Figure 1: Old Dromana Dam in March 2022. Photo Credit. Jared Reid, 2rog.

Flow-MER in the Gwydir: What Do We Do

Traditional Gamilaaraay Language of the Gomeroi nation used in this article (H. White & B. Duncan - Speaking Our Way, M. Mckemey)

The Gwydir River Selected Area Flow-MER project monitors six scientific 'indicators' to help us understand the impact of water for the environment on the landscape, plants, and animals. These include hydrology, waterbirds, fish (diversity and movement), vegetation and food webs.

Hydrology – is the study of water movement in channels and wetlands. The hydrology indicator looks at when, where and how water flows into the channels, floodplains and wetlands (Figure 1). Hydrology underpins the environmental and ecological processes in rivers and directly impacts all other indicators that we measure.

For the hydrology indicator we use publicly available websites such as the Bureau of Meteorology (Figure 2) for climate data and WaterNSW real time data for flow data. Once all the temperature, rainfall and gauge flow data is gathered, we relate the flow information to what is happening across the system.

The Gwydir system has seen large flow volumes this last water year (2021-22), driven both by rainfall in the catchment and the delivery of water, for irrigation and the environment.

Vegetation – in the lower Gwydir Valley wetlands includes either amphibious non-woody communities or flood dependent shrublands and woodlands. The diverse selection of wetland vegetation communities relies on regular inundation to survive. The duration and frequency of inundation influences the distribution of vegetation in a wetland.

Vegetation surveys are usually conducted during spring and autumn in collaboration with staff from the NSW Department of Planning and Environment (DPE). At each site we set up 20 m by 20 m quadrats (survey plot) (Figure 3). Within a plot we record which species are present, how many are present and total ground cover as a percentage. We also consider other impacts such as grazing.

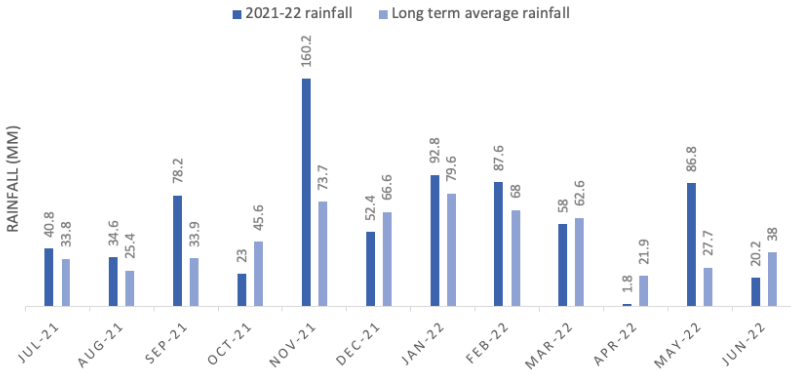

Figure 2: Rainfall data for the 2021-22 water year. November had the largest total rainfall, and the year saw significantly higher rainfall than the long term average.

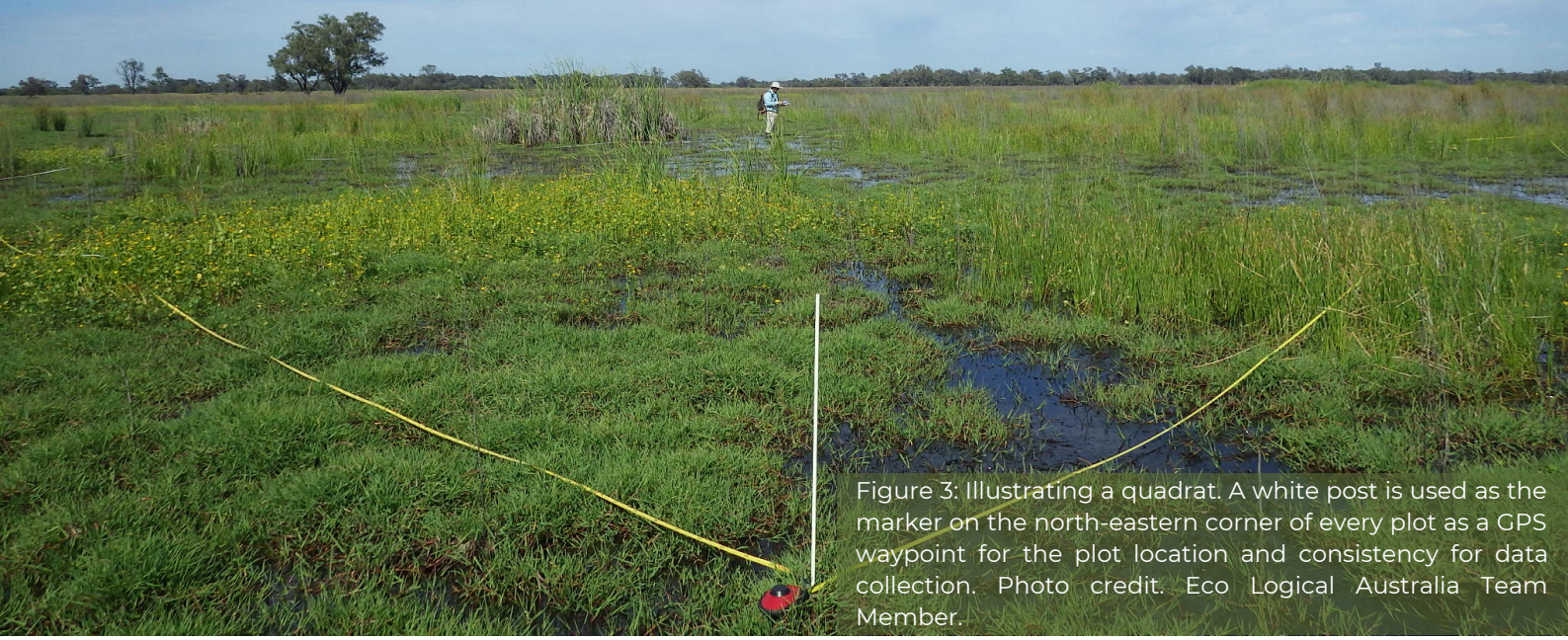

Figure 3: Illustrating a quadrat. A white post is used as the marker on the north-eastern corner of every plot as a GPS waypoint for the plot location and consistency for data collection. Photo credit. Eco Logical Australia Team Member.

Increased wetland inundation over the last couple of years gave vegetation in the Gwydir the chance to bounce back after previous dry years. We saw high species richness in water couch grassland, gulabaa (coolabah) woodland, and river cooba shrubland communities. The Gwydir now has the highest level of vegetation cover recorded within the eight years of the Flow-MER project.

Fish Diversity and Movement – involves understanding which fish are present and where and when they move. Fish presence and movement is linked to biotic (living things like other aquatic species or plants) and abiotic factors (like available habitat, light availability and temperature). Our monitoring benchmarks and describes any changes in fish community structure, abundance, and overall health.

To determine fish diversity, the Department of Primary Industries (DPI) - Fisheries team collect samples with a combination of electrofishing (Figure 4) and bait trapping. Once captured, fish are identified, measured and recorded. We also look at fish movement to determine the effect of variations in river flow on the residency, survival and movement of the dhagaay (golden perch – *Macquria ambigua*), guduu (Murray cod - *Macculochella peelii*) and gaygay (catfish – *Tandanus* sp.). We do this by inserting receivers or tags into individual fish which send a signal to receivers placed along the river when the fish swims past.

Sampling in the 2021-22 water year found a good number of 'young of year' spangled perch (*Leiopotherapon unicolor*), gaygay (catfish) and carp (*Cyprinus* sp.), additional to lots of month-old shrimp. Although the system was productive, the overall community was in poor to very poor condition, due to many species being found in very low numbers.

Food Webs – characterise the food chain within a community (who eats who or what) and also measure the production and transfer of energy within the ecosystem. We collect field data for water quality (nutrients, temperature, light and salinity), metabolism and productivity

Figure 4: John St. Vincent Welch (DPI Fisheries) holding a large guduu (Murray cod - *Macculochella peelii*) caught whilst electrofishing. Photo credit. Leo Cameron, DPI Fisheries.

Figure 5: Ben Vincent (UNE) catching aquatic microinvertebrates with a really fine net. Photo credit. Iris Tsoi, UNE.

(carbon and energy) as well as micro- and macro- invertebrates.

To collect data for the food web indicator we use tools such as a Hydrolab Quanta multi-probe which measures temperature, electrical conductivity, dissolved oxygen, pH and turbidity. Invertebrates are caught using different methods depending on where they live. For instance, benthic micro-invertebrates live in the underlying sediments and mud and are collected in core samples and then decanted through a fine sieve which has tiny holes to prevent the invertebrates from getting out. Microinvertebrates that live in the water column are collected using a drag net.

Once collected, invertebrates are preserved in alcohol until they are identified using a microscope in the laboratory.

The 2021-22 water year generally had good water quality. This was aided by freshes coming into the system helping to increase productivity and improve water quality. As a result, our data showed a high density of benthic macroinvertebrates, providing a good food source for fish, birds, frogs, and turtles.

Waterbird Diversity – large inundation events help to support significant numbers of nationally and internationally important waterbird species.

Figure 6: The Hydrolab Quanta multi-probe in Darren Ryder's (UNE) hand measures temperature, electrical conductivity, dissolved oxygen, pH and turbidity.
Photo credit. Sarah Mika, UNE.

Figure 7: Jane Humphries (CEWO) and Leah McIntosh (UNE) in the wetlands. Showing the essential components of surveying waterbirds; binoculars, waterproof paper and appropriate personal protective equipment. Photo credit. Tamara Kermode.

For the MER program, raptors, reed-inhabiting passerines and tree kingfishers along with those more traditionally known as waterbirds (such as ducks, grebes, geese, swans etc) are included under the definition of 'waterbirds'.

We undertake waterbird surveys in collaboration with staff from DPE< surveying channel, floodplain wetland and waterhole habitats across the Gwydir wetlands to detect waterbird species by looking and listening (Figure 7).

On occasions where significant numbers of waterbirds nest, we specifically monitor for waterbird breeding. We do this by carefully visiting rookery sites and counting nests, eggs and chicks to assess the stage of nesting and rearing. We also use drones to help us count nests to get a better idea of the size of each rookery site.

We have observed a total of 123 waterbird species over the course of the LTIM/Flow-MER project. These have included NSW listed threatened species such as the Australian painted snipe (*Rostratula australis*), black-necked stork (*Ephippiorhynchus asiaticus*), burraalga (brolga - *Grus rubicunda*) and dhawudjarrdalmu (magpie goose - *Anseranas semipalmata*). The 2021-22 water year saw significant colonial waterbird breeding and a diversity of species being recorded during fieldwork. To support this breeding event, water for the environment was delivered to the breeding grounds to maintain water levels under nests, just how they like it.

Managing water for the environment is a collective and collaborative effort, working in partnership with communities, private landholders, scientists and government agencies - these contributions are gratefully acknowledged.

We acknowledge the Traditional Owners of the land on which we live, work and play. We also pay our respects to Elders past, present and emerging.