Geomorphic and ecologic impacts of artificial in-channel and floodplain structures in inland Australian floodplain wetlands

Ralph, T. J., Outhet, D., Hesse, P. P., Cook, N. and Porter, A.

1 New South Wales Department of Environment and Climate Change, Australia.
2 New South Wales Department of Water and Energy, Australia.
3 Department of Environment and Geography, Macquarie University, New South Wales, Australia.
Tim.Ralph@environment.nsw.gov.au

Abstract

Intensive water resource developments and landuse changes within semi-arid zone floodplain wetlands have added to the heavy burden of agricultural and environmental stressors on inland rivers in Australia. In particular, in-channel and floodplain structures, such as weirs, embankments and canals, serve to impede, trap, divert, spread and/or convey water throughout floodplain wetlands for a variety of purposes. These structures affect flow hydraulics and processes of sediment erosion, transport and deposition across the continuum of hydrological conditions in wetlands, from channel base-flows to widespread overbank floods. Geomorphic and ecologic impacts occur at a range of spatial scales, from individual and site specific, to cumulative and system wide. Our examples from iconic floodplain wetlands in the Murray-Darling Basin show that consequences of artificial structures within channels and on the floodplain include: perturbation and redirection of flows, exacerbation of erosion and sedimentation, modification of geomorphic units and fluvial landforms, alteration of channel-floodplain connectivity, modification of the distribution and timing of floodplain inundation, and modification of in-stream and riparian habitats. In central-western New South Wales, permanent and temporary earthen embankments across low-slope channels have led to the formation of new stock watering pools or extended natural ones, altering the sediment regime and concentrating livestock impacts. In these systems, block banks are the main agents causing geomorphic change. In other cases, rubble weirs and crossings have altered channel bed levels, have mediated and/or caused erosion, and have led to changes in overbank flooding. Embankments on the floodplain also cause flow diversion and ponding. Detrimental ecologic impacts of artificial structures include habitat alteration related to flooding and barriers to fish passage, while benefits include in-channel habitat retention and provision of drought refuges. Our assessments highlight the key role of geomorphology in understanding the effects of artificial structures and for a holistic approach to management.