

TRACING THE SEDIMENT IN PELORUS SOUND

Marlborough District Council commissioned NIWA to study the sediment sources in Te Hoiere/ Pelorus Sound using the latest scientific techniques. This study enables better understanding of how human-induced and natural erosion sources have contributed to sediment composition and accumulation, and identifies the sources of sediment deposited in the river and a part of Te Hoiere/ Pelorus Sound (ie Mahau Sound).

Researchers collected samples of soils and sediment from rivers and the inner Te Hoiere/ Pelorus Sound. Sampling included topsoils, subsoils (the soils beneath the topsoil), river and streambank sediment, fine-sediment deposits in river channels, sediment cores from Mahau Sound, and surface marine sediment from the entrance to Te Hoiere/ Pelorus Sound (Chetwode Islands/ Nukuwaiata and Te Kakaho).

The full technical report can be found here: www.marlborough.govt.nz/environment/coastal/sedimentation

Key findings

Sediment is one of the main threats to New Zealand's marine environment and has impacts on freshwater ecosystems. The erosion of soil from the land and its deposition in estuaries and the sea is a natural process, but the rate sediment is being deposited is higher than before human activities disturbed the natural land cover.

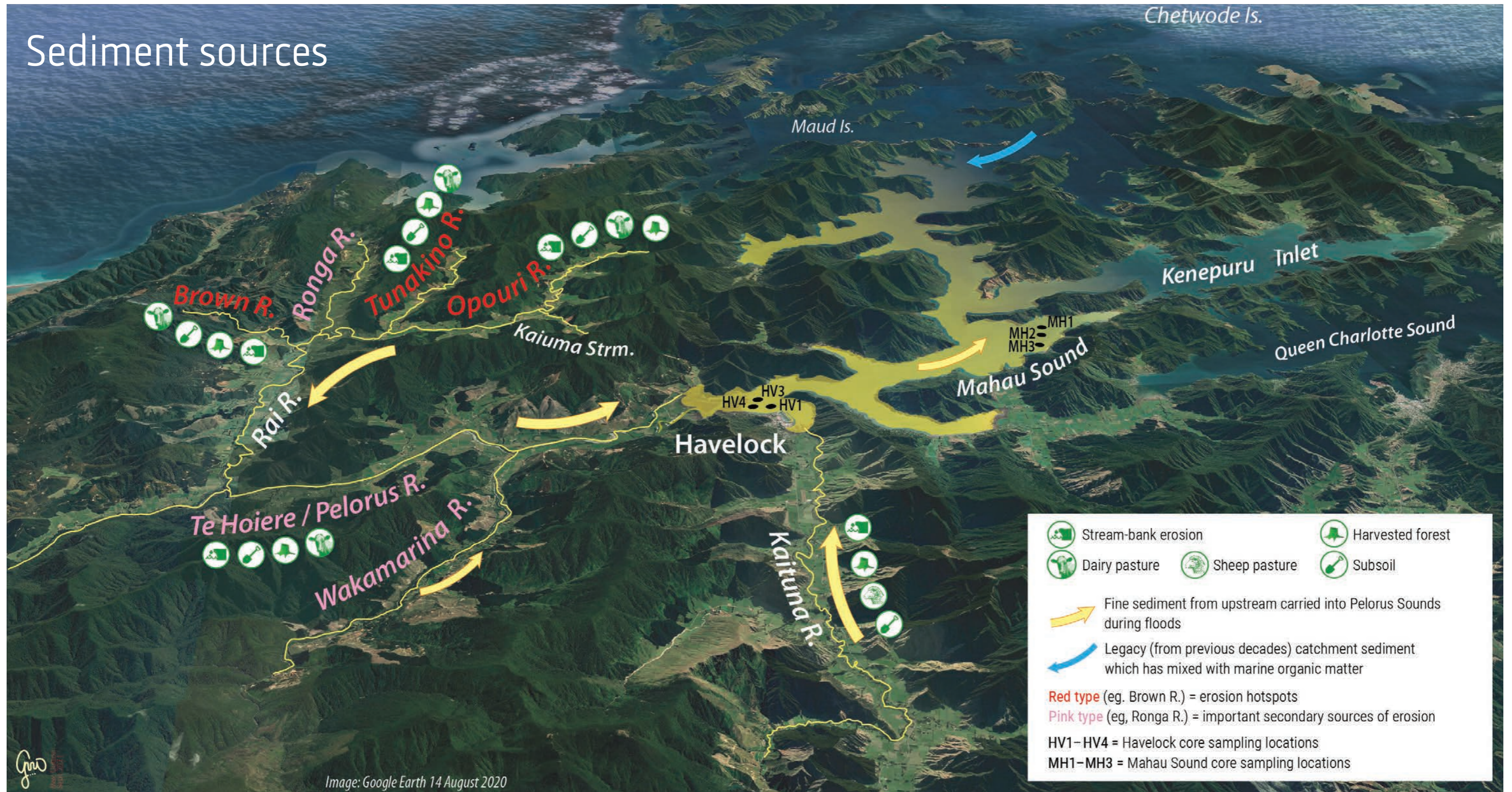
- The main contributors to sediment in Te Hoiere/ Pelorus Sound are subsoil, stream bank erosion, dairy pasture, harvested pine and native forests.
- The proportions vary according to the location.
- The effects of increased soil erosion and sedimentation have ranged in scale, from localised impacts on cockle beds due to early Māori activities in Mahau Sound to extensive catchment-wide soil erosion and sedimentation since European settlement.
- Goldmining, native forest clearance, pastoral farming and more recent agricultural and forestry activities have all left their legacy in the Marlborough Sounds waters.

How did we find this out?

Sediment accumulation rates (SAR) in Havelock Estuary and Mahau Sound over the last century were estimated using two independent radioisotope dating methods. Pre-historic SAR in the Mahau Sound were derived from radiocarbon dating of cockle shells. The shellfish remains preserved in cores from one of three sites sampled in Mahau were analysed along with environmental variables to identify what has caused change in shellfish communities over time.

Sediment sources were traced using CSSI (Compound Specific Stable Isotope) methods. This method was developed by NIWA scientists in the mid-2000s and is now used across the world. The method identifies soils by their different organic carbon biomarker. Samples were taken from streamside, riverbed and seafloor deposits at various locations. These were compared to land-use and natural reference samples. This enabled us to determine what proportion of the samples were from which erosion source (natural or human-induced). For more info on CSSI, see <https://niwa.co.nz/cssi>

Sediment sources



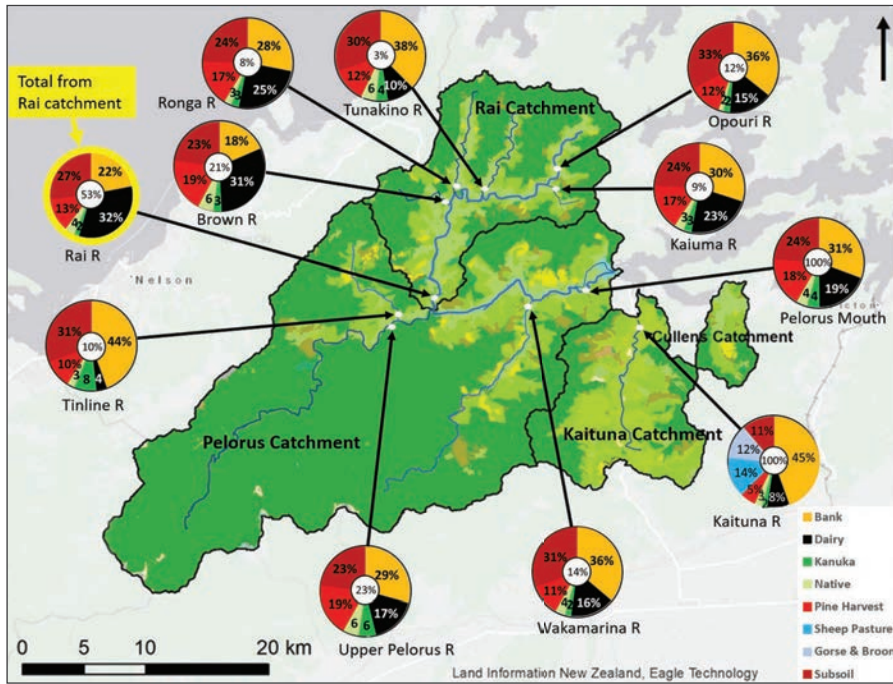
This study enabled us to understand the sources of sediment deposited on the riverbed, on the riverbanks, and in the marine environment. The sources for each river sampled are displayed above, and in percentage terms in the pie charts overleaf.

- Sediment deposited on the riverbed: the major sources of deposited fine sediment downstream in the rivers are stream-bank and subsoils (the soils beneath the topsoil). Stream-bank erosion is pronounced in the Kaituna and Tinline, upper Rai and Whakamarino (Wakamarina) subcatchments. Subsoil erosion hotspots occur in the Tinline, Whakamarino and upper Rai subcatchments (i.e., Tunakino, Opouri and Brown).
- Sediment deposited on the riverbank: dairy pasture and harvested pine are substantial sources of deposited fine sediment on riverbanks. Harvested pine topsoil contributions are highest at the outlets of the Upper Pelorus, Brown, Ronga and Kaiuma (Opouri) subcatchments. Sheep pasture topsoils

make the largest contribution to river sediment deposited near the outlet of the Kaituna River. Contributions of topsoils from native forest and kanuka scrub to river sediment deposits are uniformly low across all sampling sites in the Pelorus-Rai and Kaituna catchments.

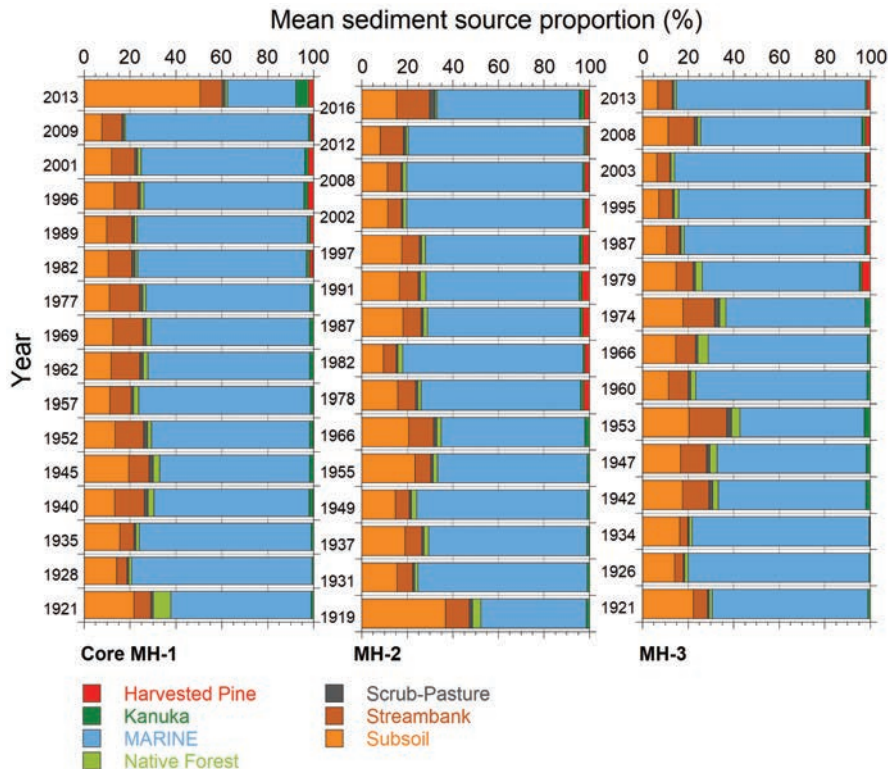
- Sediment deposited in the marine environment (see overleaf): 70% of sediment deposited over the last century in Mahau Sound is 'legacy sediment'. This marine sediment is ultimately composed of soil eroded from the surrounding catchments as well as deposited marine organic matter (e.g., phytoplankton) transported into Mahau Sound. Compared with the preceding ~2,000 years, the sediment accumulation rate over the 20th century is 10 times higher.
- Thirty percent of the deposited sediment comes from contemporary land uses over the past century (see overleaf). Subsoils are the largest contributor, followed by stream-bank erosion. Native forest and harvested pine forest (post 1979/1980) account for similar and small proportions of the sediment. Contributions from kanuka and scrub and pasture make up the remainder.

Catchment sediment sources



Sources of sediment by land use deposited at confluences and contributions (%) from major tributaries in the Pelorus-Rai and Kaituna catchments. The % in the centre of each pie chart indicates the contribution of that subcatchment to sediment in the river system. Data for river sediment collected in April 2016 and May 2018.

Mahau Sound sediment sources



Sources of sediment accumulating in Mahau Sound (inner Pelorus) since the early 20th century determined from CSSI analysis of dated cores.

Next steps

This report provides greater understanding of the sediment dynamics of Te Hoiere/Pelorus catchment. Sediment accumulation rates are 10 times greater since European settlement. Sediment has accumulated in, and circulates within the sound over time. Contemporary sediment loads add to this historic sediment.

The report also shows that the issues caused by deposited sediment have a long history. There is a large amount of 'legacy' sediment in the sound that will continue to cause environmental issues for some time after the mitigation of contemporary sources of sediment.

The Te Hoiere Restoration project is a community-led project focussed on reducing the amount of sediment and other contaminants entering the Pelorus Sound/Te Hoiere. This report is an important part of understanding what the sources of these sediments and contaminants may be.

For more information:

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