WIDS2017 Dynamic Landscapes

Proceedings of the Wetlands in Drylands Research Network Conference

Macquarie University, Sydney, Australia, 24-26 July 2017

Timothy J. Ralph ***Editor***

ISBN 978-1-74138-454-3

Spatiotemporal surface water dynamics at subcontinental scale in a major dryland region

Mirela G. Tulbure

School of Biological, Earth & Environmental Sciences, University of New South Wales, NSW 2052, Australia. Email mirela.tulbure@unsw.edu.au

Surface water is a critical resource in semi-arid areas. In Australia, competing water demands, combined with changes in climate and the way we use our land as well as multi-year droughts, such as the Millennium Drought that ended in 2010, have led to water shortages, particularly in the Murray-Darling Basin (MDB). The MDB is a large (>1 million km^2), semi-arid basin that experiences extreme hydroclimatic variability and competing water demands, of high economic importance given that it accounts for 40 % of Australia's gross value in agricultural production. In this keynote, I will present: 1) the development of a statistically validated surface water and flooding extent dynamics data product (SWD) based on three decades (1986-2011) of seasonally continuous Landsat TM and ETM+ archives and generic random forest-based models; 2) patterns in surface water extent dynamics, and 3) the quantification of key hydro-climatic drivers of surface water extent dynamics.

Investigating (non)equilibrium changes in avulsive channels in floodplain wetlands

Neda Yousefi[1], Timothy J. Ralph[1], Hsing-Chung Chang[1], Michael C. Grenfell[2] and Paul P. Hesse[1]

[1]Department of Environmental Sciences, Macquarie University, NSW 2109, Australia. Email neda.yousefi@hdr.mq.edu.au; tim.ralph@mq.edu.au; michael.chang@mq.edu.au; paul.hesse@mq.edu.au
[2]Institute for Water Studies and Department of Earth Sciences, University of the Western Cape, Bellville, South Africa. Email mgrenfell@uwc.ac.za

Floodplain wetlands are large and complex fluvial systems with networks of alluvial channels that are affected by human activities and natural processes. Avulsion, the rapid abandonment of a river channel in favour of new one, is one of the most important processes linked to sedimentation and erosion in floodplain wetlands. Avulsion can cause rearrangement of the alluvial channel network, disconnection of parts of the floodplain, and/or abandonment of parts of the wetlands. The Macquarie Marshes are one of the largest freshwater wetland systems in the Murray-Darling Basin, and channels in the Marshes are prone to erosion, sedimentation and avulsion. Channel changes can affect wetland ecology by providing the biophysical template for aquatic and terrestrial habitats, driving wetland succession and renewal, and draining wetlands in some cases. Some sites are also at risk of rapid change due to channel modifications and flow redistribution associated with engineering intervention works. Understanding the balance (or imbalance) between erosion, sedimentation, channel change and flooding is critically important for wetland management.

This study seeks to investigate drivers of channel dynamics in the Macquarie Marshes. Using cross-section data extracted from a high resolution LIDAR DEM, alluvial channels were classified into two groups: 1. primary channels (width >1 m and depth >50 cm), and 2. secondary channels (width <1 m and depth <50 cm. Bifurcation points were mapped along the primary channels and cross-sections from upstream and downstream of each bifurcation point were assessed for width, depth and area to measure changes in channel capacity. We then calculated the difference between channel width, depth and area for each primary channel and its secondary branches downstream. Our analysis in the southern Macquarie Marshes shows that of 107 bifurcation points on primary channels, 76 %

resulted in an increase of total channel capacity (where the combined capacity of bifurcate channels exceeds the capacity of the primary channel upstream of the bifurcation), 5 % led to a decline in total channel capacity, and 19 % had a combination of increase and/or decreases in total channel width, depth and area. Channels with increasing or maintained capacity can generally be considered to be in dynamic equilibrium in terms of their hydrology and sediment transport efficiency. In places, however, where channel capacity declines or where channels terminate on the floodplain, this is a clear indication of non-equilibrium conditions related to declining hydrological conditions and sediment transport efficiency. Channel metrics will be assessed at bifurcation points on secondary channels in the future and further work will determine the nature of downstream channel change and hydrological declines that drive channel breakdown in these floodplain wetlands.