

Edward/Kolety-Wakool system Environmental Flows Newsletter

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Edward/Kolety-Wakool Monitoring, Evaluation and Research Program



Water in Werai Forest, September 2021 (Photo: John Trethewie)

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Welcome to Issue 9 of the Edward/Kolety-Wakool Environmental Flows Newsletter - a quarterly newsletter that provides an update on our progress as we monitor and undertake research on the ecosystem outcomes of Commonwealth environmental watering actions in the Edward/Kolety-Wakool system.

The Edward/Kolety-Wakool Monitoring, Evaluation and Research Program (Flow-MER) is a collaboration between universities, state government agencies, consultants and local community organisations.

More information on the program can be found at:
<https://flow-mer.org.au/selected-area-edward-kolety-wakool/>
<https://www.csu.edu.au/research/ilws/research/environmental-water>



New project focusses on Werai Forest

The Werai Forest is located downstream from Deniliquin along the Edward/Kolety River, and is part of a large anabranch of the Murray River in the southern Murray-Darling Basin (**Figure 1**). It is dominated by flood-dependent river red gum forest and is part of the Central Murray Forests Ramsar site. The Wamba Wamba or Wemba Wemba, and Perrepa Perrepa or Barapa Barapa are the traditional owners of the Edward/Kolety-Wakool River system. The Werai Forest is in the process of being transferred from management by the NSW National Parks and Wildlife Service to be returned to local Traditional Owners and established as an Indigenous Protected Area (IPA). Altered water regimes of the Edward/Kolety River system have caused a reduction in the frequency and duration of spring wetland inundation and is threatening the Werai Forest ecosystem.

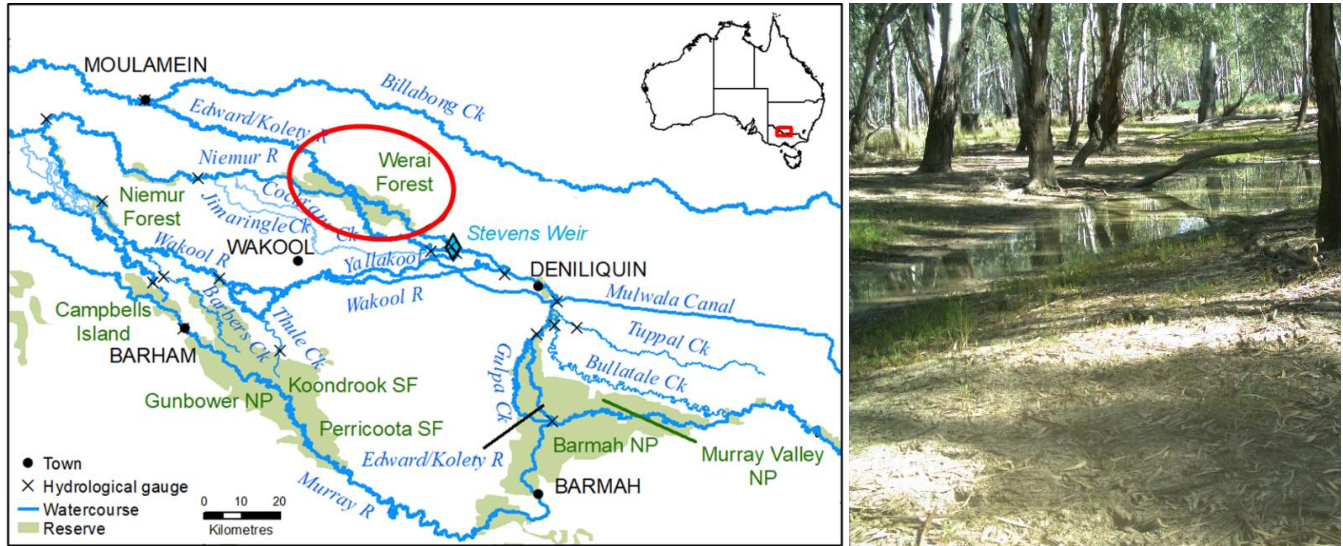


Figure 1: Location of Werai Forest along the Edward/Kolety River downstream from Deniliquin



The Edward/Kolety-Wakool Flow-MER team have commenced a new integrated project to examine the relationship between river flows, inundation of the forest (**Figure 2**), and forest ecosystem responses to inundation. The study will help will inform future environmental watering actions and forest management.

The project includes the following four inter-related components:

- 1) The first part of the project is to characterise the relationship between river flows and inundation of Werai Forest (see story on page 4). Sentinel-2 satellite imagery will be analysed for a number of key flow events to determine the inundation pathways, maximum inundation area, and timing and duration of flows returning to Colligen Creek and the Edward/Kolety River. We have installed loggers that will help document when flows arrive, peak and recede. This research will be undertaken by 2rog consulting in collaboration with CSU.



Figure 2: Left - A flood runner on the northern side of the Werai forest on 4 August. Right – Flood runner on 5 August 2021 as water from unregulated flows in the Edward/Kolety River arrives in the forest.

2) As part of the Werai project we will evaluate the potential to use drones to assess groundcover vegetation responses to environmental watering in Werai Forest (**Figure 3**). We will determine i) whether data captured by drones flown above the forest can accurately separate ground cover from canopy cover and bare earth, and ii) how effective this method is for differentiating between dead/living vegetation and different stages of plant growth. The drone research will be undertaken by Streamology, and on-ground vegetation surveys will be conducted by CSU, Murray-Darling Wetlands Working Group, and Indigenous Rangers from Yarkuwa Indigenous Knowledge Centre.



Figure 3: Left - A drone will be flown above the forest canopy to collect colour and multispectral imagery, and three-dimensional elevation data to assess ground vegetation condition. (Photo: Streamology. Right - Ground surveys of vegetation in Werai Forest will be conducted simultaneously with drone flights to ground-truth the drone data (Photo: Robyn Watts)

3) A field experiment will be undertaken to examine the primary production response following inundation of Werai Forest. We will examine the amount of oxygen produced and consumed by small organisms (e.g. algae and bacteria) in the water before, during and after an inundation event. This study will include sites within the forest, as well as examine the response when flows return from Werai Forest to Colligen Creek and the Edward/Koety River. The research will be led by La Trobe, in collaboration with Charles Sturt University and Indigenous Rangers from Yarkuwa Indigenous Knowledge Centre.

4) Community involvement and engagement is an important part this project. Indigenous Rangers will be embedded in the project team and have opportunities to share their knowledge and gain experience in fieldwork, GIS and other skills. A field day for the community will be undertaken in Werai Forest (COVID-19 regulations permitting!). A community day has previously been held in Werai forest December 2019 (**Figure 4**)(See story in [Newsletter 2](#)).



Figure 4: Community field day held in Werai Forest in December 2019 (Photo: Catherine Allan).

Characterising the hydrology of the Werai Forest

The altered hydrology of the Edward/Koety River is placing the Werai Forest at threat. Understanding the relationship between flow and inundation in the forest and surrounding system will help to better target the delivery of water for the environment to help protect the forest ecosystem. We are creating a hydrological model of the Werai Forest to provide insight into how water moves through the system and how long it stays there. This project will be done in two stages by Zrog Consulting.

Stage 1 - complete

The initial stage examined key hydrological relationships in the broader system and tested the efficacy of using Sentinel 2 remotely sensed data to map inundation within the Werai Forest environment (**Figure 5**). A project report was completed following this initial stage.

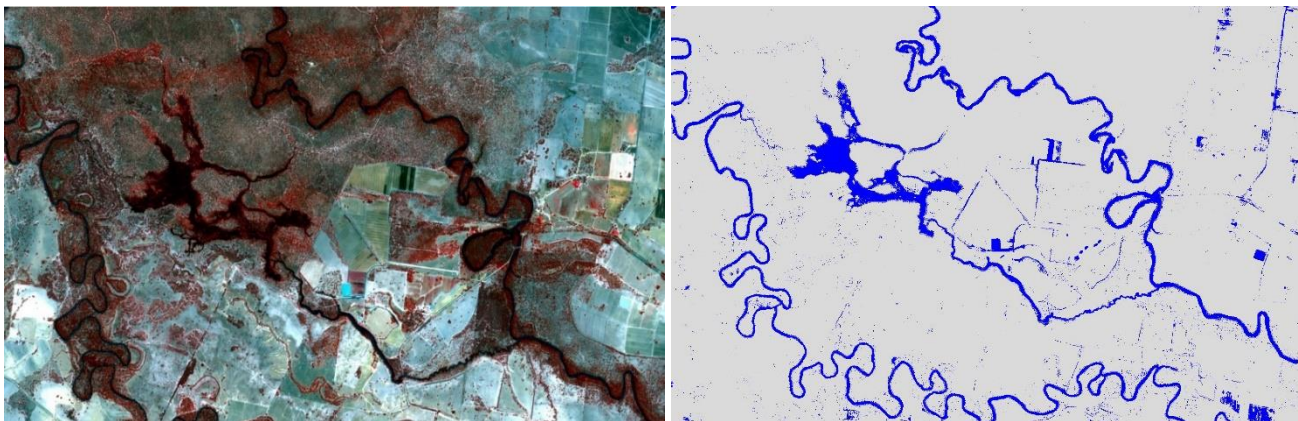


Figure 5: Left - Sentinel image of the south-east corner of the Werai Forest. Right - Inundation is shown in blue via the application of the Modified Normalised Difference Water Index with water vs non-water threshold.

Stage 2 – in progress

Following the success of Stage 1, the initial hydrological characterisation will be enhanced by including additional flow events and Sentinel 2 image sets. Late June 2021 saw the commencement of significant flows down the Edward River that peaked in mid-August at 5,705 ML/d at downstream Stevens Weir (**Figure 6**). During this event, the increased flows caused overflow at Tumudgery Weir that inundated the Werai Forest. Sentinel 2 imagery shows widespread inundation within the system caused by this flow event. We will be examining the inundation at as many inundation stages as possible, linking back to the flow volume and height at Stevens Weir to help improve knowledge of system inundation dynamics.

We are looking forward to presenting our findings to stakeholders and the community later in the year.

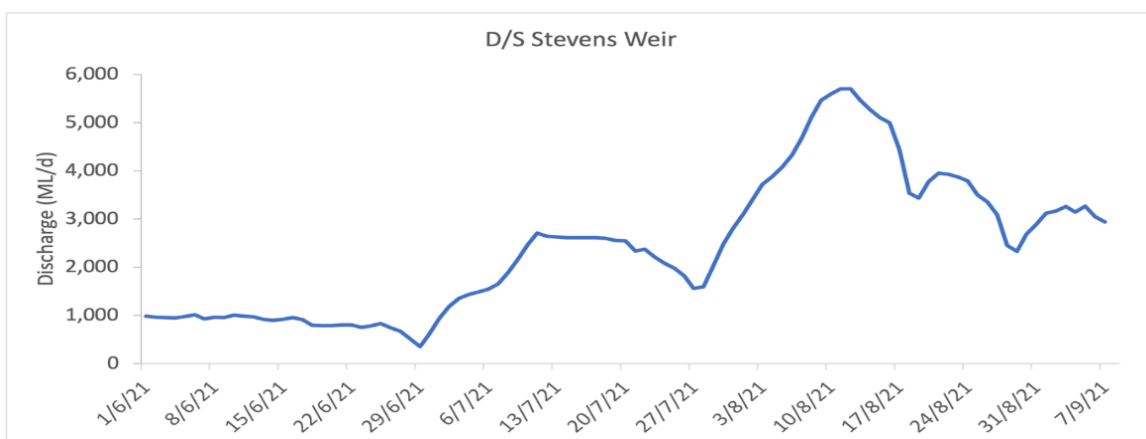


Figure 6: Discharge (ML/d) at downstream Stevens Weir (1/6/21 – 7/9/21).

Edward/Kolety-Wakool Community Survey Sneak Peek

In July and August 2021 an online questionnaire (survey) was circulated as widely as possible among people who might have an interest in the Edward/Kolety-Wakool river system. The aim was to learn about the knowledge, values and opinions people have in relation to environmental water and its use in this river system. The questionnaire had tick box and scale questions, as well as space for written comments. We are now analysing the responses and will publish a report before the end of 2021. This article shares some of the initial findings that we think might interest you.

There were nearly 60 responses to the survey, all from people who are clearly well connected with the Edward/Kolety-Wakool river system, with all but one living in the area. In general, the respondents are concerned about the health of all the rivers and creeks in the system (and beyond), and they also care about the river system’s relationship to personal livelihood and the local community.

The respondents have a good understanding of the various government agencies and groups that have a role in water management in the Edward/Kolety-Wakool system, but the trust that the respondents have in those groups varies. The written comments provided by respondents suggest that low trust relates to perceptions of inadequate consultation and accountability around water for the environment, and water in the river system more generally. Most respondents accurately identified how water for the environment had been used, such as supporting native fish and improving water quality. However, there appears to be less accurate understanding of what proportion of the water in the river system is ‘water for the environment’, as in water ordered specifically for the environment through water holdings.

While some of the questions in the survey had ‘correct’ answers, many other questions were about values, and opinions. For example, **Figure 7** shows a sample of value statements to which respondents indicated their level of agreement.

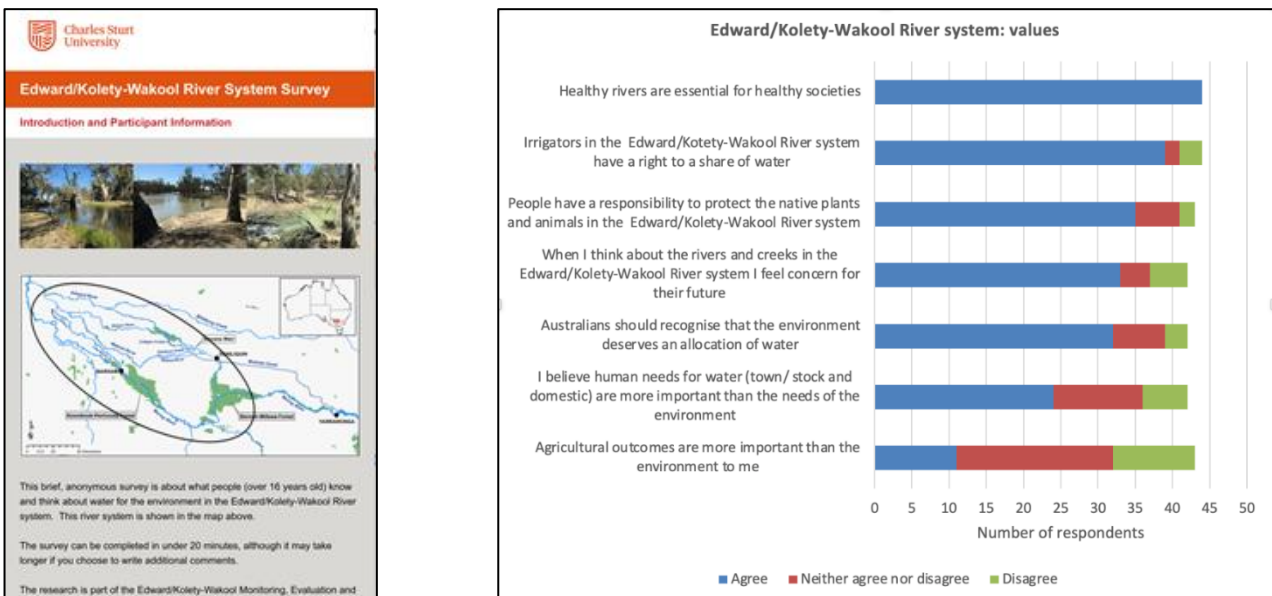


Figure 7: Left – Extract from the community online survey. Right - A sample chart showing how the results from the Edward/Kolety-Wakool community survey may be presented in the published report. This chart shows the number of respondents who agreed with the various statements.

With this style of survey we cannot generalise that what we learn applies to everyone who has an interest in the environmental water and its use in the river system. We can, however, use the results of the survey as the focus of conversations within the stakeholder communities. For example, it is notable that all of the respondents agree that healthy rivers are essential for healthy societies, but elsewhere in the survey not everyone agree with the statement that water for the environment can play a role in achieving river health. These shared values and divergent opinions are an excellent starting point for further conversations. What health means, and how to achieve it, will vary across individuals, groups and organisations, but the

common shared agreement of purpose (a healthy river) can provide a solid foundation for working through multiple meanings and opinions.

Whether you agree or disagree with the respondents of the survey, their values and understanding can provide a focus for on-going discussions. Once the report is published we will especially encourage discussion of the results among groups that were not well represented as respondents, especially women, Indigenous/Traditional Owners, young people, and water planners/ water managers.

If you would like a copy of the report when it is available, and have not already indicated this in the survey, please contact Catherine by email at callan@csu.edu.au to be added to the distribution list.

What's going on with riverbank plants during winter?

Riverbank and aquatic vegetation is important to maintain healthy river ecosystems, providing habitat and food for many animals, supporting river productivity and stabilising riverbanks. Commonwealth environmental water has been delivered in the Edward/Kooley-Wakool system to help maintain and increase periods of growth for non-woody vegetation that occur within river corridors. We monitor riverbank and aquatic vegetation in the Wakool River, Yallakool Creek and Colligen Creek once per month throughout the year. In previous newsletters ([link here](#)) we have described how environmental watering actions have supported the germination, growth and survival of plants on riverbanks.

Some riverbank and aquatic plants that germinated and grew in response to environmental watering actions in spring and summer can survive the cooler months if stock are excluded of from riverbanks. As the days get longer and the weather gets warmer, river flows that occur during spring and summer can promote growth, flowering and production of seeds of the plants that survived over winter. Flow pulses can also support the germination of new plants.

Some species of riverbank and aquatic plants senesce during winter. Senescence is a process where leaves die and nutrients from the leaves are redistributed to the tuber of the plant or into the water. Plant debris from the senescing plant accumulates on the sediments, decomposes and supports the aquatic food web. In the Wakool River large beds of floating pondweed (*Potamogeton tricarinatus*) were present in summer, but the plants senesced during autumn (**Figure 8**) and were mostly absent during winter. Similarly, in Colligen Creek healthy beds of spike rush (*Eleocharis* sp.) were present in January 2021 but had senesced in winter (**Figure 9**).



Figure 8: Left - Floating pondweed beds in the Wakool River in March 2021. Right - plant senescence in June 2021. (Photos: Sascha Healy).



Figure 9: Left - Spike rush in Colligen Creek, January 2021. Right - August 2021 (Photos: Sascha Healy).

Environmental water delivered during winter can be used to maintain connectivity of the river corridor and help prevent exposure and damage of the plant roots and tubers by frosts and feral pigs. As the weather warms up these plants will re-sprout. Environmental water delivered in spring and summer to create flow peaks that inundate riverbanks or slow down the recession of unregulated flow peaks, will support the growth of these plants along the shallow edges of rivers and creeks.

Although aquatic and riverbank plants are the focus of our monitoring, it is great to observe the plants on the adjacent floodplains responding to winter rains. During August 2021 floodplains along the Wakool River were green, lignum was in flower, black box trees were in bud and flower, and there were many floodplain groundcover species in flower (**Figure 10, 11**). What a wonderful sight!



Figure 10: Floodplain plants observed during August 2021. Left: *Ranunculus pumilio*; middle: *Geococcus pusillus*; top right: *Myosurus minimus*; bottom right: *Eclipta platyglossa*. (Photos: Sascha Healy)



Figure 11: Floodplain in zone 4 August 2021 (*Geococcus pusillus*) in flower. (Photo: Sascha Healy)

Environment water creating refuges for fish

The current wet conditions in the Murray valley have resulted in higher river flows for the first time in several years. Floodplains and low-lying wetlands have been inundated and the carbon-rich water (also known as blackwater) flowing off the floodplains is critical to wildlife in our rivers — it provides food for native fish, yabbies, shrimp and many other aquatic animals.

On 15th September The Commonwealth Environmental Water Office commenced the early delivery of environmental water via Murray Irrigation Limited escapes to create refuges (safe-zones) of better quality water for native fish, crayfish, and other aquatic animals. This is an early precautionary management action, because DO concentrations may decrease as water temperatures rise and water returns to the Edward/Kolety-Wakool system from Barmah-Millewa Forest and other low-lying areas of forest and farmlands. If DO concentrations decrease, native fish and crays can move to these refuge areas and improve their chances of survival. At the time of publishing this newsletter (30th Sept) dissolved oxygen (DO) concentrations in the Edward/Kolety-Wakool system were well above the 4.0 mg/L critical point of risk for native fish.

For more information read the [media release](#) about the early delivery of CEW from irrigation escapes to create refuge.

Update on fish monitoring

Larval fish monitoring for the 2021-22 season commenced in early September and will be conducted fortnightly at 20 sites in Yallakool Creek and the Wakool River until the beginning of March (**Figure 12**). This will be the first step in a busy monitoring season, with surveys of juvenile fish recruitment to follow during February, and a system wide fish survey in May/June at 20 sites that were previously surveyed in 2010-2015 and in 2019.



Figure 12: Jarryd McGowan setting larval drift nets in the upper Wakool River.

More information

To join the newsletter mailing list please subscribe [here](#) or contact Professor Robyn Watts, Institute for Land, Water and Society, Charles Sturt University, Albury NSW. rwatts@csu.edu.au

We respectfully acknowledge the Wamba Wamba (or Wemba Wemba), and Perrepa Perrepa (or Barapa Barapa) peoples, traditional owners of the land on which the Edward/Kolety-Wakool program is focussed. We recognise their unique ability to care for Country and their deep spiritual connection to it. We honour Elders past, present and emerging whose knowledge and wisdom has ensured the continuation of culture and traditional practices. The Edward/Kolety-Wakool team would also like to acknowledge the local landholders with whom we work and thank them for their contribution to the monitoring and research.

Trethewie J., Allan C., Minato W., Winkle S., Frazier P., Healy S., Watts R.J. (2021) Edward/Kolety-Wakool System Environmental Flows Newsletter, Issue 9. Charles Sturt University.