

# Pantanal Water Network

First International Workshop on Catchment Management  
in the Rio Cuiaba Basin

Personal Report on Workshop by Andy Vinten

(note that a formal report on the workshop will be completed by Antonio Ioris and Andy Vinten in due course, as part of the Leverhulme project)



### Summary.

1. The first workshop of the Leverhulme Pantanal Water Network project was held in Delcas Hotel, Cuiaba, on 25-27<sup>th</sup> March 2009. It was jointly organised by Pierre Girard of CPP, Antonio Ioris of ACES Aberdeen, UK and Andy Vinten of Macaulay Institute, Aberdeen, UK.
2. Prior to the workshop, Andy Vinten spent 2 days visiting one of the headwater areas of the catchment at Chapada dos Guimaraes (Rio Coxipo, Rio Arica), and Antonio Ioris and Andy Vinten spent 2 days visiting key stakeholders and academics at UFMT and SEMA (the Brazilian Environment Agency) and familiarising with the River catchment downstream of Cuiaba, as far as Barao de Malgaco. This also enabled plans for the field visit of the workshop to be drawn up.



3. The objectives of the workshop were to:
  - Facilitate the dialogue between local and international organisations
  - Bring together different perceptions of water management problems
  - Share thinking and gain an overview of sector demands
  - Assist collection and systematisation of data on the Cuiabá River Basin

These were all achieved to a large extent

4. The expected outcomes of the overall visit were to:
    - Identify main environmental pressures and socio-economic demands
    - Provide an overview of contrasting views about trends and tendencies in the catchment
    - Raise recommendations for water management and scientific research
- These were all achieved

5. The workshop timetable was as follows:

**Day 1 - Water management pressures and demands**

- Stakeholder workshops
- Presentations by Luiz Noquelli and Leandro Maraschin of SEMA (Catchment Management) and Carlos Padovani and Deborah Calheiros of Embrapa, Corumba (long term ecology)

**Day 2 field visit - rapid catchment appraisal**

Field visit - rapid catchment appraisal, covering:

- River headwater hydrology and hydro-ecology, led by Prudentio
- Cuiaba sewage treatment works, hosted by ...
- Interaction with local river users at San Antonio de Leverger, ca. 50 km. downstream of Cuiaba

**Day 3- causal relationships and future research opportunities**

- Presentation by Andy Vinten on Catchment Management and Planning in Scotland
- Presentation by Albano Araujo on Water for tomorrow, a strategic ecological flows project in the Sao Laurengo Basin.
- Presentation on integrated catchment management by Norman Brunet, University of Quebec, Canada
- Stakeholder workshop to formulate causal loop diagram of qualitative interactions in the catchment, led by Antonio Ioris
- Stakeholder workshop to identify biophysical catchment model concepts, data sources and draft scenario themes led by Andy Vinten

7 Most of the workshop was held in Portuguese and a full description of these sessions will therefore be provided by Antonio Ioris. One workshop (afternoon of Friday 27<sup>th</sup>) was in English with Portuguese translation. See below.

8 After the workshop, Andy Vinten and Deborah Calheiros (Embrapa Corumba) visited the headwaters of Cuiabazinho river at Azur Azul, (limestone hills ca. 100km north of Cuiaba) from 27<sup>th</sup> -29<sup>th</sup> March.

9 Andy Vinten also visited the area of Chaccorrore Lake and Baia Santa Mariana, just south of Barao de Malgaco from 30<sup>th</sup> March - 2<sup>nd</sup> April. During this time he gained familiarity with the hydrology and limnology of the lakes and assessed the influence of the river Cuiaba and other rivers (Rio Arica, Rio Fazenda, Rio Mutum) on the Lake system.



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Stakeholder workshop session to identify catchment model concepts, data sources and draft scenario themes, led by Andy Vinten

The workshop session was initiated by a presentation by Andy Vinten on Catchment and Planning in Scotland, followed by a simple draft conceptual view of what a Cuiaba River model might be attempting to deliver (Figure 1). This was based on perceptions of the catchment from pre-visits and meetings and previous workshop sessions, including the field trip.

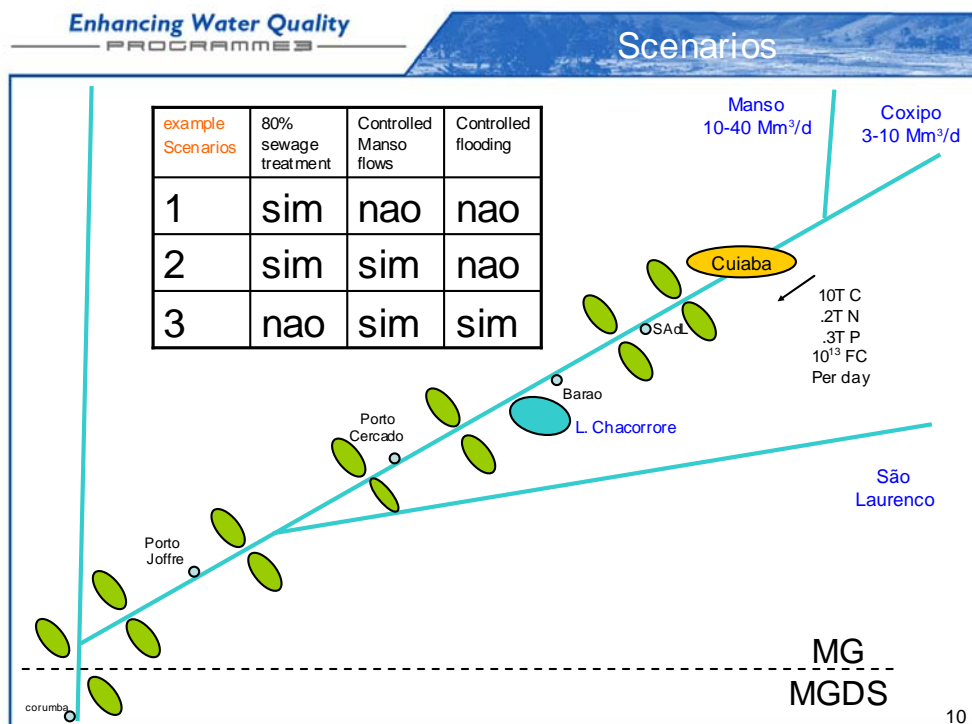


Figure 1. Conceptual biophysical model of Cuiaba River catchment and its links with the Pantanal. Note: This was used as a tool to initiate discussion, and is not a reliable description of the catchment. Green areas represent zones of potential flooding, estimates of nutrient loads and flows from verbal discussions and exercise during field visit. MG = Mato grosso state, MGDS = Matto Grosso do Sul state. Figure covers about 200km x 150km.

Comments made on the conceptual model were as follows:

1. The flow from Manso would be split about 60%: 40% between the Manso Dam and Cuiabazinho catchments.
2. Chemical data for Porto Cercado exists for C,N and P over at least 10 years.
3. In the headwaters the soluble P content is around 0.05 mg/L
4. During flooding, there is potential for the N (and P) content of the water in the flooded areas to increase, before the waters discharge back to the main channel.
5. The end of the dry season there is a large peak in nutrient concentrations in the river
6. Solid waste flushed from the urban stream channels is a major problem during flood events
7. The river shows quick flood dynamics
8. Manso Dam flows improve water quality in the dry season
9. The resolution of Digital Terrain modelling in the catchment is about 90m(horizontal) x 50m( vertical). This limits the potential for identifying potentially flooded areas by modelling.
10. Remote Sensing Data is easy to get for all of Pantanal (eg Adriano Paz, Sao Paulo University)
11. The vertical elevation needs on the ground survey
12. Its important to include fish farms (ca. 300) in the catchment model
13. Sao Laurenco and Cuiaba rivers are similar hydrologically
14. About 30% of pollution loads come from diffuse sources upstream of Cuiaba.

Comments made on the scenarios were as follows:

1. Controlled flooding might be done at end of season to flush urban streams
2. Controlled flooding may not be feasible or desirable.
3. The Manso dam licence requires a minimum of 90cm water in the river
4. There is a flood risk to housing upstream
5. Urban stormwater detention may be an option (some experience of SUDS)
6. Its important to have scenarios in relation to fishing
7. Important to discuss scenarios with stakeholders

The responses on sources of data were as follows:

1. There are 20 met stations with Rain and PET run by ? SEMA, and 3 at Manso Dam and others run by UFMT. The data are mainly held by Peter Zeilhofer at UFMT.
2. The land cover has been characterised in 2002, data held by Peter Zeilhofer
3. There are soil series data at 1:250,000 from which soil moisture estimates may be feasible
4. There is little data on groundwater - only a few boreholes and some typologies (from the state plan)
5. Vegetation data is available from the SEMA catchment plan
6. <http://www.sema.mt.gov.br/PERH/>
7. There are 6 stations + Manso dam with consistent hydrometric data
8. There are 12 stations from 1995, plus geostatistical interpolation, for monthly water chemistry in the Pantanal (? Or was it the Cuiaba river?)
9. There are only soil physical data, no chemistry
10. No data on fertiliser inputs, though these could be estimated from the state plan.
11. There is no heavy metal or pesticide data.
12. There may be some data on discharge licences from SEMA
13. There is an MSc thesis on Agriculture on the MANSO watershed
14. EMBRAPA (Deborah) has data on sediment PSA, OM and P content
15. No atmospheric input data
16. There is ecological data on the state of water bodies: chlorophyll a, zooplankton, phytoplankton, every (or for) two years (?).
17. There is a longitudinal study on the Miranda River
18. About 60-80cm amplitude in water levels (Pierre Girrard outside workshop)

Possible project: Set up multipollutant model to simulate transport of sewage pollutants downstream of Cuiaba under conditions of a range of flows, but no flooding. Then introduce scenarios of increased potential for flooding (removal of floodwaters from model), and improving sewage treatment. Calibration using longitudinal sampling of river at high and low flow conditions (or microbial data of Edna Hardoim at UFMT), and validate using long term datasets from 12 stations along river.

*Agreed structure of network interests and responsibilities.*

Contact points: Eliana, Prudêncio, Ioris, Andy

Characterisation and data compilation (Peter Zeilhofer, Carlos Padovani, Gilson, George Wandelson)

Model conceptualisation and evaluation workshop (Andy, Martyn, Sarah)

Pollutant loads and concentrations: Real time and event data capture (Debora Calheiros, Carlos Padovani, Sarah Dunn (tbc), Marc Stutter (tbc))

Emerging Pollutants (Carolina L, Carolina M.)

Environmental Economics (Manuel Lago ? tbc)

Ecological flows (Albano)

Spatial data and flooding (Carlos Padovani, Peter Zeilhofer, SEMA)

Ecological trends and trade-offs (Edna, Juliana, Selma)

Adaptation to Climate change (Normand Brunet, Moacir)

Institutional arrangements and participation (Leandro, Leo, Marcio, Ioris)

Link to Synergia project (Pierre Girard, UFMT).

*Workshop visit to Chapada dos Guimares (headwaters) and Santa Antonio De Leverger (community downstream of Cuiaba)*

We visited the springs which form the headwaters of the Rio Aricaquinho. These derive from the sandstone formation which dominates the central Planalto Plateau of Brazil. The groundwater is of high quality, but storm water is strongly affected by soya and other large scale agriculture. The Manso Dam is about 15 years old, and restricts natural flows. Th 3 turbines can run at a time, because otherwise the flow would cause flooding.



We then visited a river community about 50 km downstream (estimated travel time of water from Cuiaba, 2 days) and found that among the older members of the community there was a perception of large changes in the river, and in the bankside sediments (from white sand to fine sediment, attributed to dredging of sand for building). Many problems with damage to riparian areas. No perceived health effects, although the Barao de Melgaco area, near Lake Chacorrone has had a cholera outbreak fairly recently, and so river communities are probably vulnerable to sewage and satellite TV.



Example comments of river community dwellers at San Antonio de Leverger

A) The flow regime seems to be changing - this year the Cuiabá river height did not reach the maximum level as in other years (my consideration: it's true, but this year La Niña phenom was delayed, and now it's raining a lot in Cuiabá and likely the river will reach the maximum level).

B) More pollution is being seen in the river year after year. Tourism is prejudiced.

C) Water quality worsen and now they need to treat the water to drink it, despite several people in the city still use water directly from the river (water treatment is not available for everyone).

D) Fishery break time (piracema), when registered fishermen cannot fish in the river, is creating the opposite effect. During this time, illegal fishermen fish and take big ammounts of small fish, affecting the biodiversity. My comment: if it's true, it'll be more difficult to relate fish reduction or extinction to water quality or ecological changes in the river environment. In any situation, Pantanal ecosystem will be in peril.

(with annotations from Albano Araujo, TNC)

*Possible project: community perceptions of changes in water quality/flows as a function of distance downstream of Cuiaba city, and time relative to Dam and city development*

### Visit to Azor Azul

Andy visited this beautiful limestone dominated upper Rio Cuiabazinho over the weekend with Deborah Calheiros, of EMBRAPA, Corumba, who is an environmental chemist and eco-warrior. It required lots of driving- couldnt go to Manso Dam because of logistics and the Rio Cuiabazinho bridge was damaged, but got a feeling for the pristine headwaters, and the soya traffic!



### Visit to Lake Chacorrore and Lake Santa Mariana

We surveyed the transparency and did a spatial study of the algal species across the two lakes, which both corroborated the aerial photos of a "competition" between the effects of cuiaba river water and the clean Rio Mutum and Rio Fazenda waters on the Lakes ecology. Some interactions with the fisherman and other local stakeholders, and especially an excellent time with the owner of the Mutum Lodge, who is keen to try to develop links with the science and conservation , including potentially hosting students/field visits etc. He has a degree in biology from Cuiaba University and has done some work on the Lake chemistry (see Table 2). I understand there is a measure of flow restriction on the exits of both lakes, through submerged stone dams, and a view that the initial effects of the Manso dam were to threaten drying of the two lakes. The lake outlet dams seem to have been a response to this, to keep water in the lakes in the dry season.



**Potential project:** Monitoring the inlets and outlets of these lakes from R. Cuiaba, along with discharge estimates, and spatial limnological survey would be a valuable way perhaps of assessing the level of "treatment" achieved by flooding. Rio Mutum lodge could provide logistical support and accommodation.

Dialogue with Lake users

Fisherman (see 4\* on map) - wide range of fish caught, including Pintado (pictured), Dorado, Pacu but not much today (just sardines).



Farmer at 5\* - clearing water hyacinth to provide access to water for his 400cattle (grazed on illegally felled forest pasture on hill behind Lake).



Workers at lodge - not much change in river or fishing that they can remember. However fishery catches not recorded, which I suggested to the owner (in cowboy hat).



Record of algae observed in Lake Chacorrore and Lake Santa Mariana

Some web images of genera

Staurodesmus      Staurastrum    Xanthidium... ..Micrasterias    Desmidium



Closterium



Bambusina



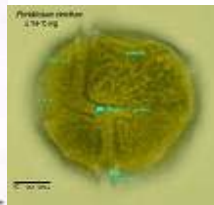
Sphaeroszoma,



Anabaena



Aphanocapsa..... Peridinium



Pediastrum



Volvox



Others: Synedra, Navicula, Scenedesmus, Chlorella, Coelastrum



		Anabaena	Peridinium	Staurastrum	Microcystis	Desmidiium	Bambusina	Xanthidium	Coelastrum	Aphanocapsa	Glenodinium	Navicula	chlorella	Pediastrum	Pandorina	Volvox	Zooplankton	Visibility depth (m) using plankton net ring	grid ref	water depth (m)	elevation
Chacorrore	Site																				
	1	x	x	x	x				x									0.4		3m	
	2	x	x							x	x							0.6			
	3	x										x						1.2			
	4	x		x										x			x	1.3			
	5																	1.2			
	2*	x	x	x										x	x			1.4	16.15.303/55.51.905		127
	3*	x						x							x			0.7	16.13.444/55.54.309		
	4*	x														x		1.2	16.16.312/55.50.312		
	5*																	1.7	16.13.291/53.53.658		
Santa Mariana	Rio Mutum			x		x	x											>2m			

Table 1. Qualitative survey of lakes

		pH	Alk mg/l	DO mg/l	SP ug/l	TP ug/l	TN ug/l
August (dry)	Rio mutum	6.3	6	3	<5	<50	<50
	Santa Mariana	6.4	3	3.3	<5	<50	60
April (wet)	Rio mutum		4	0.9	<5	30	150
	Santa Mariana		6	1.5	<5	20	<50

Table 2. Lake Santa Mariana and Rio Mutum chemistry (personal communication from owner of Mutum Lodge)



The geodesic centre of S.America