

Rebalancing our soils with biowastes: challenges and prospects

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Pine forestry and intensive agriculture have depleted the organic matter and plant nutrients in thousands of hectares of New Zealand (NZ) soils. Yet NZ stockpiles or landfills over 60% of its biosolids, which are essentially a mixture of organic matter and plant nutrients. Similarly, other biowastes, including wood-waste and treated municipal effluent, are often not applied to soils that could benefit from the organic matter and nutrients that they contain. Contaminants, such as pathogens, trace elements and xenobiotics often prevent the application of biowastes to food crops. We aimed to develop strategies to rebalance NZ's soils with biowastes that would otherwise be stockpiled, landfilled, incinerated, or enter waterways. Laboratory and lysimeter experiments demonstrated that combining biowastes with contrasting properties, for example biosolids mixed with dried or partially-pyrolised pine waste, can mitigate nitrate leaching. Whereas hitherto most biosolids addition to land in NZ have been applied to plantations of *Pinus radiata*, low wood prices have reduced the impetus to replant. New Zealand Trade and Enterprise is propounding that such areas could be planted with NZ native vegetation, including mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea ericoides*) to produce valuable products including honey and essential oil. We have found that these species kill biosolids-borne pathogens and alter N-cycling in soil, retaining more N in the root zone thereby reducing leaching. Food or fodder plants grown in degraded soils that have been rebalanced with biowaste mixtures can contain elevated concentrations of zinc and copper, which are deficient in many of NZ's agricultural systems. Elevated concentrations of zinc can protect against facial eczema. Instead of landfilling, stockpiling, or discharging into water, NZ's biowastes could rebalance our degraded soils thereby resulting in significant cost savings by avoiding landfilling and through the generation of valuable plant products on otherwise underproductive land.