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Tectonic, climatic, and human controls on landscape evolution and sediment delivery in the Waipaoa catchment, Hikurangi Subduction Margin, New Zealand

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Within the Waipaoa catchment, sediment budgets of contemporary processes, coupled with high resolution records of landscape response to climate from nearby Lake Tutira, provide a c. 7ka record of climatic and latterly (c. 0.8ka) human controls on landscape change and sediment delivery. A c. 20ka temporal understanding of the role and manifestation of climate and tectonic drivers has been developed from dating and correlation of an extensive sequence of late Pleistocene and Holocene fill and strath river terraces in the middle part of the catchment, and from Holocene marine terrace and deposits in the coastal area. Rates of vertical tectonic movements range from several mm/yr of subsidence to about 3 mm/yr of uplift. Dating of terraces and deposits by means of tephra units within and overlying the fluvial and marine deposits, and radiocarbon, indicate a primary climatic control on episodes of valley fill. The transition from infill to incision in the middle and upper catchment, and the formation of strath terraces, is coincident with the last glacial termination at about 18 cal ka. In the middle and upper catchment tectonic movements appear to be regional in scale and continuous, while in the lower catchment surface faults and subduction-related earthquakes play a larger role. In the Waihuka tributary the preservation of an unusually complete sequence of terraces formed during the 45 m of downcutting that followed the last glacial maximum are interpreted as the response to nick-point re-

treat, thus providing insight into changed river power, itself resulting from a probable combination of base-level change, reduced sediment supply in the headwaters due to ameliorating climate and reafforestation, and possible increases in rainfall following the glacial maximum. These changes in climate factors all occurred within the context of probable steady regional uplift, interspersed with episodic large subduction-related and local fault earthquakes in the lower catchment. Twentieth century deforestation of the catchment has re-created erosion rates and sedimentation similar to that inferred for the last glacial maximum suggesting that human controls on landscape change are potentially of the same magnitude as climatic controls.