THE BIG FLOOD:
WILL IT HAPPEN AGAIN?

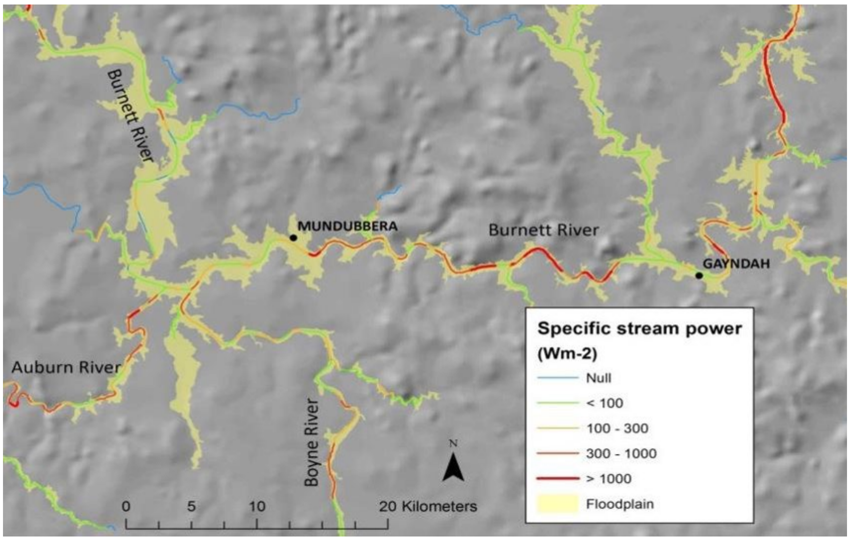
What is stream power?

Stream power is a measure of the rate of energy dissipation of flowing water against the channel bed and bank. It is the potential for flowing water to do erosion and sediment transport work. The main factors in its calculation are discharge and slope of a stream. Any increase in slope or discharge increases stream power.

Specific stream power is a measure of how stream power is applied across a stream by including width in its calculation. For a given discharge and slope, if the stream and its floodplain narrow (due to hillslopes or built structures), then specific stream power increases. A specific stream power of 300 Wm^{-2} is believed to cause significant channel bed and bank erosion. In the Lockyer Creek 2011 flood specific stream power reached 9800 Wm^{-2}.

As specific stream power is a measure of the flood potential to do erosional work along the channel banks and bed, it has the potential to be used as the basis for risk mapping and to inform catchment management.

This is a map of modelled specific stream power for a 100 year average flood for the central section of the Burnett River. River flow is from left to right. Floodwaters become confined downstream of Mundubbera with very high specific stream power before spilling overbank at Gayndah. Areas of high specific stream power (shown in red) and areas immediately downstream of these zones are at risk of erosion and flooding.



FURTHER READING

Thompson, C., and Croke, J. 2013. Geomorphic effects, flood power, and channel competence of a catastrophic flood in confined and unconfined reaches of the upper Lockyer valley, southeast Queensland, Australia, Geomorphology 197: 156-169.

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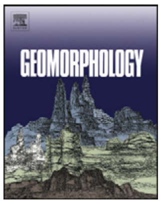

Geomorphic effects, flood power, and channel competence of a catastrophic flood in confined and unconfined reaches of the upper Lockyer valley, southeast Queensland, Australia

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ABSTRACT

Flooding is a persistent natural hazard, and even modest changes in future climate are believed to lead to large increases in flood magnitude. Previous studies of extreme floods have reported a range of geomorphic responses from negligible change to catastrophic channel change. This paper provides an assessment of the geomorphic effects of a rare, high magnitude event that occurred in the Lockyer valley, southeast Queensland in January 2011. The average return interval of the resulting flood was ~2000 years in the upper catchment and decreased to ~30 years downstream. A multitemporal LiDAR-derived DEM of Difference (DoD) is used to quantify morphological change in two study reaches with contrasting valley settings (confined and unconfined). Differences in geomorphic response between reaches are examined in the context of changes in flood power, channel competence and degree of valley confinement using a combination of one-dimensional (1-D) and two-dimensional (2-D) hydraulic modelling. Flood power peaked at 9800 W m^{-2} along the confined reach and was 2–3 times lower along the unconfined reach. Results from the DoD confirm that the confined reach was net erosional, exporting ~287,000 m^3 of sediment whilst the unconfined reach was net depositional gaining ~209,000 m^3 of sediment, 70% of the amount exported from the upstream, confined reach. The major sources of eroded sediment in the confined reach were within channel benches and macrochannel banks resulting in a significant increase of channel width. In the unconfined reach, the benches and floodplains were the major loci for deposition, whilst the inner channel exhibited minor width increases. The presence of high stream power values, and resultant high erosion rates, within the confined reach is a function of the higher energy gradient of the steeper channel that is associated with knickpoint development. Dramatic differences in geomorphic responses were observed between the two adjacent reaches of contrasting valley configuration. The confined reach experienced large-scale erosion and reorganisation of the channel morphology that resulted in significantly different areal representations of the five geomorphic features classified in this study.

For more information about the project

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