

## CHAPTER THREE

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### Direct Drivers of California's Nitrogen Cycle

### Appendix 3.7 N in California's Solid Waste

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## Appendix 3.7 N in California's Solid Waste

People, businesses, and municipalities in California dispose of a large quantity of N-rich materials in landfills. In 2008, organic materials were estimated to be 32.4% of the overall waste stream (Table 3.7.1). Food, lumber, and leaves and grass were the 1<sup>st</sup>, 2<sup>nd</sup>, and 6<sup>th</sup> most prevalent materials found with food waste representing the largest fraction (15.5%) or in absolute terms, 5,586,552 Mg (CIWMB, 2009). When only considering refuse from residential homes, the percentage of food waste increases to 25% of the 2008 waste stream, an increase from 17% in 2004. Other compostable materials, such as leaves and grass, prunings, branches and stumps, and manures, account for 7.2% of waste.

Construction is another contributor to N accumulation in the waste stream. Even with the recent precipitous decline in construction activity (CA DOF, 2013), the quantity of construction and demolition material reaching the landfill is increasing. CIWMB (2009) estimates that as much as 29% (10.5 million Mg) of the solid waste stream in 2008 was derived from construction and demolition activities, a 33% increase in the quantity of such materials since 2004. Fifty percent of this total (14.9% of the total waste stream or 5,230,357 Mg) is derived from lumber, a 48% increase between 2004 and 2008.

An increasing fraction of organic waste is processed for reuse. Between 2000 and 2008, there was an 81% increase in the amount of such material processed (Cotton, 2010). Largely the increased processing results from landfill diversion programs but sources of feedstock include: wastewater treatment plants, municipalities, and agricultural sources as well. The greatest portion of materials in 2008 was derived from individuals who self-haul (28%) and commercial sources (25%).

Processors and composters produce a small number of products (less than 5) that are distributed and applied to land. Agricultural, landscape, and nursery are the principal sinks for recycled organic wastes, accounting for 46% of the total across five regions. More than 26% of the organic materials are used at landfills (beneficial reuse and alternative daily cover). Regional

differences in reuse are apparent (Table 3.7.2). In Southern California, 50% of the materials are spread as alternative daily cover at landfills where it is placed on the surface of refuse to control nuisance (e.g., blowing litter and odor). In contrast, nearly half (48%) are recycled to agricultural soils in the Central Valley. Differential reuse determines the reentry of N into California N cycle. The N dynamics and fate will change with application.

So, there are data to understand ‘who’ and ‘what’ is being disposed of as solid wastes. But an equally important question to understand N flows is ‘where’ the solid waste and imbedded N originated. Was the material transferred into California representing an importation and concentration of N in the state? Or was the material mobilized from within California? Answering such questions requires greater resolution on the materials being landfilled and assumptions about the distribution of production which are not realistic to make at this time. Still, with the local importance of landfills and solid waste on N cycles, these types of question may deserve more attention in the future.

**Table 3.7.1. Composition of California’s solid waste stream: 1999, 2003, and 2008.**

Sample numbers were 1682, 550, and 751 in the three years respectively. Much of the solid waste disposed of in landfills contains nitrogen (N), raising concerns for N<sub>2</sub>O and NO<sub>3</sub><sup>-</sup> emissions. Despite becoming a lesser percentage of total waste stream, the absolute amount of organic waste disposed of in landfills has remained relatively constant between 1999 and 2008. Food represents a significant fraction of this waste. Source: CIWMB, 2009.

Material	1999		2003		2008	
	Est. %	Est. Mg	Est. %	Est. Mg	Est. %	Est. Mg
Paper	30.2	9,743,635	21	7,660,512	17.3	6,221,223
Glass	2.8	917,377	2.3	849,792	1.4	513,221
Metal	6.1	1,962,821	7.7	2,825,629	4.6	1,641,383
Electronics			1.2	436,587	0.5	196,181
Plastic	8.9	2,867,672	9.5	3,455,397	9.6	3,453,812
Organic	35.1	11,328,585	30.2	11,034,972	32.4	11,689,451
Construction & Demolition	11.6	3,728,247	21.7	7,919,991	29.1	10,501,036
Household Hazardous Waste	0.3	96,593	0.2	66,754	0.3	109,522
Special Waste	3.1	1,007,117	5.1	1,848,857	3.9	1,402,648
Mixed Residue	1.8	578,610	1.1	396,765	0.8	300,118

**Table 3.7.2 Regional distribution and use of composting and processing products (Mg) in 2008.** Distribution of organic wastes to land represents an important recycling of nitrogen (N) into the California's N cycle. Based on the recent survey of composting and processors, agriculture and landfills are the primary sinks for recycling organic waste. Source: CalRecycle, 2010.

Use	Region				
	Bay Area	Central Coast	Central Valley	Northern	Southern
Agricultural	358,323	413,365	1,534,508	52,048	462,726
Landscape	306,610	97,371	284,656	32,022	461,169
Nursery	60,656	1,768	93,330	1,947	232,499
Caltrans		4,740	16,484		11,385
Alternative Daily Cover	83,694	10,807	140,572	3,131	2,124,637
Biomass Fuel	399,840	56,258	1,014,725	37,858	652,805
Municipal		4,843	4,845	765	10,383
Beneficial Reuse at Landfills	20,425	27,906		174	108,215
Other	112,296	556	88,100		208,297
<b>Total</b>	<b>1,341,844</b>	<b>617,614</b>	<b>3,177,219</b>	<b>127,944</b>	<b>4,272,115</b>

## References

- CA DOF, 2013. Historical County and City Estimates [WWW Document]. Reports and Research Papers. URL <http://www.dof.ca.gov/research/demographic/reports/view.php#objCollapsiblePanelEstimatesAnchor> (accessed 6.6.15).
- CalRecycle, 2010. Third Assessment of California's Compost- and Mulch-Producing Infrastructure -- Management Practices and Market Conditions (No. DRRR-2010-007).
- CIWMB, 2009. California 2008 Statewide Waste Characterization Study (IWMB-2009-023). CalRecycle (California Department of Resources Recycling and Recovery).
- Cotton, M., 2010. Integrated Waste Management Consulting [WWW Document]. URL <http://www.mattcotton.com/>