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Carrier bags – Environmental Impact

The following paper is an update to the research paper from 2011 *Comparison of Environmental Impact of Plastic, Paper and Cloth Bags* (NIAR 139-11). This paper details some of the most referenced and peer reviewed research that has been conducted on the overall environmental impacts of different types of carrier bags.

Introduction

The following paper is concerned with the overall environmental impact of different types of carrier bags. Recently the environmental impacts of carrier bags and other options have been debated greatly with the introduction of a carrier bag levy in Northern Ireland. While evidence from the Department of the Environment suggests that the number of plastic bags used has decreased dramatically since the introduction of the levy in 2012, questions have been raised in relation to rolling out the levy to target other types of bags due to their environmental impacts. As a result, the environmental impacts of all types of carrier bags has been a topic for debate, therefore this paper aims to pull together some of the most widely used research in this area.

A common approach adopted when considering the overall environmental impacts is the 'Life Cycle Assessment' (LCA) of carrier bags. This takes into account the environmental impacts of the production, use and disposal of different types of carrier bags.

The EU Commission has recently put forward a proposal for an EU wide plastic bag levy. This paper will look at the EU's Impact Assessment in terms of the evidence used to consider the overall environmental impacts of carrier bags. Finally it also considers a number of other studies not used in the EU's proposal.

Evidence

In 2013 the European Commission (the Commission) communicated a proposal for a "*DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 94/62/EC on packaging and packaging waste to reduce the consumption of lightweight plastic carrier bag".*[1] An impact assessment was carried out which gives an overview of LCA studies of different carrier bags dating from 2004 to 2011. The evidence used in the Commission's impact assessment includes:

1. ***Life cycle assessment of supermarket carrier bags: a review of the bags available in 2006* – UK Environment Agency (EA) (2011).**[2]

   The RaISe paper *Comparison of Environmental Impact of Plastic, Paper and Cloth Bags (NIAR 139-11)* from 2011 acknowledges the development of this report, however, at the time of writing the results of the study had been held back from being published.

   Now in the public domain the EA report considers the types of carrier bags available from UK supermarkets only and does not examine personal bags or carriers given out

[1] Proposal for EU Directive on reducing consumption of lightweight plastic carrier bags http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52013PC0761:EN:NOT

[2] UK Environment Agency (2011) *Life cycle assessment of supermarket carrier bags: review of the bags available in 2006* https://publications.environment-agency.gov.uk/skeleton/publications/SearchResults.aspx

by other high street retailers. The report gives descriptions of different types of carrier bags on page 12/13. The key findings of the report include:

- Reusing bags (all types) as many times as possible, including reuse as replacement for bin liners, is key to reducing their environmental impacts.
- Paper, LDPE (low density polythene), non-woven polypropylene and cotton bags should be reused at least 3, 4, 11, and 131 times respectively to have a lower global warming potential than conventional HDPE (high density polythene) carrier bags that are not reused. The number of times each would have to be reused when conventional HDPE carrier bags are reused is shown in Table 1 below.

Table 1: The amount of primary use required to take reusable bags below the global warming potential of HDPE bags with and without secondary reuse.

	HDPE bag (No secondary reuse)	HDPE bag (40.3% reused as bin liners)	HDPE bag (100% reused as bin liners)	HDPE bag (Used 3 times)
Paper bag	3	4	7	9
LDPE bag	4	5	9	12
Non-woven PP bag	11	14	26	33
Cotton bag	131	173	327	393

Source: UK Environment Agency (2011)[3]

2. *Life Cycle Assessment for Three Types of Grocery Bags – Recyclable plastic; Compostable, Biodegradable Plastic; And Recycled, Recyclable Paper* – Boustead Consulting & Associates (2007)[4]

This peer reviewed study compared three types of bag: the conventional ploythene bag (HDPE), biodegradable/compostable plastic bags and paper bags. The results show that, in general, single use plastic bags made from polythene have lower environmental impacts in relation to the other bags in the study i.e. they use less energy and water, and produce less greenhouse gases and solid waste compared to both compostable plastic bags and paper bags. The study found that:

[3] ibid

[4] Boustead Consulting and Associates (2007) *Life Cycle Assessment for Three Types of Grocery Bags – Recyclable plastic; Compostable, Biodegradable Plastic; And Recycled, Recyclable Paper* http://heartland.org/policy-documents/life-cycle-assessment-three-types-grocery-bags-recyclable-plastic-compostable-biode

- On consumption of non-renewable energy, paper bags used 3.4 times more than plastic bags;
- On consumption of water, paper consumed 17.3 times more than plastic;
- On emissions of greenhouse gases, paper emitted two times more than plastic; and
- On municipal solid waste generation, paper bags generated 4.8 times more solid waste than plastic bags. The following table provides a summary:

Table 2: Impact Summary of Various Bag Types

	Impact Summary of Various Bag Types (Carrying Capacity Equivalent to 1000 Paper Bags)		
	Paper (30% Recycled Fiber)	**Compostable Plastic**	**Polyethylene**
Total Enegy Usage (MJ)	2622	2070	763
Fossil Fuel Use (kg)	23.2	41.5	14.9
Municipal Solid Waste (kg)	33.9	19.2	7.0
Greenhouse Gas Emissions (CO2 Equiv. Tons)	0.08	0.18	0.04
Fresh Water Usage (Gal)	1004	1017	58

Source: Boustead (2007)[5]

3. *Impact assessment of Carrefour plastic carrier bags*, Carrefour, France – PWC/Eco Bilan (2004).[6]

In 2004, Eco Bilan (a division of PriceWaterhouseCoopers) carried out a life cycle analysis on paper and plastic bags for Carrefour, a large French retailer.

This report was also cited in the evidence used in the Scottish Government's *Proposed Plastic Bag Levy – Impact Assessment 2005.*[7][8]

The Scottish report highlighted that the Carrefour study assessed the environmental impact of the energy use, resource use, waste generation and pollutant emissions from the lifecycle of each type of bag by examining their contribution to eight environmental indicators relative to the lightweight plastic bag.

[5] ibid

[6] Pwc/Eco Bilan (2004) *Impact assessment of Carrefour plastic carrier bags*. Available at Évaluation des impacts environnementaux des sacs de caisse Carrefour. For a brief summary of the report in English refer to Ecobilan-Carrefours Study

[7] Scottish Government (2005) *Proposed Plastic Bag Levy - Impact Assessment* (http://www.scotland.gov.uk/Publications/2005/08/1993154/32004

[8] In 2013 the Minister announced plans to bring regulations for a levy by October 2014. For information see Scottish Government News (2013) http://www.scotland.gov.uk/News/Releases/2013/06/carriersbags28062013

The lightweight plastic bag was given a score of 1 in all categories as a reference point. A score greater than 1 indicates that another bag makes more contribution to the environmental problem than a lightweight plastic bag. A score of less than 1 indicates that it makes less of a contribution, i.e. it has less environmental impact than a lightweight plastic bag.

Table 3: Environmental impacts of different types of carrier bag relative to a lightweight plastic carrier bag

Indicator of environmental impact	HDPE bag (lightweight)	Reusable LDPE bag (used 2x)	Reusable LDPE bag (used 4x)	Reusable LDPE bag (used 20x)	Paper bag (single use)
Consumption of non-renewable primary energy	1.0	1.4	0.7	0.1	1.1
Consumption of water	1.0	1.3	0.6	0.1	4.0
Climate change (emission of greenhouse gases)	1.0	1.3	0.6	0.1	3.3
Acid rain (atmospheric acidification)	1.0	1.5	0.7	0.1	1.9
Air quality (ground level ozone formation)	1.0	0.7	0.3	0.1	1.3
Eutrophication of water bodies	1.0	1.4	0.7	0.1	14.0
Solid waste production	1.0	1.4	0.7	0.1	2.7
Risk of litter[27]	1.0	0.4	0.4	0.4	0.2

Source: Scottish Government 2005[9]

According to the Scottish Government report the overall conclusion from the Carrefour study indicated that reusable plastic bags ('bags for life') are more sustainable than all types of lightweight carrier bags (plastic, paper, or degradable) if used four times or more (see columns 4 and 5 in table above), offering the greatest environmental benefits over the full life cycle of any bags used. Paper carrier bags have a bigger environmental impact than lightweight plastic bags in all categories apart from risk of litter.

[9]Taken from the Scottish Government (2005) *Proposed Plastic Bag Levy - Impact Assessment* (http://www.scotland.gov.uk/Publications/2005/08/1993154/32004