Report to Land & Water Australia




Ecosystem processes in tropical rivers: conceptual models and future research.

Final milestone report on the gulf reconnaissance component

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ABSTRACT

As part of the developmental phase of the Tropical Rivers and Coastal Knowledge (TRaCK) Program this project was instigated to undertake a reconnaissance of all rivers draining into the Gulf of Carpentaria, as well as collecting baseline data and undertaking regional stakeholder consultation.

The primary field component of this project was undertaken during September and October 2004, during which time an aerial reconnaissance was completed along the trunk streams of all major rivers draining into the Gulf of Carpentaria. Global Positioning System (GPS) located videography was successfully trialled in this reconnaissance using a non gyro-stabilised mounting from a twin engine, fixed wing platform. Using this approach, high-resolution imagery (1 – 2m) of the channel and riparian zone was collected along 13500km of river channel over 43 hours of flying time. The imagery collected equates to around 52% of the channel network defined by the 1:5M topographic network, which is the network being used to define the streams being classified in an affiliated project. At around $5.50 per river kilometre, this approach has proved to be an efficient and cost effective method of undertaking reconnaissance of large remote area river systems, which at the same time provides a high quality permanent record of the river channel that can effectively form the baseline inventory for subsequent research.

At stopovers during the aerial reconnaissance, consultation was also undertaken with a broad cross-section of stakeholder groups around the Gulf of Carpentaria. The primary objectives of these meetings was to provide stakeholders with some background on the forthcoming Tropical Rivers Program, as well as to elicit feedback on research and management issues within the region. Extremely positive feedback was gained from all of these engagements. Meetings were held with various graziers, Aboriginal Leaders (incl. Mr Murandoo Yanner at Burketown, Thomas Hudson and others at Kowanyama), council representatives (Burke Shire Council, Etheridge Shire Council), NRM groups (Mitchell River Watershed Management Group, Northern Gulf NRM Group in Georgetown) and Northern Land Council representatives in Borroloola. Subsequent meetings have also been held with, Cape York Peninsula Development Authority, Qld Department of Communities Cape York Community Engagement Group, Southern Gulf Catchments Group, Kowanyama Aboriginal Council.

In summary, the reconnaissance and community consultation undertaken within this project have provided the strategic foundations necessary for implementation of the next phase of research development under the Tropical Rivers Program within the Gulf of Carpentaria region.

Principal investigators: *Overall Project* - **Prof Stuart Bunn**, **Dr Michael Douglas (CDU)**
This Component - **Dr Andrew Brooks**
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1) PROJECT LOGFRAME:

To achieve the project objectives identified in 4.3 and 4.5 of the (original joint) Application (see below) using the approach outlined in section 7.3.2 of the Application

2) **PROJECT OBJECTIVES** *(as stated in Section 4 of the original joint proposal with CDU)*

4.1 Develop conceptual models of tropical river ecosystems that:
- identify important biophysical processes and linkages between floodplains, rivers and coastal ecosystems and
- include predictions of the likely responses to water resource development and land-use change.

4.2 Identify major knowledge gaps and prioritise the critical R&D that is necessary to test these models, with a particular focus on the relationships between river discharge, and lateral and longitudinal connectivity with floodplains and coastal ecosystems, respectively.

4.3 Undertake preliminary field studies to:
- **identify potential study sites,**
- **assess feasibility logistics and OH&S issues of proposed methodologies and**
- **collect essential reference data.**

4.4 Identify a framework for a large coordinated and integrated R&D program that identifies:
- opportunities for integration of biophysical and socio-cultural research,
- potential funding partners,
- key stakeholder groups and additional R&D providers (if necessary) to complement the skills of the core consortium.

4.5 Initiate engagement with stakeholders to ensure that future R&D is relevant and culturally appropriate.

3) PROJECT APPROACH - relevant component as per section 7.3.2 of the original proposal

7.3.2 Gulf Reconnaissance/ Site Selection and Ground Truthing

Parallel Qld Smart State Project

Given the vast area encompassed by the Gulf Drainage Division and the limited extent of existing biophysical knowledge of rivers in this region, it was never going to be possible to undertake sufficient detailed biophysical investigations to fully represent the natural range of variability of ecosystem processes across such a large area. As a means of addressing this issue, a study is currently underway by Dr Andrew Brooks using remote sensing and GIS data that will provide a means of characterising the Gulf riverine landscape. The first phase of this study involves a coarse resolution analysis of the catchment characteristics and channel network typology for all rivers of the Carpentaria drainage division. In addition to providing the means for selecting representative rivers for detailed analysis, this characterisation will also be critical to the development of conceptual models of the different types of rivers within the Gulf and Territory, and will enable us to define the spatial relevance of models developed for individual rivers in different bioregions. In this GIS study, each river will be characterised according to basin morphometry, climate, hydrology, geology, soil associations and vegetation.

This Project

A critical component of any desktop modelling exercise or spatial landscape analysis is to ground truth data used to undertake the analysis, particularly when such an analysis will be used as a basis for selecting sites for ground based fieldwork. Given the large area encompassed by Gulf catchments, the only way of undertaking effective reconnaissance is by air. In this component of the study we propose to undertake an aerial reconnaissance of the Gulf as a means of addressing a number of critical issues that necessarily arise in the early establishment phase of a large-scale research programme. The objectives of the reconnaissance are:

- To provide initial ground-truthing for the first draft of the Gulf rivers typological analysis,
- to provide a means of identifying field study sites that will meet the objectives of an integrated multi-disciplinary research programme,
- to scope field access, OHS and other logistical issues,
- to provide an opportunity for the collection of some initial sediment and soil samples for geochemical analysis in both source and sink zones within selected catchments, and
- to provide an opportunity to meet some of the key stakeholders within the Gulf.

3) PROJECT IMPLEMENTATION

Aerial Reconnaissance

The primary field component of this project was undertaken during September and October 2004 and the involved the completion of a reconnaissance flight to visually survey all of the major rivers draining into the Gulf of Carpentaria. Coupled with the flight we also took the opportunity at various stops along the route to meet with as many regional stakeholders as possible to discuss the broader objectives of the tropical rivers program and to scope out some of the logistical issues associated with undertaking future research in this region. As a means of ensuring we collected a permanent record of the aerial reconnaissance in a highly accessible spatially located format, we filmed the entire flight path using GPS located aerial videography. This technology enabled us to rapidly gather relatively high resolution (1-2m res) data on channel and riparian condition throughout the Gulf of Carpentaria. Previously this technique had been used over relatively confined areas in south-eastern Australia from a helicopter platform using a gyro stabilised camera. In the Gulf a helicopter platform would have been prohibitively expense given the distances and time involved, so we trialled the use of a fixed mount camera on a fast, twin-engine light aircraft (plates 1 & 2). Implementing this required the development of a new – non gyro-stabilised mounting system for the video camera, as well as convincing the aerial charter company to allow us to cut a hole in the floor of their plane through which the camera could be mounted. Modifying the external skin of an aircraft is no simple task – as the plans have to be certified by CASA and modifications carried by a certified aeronautical engineer. Despite this, we were able to convince local air charter operators Savannah Airlines, based in Burketown, to modify one of their planes and to undertake the charter. Engaging Savannah Airlines turned out to be a major bonus for meeting the stakeholder consultation component of the project, as their director, Paul Poole, turned out to be a major political force in the Southern Gulf. Being the effective equivalent of the region's taxi driver (which is not intended to diminish Paul's role as a pilot and small airline operator – rather an indication of the significance of aerial charter services in connecting communities within the Gulf Region), Paul knows pretty well everyone within the region, what they are up to, and what the major social, environmental and economic issues are in the region. This connection was an invaluable entrée into the region.

Plate 1 Camera setup through the floor of the plane

Plate 2 Beechcraft Barron used for aerial video survey

Stakeholder Consultation & Engagement

Prior to undertaking the aerial reconnaissance a mail out was undertaken, along with follow up phone calls, to all regional NRM groups, shire councils, Aboriginal Councils and Land Councils. This provided us with an opportunity to provide some background about the broader objectives of the Tropical Rivers Program, as well as the immediate goals of our reconnaissance. From this initial contact, meetings were arranged at various points along the reconnaissance route, enabling us to begin the process of community engagement within the region. Working on the ground in this part of the Gulf country is only possible once the trust of local people has been gained, and this usually requires personal introduction by someone within the local community who is prepared to vouch for your *bona fides*. Developing these links and the trust of locals obviously requires more than one meeting, however considerable progress has been made during this project in developing these relationships. Initial meetings were held with local stakeholders at various stopovers around the region, including Mareeba, Georgetown, Burketown and Borroloola. Meetings were held with Graziers, Aboriginal Leaders (including Mr Murandoo Yanner at Burketown, Thomas Hudson and others at Kowanyama), council representatives (Burke Shire Council, Etheridge Shire Council), NRM groups (Mitchell River Watershed Management Group, Northern Gulf NRM Group in Georgetown) and Northern Land Council representatives in Borroloola.

4) PROJECT OUTCOMES

4a) Aerial Reconnaissance

Aerial Videography of primary channels along all Major River Draining into the Gulf of Carpentaria was collected across a 10 day period in late September/early October 2004. The aircraft followed the channels of these rivers at an average elevation of around 2000 – 3000 feet (Table 1) over a 10 day period, flying an average of 4 – 5 hours per day. GPS located digital video footage of the whole flight was collected with a professional quality digital video camera mounted through the floor of the aircraft. Using this arrangement imagery of the channel and riparian zone was very efficiently collected along 13500km of river channel with an average field of view of 1 km (Figure 1) at a total cost of around $75000 (or $5.50/km). The budget contributed towards this project by LWA was augmented by additional funds from CRL and the Smart State Fellowship project. This dataset alone provides an invaluable baseline inventory of the river channel and riparian condition for the rivers surveyed, but when combined in a GIS platform with a range of additional data layers, forms an extremely valuable basis for validating the GIS and remote sensing derived geomorphic river classification being undertaken in the parallel Qld Smart State project, as well as for NRM planning. Given that the imagery is GPS located (a GPS location was encoded every second onto the videotape), it is possible to convert the video stream into a format that can be viewed within a standard Arc-Info platform. The entire flight path can be overlaid on any relevant GIS coverage or imagery, and the corresponding video imagery extracted at any given point along the route. This provides an extremely efficient means of instantaneously viewing the data at any location without the need to trawl through hours of videotape to locate a site of interest. Furthermore, digital stills taken of the surrounding landscape during the flight can also be spatially located and viewed in a similar manner. During the flight approximately 1100 digital still photographs were taken to complement the 43 hours of video footage.

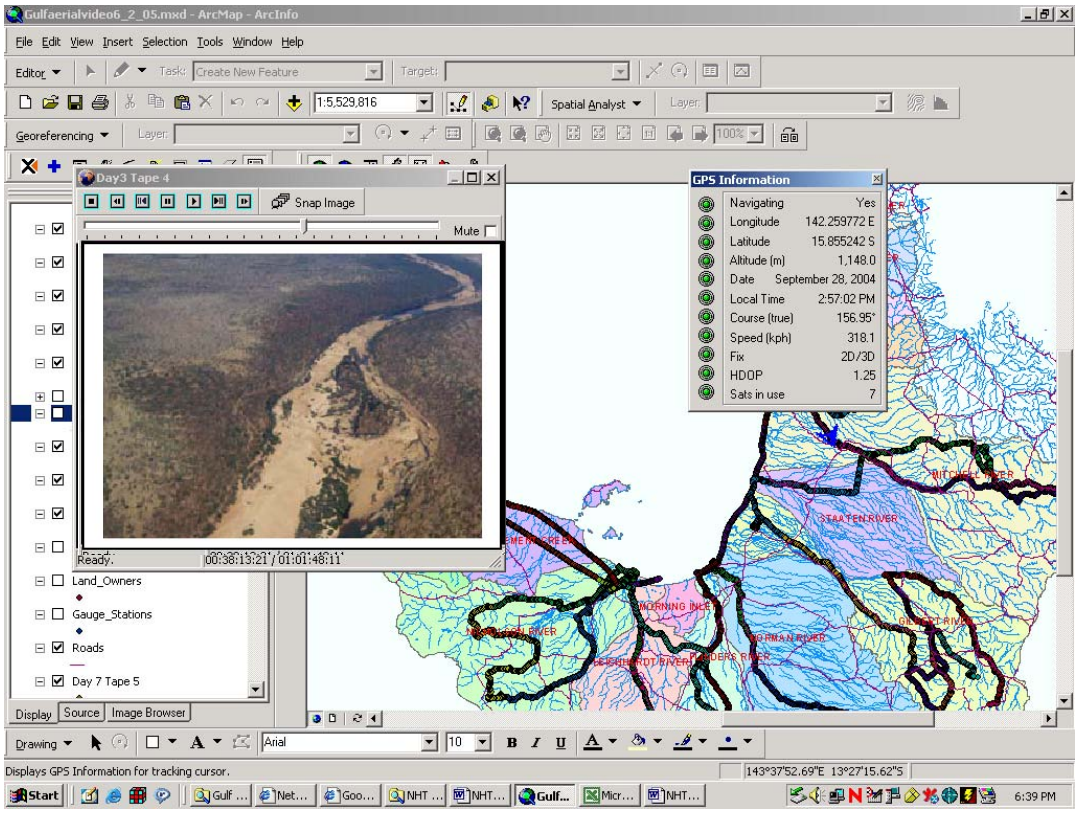

Figure 1 – Screen shot of the ArcInfo setup showing the video imagery with the GPS location data and the ground location of the imagery (circled arrow on the dark flight path line below GPS box).

total flying time	43 hrs	**av field of view width**	1008 m
average ground speed	315 kmph	**total area filmed**	13653 km2
Total river length flown	13500 km	**total land area of Gulf**	642000 km2
% of 1:5M network surveyed	51.8%	**% of total catchment area covered**	2.12 %
average altitude above ground	800m	**Cost per km of river surveyed**	~ $5.50

Table 4 Aerial Videography statistics

4b) Stakeholder Engagement

As part of the reconnaissance trip a string of mainly small meetings (usually 2 or 3 members of staff from each organisation) were held with broad cross section of regional stakeholders. Meetings were held with the following groups: Mitchell River Watershed Management Group, Northern Gulf Resource Management Group, Etheridge Shire Council, Carpentaria Land Council, Cape York Peninsula Development Authority, Cape York Community Engagement Group - Qld Department of Communities, Burke Shire Council, Northern Land Council - Borroloola Office, Southern Gulf Catchments. As a follow up from these initial contacts, in February 2005, Dr Brooks convened and chaired a strategic meeting in Cairns with all key NRM stakeholder groups in the Gulf region – including the Mitchell River Watershed Management Group, Northern Gulf Resource Management Group, Cape York Peninsula Development Authority, Cape York Community Engagement Group - Qld Department of Communities and Southern Gulf Catchments Group. The purpose of this meeting was to outline our broad research agenda, as well as some of the specific research outcomes and to further develop collaborative links that had been established during the reconnaissance trip in 2004.

We received an extremely positive response regarding the broader program aims from virtually all groups contacted. As a result of these efforts strong relationships have already been forged with most of the key stakeholder groups, many of which have been further developed during the year. Burke Shire Council, for example, has offered us the use of their offices and vehicles when we are undertaking research in that area. We have also just returned from a ground trip undertaking field sampling around the Mitchell River accompanied by two staff members from the Mitchell River Watershed Management Group who assisted us with our field data gathering and above all providing us with personal introductions to a large number of station owners and other stakeholders around the region.

4c) Communication Outcomes:

Interim project outcomes have been presented at a number of meetings and conferences during the past year.

November 2004
A presentation of some preliminary research results was also given at a Research consortium workshop held in Darwin.

December 2004
A paper entitled "Recent and ancient controls on riverine landscapes of the Gulf of Carpentaria" was presented at the Australian Rivers Research Network Meeting held at Wollongong University Nov 30 and Dec 1, 2004.

February 2005
A presentation of some preliminary research findings as well as an outline of the broad research program objectives was given to a focused group of 12 representatives from all the key Natural Resource Management groups in the Gulf.

July 2005
A workshop was held at the Griffith University Eco-Centre for around 20 year 11 and 12 high school students to provide them with an overview of the research work being undertaken in the Tropical Rivers Program and to give them some "hands on" experience using some of the remote sensing techniques being employed as part of our program.

Other communication outputs

Over the past 12 months I have conducted 2 live interviews with Regional ABC radio at Mt Isa about the objectives of the project and the implications for communities in the Gulf. An article was also published in the North West Star - Mt Isa in November 2004. An article featuring the project was also published in the July edition of Rip Rap magazine.

5) INDICATORS OF PROJECT SUCCESS (RETURN ON LWA'S INVESTMENT)

Given that this project was part of a larger scoping activity aimed at research development, one measure by which project success can be measured is through the additional research funds generated. A number of related projects have been funded as a result of efforts undertaken during the course of this project and several others are pending.

- CRL Research Development Grants (**$90K**) towards 5 pilot projects in the Gulf

- Griffith University Research Grant (**$13.8K**) towards a pilot study investigating sediment sources and sinks in the Mitchell River Catchment.

- Perhaps the greatest outcome of this scoping project with CDU & UWA, is the development of a Tropical Rivers Research Consortium and a comprehensive research prospectus. In addition to contributing to the goals of the L&WA Scoping project, the latter has been developed at the request of Senior Officers of the Tropical Science, Knowledge and Innovation (SKI) Initiative. Chief Scientists from Qld, WA and the NT have endorsed this proposal and further discussions are currently underway to attract major funding partners. Details of this will be presented in the joint Final Report with CDU and UWA.