often outweighed by economic and even environmental arguments in cost-benefit analysis. Absence of information on sociocultural services and the inherent difficulties of assessing, valuing and communicating information regarding these services leads to inequitable decision making.

Therefore, sociocultural valuation would benefit from attaching derived values to other identified wetland services e.g., regulating and provision services – which are most commonly coupled with ecological and economic values respectively. The subsequent process may enable one to identify the relative sociocultural importance of wetlands services for each stakeholder. Once the sociocultural importance is made explicit, it can assist in identifying (potential) competing interests between the services and stakeholders that use them.

"Everyone will say they want to protect this or that but if people don't actually know why they should conserve nature, well, then there is just no point."

The weight that cultural services carry in decision-making depends on the importance that stakeholders attach to them. To some extent, this importance (and perception) can be assessed using expert opinion and best professional judgement; however, a participatory approach (adapting preference tools such as "pebble distribution method") is necessary as a first step in abstracting culturally divergent value systems[32].

8.2 Policy

The undervaluation of ecosystems in policy formulation has often accelerated the processes of environmental degradation (e.g. through perverse subsidies, minimal penalties, or a preference for short-term economic gains accumulating to private beneficiaries but at a larger cost to broader society) (Emerton, 2006). A number of recommendations can be drawn from the analysis in order to improve institutional arrangements:

It is important to clearly define the roles and mandates of relevant institutions and promote sectoral co-operation and coordination, particularly between legislation, government departments and among the various branches within them.

To date, the conservation of wetlands appeared to be a side-product of other development and conservation efforts. Delegating responsibilities to a single institution to plan, operate and maintain systems for monitoring and supervising the activities that affect the wetlands in the research areas can be an important step forward. The multiple indirect legislative impacts on wetlands should be minimized through a frequent review of policies to harmonize them and to ensure consistency in their objectives and management approach (e.g. the review of guidelines for clearing native vegetation under the Pastoral Lands Act and Planning Act is a positive step).

[29] The nascent database is currently undergoing expansion and can be located at: http://topshare.wur.nl/naturevaluation/73766.
[30] Existing case studies such as: PES in South America; RUPES in South-East Asia; MBIs through the NHT in Australia; Ecosystem Marketplace/Katoomba Group; IUCN key publications, e.g. "Value" (Emerton & Bos, 2004) and IUCN/WANI "Values & Rewards" (Emerton (ed), 2005); and WWF key publications e.g. "Living Waters" (Schuyt & Brander, 2004) and "The Green Buck"(Le Quesne & McNally, *undated*). Alternatively, use search keywords such as: ecosystem services, economic valuation, ecosystem payments & markets.
[31] Peter Till. Resurgence Magazine. May/June 2006 No. 236.
[32] For further information, refer to "Cultural Values of Nature": http://topshare.wur.nl/naturevaluation/73757
Task Force on Cultural and Spiritual Values of Protected Areas: http://topshare.wur.nl/naturevaluation/71205
Or contact: Bas.Verschuuren@wur.nl

There is a need to develop direct legislative protection for wetlands, in line with national and international guidelines, which not only recognises the services provided but can demonstrate how to involve people in management with traceable outcome and reporting mechanisms.

The various NRM issues (such as weeds, feral animals, fire etc) associated with services provided by the wetlands can be minimized by avoiding disjointed management approaches across the land tenures (e.g. pastoral land, crown land), and by promoting joint planning and management schemes across all the land tenures (e.g. regional weed management plan).

Individual management of various issues at the local level should be integrated at a higher level planning framework (e.g. the NT INRM Plan which strategically fits other local management plans into an overarching plan). In addition, a structured planning process and improved mechanisms to identify current gaps and inconsistencies should be endorsed (e.g. with stakeholder consultation).

Establishing Integrated Catchment Management (ICM) is an opportunity to promote wetland conservation in the context of catchment planning as it provides a forum for stakeholders' involvement in the management approach.

Consideration should be given to the development of a custodial catchment authority with a statutory strategic catchment plan, particularly in the Daly River catchment.

In line with the above, the catchment authority should consider the diverse perceptions on the same issue and act as a forum to plan, develop and resolve conflicts between stakeholder groups. Recognition of all stakeholders and opportunities for involvement is essential for building a "whole of government approach" to conservation and land management.

Finally, it is necessary to build on existing local land management activities (e.g. indigenous ranger programmes, Landcare and Rivercare activities) with suitable incentives and resources (funding, training) to ensure long-term viability.

8.3 Management

Broadly speaking, it is recommended that management adopt steps for implementing the Ecosystem Approach (see Shepherd, 2004) but which additionally stresses the importance of understanding that knowledge will inevitably be incomplete at the beginning but that it will grow over time. More importantly, it demands realism in that often we must settle for what is possible, not what is theoretically ideal (Shepherd, 2004).Therefore flexible planning systems, that are centred on objectives, not activities, are needed.

Adopt integrated ecosystem assessment within current management frameworks. As described in the previous chapter, the approach may be applied to current NT INRM planning at a strategic level in terms of understanding what management targets are actually addressing at an ecosystem level.

Conservation efforts have historically been hindered by an inattention to ecosystem values - which have made it more difficult to justify or sustain activities in economic and development terms - or to compete with other seemingly more profitable investments , resource options and land-uses (after Emerton, 2006).

The outcomes of this assessment are likely to assist in prioritizing targets and making options for potential trade-offs, risks and uncertainties more transparent. At a catchment level, adopting tools such as ecosystem services analysis will assist in developing required value assessment frameworks for equitable resource allocation and outcomes for multi-functional land use. It will also assist in understanding the value of on-ground management in terms of how actions are addressing the maintenance of key ecosystem services.

Concerted efforts need to be made to bridge the current gap between operational and strategic management objectives and outcomes.

Explore options available under the Ramsar Convention for Wetlands. Ramsar offers detailed technical and policy guidance for adopting 'wise-use' approaches to wetland management. Such guidance is in line with the ecosystem-based approach taken in this assessment as well as through the 2005 Millennium Ecosystem Assessment. The Northern Territory Government could potentially gain advantages by listing more sites under the Convention. In addition, the practical experience of wetland managers in the NT could also be profitably shared in terms of refining and operationalising guidance advocated through international agreements. Listing wetlands under the Ramsar Convention across different tenures can be resource and time intensive; however, benefits include the flexible nature of the listing, the recognition a listing provides to the wetland owner, and the enhanced priority the wetland receives for Natural Heritage Trust and National Action Plan on Salinity funding (Scott, 2004). Finally, it must be reiterated that conservation measures (through zoning, protected areas or listing) designed to protect sensitive wetland ecosystems must be addressed at an ecosystem level with sustainable management arrangements encompassing entire landscapes:

> A quest to assign importance to the separate pieces of the [wetland/landscape] jigsaw is quixotic, because we can ill afford to lose any of them. It is the integrity and linked ecological function of the whole that must be protected and maintained (Whitehead & Chatto (1996) by Scott, 2004).

Increase education and awareness of ecosystem benefits in society

"As far as on-ground environmental education [goes], the only people that are getting that are schoolkids...through their curriculum. There is no [other] environmental education happening so where do people get the information from?"

Not only does there need to be a significant conceptual shift in the way Government and policy-makers approach natural resource management, but this needs to be coupled with a program of communicating the value of ecosystems in a consistent and coherent way to broader society. Governments can be paralysed or are understandably unwilling to adopt politically unpopular decisions. This is particularly the case in the NT where Government is more easily at the mercy of a small population with politically influential sectoral groups that have greater access to Government. The NT public is generally aware of the need to protect ecosystems and understands the attachment they have to certain environments;[33] however, they often lack the information that would empower them to take the action required in order to preserve ecosystem benefits for human well-being into the future.[34] Once the benefits and values of ecosystems are known and clearly communicated, then there will be a greater acceptance of decisions that assist in the sustainable management of wetland resources.

"Ecosystem services are being talked about nationally but are not really coming through at an NT level. We don't have the scientific understanding and background for it to really hit the ground in the NT. People find it difficult to kind of grasp and difficult to get hold of. I think people intrinsically understand the value of an ecosystem, the value of a wetland or river – people understand aesthetics and the kind of attachment you have to an area; people know that this leads to this and this. People understand the basic concepts but I don't think that is really translated to what it needs to be to understand ecosystem services. I think there is probably a bit of education that needs to be done there."

[33] Ramsar communication material: http://www.ramsar.org

[34] There also remains a question whether society is ready to accept some of the tough trade-offs that may be required.

8.4 Final Word

Integrated ecosystem assessment can offer a significant contribution to the ecologically sustainable management and wise-use of wetlands in northern Australia. In line with outcomes of the recently released Millennium Ecosystem Assessment, the results this study vindicate the message that an integrated, cross-sectoral and ecosystem-based approach to management is needed to sustain the critical services provided by wetlands.

Beyond this, the assessment sought to deliver arguments that extend beyond the traditional - and often counter-productive - conservation versus development debate by drawing attention to the importance of investing in natural capital for a sustainable future. In other words, healthy ecosystems are the basis for a healthy economy and a healthy society.

Ecosystem valuation was presented as a key tool for increasing our knowledge on the value of the flow of benefits derived from wetland ecosystems now and in the future. An insight into the value of ecosystems can help shed light on the net cost or benefit of a proposed management intervention, e.g. conservation measures and bring greater transparency in understanding the distribution of ecosystem benefits across different groups. Finally, in perceiving what is 'at stake', valuation can assist in the development of equitable financing arrangements to reward sustainable land management.

There is a growing appreciation in the Northern Territory of the need to recognise wetlands values and suitably incorporate them into management and planning frameworks. In building 'whole-of-government' support, a greater focus will need to be given to raising awareness of the diverse benefits that healthy ecosystems deliver to society. In addition, in acknowledging that the majority of wetlands exist on privately held land, Government must ensure that a range of options and incentives are available to encourage landholders to manage wetlands with a goal to retain the ecosystem services they provide and engage in ecologically sustainable and culturally acceptable activities (Whitten et al, 2002). If this is achieved, then it is far more likely that current and future strategies advocating the practical and sustainable management of wetlands will receive the full support and backing that is desired by many in the wider community.

"We [the Government] are certainly in favour of a more objective framework for decision-making which can at least put all the cards on the table. We are getting to the stage in the NT when we need to make some hard decisions and need to have some trade-offs. So some of the things you're working on may have some value for not only wetland management but for broader management – that's why I have some sense [of interest] in seeing what comes out of your work".

Stakeholder Quotes

"The local groups were trying to bring some independence into the process. Eventually the government stopped the funding. This strongly de-motivated the local groups and with a sense of 'un-recognition' of the local efforts, the groups' motivation collapsed considerably"

"We're wealth creators, you know, we create wealth by harvesting a resource."

"Parks [PWCNT] produce all these fantastic reports and they just go into hyperspace"

"We can really only address issues that won't cost money; for example, like trying to change land practices"

"…more research has to be conducted on native grasses than on improved pasture species that become potential weeds…"

"I think one of the biggest problems we face in environmental management is Government – it is the tension between the State [Territory] Government and Federal Government."

"The Commonwealth can't see the people attached to the negotiations; a 'hiccup' for them is my job"

"The problem [of weeds] is that big and the population is that small here that even if you had money you'd have to import armies, really, to start looking after it."

"…There is no policy to support the [DRCRG] group process and is very ad hoc. The consultation is very ordinary, unsystematic and not a model of best practice"

"The decision of the Government from the beginning excluded conservation interests and recognition of Aboriginal interest. The plan is integrated only in the sense that every one is doing everything everywhere but not integrated in a sense of having a vision about how the area would look like in the long run".

"Why are we actually doing this sort of [integrated ecosystem] assessment anyway? Because the previous ways of trying to tell people this sort of thing [i.e. the value of the environment] have not worked."

"We've just got to be balanced – people have to make money out of using the land but they've got to be reasonable about the way they make money...and also they shouldn't impact on their neighbours. And to try and work out how you frame that into a policy with declaration behind it is difficult."

"The current [Territory] Government is very proactive...in indigenous and Greens and they just see them as more votes than we [farmers] would ever provide and that's the way it goes.

"Environmental factors are the last things that are considered – there is a vested financial interest in lobbying; so much lobbying is already worked up that you feel your voice isn't heard"

"[We have] frustration with Government intervention. You know, they ask us to do a particular job, we give the information to the Government and the Government ignores the information. And it is a vote winner."

"...If you're [a landholder] making good money, you'll spend a lot of money on your peripheral things such as your fences and mainly your weeds and erosion. If you can't make good money, the first things that farmers cross of their list – whether you like it or not – is weed control and erosion. It's silly, because if affects you long-term, you save some money short term but if you haven't got any money in your pocket that's what you're forced to do."

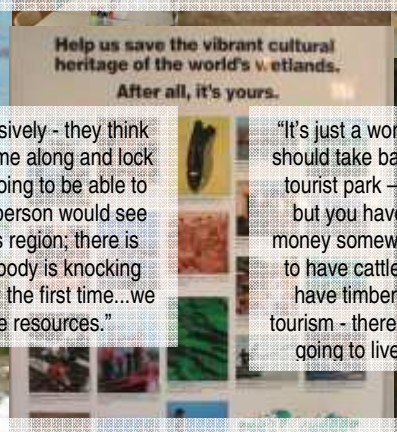
"Management is just how they all fight themselves out; that political process where the strongest ones impose their ideology on the landscape and that then becomes the truth of fact. I don't believe in any objective measurement of anything in that sense."

"It needs to be consultation with people [e.g. stock inspectors, weed sprayers] who know what they are talking about...we've lost a lot of that practical knowledge...We used to have crews of weeds people going around spraying weeds and they would go to the farm...that night you'd sit down have a beer and you would feed them and you'd sit around and say, 'What have you found?'...and the more that we did as a company or an individual the more they would help us and it was all interaction...it was great...[but] all you get now is someone pulling up in a Commodore ... [after] sitting at a desk all the time - and as soon as you get them walking in the door the farmers go, 'Aww, another bureaucrat'...They [landholders] have got to know you otherwise they think it is just some turkey from town ringing and they don't know what is going on. And it is going to bite them eventually as it is a way of the whole system...we're being ruled by people who live in cities."

"You might come up with the model that works brilliantly but it has to engage with the policy world and government world; that's what you're faced with"

"Government cannot send people across the NT to do weed and feral management - it is just not possible; there is [sic] not the resources...so the most sensible thing is to use the people that are out there on the land and support them to do it ... where we do have communities, we need to tap into it"

"There's no sustainable management practices – we are simply using the same old practices that they used down south...So the traditional European ways of doing things are still alive today, 200 years later, in Australia - in a growing, innovative and 'new' country, we are still old 'Pommies'...doing it badly."



"They [industry] are just acting so defensively - they think that the Green movement is going to come along and lock up all this country and nobody is ever going to be able to grow a peanut but, I mean, any logical person would see that we need industry to develop in this region; there is potential for industry development - nobody is knocking that - but do it properly and do it properly the first time...we don't have many chances with these resources."

"It's just a world-wide phenomenon that people say, 'We should take back all the wetlands and make it into a huge tourist park – we should do this and we should do that' but you have to make money; someone has to make money somewhere. You've got to have mines, you've got to have cattle, you've got to have buffalo, you've got to have timber. You know, we're not all going to live off tourism - there's no way we can do that - and we're not all going to live off Government national parks [either]."

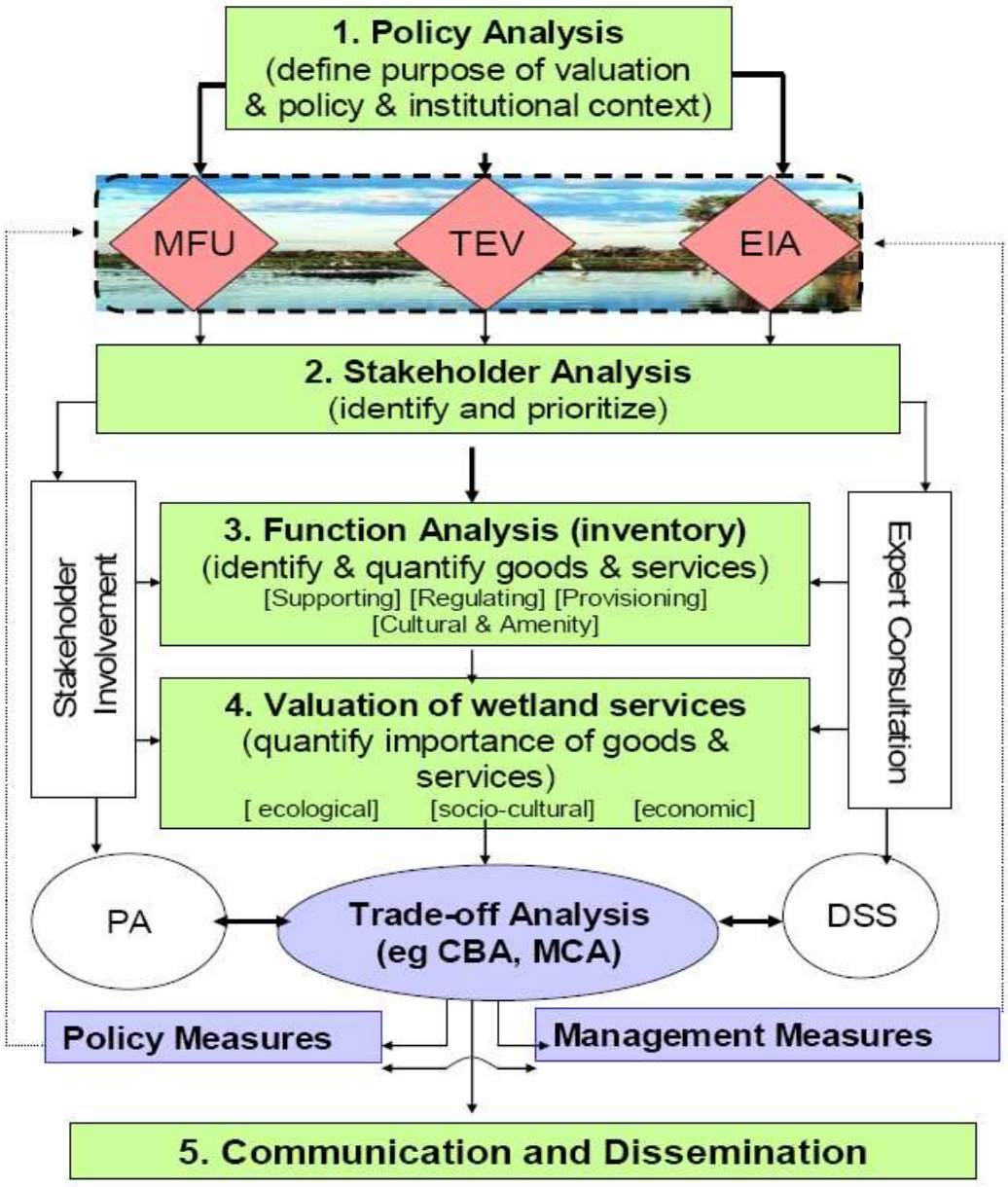
"The management strategy depends on the political environment and at this point in time the landholders still have the biggest say. There is no strong conservation movement and conservation needs an equal voice as the broader public are just not fired up about environmental issues. The NT public is fairly parochial and most people just don't understand what the long-term consequences are; most people still see the NT as a natural wilderness as the mistakes are not obvious. People won't get upset until it affects them personally – if they can still go hunting, camping and fishing then everything is fine."

"A lot of communities up here are very interested in volunteering their time and going out and doing things for the environment and that's fantastic - you couldn't ask for more - but they lose faith and they lose hope when they can't get access to the resources they need and when they are overworked."

"Because of the context of NT and the size, Joe Public has incredible access to the Government at the end of the day...sitting out on his property he can ring up the Minister's office and, if not speak to him, at least speak to one of his advisers – that doesn't happen in other States [of Australia]. So anyone can ring up and be heard. This Government is very much in touch with its 200 000 people [and it's] the old adage of, "Whoever screams loudest gets heard". So if someone keeps whinging then eventually some dollars get pushed that way to oil that squeaky wheel. It is the reality of Government administration in the NT – so it is not always the good science and information coming up from Government departments or department research programs or extension that necessarily shape the way Government resources are allocated. It is not all doom and gloom but they are some of the issues."

Appendix

A framework for integrated assessment and valuation of wetland services



Source: de Groot *et al*, 2006; adapted from Zylstra, Verschuuren & Shrestha (*unpublished*) 2004; de Groot *et al*, 2002

Abbreviations:

MFU: Multi-Functional Use - assessment of options and trade-offs for multi-functional use of wetlands
TEV: Total Economic Value - assessment of the total contribution (value) of wetlands to the economy at different scales (local, national, global)
EIA: Environmental Impact Assessment - assessments of the effects/impacts (ecological and socio-economic) of wetland conversion or proposed conversion
PA: Participatory Approach
DSS: Decision Support System
CBA: Cost Benefit Analysis;
MCA: Multi-Criteria Analysis.

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