MDBA Modelling Myths

Why modelling is not enough to devise the Basin Plan

Peer Reviewed Quantitative Evidence-based versus Hydrological Modelled Flows

Definitions:

What is hydrological modelling?

It is a simplification of a real-world system that aids in understanding, predicting, and managing water resources. It should only be considered robust if 'peer reviewed' and preferably published in a scientific journal.

What is quantitative research/data collection?

It is the systematic empirical investigation of the real-world using data that is collected by a researcher from first-hand sources, using methods like experiments that are repeatable and publishable. It should only be considered robust if 'peer reviewed' and preferably published in a scientific journal.

What is Peer review?

It is one of the gold standards of science. It's a process where scientists ("peers") who are experts in the same field evaluate the quality of other scientists' research, ideas and models. Research cannot be considered robust unless peer review has occurred, and preferably published in a scientific journal.

Short Background

Murray Darling Basin (MDB) Plan was devised with virtually no stakeholder engagement by the Murray Darling Basin Authority as the plan that would restore the health of the wetlands and rivers of the basin.

The MDB Plan is based on the results of the 'Benchmark Model', an inundation model which assumes if you inundate an area of floodplain for a set period of time, you will restore the health of that system (MDBA 2012a). This is an assumption, not a reality, epecially in what is now a heavily modified landscape, regulated, host to a number of introduced species such as carp, and devoid of much natural wetland vegetation and native species.

Figure 1 displays the thinking behind the Basin Plan and that 'natural' type inundation of the floodplain is key to restoring river and wetland heath. Under the Plan, a long-term average sustainable diversion limit (SDL) is established for the Basin for both surface water and groundwater resources, and individual SDLs are established for each of the surface water and groundwater SDL resources that span the Basin. In each instance, these SDLs represent an environmentally sustainable level of take (ESLT) of water for those water resources.

The MDB Plan's just add water approach is failing and they are unable to deliver it. The MDB Plan will continue to fail as the plan was based on flawed non peer-reviewed modelling assumptions that are pedalled as the truth, when all models are inherently wrong. Inundation of these landscapes will simply not work to restore them and 13 billion of tax payers money will be wasted and livelihoods destroyed, unless we move away from an 'Just Add Water Approach'.

1 The benchmark model is a modification of the BP-2800 scenario (model run 847 (MDBA, 2012a)), which informed development of the Basin Plan, with a set of mandated refinements described in Schedule 6 (Part 2) of the Basin Plan and a number of non-mandated changes jurisdictions have agreed to be included in the benchmark model.

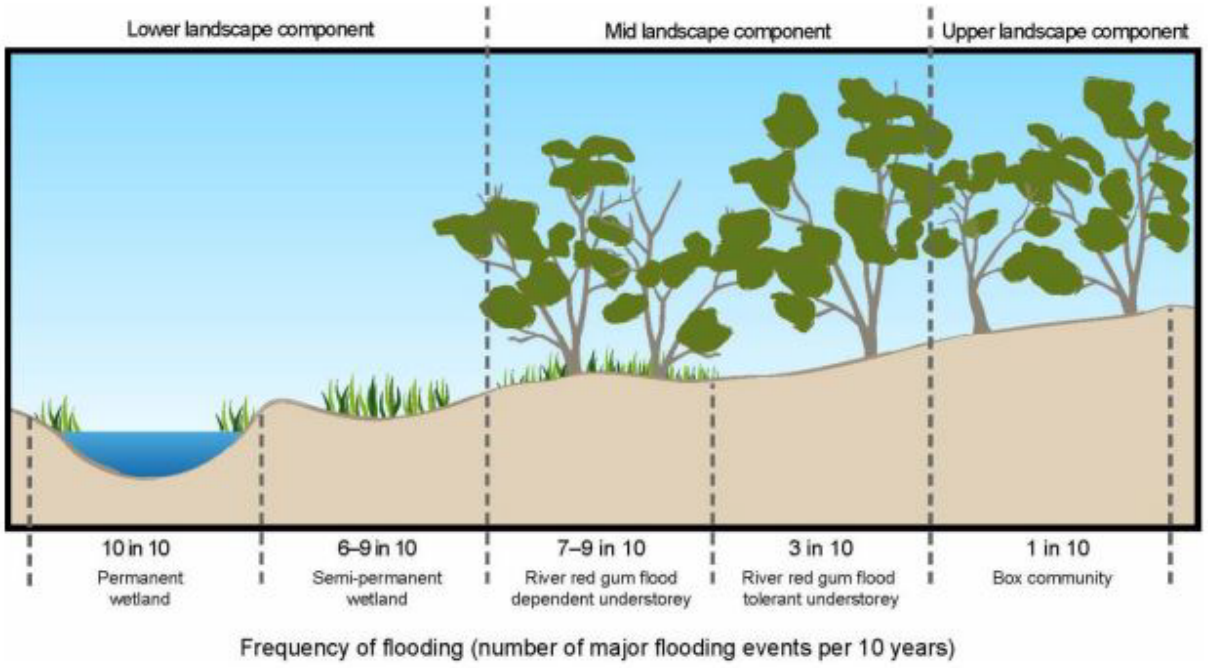

Figure 1. Flooding requirements of selected vegetation communities for Murray Darling based lowland forests (Source: based on Ecological Associates 2006).

Evidence-based studies clearly show modelled flows are incorrect

MDBA Modelling – Gunbower Wetlands, *Murray River, Victoria*

MDBA 2012b - Flooding of the Gunbower wetlands is initiated at 15,200 ML/d (MDBA 2012a). The modelling conducted suggests that in approx. 7-9 years out of 10 flows would have exceeded 20,000 ML/d and inundated the majority of wetlands in Gunbower. Based on these modelled assumptions, watering regimes to match 9 in 10 years have been devised.

Quantitative Evidence-based
A report from Gell et al (2018)

Paleo-ecology methods found that
→ Pre River Regulation (weirs, locks, dams, pumps) many Gunbower Wetlands were

- intermittent/seasonal, and regularly dried out
- no net sediment accumulation (due to frequency and length of dry periods)
- any sediment build up was lost due to dry phases

→ After River Regulation (post 1922),

- Increased wet periods, resulting in more lagoonal conditions allowing incoming sediments to settle.
- Wetlands are filling up with sediment at an unnatural rate of 3-5mm a year
- Decreased dry periods resulting in sediment build up
- Increased frequency and duration of inundation of wetlands may have increased nutrient load producing excessive algae

A peer reviewed journal paper (Gell et al 2019) of a study of 62 MDB wetlands, the authors concluded that less regular inundation, rather than more, is a viable option in restoring the ecological function of these floodplain wetlands and in slowing sediment infill in the Murray Darling Wetlands.

Gunbower is just one example of how the MDBA modelling data used to determine the environmental water requirements doesn't fit peer-reviewed scientific data. Now with more frequent inundation than naturally occurred, sediment is filling the wetlands and excessive carp breeding is occurring. This will inevitably lead to a decline in wetland health from pre-regulated conditions.

Other supporting evidence against MDBA modelled flows

- Blackmore et al (2017) an Independent Expert Panel (the Panel) was asked by the Victorian and New South Wales (NSW) Governments to complete a review of the Sustainable Diversion Limits adjustment mechanism (SDL adjustment mechanism) and in particular the application of the mechanism, key assumptions, interpretations and environmental outcomes.

- The assumption that simply inundating an area to a certain height and for a certain length of time will return the health of a system is a flawed assumption. Blackmore et al (2017) criticized the modelling (Benchmark model) which had been only developed in preliminary draft form, and had never been agreed, finalised and published, and until it was, would continue to be unscientific and a lack of trust would continue.

- The Panel was not able to find a readily available, easy to interpret, single source of truth describing the flow constraints incorporated into model runs.

- They also noted 'there is little evidence to support the link between the default limits prescribed in the Plan and ecological impacts, nor is there any evidence to support the position that ecological impacts are typically binary (pass/fail) in nature. For most ecological assets the impacts are gradational (gradual or staged) and therefore a simplistic pass / fail test in the adjustment mechanism is inappropriate.

- The Panel recommended that 'effective decision making in relation to the SDL adjustment mechanism should be reviewed and improved in a way that intelligently interfaces with assessment method results to allow a package of supply measures to be assessed, and an associated supply contribution to be determined and agreed'. None of this has been done to date.

The establishment of a stable, agreed, clear and accessible benchmark as the basis upon which to assess a range of proposed supply measures is critical. Without this the uncertainty about environmental equivalence will be greater than necessary and the modelled supply contribution will continue to be contested.

- Doody et al (2015) concludes that the red gums should go no longer than seven years without being flooded, assuming below average rainfall, and
- Doody et al (2017) found that many black box (a reason for the need of high inundation of the floodplain; Figure 1) areas had not received natural overbank floodwater for over 30 years, were in poor condition, but were still surviving.
Question - Why are flooding regimes for large expanses of redgum forests designed to occur in 7-9 out of 10 years, when this is clearly not needed for tree survival or recruitment?
After the loss of connection many of these higher black box areas were artificially watered from excess irrigation runoff, deemed 'wasteful' at the time, so no longer occurs.

- Baumgartner et al (2014) reviewed the lifecycle requirements of MDB native fish and devised watering regime recommendations for key species groups. For floodplain specialists the most sensitive species to hydrological change; it was concluded that at 'least two, preferably three, bankfull or floodplain inundation events would be needed per decade to prevent wetland drying to also provide these fish opportunities to disperse and expand distributions.
In addition for fish it has been modelled (Phillips 2002) that environmental flows only, wouldn't even get us half way to the former Native Fish Strategy target of 60% of pre-European fish abundance, and that multiple measures were needed to recover fish populations. This has been re-iterated and further supported by more recent literature (Baumgartner et al 2019), that advocates for a multiple measures approach, not just add water.
Question - Again, why do floodplain wetlands need 7-9 years in 10 flooding regimes?

- Koehn (2016) Arthur Rhylah Institute report modelled the impacts of carp breeding in response to different floodplain inundation rates.

- The model indicates that the highest risk scenarios for Carp population increases all relate to floodplain inundation

- The model indicates that floodplain inundations can create a spike in Carp populations that can endure for some time after the flow event.

- The Lower Lakes remains a significant source Carp population, and the Carp population in the Lower Lakes produces large numbers of Carp available for dispersal to other parts of the river system, as exhibited by congregations of Carp at Lock 1.

- Any flooding of the Werai Forest is likely to increase the carp population in the Edward–Wakool River System and Carp abundance doubled and the modelling indicated that the moderate flows that inundated the Werai Forest would maintain the Carp population in the Edward–Wakool system indefinitely.

Question - Why are we proposing inundation of wetlands every 7- 9 years out of 10, when evidence shows that carp recruitment in this regime will be excessive?

Way Forward

Evidence-based Adaptive Management

Despite the overwhelming evidence that the model used and the modelled results are based on flawed assumptions, are inaccurate and don't present the ecological reality of the MDB, the model still underpins the entire implementation of the MDB Plan. The current MDB Plan views water and large inundation events as the solution to restore floodplains now heavily modified) to an acceptable level of health, but flow is only one driver.

For the MDB Plan to succeed a multiple measures approach is needed as has been advocated for by many scientists (e.g. Baumgartner et al 2019) and communities, and the MDB Plan adapted as new evidence (such as Gell's work) is published under peer-review.

Recommendations:

1. Stop further acquisition of water, including through the SDLAM projects and the 450 GL of Upwater.

2. Invest the remaining funds set aside for water acquisition in evidence-based multiple measures approach, including engineering, management and ecological solutions devised through a partnership led base.

3. Conduct an independent international peer review of the floodplain inundation modelling, as proposed in the panel in Blackmore et al (2017) - The establishment of a stable, agreed, clear and accessible benchmark as the basis upon which to assess a range of supply measures is critical.

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