

Supplementary Material

Enhancing whole-of-river conservation

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Typology/conservation assignment example

We provide an informal preliminary example of the suggested process for illustrative purposes. During further development this will likely need modification.

We examine two small catchments – Running River and adjacent Oaky Creek – in the northern part of the Burdekin catchment (Fig. S1). Some detailed information is available for Running River, particularly for its tributary, Birthday Creek. Little specific information is available for Oaky Creek, but it provides an interesting contrast with Running River because of their different flow regimes (intermittent *v.* perennial). The characteristics of the catchments are captured in a preliminary typology, and conservation categories are assigned according to the known or likely biodiversity, ecological characteristics and condition of stream sections (Table S1).

The most prominent discriminators in Table S1 involve the hydrogeomorphic zone, described by stream size, position in the landscape and flow regime. Some of the descriptors include some redundancy – for example, gradient and substrate are closely linked, as are lithology and conductivity – but are included as potentially useful characteristics. A small suite of descriptors is sufficient for a coarse classification of river sections, as presented in Table 4 of the main document.

The disturbance category follows Queensland Government usage and is assigned according to information provided in the table. Note that disturbed reaches may have high conservation value, reflecting government application of the categories, which is intended to underpin management actions for improvement (Godfrey and Pearson 2012; Queensland Government 2019). An example of the dichotomy between conservation value and disturbance is the occurrence in south-eastern Queensland of the lungfish (*Neoceratodus forsteri*), which is an iconic endemic species from an ancient lineage, commanding the highest level of conservation interest, despite inhabiting disturbed rivers. Similarly, the platypus (*Ornithorhynchus anatinus*), another iconic species, occurs in both pristine and moderately disturbed systems, including tributaries of the Burdekin River such as Running River and Broken River (Fig. S2).

We provide brief justification for the conservation categories applied. Each would be supported by an expert elicitation process.

We contend that applying this process to the whole catchment by river section (or lentic water body) should be straightforward, with much of the geomorphic, hydrological and landscape information available through government databases, and the levels of disturbance, biodiversity and ecological information available through published material and expert elicitation. Conservation category is intended to guide planning of land-use, infrastructure etc. and the application of appropriate constraints.

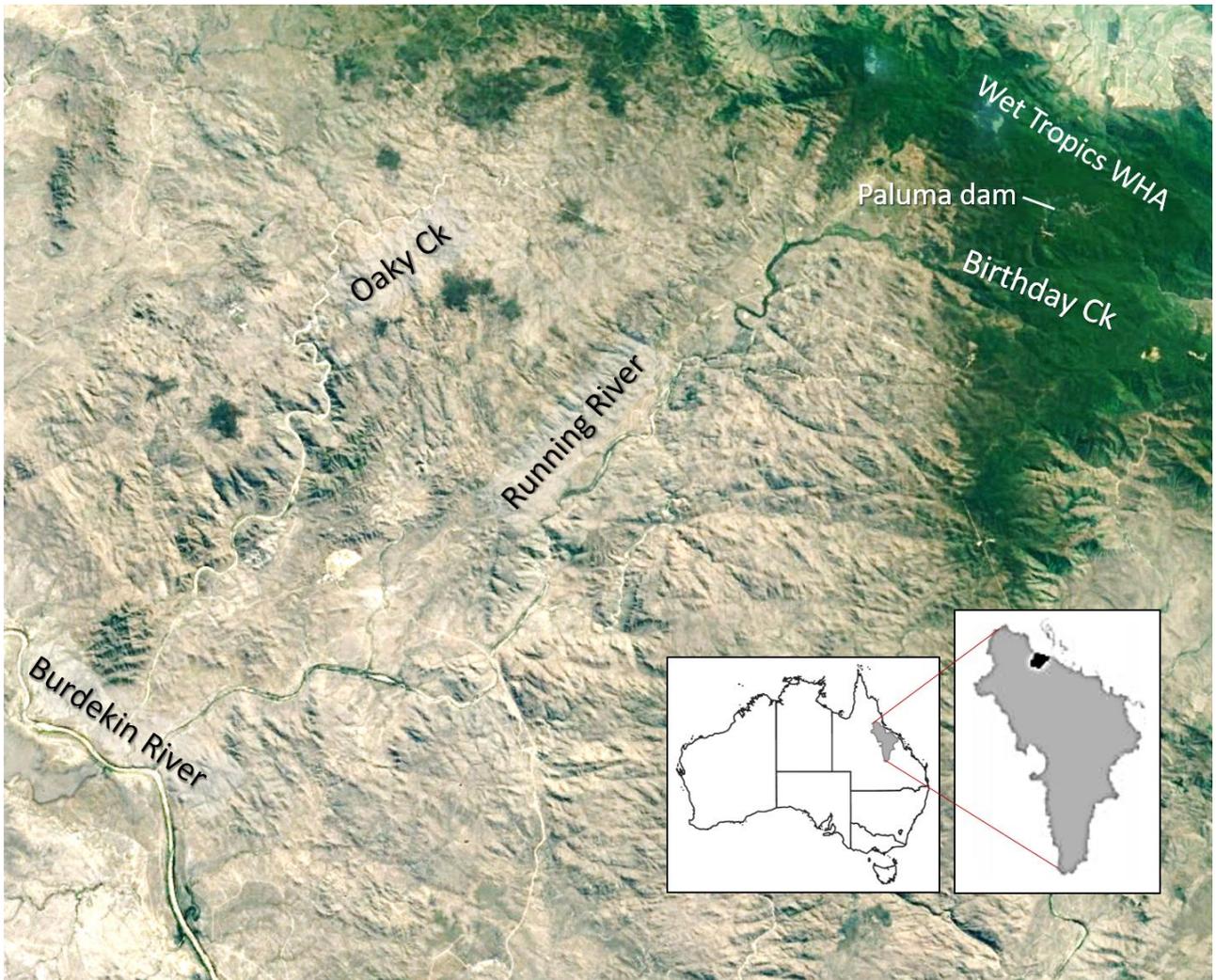


Fig. S1. Google Earth image showing Running River and Oaky Creek catchments. Dark green indicates forest (mainly closed rainforest); most of the rest of the catchments are vegetated by grassy open woodland. WHA, World Heritage Area. Insets show location of the catchments.

Table S1. Example of riverine typology (zone characteristics) and conservation categories of Burdekin tributaries, Running River and Oaky Creek, based on preliminary information only.

Descriptors	Running River		Oaky Creek		Burdekin River
Typology					
Zone (order)	Headwater (1–3)	Upper river (4–5)	Headwater (1–3)	Upper river (4)	Upper river (5–6)
Gradient	Steep	Low	Steep	Low	Low
Flow	Perennial	Perennial	Intermittent	Intermittent	Perennial
Lithology	Granite	Granite	Granite	Granite	Granite/basalt
Substrate	Rock/cobble	Sand	Rock/sand	Sand	Sand
Conductivity	Very Low	Low	Low	Low	Moderate
Water quality	Good	Good	Good	Good? (Mine?)	Good
Catchment vegetation	Forest	Woodland	Woodland	Woodland	Woodland
Riparian condition	Good	Good	Good	Moderate	Moderate
Land use	Conservation	Grazing	Grazing	Grazing	Grazing
Infrastructure upstream	Paluma Dam on small tributary	Nil	Nil	Mine	Nil
Infrastructure downstream	Major – BFD	Major – BFD	Major – BFD	Major – BFD	Major – BFD
Connectivity upstream	Good	Good	Good	Good	Good
Connectivity downstream	Restricted – BFD	Restricted – BFD	Restricted – BFD	Restricted – BFD	Restricted – BFD
Instream vegetation	Bryophytes	Patchy	Very limited	Very limited	Patchy
Translocated/exotic fauna	Nil	At least one species	?	?	Several species
Biodiversity	Invertebrates high; fish low	Invertebrates? Fish higher	?	?	Inverts moderate, fish higher
Ecological knowledge	Good	Moderate	Limited	Limited	Moderate
Representativeness	High	High	?	?	High
Disturbance ^A	1	2–3	2–3	2–3	2–3
Conservation and management					
Conservation category ^B	1	1	2?	2?	2
Justification	Near pristine, in conservation area, biodiverse	Despite land use, excellent example of its type, including biodiversity	Probably good example of its type, given land use	Probably good example of its type, given land use	Despite BFD, land-use etc., important for biodiversity & ecological processes
Management actions indicated	Protect, maintain	Fencing, off-stream water points	Fencing, off-stream water points	Fencing, off-stream water points	Flow adjustment, riparian management

BFD, Burdekin Falls dam.

^ADisturbance score follows Queensland Government (2019) categories: 1, High Conservation Value; 2, Slightly Disturbed; 3, Moderately Disturbed; 4, Highly Disturbed.

^BConservation category: 1, very high value; 2, high value; 3, moderate value; 4, low value; ?, uncertain.

a



b



Fig. S2. (a) Platypus habitat in the upper Broken River; (b) platypus at the same site. Turbidity is due to run-off from a dairy farm.

References

Godfrey, P., and Pearson, R. G. (2012). Wet Tropics waterways condition assessment: Mulgrave, Russell, Johnstone and Herbert rivers. Australian Centre for Tropical Freshwater Research report number 12/03, James Cook University, Townsville, Qld, Australia.

Queensland Government (2019). 'Environmental Protection (Water and Wetland Biodiversity) Policy 2019.' Department of Environment and Science, Brisbane, Qld, Australia. Available at <https://environment.des.qld.gov.au/management/policy> [Verified 15 June 2021].