

How exploding stars have helped identify erosion hot-spots in catchments adjacent to the Great Barrier Reef

R. Bartley¹, Jacky Croke² and John Chappell³

¹ CSIRO Land and Water, Brisbane

² School of Geography, University College, Dublin

³ College of Science, The Australian National University, ACT 2601, Australia

There is considerable evidence that the amount of sediment reaching the Great Barrier Reef (GBR), Australia, has increased since agricultural development commenced in the 1870's. This sediment is having deleterious effects on freshwater and marine ecosystems. However, identifying the primary source and processes driving the increased sediment delivery has been challenging due to the large size and diversity of adjacent catchments.

This study was the first of its kind in Australia to compare long-term (~100 to >10,000 year) erosion rates derived from terrestrial cosmogenic nuclides (TCN's; ¹⁰Be) with contemporary erosion rates obtained by monitoring sediment fluxes over ~5-10 years. This study was conducted in the Burdekin catchment, which is the largest source of contemporary sediment to the Great Barrier Reef lagoon. Following rigorous testing of the assumptions for this technique [1], the ratio of these two data sets provided a measure of the accelerated erosion factor (AEF) for the major sub-basins in the Burdekin catchment [2].

Results show that three out of five of the major sub-catchments in the Burdekin basin have AEF's greater than 1.0. In the Bowen and Upper Burdekin sub-catchments, the AEF is 7.47 (\pm 3.71) and 3.64 (\pm 0.5), respectively. This suggests that erosion rates in these sub-basins are well above the natural background erosion rates, which is largely to be due to the relatively high slopes, higher rainfall and intensive land use (grazing and mining) compared to other parts of the catchment.

This study has important implications for how GBR water quality targets are set and evaluated. Without an understanding of the natural susceptibility of a catchment to erosion, resources for remediation may be incorrectly allocated to areas that appear to be producing high sediment yields, when in fact they have landscape attributes that generate large volumes of sediment even in the absence of land use change (e.g. agriculture). Remediating catchments with high AEF's to reduce erosion and sediment delivery is likely to take several decades, and will require a range of approaches including pasture and rangeland management, as well as targeted erosion control in highly gullied landscapes.

- [1] Croke, J., Bartley, R., Chappell, J., Austin, J.M., Fifield, K., Tims, S.G., Thompson, C.J. and Furuichi, T., 2015. ¹⁰Be-derived denudation rates from the Burdekin catchment: The largest contributor of sediment to the Great Barrier Reef. *Geomorphology*, 241: 122-134, <http://dx.doi.org/10.1016/j.geomorph.2015.04.003>.
- [2] Bartley, R., Croke, J., Bainbridge, Z.T., Austin, J.M. and Kuhnert, P.M., 2015. Combining contemporary and long-term erosion rates to target erosion hot-spots in the Great Barrier Reef, Australia. *Anthropocene*, 10(1-2), <http://dx.doi.org/10.1016/j.ancene.2015.08.002>.