Preliminary results from seven years of hydro-geomorphic monitoring of a reach scale river restoration project

Stephen Addy1
1The James Hutton Institute, Craigebuckler, Aberdeen AB25 2RX
Email: stephen.addy@hutton.ac.uk

Introduction
There is a lack of evidence on the geomorphic responses to restoring low energy, straightened rivers. Improving knowledge of benefits and pitfalls over longer timescales (i.e. 5-10 years) would help to anticipate responses in other projects and plan accordingly.

The Logie Burn in Aberdeenshire, NE Scotland (Fig. 1), drains a ~25 km² catchment with mixed land use. A 236 m reach was restored in October 2011 by reconnecting its old meandering planform. (Fig. 2).

A before and after monitoring program sought to determine the morphological and sedimentary responses. So far, 7 years of data have been collected as summarised here. An earlier study covered the first 3 years (Addy & Wilkinson, 2019).

Methods

- Geomorphic surveys (annual or biennial)
  - Topographical surveys (total station & dGPS)
  - Bed sediment sampling (top 5 cm layer)
  - Visual classification of substrate type
- Discharge monitoring
  - 15 min discharge record over 2011-18 (Fig. 3)
- Morphological change analysis
  - 0.25 DEMs produced and analysed in ArcGIS
  - DEMs of difference produced in GCD 7
- Pool volume change analysed in RBT 4
- Laboratory methods
  - Sieving and weighing of sediment
  - Bed total phosphorous concentration
  - Substrate diversity

Results

- Elevation change (m): Restored reach (net 2011-2018 change: 137 ± 120 m³).
- Erosion: 160.4-160.8, 161.2-161.6, 162.4-162.8
- Deposition: 160.4-160.8, 161.2-161.6, 162.4-162.8
- Pool volume change.
- Net deposition between 2011 and 2018 (Fig. 4).
- Substrate diversity.
- Total phosphorous concentration.

Conclusions
- Restored reach showed a net sediment gain of 137 ± 20 m³ over 7 years (Fig. 4) reflecting wood input (Fig. 4(C)) and a channel gradient decrease (Fig. 5(A)). Control reach had a smaller net sediment gain.
- Pool volume varied (Fig. 5(B)) but was greater in 2018 than prior to and immediately after restoration. Substrate diversity declined following restoration but was higher in 2018 than pre-restoration (Fig. 5(C)).
- Total phosphorous storage evolved to a higher level than pre-restoration (Fig. 6) reflecting the net sediment gain. Grain size distributions were similar between years and treatments (Fig. 7).

Acknowledgements
This work was funded by the Rural & Environment Science & Analytical Services Division of the Scottish Government. Sir Alexander Dinnet and Kind Estate are thanked for access. Helen Watson, Carol Taylor, Dave Brough, Adam Wyness and others are thanked for their assistance. An earlier study covered the first 3 years (Addy & Wilkinson, 2019).

Reference