



Australian Government

Department of the Environment, Water, Heritage and the Arts

Marine and Tropical Sciences Research Facility Milestone Report, June 2009

Program 7: Halting and Reversing the Decline of Water Quality

Project 3.7.4: Wetlands and floodplains: Connectivity and hydro-ecological function

Project Leader: Dr Jim Wallace, CSIRO

Summary

The project has again made good progress in the last six months. New analyses of post-flood wetland connectivity have been completed and show much longer connection times than during floods. This work will be presented at the “*Challenges in Environmental Science and Engineering*” Conference to be held 14-17 July 2009 in Townsville. Close collaboration on the work with MTSRF partners in Project 3.7.3 (Richard Pearson, Angela Arthington and PhD students) continues and the result is a strongly linked joint hydrological and ecological study of a series of wetlands in the Tully-Murray. The project's paper on flood loads has now been accepted by the journal *Marine and Freshwater Research* and will appear in its Special Issue on Great Barrier Reef Water Quality. We also continued to record flood depths, suspended sediment and nutrient concentrations in flood waters during over bank events in the Tully-Murray catchments during the 2008/09 wet season.

Project Results

Description of the results achieved for this milestone

(a) Use of the MIKE21 hydro-dynamic model to estimate wetland connectivity

Progress continues with the use of the MIKE21 model to calculate connectivity indices for ten different wetlands in the Tully-Murray catchments. The analysis of connectivity during flood events is complete. New analyses of post flood wetland connectivity have also been carried out. This analysis draws heavily on a painstaking analysis of the LiDAR data, from which the stream and cane drain network is derived along with accurate cross-sections of these channels. These wetland connectivity analyses are developed in close collaboration with Richard Pearson (JCU) and Angela Arthington (GU), so that the connectivity indices derived can be used to help explain patterns that they observe in the wetland ecology. The results of these novel analyses have been reported at the MTSRF Annual Conference in April 2009. The results have also been written up in draft form for journal publication¹, thereby meeting the main 30 June 2009 milestone requirement.

¹ Wallace, J., Stewart, L., Hawdon, A., Keen, R., Karim, F. and Kemei, J. (2009) Flood water quality and marine sediment and nutrient loads from the Tully and Murray catchments in North Queensland, Australia. [Marine and Freshwater Research](#) 60: 1123-1131.

Meetings between CSIRO staff of Project 3.7.4 and JCU staff and PhD students continue resulting in a strongly linked joint hydrological and ecological study of a series of wetlands in the Tully-Murray. Data is freely exchanged between the partner organisations (e.g. data from wetland hydrological (CSIRO) and ecological (JCU/GU) surveys are exchanged at our joint meetings and joint field surveys were carried out in the Tully-Murray during May 2009).

(b) Hydro-dynamic modelling of sediment and nutrient loads for the Tully-Murray catchments

During the past six months progress has been made in the use of the MIKE21 hydrodynamic model for direct prediction of sediment and nutrient transport across the Tully-Murray floodplain. Fazlul Karim attended a DHI training course in Brisbane on the use of the MIKE21 sediment transport model and successfully tested the running of this model on his CSIRO computer. We are now ready to begin the hydrodynamic modelling of sediment loads. As a forerunner to this we have computed flood discharges using the MIKE21 model and added measured sediment and nutrient concentration to estimate loads to the ocean. This work will be presented at the "Challenges in Environmental Science and Engineering" Conference, 14-17 July in Townsville.

The combined analyses of flood water quality from all of the flood events (13) between 2006 and 2008 has been written up in a paper that is to appear with other papers on water quality research in the Tully-Murray catchments in a Special Issue of *Marine and Freshwater Research* (see [footnote](#), page 1, this report).

We have also continued to record flood depths, suspended sediment and nutrient concentrations in flood waters during over bank events in the Tully-Murray catchments during the 2008/09 wet season. This was done using the semi-automated flood water quality sampling system that was designed and installed in the Tully-Murray floodplain during 2006 (see Hawdon *et al.* 2007).

(c) Summary of communications and liaison activities

- The flood loads paper in the Great Barrier Reef Water Quality Special Issue of *Marine and Freshwater Research* has been published.
- Fazlul Karim presented the results of MTSRF Project 3.7.4 at the Annual MTSRF Conference in Townsville (28-30 April 2009).
- Jim Wallace, Fazlul Karim, Angela Arthington and Richard Pearson attended the RRRC Water Quality Research Directions Workshop at James Cook University on 5 March 2009.
- Jim Wallace attended the joint RRRC / GBRMPA Receiving Water Quality Modelling Workshop at the Australian Institute of Marine Science on 6 March 2009. This led to a joint bid by the CSIRO, ACTFR and AIMS on a dynamically linked floodplain-marine receiving water quality model for the Tully region.
- Fazlul Karim attended a DHI sediment transport modelling course in Brisbane in May 2009.
- Freshwater quality sub-projects collaboration: Further meetings have taken place between Jim Wallace, Richard Pearson and Angela Arthington to develop sub-project details and collaborative links between Projects 3.7.3 and 3.7.4.

(d) Publications arising from the project and associated research

- KARIM, F., HENDERSON, A., WALLACE, J. S., RASH, P., ARTHINGTON, A.H, PEARSON, R. 2009. Quantifying wetland connectivity during and after floods in the Tully-Murray floodplain using hydrodynamic modelling. In: Proceedings of the 2009 Marine and

Tropical Sciences Research Facility Annual Conference, Reef and Rainforest Research Centre Limited (In press).

- KARIM, F., WALLACE, J., HENDERSON, A., HAWDON, A. AND KEEN, R. 2009. Modelling Overbank Flood Events and their Sediment Transport to the Great Barrier Reef Lagoon. In: "*Challenges in Environmental Science and Engineering*", 14-17 July 2009, Townsville.
- WALLACE, J.S., STEWART, L.S., HAWDON, A., KEEN, R., KARIM, F. and KEMEI, J. 2009. Flood water quality and marine sediment and nutrient loads from the Tully and Murray catchments in north Queensland, Australia. *Marine and Freshwater Research* 60: 1123-1131.
- ARTHINGTON, A. H. 2008. Water scarcity, environmental flows and floodplain ecology. In proceedings of the CERF Conference, 16th September 2008, Canberra.
- WALLACE, J.S., STEWART, L.S., HAWDON, A. and KEEN, R. 2008. The role of coastal floodplains in generating sediment and nutrient fluxes to the Great Barrier Reef lagoon in Australia. *International Journal of Ecohydrology and Hydrobiology* 8: 183-194.
- KARIM, F., HENDERSON, A., WALLACE, J., RASH, P. 2008. An assessment of wetland connectivity in the Tully-Murray floodplain using a hydrodynamic model. In proceedings of MTSRF Annual Conference, 28-30 April 2008, Cairns.
- WALLACE, J.S., STEWART, L.S., HAWDON, A. and KEEN, R. 2008. The impact of floods on sediment and nutrient fluxes from the Tully-Murray catchments to the GBR lagoon. CSIRO Land and Water Science Report No. /08; 53pp.
- KARIM, F AND WALLACE, J.S. 2008. Assessment of Sediment and Nutrient Transport across the Tully-Murray Floodplain using the SedNet Model. Report to the Marine and Tropical Science Research Facility. CSIRO Land and Water Science Report No. 59/08; 18pp.
- WALLACE, J.S., HAWDON, A., KEEN, R. and STEWART, L. 2007. Flood water quality and sediment and nutrient loads to the Coral Sea after cyclone Larry. In: *Abstracts: Cyclone Science Seminar: Impacts of cyclones on terrestrial tropical ecosystems – insights from severe cyclones Larry and Monica*. 27-18 September 2007, Australian Tropical Forest Institute, JCU, Cairns
- HAWDON, A., KEEN, R., KEMEI, J., VLEESHOUWER, J. and WALLACE, J.S. 2007. Design and application of automated flood water quality monitoring systems in the Wet Tropics. CSIRO Land and Water Science Report 49/07; 27pp.
- WALLACE, J.S., ARTHINGTON, A.H., AND PEARSON, R.G. 2007. Hydro-ecological modelling in coastal catchments: connectivity and hydro-ecological function. Report from the MTSRF Workshop held at the CSIRO Davies laboratory, Townsville, 19 – 20 April 2007. CSIRO Science Report XX/07; 55pp.
- WALLACE, J.S., HAWDON, A., KEEN, R. and STEWART, L.S. 2007. Water quality during floods and their contribution to sediment and nutrient fluxes from the Tully-Murray catchments to the GBR lagoon. Report to FNQNRM for their Water Quality Improvement Plan. CSIRO Science Report Y/07; 35pp.
- WALLACE, J.S., BOHNET, I., DISHER, M., FORD, P., GEHRKE, P., HARTCHER, M., HAWDON, A., HENDERSON, A., HODGEN, M., McJANNET, D., KEEN, R., McKEOWN, A., LARSON, S., METCALFE, D., ROEBELING, P., STEWART, L., VLEESHOUWER, J., WEBSTER, T., WESTCOTT, D. and WILLIAMS, K. 2006. Floodplain renewal research in coastal lowlands adjacent to the Great Barrier Reef, Australia. *Proceeding of the 2nd International Conference on Estuaries and Coasts*, Guangzhou, China 28-30 November 2006. Vol 2, 662-669.