Why do we need to recycle paper if “dirty” paper cannot be recycled?

–WALL-E

“What is the cost of a standard A4 piece of paper (including negative externalities)?”

–Scrooge McDuck

“The cost of the paper is only about 10–11% of the lifecycle cost of that paper, according to a government study conducted by California's Alameda County. The main costs of paper documentation fall into copying, delivery, handling, storage, and retrieval of that paper, with copying costs at 33% and distribution costs at 56%, according to the Alameda study”

“Profiting From Source Reduction: Measuring the Hidden Benefits”

Printing & Writing Papers
Life-Cycle Assessment Summary Report

The American Forest & Paper Association

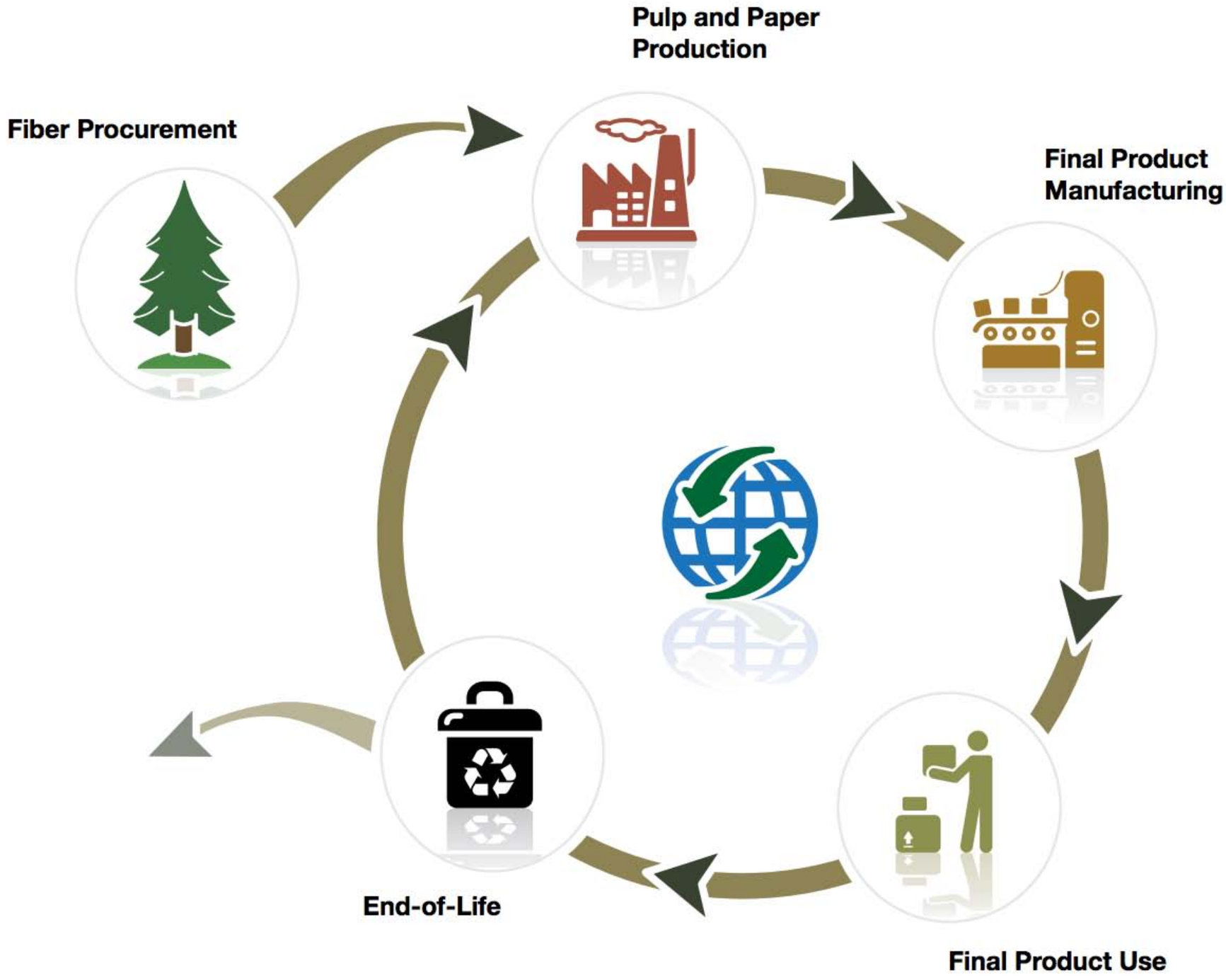


Table 1. Printing and Writing Products
Average P&W Paper Products Studied

Characteristics	PAPER PRODUCT			
	Ream of office paper	**Catalog**	**Telephone directory**	**Magazine**
Paper grade	Uncoated freesheet (UCF)	Coated freesheet (CF)	Uncoated mechanical paper	Coated mechanical paper
Basis weight	20 # (75 gsm)	45 # (68 gsm)	22 # (36 gsm)	38 # (57 gsm)
Number of pages	1,000 pages (500 sheets)	72 pages (36 sheets)	1,200 pages (600 sheets)	120 pages (60 sheets)
Format	8½" x 11"	8" x 10½"	8½" x 10½" x 2"	8" x 10½"
Cover pages/ packaging	Paper wrap	2 covers (CF), 60 # (90 gsm)	2 covers (bleached board), 123 # (200 gsm)	2 covers (CF), 60 # (90 gsm)
Printing*	Not included	64% offset, 36% rotogravure	Offset printing	64% offset, 36% rotogravure
Functional unit	The production in the U.S. and Canada, delivery to an average U.S. customer, use and final disposal or recovery of one standard ream of office paper	The production in the U.S. and Canada, delivery to an average U.S. customer, use and final disposal of standard catalog	The production in the U.S. and Canada, delivery to an average U.S. customer, use and final disposal of a standard telephone directory	The production in the U.S. and Canada, delivery to an average U.S. customer, use and final disposal of a standard magazine
Weight of paper (dry)	Uncoated freesheet: 2.15 kg (4.73 lb)	Coated freesheet: 0.135 kg (0.297 lb)	Uncoated mechanical: 1.18 kg (2.60 lb) Bleached board: 0.0244 kg (0.0538 lb)	Coated mechanical: 0.176 kg (0.388 lb) Coated freesheet: 0.0093 kg (0.0204 lb)
Recycled content	4%	5%	20%	2%
Recovery rate**	71.5%	32.7%	19.1%	38.6%

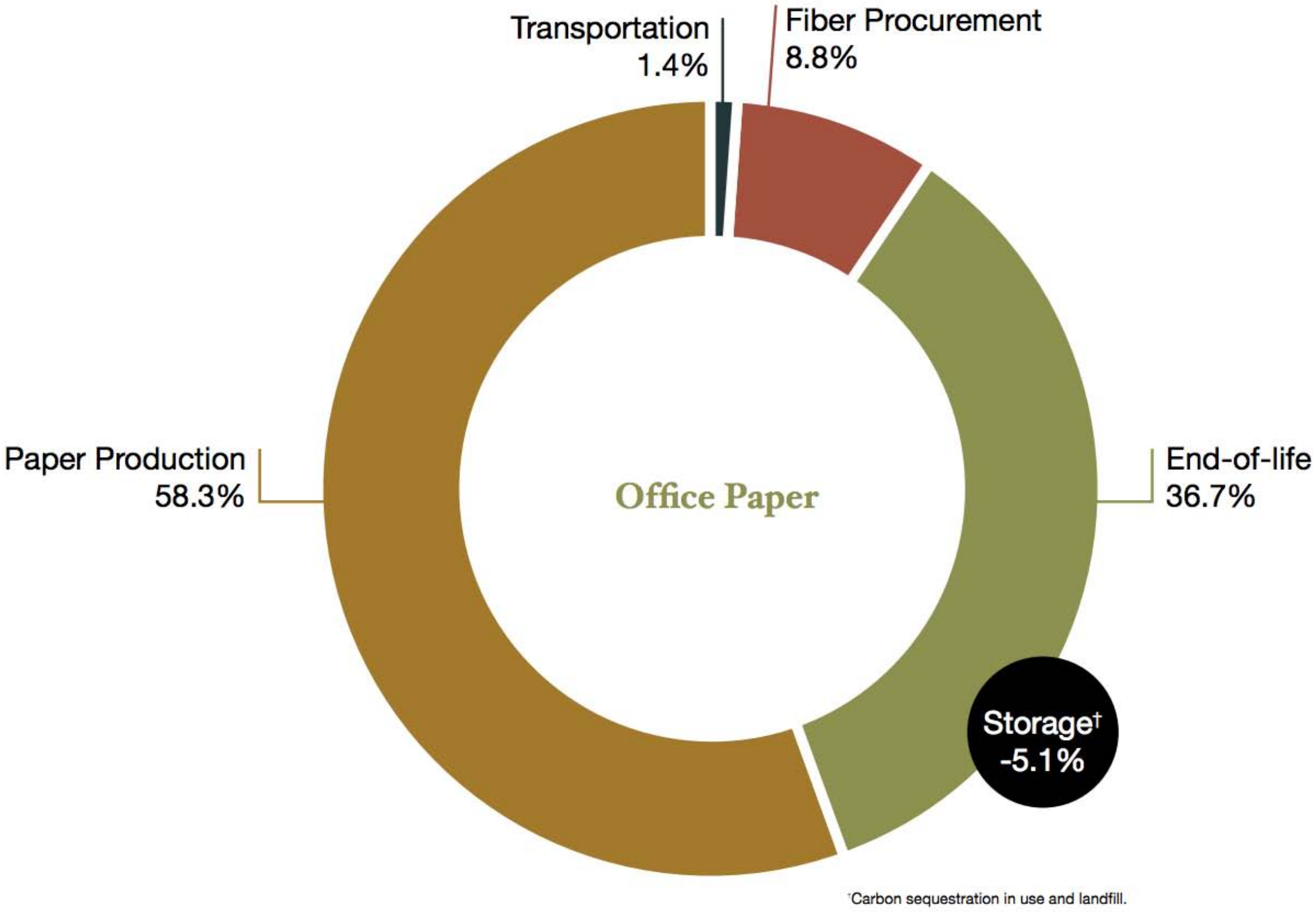
*Magazine Publishers of America 2008.
**EPA estimate

Table 2. LCIA Results
Ream of Office Paper

Impact category	Unit	Total (ream)	1. Fiber procurement	2. Uncoated freesheet production	4. Transport of UCF	5. End-of-life	Carbon storage†
Global warming	kg CO_2 eq.	4.25	8.8%	58.3%	1.4%	36.7%	-5.1%
Acidification	H^+ moles eq.	1.43	12.6%	83.5%	2.9%	0.9%	N/A
Respiratory effects	kg $PM_{2.5}$ eq.	0.00676	5.1%	93.6%	0.7%	0.6%	
Eutrophication	kg N eq.	0.00775	3.5%	38.8%	0.6%	57.2%	
Ozone depletion	kg CFC-11 eq.	2.60E-07	8%	77%	5%	11%	
Smog	kg NOx eq.	8.81E-03	26.2%	58.5%	10.9%	4.4%	
Fossil fuel depletion	MJ surplus	3.02	16.5%	78.7%	3.5%	1.2%	

†Carbon sequestration in use and landfill.

Figure 3. Distribution of Carbon Footprint



†Carbon sequestration in use and landfill.

Life cycle impact assessment (LCIA) of paper making process in Iran

Sotoodehnia Poopak and P. Agamuthu, 2011.*
African Journal of Biotechnology Vol. 10(24), pp. 4860-4870, 6 June, 2011

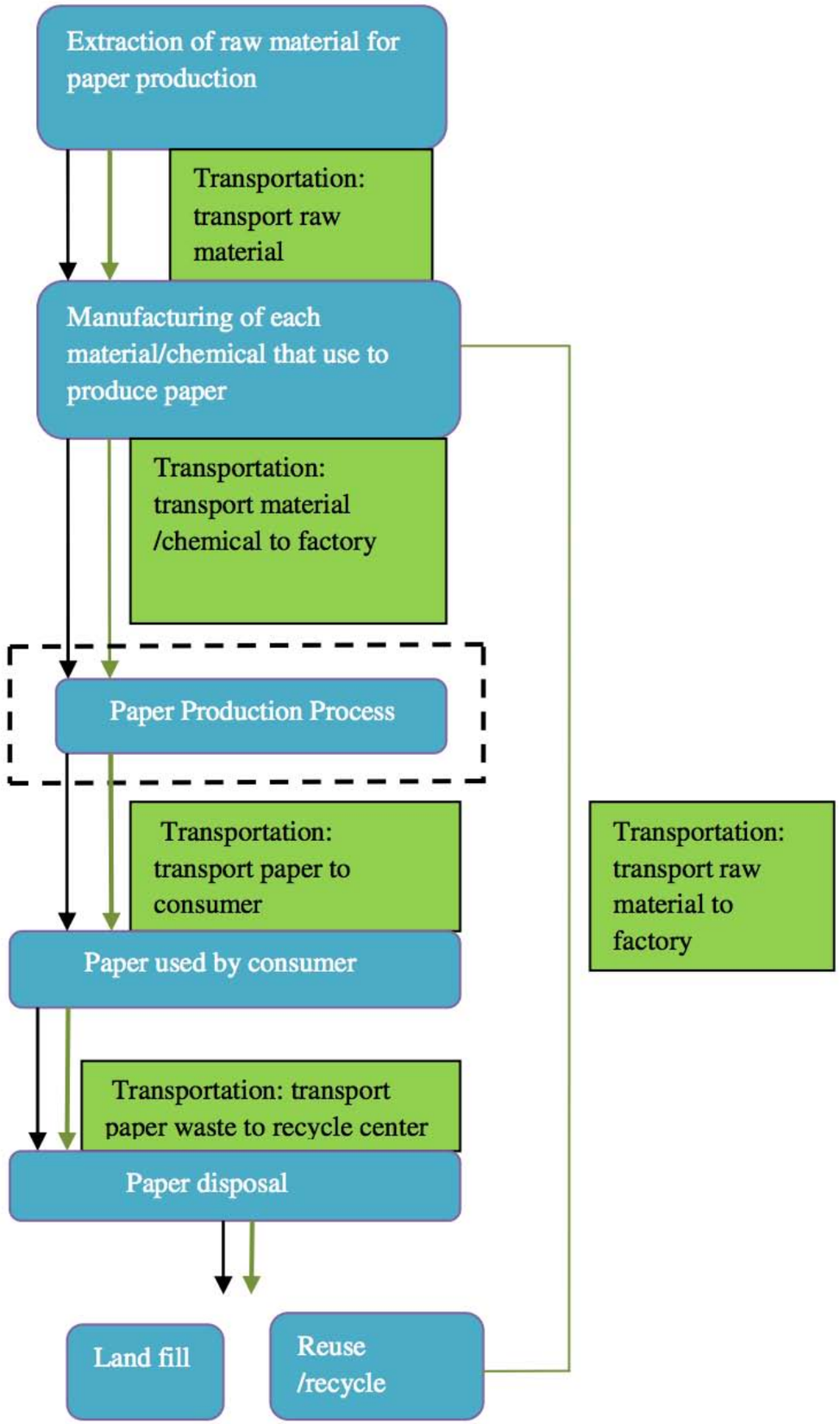


Figure 4. Life cycle of paper and system boundary of this study (dotted line).

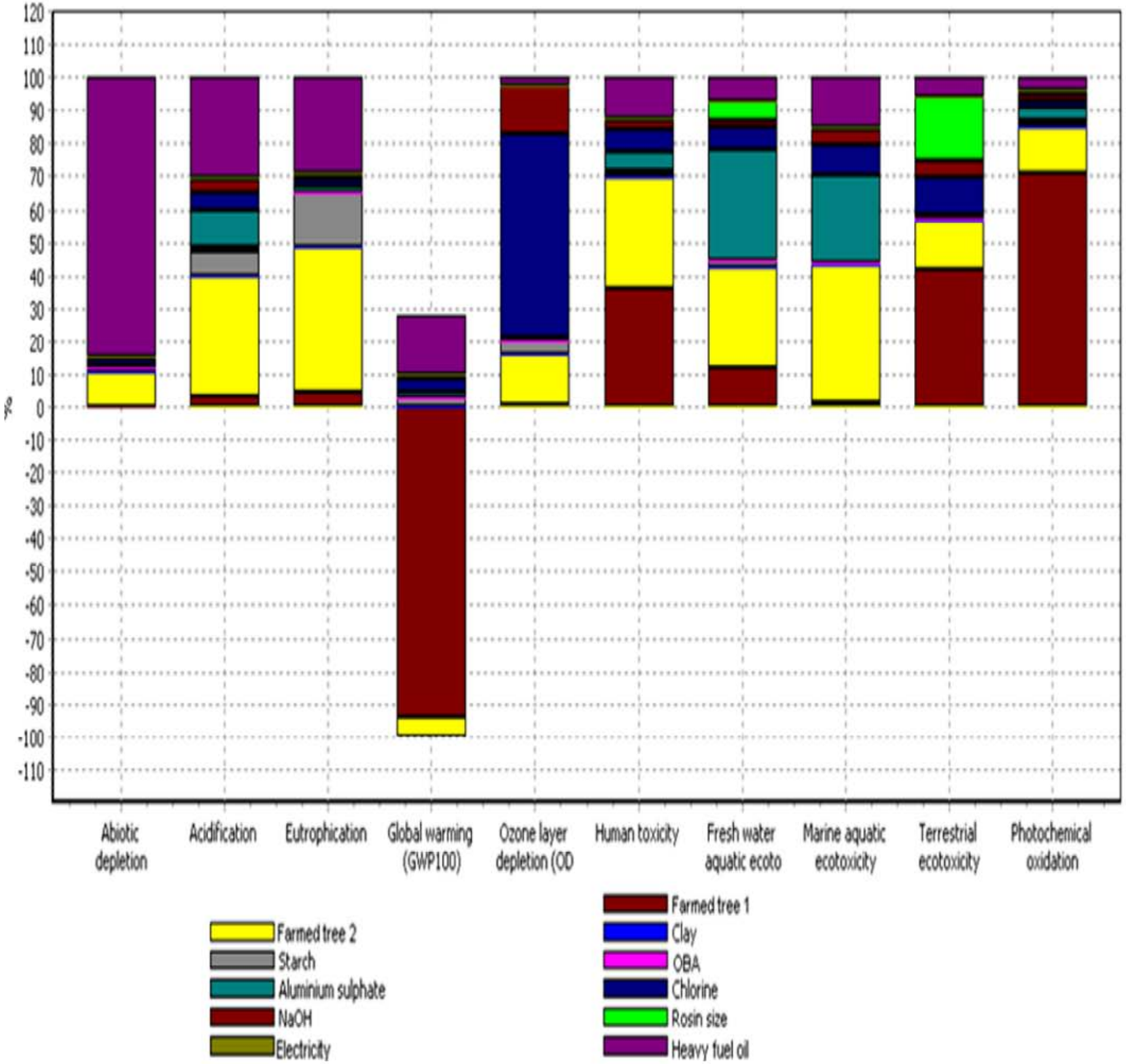


Figure 5. Impact of paper production process from all inputs for producing of one metric tonne of paper for one year.

EC.716 / EC.786 D-Lab: Waste
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