

# The potential and risks of biosolids application in opencast mine restoration

Dr Stephane Boyer<sup>1,2</sup>, Dr Benjamin, R. Waterhouse<sup>2</sup>, Dr Karen L. Adair<sup>3</sup>, Prof. Stephen D. Wratten<sup>2</sup>

<sup>1</sup>Unitec Institute of Technology, <sup>2</sup>Bio-Protection Research Centre, <sup>3</sup>Canterbury University

Biosolid is a municipal waste material that represents a very economical and continuous source of organic matter that can be mixed with or spread on stockpiled soil during the restoration process. Due to sterilisation by heat-treatment, biosolids contain very low levels of bacteria and present no direct health concerns. Chemically, however, they can contain varying concentrations of trace elements, heavy metals and micronutrients that, may impact on soil fauna and soil food webs when present in high concentrations. We designed two pot trial experiments to investigate the potential impact of biosolids application on plant growth, soil microbial communities, soil fauna survival and growth as well as accumulation of potentially toxic elements after 5 months treatments. The first was an agricultural experiment where European earthworms and oilseed rape were exposed to low rates of biosolids as recommended for use in agriculture. The second experiment replicated a mine restoration process where native New Zealand earthworms and a native grass were exposed to high rates of biosolids as currently applied in restoration trials in New Zealand.

The application of biosolids substantially increased plant production in both experiments. European earthworm biomass was enhanced by the addition of low levels of biosolids, but earthworm tissue samples showed elevated levels of copper. Copper could be bioaccumulated in the food web and have negative effects on earthworm predators(1). In the mine restoration experiment the ratio of soil/biosolids was 1:4 and all endemic earthworms died.

These two studies highlight potential benefits of using biosolids in increasing or recovering ecological functions such as biomass production in native plants as well as some aspects of soil microbiology. However, our results also stressed that the use of biosolids requires well-researched and responsible application due to direct impacts on earthworms and indirect impacts through bioaccumulation of toxins that may harm earthworm predators.