DRAFT PROPOSAL

Development of Large Scale Composting of Green Waste on Guam

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Background

We propose to develop Guam's first large-scale composting operation for efficient conversion of green waste into organic material which will be used to build and improve the island's soils. Given that Guam is a tropical tourist destination, there is a year-round steady stream of high quality green waste from hotel landscapes. In addition to this steady stream, there are other sources of green waste which are episodic:

- Many cubic yards of damaged vegetation to be disposed of following every typhoon.
- Vegetation removed during land clearing operations. It is expected that development for the impending military buildup on Guam will produce a lot of such material.
- The Guam Coconut Rhinoceros Beetle Eradication project is currently removing many cubic yards of rotting vegetation infested with rhino beetle grubs.

Currently, very little of Guam's green waste on Guam is being composted. Up until recently most was buried at the Ordot Dump. This situation is highly undesirable and the need for large-scale composting on Guam has become critical for three major reasons reasons:

- Solid waste disposal on small tropical islands is problematic. Sufficient, suitable land area is expensive and contamination risks from runoff into surrounding watersheds and reefs are high. The solid waste disposal problem on Guam has become a crisis. Twenty-two years after being cited by the US EPA, the Ordot Dump, the island's only municipal site for solid waste disposal, continues to leach contaminants, posing an environmental and health hazard (Guam Solid Waste Receivership Information Center 2009). The US District Court of Guam has placed the Ordot Dump under a receivership with the intent of forcefully shutting the down the operation. In an attempt to temporarily extend the life of the dump, the receivership no longer accepts "yard waste" at the site. Prior to this change, 40 percent of the waste taken to the Ordot Dump waste yard waste (Guam Integrated Solid Waste Management Plan 2006). Users are being asked to compost whatever they can on their own property and to deliver the remainder to Primo's Hardfill in Northern Guam. This commercial facility accepts green waste for a fee of four dollars per cubic yard. Green waste and wood waste are ground into mulch, which is made available to residents for free. The receivership has also banned cardboard and paper from the dump. However, they had to cancel this ban in December 2008 when Guam Transport and Warehouse (GTW), the only outlet for mixed paper on Guam, has announced that it was discontinuing pick-up of mixed paper given its inability to find markets due to the global recession and drop in the price of paper. Off-island recycling is cost prohibitive because the island is geographically disadvantaged due to its remote location. Processing plants are far away and shipping costs are high. **There is an urgent need to develop large scale composting of organic solid waste on Guam to minimize cost and undesirable environmental effects of legal and illegal dump sites and to enable utilization of green waste as a resource which is currently wasted.**

- Guam law prohibits importation of soil except in small quantities for research (Guam Administrative Rules and Regulations 1986). However, this law is not enforced and Guam's hardware stores and plant nurseries import large quantities of packaged soil and soil amendments including compost, mulch, manure, peat, and sphagnum moss. These imported packages are a potential pathway for invasive species entering Guam because contents are often infested with live arthropods, worms, seeds and microorganisms (Moore, personal observation and testimony from nurserymen) and none of this material is being inspected. **A source of cheap, locally produced compost will reduce the need to import some of this material, thereby reducing the risk of accidental pest introduction.**

- A large pest eradication project has been launched on Guam to get rid of the coconut rhinoceros beetle which was first detected in 2007. This major pest of coconut palms breeds in decaying coconut logs which are very abundant on Guam as the result of trees killed during typhoons. A major tactic of the eradication project is sanitation: removal of potential rhino beetle breeding sites. To date, the project has collected more than 1500 cubic yards of rotting coconut logs and is currently facing a materials handling problem outlined in a recent report:

Extracted from Moore 2009. Semiannual progress report on the Guam coconut rhinoceros beetle eradication project. May 10, 2009.
http://guaminsects.net/anr/sites/default/files/CRB%20Progress%20Report%2020090510.pdf

Impediments to Progress

Materials Handling Problem. Proper disposal of rotting coconut material collected from breeding sites by the sanitation crew in addition to handling a continuous stream of potentially infested green waste from hotel landscapes has become a major problem. The original eradication plan called for composting the organic material. The composting process generates enough heat to kill CRB and other insects and quickly converts the rotting coconut into compost which cannot be used as food by the CRB. This compost would then be use to enrich the soil at hotel sites throughout Tumon. The whole operation was to be done without transporting any potentially infested material out of the infested area, thus eliminating the risk of accidentally spreading CRB to other parts of the island. Unfortunately, the project ran into a materials handling problem. The first step in composting is to reduce the material into small chunks using a chipper. Project personnel have not been able to find a chipper on island that is suitable for wet, fibrous coconut. All the machines tried to date clog in much the same way that a lawnmower clogs on rainy day. A chipper which is designed to handle our material has been sourced and will be purchased using part of the $500,000 from GovGuam. The current process is very unsatisfactory, very expensive, and very "ungreen":

1. potentially infested material is loaded into roll-off bins and trucked to Oka Point
2. material is unloaded, sealed in a tarp, and fumigated with methyl bromide to kill all insects
3. material is reloaded, trucked to a hard fill in the north of Guam and buried

Accession of suitable equipment for establishment of a composting operation will eliminate the need for fumigation. Chipping will greatly reduce the volume of material to be handled, and the valuable organic material will be be returned to the community instead of adding to unnecessary solid waste in the hard fill. If successful, the composting operation could become a model for dealing with green waste after typhoons.

Establishment of a large-scale composting operation will solve the current materials handling problem faced by the Guam Coconut Rhinoceros Beetle Eradication project. Rotting coconut logs will be chipped and transformed into compost which can no longer be used as food by rhino beetle larvae. Maintenance of compost windrows at above 140 degrees F. will prevent infestation by insects during the composting process.

The University of Guam Cooperative Extension Service and the Guam Department of Agriculture have promoted small scale, house-hold level, composting for many years. However, recent developments outlined above have increased the urgency for development of large-scale composting on Guam:.Some work towards developing large-scale composting on Guam has already been done. Dr. Golabi, a soil scientist at the University of Guam, has established a composting demonstration site at the University's Agricultural Experiment Station at Yigo in Northern Guam. A windrow system has been operated at this site for the past three years.

Approach

Processing site. The Northern Guam Soil and Water Conservation District (NGSWCD) has a secured 3 acre parcel of property ideal for staging and processing compost. This site is located about one mile from the existing composting demonstration site at the University of Guam's Agricultural Experiment Station in Yigo, Northern Guam. The area is also readily accessible for green waste drop off and compost pick up. The NGSWCD is currently working with the Department of Defense in diverting green waste created from the impending military build up and make it available to farmers and homeowners. Northern Guam is a limestone plateau with a very thin soil layer, typically only 2 inches thick, so there is a huge demand for compost and soil in this area.

Composting Method. There are many methods of composting organic materials. These include active windrow (with turning), passive composting piles, passively aerated windrow (supplying air through perforated pipes embedded in the windrow), active aerated windrow (forced air), bins, rectangular agitated beds, silos, rotating drums, containers, anaerobic digestion, and vermicompost (using earthworms) (Humenik, and J.R. Miner, 1983).

In this project we are proposing to use active windrow, which requires a 'pull-behind compost turner' called 'AEROMASTER' compost turner. The 'AEROMASTER' compost turner is capable of turning large piles of compost and provides maximum blending and aeration (Midwest Bio-System, 1997). In addition the mechanical watering of the system assures proper moisture content throughout the pile in just one pass. Water is supplied by either a direct hose connection or a pull-behind water tank (Midwest Bio-System, 1997). Adding water as the pile is turned assures each particle of organic material is moistened for maximum microbe growth and material breakdown.

Turning compost allows oxygen in and carbon dioxide (CO_2) out. By turning we provide an aerobic condition for an aerobic process because anaerobic microbes can be toxic to plants. With a good process, aerobic microbes produce CO_2 as the organic material being composted passes through the stomach of the microbes. Turning allows oxygen to circulate and creates an environment for the aerobic microbes to continue to function.

The composting material should be turned whenever the temperature rises above 145^0F to prevent overheating, which kills the composting microorganisms. A temperature below 104^0F may indicate lack of adequate oxygen and a need for turning. If the composting material is dry (water content is less than 40 percent), water should be added to activate the composting process. In some cases, water content lower than 40 percent may result in overheating and a need for watering. If adding water is not an option, turning should regulate the temperature. Ideally, 50 –

55% moisture levels should be kept through the process to create an optimal microbial environment. The composting period may take longer if water content is not maintained at a proper level (Eghbal, 2001). Therefore, daily reading of temperature, CO_2, and moisture levels will be taken to monitor the compost operation for a quality final renewable product to be used not only as soil conditioner but also as fertilizer in order to improve the quality of the degraded soils. In addition, the carbon/nitrogen ratio of the mulch will be monitored to determine compost maturity. The University of Guam Soil lab is equipped with an state of the art C/N analyzer which may be used for this purpose.

.**Equipment.** An Aeromaster compost turner is available at the Yigo Agricultural Experiment Station. However, it is not fully equipped. It requires installation of a hydraulic system to make it convertible into a road transport configuration and it requires a water tank. In addition to these accessories, a suitable 55 hp tractor with a compatible hitch, PTO, and hydraulics is required to operate this implement. We propose purchasing a new tractor for this purpose.

Two chippers are available. A large, general purpose chipper is owned by the experiment station. In addition, the Eradication Project has purchased its own chipper. This is a model designed to handle damp, fibrous wood such as coconut.

A dump truck is available, but requires some repairs.

Budget

(Estimate funds required to establish and run a large-scale composting operation for one year)

Equipment			
Aeromaster compost turner (AES)	Available but needs hydraulics and water tank		$6,000
General purpose chipper (AES)	Available		$0
Specialized chipper for coconut (CRB)	On order – arrives Sept. 2009		$0
Tractor (AES)	Unavailable – to be purchased		$55,000
Dump truck	Available – repairs needed		$5,000
		Subtotal	**$66,000**
Supplies			
Fuel and vehicle service			$13,600
Public outreach			$4,000
Miscellaneous supplies			$4,000
		Subtotal	**$21,600**
Personnel			
Operations Manager (+benefits)			$40,000
Heavy Equipment operator (+benefits)			$36,000
Laborers 2 (+benefits)			$50,000
Research assistant (+benefits)			$25,000
Administrative assistant (+benefits)			$25,000
		Subtotal	**$176,000**
Travel			
Consulting trip to Guam by Dr. Das			$3,500
		Subtotal	**$3,500**
Indirect costs (57% of personnel)			**$100,320**
		TOTAL	**$367,420**

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