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Changes in hydrology and carbon cycling following Late Holocene deforestation in a New Zealand lake catchment

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New Zealand was one of the last major land masses to be impacted by humans, with two waves of settlement occurring in the last 800 years. Polynesian (Maori) settlers arrived in New Zealand ca. 1250 A.D., while major European settlement occurred after 1840 A.D. A major impact of both phases of settlement was clearance of indigenous forest. An increasing number of pollen and macroscopic charcoal records reveal the timing and extent of past forest clearance in New Zealand. Only a few records explore the wider implications of this land use change in terms of catchment biogeochemical cycles and aquatic ecosystem functioning. We used multiple proxies from a lake sediment core from a cleared catchment to explore changes in catchment hydrology and carbon cycling after forest clearance. One of the most interesting findings emerged from paired radiocarbon dates on terrestrial targets (e.g. leaves and charcoal) and seeds from the aquatic plant *Myriophyllum*. The offset between terrestrial and aquatic radiocarbon ages increased to 1000 years and then decreased to 100 years within three centuries of local Maori forest clearance. There was a further increase in the radiocarbon age offset to 1500 radiocarbon years within decades of the start of the European forest clearance. We argue that the offset between terrestrial and aquatic radiocarbon ages results from an increased contribution of old dissolved inorganic carbon from groundwater to the lake after forest clearance. Forest clearance reduced evapotranspiration, increased aquifer recharge and increased the contribution of groundwater to the lake. This interpretation is supported by a major increase in the δ^{13}C of *Myriophyllum* seeds following Maori deforestation. At the time of abstract submission the results are pending for δ^{18}O analysis on *Myriophyllum* seeds and aquatic insects. This will provide a further test for changes in catchment hydrology following deforestation. Reviews of catchment impacts on hydrology and carbon cycling have shown an increased catchment water yield and flux of old carbon in disturbed catchments. Our study provides one of the most comprehensive records of forest clearance and provides valuable insights into the causal mechanisms and consequences of these changes.