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Dune development and migration to damage long established vegetation colonies in the lahar deposition zone of Ruapehu Volcano, New Zealand

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This study reports migration of dunes that mainly originate from lahar deposits and gully erosion, in the Rangipo Desert on the skirts of the Ruapehu Volcano, New Zealand. Although the Rangipo Desert is not a dry desert (average annual rainfall: 1100mm), the occasional supply of volcanic materials from Ruapehu, strong wind (average maximum speed in a day: 12 m/s) together with low winter temperatures has created a desert-like landscape. The study site consists of a flood plain with sporadic tussock and alpine to sub-alpine vegetation colonies which often form mound-like structures and sand dunes on terraces on the flanks of the volcano. The accretionary mounds and dunes comprise layers of tephra and pumice of various ages, together with interstitial wind-blown materials. While shrubs thrive on these terrace tops, it was observed that migrating dunes of 3 m in height have progressively buried and killed vegetation at two sites. Aerial photographs taken in 2000 and 2011 indicated that the dunes originated from pockets of lahar deposits and gully out-wash materials on the flood plain and were migrating in the major leeward wind direction (Northeast), or towards the sites. The migration rate at one site was estimated at 5 m/year from the photography. The flood plain pockets had formed at points where the floor slope changed from steep to gentle. As they contain finer materials than their surroundings, they have produced a series of sequential dunes. The exposed floor between the dunes comprises pumice layers of low infiltration capacity, suggesting that dunes migrate and develop as they strip off floor deposits. Subsequent exposure of the layers induces surface flow concentration in wet weather to cause gully incision. In conclusion, lahar occurrence is a major controlling factor in development in the landscape of the Rangipo Desert, by not only directly flowing at times into the flood plain, but also by producing migrating dunes that impact on existing vegetation colonies and helping to stimulate gully development long after their occurrence.