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Soil Quality State and Trends in New Zealand's Largest City after Fifteen Years

Authors : Fiona Curran-Cournane

Abstract : Soil quality monitoring is a science-based soil management tool that assesses soil ecosystem health. A soil monitoring program in Auckland, New Zealand's largest city, extends from 1995 to the present. The objective of this study was to firstly determine changes in soil parameters (basic soil properties and heavy metals) that were assessed from rural land in 1995-2000 and repeated in 2008-2012. The second objective was to determine differences in soil parameters across various land uses including native bush, rural (horticulture, pasture and plantation forestry) and urban land uses using soil data collected in more recent years (2009-2013). Across rural land, mean concentrations of Olsen P had significantly increased in the second sampling period and was identified as the indicator of most concern, followed by soil macroporosity, particularly for horticultural and pastoral land. Mean concentrations of Cd were also greatest for pastoral and horticultural land and a positive correlation existed between these two parameters, which highlights the importance of analysing basic soil parameters in conjunction with heavy metals. In contrast, mean concentrations of As, Cr, Pb, Ni and Zn were greatest for urban sites. Native bush sites had the lowest concentrations of heavy metals and were used to calculate a 'pollution index' (PI). The mean PI was classified as high (PI > 3) for Cd and Ni and moderate for Pb, Zn, Cr, Cu, As, and Hg, indicating high levels of heavy metal pollution across both rural and urban soils. From a land use perspective, the mean 'integrated pollution index' was highest for urban sites at 2.9 followed by pasture, horticulture and plantation forests at 2.7, 2.6, and 0.9, respectively. It is recommended that soil sampling continues over time because a longer spanning record will allow further identification of where soil problems exist and where resources need to be targeted in the future. Findings from this study will also inform policy and science direction in regional councils.

Keywords : heavy metals, pollution index, rural and urban land use, soil quality
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