APPLYING NATURAL FLOOD MANAGEMENT PRINCIPLES TO AUSTRALIAN CATCHMENTS

J Kemp¹, A Brooks¹, J Stout¹, I Rutherfurd², R. Sharpe¹, I Reinfelds³, T. Cohen⁴, T. Pietsch¹

¹Griffith University, Nathan, QLD
²University of Melbourne, Parkville, VIC
³Department of Primary Industries – Water, Sydney, NSW
⁴University of Wollongong, Wollongong, NSW

Abstract
Nature-based approaches to river management employ self-sustaining, bioengineered channel designs including the reintroduction of woody debris to channel beds, enhancement of sinuosity, and re-establishment of riparian forest. A variety of initiatives in different countries have characterised as ‘Building with Nature’ and ‘Room for the River’ (Netherlands), Nature-based Solutions (International Union for the Conservation of Nature), and Natural Flood Management (UK). The term adopted here, Natural Flood Management (NFM), embodies the broad range of efforts in a number of countries over several decades to attenuate flood flows by restoring the natural hydraulic function of the floodplain, using a catchment-wide approach to flood control. The technique has yielded promising results in small and medium sized catchments in the UK and US, and its application to Australian catchments is presently being trialled in the Hunter Valley, in south-east Queensland, and in coastal catchments of Victoria. If successful, NFM has the potential to offer significant flood relief to rural and urban populations with relatively low costs for implementation and ongoing maintenance. The approach also offers the subsidiary benefits of enhanced channel stability, improved ecosystem function and water quality. This paper examines recent trials of NFM in eastern Australia and some important considerations attending its implementation as an effective flood mitigation strategy.

Natural Flood Management
Natural Flood Management (NFM) represents a major change in flood management in Australia, and quantified investigations into the effects of riparian vegetation on flood hydrology are urgently needed. This requires a combination of empirical, field-based evidence within the period of reliable streamflow records, and catchment modelling. Research conducted elsewhere has shown that well vegetated river corridors may reduce flood severity at the catchment scale by slowing down the passage of flood flows, restoring the connection between the channel and its floodplain, and increasing the temporary storage of flood waters (Lane, 2017). Significant attenuation of floods has been observed after rehabilitation of streams in small catchments in the UK (McLean et al., 2013; Jacobson et al., 2015; Dixon et al. 2016; Lane 2017; Metcalfe et al., 2017), and in intermediate size catchments in the US (Woltemade and Potter, 1994; Jacobson et al. 2015). Despite this, unambiguous evidence of effective flood attenuation is not yet available (Lane, 2017). In large catchments, attenuation becomes difficult to detect. Attenuation depends on the structure of the drainage basin and the relative influence of restored tributaries so the link between riparian zone management and flood risk is specific to each catchment and even to each flood (Patinson and Lane, 2012). The concept remains to be fully tested in Australian perennial streams, but the available studies provide promising results. These results are summarised in Table 1, below.
Table 1 Effectiveness of Natural Flood Management techniques in Australian catchments

<table>
<thead>
<tr>
<th>Technique</th>
<th>Study area</th>
<th>Basin area (km²)</th>
<th>Change in flood stage (m)</th>
<th>Change in flood wave celerity (ms⁻¹)</th>
<th>Change in flow velocity (%)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian regrowth. Streamflow records of flood behaviour</td>
<td>Wollumbi Brook, NSW</td>
<td>1,850</td>
<td>-</td>
<td>0.71</td>
<td>-</td>
<td>Fryirs et al. (2018); Cohen et al. (unpub.)</td>
</tr>
<tr>
<td>Riparian regrowth. streamflow records of flood behaviour</td>
<td>Hunter River, NSW</td>
<td>17,320</td>
<td>-</td>
<td>0.11</td>
<td>-</td>
<td>Fryirs et al. (2018)</td>
</tr>
<tr>
<td>Riparian forest (2D model)</td>
<td>Caboolture River, SE Qld</td>
<td>380</td>
<td>0.18</td>
<td>-</td>
<td>9</td>
<td>Sharpe (2012)</td>
</tr>
<tr>
<td>Riparian forest, (ID model)</td>
<td>Mt Emu Ck, Victoria</td>
<td>1,250</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>Rutherfurd et al. (unpub.)</td>
</tr>
</tbody>
</table>

References


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