Putting a green cap on garbage dumps

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Landfill sites produce the greenhouse gases, methane and carbon dioxide, as putrescible waste decays. Growing plants and trees on top of a landfill, a process known as 'Phytocapping', could reduce the production and release of these gases, according to Australian scientists writing in a forthcoming issue of *International Journal of Environmental Technology and Management*.

Despite legislative pressures to reduce landfill use, in certain parts of the world it remains the most economical and simplest method of waste disposal.

Biodegradation of organic matter in a landfill site occurs most rapidly when water comes into contact with the buried waste, explains Kartik Venkatraman and Nanjappa Ashwath of the Department of Molecular and Life Sciences, at Central Queensland University (CQU), Rockhampton, Australia. They point out that conventional approaches to reducing this effect involve placing compacted clay over the top of a landfill to form a cap that minimizes percolation of water into the landfill.

Some sites do not attempt to prevent water percolation and biodegradation and instead install gas collection systems to trap the methane released.

The use of clay capping has generally proved ineffective in trials in the USA, the researchers say. The problem being that in arid regions the clay cap dries out and cracks allowing water to easily percolate into the

landfill. Equally problematic, methane gas collection is an inordinately expensive option for many Australian landfills that do not reach the methane production threshold to enable efficiency.

Hence, a new technique, known as phytocapping, which involves placing a layer of top soil and growing dense vegetation on top of a landfill, was successfully trailed at Rockhampton's Lakes Creek Landfill not far from Central Queensland University. This research was conducted by Kartik Venkatraman and Nanjappa Ashwath (CQU) in conjunction with the Rockhampton Regional Council and Phytolink Pty LTD.

Selected plant species are established on an unconsolidated soil placed over the waste. The soil acts both as "storage" and "sponge" and the plants as "bio-pumps" and "rainfall interceptors". For an effective site water balance, it is important that appropriate plant species are chosen and the soil depth optimized. As such, the team has investigated the effects of different ranges of species as well as soil depth.

The team's studies of the benefits of a landfill phytocap show that the approach can reduce surface methane emission four to five times more than the adjacent un-vegetated site. They found that a cap of 1400 mm thickness also reduces surface methane emissions 45% more than a cap half as thick.

The team also looked at the effects of nineteen tree species, including acacias, figs, eucalyptus, and other Australian native species, growing in the phytocap to determine which species are most effective at reducing water percolation and methane emissions. The root system acts as a good substrate to methanogens, which oxidizes methane thereby reducing methane emission into the atmosphere.

The benefits of phytocapping include, cutting in half the cost of landfill remediation and providing biodiversity corridors along which wild

species can travel. The process also inverts the aesthetic qualities of landfills adjacent to urban communities, and in some cases, introduces economical benefits such as timber and fodder. "The establishment of phytocaps would offer an additional and economical way of reducing methane emission from landfills," the researchers conclude.

Citation: "Can phytocapping technique reduce methane emission from municipal landfills?" by Kartik Venkatraman and Nanjappa Ashwath in Int. J. Environmental Technology and Management, 2009, 10, 4-15

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