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Policy and research focusing on fine sediment delivery to the Great Barrier Reef lagoon, northeastern Australia

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The Reef Water Quality Protection Plan 2013 (State of Queensland, 2013) stated that over the past 100 years, the land catchment areas adjacent to the Great Barrier Reef (GBR) World Heritage Area have undergone extensive development for agricultural production, urban expansion, transport infrastructure, tourism and mining, and this has led to elevated levels of pollutants leaving these catchments and entering the reef, with the largest contributor being agricultural land use activities. A multidisciplinary group of scientists reviewed the advances in scientific knowledge of water quality issues in the GBR and reported their views in the 2013 Scientific Consensus Statement (State of Queensland, 2013). The overarching consensus was that key GBR ecosystems were showing declining trends in condition due to continuing poor water quality, cumulative impacts of climate change and increasing intensity of extreme events. One of their conclusions highlighted nitrogen discharge, fine sediment discharge and pesticide discharge from the adjacent catchments as the greatest water quality risks to the GBR. Nitrogen is associated with crown-of-thorns starfish outbreaks; fine sediment reduces the light available to seagrass ecosystems and inshore coral reefs; and pesticides pose a risk to freshwater and some inshore and coastal habitats. Based on the 2013 Scientific Consensus Statement, the Reef Water Quality Protection Plan set water quality targets for 2018, which, in priority areas, aimed to reduce anthropogenic end-of-catchment loads of dissolved inorganic nitrogen, sediment (and particulate nutrients) and pesticides by 50%, 20% and 60%, respectively.

Rationally driven by these policy contexts, particularly in recent years, an increasing number of hydrological, geomorphological and sedimentological studies have investigated sediment movement in the GBR adjacent catchments and subsequent sediment delivery to the GBR lagoon. Frameworks of studies include identifying sediment sources and erosion processes, estimating sediment loads, characterizing sediment transport processes both in the catchments and lagoon, and constructing sediment budgets. A series of studies published by Christopher Fielding and colleagues in the late 1990s and early 2000s provide a notable mass of knowledge on sediment movement, sedimentary features and related landforms in the GBR adjacent catchments and near-shore lagoon (e.g. Fielding et al., 1996, *Terra Nova* 8, 447-457; Fielding et al., 2006, *Journal of Sedimentary Research* 76, 411-428). More recent studies, Kroon et al. (*Marine Pollution Bulletin* 65, 167-181, 2012) estimated a 5.5-fold increase in current total suspended solids since the European settlement in the late 18th century. Lewis et al. (*Earth and Planetary Science Letters* 393, 146-158, 2014) revealed that most fine sediment from the Burdekin River, the largest single source of sediment to the GBR lagoon, was retained within 50 km of the river mouth into the lagoon, rather than advected northwards via longshore drift processes. While the 'whole-of-catchment' approach is guided by the Reef Water Quality Protection Plan and recent catchment-scale studies have significantly accumulated knowledge of sediment movement and delivery in the GBR adjacent catchments, hydrogeomorphic studies at finer scales in major source areas that consider transport routes would further reveal important and key mechanisms of sediment movement and delivery processes.

Keywords: water quality, management policy, Great Barrier Reef, sediment movement, sediment delivery, hydrogeomorphology