Using nutrient-rich wastes in plant nurseries, forestry and native plantings

This project looked at the feasibility of using nutrient-rich wastes in plant nurseries, and for managing plantings of tree species. The project includes exotic and indigenous (native) forestry species.

What are nutrient-rich wastes?

Nutrient-rich wastes include:

- dairy shed effluent
- municipal wastewater
- biosolids
- horticultural waste
- dairy and meat processing wastes.

They are rich in nutrients such as nitrogen, phosphorus, potassium and/or organic matter.

Nutrient-rich wastes can be used:

- for irrigation or fertigation in nurseries or planted areas (wastewater)
- as planting mix supplements (unprocessed or minimally processed sludges, slurries or solids)
- as planting mix (composted or processed slurries or solids).

What are the benefits of nutrient-rich wastes?

There are benefits to using nutrient-rich wastes. Using municipal wastewater can decrease the amount of clean water needed. It also provides an enriched water supply for nurseries.

Adding slurries, sludges or solid waste to soil helps it hold more water. The wastes improve the soil's structure and biological activity. They also provide nutrients. These benefits encourage productivity.

The use of nutrient-rich wastes in forestry and nurseries supports New Zealand's move to a circular economy.

Are there any risks?

The potential benefits need to be balanced against the management of risks. Potential health, safety and environmental risks depend on the type of waste used. Most risks can be managed by treating the waste, and by managing the rate and method by which the waste is applied.

There can be social and cultural issues. In particular, with the use of human waste (biosolids). These issues can be dealt with through appropriate engagement processes.

Application of biosolids using a modified spreader at Rabbit Island, Nelson.

Te Kāwanatanga o Aotearoa
New Zealand Government

Using nutrient-rich wastes in nurseries

The use of nutrient-rich wastewater is beneficial for nurseries. Water access is critical for nurseries. The wastewater decreases the amount of clean water used and provides an enriched water supply.

Using solid or slurry waste can reduce the need for fertilisers or substrate.

Being near to a wastewater plant is an important factor. This study found 6 nurseries servicing the commercial forestry sector within 5km of a waste processing plant.

Using nutrient-rich wastes in forestry plantings

The main opportunity for using nutrient-rich wastes in forestry is to increase production. The wastes can cut rotation time with little loss to wood quality.

Applying wastes to commercial forestry sites has lots of potential. About 260,000 hectares of commercial forestry is on sandy soils. These sites are within 20km of a processing plant that produces nutrient-rich waste. Sandy soils have the potential to benefit most from the waste.

Using nutrient-rich wastes for native plantings

Using nutrient-rich wastes for native plantings can increase growth rates resulting in quicker canopy closure. This helps survival rates too.

Woody debris is useful for managing weeds and excluding browsing animals.

Native plantings on poor quality soils will get the most benefits from nutrient rich wastes, especially when the aim is to bring back the native ecosystem. Poor quality soils have poor structure and little organic matter and nutrients. The natural humus layers and woody materials in the soil are gone.

New plantings may need water to ensure survival. Using tankers to apply nutrient-rich wastewater reduces the need for clean water.

Whenever introducing potentially hazardous waste to your operations, make sure all regulations are followed and risk assessments have been carried out.
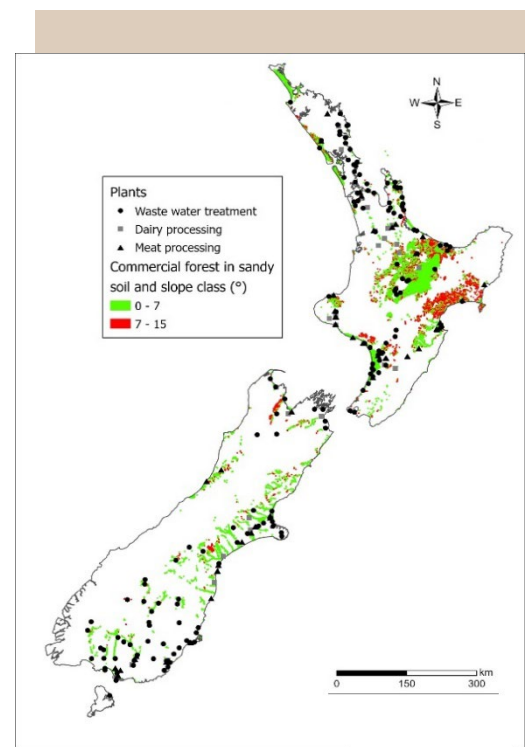
Proximity of municipal wastewater treatment plants, dairy factories, and meat-processing plants to commercial forestry located on sandy soils.

Table 1: Summary of potential uses of nutrient-rich wastes in plant nurseries and incentives for their use

Waste	Use	Incentives for use
Wastewater – municipal, dairy factory, meat processing, food processing	Irrigation – containers, seedling beds, mother beds	Beneficial in water-deficient areas Avoids water stress Decreases the amount of clean water needed (cost saving where this is a cost) Re-uses wastewater
Sludges/solid materials	Supplements to seedling beds	Improves water-holding capacity of soils Improves soil structure Improves soil biological activity Adds slow-release nutrients
Composted/modified sludges/solid materials	Planting mix – containers, application to mother beds	Improves soil biological activity Re-uses waste materials/offsets use of new materials Reduces need for inorganic fertilisers

Table 2: Summary of potential uses of nutrient-rich wastes in commercial forestry and incentives for their use

Waste	Use	Incentives for use
Sludges/solid materials	Site preparation	Adds slow-release nutrients for growth promotion Improves water-holding capacity Improves soil structure
Wastewater – municipal, dairy factory	Irrigation	Avoids water stress Decreases the amount of clean water needed Reduces discharge to aquatic systems
Sludges	In-forest application at age 3–5 years	Adding slower-release nutrients helps deficiencies and promotes growth

Next steps for using nutrient-rich wastes in nurseries and forestry plantings

- Form partnerships between nutrient-rich waste producers and nurseries, landscape suppliers (where these provide planting mix to nurseries) or forestry companies. Build knowledge between providers and recipients of each other's requirements. Requirements could be composition of wastes or supply needs.

- Gather information on the nutrient qualities of different nutrient-rich wastes from producers. Evaluate how suitable they are for different purposes, for example as supplements added to planting mix.

- Further location-specific assessment of the benefits and constraints. Evaluate what nutrient-rich wastes are available within reasonable proximity of the site.

- Complete further research on:
  - the influence of nutrient-rich wastes on soil mycorrhizae (root fungi)
  - the role of nutrient-rich wastes on restoring whole ecosystems
  - how much increased plant growth increases carbon storage.

Table 3: Summary of potential uses of nutrient-rich wastes for native plantings and incentives for their use

Waste type	Use	Incentives for use
Woody debris, woody mulches	Site preparation	Protects microsites, prevents erosion, conserves water in dry/warm sites, suppresses weeds, excludes browsers (deer, hares, rabbits) Enhances nutrition when mixed with compost
Sludges and modified sludges	Site preparation	Improves degraded soils and builds soils Improves water-holding capacity Improves soil structure Improves organic matter Adds slow-release nutrients
Wastewater — municipal	Irrigation after planting	Decreases the amount of clean water needed

Want more information?

Full report — MPI One Billion Trees Science

For more information about managing planting delays see the Canopy website.

Acknowledgements

April 2022