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From soils to rivers and estuaries: the movement of black C across a sub-tropical landscape

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Australia's landscapes have been significantly altered since European settlement (e.g. through clearing and agriculture, urban expansion and water resource development), leading to changes in erosion rates and changes in the types of material transported from the land to the rivers and estuaries. Specifically, the enhanced delivery of sediments and nutrients from the land to rivers and coastal areas has led to significant changes in ecological processes, particularly in the Great Barrier Reef in-shore ecosystems. Strategies are underway to reduce the sediment load from the catchment of the Fitzroy River Basin to the Keppel Bay area of the Great Barrier Reef (GBR). While the type of erosion and the dominant sources of sediment from the catchment and into the GBR have been studied, little information exists as to the type of organic matter associated with the sediment. Enhanced erosion and sediment transport is generally linked to increased ecological activity based on the assumption that much of the organic matter delivered from the soils to the rivers and estuaries is readily bioavailable.

A combination of spectroscopic (mid-infrared and nuclear magnetic resonance spectroscopy) and isotopic analyses of organic matter in soils, rivers and estuaries provides information a) on the main source areas in the catchment, b) the degree of bioavailability and c) the potential for biosequestration of land-derived carbon in marine sediments.

This study found that combustion-derived black carbon (BC) constituted a large proportion of the organic carbon in soils in some areas of the catchment and tended to accumulate in areas of deposition (dams and weirs) within the Fitzroy River Basin.

In the Fitzroy estuary, BC may constitute over 50% of the total organic matter. These findings have important implications with regard to the ecological impact of terrestrial derived material on marine ecosystems and model predictions of carbon storage and utilization. If less than 50% of organic matter is bioavailable, the ecological impact is expected to be less pronounced than currently predicted. Furthermore, the amount of BC accumulating in dams and weirs and in estuarine environments may constitute a significant long-term carbon sink.